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Chattagram International Medical College commenced to publish a peer reviewed scientific Journal from 1st January 2016 which is recognized by BMDC and having International Standard Serial Number (ISSN) 2520-484X. The journal publishes article of authors from any part of the globe, but has a special interest in publishing research articles of authors from Bangladesh and of relevance to developing countries. It publishes Editorial, Original (Research) articles, Special articles, Review articles, Short Communications, Case report and letters on new findings of Medical Science.

Chattagram International Medical College journal is published in english, biannually eg. January and July with prior approval of Editorial board.

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Student Support Centre: Creating a New Horizon for Holistic Student Support in Medical Education

Rokshana Ahmed^{1*}

There is a high level of psychological stress in medical education, especially among medical students in the world.¹ Although academic and clinical stressors are significant factors, lack of and poor access to support services can cause students to suffer their struggles in silence.²

The journey towards a competent doctor is rough and tough. In the field of medicine, however, a “Sink or swim” culture for learning has long existed where students are expected to deal with their own challenges and difficulties. Students' learning needs and resources differ among medical schools because they come from a variety of socioeconomic and cultural backgrounds. Medical training programs aim to impart the necessary knowledge and skills, but numerous students face multiple academic, personal and financial hurdles which can induce emotional stress.³ This stress can have a negative impact on self-confidence, professional development and even academic success or dropping out if support is lacking.⁴ It is not the medical student's responsibility or indeed any student, to handle these problems on their own. A well established and comprehensive student support system is thus essential and not an add-on to good medical education.⁵

Stakeholders views highlighted that there are complex and interconnected challenges on the part of the medical student. In the academic realm, a number of students are challenged by the complexity of the curriculum, the frequency of information and the unfamiliarity of medical terminology. These difficulties may be further

compounded by traditional teaching approaches that do not actively engage learners.⁶ In addition to these issues, some students encounter personal and family issues outside the classroom, such as problems adjusting to life in the hostel, overuse of the smartphone and addiction to games, and problems with mental health such as depression.⁷ Furthermore, many students lack motivation, and they are feeling anxious, especially if they are pushed to opt for medical studies by their parents.⁸ These are all factors that can have a detrimental impact on academic achievement as well as mental health.

The problem that is the most alarming is the lack of understanding by the different players in a student's education. There is evidence of variation in perceptions of difficulties and their impact on academic performance and well-being between the parent, faculty member and student.⁹ Parents may not be aware of the learning and thinking challenges that come with a rigorous medical curriculum.¹⁰ While students are aware of significant personal issues as barriers to learning (Including language barriers, financial difficulties and major family problems) faculty members may not be. This means that certain facets of wellbeing may be neglected, when the focus is only on attainment.¹¹ This requires improved communication and a common understanding between students, parents and educators.

Medical schools must shift away from old-fashioned and disjointed support of medical students and substitute this with a more active and future-focused strategy to foster their academic success and well-being. What is better is to use a coordinated team approach and integrate the students, parents, faculty members and college administrators.¹² Medical schools should develop an environment conducive to a supportive attitude to challenges rather than recognizing and punishing “Problem learners.” In the current

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model, teachers assume a role of facilitators and mentors in addition to being educators by assisting students in finding solutions and solving problems during the training process.¹³

In Medical schools, there is a need for investment in faculty development, to enable faculty members to properly support students. Faculty is needed to be trained on the signs and symptoms of learning difficulties, teaching gap fillers, effective study strategies, and set up a learning environment that is supportive and interactive.¹⁴ Close collaboration with families is also key. Parent-Teacher meetings should include more than just academic results and allow parents to become familiar with the requirements and difficulties of medical education.¹⁵ Further, access to professional support services such as mental health counselling, help with interpersonal conflict and language support for learners with communication difficulties should be provided at institutions.¹⁶ All of these can help create a more supportive educational environment and enhance student well-being and success.

There needs to be a shift in the way medical schools support students in order to be able to make meaningful improvements. It is important for institutions to ensure the accessibility, responsiveness and proactiveness of their current support services, rather than developing additional ones, to cater for student needs. This will take a number of targeted reforms.

Enhance Access to Support Services: The institutions should have clear and simple routes for when students need support. A clearly labeled and assigned point of contact can help students get on the right track to available academic, personal or mental health services and resources in a timely manner.

Maintain Confidentiality: Students need to feel secure when seeking assistance. Medical schools need to make it clear from the start of training that using counseling/mental health services is confidential and won't impact negatively on academic progression or future job opportunities .

Foster Help-Seeking Behaviour: Institutions should foster a culture of seeking help. The concepts of mental health, stress management and well-being should be introduced in orientation programmes, workshops and other training activities throughout the medical training .

The objective of a medical college must go beyond just getting good grades and getting trained for a medical profession. It should enable a space to be created where pupils' personal, emotional and intellectual growth can be nurtured during their learning experience. Medical schools that provide students with a collaborative, student-centred support system have the potential to better meet the needs of their students, encourage their health and wellbeing and foster the development of competent, resilient and compassionate doctors of the future.

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Anxiety, Depression and Post-Traumatic Stress Disorder among First-Year Medical, Dental and Nursing Students at the time of Admission

A S M Redwan^{1*} Md Nur Nabi Islam² Mohammad Kamrul Islam³

Abstract

Background: The mental health of students entering health sciences education is a critical predictor of academic success and professional well-being. Unlike transient academic stress, Post-Traumatic Stress Disorder (PTSD) is a severe, chronic condition requiring specialised intervention, underscoring the critical need for its early identification at admission. This study analysed the admission mental health screening records of first-year medical, dental, and nursing students to determine the prevalence of depression, anxiety and PTSD.

Materials and methods: It was a cross section study and we studied the record of mental health screening records of all students admitted to Chattagram International Medical College (CIMC) Chattagram International Dental College (CIDC) and Chattagram International Nursing College (CINC) in the academic years 2022 to 2025. Validated Bangla versions of the Patient Health Questionnaire-9 (PHQ-9) Generalized Anxiety Disorder-7 (GAD-7) and Primary Care PTSD Screen for DSM-5 (PC-PTSD-5) have been used during the admission process. Cut-off value for depression were (PHQ-9 $\geq$ 10) anxiety (GAD-7 $\geq$ 10) and positive PTSD screen (PC-PTSD-5 $\geq$ 3 with trauma exposure). Data from 369 students (75.9% female, mean age 20.0 $\pm$ 1.6 years) were analysed using SPSS.

Results: The prevalence of clinically significant depression was 6.8%, anxiety 6.2%, and PTSD 5.7%. Nursing students represented the highest burden for all three conditions (depression 12.0%, anxiety 10.2%, PTSD 8.3%), significantly exceeding medical and dental students ($p < 0.05$). Female students showed a non-significant trend toward higher depression (7.9% vs 3.4%) and anxiety (7.5% vs 2.2%).

Conclusion: A notable subset of students entering health sciences colleges in Chattagram already carries psychological morbidity, including PTSD—a condition that transcends typical stress responses and necessitates trauma-focused care. These findings underscore the value of routine mental health screening at admission and highlight the need for targeted, specialised support services, especially for female and nursing students.

Key words: Anxiety; Admission screening; Depression; Dental; Medical; Nursing; PTSD.

Introduction

The transition into professional health sciences education is universally acknowledged as a period of heightened stress. For most students, the intense academic workload, frequent examinations, and exposure to cadaveric dissection represent significant but ultimately manageable challenges that foster resilience over time.¹ International systematic reviews consistently report that 27–30% of medical students experience depression, while 34–44% suffer from significant anxiety during their training.^{2,3} In low- and middle-income countries, where institutional mental health services are often scarce, these figures can be even higher.⁴

However, a critical distinction must be made between the transient stress reactions that most students navigate successfully and the clinically significant mental health conditions that require professional intervention. Among these, Post-traumatic

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Stress Disorder (PTSD) occupies a particularly important position. Unlike situational anxiety or depressive symptoms that typically remit with time, peer support and academic adaptation, PTSD is a severe and often chronic condition arising from exposure to actual or threatened death, serious injury or sexual violence.⁵ Its hallmark symptoms—intrusive re-experiencing, persistent avoidance, negative alterations in cognition and mood and marked hyperarousal—do not resolve through ordinary coping mechanisms and frequently require specialised trauma-focused psychological or pharmacological treatment.⁶

Bangladesh has witnessed a rapid expansion of private health sciences education, with Chattogram being no exception. However, epidemiological data on the psychological well-being of students at the point of admission remain scarce. Previous local studies, conducted predominantly on senior medical students, have reported depression rates between 22% and 62%.⁷⁻⁹ A 2021 survey at a Chattogram public medical college found 39% of students had at least mild depression, while a dental student study documented moderate-to-severe anxiety in 28%.^{10,11} Critically, these investigations were conducted after students had already spent considerable time in their programs and did not assess PTSD.

The omission of PTSD screening is particularly concerning given the high burden of trauma exposure in Bangladesh. A nationally representative community study found that over 60% of adults had experienced at least one traumatic event, with road traffic accidents, domestic violence, and natural disasters being most prevalent.¹² A recent university-based survey in Dhaka reported a PTSD prevalence of 7.1% among general students.¹³ For health sciences students entering demanding professional programs, the implications of untreated PTSD are profound. Symptoms such as impaired concentration, sleep disturbances, emotional numbing and hypervigilance directly undermine the cognitive and interpersonal capacities essential for academic success.¹⁴ Students carrying untreated PTSD into their first year may struggle disproportionately with the rigorous curriculum, potentially leading to academic failure, dropout, or worsening of their mental health condition.

Unlike stress management workshops or peer support—which may suffice for students experiencing adjustment difficulties—PTSD requires evidence-based treatments such as cognitive-behavioural therapy or eye movement desensitisation and reprocessing [6]. Identifying students with probable PTSD at admission enables early referral to specialised services, potentially preventing a trajectory of deteriorating well-being and academic underperformance. To date, no published study has examined PTSD prevalence among health sciences students in Chattogram, and even fewer have done so using data collected at the precise moment of admission—a critical window for early intervention.

The present study set out to address these gaps by analysing the mandatory mental health screening records of first-year medical, dental, and nursing students during the time of their admission to three private institutions in Chattogram. The objectives were: i) to determine the prevalence and severity of depression, anxiety and PTSD using validated instruments; ii) to compare prevalence across institutions and by gender iii) to explore whether the year of admission was associated with mental health outcomes.

Materials and methods

This cross-sectional study investigated the institutional mental health screening records. Since 2022, Chattagram International Medical College (CIMC) Chattagram International Dental College (CIDC) and Chattagram International Nursing College (CINC) have implemented a policy of mandatory mental health assessment for all newly admitted students. The screening takes place during the admission orientation week and was conducted by a psychiatrist using standardised self-report instruments named as Patient Health Questionnaire-9 (PHQ-9) Generalized Anxiety Disorder-7 (GAD-7) and Primary Care PTSD Screen for DSM-5 (PC-PTSD-5). For this study, we analysed the records of all students who were admitted in the academic sessions 2022, 2023, 2024 and 2025 and who completed the screening.

Approval was obtained from the principals of three institutions for using the records. As the data were fully anonymised before analysis, the requirement for additional individual consent was waived.

A total of 400 students were eligible based on admission rosters. Of these, 369 completed the

screening, yielding a coverage rate of 92.3%. After excluding 12 records with missing demographic or key outcome variables, 357 valid records were available for the final analysis. The sample included students from CIMC (Medical, 42.8%) CIDC (Dental, 27.9%) and CINC (Nursing, 29.3%). The gender distribution was 75.9% female and 24.1% male, reflecting the gender composition of the nursing program, which is predominantly female.

The screening battery consisted of three validated instruments, all translated into Bangla and culturally adapted for use in Bangladesh.

i) Patient Health Questionnaire-9 (PHQ-9):

This nine-item scale measures depressive symptoms over the past two weeks. Each item is scored from 0 ("Not at all") to 3 ("Nearly every day") yielding a total range of 0–27. Standard severity categories are: 0–4 none/minimal, 5–9 mild, 10–14 moderate, 15–19 moderately severe and 20–27 severe depression. A cut-off score of 10 has a sensitivity of 88% and specificity of 88% for major depressive disorder.¹⁵ The Bangla version of the PHQ-9 has demonstrated good internal consistency (Cronbach's $\alpha = 0.86$) in Bangladeshi student populations.¹⁶

ii) Generalized Anxiety Disorder-7 (GAD-7):

This seven-item scale assesses anxiety symptoms over the preceding two weeks. Scores range from 0 to 21, with established cut-offs of 0–4 minimal, 5–9 mild, 10–14 moderate and 15–21 severe anxiety. A score of 10 is the recommended threshold for identifying probable clinical anxiety (Sensitivity 89%, specificity 82%).¹⁷ The Bangla GAD-7 has been validated with satisfactory psychometric properties ($\alpha = 0.89$).¹⁸

iii) Primary Care PTSD Screen for DSM-5 (PC-PTSD-5):

This brief screening tool first asks about lifetime exposure to a traumatic event (e.g. Serious accident, physical/sexual assault, natural disaster, war, witnessed death). Those responding "Yes" complete five symptom items (Nightmares, avoidance, hypervigilance, numbness, guilt/blame) rated as present (1) or absent (0). A total symptom score of ≥ 3 constitutes a positive screen for PTSD.¹⁹ The Bangla adaptation was pilot-tested on 20 students, showing acceptable face validity and test-retest reliability ($\alpha = 0.72$).

Descriptive statistics (Frequencies, percentages, means, standard deviations) were computed for

demographic variables and outcome measures. The prevalence of depression (PHQ-9 ≥ 10) anxiety (GAD-7 ≥ 10) and PTSD (PC-PTSD-5 ≥ 3 among those reporting trauma) was calculated for the total sample and for subgroups defined by institution, gender and admission year. Between-group differences were evaluated using the chi-square test or Fisher's exact test where expected cell counts were less than 5. Effect sizes were expressed as Cramér's V for categorical analyses. A two-tailed p-value < 0.05 was considered statistically significant. All analyses were performed using IBM SPSS Statistics version 25.0.

Results

The demographic profile of the 357 participants with complete data is presented in Table I. The mean age was 20.0 ± 1.6 years (Range 17–29). Medical students constituted 42.8% of the sample, dental 27.9% and nursing 29.3%. Females accounted for 75.9%, a proportion driven largely by the nursing college. The admission years were distributed as 2022 (30.3%) 2023 (41.2%) 2024 (16.0%) and 2025 (12.6%).

Table I Demographic characteristics of the study sample (n = 357)

Variable	n	%
Institution		
CIMC (Medical)	153	42.8
CIDC (Dental)	100	27.9
CINC (Nursing)	104	29.3
Gender		
Female	271	75.9
Male	86	24.1
Admission Year		
2022	108	30.3
2023	147	41.2
2024	57	16.0
2025	45	12.6
Age (Years)	Mean $\pm$ SD	20.0 ± 1.6

The mean PHQ 9 score was 4.5 ± 4.9 . Table II shows the distribution of depression severity. Overall, 79.2% of students fell into the none/minimal category, 14.1% had mild depression, 5.4% moderate, 0.8% moderately severe and 0.5% severe depression. The prevalence of clinically significant depression (PHQ 9 ≥ 10) was 6.8% (24/357).

Nursing students displayed the highest rate of major depression (12.0%) significantly greater than medical (5.1%) and dental (3.9%) students ($\chi^2 = 8.97$, $p = 0.011$, Cramér's $V = 0.16$). Females had a higher prevalence than males (7.9% vs 3.4%), but this difference did not reach statistical significance ($p = 0.11$). No significant difference was found across admission years ($p = 0.62$).

Table II Depression severity (PHQ-9) by institution and gender

Variable	None/Minimal n(%)	Mild n(%)	Moderate n(%)	Moderately Severe n(%)	Severe n(%)	p-value
Institution						0.011
CIMC	128 (83.7)	17 (11.1)	7 (4.6)	0 (0.0)	1 (0.7)	
CIDC	83 (83.0)	13 (13.0)	4 (4.0)	0 (0.0)	0 (0.0)	
CINC	72 (69.2)	20 (19.2)	9 (8.7)	3 (2.9)	1 (1.0)	
Gender						0.11
Female	210 (77.5)	41 (15.1)	16 (5.9)	3 (1.1)	2 (0.7)	
Male	73 (84.9)	6 (7.0)	4 (4.7)	0 (0.0)	0 (0.0)	

The mean GAD-7 score was 3.0 ± 4.1 . Minimal anxiety was reported by 82.9% of students, mild by 10.8%, moderate by 3.5%, and severe by 2.7% (Table III). The overall prevalence of clinical anxiety (GAD-7 10) was 6.2% (22/357).

Again, nursing students exhibited the highest prevalence of clinical anxiety (10.2%) significantly higher than medical (4.4%) and dental (4.9%) students ($\chi^2 = 6.92$, $p = 0.031$, Cramér's $V = 0.14$). Female students showed a trend toward more anxiety than males (7.5% vs 2.2%, $p = 0.06$). Admission year was not significantly associated ($p = 0.48$).

Table III Anxiety severity (GAD-7) by institution and gender

Variable	Minimal n(%)	Mild n(%)	Moderate n(%)	Severe n(%)	p-value
Institution					0.031
CIMC	131 (85.6)	15 (9.8)	4 (2.6)	3 (2.0)	
CIDC	86 (86.0)	9 (9.0)	3 (3.0)	2 (2.0)	
CINC	78 (75.0)	15 (14.4)	6 (5.8)	5 (4.8)	
Gender					0.06
Female	219 (80.8)	33 (12.2)	11 (4.1)	8 (3.0)	
Male	77 (89.5)	6 (7.0)	2 (2.3)	1 (1.2)	

A lifetime traumatic event was reported by 21.7% (80/369) of students. Among these, 21 (26.3%) scored ≥ 3 on the PC-PTSD-5 symptom scale, resulting in an overall PTSD prevalence of 5.7%.

PTSD was most common among nursing students (8.3%) followed by medical (4.4%) and dental (3.9%) students, but these differences did not reach statistical significance ($p = 0.26$). Female students had a higher prevalence than males (6.8% vs 2.2%, $p = 0.09$). No association emerged with admission year ($p = 0.71$).

Discussion

This analysis of admission mental health screening records provides one of the first insights into pre-existing psychological distress among first-year medical, dental and nursing students in Chattogram, Bangladesh. The key findings indicate that approximately 1 in 15 students enters these demanding professional programs already suffering from clinically significant depression, anxiety or PTSD, with nursing students bearing the greatest burden.

The depression prevalence of 6.8% observed in this study is substantially lower than the 39% reported by Islam et al. among senior medical students in Chattogram.¹⁰ This discrepancy likely reflects the timing of assessment. The admission screening captures mental health before the full brunt of academic stress has taken hold. Consistent with this interpretation, meta-analytic evidence shows that depression prevalence escalates over the course of medical school, peaking in the clinical years.² Our finding that first-year medical students had a relatively low depression rate (5.1%) suggests that the major psychological toll occurs after the initial transition, reinforcing the need for longitudinal surveillance.

The prevalence of anxiety (6.2% overall, 4.4% in medical students) was also lower than earlier Bangladeshi reports. Rahman et al. documented moderate-to-severe anxiety in 28% of dental students in Chattogram, but their sample included senior students facing board examinations and patient care responsibilities.¹¹ In addition, the use of the GAD-7 with a stringent cut-off of ≥ 10 optimises specificity, which likely yields lower prevalence estimates than the less strict cut-offs used in some previous studies. The mental health advantage of the admission period is again evident: students have not yet encountered the cumulative academic pressures that characterise later training. The 5.7% prevalence of PTSD is a particularly noteworthy and clinically significant finding. To

our knowledge, this is the first study to screen for PTSD among health sciences students in Chattogram at the point of admission. The result aligns closely with the 7.1% prevalence found among university students in Dhaka by Hossain et al. and with community data showing substantial lifetime trauma exposure in Chattogram.^{13,12} Importantly, while mild depression or anxiety may be ameliorated through academic adjustment and general wellness programs, PTSD entails a distinct pathophysiology and clinical course.^{6,14} Students with probable PTSD at admission are unlikely to benefit from generic counselling alone; they require evidence-based trauma-focused interventions such as cognitive-behavioural therapy or eye movement desensitisation and reprocessing.⁶ Thus, their identification at the point of entry is not merely an epidemiological exercise but a clinical imperative. The fact that over one-fifth of students reported lifetime trauma exposure further underscores the need for trauma-informed care within the educational environment. Although the PC-PTSD-5 is a screening tool and may overestimate true PTSD compared with structured clinical interviews, it reliably identifies individuals who would benefit from further evaluation and support.

A concerning finding is the disproportionate psychological distress among nursing students. The nursing college contributed the highest rates of depression (12.0%), anxiety (10.2%) and PTSD (8.3%) significantly exceeding the medical and dental cohorts. This pattern is consistent with international literature showing that nursing students experience greater stress and poorer mental health than their medical peers, often due to lower perceived professional status, limited autonomy, and a gender composition that is overwhelmingly female.^{20,21} In Bangladesh, nursing continues to be an undervalued profession, and students may carry additional societal pressures and financial constraints.²² This vulnerable group requires targeted mental health interventions, including peer support networks, professional counselling, and awareness programs to reduce stigma. The elevated rates of all conditions, including the most severe (PTSD) highlight the urgent need for specialised, trauma-informed support structures tailored to nursing students.

Female students had a consistent trend toward higher depression and anxiety, although the

difference was not statistically significant. This pattern mirrors the global mental health landscape, where women are approximately twice as likely as men to experience depression and anxiety disorders.²³ The under-representation of males (24.1%) particularly in the nursing college, may have limited the statistical power to detect significant gender effects. Future studies with larger, balanced samples are warranted.

The lack of association between admission year and mental health outcomes suggests that, at least at entry, there has been no trend in psychological distress among incoming students over the four-year period studied. This stability may reflect consistent admission criteria and societal conditions, however, given the ongoing socioeconomic challenges in Bangladesh, ongoing monitoring is essential.

Limitation

This study has several strengths. First, it utilised data from a systematic, admission screening program, virtually eliminating selection bias and yielding a high response rate. Second, it employed internationally validated instruments with well-established cut-offs, allowing meaningful comparisons with global literature. Third, the simultaneous assessment of depression, anxiety and PTSD provides a comprehensive mental health profile.

Among the limitations, the cross-sectional nature of admission records bars assessment of causal relationships. Self-report questionnaires, though valid, cannot replace clinical interviews, and may be subject to under-reporting due to mental illness being stigmatised. The data were drawn from three private institutions sharing a single campus, thus, the findings may not generalise to public medical colleges or universities in other parts of Bangladesh. Additionally, we did not have information on potential confounders such as socioeconomic status, family history of mental illness, or pre-existing psychiatric treatment, all of which may influence mental health. Finally, the modest sample size, particularly for male students and the dental college, limited the power to detect smaller effects.

Conclusion

A significant minority of first-year medical, dental and nursing students in Chattogram enter their programs with clinically meaningful depression, anxiety or PTSD. The presence of PTSD at admission is particularly alarming because these

students carry a chronic, debilitating condition that transcends typical stress responses and necessitates trauma-focused professional intervention. Nursing students and female trainees are especially vulnerable. Mental health screening at admission represents an excellent opportunity for early identification and support. We recommend that all Bangladeshi health sciences colleges implement routine psychological assessment and establish accessible, trauma-informed mental health services to safeguard the well-being of the future healthcare workforce.

Recommendation

A longitudinal prospective study will provide insights into the trajectory of mental health during health sciences education and identify critical intervention windows. Future research should incorporate structured psychiatric interviews to validate the screening diagnoses, include public institutions, and assess whether early trauma-focused intervention improves academic outcomes and reduces drop-out rates compared to standard wellness programs. Qualitative studies exploring the lived experiences of distressed students would complement the quantitative findings.

Disclosure

All the authors declared no conflict of interest.

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Prospective Evaluation of Spinal Anaesthesia with Intravenous Sedation in Children Underwent Lower Abdominal Surgeries

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Abstract

Background: Spinal Anaesthesia (SA) is an attractive alternative to general anaesthesia for paediatric lower abdominal surgery, particularly in resource-limited settings, but data from Bangladeshi centres remain limited. A simple, intravenous sedation regimen may facilitate spinal anaesthesia while maintaining cardiorespiratory stability. This study aimed to describe the perioperative profile, intraoperative complications and early postoperative outcomes of children undergoing lower abdominal and infra-umbilical surgery under SA with a sedation protocol in a Bangladeshi tertiary hospital.

Materials and methods: This prospective observational study included 106 children aged 3–13 years undergoing elective lower abdominal or infra-umbilical surgery under SA at Chattagram International Medical College Hospital from January 2024 to November 2025. All patients received intravenous ketamine (1-2 mg/kg) Diazepam (0.1-0.3 mg/kg) and atropine (20-40µg/kg) for sedation, followed by SA with 0.5%

hyperbaric bupivacaine (0.3-0.5 mg/kg). Demographic data, ASA status, type and duration of surgery, duration of anaesthesia, intraoperative cardiorespiratory events and length of hospital stay were recorded and analyzed descriptively.

Results: The mean (SD) age was 8.0 (3.0) years; 75.5% were male and 90.6% were ASA I. Hernia operations and appendectomies accounted for most procedures. Surgical duration was 30–60 minutes in just over half of cases, with over one-third exceeding 1 hour. Intraoperative complications were infrequent: irregular respiratory pattern, apnea/hypoventilation, hypotension and bradycardia were each recorded in a small minority of patients and only 1.9% required conversion to general anaesthesia. Postoperatively, 84.0% of children were discharged within 6–12 hours and fewer than 10% stayed beyond 12 hours.

Conclusion: In this setting, SA with ketamine–diazepam–atropine sedation appears feasible and well tolerated for paediatric lower abdominal surgery, with low rates of cardiorespiratory events and a predominantly short-stay postoperative course.

Key words: Diazepam; Ketamine; Lower abdominal surgery; Paediatric; Spinal anaesthesia.

Introduction

Spinal Anaesthesia (SA) has re-emerged as an important option for paediatric infra-umbilical surgery, offering a pragmatic alternative to General Anaesthesia (GA) in selected children.¹ International experience suggests that, when performed by trained providers, paediatric SA is associated with a low incidence of serious complications and favourable recovery, including reduced airway manipulation, less exposure to volatile agents, and stable haemodynamics.^{2,3} These benefits are particularly relevant for short to intermediate lower abdominal and urogenital procedures such as herniotomy, appendicectomy

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and circumcision, where a single intrathecal injection can provide adequate surgical anaesthesia.¹ However, technical challenges, concerns about block failure and the need for cooperation during lumbar puncture have limited its wider adoption, especially in younger and anxious children.⁴

Sedation is frequently used to facilitate positioning and lumbar puncture, and to maintain comfort while preserving spontaneous ventilation. Among the various regimens, the combination of ketamine and diazepam is widely used in paediatric procedural sedation. Ketamine provides dissociative anaesthesia, potent analgesia and relative preservation of airway reflexes, but can cause increased salivation, cardiovascular stimulation and emergence phenomena. diazepam offers anxiolysis, amnesia and anticonvulsant properties, and can attenuate ketamine-related psychomimetic effects.^{3,5} The addition of atropine aims to reduce vagally mediated bradycardia and ketamine-induced hypersalivation. Together, ketamine– diazepam –atropine constitutes a simple, low-cost regimen that can be administered as fixed small doses without infusion technology, making it attractive in resource-limited environments.⁶

In low- and middle-income countries, including Bangladesh, paediatric anaesthesia is often delivered in high-volume tertiary hospitals with variable access to advanced monitoring and critical care.⁴ In such settings, SA for lower abdominal surgery may help to avoid airway instrumentation and reduce perioperative resource use, yet its safety depends critically on the chosen sedation strategy. Despite growing regional interest in paediatric regional anaesthesia, systematically collected data from Bangladeshi hospitals on paediatric SA, particularly using standardized, fixed-dose ketamine– diazepam –atropine protocols are extremely limited.⁷⁻¹⁰ Most published data on ketamine– diazepam sedation for spinal anaesthesia derive from high-resource settings, use weight-based dosing, and involve more intensive monitoring than is routinely available in many South Asian operating theatres.²

The present prospective observational study from a tertiary hospital in Chattogram, Bangladesh, was therefore undertaken to describe intraoperative cardiorespiratory events and early postoperative outcomes in children receiving SA with sedation for lower abdominal surgery.

Materials and methods

This hospital-based prospective observational study was conducted at the Department of Anaesthesia, Chattagram International Medical College Hospital, Chattogram, Bangladesh from January 2024 to November 2025. Prior approval was obtained from the institutional Ethical and Review Committee. Written informed consent was obtained from parents or legal guardians, with age-appropriate assent from children where applicable. The study included consecutive children aged 3–13 years scheduled for elective lower abdominal or infra-umbilical surgery deemed suitable for SA. Eligible patients were ASA physical status I–II, without coagulopathy, local spinal infection, major spinal deformity, or known allergy to study drugs. Emergency cases and those planned for primary GA were excluded. All included cases were managed according to the departmental SA protocol and no randomization or additional intervention was introduced.

Preoperative assessment included history, examination, ASA grading, and recording of age, sex, weight, and height. Fasting followed institutional paediatric guidelines. In the operating room, an intravenous cannula was placed, and baseline heart rate, non-invasive blood pressure, respiratory rate and peripheral oxygen saturation were recorded. All patients were premedicated with iv diazepam (0.1-0.3mg/kg) body weight. Baseline vital parameters were noted and iv fluid ringer lactate 5ml/kg was given over 15 minutes. To keep the child immobile and cooperative IV ketamine was given in 1mg/kg body weight. Additional (20-40 µg/kg) atropine was given to reduce vagally mediated bradycardia and ketamine-induced hyper salivation and O₂ with mask was given at 3-4 lit/min given. Under aseptic conditions, SA was performed with 0.5% bupivacaine in 8.5% dextrose at a dose of (0.3-0.5 mg/kg) of body weight. Surgery proceeded once block adequacy was confirmed. Inadequate or failed blocks were converted to GA and recorded.

Throughout surgery, patients were monitored with continuous electrocardiography and pulse oximetry and intermittent non-invasive blood pressure, with respiratory pattern observed clinically and supplemental oxygen given as required. Data were entered prospectively into an Excel master sheet. Recorded variables included: age, sex, surgical procedure, weight, height, ASA group, duration of anaesthesia, duration of surgery, intra-operative

irregular respiratory pattern, apnea or hypoventilation, bradycardia, hypotension, postoperative hospital stay, and conversion to GA. The primary outcomes were the incidence of intra-operative cardiorespiratory events (Irregular respiratory pattern, apnea or hypoventilation, bradycardia, hypotension) and the proportion of cases requiring conversion to GA. Secondary outcomes were distributions of anaesthesia and surgery duration categories and postoperative length of stay. Data were analyzed descriptively: continuous variables (Age, weight, height) were summarized as mean $\pm$ standard deviation, and categorical variables as frequencies and percentages.

Results

The study included 106 children between 3 and 13 years, with an average age of 8 years and mean weight and height of approximately 28 kg and 127 cm, respectively. Just over half of the cohort were in the 6–10-year age group, with smaller but substantial proportions in the 3–5-year and 11–13-year ranges. Around three-quarters of the children were male. Most participants were classified as ASA physical status I, with a small minority in ASA II, indicating that the sample largely comprised otherwise healthy children. Lower abdominal and infra-umbilical procedures were dominated by hernia operations and appendectomies, which together accounted for the great majority of cases, while other surgeries such as incision and drainage, urethroplasty, circumcision, orchidopexy/orchidectomy, excision procedures, glanuloplasty and fistula repair were individually uncommon (Table I).

Table I Demographic characteristics of the children undergoing SA (n=106)

Variable	Category	Frequency	Percentage
Age (years)			
	3-5	28	26.4
	6-10	54	50.9
	11-13	24	22.6
Gender			
	Male	80	75.5
	Female	26	24.5
ASA group			
	ASA I	96	90.6
	ASA II	10	9.4

Variable	Category	Frequency	Percentage
Surgical procedure			
	Appendectomy*	33	31.1
	Hernia operation†	51	48.1
	Incision and Drainage	4	3.8
	Polypectomy	3	2.8
	Urethroplasty	3	2.8
	Circumcision	2	1.9
	Orchidectomy	2	1.9
	Orchiopexy	2	1.9
	Excision of baker cyst	2	1.9
	Excision and Biopsy	1	0.9
	Exploration of umbilicus	1	0.9
	Glanuloplasty	1	0.9
	Repair of fistula	1	0.9

*Bilateral herniotomy, Hernioplasty and Herniotomy †Appendectomy (Open and laparoscopic) ASA: American Society of Anesthesiologists.

Among the 106 children, recorded anaesthesia time was predominantly long, with most cases documented as lasting more than 4 hours and a smaller subset falling within 1–4 hours; very few procedures had anaesthesia times under 1 hour. In contrast, the actual surgical duration was generally shorter. Just over half of the operations were completed within 30 minutes to 1 hour, around one-third extended beyond 1 hour, and only a small minority were finished in less than 30 minutes. Overall, the data indicate that while spinal anaesthesia was maintained over several hours in most children, the majority of surgical procedures themselves were of moderate duration (Table II).

Table II Duration of anesthesia and duration of surgery children undergoing SA (n=106)

Variables	Category	Frequency	Percentage
Duration of anaesthesia			
	< 1 hour	3	2.8
	1-4 hour	23	21.7
	>4 hour	80	75.5
Duration of surgery			
	<30 minute	10	9.4
	30 minute-1 hour	57	53.8
	> 1 hour	39	36.8

Intraoperative complications during spinal anaesthesia were infrequent. Transient bradycardia was the most commonly recorded event, whereas

irregular respiratory pattern, apnea or hypoventilation and hypotension were each observed in only a small minority of children. Conversion from spinal to general anaesthesia was rare. Overall, most procedures were completed under spinal anaesthesia without any documented cardiorespiratory instability or need to change the primary anaesthetic technique (Table III).

Table III Intraoperative complications of the children undergoing SA (n=106)

Intraoperative complications	Frequency	Percentage
Intra-operative irregular respiratory pattern	3	2.8
Intra-operative apnea or hypoventilation	2	1.9
Intra-operative bradycardia	9	8.5
Intra-operative hypotension	4	3.8
Conversion to general anesthesia	2	1.9

Most children were managed as short-stay patients following spinal anaesthesia. The large majority remained in hospital for 6–12 hours after surgery, with only a small proportion discharged earlier than 6 hours and a similarly small group staying beyond 12 hours. Overall, the pattern indicates that overnight admission was uncommon and that postoperative observation typically extended into but not far beyond, the first postoperative half-day (Figure 1).

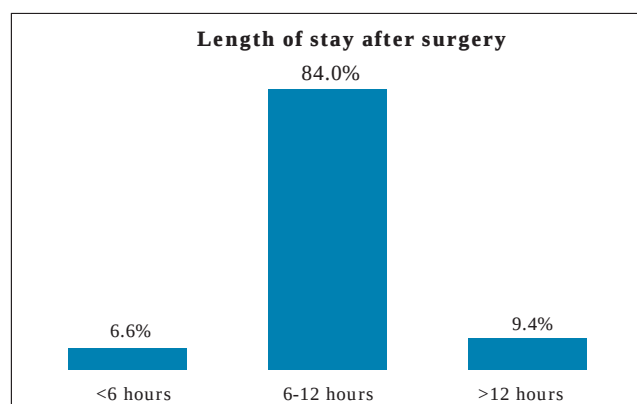


Figure 1 Length of stay in hospital stay after surgery in children undergoing SA

Discussion

The demographic profile of the studied children shows a cohort of predominantly school-aged children undergoing SA for lower abdominal and related procedures, with a mean age of 8 years and most children falling between 6 and 10 years. This age distribution is broadly comparable to other paediatric SA reports from South Asia and similar

settings. Hannan et al. described a Bangladeshi series of 5–8-year-old children undergoing laparoscopic appendectomy under spinal or general anaesthesia, demonstrating that mid-childhood is a common age window for adopting spinal techniques in clinical practice.⁸ Shama et al. likewise recruited children aged 3–12 years for lower abdominal surgery in their randomized trial of intrathecal bupivacaine with or without midazolam, again centering on the 3–12-year range that overlaps closely with the present sample. Similar to previous studies, present study included predominantly ASA I children.⁹⁻¹¹ From a pathophysiological standpoint, limiting SA and sedative exposure to children with normal cardiovascular reserve reduces the likelihood that sympathetic blockade or sedative-related respiratory depression will unmask underlying cardiorespiratory instability.

In this study, almost half of procedures being hernia operations and about one-third appendectomies, aligns closely with the surgical spectrum reported in other regional series. Talukder et al. found that herniotomy, urethroplasty, orchiopexy and other sub-umbilical procedures comprised the bulk of their spinal anaesthesia cases at a Bangladeshi district hospital, while Hossain et al. also focused on infra-umbilical and lower extremity surgeries, many of which were inguinal hernia repairs.^{9,10} Hannan et al. restricted their cohort to laparoscopic appendectomy but highlighted that spinal anaesthesia can be successfully extended even to minimally invasive abdominal procedures in selected children.⁸ The present distribution, combining both appendectomies (Open and laparoscopic) and a high proportion of hernia repairs, therefore reflects typical lower abdominal pathology in this age group and supports the external validity of the cohort for evaluating paediatric spinal anaesthesia in South Asian surgical practice.

A male predominance of around three-quarters in the current sample is consistent with the underlying epidemiology of the surgical conditions represented. Inguinal hernia, undescended testes, distal hypospadias and other urogenital anomalies are more common in males and series dominated by these procedures routinely report a higher proportion of boys. Talukder et al. reported a similar skew toward male patients in their Bangladeshi spinal anaesthesia series and Hannan

et al. also observed that many spinal cases for laparoscopic appendectomy in their cohort were male.^{9,8} This pattern, combined with the ASA I–II distribution and mid-childhood age range, places the present cohort firmly within the mainstream of published paediatric SA practice, complementing data from younger infants and broader narrative reviews that emphasize the overall safety and feasibility of spinal techniques in children when applied judiciously.^{1,12}

In this study, most operations completed within or slightly beyond an hour, but the majority of anaesthetic times recorded as exceeding 4 hours highlights an interesting disparity between surgical and anaesthetic duration. In paediatric SA literature, surgery for infra-umbilical procedures is typically of short to moderate length. Shama et al. reported mean operative times of approximately 70 minutes for lower abdominal surgery in children receiving intrathecal bupivacaine with or without diazepam, reflecting similar “One-hour range” case lengths to those seen in the present series.¹¹ Lönnqvist’s narrative review notes that, even when recommended weight-based doses of long-acting local anaesthetics are used, spinal block duration in paediatric patients is typically around 60 minutes in neonates and infants and increases to approximately 3 hours in older children of about 10 years.¹

The low overall incidence of intraoperative complications in this studied patients is consistent with the accumulating evidence that SA in children is hemodynamically stable and generally safe. In the present series, only a small proportion of children experienced irregular respiratory patterns, apnea or hypoventilation, hypotension or conversion to general anaesthesia, with bradycardia representing the most frequent event. Comparable studies from South Asia and other regions report similarly reassuring profiles. Shrestha et al. observed only a single intraoperative apnea (1.7%) among 58 children under 4 years, with no major haemodynamic instability, concluding that spinal anaesthesia produced minimal intra- and postoperative variation in blood pressure and heart rate.¹²

Talukder et al. reported shivering, transient breathing difficulty and nausea/vomiting as occasional events but noted no episodes of hypotension, bradycardia or neurological deficit in

32 Bangladeshi children undergoing sub umbilical surgery.⁹ Similarly, Hossain et al. described stable systolic and diastolic pressures, respiratory rate and oxygen saturation throughout the intraoperative period in 50 children aged 4–10 years, most of whom also received ketamine with or without diazepam as part of their anaesthetic regimen,¹⁰ Together, these findings and the current data reinforce the view that SA, when carefully conducted, produces relatively few clinically significant cardiorespiratory events in otherwise healthy paediatric patients.

When comparing specific complication patterns, the respiratory event rates in this study appear lower than those reported in some series that use deeper or continuous sedation. Bong et al. Employing dexmedetomidine-based sedation with caudal anaesthesia in neonates and infants, documented intraoperative irregular respiratory patterns in 36% and apnea or hypoventilation in 10% of patients, although most episodes were mild and responsive to stimulation or oxygen.¹³ In contrast, the present ketamine–diazepam–atropine regimen was associated with much lower rates of irregular breathing and apnea/hypoventilation. Shrestha et al. also reported only a single case of apnea, which they attributed plausibly to intravenous sedatives rather than the spinal block itself.¹²

The haemodynamic complication profile in this study also aligns broadly with published experience, although the proportion with bradycardia is somewhat higher than in some reports. Bong et al. observed mild bradycardia in 6% and hypotension in 6% of infants sedated with dexmedetomidine during caudal anaesthesia, while Talukder et al. reported no cases of intraoperative hypotension or bradycardia in their Bangladeshi series.^{13,9} Lönnqvist’s narrative review emphasizes that, compared with general anaesthesia, spinal anaesthesia in children is associated with better preservation of blood pressure and a lower incidence of hypotension and bradycardia, particularly in inguinal hernia repair.¹ The very low conversion-to-GA rate in this cohort is comparable with other dedicated paediatric spinal programmes. In the present series, only a small fraction of children required conversion, similar to the 2% conversion rate reported by Handlogten et al. in 102 infants undergoing urologic surgery under spinal anaesthesia with intranasal dexmedetomidine and fentanyl sedation.¹⁴

Lönnqvist notes that modern paediatric spinal practice generally achieves high success rates with low serious complication rates when appropriate dosing, careful technique and age-appropriate monitoring are applied.¹

In this study, most children stayed in hospital for 6–12 hours after surgery, supporting SA as a short-stay or extended day-case technique but indicating slightly longer routine observation than in some reports. Handlogten et al. found a median stay of just over 5 hours for infants undergoing urologic surgery under spinal anaesthesia, with shorter hospitalization than in those receiving general anaesthesia, while Hannan et al. reported that children having laparoscopic appendectomy under spinal anaesthesia were more likely to be discharged the same day and at lower cost than those under general anaesthesia.^{14,8}

Limitations

This study has several important limitations that should be considered when interpreting the findings. It was a single-centre observational series without a contemporaneous control group receiving GA or alternative sedation regimens, so causal inferences about superiority or non-inferiority of spinal anaesthesia cannot be drawn. The sample size, although larger than some earlier local reports, remains modest and limited to ASA I–II children, which restricts generalizability to higher-risk patients with significant comorbidities.

Conclusions

In conclusion, this study indicates that SA using a uniform low dose of hyperbaric bupivacaine, combined with ketamine–diazepam–atropine sedation, is a feasible and apparently safe technique for lower abdominal and infra-umbilical surgery in otherwise healthy children in a Bangladeshi tertiary hospital. Intraoperative cardiorespiratory complications were uncommon, conversion to GA was rare, and most patients were managed within a short-stay (6–12-hour) postoperative pathway without the need for prolonged hospitalization. These findings support the wider adoption of paediatric SA as part of a cost-conscious, resource-appropriate strategy for sub-umbilical surgery in similar low- and middle-income settings. Further prospective studies should compare SA with GA and evaluate alternative sedative combinations, using robust endpoints such as block success, intraoperative stability, postoperative pain scores, recovery quality, unplanned admissions, costs and parent/patient satisfaction.

Disclosure

All the authors declared no conflict of interest.

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Neurodevelopmental Outcomes in Term Neonates with Moderate to Severe Perinatal Asphyxia Using Rapid Neurological Development Assessment

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Abstract

Background: Perinatal asphyxia is an important cause of infant death and neurodevelopmental disability in the long term, especially in low-resource environments. Developmental deficits should be identified early to be addressed as soon as possible. The purpose of the study was to assess the early neurodevelopment among term infants with moderate to severe perinatal asphyxia with the help of the Rapid Neurological Development Assessment (RNDA) tool, as well as the outcome at the age of three months.

Materials and methods: This prospective observational study was carried out in a tertiary care hospital in Bangladesh in the period between November 2022 and October 2023. Fifty six term infants (37 weeks gestation and above) with moderate to severe perinatal asphyxia were recruited. The neonatal period was used to measure neurodevelopment using the RNDA tool and at the three months of follow-up. The Wilcoxon signed-rank test was used to assess changes in neurodevelopmental status.

Results: Most neonates showed moderate to severe impairment of various domains at discharge and they included motor, sensory, cognitive and

behavioral functions. At three months, there was significant improvement in all domains ($p < 0.001$) and a decrease in the frequency of seizures ($p = 0.012$). Nonetheless, neurodevelopmental deficiencies remained in a percentage of infants.

Conclusion: Moderate to severe perinatal asphyxia is linked to significant early neurodevelopmental disability. Even though substantial improvement has been achieved in the first three months, chronic deficits raise the necessity of organized follow-up and early intervention with the assistance of such tools as RNDA.

Key words: Early developmental assessment; Neonate; Neurodevelopmental impairment; Perinatal asphyxia; Rapid Neurological Development Assessment (RNDA).

Introduction

Perinatal asphyxia continues to be a key health issue of concern in the world and a leading cause of neonatal death and neurodevelopmental disability in the long run, especially in Low- and Middle-Income Countries (LMICs). It is characterized by the inability to start and maintain an appropriate level of respiration at birth, which leads to the inefficiency of gas exchange, hypoxemia, hypercapnia, and metabolic acidosis.^{1,2} Although most neonates can effectively adapt between intrauterine and extrauterine existence due to the capability of cardiopulmonary adaptation, a group of neonates suffer as a result of hypoxic-ischemic insult, which can result in multi-organ dysfunction, such as the case of irreversible brain injury.¹

The disproportionate burden of perinatal asphyxia occurs in resource-constrained settings, where access to quality obstetric services, capable birth attendance and neonatal intensive care services might be suboptimal.^{3,4} Moderate to severe asphyxia

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survivors are more likely to experience adverse neurodevelopmental outcomes, such as cerebral palsy, impaired cognitive and visual and hearing impairments and learning disabilities.^{5,6} The burden of neurodevelopmental disability is high in Bangladesh where improvements in neonatal survival have been made, with cerebral palsy being experienced by about 3.7 per 1000 children.⁷ As perinatal asphyxia is known as a significant risk factor, it poses the risk of long-term neurological impairment several-fold higher than that of unaffected infants.⁸

Timely detection of neurodevelopmental impairment among high-risk neonates is important to enable timely intervention which could lead to better long-term outcomes. Infants with moderate to severe perinatal asphyxia should thus be provided with developmental follow-up programs especially within the early years of life when neuroplasticity is at its peak.⁹ The identification of muscular and motor abnormalities along with sensory domain of the brain at an early stage enables the prompt referral to the relevant rehabilitative facilities, such as physiotherapy and occupational therapy.¹⁰ In most LMIC contexts, however, such as Bangladesh, neurodevelopmental screening is not a regular part of neonatal care, and thus is recognized and treated later.

Rapid Neurological Development Assessment (RNDA) is a validated and structured screening tool to be used in low-resource countries. It allows the overall evaluation of various neurodevelopmental areas, such as gross and fine motor skills, vision, hearing, expressive speech, cognition, behavior and seizures.¹¹ RNDA is relatively easy, possible and contextually relevant as compared to more resource-intensive tools, thus suitable with high-risk infants to identify developmental delay as early as possible. Although it may be useful, it has minimal evidence on its usage in early infancy on neonates with cases of perinatal asphyxia especially in Bangladeshi setting.

Since the perinatal asphyxia is high and routine screening of the developmental status is absent, the assessment of early neurodevelopmental outcomes through a simple and a structured instrument like RNDA is necessary. Chattagram International Medical College Hospital is a non - Government Medical College Hospital in Chattogram and has neonatal intensive care unit

and Shishu Bikash Candro. The purpose of the current research is to evaluate neurodevelopmental impairment among term neonates with moderate and severe perinatal asphyxia and to determine the change in the developmental status within the first 3 months of life.

Materials and methods

This is a prospective observational study which was carried out in the Department of Pediatrics, Chattagram International Medical College Hospital, Chattogram, Bangladesh during the period between November 2022 and October 2023. The population involved in the study was neonates (Gestational age of 37 or more and term) who were admitted to the neonatal unit with moderate to severe perinatal asphyxia at the time of the study.

Operational Definition of Perinatal Asphyxia

The term perinatal asphyxia was used to denote the failure to start and sustain the proper respiration at birth, with the assistance of clinical results. The severity was determined based on the Sarnat and Sarnat grading of hypoxic-ischemic encephalopathy (HIE):

Moderate asphyxia: Stage II HIE.

Stage III HIE: Severe asphyxia.

Inclusion criteria

- Term neonates (≥ 37 weeks gestation)
- Moderate to severe perinatal asphyxia (Stage II or III of HIE) was diagnosed.
- Consent of parent/guardian received.

Exclusion criteria

- Infants with inborn defects or chromosomal disorders.
- Infants who are neonates and have severe systemic illness not due to perinatal asphyxia.
- Infants who were lost to follow-up.

Fifty-six neonates were recruited through consecutive sampling according to the eligibility criteria. Formal sample size calculation was not done as no previous local data were available of early neurodevelopmental impairment in asphyxiated neonates using the RNDA tool. To make sure that there was enough representation in this single-center study, all cases that were eligible and that were presented during the period of study were included.

A structured case record form was used to collect the data. Maternal variables were age, antenatal care status and comorbidities like hypertension, diabetes mellitus, anemia and obstetric complication. Neonatal outcomes variable were sex, weight at birth, gestational age, delivery mode and asphyxia severity. Potential confounding factors were noted.

Neurodevelopmental Assessment

The neonatal period (0-28 days) and the three months of age were used to measure neurodevelopmental status using Rapid Neurological Development Assessment (RNDA) tool. The RNDA assessed various areas such as primitive reflexes, gross motor, fine motor, vision, hearing and speech, cognition, behavior and seizure activity. All domains were rated as normal, mild, moderate or severe impairment on the basis of standardized criteria. The evaluations were conducted by the trained clinicians to maintain consistency.

Follow-up and Attrition

Follow-up assessment was planned to be done at three months to all the enrolled neonates. Among the 56 neonates, 43 of them underwent both the baseline and follow-up measures, and 13 (23.2) of them lost to follow-up because of non-attendance or failure to contact caregivers. Participants with full paired data were analyzed in the final analysis.

The data were processed with the help of the corresponding statistical tools. Continuous variables were summarized in terms of mean and standard deviation, categorical variables were summarized in terms of frequencies and percentages. Wilcoxon signed-rank test was utilized to compare the RNDA scores at the discharge and three months. The p-value below 0.05 was taken as a significant value.

The Institutional Ethics Committee of Chattagram International Medical College gave ethical approval. Written informed consent was obtained from parents or legal guardians. The study was done in a confidential and anonymous way.

Results

A total of 56 neonates were assessed for eligibility and enrolled in the study. Of these, 43 completed the 3-month follow-up, while 13 were lost to follow-up.

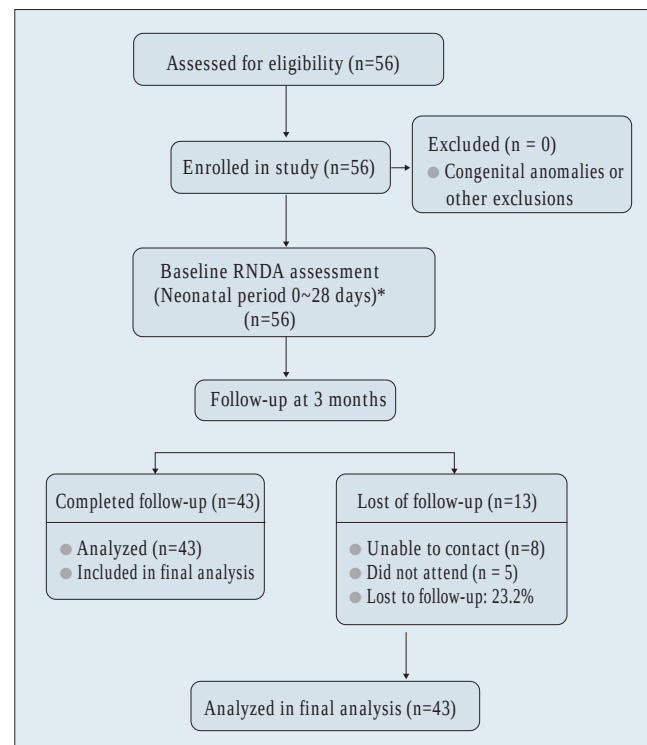


Figure 1 Flow diagram of participant recruitment, follow-up and analysis

Table 1 Demographic Characteristics of the Participants

	Number	Percentage	Mean (SD)
Age in Yrs (Mother)			24.6 (11.2)
Gender			
Male	35	62.5	
Female	21	37.5	
Residence			
Rural	42	75	
Urban	14	25	
Birth weight			
Normal	36	64.3	
Low birth weight	20	35.7	
Maternal Antenatal Care			
Yes	53	94.6	
No	3	5.4	
Mopde of delivery			
Vaginal	34	60.7	
LSCS	22	39.3	

A total of 56 participants were included in the study. The mean maternal age was 24.6 ± 11.2 years. The majority of the neonates were male (62.5%) and most participants were from rural areas (75%).

Regarding birth characteristics, 64.3% of the neonates had normal birth weight, while 35.7% had low birth weight. Almost all mothers (94.6%) received antenatal care.

In terms of delivery mode, 60.7% of the neonates were delivered vaginally, whereas 39.3% were delivered by lower segment cesarean section (LSCS) (Table I).

Risk Factors of the Participants:

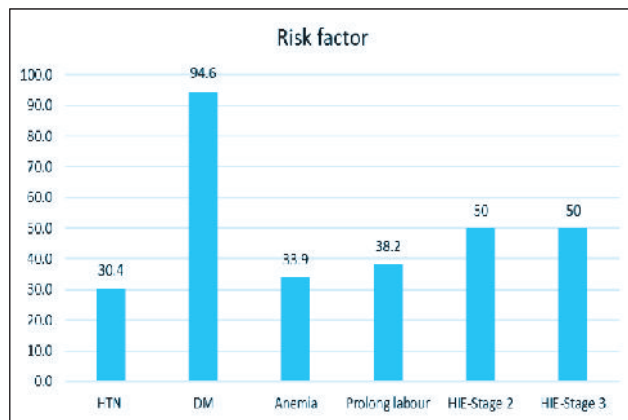


Figure 2 Risk factors of participants

The distribution of maternal and perinatal risk factors is presented in Figure 2. Among these, maternal gestational diabetes was the most common risk factor (94.6%), followed by hypoxic ischemic encephalopathy (HIE) stage II and III (50% each).

Other notable risk factors included prolonged labor (38.2%) anemia (33.9%) and maternal hypertension (30.4%).

Table II Comparison of RNDA Scores at Discharge and After 3 Months

Characteristics	RNDA At discharge Mean (SD)	RNDA After 3 months Mean (SD)	p value
Primitive reflex	2.2 (0.6)	1.6 (0.5)	<0.001
Gross motor	2.7 (0.5)	1.8 (0.7)	<0.001
Fine motor	2.7 (0.5)	1.6 (0.6)	<0.001
Vision	2.3 (0.7)	1.4 (0.5)	<0.001
Hearing	1.9 (0.7)	1.3 (0.5)	<0.001
Speech	2.6 (0.7)	2.0 (0.8)	<0.001
Cognition	2.3 (0.7)	1.6 (0.7)	<0.001
Behavior	2.6 (0.6)	1.8 (0.5)	<0.001
	Number	Number	
Seizure	19	6	0.012

Table II shows the comparison of RNDA scores at discharge and after 3 months of follow-up.

A significant reduction in RNDA scores was observed across all domains, including primitive reflex, gross motor, fine motor, vision, hearing, speech, cognition, and behavior at 3 months compared to discharge ($p < 0.001$ for all domains).

Additionally, the number of seizure episodes significantly decreased from 19 at discharge to 6 after 3 months ($p = 0.012$).

These findings indicate a statistically significant improvement in neurodevelopmental outcomes over time

p-value evaluated on Wilcoxon sign rank test.

Table III Severity-wise Distribution of RNDA Scores

RNDA	Mild		Moderate		Severe		Total	
	At discharge	After 3 months	At discharge	After 3 months	At discharge	After 3 months	At discharge	After 3 months
Primitive reflex	6(10.7)	19(33.9)	33(58.9)	22(39.3)	17(30.4)	1(1.8)	123	66
Gross motor	1(1.8)	15(26.8)	13(23.2)	21(37.5)	42(75)	6(10.7)	153	75
Fine motor	1(1.8)	21(37.5)	14(25)	18(32.1)	41(73.2)	3(5.4)	152	66
Vision	6(10.7)	26(46.4)	26(46.4)	15(26.8)	23(41.1)	1(1.8)	127	59
Hearing	14(25)	33(58.9)	32(57.1)	7(12.5)	10(17.9)	2(3.6)	108	53
Speech	5(8.9)	11(19.6)	14(25)	19(33.9)	37(66.1)	12(21.4)	144	85
Cognition	8(14.3)	22(39.3)	23(41.1)	16(28.6)	25(44.6)	4(7.1)	129	66
Behaviour	3(5.4)	11(19.6)	16(28.6)	28(50)	37(66.1)	3(5.4)	146	76
Seizure	19(33.9)	6(10.7)	36(64.3)	36(64.3)	1(1.8)	0	94	78

The severity distribution of RNDA scores at discharge and after 3 months is presented in Table III.

At discharge, a considerable proportion of neonates had moderate to severe impairment across different domains. However, after 3 months of follow-up, there was a marked shift toward milder categories.

For example, in primitive reflex, moderate and severe impairments decreased substantially, with a corresponding increase in mild cases. Similar trends were observed across gross motor, fine motor, vision, hearing, speech, cognition and behavior domains.

Seizure severity also showed notable improvement, with a reduction in moderate and severe cases and an increase in seizure-free or mild cases after follow-up.

Overall, all domains demonstrated statistically significant improvement over time ($p < 0.001$), except seizures, which also showed significant improvement ($p = 0.012$)

Discussion

This paper compared the neonatal neurodevelopment in moderate and severe perinatal asphyxia infants at term with the use of the RNDA tool and showed significant deficits across various domains at discharge and significant improvement three months later. These results are valuable to the understanding of the dynamic character of early neurodevelopment in high-risk neonates and the possible time window of the early intervention.

The average mother age (24.6 ± 11.2 years) indicates a large proportion of young mothers which is in line with the past researches done in similar environments.^{11,12} Nevertheless, as Crawford points out, maternal age in itself did not seem to have a direct effect on the risk of perinatal asphyxia, implying that the effect of maternal age is probably mediated by other obstetric or socioeconomic factors, but not as an independent determinant.¹³

The study cohort had a male dominance, which is in line with previous reports that show male neonates are more vulnerable.¹⁴ The pathophysiology is still unclear, but it has been postulated that sex-related differences in fetal adaptation to hypoxic stress could be the cause of this difference. However, the lack of correction of the possible confounders in the study makes it impossible to determine a causal relationship.

The majority of the participants are rural residents (75%) which indicates a possible difference in the access to timely obstetric and neonatal care. Although this observation is contrary to a few reports, which have underlined urban-rural discrepancies, it is probably a result of the catchment population of the research centre.¹⁵ The lack of trained birth attendants and promptness of referral systems in rural areas could be associated with a more severe perinatal asphyxia, but this study did not directly compare access to healthcare and delay in rural areas.

Neonatal birth weight below 2500 grams was found in 35.7% of the babies, which is consistent with the literature that it is a major risk factor of perinatal asphyxia and poor neurodevelopmental

outcomes.^{16,17} Nevertheless, the study did not stratify outcomes according to birth weight categories, which does not allow concluding on its independent impact on neurodevelopmental trajectories.

Although the antenatal care utilization was high (94.6%) it was noted that a significant amount of perinatal asphyxia existed. This observation begs the question of the quality and efficacy of the antenatal care services as opposed to coverage. Past research also highlights that access is not sufficient to achieve the best results unless there is quality care and proper risk identification.¹⁸ Absence of a very close evaluation of the quality of antenatal care in this study is a significant limitation.

This cohort had an extremely high prevalence of maternal comorbidities (94.6%) especially Gestational diabetes mellitus. Although this indicates a close relationship with negative neonatal events, the disproportionately high percentage makes selection bias or documentation bias a possibility. Moreover, there is no multivariate analysis that will allow concluding on whether these factors independently caused neurodevelopmental impairment. Other identified risk factors, including malpresentation as defined by Daga AS were not found, which can be attributed to the variances in the population characteristics or sample size.¹⁹

One of the strengths of this research is that neurodevelopment was longitudinally evaluated with a validated and structured tool (RNDA). At discharge, gross motor, fine motor, behavioral and cognitive domains showed severe impairments suggesting that there was widespread neurological impact in the aftermath of hypoxic insult. The improvements in all domains, such as motor, sensory, cognitive and behavioral functions, were statistically significant ($p < 0.001$) over the three-month follow-up period and the frequency of seizures decreased ($p = 0.012$).

These results are comparable to other studies, such as that of Man Banu et al. that also indicated an improvement in early neurodevelopment of asphyxiated neonates.²⁰ This recovery, especially in the acute cases, can be due to neuroplasticity and the possibility of reversing the initial neurological impairment in case of right supportive care. Nonetheless, these enhancements should be taken

with a grain of salt because initial improvements do not always indicate future neurodevelopmental conditions.

Enhancements of sensory areas, such as sight and hearing and higher processes like thinking and behavior further indicate the possible advantage of early monitoring and intervention. Other reports have cited similar trends in research that assesses high-risk neonates.^{20,21} However, the fact that the follow-up period in this study was short, three months, does not allow evaluating persistent or late-onset deficits that are especially important in hypoxic-ischemic encephalopathy.

Limitations

There are a number of limitations to this study. First, the sample size (n=56) is relatively small and diminishes the external validity of the results. Second, the loss to follow-up of 13 participants can have created bias due to attrition, which is likely to have impacted the results estimates. Thirdly, the lack of a control group does not allow making comparative interpretations and does not allow determining the actual extent of neurodevelopmental impairment that can be attributed to perinatal asphyxia. Fourth, the research was mainly based on descriptive and non-parametric analysis with no confounding variables, which limits causal inferences. Lastly, the brief follow-up method fails to measure neurodevelopmental outcomes in the long run which are essential in situations that relate to hypoxic brain injury.

In spite of this, the study shows the clinical usefulness of early neurodevelopmental screening by RNDA and the significance of systematic follow-up of neonates with perinatal asphyxia. These results confirm the necessity to incorporate early development assessment and intervention plans into the standard neonatal care, especially in low-resource centers.

Conclusion

Term infants with moderate to severe perinatal asphyxia have a heavy load of early neurodevelopment impairment in several domains at discharge. Even though the difference showed great improvement at three months of follow-up ($p < 0.001$), a high percentage of the infants still had residual deficits, signifying that they were yet to recover neurologically in early infancy. These

results underscore the idea that early clinical recovery does not always indicate normal neurodevelopment in the long-term. Hence, neurodevelopmental screening intervention, based on such tools as RNDA and the provision of timely intervention and a systematic follow-up is crucial to maximize the outcomes in this at-risk group.

Recommendation

The screening of early neurodevelopmental stages must be part of the routine follow-up of the neonates with perinatal asphyxia. Infants diagnosed with developmental delays need to be referred early to developmental therapy and multidisciplinary rehabilitation services. Neonatal follow-up interventions and incorporation of neurodevelopmental testing into the neonatal care system can be used to help decrease the long-term disability in the vulnerable group.

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Disclosure

All the authors declared no conflict of interest.

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Interaction of HbA1c, BMI and Waist Circumference on Insulin Resistance: A Cross-Sectional Analysis

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Abstract

Background: Type 2 Diabetes Mellitus (T2DM) is closely associated with obesity, insulin resistance, and dyslipidemia. Understanding the interrelationship among these metabolic parameters is essential for identifying individuals at risk and improving disease management. The purpose of the study is to evaluate and compare glycemic, adiposity and central obesity indicators with insulin resistance (HOMA-IR).

Materials and methods: A cross-sectional study was conducted among 160 participants (80 diabetics and 80 non-diabetics). Anthropometric indices (BMI, waist-to-hip ratio), biochemical parameters (FBS, 2-hour postprandial glucose, HbA1c, fasting insulin, lipid profile) and HOMA-IR were analyzed. ANOVA was applied to determine the effects of BMI, HbA1c, and waist circumference (WC) status and their interactions on HOMA-IR.

Results: Diabetic individuals showed significantly higher BMI, waist-to-hip ratio, FBS, 2HAPG, HbA1c, fasting insulin, HOMA-IR, triglycerides, and LDL levels compared to non-diabetics ($p < 0.05$). Among diabetics, obesity (75%) and severe insulin resistance (95%) predominated. ANOVA revealed a significant association of HbA1c status with HOMA-IR ($p < 0.001$). The interaction between BMI, HbA1c and WC was also highly significant ($p = 0.001$) indicating that insulin

resistance is amplified in obese individuals with poor glycemic control and increased central adiposity ($R^2 = 0.688$).

Conclusion: Diabetes is characterized by increased BMI, poor glycemic control, insulin resistance, and an atherogenic lipid profile. HbA1c emerged as the strongest independent predictor of insulin resistance, with synergistic effects from BMI and waist circumference, underscoring the multifactorial nature of metabolic dysregulation in T2DM.

Key words: Body Mass Index; Diabetes Mellitus; Glycated hemoglobin; Homeostatic Model Assessment of Insulin Resistance (HMAIR); Waist Circumference; Waist hip ratio

Introduction

Insulin Resistance (IR) lies at the core of the pathophysiological link between excess adiposity, impaired glucose metabolism, and cardiometabolic disorders. Hemoglobin A1c (HbA1c) serves as a standardized indicator of chronic glycemia, reflecting average blood glucose concentrations over approximately three months. It has been recommended by professional guidelines as a diagnostic and monitoring tool for diabetes and prediabetes, due to its analytical stability and strong correlation with mean plasma glucose levels.¹

Obesity particularly central or visceral adiposity is a major determinant of IR. While body mass index (BMI) provides a measure of overall adiposity, it fails to capture fat distribution accurately.^{2,3} In contrast, Waist Circumference (WC) and related indices such as the waist-to-height ratio (WHR) better reflect visceral fat accumulation, which is metabolically active and closely associated with IR.^{4,5,6} Comparative studies have consistently demonstrated that WC and WHR outperform BMI in identifying individuals with IR and metabolic syndrome across various populations.^{4,7,5,6}

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Epidemiologic data further emphasize the widespread prevalence of IR and hyperinsulinemia. Analyses of national surveys indicate a rising burden of IR even among individuals without overt diabetes, underscoring the need for pragmatic and accessible screening tools.⁸ Anthropometric and biochemical parameters when evaluated together can thus provide complementary insights into metabolic risk.

Notably, HbA1c levels, even within the non-diabetic range, have been found to correlate positively with indices of IR such as HOMA-IR.⁹ Coexistence of elevated HbA1c and increased adiposity, particularly central fat accumulation, exacerbates insulin resistance and predisposes individuals to type 2 diabetes and hepatic steatosis. Several cross-sectional studies have reported nonlinear and synergistic relationships between adiposity markers and glycemic parameters, suggesting that central obesity modifies the association between chronic glycemia and IR.^{2,4,6}

Ethnic and regional variations significantly influence the optimal cut-off values of anthropometric indices. Populations of South Asian origin, for example, exhibit greater IR and visceral fat deposition at lower BMI values than Western populations, necessitating population-specific WC thresholds for defining metabolic risk.^{4,7} This reinforces the rationale for pairing HbA1c measurement with WC and BMI assessment to enhance the predictive power of IR screening in different demographic contexts.

Against this background, the present cross-sectional analysis investigates the interactive effects of HbA1c, BMI and WC on insulin resistance.¹⁰ By evaluating main and interaction effects, this study aims to clarify whether central adiposity modifies the relationship between chronic glycemia and IR beyond overall body mass. Identifying combinations of simple, low-cost clinical parameters that effectively predict IR could guide early intervention strategies, especially in resource-limited settings where laboratory-based measures of insulin sensitivity are not routinely feasible.^{9,10}

Materials and methods

A cross-sectional analytical study was conducted over a period of 1 year (July 2023 to June 2024) in Department of Biochemistry and Department of Endocrinology, Chattogram Medical College. A total 160 patients were taken. Of these consecutive 80 were DM patients and 80 non-DM patients as a comparison group to test the hypothesis. Patients attending endocrine outdoor with DM and non-DM of either sex, age between 40 to 70 years were included in the study. Patients who were taking steroid, tricyclic antidepressants, monoamine oxidase inhibitors, known DM, Hemoglobinopathies, Iron deficiency anemia, Hemolytic anemia, Carcinoma, Chronic Renal Failure and women with pregnancy were excluded. After taking approval of Ethical Review committee of Chittagong Medical College study participants were selected from the OPD of the department of endocrine, Chittagong Medical College hospital, who had come for their regular checkup. After taking a brief history, measured anthropometric parameters (BMI, WHR, WC) and preliminary selection the purpose of the study was explained in detail to each subject and their informed verbal consent was taken. Then they were requested to report to department of Biochemistry, CMC in the morning between 8.00 am to 9.00 am following an overnight (8-12 hour) fasting for fasting blood glucose. On the day of blood collection, FBS, 2HAPG, HbA1c, fasting insulin, HOMA-IR, triglycerides and for LDL sample was taken. When the study participants were reported, informed written consents were taken. A predesigned case record form was used to record relevant clinical and sociodemographic data from study participants who gave consent. Height and weight were measured by using free standing stadiometer (Wincon, model ZT 120) and calculated BMI (Weight in kg/height in m²). WC and hip circumference were measured by using measuring tape. WC was measured between midpoint between last rib and iliac crest. Hip circumference was measured by widest point over buttock. The guideline of south. Asian for BMI cut-offs value. HbA1C will be measured by High Performance Liquid Chromatography (HPLC) method in Bio-Rad D10 system. Fasting serum insulin measured by The ADVIA Cantaury Insulin assay was a two-site sandwich immunoassay using direct chemiluminescent technology and HOMA-IR was calculated.

Results:**Table I** Comparison of Biochemical and Anthropometric parameters among the study population

Parameter	Diabetic (Mean $\pm$ SD)	Non-diabetic (Mean $\pm$ SD)	p-value
BMI (kg/m ²)	25.19 $\pm$ 1.27	22.42 $\pm$ 1.41	0.001
W:H ratio	0.90 $\pm$ 0.07	0.83 $\pm$ 0.05	0.001
FBS (mmol/L)	8.78 $\pm$ 1.59	5.27 $\pm$ 0.28	0.001
2HAPG (mmol/L)	14.14 $\pm$ 2.63	6.99 $\pm$ 0.54	0.001
HbA1c (%)	8.37 $\pm$ 1.52	5.58 $\pm$ 0.45	0.001
F. Insulin	20.23 $\pm$ 5.73	9.68 $\pm$ 1.69	0.001
HOMA-IR	8.01 $\pm$ 2.95	2.27 $\pm$ 0.41	0.001
TG (mmol/L)	2.87 $\pm$ 0.65	1.60 $\pm$ 0.11	0.03
LDL (mmol/L)	3.57 $\pm$ 0.54	2.18 $\pm$ 0.25	0.02

p-value significant at <0.05 and highly significant at < 0.01.

The Table I shows that diabetic individuals have significantly higher BMI and waist-to-hip ratio compared to non-diabetics, indicating greater obesity and central adiposity. Glycemic parameters including fasting blood sugar, 2-hour postprandial glucose, and HbA1c were markedly elevated among diabetics, confirming poor glycemic control. Furthermore, fasting insulin levels and HOMA-IR were significantly higher in diabetics, reflecting hyperinsulinemia and insulin resistance. Lipid profile differences were also evident, as triglycerides and LDL cholesterol were elevated in diabetics, suggesting an atherogenic lipid pattern. Overall, these findings highlight that diabetes is associated with increased adiposity, hyperglycemia, insulin resistance and dyslipidemia, with all parameters showing statistically significant differences (p<0.05) underscoring metabolic risk factors in diabetic individuals.

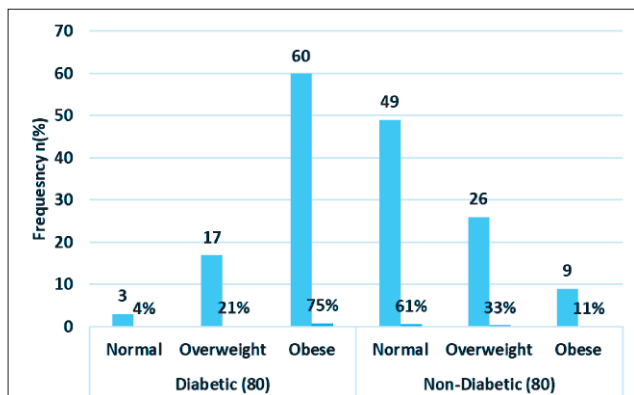
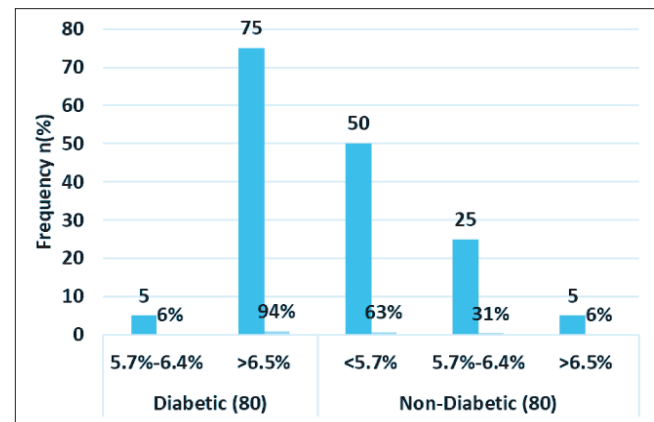
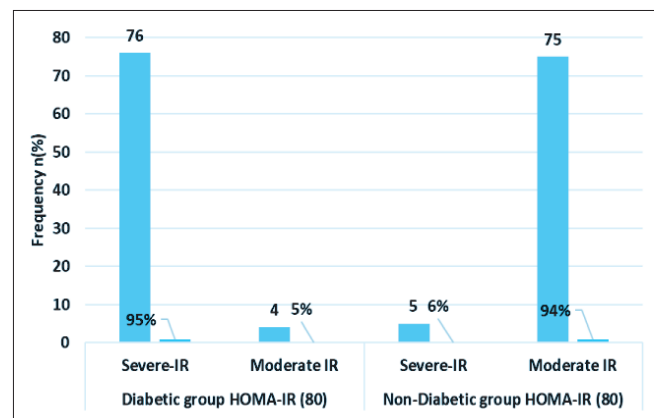
**Figure 1** Frequency distribution of BMI status among the study population (n=160)

Figure 1 shows the frequency distribution of BMI status among the study population shows a contrast between diabetics and non-diabetics. Among the diabetics, obesity was overwhelmingly predominant (75%) followed by overweight (21%) with only a small fraction having normal BMI (4%). In contrast, the non-diabetic group had a majority with normal BMI (61%) while 33% were overweight and only 11% obese.

**Figure 2** Frequency distribution of HbA_{1c} among the study population (n=160)

The Figure 2 shows that most diabetic patient (94%) had HbA1c levels above 6.5%, indicating poor glycemic control, while only a small fraction (6%) were in the prediabetic range (5.7–6.4%). In contrast, most non-diabetics had normal HbA1c levels (<5.7%) accounting for 63%, followed by 31% in the prediabetic range, and only 6% with HbA1c >6.5%.

**Figure 3** Frequency distribution of IR status among the study population (n=160)

The Figure 3 illustrates the distribution of Insulin Resistance (IR) status, assessed by HOMA-IR, among diabetics and non-diabetics (n = 160). In the

diabetic group, severe IR was dominant, observed in 76 individuals (95%), with only 4 individuals (5%) showing moderate IR. Conversely, in the non-diabetic group, the majority (75 individuals, 94%) demonstrated moderate IR, while only 5 individuals (6%) had severe IR.

Table II ANOVA test for association of Risk factors (BMI status, HbA_{1c} status, WC status) with HOMA-IR among the study population (n=160)

ANOVA				
Dependent Variable: HOMA-IR				
Source	Sum of Squares	Mean Square	F	p-value
BMI status	9.10	4.55	1.04	0.36
HbA _{1c} status	307.50	153.75	35.15	0.001*
WC status	5.65	5.65	1.29	0.26
BMI status * HbA _{1c} status	31.97	7.99	1.83	0.13
BMI status * WC status	26.29	13.14	3.01	0.04*
HbA _{1c} status * WC status	17.29	8.64	1.98	0.14
BMI status * HbA _{1c} status * WC status	50.33	25.16	5.75	0.001*

a. $R^2 = 0.688$

b. BMI status (Normal, overweight, obese) HbA_{1c} status (<5.7%, 5.7%-6.4%, >6.5%); WC status (Male >0.9, Female >0.8)

*p-value significant at < 0.05 and highly significant at <0.01.

Table II shows that the ANOVA examined the effect of BMI status (Normal, overweight, obese) HbA_{1c} status (normal, prediabetes, diabetes), and waist circumference (WC status: low, high) influence HOMA-IR.

Main Effects

HbA_{1c} status had a strong and significant effect on HOMA-IR. This means that as HbA_{1c} increases from normal to prediabetic and diabetic levels, HOMA-IR also rises significantly, showing a link between blood sugar control and insulin resistance. BMI status (normal, overweight, obese) by itself did not show a significant effect. This suggests that BMI alone may not fully explain changes in insulin resistance once HbA_{1c} is considered. WC status also did not independently predict HOMA-IR.

Interaction

Importantly, the combined effect of BMI, HbA_{1c}, and WC was statistically significant. This indicates

that the relationship between HbA_{1c} and HOMA-IR is not uniform across all individuals, it depends on both their BMI category and waist circumference. The impact of poor glycemic control (High HbA_{1c}) on insulin resistance (HOMA-IR) is more pronounced in individuals who are both overweight/obese and have high waist circumference.

Discussion

In our cross-sectional analysis of 160 participants (80 with diabetes, 80 non-diabetic), we observed markedly elevated glycemic markers (Fasting blood sugar, 2-h post-prandial glucose, HbA_{1c}) fasting insulin and HOMA-IR in the diabetic group, consistent with hyperinsulinemia and insulin resistance, lipid profiles also showed a more atherogenic pattern (Higher triglycerides and LDL) in diabetics. These findings align with existing evidence that poor glycemic control accompanies insulin resistance and dyslipidemia in type 2 diabetes. For example, in the Hoorn Study cohort, higher HbA_{1c} and HOMA-IR were significantly associated with incident diabetes.⁹

The anthropometric findings in our study are also noteworthy. Among diabetics, 75% were obese and 21% overweight, by contrast, among non-diabetics 61% were normal BMI, 33% overweight and only 11% obese. This substantial excess of adiposity in the diabetic group underscores the well-established link between obesity and insulin resistance. Previous research among adolescents also found that WC had a stronger correlation with HOMA-IR than BMI.¹¹

In our main analytic model (ANOVA) we found that HbA_{1c} status had a strong independent effect on HOMA-IR, whereas BMI status and WC alone did not. Importantly, the three-way interaction of BMI × HbA_{1c} × WC was significant: the adverse effect of elevated HbA_{1c} on HOMA-IR was amplified in overweight/obese individuals with increased waist circumference. This suggests that glycemic dysregulation (Elevated HbA_{1c}) may have a more pronounced effect on insulin resistance in the presence of both general and central adiposity. This interactive finding adds nuance to the literature: many prior studies have shown independent associations of BMI or WC with IR, but fewer have explicitly documented effect-modification by adiposity on the glycaemia-IR relationship. For example, a recent study among non-diabetics noted that BMI and WC had similar AUCs for detecting IR (AUC ~0.78) but did not explore such three-way interactions.^{9, 12}

Our findings are also consistent with more recent evidence highlighting the complementary roles of anthropometric and glycemic markers in predicting insulin resistance.³ Where demonstrated that although advanced body composition measurements using bioelectrical impedance provide detailed estimates of visceral adiposity, simple clinical indices such as BMI and waist circumference remain reliable and practical predictors of insulin resistance in routine clinical practice. Their study further emphasized that combining anthropometric measures with biochemical markers improves the identification of individuals at high metabolic risk. Similarly, our findings indicate that HbA_{1c} alone is a strong determinant of HOMA-IR but its predictive value is enhanced when interpreted together with BMI and waist circumference, particularly among obese individuals with central adiposity. These observations support the concept that integrating glycemic and anthropometric parameters provides a more comprehensive assessment of insulin resistance than relying on any single indicator.

A point of divergence: While many studies report WC or visceral adiposity as a stronger predictor of insulin resistance than BMI alone, in our cohort WC alone did not independently predict HOMA-IR once HbA_{1c} status was included. This might reflect our sample (Diabetes vs non-diabetic) and suggests that in the context of overt glycemic dysregulation the role of HbA_{1c} may dominate, with adiposity acting more as a modifier. Moreover, our interaction findings may imply that interventions targeting glycemic control may yield maximal benefit in those with both elevated BMI and central fat accumulation. In sum, our results emphasize that insulin resistance in diabetics is influenced not only by hyperglycemia but by the combined burden of adiposity and central fat.

Limitation

In this study age ranges of subjects taken was 40 to 70 years. Type 2 diabetes mellitus is prevalent in this age group. So, type 1 diabetes mellitus were not included in this study.

Conclusion

Diabetes is characterized by increased BMI, poor glycemic control, insulin resistance, and an atherogenic lipid profile. HbA_{1c} emerged as the strongest independent predictor of insulin resistance, with synergistic effects from BMI and waist circumference, underscoring the multifactorial nature of metabolic dysregulation in T2DM.

Recommendation

- The sample size could be increased substantially so that a generalized conclusion could be made among the Bangladeshi population.
- Community based interventions should be aimed to convey awareness to follow a healthy lifestyle, promote healthy food alternatives and increase in physical activity.

Acknowledgement

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Disclosure

All the authors declared no competing interest.

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Comparison between Chromogenic agar media and Conventional Culture media for Isolation and Identification of Uropathogenic Bacteria in a Tertiary Care Hospital

Mohammed Sheran^{1*}

Abstract

Background: Urinary Tract Infection (UTI) is among the most prevalent bacterial infections globally and a leading cause of antimicrobial consumption. Rapid and accurate identification of uropathogens is essential for targeted therapy and antibiotic stewardship. Chromogenic agar media offer enzyme-based colour differentiation of organisms directly on primary culture plates, potentially reducing diagnostic turnaround time. To compare Hicrome UTI chromogenic agar with combined Blood Agar (BA) and MacConkey Agar (MAC) for isolation and presumptive identification of uropathogens.

Materials and methods: A cross-sectional observational study was conducted from April 2022 to March 2023 at Chattagram International Medical College Hospital, Bangladesh. Mid-stream clean-catch urine samples were collected from 288 clinically suspected UTI patients. Each specimen was inoculated in parallel on Hicrome UTI agar, Blood agar and MacConkey agar. Identification was confirmed by standard biochemical tests.

Results: Out of 288 urine samples, 143 (49.65%) yielded significant bacterial growth. Chromogenic agar and Blood agar each isolated 100% of organisms, while MacConkey agar isolated only 71.32%. Presumptive identification on primary culture plates was significantly higher on chromogenic agar (96.50%) compared to combined BA+MAC (79.72%) ($p < 0.001$). *E. coli* was the predominant isolate (45.45%), followed by *Klebsiella* spp. (22.38%) and *Staphylococcus saprophyticus* (18.87%).

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Conclusions: Chromogenic agar medium demonstrated superior performance in presumptive identification of uropathogens compared to conventional media, supporting its implementation as a primary screening medium in clinical microbiology laboratories.

Key words: Blood agar; Chromogenic agar; MacConkey Agar; Uropathogens.

Introduction

Urinary Tract Infections (UTIs) represent one of the most frequently diagnosed bacterial infections in both community and healthcare settings worldwide, accounting for a substantial proportion of outpatient consultations and hospital-acquired infections.^{1,2} The condition is defined microbiologically by the presence of $\geq 10^5$ colony-forming units (CFU)/mL of a uropathogen in a properly collected midstream clean-catch urine specimen.³ Women are disproportionately affected due to the anatomical proximity of the female urethra to the periurethral flora, with approximately 20% of women experiencing at least one UTI episode during their lifetime.⁴

The accurate and timely identification of causative organisms is critical for appropriate antimicrobial therapy and the prevention of treatment failure, recurrence, and the emergence of antibiotic resistance.⁵ Conventional urine culture relies on a combination of Blood Agar (BA) and MacConkey Agar (MAC) each medium presenting specific limitation. Blood Agar, though broadly supportive of most uropathogens, cannot differentiate colonies of distinct Gram-negative species and fails to inhibit swarming of *Proteus* spp., thereby complicating colony enumeration. MacConkey Agar selectively supports Gram-negative organisms but does not permit growth of clinically significant Gram-positive uropathogens such as *Staphylococcus saprophyticus*.^{6,7}

Chromogenic media represent a significant technological advance in clinical diagnostic

microbiology. These formulations incorporate specific chromogenic substrates that are hydrolysed by genus- or species-specific bacterial enzymes, generating colonies of characteristic and distinguishable colours directly on the primary culture plate.⁸ This enables presumptive organism identification within 18-24 hours of incubation, bypassing or substantially reducing the need for time-consuming secondary biochemical tests. In addition, chromogenic media support the growth of both Gram-negative and Gram-positive organisms simultaneously, making them potentially superior to the conventional BA+MAC combination [9,10]. So the present study has been designed to compare the Chromogenic medium (Hicrome UTI agar) with the conventional media (Blood agar & MacConkey agar) in terms of isolation of uropathogens.

Materials and methods

This cross-sectional observational study was conducted in the Department of Microbiology, Chattagram International Medical College Hospital, Bangladesh, from April 2022 to March 2023. Ethical clearance was obtained (IRB No.CIMC/IRB/05/21-4). Using a calculated sample size of 288, clean-catch mid-stream urine samples were collected from clinically suspected UTI patients. Samples were processed within 2 hours. Using a calibrated wire loop (0.01 ml), samples were inoculated onto BA, MA and Chromogenic agar (Hicrome UTI agar, Himedia). Plates were incubated aerobically at 37°C for 18-24 hours. Significant bacteriuria was defined as $\geq 10^5$ CFU/ml. After overnight incubation, plates were examined for colony morphology. On Chromogenic agar, identification was based on manufacturer-provided color charts (e.g. Pink-red for *E. coli*, blue for *Klebsiella*/*Enterobacter*, diffuse brown for *Proteus*). On conventional media, identification was based on standard haemolysis and lactose fermentation patterns. All presumptive identifications were subsequently confirmed using standard biochemical and susceptibility tests (MIU, TSI, Citrate, Coagulase, Novobiocin sensitivity). Data were analyzed using standard statistical procedures. The comparison of presumptive identification rates between Chromogenic agar and combined conventional media was evaluated using the modified Chi-square test with Yates correction. A p-value of < 0.05 was considered statistically significant.

Results

Out of 288 urine culture, 143 (49.65%) yielded significant bacterial growths and 145 (51.35%) showed no growth. Among the 143 culture-positive samples *Escherichia coli* was the leading bacteria isolated from 65 (45.45%) samples followed by *Klebsiella* spp 32 (22.38%) *Staph. Saprophyticus* 27 (18.87%) *Enterococci* spp. 14 (09.80%) *Pseudomonas* spp. 4 (2.80%) and *Acinetobacter* spp 01 (0.70%). Comparative results of three culture media for their rate of isolation of uropathogens are shown in Table-I. It was observed that both HiCrome UTI agar and blood agar media supported 100% bacterial growth, while 102 (71.32%) growths were observed in MAC agar.

Table I Distribution of bacterial strains grown on different media

Name of bacterial strains	Number of isolates grown on culture media			Total no. of bacteria
	Chromogenic Agar	Blood Agar	Mac Conkey Agar	
<i>Escherichia coli</i>	65	65	65	65
<i>Klebsiella</i> spp.	32	32	32	32
<i>Staphylococcus saprophyticus</i>	27	27	00	27
<i>Enterococci</i> spp.	14	14	00	14
<i>Pseudomonas</i> spp.	04	04	04	04
<i>Acinetobacter</i> spp.	1	1	1	1
Total	143 (100)	143 (100)	102 (71.32)	143

For presumptive identification of bacterial species (Table-II) by colony characteristics on primary culture plate, out of 143 bacterial isolates, 138 (96.50%) could be differentially identified on HiCrome UTI agar against 92 (79.72%) on combined BA and MAC agar media.

Table II Comparison of media for presumptive identification in primary culture plates after 24 hrs of incubation on the basis of colony morphology

Total no. of isolates	No.	No. of isolates primarily Identified on	
Name of isolates	No.	Chromogenic Agar	Blood & Mac Conkey Agar
<i>Escherichia coli</i>	65	62 (95.38)	57 (88.00)
<i>Klebsiella</i> spp.	32	32(100.00)	28(87.50)
<i>Staph.saprophyticus</i>	27	27 (100.00)	27 (100.00)
<i>Enterococci</i> spp.	14	14 (100.00)	00(00.00)
<i>Pseudomonas</i> spp.	04	04(100.00)	03(75.00)
<i>Acinetobacter</i> spp.	01	00(00.00)	00(00.00)
Total	143	138 (96.50)	92 (79.72)

The rate of presumptive identification of the isolates was found significantly higher ($p < 0.001$) on HiCrome UTI agar than combined BA and MAC agar as primary urine culture medium (Table III).

Table III Comparison of Chromogenic agar with Blood agar and MacConkey agar media in presumptive identification of uropathogens (n= 143)

Chromogenic Agar	Blood + MacConkey Agar: Identified	Blood + MacConkey Agar: Not Identified	Total
Identified	92	46	138
Not Identified	0	5	5
Total	92	51	143

$\chi^2 = 6.667$, $p < 0.001$ - Highly Significant.

(Modified χ^2 TEST with Yates Correction done)

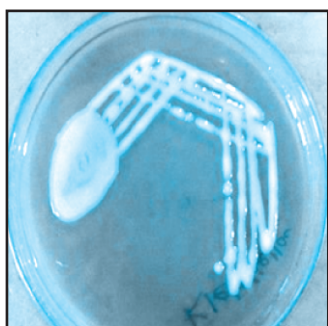


Figure 1 Growth of Klebsiella spp. on MacConkey agar media



Figure 2 Growth of Escherichia coli on MacConkey agar media

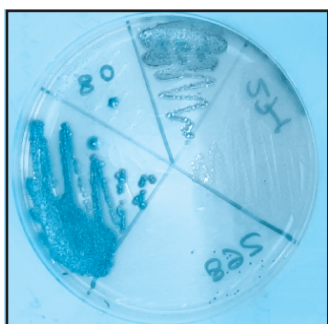


Figure 3 Growth of E.coli, Klebsiella spp. and Pseudomonas spp. on chromogenic agar media.

Discussion

The rapid diagnosis of UTIs is paramount in clinical microbiology. My finding clearly demonstrate the diagnostic superiority of Chromogenic agar over the conventional BA/MA combination for presumptive identification ($p < 0.001$). This aligns with studies by Sharmin et al. and Jadhav et al. who also reported significantly higher presumptive identification rates with chromogenic media.^{11,12} In this study I could not presumptively identify 01 species of Acinetobacter spp. on Chromogenic agar, further identification tests has to be done for definite speciation. In my study 5% of E.coli did not gave expected color probably because of absence of β -D- galactosidase in those strains. Identification of these variant was done by further biochemical tests. Jadhav et al. Akter et al. Sharmin et al. and Aspevall et al. also found similar findings.^{11,12,13,14}

Limitation

In this study sample size was small due to limitation of budget, time and resource.

Conclusion

In conclusion to my study, Chromogenic agar media had a superior isolation and presumptive identification rate when compared to combined Blood and MacConkey agar media. Escherichia coli, klebsiella spp and Staphylococcus saprophyticus were the common pathogen found causing UTI.

Acknowledgement

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Disclosure

The author declares that there is no conflict of interest.

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Common Misconceptions About Physical Medicine and Rehabilitation in Bangladesh: A District Hospital Survey

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Abstract

Background: Misconceptions about Physical Medicine and Rehabilitation (PMR)—including conflation with physiotherapy, uncertainty about whether PMR provides surgery and limited understanding of PMR's clinical scope—may delay timely rehabilitation and weaken referral pathways. Rehabilitation is increasingly emphasized as a core health system function to address growing needs related to functioning and disability. To estimate the prevalence of common misconceptions and knowledge gaps about PMR among adult PMR outpatients attending a district public hospital in Bangladesh.

Materials and methods: A descriptive cross-sectional survey was conducted among 186 adults attending the PMR outpatient department of General Hospital, Cumilla, Bangladesh, from July to December 2025. An interviewer-administered questionnaire assessed PMR-related knowledge and beliefs. Four misconception/knowledge-gap indicators were examined: belief that PMR and physiotherapy are the same; belief that surgical operations are performed in the department; incorrect or uncertain understanding of PMR physicians' specialty; and narrow or uncertain

understanding of conditions treated by PMR. Results are presented as frequencies, percentages, and 95% Confidence Intervals (CI).

Results: Participants' mean age was 44.75±13.71 years, 52.2% were women and 52.7% resided in rural areas. Monthly family income was <10,000 BDT in 34.4% (64/186) 10,000–20,000 BDT in 28.0% (52/186) and >20,000 BDT in 37.6% (70/186). The belief that PMR and physiotherapy are the same was reported by 61.8% (115/186, 95% CI 54.9–68.8). Belief that surgical operations are performed in PMR was reported by 7.0% (13/186, 95% CI 3.3–10.7) while 34.4% (64/186, 95% CI 27.6–41.2) were unsure. Only 28.0% (52/186, 95% CI 21.5–34.4) correctly identified PMR physicians as rehabilitation specialists, and 63.4% (118/186, 95% CI 56.5–70.4) did not know. Regarding conditions treated by PMR, 62.4% (116/186, 95% CI 55.4–69.3) did not know and 31.2% (58/186, 95% CI 24.5–37.8) believed PMR treats only pain, only 6.5% (12/186; 95% CI 2.9–10.0) selected scope-correct options.

Conclusion: Misconceptions and uncertainty about PMR were common even among PMR outpatients in a district public hospital. Low-cost strategies such as clearer service branding and brief structured counseling may reduce misconceptions and support timely rehabilitation utilization.

Key words: Health literacy; Misconceptions; Outpatient survey; Physical Medicine and Rehabilitation; Rehabilitation services.

Introduction

Rehabilitation has emerged as a fundamental component of healthcare systems worldwide, particularly given the expanding needs related to functioning and disability driven by population ageing, increased survival after acute illness or injury and the rising burden of chronic musculoskeletal and neurological conditions.¹⁻³ The Global Burden of Disease Study 2019 estimated

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that 2.4 billion people globally live with health conditions that could benefit from rehabilitation.¹

Physical Medicine and Rehabilitation (PMR) represents a physician-led specialty focused on optimizing functioning and managing disability across diverse conditions. PMR practice typically encompasses comprehensive clinical assessment, diagnosis, medical management, structured exercise prescription, patient education and coordination with allied health professionals including physiotherapists.⁴⁻⁵ Despite the growing recognition of rehabilitation's importance, access remains limited in many low- and middle-income countries due to workforce shortages, infrastructure constraints, and weak integration with other clinical services.⁶⁻⁸

Beyond these supply-side barriers, demand-side factors—particularly patient knowledge and perceptions about rehabilitation—may significantly influence healthcare-seeking behavior, adherence and outcomes.⁹⁻¹¹ In many settings, rehabilitation is popularly equated with physiotherapy alone and the distinct role of PMR physicians remains poorly understood. Such misconceptions may create unrealistic expectations, delay appropriate referrals or lead to premature disengagement when rapid symptom resolution does not occur.¹²⁻¹⁴

In Bangladesh, district-level public hospitals serve as crucial access points for specialized outpatient care for both urban and rural populations. However, published evidence examining patient understanding of PMR services in these settings remains scarce. Measuring misconceptions among individuals already attending PMR clinics provides insight into communication gaps at the point of service delivery and identifies opportunities for low-cost educational interventions.

This study aimed to estimate the prevalence of common misconceptions and knowledge gaps about PMR among adult outpatients attending a district public hospital PMR department in Cumilla, Bangladesh.

Materials and methods

A hospital-based descriptive cross-sectional study was conducted during the period from July-December 2025 in the PMR Outpatient Department of General Hospital, Cumilla, Bangladesh.

Adults aged ≥ 18 years attending the PMR outpatient department during the study period were eligible. Critically ill patients, individuals with severe cognitive/communication impairment preventing reliable responses, and those refusing participation were excluded.

A total of 186 completed interviews were included. Participants were selected using a systematic sampling approach based on outpatient flow (every eligible patient after a random start).

A structured interviewer-administered questionnaire (Bangla) was used. The present analysis focused on four misconception/knowledge-gap items, translated into English as follows:

- “Do you think Physical Medicine and Rehabilitation (PMR) and Physiotherapy are the same thing?” (Yes/No/Don't know)

- “Do you think surgical operations are performed in this department?” (Yes/No/Don't know)

Do you think PMR is same is medicine? (Yes/No/Don't know)

- “What type of doctor is a Physical Medicine and Rehabilitation (PMR) physician?” (Medicine specialist/Surgeon/Rehabilitation specialist/Don't know). The correct response for analysis was “Rehabilitation specialist.”

- “In your opinion, what types of conditions are treated in Physical Medicine and Rehabilitation (PMR)?” (Only pain/Bone, joint and nerve conditions/Long-term disability/Don't know). For analysis, “Bone, joint and nerve conditions” and “Long-term disability” were treated as scope-correct responses.

Socio-demographic variables included sex, residence (Rural/urban) and monthly family income (<10,000 BDT; 10,000–20,000 BDT; >20,000 BDT).

Categorical variables were summarized using frequency (%). For key proportions, 95% binomial Confidence Intervals (CI) were reported. Analyses were performed using SPSS version 26.0 (IBM Corp. USA).

Administrative permission was obtained from the hospital authority. Written informed consent was obtained from all participants. Data were anonymized.

Results

The mean age was 44.75 ± 13.71 years. Females constituted 52.2% (97/186) and rural residents 52.7% (98/186). Monthly family income was <10,000 BDT in 34.4% (64/186) 10,000–20,000 BDT in 28.0% (52/186) and >20,000 BDT in 37.6% (70/186).

Table I Selected socio-demographic characteristics (n=186)

Variable	Category	n	%
Gender	Male	89	47.8
	Female	97	52.2
Residence	Rural	98	52.7
	Urban	88	47.3
Monthly family income (BDT)	<10,000	64	34.4
	10,000–20,000	52	28.0
	>20,000	70	37.6

A total of 61.8% (115/186, 95% CI 54.9–68.8) believed PMR and physiotherapy are the same, while 12.4% (23/186, 95% CI 7.7–17.1) correctly disagreed and 25.8% (48/186, 95% CI 19.5–32.1) were unsure.

Belief that surgical operations are performed in PMR was reported by 7.0% (13/186, 95% CI 3.3–10.7). However, uncertainty was substantial: 34.4% (64/186, 95% CI 27.6–41.2) responded “Don’t know.”

Only 28.0% (52/186, 95% CI 21.5–34.4) correctly identified PMR physicians as rehabilitation specialists, 63.4% (118/186; 95% CI 56.5–70.4) did not know.

Understanding of PMR scope by condition type was limited: 62.4% (116/186, 95% CI 55.4–69.3) responded “Don’t know” and 31.2% (58/186, 95% CI 24.5–37.8) believed PMR treats only pain. Only 6.5% (12/186, 95% CI 2.9–10.0) selected scope-correct responses.

Table II Misconceptions and knowledge gaps about PMR (n=186)

Domain	Response category	n	% (95% CI)
PMR and physiotherapy are the same	Yes	115	61.8 (54.9–68.8)
	No	23	12.4 (7.7–17.1)
	Don't know	48	25.8 (19.5–32.1)
Surgery is performed in the department	Yes	13	7.0 (3.3–10.7)
	No	109	
	Don't know	64	34.4 (27.6–41.2)
PMR physician is a rehabilitation specialist	Correct	52	28.0 (21.5–34.4)
	Incorrect	16	8.6 (4.6–12.6)
	Don't know	118	63.4 (56.5–70.4)
Conditions treated by PMR	Only pain	58	31.2 (24.5–37.8)
	Bone/joint/nerve conditions	11	5.9 (2.5–9.3)
	Long-term disability	1	0.5 (0.0–1.6)
	Don't know	116	58.6 (51.5–65.7)
	Scope-correct (combined)	12	6.5 (2.9–10.0)

Discussion

This study documented substantial misconceptions and knowledge gaps about PMR among patients already receiving care at a district-level PMR outpatient clinic. Three key patterns emerged. First, conflation of PMR with physiotherapy was common, with nearly two-thirds of respondents believing the two are identical. Second, although outright misconceptions about surgery were uncommon, uncertainty was marked, with more than one-third unsure whether surgical procedures are performed in PMR. Third, knowledge about both the professional identity of PMR physicians and the scope of conditions managed was strikingly limited, with “Don’t know” responses predominating.

The high prevalence of the belief that PMR equals physiotherapy likely reflects common usage in everyday language. In many communities across South Asia, “Physio” serves as shorthand for any rehabilitation service.¹⁵ This linguistic habit, while understandable, may inadvertently obscure the medical assessment, diagnostic reasoning, and treatment coordination roles central to PMR practice. When patients arrive expecting only

hands-on therapy, they may be surprised—or confused—by a consultation that includes history-taking, examination, prescription of medication or advice regarding activity modification and self-management.

The large proportion of "Don't know" responses is noteworthy. In health literacy research, uncertainty often signals a modifiable gap rather than firmly held misinformation.^{9,16} This is encouraging from an intervention perspective: uncertain individuals may be more receptive to structured education than those holding strong incorrect beliefs. The findings suggest that many patients reach PMR services without prior explanation of what the service entails, possibly reflecting gaps in referral communication or reliance on informal pathways such as advice from family or neighbors.

Limited understanding of PMR scope—particularly the high proportion who either did not know or believed PMR treats "Only pain"—has practical implications. PMR's role extends across musculoskeletal disorders, neurological rehabilitation, chronic pain syndromes, post-stroke care, and functional restoration after injury or surgery.^{4,5} If patients and referring providers perceive PMR narrowly, opportunities for timely intervention in conditions such as stroke, spinal cord injury or chronic disability may be missed. Moreover, rehabilitation often requires sustained engagement over weeks or months, and patients who misunderstand the service may disengage early if immediate pain relief does not occur.^{12,17}

Why Misconceptions Matter for Rehabilitation Delivery

Rehabilitation differs from many episodic healthcare encounters in that it typically involves serial visits, home-based exercises, behavioral change, and gradual functional improvement rather than rapid symptom abolition.¹⁸ Patient activation, adherence and realistic expectations are therefore especially important.¹⁹⁻²⁰ Health literacy and communication quality have been consistently linked to these outcomes in chronic disease management.^{9,21,22} When patients hold inaccurate mental models of a service, they may be less likely to follow through on recommendations or may experience dissatisfaction when their expectations are unmet.

Possible Explanations

Several factors may contribute to persistent misconceptions:

i) Referral pathways: Patients attending without formal referral or structured orientation may arrive with assumptions shaped by hearsay rather than professional guidance.

ii) Time constraints: High patient volume in public outpatient settings often limits consultation duration, reducing opportunity for explanation and counseling.²³

iii) Terminology and signage: In the absence of clear, patient-friendly communication materials, clinic names and departmental labels may not convey meaning to lay users.

iv) Health literacy variability: Educational background, prior healthcare exposure, and general health literacy shape individuals' ability to navigate and interpret specialized services.^{9,24}

Implications for Practice and Policy

The findings point toward several feasible, low-cost interventions:

Structured Initial Counseling: A brief (60–90 second) standardized explanation at first contact could clarify what PMR is, how it relates to but differs from physiotherapy, what to expect during the visit and what conditions PMR addresses. Use of "Teach-back" techniques—asking patients to repeat the plan in their own words—can confirm understanding and is supported by evidence from chronic disease care.^{21,25}

Clear Service Branding and Patient Materials: Simple posters and leaflets in Bangla stating "PMR is not the same as physiotherapy," listing common PMR conditions and explaining the multidisciplinary nature of rehabilitation could passively reinforce correct understanding over time.^{16,24}

Improved Referral Communication: Brief orientation sessions or written referral protocols for other departments (Orthopedics, neurology, general medicine) can ensure patients receive consistent messaging before arrival. Better integration of rehabilitation within broader clinical pathways is a recurring theme in global rehabilitation systems literature.^{6-8,26}

Training and Awareness for Frontline Staff: Receptionists, nurses and support staff often provide informal information to patients. Ensuring consistent messaging across the team may reduce confusion.

Limitations

This study contributes district-level evidence from Bangladesh and employs direct measurement of specific misconceptions, including separate coding of uncertainty. Reporting "Don't know" as a distinct category rather than collapsing it with incorrect responses is a methodological strength, as it highlights where information deficits are most pronounced.

Several limitations warrant mention. The single-site design limits generalizability, misconception patterns may differ in urban tertiary centers or rural community settings. The cross-sectional design precludes causal inference, we cannot determine whether misconceptions preceded attendance, delayed initial presentation or influenced subsequent adherence. The sample included only individuals who attended PMR, misconceptions in the broader community—including those who might benefit from rehabilitation but never seek it—may be even greater. Responses were self-reported and may reflect guessing or socially desirable answers. Finally, the study did not assess potential predictors such as education level or prior healthcare experience, nor did it evaluate whether correcting misconceptions improves follow-up or functional outcomes.

Recommendations

Future research should explore factors associated with misconceptions (e.g. Educational attainment, prior exposure to rehabilitation, source of referral) and test interventions designed to address them. Randomized trials or quasi-experimental studies evaluating brief educational interventions—such as illustrated pamphlets, teach-back counseling, or video-based orientation—could provide actionable evidence for service improvement. Longitudinal studies linking baseline knowledge to adherence, satisfaction, and functional outcomes would strengthen the case for prioritizing patient education in rehabilitation services. Finally, qualitative inquiry into patients' mental models of rehabilitation could yield richer insights into the cultural and contextual factors shaping these beliefs.

Conclusion

Misconceptions and uncertainty about PMR were common among adult outpatients attended at PMR Department in Bangladesh. Nearly two-thirds

believed PMR and physiotherapy are the same, most could not identify the professional specialty of PMR physicians, and knowledge of PMR's clinical scope was limited. These findings highlight actionable gaps in patient-provider communication and suggest that structured, patient-centered, root level campaign educational strategies—delivered at low cost within existing outpatient workflows—may reduce misconceptions and support more appropriate, timely and sustained use of PMR services.

Disclosure

All the authors declared no conflict of interest.

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Evaluation of Clinical Presentation of Hypothyroidism: A Hospital-Based Study

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Abstract

Background: Hypothyroidism is a common endocrine disorder in Bangladesh resulting from deficient thyroid hormone production or resistance to its action. Clinical manifestations vary depending on the cause, duration and severity, ranging from subclinical hypothyroidism to overt disease and myxedema coma. A high index of clinical suspicion is required for timely diagnosis. This study aimed to evaluate the clinical presentations of hypothyroidism among hospitalized patients.

Materials and methods: This cross-sectional hospital-based study was conducted at Comilla Medical College Hospital from December 2010 to June 2011. A total of 50 patients aged 12–50 years of both sexes with clinically suspected hypothyroidism were included. Diagnosis was established through detailed clinical history and physical examination and was biochemically confirmed at the Institute of Nuclear Medicine and Allied Sciences, Comilla. Data regarding demographic characteristics, clinical symptoms and physical signs were collected and analyzed using descriptive statistics.

Results: Among the 50 patients, the highest age incidence was observed in the 4th and 5th decades. The male-to-female ratio was 1:6; 62% were married and 64% were from rural areas. The most common symptoms were lethargy (62%) cold

intolerance (56%) dry skin (56%) constipation (52%) and decreased appetite (52%). Common clinical signs included weight gain (65%) delayed ankle reflexes (58%) puffiness of face (56%) decreased pulse rate (54%), and edema (48%).

Conclusion: Hypothyroidism presents with diverse but characteristic clinical features in our population, with higher prevalence among middle-aged females. Early recognition based on common symptoms and signs is essential for prompt diagnosis and management.

Key words: Clinical Presentation; Evaluation; Hypothyroidism.

Introduction

Hypothyroidism usually results from decreased production of thyroid hormones or resistance to them. It is a condition resulting from insufficient production or diminished action of thyroid hormones. It may begin in utero or later in life.^{1,2,3}

Hypothyroidism is characterized by a generalized reduction in metabolic function that most often manifests as a slowing of physical and mental activity. The clinical presentations may vary from mild and asymptomatic to severe and overt disease and may also depend on the patient's age, gender and physical condition. In most spontaneous cases, a decrease in thyroid function occurs gradually, with sub-clinical hypothyroidism progressing over time to overt hypothyroidism.^{1,2,3} Although clinical symptoms may suggest hypothyroidism, they usually are not specific, which can only be confirmed by laboratory assessments of thyroid function. Hypothyroidism may be associated with either a decrease or an increase in thyroid size (Goiter). Some patients will present with obvious symptoms of hypothyroidism and minimal changes in thyroid hormone levels, whereas others will have subtle symptoms despite markedly abnormal thyroid function.^{1,2,3}

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Because of the wide-ranging physiologic effects of thyroid hormones, hypothyroidism can have profound detrimental effects on numerous organ systems. In very young infants, hypothyroidism can result in irreversible mental retardation and slowed physical growth unless thyroid hormone replacement therapy is initiated within weeks after birth. This has led to the routine testing for congenital hypothyroidism in newborn infants. In most patients, primary hypothyroidism can be confirmed by appropriate laboratory tests and subsequently treated with thyroid hormone replacement therapy.^{1,2,3} Unusual presentations of acute hypothyroidism often go unrecognized and delay the onset of effective therapy.² In the iodine efficient areas like the United States, hypothyroidism is seen in 1-8% of the general population; but in iodine deficient areas its prevalence is 10-20 folds more.²

Annual incidence of autoimmune hypothyroidism is 4 in 1000 in female and 1 in 1000 in male. Its prevalence rises after 60 years-old and approaches to 6-7%. Generally, one male suffers from hypothyroidism in contrast to 5-10 females.² In iodine-replete areas, autoimmune thyroid disease and thyroablative therapy are the major reasons of hypothyroidism. Even in children and adolescents autoimmune thyroiditis is the commonest cause of non-endemic thyromegaly and acquired hypothyroidism.⁴ However, worldwide, iodine deficiency is the leading cause.⁵

One study suggested that the presentation of hypothyroidism is altered in the elderly in comparison with young patients because there are fewer signs or symptoms and diminished frequency of some classical signs.⁶ However; clinical features vary significantly among different populations owing to their climate, education status and awareness about the disease. The presentation of hypothyroidism is non-specific and high degree of suspicion is required for its early diagnosis.³

The frequency of hypothyroidism, goiters, and thyroid nodules increases with age. Hypothyroidism is most prevalent in elderly populations, with 2% to as much as 20% of older age groups having some form of hypothyroidism. The Framingham study found hypothyroidism (TSH >10 mIU/L) in 5.9% of women and 2.4% of men older than 60 years.⁷ In NHANES 1999-2002, the odds of having hypothyroidism were 5 times greater in persons aged 80 years and older than in individuals aged 12-49 years.⁸

Materials and methods

This cross-sectional study was conducted in the Department of Medicine, Comilla Medical College & Hospital, Comilla, over a period of six months (From December 2010 to June 2011). The study aimed to evaluate the clinical presentation of hypothyroidism. The sample size was determined using the cross-sectional sample size determination formula ($n = (z^2PQ/d^2)$), considering a 3% margin of error and a prevalence of 15% in a hospital-based setting. After adding a 10% non-response rate, a total of 63 subjects were targeted. Purposive sampling technique was employed to select the study participants.

Newly diagnosed hypothyroid patients of both sexes aged 12–60 years, confirmed clinically and biochemically, were included in the study. Patients who were unwilling to participate, refused investigations, or were already receiving thyroxine replacement therapy were excluded. Data were collected using a predesigned structured questionnaire that included demographic information and clinical features. Written informed consent was obtained from all enrolled patients prior to participation.

All collected data were recorded systematically, entered into a computer, and analyzed using SPSS version 16. The results were presented in tabulated form and inferences were drawn based on descriptive analysis of the compiled data.

Results

This cross-sectional study was conducted in a tertiary-level hospital in Bangladesh. Total 50 patients were recruited according to the inclusion criteria and up on fulfilling the informed written consent form.

Table I Sociodemographic characteristics of the patients (n=50)

Age group (In years)	Number of patients	Percentage
12 – 20	10	20
21 – 30	8	16
31 – 40	7	14
41 – 50	20	40
51-60	5	10
Gender		
Male	7	14
Female	43	86
Residence		
Rural	32	64
Urban	18	36
Marital status		
Married	32	62
Unmarried	18	36

In this study, the highest age incidence of hypothyroidism was observed in the 4th to 5th decades of life (40%). Five patients (10%) were older than 50 years, while twenty patients belonged to the 12–20 years age group, indicating early presentation. Among the hypothyroid patients, 14% were male and 86% were female and all were admitted to the medicine ward during the study period. A higher proportion of cases was found among rural residents (64%). Additionally, thirty-two patients (62%) were married.

Table II Common Symptoms of Hypothyroidism (n=50)

Type of sensations of Hypothyroid patients		
Increased sensations of	Number of patients	Percentage
Cold	28	56
Normal	22	44
Appetite changes of Hypothyroid patients		
Appetite changes†	Number of patients	Percentage
Decreased	26	52
Normal	24	48
Lethargy among hypothyroid patients		
Lethargy	Number of patients	Percentage
Present	31	62
Absent	19	38
Menstrual abnormality of premenopausal female of hypothyroid patients		
Menorrhagia	Number of patients	Percentage
Present	2	18.18
Absent	9	81.82

Cold intolerance was observed in 56% of hypothyroid patients. Regarding appetite, 48% of patients had a normal appetite, while 52% experienced decreased appetite. Lethargy was reported by 62% of the patients. Among the 11 premenopausal female participants, menstrual abnormalities were also assessed and 18.18% of them presented with menorrhagia.

Table III Common Signs of Hypothyroidism

	Present	Absent
Increased Wt	56%	44%
Slow Tendon Reflexes	58%	42%
Edema	48%	52%
Puffiness of Face	56%	44%
Bradycardia	36%	64%
Goitre	20%	80%
hypertension	30%	70%
Ascities	8%	92%
vitaligo	4%	96%

The Table shows the common signs of hypothyroidism. The clinical signs were categorized according to their frequency in the study population. The most common signs (>50%) were slow tendon reflexes (58%) increased weight (56%) and puffiness of the face (56%). Moderately common signs (20–50%) included edema (48%) bradycardia (36%) hypertension (30%) and goitre (20%). Rare signs (<10%) were ascites (8%) and vitiligo (4%). These findings indicate that neuromuscular slowing, weight gain and facial puffiness were the predominant clinical features, while ascites and vitiligo were uncommon presentations in this group.

Discussion

In the adult, the onset of hypothyroidism is usually so insidious that typical manifestation may take month or year to appear and go unnoticed by family and friends.⁹ So scale for assessment of clinical symptoms suggesting hypothyroidism is required for earlier identification of hypothyroidism.¹⁰

One study suggested that presentation of hypothyroidism is altered in the elderly in comparison with young patient because there are fewer signs or symptoms and diminished frequency of some classical sign. However, clinical features vary significantly among different population owing to their climate, educational status and awareness about the disease.

In the other study most sufferers were in the 3rd and 4th decade of life, but in our study, it was seen in the 4th and 5th decade of life.

The female-to-male ratio in hypothyroidism ranges from 2:1 to 8:1 in various epidemiological surveys. In a survey of 2,779 persons carried out in County Durham, England, hypothyroidism was detected in 1.9% of women and was overt in 1.4%. The prevalence in men was less than 0.1 percent. Recent surveys indicate hypothyroidism to be more prevalent in the elderly population, reaching as high as 20%. A study of the Framingham population showed that 5.9% of the women and 2.4% of men above the age of sixty had serum TSH levels more than 10mU/L, but in our study shows male and female ration 1:6 which almost nearer to other study. it has been suggested that sex hormone has important role in the autoimmune hypothyroidism.^{11,12,13}

In other study among hypothyroid patient relationship with marital status, residence and menorrhagic abnormality was 56%, 58%, 10% respectively, but in our study 62% married, 64% rural residence, 18% menorrhagic patient are affected.

The signs of hypothyroidism as elicited by the physicians were more specific and helpful in identification of hypothyroid patients. These comprised of skin changes (Dry coarse skin and coarse hair) obese or fat appearance, facial oedema, non-pitting peripheral oedema.

Among hypothyroid patient in Murray's, Lermann's, Watanakunakorn's study ankle reflexes 77%, dry skin 76%, lethargy 90%, cold intolerance 64%, puffiness of face 60%, bradycardia 58%, constipation 48%, weight gain 56%, cold skin 50%, paresthesia 52%.¹⁴

In our study lethargy 62%, delayed ankle reflexes 58%, dry skin 56%, cold intolerance 56%, weight gain 56%, puffiness of face 55%, appetite 52%, bradycardia 34%, constipation 52%, oedema 48% and goiter 20%.

When we compare our study to already available data on this subject, we come across some very interesting observations. We realize that most of the signs and symptoms have the same trend though the prevalence might be different. For example, lethargy has been reported as one of the commonest symptoms of hypothyroidism with a prevalence of 90% Murray's, Lermann's, Watanakunakorn's study.^{15,16,10}

In our study too, lethargy was mentioned by 62% of the cases and was the most prevalent feature. Similarly, cold intolerance that was found in 56% of the Lermann's Murray's, Watanakunakorn's series and 64% of the was prevalent in our study.^{15,16,10} While skin changes like dry, coarse skin, hoarseness and hair-loss were almost similar in our study what has been described in the literature. In the other hand, constipation, weight gain, oedema of the face and non-pitting peripheral oedema, had some comparable prevalence to all the studies. Slow relaxation of ankle reflexes was found in 58% of our population as compared to the 77% in literature. This was a subjective measurement and the results could be subjected to error.

Most of the information that we get about the clinical manifestations of hypothyroidism is from literature of the western countries. Their level of education, awareness about the diseases and health care facilities are quite different from ours. The climate and cultural norms are also very dissimilar. The pathophysiology of the disease always remains the same, but the perception of symptoms, their recognition and expression differ in every population as governed by the above mentioned determinants.

Hence, there is a need for every community to define the expression and prevalence of their common disorders in order to recognize them early and correctly. The diagnosis of hypothyroidism may be overlooked for several years because of the insidious and non-specific nature of symptoms that further complicates the detection of hypothyroidism. Therefore, it is very critical to have a high degree of suspicion in assessing the patients having such a vague presentation. The importance of clinical picture cannot be stressed more; however, a support from laboratory investigations should be sought whenever and wherever required.

Limitations

This is a hospital-based study. For better evaluation of clinical features of hypothyroidism community-based study is warranted. Moreover, due fund constrains and time limitation, the current study could recruit not more than 50 subjects.

Conclusion

The presentation of hypothyroidism is non-specific and high degree of suspicion is required for its early diagnosis. In the present study, common signs and symptoms of hypothyroidism were different compared with other studies. It seems that the socio-demographic and nutritional behaviors are among the probable causes. A significant difference in this study was that the age of patients was in the higher range compared to the other studies and symptoms of lethargy, delayed ankle reflexes slight comparable; suggesting that some environmental factors and different ethnicities may have a role in these findings. A large-scale study is needed to reveal the actual situation regarding etiology and prompt management to reach a favorable outcome in our country.

Recommendation

To determine the maximum clinical features among hypothyroid patients of Bangladesh, a well-designed, of larger sample size and community-based or multi-centered prevalence survey will be needed, requiring a huge fund and resources, including skilled personnel.

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Disclosure

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Beyond Motherhood: Exploring Sociodemographic Vulnerabilities and Well-being among Pregnant and Postpartum Women in Chattogram

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Abstract

Background: Maternal health is strongly influenced by sociodemographic and contextual factors during pregnancy and the postpartum period. Understanding these determinants is essential for identifying vulnerable groups and improving maternal wellbeing, particularly in low- and middle-income settings. This study aimed to examine the sociodemographic characteristics and associated factors among pregnant and postpartum women in Chattogram, Bangladesh.

Materials and methods: A cross-sectional study was conducted among 508 maternal women recruited from Chattogram Maa-O-Shishu Hospital in Chattogram, Bangladesh. Data were collected on key sociodemographic and reproductive variables. Descriptive statistics and Chi-square tests were used to assess associations between maternal stage (Trimester vs postpartum) and sociodemographic variables.

Results: The mean age of participants was 26.28 years (SD $\pm$ 4.53). Most participants were in the postpartum stage, had planned pregnancies and reported good support systems. Significant associations were found between maternal stage and planned pregnancy, support system, sleep

quality, employment status, socioeconomic status, and domestic violence exposure. No significant associations were found for physical health condition and access to healthcare. Additionally, socioeconomic status was significantly associated with domestic violence, support system was strongly associated with sleep quality and education was significantly related to employment status.

Conclusion: The findings highlight that postpartum women are comparatively more vulnerable to adverse sociodemographic conditions, particularly regarding sleep quality, support systems and exposure to domestic violence. Socioeconomic status, education, and social support emerged as key determinants of maternal wellbeing. Targeted interventions addressing these factors are essential to improve maternal health outcomes in Bangladesh.

Key words: Maternal health; Postpartum women; Sociodemographic factors; Bangladesh.

Introduction

Maternal health remains a critical public health concern globally, particularly in low- and middle-income countries where women often face multiple socioeconomic and structural challenges during pregnancy and the postpartum period.^{1,2} The perinatal phase, encompassing both pregnancy and the postpartum period, is characterized by profound biological, psychological, and social changes that significantly influence women's overall wellbeing.³ While considerable attention has been given to maternal mortality and clinical outcomes, there is growing recognition of the importance of understanding the broader sociodemographic context in which maternal health is embedded.

Sociodemographic factors such as age, education, employment status and Socioeconomic Status (SES) play a crucial role in shaping maternal

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experiences and health outcomes. Previous research has consistently shown that lower SES is associated with reduced access to healthcare, increased exposure to stressors, and poorer health outcomes among women.⁴ In developing countries like Bangladesh, socioeconomic disparities remain pronounced, often limiting women's autonomy and decision-making capacity regarding healthcare utilization.^{5,6} Among the various social determinants, social support has been identified as a key protective factor during the perinatal period. Strong support systems from family members, partners, and the community can buffer the adverse effects of stress and improve both physical and psychological wellbeing.⁷ Conversely, inadequate support has been linked to poor sleep quality, increased stress, and adverse maternal outcomes.^{8,9} Sleep quality itself is an important yet often overlooked aspect of maternal health, with studies indicating that sleep disturbances are common during both pregnancy and the postpartum period due to physiological changes and caregiving demands.¹⁰

Another critical issue affecting maternal wellbeing is exposure to domestic violence. Intimate Partner Violence (IPV) during pregnancy and postpartum has been recognized as a major public health concern, with significant implications for both maternal and child health.¹¹ Evidence suggests that women from lower socioeconomic backgrounds are at higher risk of experiencing violence, highlighting the intersection between economic vulnerability and gender-based risks.¹² Despite its importance, domestic violence remains underreported in many settings due to stigma and fear, particularly in conservative societies.

The postpartum period, in particular, is often associated with increased vulnerability due to the combined effects of physical recovery, caregiving responsibilities and social adjustments. Research indicates that women in the postpartum phase may experience higher levels of stress, reduced support and greater risk of adverse outcomes compared to pregnant women.¹³ However, evidence from Bangladesh and similar contexts remains limited, especially regarding the interplay of sociodemographic factors during this critical period.

Despite the growing body of literature on maternal health, most studies have focused on clinical or psychological outcomes, with comparatively less

attention given to the comprehensive sociodemographic profile and its associated factors. Understanding these patterns is essential for identifying vulnerable groups and designing targeted interventions. Therefore, the present study aims to examine the sociodemographic characteristics and associated factors among pregnant and postpartum women in Chattogram, Bangladesh. By exploring the relationships between maternal stage and key sociodemographic variables, this study seeks to provide insights into the social and contextual determinants that shape maternal experiences in a resource-limited setting.

Materials and methods

A cross-sectional study design was employed to explore the sociodemographic characteristics and associated factors among pregnant and postpartum women. The study was conducted at Chattogram Maa-O-Shishu Hospital in Chattogram, Bangladesh from January 2025 to December 2025. A total of 508 maternal women participated in the study. Participants included both pregnant (Trimester) and postpartum women. Convenience sampling was used to recruit respondents who met the inclusion criteria and provided informed consent. A structured questionnaire was used to collect data on sociodemographic and reproductive health-related variables. The following variables were included: age, maternal stage, parity, pregnancy planning status, social support system, sleep quality, educational level, employment status, socioeconomic status, previous pregnancy loss, physical health condition and domestic violence exposure, access to healthcare. All variables were categorized and coded for statistical analysis.

Data were analyzed using SPSS software. Descriptive statistics (Frequency, percentage, mean and standard deviation) were used to summarize participant characteristics. To examine associations between maternal stage (Trimester vs postpartum) and sociodemographic variables, Chi-square (χ^2) tests were conducted. Cramer's V was used to assess the strength of associations. Additionally, Chi-square tests were applied to explore relationships among sociodemographic variables. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 508 maternal women participated in the study. Sociodemographic characteristics are presented in Table I. The mean age was 26.28 years

(SD $\pm$ 4.53) ranging from early to late reproductive age. Most participants were in the postpartum period (61.2%) while 38.8% were in the trimester stage. More than half were primiparous (52.0%) followed by parity two (32.7%) parity three (13.6%) and a small proportion with four or more children (1.8%). The majority of pregnancies were planned (84.6%). Most women reported a good support system (95.5%). Sleep quality was mainly average (58.5%) followed by good (24.2%) and poor (17.3%). Regarding education, over half had secondary education (53.0%) followed by higher (23.8%) and primary education (22.8%) while only 0.4% had no formal education. Most participants were unemployed (87.0%) and belonged to middle socioeconomic status (74.0%). Previous pregnancy loss was reported by 21.7% of women. Most participants reported good physical health (89.2%) and good access to healthcare (95.9%) while domestic violence exposure was reported by 3.5%.

Table I Sociodemographic Characteristics of Participants (n = 508)

Variable	Category	n	%
Age (Years)	Mean $\pm$ SD	26.28 $\pm$ 4.53	
Maternal Stage	Trimester/Pregnancy	197	38.8
	Postpartum	311	61.2
Parity	1	264	52.0
	2	166	32.7
	3	69	13.6
	≥ 4	9	1.8
Planned Pregnancy	Yes	430	84.6
	No	78	15.4
Support System	Good	485	95.5
	Poor	23	4.5
Sleep Quality	Poor	88	17.3
	Average	297	58.5
	Good	123	24.2
Education	None	2	0.4
	Primary	116	22.8
	Secondary	269	53.0
	Higher	121	23.8
Employment	Employed	66	13.0
	Unemployed	442	87.0
SES	Low	27	5.3
	Middle	376	74.0
	High	105	20.7
Previous Pregnancy Loss	Yes	110	21.7
	No	398	78.3
Physical Health	Good	453	89.2
	Poor	55	10.8
Domestic Violence	Yes	18	3.5
	No	490	96.5
Healthcare Access	Good	487	95.9
	Poor	21	4.1

Chi-square analysis revealed several significant associations between maternal stage and sociodemographic variables (Table II). Pregnancy planning was significantly associated with maternal stage ($\chi^2 = 5.46$, $p = .019$) with a higher proportion of unplanned pregnancies among postpartum women (18.3%) compared to trimester women (10.7%). A significant association was also found for support system ($\chi^2 = 4.64$, $p = .031$) where postpartum women reported slightly poorer support. Sleep quality differed significantly between groups ($\chi^2 = 6.98$, $p = .030$) with higher rates of poor sleep among postpartum women (19.9%) than trimester women (13.2%). Employment status was strongly associated with maternal stage ($\chi^2 = 11.64$, $p = .001$) indicating higher employment among postpartum women. Socioeconomic status also showed a significant association ($\chi^2 = 9.97$, $p = .007$) with postpartum women more represented in higher SES groups. Domestic violence exposure was significantly associated with maternal stage ($\chi^2 = 11.82$, $p = .001$) with all reported cases occurring in the postpartum group, indicating higher vulnerability in this stage. In contrast, no significant associations were observed for physical health condition ($p = .118$) or access to healthcare ($p = .191$). Overall, effect sizes were small to moderate (Cramer's $V = .096-.153$) suggesting modest associations despite statistical significance.

Table II Association Between Maternal Stage and Sociodemographic Factors

Variable	χ^2	df	p-value	Cramer's V
Planned Pregnancy	5.46	1	.019	.104
Support System	4.64	1	.031	.096
Sleep Quality	6.98	2	.030	.117
Employment Status	11.64	1	.001	.151
Socioeconomic Status	9.97	2	.007	.140
Domestic Violence	11.82	1	.001	.153
Physical Health	2.44	1	.118	.069
Healthcare Access	1.71	1	.191	.058

Note: χ^2 = Chi-square test statistic, df = degrees of freedom, p-value indicates statistical significance ($p < 0.05$) Cramer's V indicates the strength of association.

Further analysis revealed significant interrelationships among key sociodemographic factors (Table III).

Socioeconomic status was significantly associated with domestic violence exposure ($\chi^2=10.99$, $p=.004$). Women from lower socioeconomic backgrounds reported disproportionately higher rates of domestic violence compared to those from middle and high SES groups, highlighting economic vulnerability as a critical risk factor. A strong and highly significant association was observed between support system and sleep quality ($\chi^2 = 21.74$, $p < .001$, Cramer's $V = .207$). Women reporting poor social support were significantly more likely to experience poor sleep quality, indicating the protective role of social support in maternal wellbeing. Socioeconomic status was also significantly associated with access to healthcare ($\chi^2 = 6.06$, $p = .048$). Women from higher SES groups reported better access to healthcare services, whereas poorer groups faced comparatively limited access.

Table III Interrelationship Among Sociodemographic Variables

Variables	χ^2	df	p-value	Cramer's V
SES × Domestic Violence	10.99	2	.004	.147
Support System × Sleep Quality	21.74	2	.000	.207
SES × Healthcare Access	6.06	2	.048	.109

Discussion

The present study aimed to examine the sociodemographic characteristics and associated factors among pregnant and postpartum women in Chattogram. The findings revealed several important patterns related to maternal stage, socioeconomic factors and social support systems, which have significant implications for maternal health and wellbeing.

One of the key findings of this study is that postpartum women appeared to be more vulnerable across several sociodemographic dimensions compared to pregnant women. Specifically, postpartum participants reported higher rates of unplanned pregnancy, poorer support systems, poorer sleep quality, and exclusive exposure to domestic violence. This finding is consistent with previous research indicating that the postpartum period is a critical phase characterized by increased psychological, physical, and social challenges.³ The transition to motherhood often brings new responsibilities, sleep disruption and role strain, which may explain the

observed differences in sleep quality and perceived support. Moreover, the increased reporting of domestic violence in the postpartum group aligns with global evidence suggesting that intimate partner violence may escalate during or after pregnancy.¹⁴

Socioeconomic status emerged as an important determinant in this study. Women from lower socioeconomic backgrounds reported significantly higher exposure to domestic violence, which is in line with prior studies conducted in low- and middle-income countries.¹⁵ Financial stress, dependency and limited access to resources may increase vulnerability to abusive relationships.

Furthermore, higher socioeconomic status was associated with better access to healthcare services. This finding supports existing literature suggesting that economic resources play a crucial role in enabling healthcare utilization, especially in developing country contexts.¹⁶ Women from higher SES groups may have better awareness, affordability and autonomy in seeking healthcare services.

The study also highlights the critical role of social support in maternal wellbeing. A strong association was observed between support systems and sleep quality, where poor support increased poor sleep significantly. This is consistent with previous findings that social support acts as a protective factor against stress and improves both physical and psychological outcomes during the perinatal period.¹⁷ Social support may buffer the negative effects of stress and facilitate better coping mechanisms, thereby improving sleep quality and overall wellbeing. Conversely, lack of support may lead to emotional distress, increased burden and sleep disturbances.

Recommendation

The findings of this study have important practical implications. Firstly, postpartum women should be considered a high-risk group and targeted for additional support services. Secondly, interventions aimed at improving social support systems and addressing domestic violence are essential for enhancing maternal wellbeing. Additionally, policies focusing on improving socioeconomic conditions and educational opportunities may have long-term benefits for maternal health outcomes.

Limitations

This study has several strengths, including a relatively large sample size ($n = 508$) and comprehensive coverage of key sociodemographic variables. However, some limitations should be noted. First, the cross-sectional design limits causal interpretation. Second, the reliance on self-reported data may introduce reporting bias, particularly for sensitive issues such as domestic violence. Third, the absence of psychological outcome variables restricts the ability to examine direct mental health impacts.

Conclusion

In conclusion, the study demonstrates that postpartum women in Chattogram are comparatively more vulnerable in terms of social and contextual factors. Socioeconomic status, social support and education play critical roles in shaping maternal experiences. Addressing these factors through targeted interventions and policy initiatives is essential for improving maternal health and wellbeing in Bangladesh.

Disclosure

All the authors declared no conflict of interest.

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Gender Related Variation in Learning Outcomes and Satisfaction Following Quiz- Based Learning among Medical Undergraduates

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Abstract

Background: Quiz-based teaching is a method of teaching and learning that provides education with entertainment. It has been widely used in recent years in complementing learning among medical undergraduates. Learners of different genders are found to have better learning achievement through game-based learning. This study aims to analyze gender related variation in learning outcomes and satisfaction following quiz-based learning among medical undergraduates.

Materials and methods: An experimental study was conducted among 126 first-year medical students of two medical colleges in Chattogram, Bangladesh. Students were randomly allocated into two groups: experimental and control groups. Traditional Lecture-Based Learning (TLBL) was used for teaching selected topics in the control group, and the quiz-Based Learning (QBL) method was used in the experimental group. Just after implementing two teaching methods, students in both groups were given a post-intervention test to measure their knowledge achievement. A retention test was arranged after two weeks to assess the students' retention of knowledge. They were also given a questionnaire to measure their satisfaction in both groups. Pre- test score, post-

test score, retention test score and satisfaction score were analyzed in male and female between two groups using independent sample t-test.

Results: Among male students, no statistically significant difference was observed in pre-test score between experimental and control group but the post-test scores, retention-test scores and satisfaction scores were significantly higher in experimental group. Among female students, there was no statistically significant difference in pre-test score, post-test score and retention-test score between experimental and control group but the difference in satisfaction score was statistically significant. The use of quiz in this study receives positive response from learners regardless of gender.

Conclusion: This study suggests quiz-based learning was associated with improved knowledge achievement, retention and student satisfaction compared with traditional lecture-based learning.

Key words: Gender variation; Medical undergraduates; Quiz-based teaching; Traditional lecture-based learning.

Introduction

Learning in the new era capitalizes on the use of new strategy to attract students in gaining new knowledge and achieve better learning outcomes. Among these strategies, game or quiz act as a medium that offers entertainment in learning. The incorporation of games in the learning content facilitates the utilization of knowledge intended to be learned and increase the depth of understanding in this content. The impact of quiz-based teaching lies in triggering students' intrinsic motivation and interaction.¹

Genders can have varying effects on academic performance with studies showing mixed result. This difference may be influenced by other factors like parental education, teaching methodologies and individual motivation which can be more influential than gender itself.²

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The interactive teaching methodology has been appreciated in medical colleges because it provides the concepts related to the functional mechanism of different organ systems.³ This method assists in deep learning in interactive way and promotes achievement of knowledge. The primary objective of this innovative teaching and learning approach is to stimulate students' curiosity about new information.^{3,4,5} The traditional lecture alone is a poor method of transferring information without active engagement of students. To make the medical subjects interesting, it is important to implement interesting method for teaching and learning.³

Quiz-based learning emphasizes on engagement and learning, which influences the motivation and learning achievements of learners. Prensky pointed out that the game-based learning involves high engagement of learners.⁶ Gender difference is further accentuated in these types of learning situations. Current researches on gender differences in quiz-based learning primarily focused on the preferences of quiz-types and comparison of learning methods.¹ Studies have shown that different genders prefer different game achievement goals which affect learning outcomes. Few studies have analyzed the motivation and learning achievements in relation to learning and engagement.¹ Many researchers suggested that game or quiz had a good impact on learning and it helped the students to gain knowledge.^{3,4,7,8,9} Although quiz -based learning has an important role to improve learning outcome by motivating students, there is still a lack of effective guideline on using quiz in educational context.¹⁰ Therefore, this study was conducted with the aim to analyze the impact of gender on learning achievements and satisfaction by looking at the relationship between engagement in quiz and learning.

Materials and methods

This experimental study was carried out from January 2024 to December 2024 in the Department of Physiology, Chittagong Medical College and Institute of Applied Health Science, Chattogram, Bangladesh. Stratified random sampling was done to select 126 students from both institute (CMC: 80 students and IAHS:46). Information regarding demographic information, general health and history of present and past illness was taken from study subjects by

interviewing. Information was recorded in data collection form and an ID number was given to each subject.

The selected topic of discussion was announced two weeks in advance. Participants were instructed to gain knowledge regarding the topic from textbook and also from internet. Before implementation of quiz-based learning and lecture method, a pre-intervention test was conducted to measure their baseline level of knowledge in selected topic.

Based on the learning and teaching method, participants were randomly divided into experimental and control group by lottery. Quiz-based teaching was implemented to experimental group and traditional lecture-based teaching was delivered to control group.

Students assigned to the quiz -based learning were divided into 5 sub-groups. The rules of this teaching method were explained to them.

There were four sessions in quiz -based learning: MCQ round, explanatory type round, rapid fire round and image-based round.^{3,11,12}

In MCQ round, 5 MCQ questions (one for each team) were shown in power point projector in the classroom and they had to answer each question verbally in 2 minutes.

In explanatory type round, there were explanatory and applied type questions in paper chit in two different bowls. One student from each team picked up two paper chits from two different bowls and other students of that team explained these 2 questions in 2 minutes.

In rapid fire round, 10 short answer type questions were shown in the power point projector for each team and they had to answer the questions verbally in 2 minutes.

In image-based round, 5 image-based questions included figures, diagrams and applied aspects were shown in power point projector. Each question had to be answered verbally in one minute.

At the end, the team with the highest score received a token gift.

At the same day, students assigned to traditional lecture group received a lecture, where a teacher delivered her lecture on the same topic of quiz -based learning. After implementation of both teaching method, a post-test was taken to assess their knowledge achievement. A retention test was arranged after two weeks to assess the students'

retention of knowledge and a satisfaction survey was done in both group by a questionnaire reflecting the attitude of the students. The questionnaire was given to the students to measure their satisfaction which was comprised of 10 statements which was marked with 5-point-likert scale (0=strongly disagree, 1=disagree, 2=neutral, 3=agree, 4=strongly agree).

After collection, data regarding pretest score, post-test score, retention test-score and satisfaction score were compiled in Microsoft Excel sheet and then they were fed into SPSS for processing and analysis. Quantitative or continuous data was expressed as mean $\pm$ Standard Deviation (SD). Independent sample 't' test was used to compare the mean of quantitative variables respectively in male and female between two groups (Experimental and control). $p \leq 0.05$ was considered statistically significant.

Results

Table I Comparison of learning outcomes and satisfaction between experimental and control group among male students

Scores	Experimental Group (Male) (n=38) Mean $\pm$ SD (Range)	Control Group (Male) (n=25) Mean $\pm$ SD (Range)	p value (t value)
Pre-test score	6.68 $\pm$ 1.18 (4.20 - 8.80)	6.41 $\pm$ 0.73 (4.80 - 7.40)	0.307 (t=1.029)
Post-test score	8.61 $\pm$ 0.74 (5.60 - 9.60)	7.82 $\pm$ 0.78 (6.20 - 9.40)	<0.001* (t=4.019)
Retention score	7.73 $\pm$ 0.82 (5.60 - 9.40)	6.77 $\pm$ 0.69 (5.20 - 8.20)	<0.001* (t=4.757)
Satisfaction score	34.34 $\pm$ 3.20 (29.00 - 40.00)	17.76 $\pm$ 9.11 (1.00 - 36.00)	<0.001* (t=10.391)

Independent sample 't' test was done to compare learning outcomes and satisfaction between experimental and control group among male students. Data were expressed as mean $\pm$ SD. Values in parenthesis indicate ranges. SD: Standard Deviation, n= number of subjects in each

group, Experimental group: Received quiz- based learning, Control group: Received traditional lecture-based learning. *This depicts comparison between groups. * $p < 0.05$.

Table I shows there was no statistically significant difference ($p=0.307$) in pre-test score between experimental and control group among male students but the post-test scores, retention-test scores and satisfaction-scores were significantly higher ($p < 0.05$) in experimental than control group among male students.

Table II Comparison of learning outcomes and satisfaction between experimental and control group among female students

Scores	Experimental Group (Female) (n=25) Mean $\pm$ SD (Range)	Control Group (Female) (n=38) Mean $\pm$ SD (Range)	p value (t value)
Pre-test score	6.63 $\pm$ 0.93 (4.40 - 8.00)	6.64 $\pm$ 1.04 (4.00 - 9.20)	0.985 (t=0.019)
Post-test score	8.04 $\pm$ 0.61 (6.80 - 9.00)	7.98 $\pm$ 0.74 (5.20 - 9.20)	0.756 (t=0.313)
Retention score	7.47 $\pm$ 0.96 (5.80 - 9.00)	7.31 $\pm$ 0.87 (5.20 - 9.00)	0.512 (t=0.660)
Satisfaction score	32.13 $\pm$ 4.34 (25.00 - 40.00)	16.39 $\pm$ 8.44 (2.00 - 36.00)	<0.001* (t=8.85)

Independent sample 't' test was done to compare learning outcomes and satisfaction between experimental and control group among female students. Data were expressed as mean $\pm$ SD. Values in parenthesis indicate ranges. SD: Standard Deviation, n= number of subjects in each group, Experimental group: Received quiz-based learning, Control group: Received traditional lecture-based learning. *This depicts comparison between groups. * $p < 0.05$.

Table II shows there was no statistically significant difference in pre-test score ($p=0.985$) post- test score ($p=0.756$) and retention-test score ($p=0.512$) among female students between experimental and control group but the difference in satisfaction score between experimental and control group among female students was statistically significant ($p < 0.001$).

Table III Comparison of learning outcomes and satisfaction between male and female in experimental group

Scores	Male (n=38)	Female (n=25)	p value
Pre-test score	6.68 ± 1.18	6.63 ± 0.93	0.867
	(4.20 - 8.80)	(4.40 - 8.00)	(t=0.168)
Post-test score	8.61 ± 0.74	8.04 ± 0.61	0.002*
	(5.60 - 9.60)	(6.80 - 9.00)	(t=3.198)
Retention score	7.73 ± 0.82	7.47 ± 0.96	0.262
	(5.60 - 9.40)	(5.80 - 9.00)	(t=1.132)
Satisfaction score	34.34 ± 3.20	32.13 ± 4.34	0.028*
	(29.00 - 40.00)	(25.00 - 40.00)	(t=2.256)

Independent sample t-test was done to compare learning outcomes and satisfaction between male and female in experimental group. Data were expressed as mean ± SD. Values in parenthesis indicate ranges. SD: Standard Deviation, n= number of subjects in each group, Experimental group: Received quiz-based learning, Control group: Received traditional lecture-based learning. *This depicts comparison between groups. *p<0.05.

Table III shows there was no statistically significant difference in pre-test score (p=0.867) and retention-test score (p=0.262) between male and female students in experimental group but the post-test scores and satisfaction scores were significantly higher (p<0.05) in male than female students in that group.

Discussion

This study compared the effect of two teaching strategies-lecture and quiz-based learning among medical undergraduate of both genders. Analysis of different scores among male students showed no significant difference in pre-test score between experimental and control group which suggests similar baseline knowledge in boys of both groups, but significant higher post-test score, retention-test score and satisfaction score in experimental male students suggests male students learned better by quiz -based teaching-learning method (Table I). On contrary, among female students, mean of pre-test score, post-test score and retention-test score is higher in experimental group than control, but it is not statistically significant suggesting similar impact of both teaching method on female students' further learning of the topic (Table II).

On the other hand, higher satisfaction score in experimental group compared to control group in females demonstrated similar attitude to QBL as male students. This dissimilarities between male & female in post-test scores and retention scores suggest that game- based learning may be more interesting and more effective for male students' learning. This result is consistent with other study in which the male students had slightly higher scores in academic performance compared to the female counterparts.² In another study, researcher found there was no significant association between gender with higher or lower post-test scores.⁸ According to our assessment, significantly higher post-test scores of the experimental group than the control group in both genders indicating greater effect of QBL on their knowledge achievement (Table I & II). From our findings, it can be observed that male learners were found to exhibit a higher preference and motivation for quiz-based learning and have better engagement and learning performance compared to female learners (Table III). Previous studies have shown that the setting of achievement goals affects the performance of learners of different genders, in which higher achievement goals produces better learning performance. Male learners tend to set a higher achievement goal in quiz-based learning than females, hence they tend to have a better learning achievement. The differences of receiving and processing information by learners of different genders affect their learning outcomes in a game-based learning environment¹. The post test scores reflecting immediate knowledge achievement by quiz-based learning is significantly higher in male than female but in case of retention of knowledge, there is nonsignificant difference between both genders (Table III). This may be due to quiz -based learning strategy enhance cognitive level of medical students and also help them to retain academic content. However, quiz-based learning produces better learning outcomes regardless of learners' gender (Table I & II). Similar to the findings in previous studies, learners in the game-based course were found to perform significantly better in the post-test than their counterparts in the traditional lecture-based course^{4,5,8} The integration of games with educational content makes knowledge and learning fun, challenging, yet achievable.⁶ The multimedia environment created by games also

provides diverse learning resources, which enrich the learning contents and raise learning effectiveness.¹ The quiz specially designed for this study provides the students an interactive session which helped them in strengthening their knowledge and application of this knowledge through a series of game contents. Learning can be made enjoyable through quiz-based learning, which can inspire the students to enrich their knowledge.¹³

Limitation

- This study was conducted with small sample size.
- This study was conducted only in two medical colleges. This might not be a proper representation of the total population of Bangladeshi medical undergraduates.

Conclusion

This study examines the impact of gender on quiz - based learning from the relationship of learning and engagement. From the results of this study, it can be concluded that quiz - based learning may be more interesting and effective for male students as there is significant differences in the immediate learning achievement between genders but better retention of knowledge is observed in both genders. The results showed that the quiz delivers high engagement and interactivity for both male and female learners. This high learning engagement leads to better academic performance in learners of both genders.

Disclosure

All the authors declared no conflict of interest.

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Frequency of Primary Aldosteronism among Hypertensive Patients Attending a Tertiary Care Hospital in Bangladesh

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Abstract

Background: Primary Aldosteronism (PA) is the most common treatable cause of secondary HTN, but it is largely underdiagnosed in most parts of the world, including Bangladesh. This study tries to determine the frequency of PA in Bangladesh Medical University (BMU) a tertiary care hospital in Bangladesh, which might be helpful in the future management of this group of hypertensive patients. To determine the frequency of Primary Aldosteronism among hypertensive patients attending a tertiary care hospital of Bangladesh (BMU).

Materials and methods: This cross-sectional observational study was conducted at Endocrine Hypertension Clinic, Department of Endocrinology, BMU. All hypertensive patients 18 years and above were assessed in Endocrine Hypertension Clinic. Following withdrawal from all the interfering medications, non-interfering medication were prescribed and patients were screened using ARR >50pmol/mU and diagnosis was confirmed or excluded by an intravenous saline infusion test using PAC 4-hour-SST >170pmol/l as per Endocrine Society guidelines.

Results: A total of 314 patients were interviewed, out of which 104 patients attended the Endocrine hypertension clinic and underwent screening test with ARR. Among these patients, 44 patients were found to be screen negative while 60 were found to

be screen positive. The screen-positive patients were challenged with the SST and based on PAC 4-hour-SST >170pmol/l, 34 patients were biochemically confirmed as having PA, and the remaining 70 were found to be non-PA hypertensive subjects. These non-PA subjects included 44 ARR negative patients and 26 SST negative patients. So, the frequency rate of PA at our tertiary care hospital was 32.6%.

Conclusion: The frequency of PA among hypertension patients attending the Endocrine hypertension clinic in BMU was 32.6%, which corresponds to the current international data and supports the fact it is now the most common cause of secondary hypertension. As the frequency is high, a large-scale population study should be done to detect the actual population frequency of PA among our Bangladeshi population to prevent the deleterious effect of PA.

Key words: Conn's syndrome; Frequency; Hypertension; Prevalence; Primary aldosteronism; Young hypertension.

Introduction

Primary Aldosteronism (PA) is defined by the autonomous hypersecretion of aldosterone from the adrenal cortex, which results in increased plasma aldosterone levels and suppression of renin.¹ This disorder was first identified in 1955 by Dr. Jerome Conn, who documented the case of a 34-year-old female patient suffering from resistant hypertension, low potassium levels, excessive production of aldosterone and reduced Plasma Renin Activity (PRA) all of which were associated with an aldosterone-secreting adrenal adenoma.² This autonomous aldosterone production resulted in elevated aldosterone levels despite increased sodium intake or blood volume, alongside low or suppressed renin levels. This unregulated aldosterone secretion lead to sodium retention, lower plasma renin levels, high blood pressure, damage to the cardiovascular system and

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increased potassium loss, resulting in various levels of hypokalaemia.³

Research indicates that individuals diagnosed with primary aldosteronism face a four to twelve times greater risk of experiencing myocardial infarction, stroke, coronary artery disease, arrhythmias, and lower health-related quality of life compared to those suffering from primary hypertension, regardless of their blood pressure levels.⁴ Recent investigations conducted over the past several decades demonstrate that the prevalence of primary aldosteronism varies between 4.6% and 13% among patients with uncomplicated hypertension in primary care settings, while it may reach up to 30% in individuals with treatment-resistant hypertension.^{5,3} Therefore, it is essential to conduct screenings for primary aldosteronism to enhance hypertension management and to raise public awareness about its potentially severe consequences. Primary aldosteronism stands as the most prevalent and treatable cause of secondary hypertension, yet it remains largely undiagnosed across many regions, including Bangladesh. This study aims to assess the prevalence of primary aldosteronism at Bangladesh Medical University (BMU) a tertiary care facility in Bangladesh, which will assist in the better management of this specific group of population with hypertension.

Initially, it was thought that only 1% of individuals with high blood pressure had primary aldosteronism, making it an uncommon condition. But with use of Aldosterone-Renin Ratio (ARR) as a screening test for detection of primary aldosteronism, as suggested by the Endocrine Society 2016 guideline³, the detection of primary aldosteronism has significantly increased by five to fifteen times.^{2,6} To calculate the ARR, both plasma renin activity or Direct Renin Concentration (DRC) and Plasma Aldosterone Concentration (PAC) must be measured. It has a negative predictive value of 100% and a high sensitivity range of 68% to 94%, but its specificity is only moderate.⁶ Therefore a single ARR report is not recommended for a definitive diagnosis and in order to make wise clinical decisions, it's critical to recognize the limitations of the ARR's accuracy and dependability. Figure 1 depicts the diagnostic flowchart.

The concentration of aldosterone and renin are affected by a numerous factors, including posture,

potassium levels, high dietary sodium intake, medications that suppress renin production and other conditions such as aging, renal impairment, pregnancy, renovascular hypertension and malignant hypertension.⁷ Additionally, false positive results may be observed in females during the luteal phase of the menstrual cycle in premenopausal women or when taking oral contraceptive pills.¹ These influences can cause the Aldosterone-to-Renin Ratio (ARR) to give false positive results, even when aldosterone levels are either low or within the acceptable range. Therefore, it is important to address, replace or avoid these factors before conducting the screening test.

Patients who have an aldosterone-renin ratio above 50pmol/mU underwent a confirmatory diagnostic test to confirm or exclude primary aldosteronism.

The guidelines mention four confirmatory testing procedures. These include oral sodium loading test, saline infusion test, fludrocortisone suppression test, and captopril challenge test. All these confirmatory tests indicate that aldosterone should normally be suppressed with the above interventions. However persistent aldosterone production implies autonomous renin-independent aldosteronism, thus confirming primary aldosteronism. Here we used Saline suppression test as confirmatory testing procedure and PAC-4Hr SST >170pmol/l were considered as positive for primary aldosteronism.

Hence by underwent this study, we determine the frequency of primary aldosteronism among the hypertensive patients attending the OPD in Bangladesh Medical University. We aim to establish that screening for primary aldosteronism is crucial not only for better management of hypertension but also to create mass awareness among the community to minimize its devastating effects.

Materials and methods

This cross-sectional observational study was conducted at Endocrine Hypertension Clinic, Department of Endocrinology, BMU, following approval from Institutional Review Board (IRB) during period between April 2022 to March 2025 (Reg no: 4315, Dated 11th April 2023). To avoid selection bias, all hypertensive patient aged 18 years and above were interviewed from Outpatient Department of Cardiology, Nephrology, Internal Medicine, stroke clinic and on referral basis were

referred to the clinic for further evaluation. Patients with heart failure (Grade III/IV) decompensated cirrhosis of liver, renal failure (eGFR <30ml/min/1.73m²) malignancy, pregnancy or any acute illness were excluded from the study. The patients were then recruited after taking informed written consent.

Individuals with pre-existing hypertension or newly diagnosed hypertensive individuals aged 18 and above were chosen for this research. Hypertension was identified based on two criteria: i) If the office blood pressure readings were $\geq 140/90$ mmHg during at least two separate visits within a six-month timeframe ii) if the home blood pressure measurements (Using a digital monitor) were 135/85 mmHg.⁸ Patients with complicating health issues such as confirmed secondary hypertension, significant cardiovascular problems (For example, recent heart attack, unstable heart failure, or any cardiac issues) or liver diseases (Including cirrhosis, liver cancer or any signs of liver dysfunction) were excluded from the research. Additionally, individuals with a history or current diagnosis of cancer, recent stroke, co-existing health conditions, those who are pregnant or breastfeeding, and those currently using steroids, oral contraceptives, non-steroidal anti-inflammatory drugs, or licorice were also excluded. Any medications that could interfere with the study, such as spironolactone, were discontinued four weeks prior to the evaluation, while medications such as beta-blockers, ACE inhibitors, angiotensin II receptor blockers, and dihydropyridine calcium channel blockers were halted two weeks before testing and substituted with non-interfering alternatives such as verapamil, hydralazine and prazosin. If necessary, hypokalemia were corrected.

These individuals were subsequently evaluated at the Endocrine Hypertension Clinic (EHC). A data form was used to document their medical history and clinical details, while blood samples were collected for laboratory testing. The data form contained information on demographics, clinical features, test outcomes, medications provided and the patient's clinical diagnosis. Following the Clinical Practice Guidelines set by the Endocrine Society, we noted how many criteria the patient met for additional statistical evaluation.

The cutoff level for a positive ARR was considered at ARR >50pmol/mU. The diagnosis of PA was then confirmed by an intravenous saline loading test (2 liters of 0.9% normal saline infused over 4 hours) which was considered positive if PAC 4-hour-SST >170pmol/l.

Blood samples were collected in the mid-morning (8:30-10 am) after the patient had sat, stood, or walked for at least 2 hours and then remained seated for a minimum of 5–15 minutes. PAC will be assessed through Liaison automated chemiluminescence immunoassay and LC-MS methods as well. The coefficients of variation for both intra-assay and inter-assay are 3.5% and 9.6% (At 188 pmol/l) respectively. DRC was assessed with the Liaison automated chemiluminescence immunoassay. The intra- and inter-assay variability coefficients for the PRC test are 6.6% and 10% (At 24.0 mU/l) respectively.

Version 25 of the SPSS software was used to analyze all of the data. For qualitative values, the results were expressed as frequencies or percentages, for quantitative values with a normal distribution, the results were expressed as mean ($\pm$ SD/SE). Clinical and metabolic results were used to create subgroups, which were then compared using the Chi-square test and, when appropriate, the unpaired t-test. The Mann-Whitney U test was employed to quantify group differences for continuous variables that did not have a normal distribution. Spearman or Pearson correlation are used, depending on the situation, to examine correlations between variables. To modify the impact of the factors, regression analysis was performed. A p value of less than 0.05 was deemed statistically significant.

Results

A total of 314 patients were interviewed, out of which 104 patients attended the Endocrine hypertension clinic and underwent screening tests with ARR. Among these patients, 44 (42%) were found to be screen negative, while 60 (58%) were found to be screen positive. The screen-positive patients were challenged with the SST and based on PAC 4-hour SST >170pmol/l, 34 patients were biochemically confirmed as having PA, and the remaining 70 were found to be non-PA hypertensive subjects. The non-PA subjects included 44 ARR negative patients and 26 SST negative patients as shown in Figure 2.

The study revealed 32.6% of our study population had PA, while the remaining 63% did not as illustrated in Figure 3. This is of great significance as previously it was thought that PA is a rare disorder. However it is now recognized as the most common cause of secondary HTN as demonstrated by our study and also other studies mentioned previously.

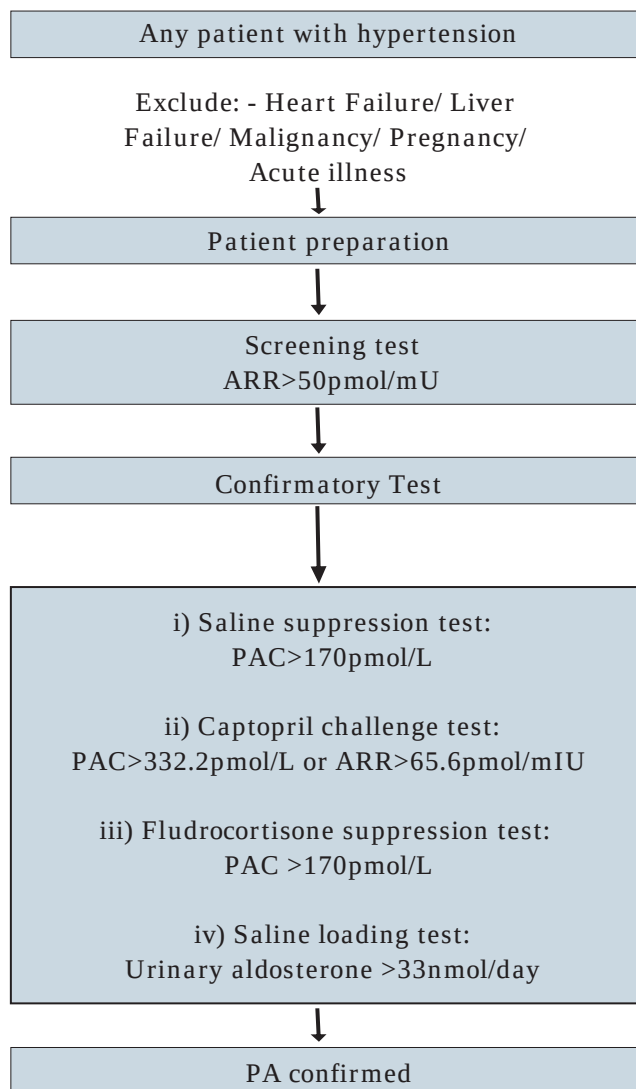


Figure 1 Diagnostic algorithm of Primary aldosteronism

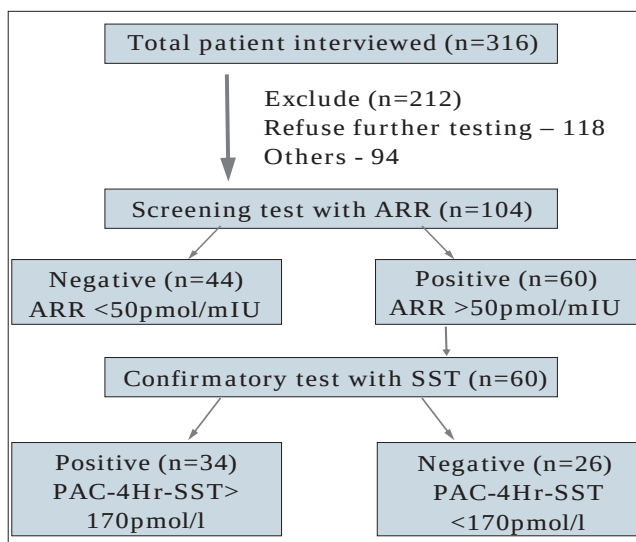


Figure 2 Distribution of study subjects

Abbreviations: ARR-Aldosterone to Renin Ratio, PAC-Plasma Aldosterone Concentration, SST-Saline Suppression Test, PA-Primary Aldosteronism, non-PA-non-Primary Aldosteronism

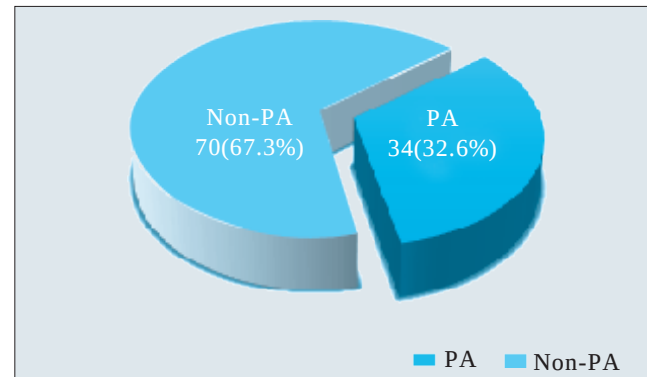


Figure 3 Frequency of PA among the studied population at Endocrine HTN Clinic

Data is expressed as frequency and percentage. PA- Primary Aldosteronism, Non-PA- Non Primary Aldosteronism

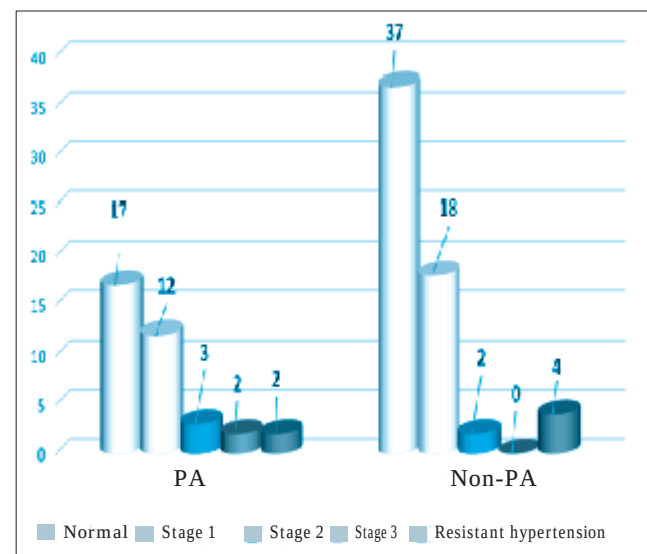


Figure 4 Stages of hypertension in PA and Non-PA patients

Data were expressed as frequency. p-value is reached through chi-square test for categorical values. Here stage 1 HTN is between 140-159/90-99mmHg, stage 2 between 160-179/100-109mmHg, stage 3 between >180/110mmHg. Resistant Hypertension is defined as Persistent BP >140/90 with 3 maximum tolerated antihypertensive (Including diuretic) or Controlled BP (<140/90 mm Hg) on ≥4 antihypertensive drugs.

Discussion

This study was intended to explore the frequency of PA among hypertensive patients attending endocrine hypertension clinic in a tertiary care setting (BMU). It revealed 32.4% of our studied population had PA. This frequency data corresponds to the current frequency rate reported in referral centers/tertiary care hospital around the world.³ However, studies done in the last few decades have reported the frequency of PA to be ranging from 4.6% to 13% in patients with uncomplicated HTN in primary care settings and up to 30% in those with treatment-resistant hypertension in tertiary care settings.^{5,3} We attribute the increase in frequency in our study to advancements in analyzer assay methods and heightened awareness among the hypertensive population through various seminar, health camp and OPD consultations.

A recent study has revealed that one in five individuals in Bangladesh experiences hypertension, with roughly 20% of adults and 40-65% of older people affected by HTN and the situation continues to worsen.^{9,10} In the PAPY (Primary Aldosteronism Frequency in hYpertensives) research, Rossi and colleagues identified an overall frequency of primary aldosteronism at 11.2% within a group of more than 1,100 patients who were newly diagnosed with hypertension and sent to various Italian hypertension clinics, among these patients, 6.6% had grade I hypertension, while 19% presented with grade III hypertension.⁷ Strauch and associates indicated a 19% occurrence of primary aldosteronism in a Central European group of individuals suffering from moderate to severe hypertension. The occurrence of primary aldosteronism in these hypertensive populations was outlined as follows: 4.7% with normal and high normal blood pressure, 5.7% with grade I hypertension, 8.3% with grade II hypertension and 18.6% with grade III hypertension.¹¹ Alternatively, Kreze and his team discovered that within the primary aldosteronism patients, 13.2% had high normal blood pressure, 26.3% had grade 1 hypertension, another 26.3% had grade II hypertension and 34.2% had grade III hypertension.¹² A similar comparison was done in our study, as shown in figure 4, where we found that PA is more common in patients with well controlled BP on medication and stage I hypertensive contrary to

the established myth of being more common in resistant hypertension. About 17 patients had normal BP on drugs which is about 37%, 12 had stage I hypertension representing 18% of population. Resistant hypertension on the other hand was least common, present in 2 patients that is about only 4% of study population.

A study by Gordon et al. in 1994, in collaboration with Greenslopes Hospital in Brisbane, Australia, found a frequency of 8.5%, while a similar study was done by Libianto et al. in 2022 at Monash Health reported, reported frequency almost doubled to 14%.^{13,14} This is very much alarming and as frequency of PA is on the rise worldwide.

Limitation

This was a cross sectional study and limited number of population due to financial constraints.

Conclusion

In conclusion, given the increasing frequency of primary aldosteronism globally, screening for this condition should be integrated into the standard evaluation of hypertension patient to mitigate the risk of comorbidities and mortality among the population.

Recommendation

Further study is required and nationwide awareness campaign is essential to prevent its devastating effects and to provide early treatment. Due to financial constraints our study was done on a limited number of population, hence a large population-based study should be undertaken to determine PA's actual community frequency in the Bangladeshi population. A widespread campaign among physicians and patients should be done.

Acknowledgement

We would like to show our gratitude to the Department of Endocrinology and respective OPD Departments of Bangladesh Medical University (BMU).

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Disclosure

All the authors declared no conflict of interest.

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Musculoskeletal Issues in Diabetes: Patterns observed in the Department of Physical Medicine and Rehabilitation at a Tertiary Care Hospital

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Mohammed Arman^{5*} Md Abirul Islam⁶ Shafiul Karim Md. Elias⁷

Abstract

Background: Musculoskeletal disorders are common among individuals with diabetes mellitus and contribute significantly to morbidity, functional limitation, hospitalization and reduced quality of life. This study aimed to assess the distribution and characteristics of musculoskeletal disorders among individuals with diabetes attending the Department of Physical Medicine and Rehabilitation, Jalalabad Ragib-Rabeya Medical College and Hospital, Sylhet.

Materials and methods: A cross-sectional study was conducted from January to June 2025. Data were collected from indoor and outdoor patient logs and clinical records of the Department of Physical Medicine and Rehabilitation. A total of 916 individuals with diabetes and musculoskeletal complaints were included.

Results: Among 916 participants, 268 were male (29.25%) and 648 were female (70.74%). The most common age group was 42–45 years (34.4%), followed by 53–62 years (25.32%). Housewives constituted the largest occupational group (54.48%)

followed by businessmen (21.83%) service holders (10.9%) teachers (7.22%) and cultivators (5.45%). Non-inflammatory arthropathies were more common than inflammatory arthropathies. Prolapsed lumbar intervertebral disc was the most frequently reported condition (21.18%) followed by adhesive capsulitis (13.97%) cervical spondylosis (11.14%) and lumbar spondylosis (5.90%).

Conclusion: Musculoskeletal disorders are frequent among individuals with diabetes, with non-inflammatory conditions being more prevalent. Early recognition, physician awareness and rehabilitation-based management are essential to reduce disability and improve functional outcomes. Further research is needed to explore underlying mechanisms and develop targeted preventive and therapeutic strategies.

Key words: Inflammatory arthropathies; Musculoskeletal disorders; Non-inflammatory arthropathies; Prolapsed lumbar intervertebral disc.

Introduction

Diabetes Mellitus (DM) is a chronic disorder defined as persistent hyperglycaemia.¹ About 3-7% of the adult population are suffering from DM across the country.² MSDs are primary features of much multisystem illness, not only in the autoimmune joint and connective tissue disease but also metabolic, endocrine, neoplastic and infectious condition.³ MSDs are due to micro vascular and neurological complications.⁴ The prevalence of MSDs has significantly increased (1.7-2.1) times in a patients suffering from type-2 DM when compared to individuals without diabetes.⁵ Type-I DM results from a complete deficiency of insulin due to the autoimmune mediated destruction of Insulin producing B cells in the pancreas. Type-2 DM represents most of the DM cases (around 95%). There is insulin resistance, excessive fat metabolism, resulting in a relative deficiency of that hormone.⁶ Diabetic patients with MSDs are categorized in the following ways⁷:

1. Associate Professor of Physical Medicine and Rehabilitation Jalalabad Ragib-Rabeya Medical College, Sylhet.
2. Associate Professor of Physical Medicine and Rehabilitation Khulna Medical College, Khulna.
3. Indoor Medical Officer of Physical Medicine and Rehabilitation Jalalabad Ragib-Rabeya Medical College, Sylhet.
4. Professor of Physical Medicine and Rehabilitation Jalalabad Ragib-Rabeya Medical College, Sylhet.
5. Assistant Professor of Physical Medicine and Rehabilitation Chattagram International Medical College, Chattogram.
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A. Fibro proliferative disorders of the soft tissue:

- Limited joint mobility syndrome
- Adhesive capsulitis
- Dupuytren's contracture
- Carpal tunnel syndrome
- Stiff hand syndrome
- Flexor tenosynovitis.

B. Joint disorder:

- Neuropathic arthropathy
- Gouty arthritis
- Osteoarthritis (OA)
- Rheumatoid Arthritis (RA)

C. Muscle related disorders:

- Diabetic amyotrophy
- Diabetic muscle infraction.

D. Skeletal disorders:

- DISH (Diffuse idiopathic skeletal hyperostosis)
- Osteoporosis
- Osteoporosis with fracture.

Exact mechanism of MSDs in DM is unclear. Changes in collagen deposition and progressive non-enzymatic glycosylation in connective tissue may be the cause.⁸

The objective of this study is to identify and analyze the pattern of musculoskeletal issues observed in diabetic patients presenting to the Department of Physical Medicine & Rehabilitation highlighting of correlation between disease duration, metabolic control and functional disability.

Materials and methods

In the six month period from January 2025 to June 2025, a cross-sectional study was undertaken at the Department of Physical Medicine and Rehabilitation, Jalalabad Ragib-Rabeya Medical College, Sylhet. Data was extracted from indoor and outdoor patients' log and clinical records. All the data were checked. Descriptive statistics such as frequency, percentage, mean and standard deviation were used to describe pattern of the musculoskeletal disorders.

Results

A total of 916 diabetic patients with musculoskeletal disorders were studied. Out of them (70.74%) 648 were female and 268 (29.26%) were male (Figure 1).

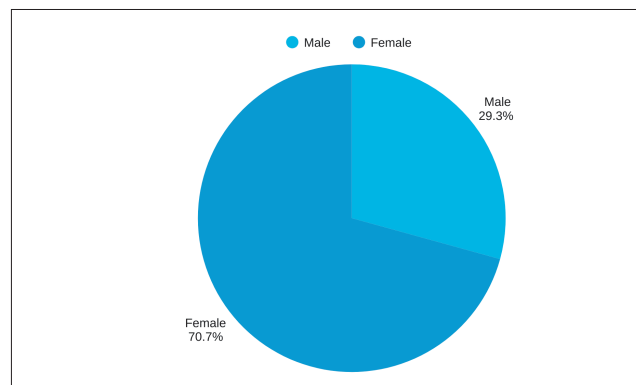


Figure 1 Patient Gender Distribution

Out of 916 patients, 34.49% were between the age group of 43-52 and 25.32% were between age group 53-62 years (Figure 2).

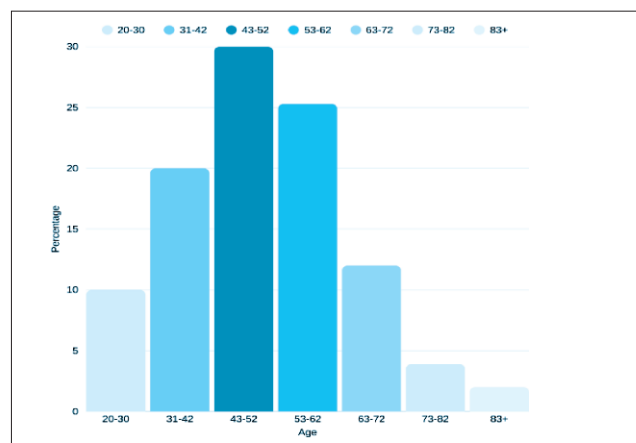


Figure 2 Age Distribution

Mean age and Standard deviation = 52.09 ± 13.12 years.

Majority were housewives (54.58%) followed by businessmen (21.83%) Service holder (10.9%) teachers (7.22%) and cultivators (5.45%) (Figure 3).

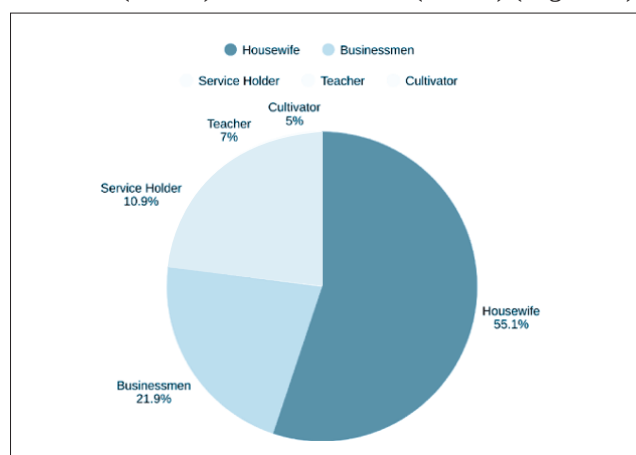


Figure 3 Occupational Distribution

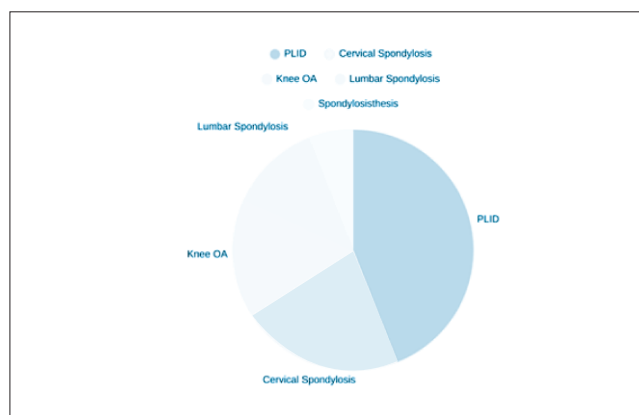


Figure 4 Non-inflammatory articular disorders

PLID constituted about 21.17%, cervical spondylosis 11.13%, Knee OA 7.53%, lumbar spondylosis 5.89% and spondylolisthesis 2.51% as non-inflammatory arthropathy (Figure 4).

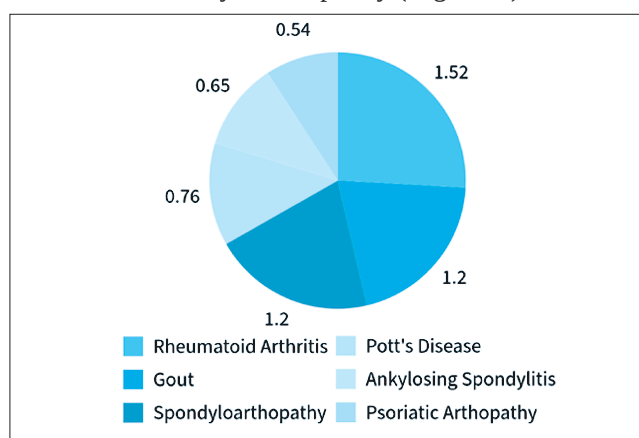


Figure 5 Inflammatory articular disorders

Rheumatoid Arthritis is one of the most common 1.52% among the inflammatory articular disorders (Figure 5).

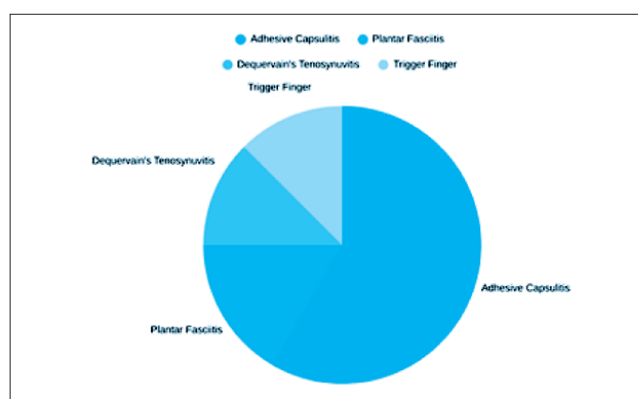


Figure 6 Soft Tissue Rheumatism

In soft tissue rheumatism, most common is adhesive capsulitis 13.97%, followed by plantar fasciitis 3.6%, Dequervain's tenosynovitis 2.94% and lastly Trigger finger, 2.6% Figure 6.

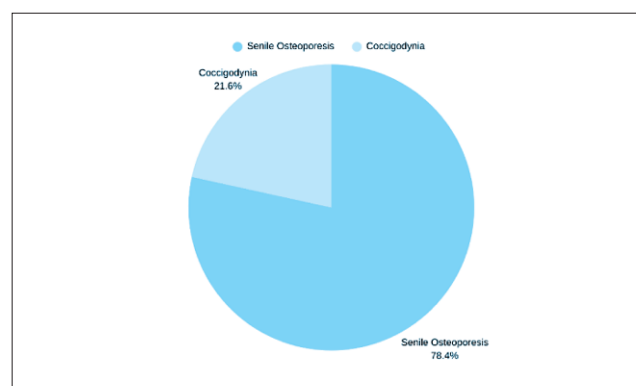


Figure 7 Incidence of bone

Senile Osteoporosis 4.36% and Coccydynia 1.2% among incidence of disorders of bones (Figure 7).

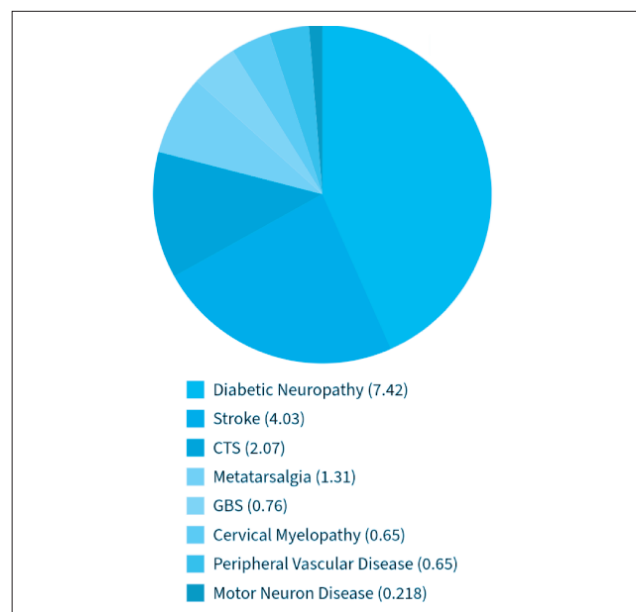


Figure 8 Incidence of Neurological Disorder

Among incidence of neurological disorders, diabetic neuropathy 7.42% is the commonest (Figure 8).

Discussion

Managing disabling MSDs is one of the most prevalent health issues faced in clinical practice with millions of individuals suffering from it all over the world. The present study was hospital based, done in a tertiary care hospital in Sylhet. In the current study total 916 patients were reported and among them 70.74% were female and 29.25% were male which were similar to Barki et al.⁹ He showed 42.1% were male and 57.9% were female. Khan et al. showed in his observations 55.1% were female and 44.9% were male in 2062 diabetic patients with MSDs.¹⁰ 34.49% were between 42-52

years of age, 17.09% between 31-41 years of age and mean age was 52.09 ± 13.12 years. Rahim et al. showed mean age was found 48.87 ± 12.03 years in diabetic group which was similar to study done by Sharmin et al.^{11,12} She showed the mean age was 48.37 ± 12.03 years in diabetes patients. Majority patients were housewives (54.58%) followed by businessman (21.83%) service holder (10.9%) teachers (7.22%) and teachers (5.45%). Sharmin et al. showed 7.4% were businessman, 56.5% were housewives, 9% were teachers and 13.8% were service holders and their results support our study.¹²

In non-inflammatory articular disorders according to frequency there were PLID (21.18%) cervical spondylosis (11.14%) Knee osteoarthritis (Knee OA) (7.53%) lumbar spondylolisthesis (2.51%) and lumbar spondylosis (5.90%). Bjella et al. found in his study lumbar spondylosis and cervical spondylosis were commonest (31%).¹³ Chen et al. found that on accelerated the degeneration process of the disease by microangiopathy.¹⁴ Autophagy of the nucleus pulposus and annulus fibrosis cells also appear to play an important role in lumbar degenerative disc disease. In the study of Asadian et al. studied in 2016.¹⁵ They found 29.1% lumbar spondylosis in diabetic patients. Frymoer et al. reported that degenerative Spondylolisthesis was more prevalent in diabetic patients.¹⁶ Alam et al. studied that spine disease were the most common followed by degenerative conditions.¹⁷ Nieves-plaza et al. in 2013 reported OA among diabetic patients was 49%.¹⁸ But in contrast in Bangladeshi study by Khan et al. In 2008 reported 8.1% OA knee joint in diabetic patients.¹⁰

In the present study inflammatory articular disorder reported as Rheumatoid Arthritis (RA) 1.53%, Ankylosing Spondylitis and psoriatic arthritis 0.66% and 0.55%, Undifferentiated Spondyloarthropathies and Gout 1.2%, Pott's disease 0.76%. RA was the commonest inflammatory arthropathy reported by Alam et al.¹⁷

Soft tissue rheumatism among diabetic patients, in our study example like – Adhesive Capsulitis (13.97%) emerging as the most prevalent condition. It was followed by Plantar fasciitis (3.64%) De Quervain's tenosynovitis (2.95%) and Trigger finger (2.61) Umesh et al. and Cagliero et al. reported a high prevalence of Adhesive Capsulitis (18%) among diabetic patients that is nearly

similar to our study.^{19,20} Majjad et al. and Kamiab et al. identified Carpal tunnel syndrome and plantar fasciitis as common complications in diabetic populations suggesting that these conditions are intrinsic consequences of longstanding diabetes.^{21,22}

In the present study 4.37% patients reported as senile osteoporosis and 1.2% as coccydynia. Shan et al. reported 33.3% were osteoporosis with DM.²³

In our study, neurological manifestation as diabetic neuropathy reported 7.42% followed by stroke 4.04% carpal tunnel syndrome reported 2.07%, metatar salgia 1.3%, Guillain-Barre-Syndrome (GBS) 0.76%, cervical myelopathy and peripheral vascular disease 0.66% motor neuron disease (MND) 0.218%. Kudsi et al found 7% of diabetic neuropathy which is similar to our study. Boulton et al. stated that polyneuropathy is estimated to occur at least 20% of diagnosed patients.²⁴ Marsy et al. stated insulaemic stroke prevalence was significantly higher in diabetic patients.²⁵

DM is associated with a wide variety of musculoskeletal complications. These complications significantly compromise the patient's quality of life. These complications are generally neglected and poorly managed as compared to other complications like – kidney disease, cardiovascular disease, skin disease etc. Nowadays both incidence and life expectancy of diabetic patients have increased prevalence and clinical importance of musculoskeletal manifestations in diabetic patients.²⁶

Limitations

- Short span of observation
- The design of this study was hospital which might not reflect the accurate occurrence of the MSDs in this region
- Study could not allow us to retrieve other vital patient information – physical activity, smoking. Status would have been useful.

Conclusions

Musculoskeletal disorders are common among individuals with diabetes attending Physical Medicine and Rehabilitation services, with non-inflammatory conditions being more prevalent than inflammatory disorders. Prolapsed lumbar intervertebral disc, adhesive capsulitis and degenerative spinal conditions were the most frequently observed clinical entities. These findings highlight the importance of early identification and comprehensive rehabilitation-based management of

musculoskeletal complications in diabetic patients to reduce pain, functional limitation and disability. Increased awareness among physicians and integration of musculoskeletal assessment into routine diabetic care may improve patient outcomes.

Recommendation

Further studies incorporating metabolic parameters and longitudinal follow-up are recommended to better understand underlying mechanisms and guide targeted interventions.

Disclosure

All the authors declared no conflict of interest.

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Comparative Effectiveness of Home-Based and Hospital-Based Exercise Programs in Post-Stroke Rehabilitation: A Randomized Clinical Study

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Abstract

Background: Stroke is one of the leading causes of morbidity and long-term disability worldwide. Early initiation of rehabilitation procedures can significantly enhance neurological recovery and improve long-term outcomes and quality of life. Exercise serves as the cornerstone of stroke rehabilitation. The patient's improvement and functional outcome can be objectively assessed using the Functional Independence Measure (FIM) score. The aim of study is to compare between the hospital based supervised exercise and home based exercise in early rehabilitation of patients stroke patients.

Materials and methods: This randomized controlled study was conducted in the Department of Physical Medicine and Rehabilitation, Dhaka Medical College Hospital, Dhaka, involving 78 patients with a first-ever stroke who attended rehabilitation within four weeks of onset. Participants were selected through consecutive sampling from the outpatient department and randomly allocated into two groups: Group A (n = 39) who received home-based exercise programs, and Group B (n = 39) who received hospital-based supervised exercise therapy. Patients with serious comorbidities were excluded to ensure a more

homogenous sample. Functional impairment was assessed using the validated Bangla version of the Functional Independence Measure (FIM) score, an 18-item, 7-level scale evaluating independence across six domains: self-care, sphincter control, transfers, locomotion, communication and social cognition, with scores ranging from 18 (Complete dependence) to 126 (Complete independence).

Results: Among the 78 participants, 45 were male and 33 were female, yielding a male-to-female ratio of 1.36:1. The overall mean FIM gain across all participants was 43.27 ± 20.06 . After 12 weeks of rehabilitation, the mean FIM gain in Group B (Hospital-based supervised exercise) was 48.56 ± 21.22 , whereas in Group A (home-based exercise) it was 37.97 ± 17.52 . The difference in FIM score improvement between the two groups was statistically significant ($p < 0.005$).

Conclusions: The hospital based supervised exercise is superior than home based exercise in early rehabilitation of stroke patients.

Key words: Exercise; FIM; Rehabilitation; Stroke.

Introduction

Stroke is a complex and heterogeneous condition comprising various subtypes, each with distinct clinical presentations and epidemiological patterns. It ranks as the second leading cause of death globally and remains the foremost cause of physical disability in adults.¹ The World Health Organization defines stroke as a syndrome characterized by the sudden onset of focal or global neurological dysfunction, lasting for at least 24 hours or resulting in death, with no apparent cause other than a vascular origin.² Strokes can be broadly classified as either ischemic or hemorrhagic and are most commonly observed in middle-aged and older adults, whereas their occurrence in younger individuals is relatively rare.³

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The global incidence of stroke is approximately 2 per 1,000 population, equating to nearly 200 new cases per 10,000 individuals annually.⁴⁻⁵ In Bangladesh, a study reported that 43.4% of admissions to neurology inpatient departments were due to cerebrovascular diseases, primarily stroke.⁶⁻⁷ Another study in our country found that 67.9% of strokes were ischemic, while 32.1% were hemorrhagic.⁸ Stroke prevalence is notably higher among rural Bangladeshi men compared to their urban counterparts.⁹

According to established stroke rehabilitation guidelines, therapeutic interventions should begin promptly after diagnosis and once any life-threatening conditions are stabilized.¹⁰ Early rehabilitation may be initiated within 3 to 30 days following stroke onset.¹¹ Some researchers advocate starting rehabilitation as early as possible after the acute event.¹² Stroke rehabilitation is a continuous process that should start within days of onset and continue as long as functional gains are observed.¹³ A multidisciplinary and coordinated team approach is essential for effective rehabilitation outcomes.¹⁴

There is clear consensus that the aim of stroke rehabilitation is to reduce the disabling effects of brain injury on everyday life by applying a combination of therapeutic and problem-solving techniques.¹⁵ Stroke is not only a neurological condition but a life-altering event for the entire family. Patient progress and rehabilitation outcomes are commonly assessed using standardized functional measures, with the Functional Independence Measure (FIM) being the most widely used.¹⁶ The FIM assesses 18 items across six functional domains—self-care, sphincter control, mobility, locomotion, communication and social cognition—using a seven-level scale. It is a reliable and practical tool for periodic evaluation of functional progress.¹⁷

Various strategies have been employed to improve post-stroke functional status. Research focusing on mobility training has demonstrated significant functional improvements in stroke survivors.¹⁸ Recovery is largely influenced by neuroplasticity—the brain's ability to reorganize itself—whereby undamaged neural pathways take over the functions of injured areas. This process is stimulated by structured, progressive physical exercise programs.¹⁹ Exercise prescriptions are tailored according to muscle strength and include

passive range of motion, stretching, active-assisted and resistive exercises, proprioceptive neuromuscular facilitation and balance training. Rehabilitation typically progresses from sitting balance to standing balance, followed by gait and coordination training using assistive devices such as parallel bars, canes, walkers or walking sticks.²⁰ One of the practical advantages of home-based stroke rehabilitation is cost-effectiveness, as it reduces the length of hospital stay and associated healthcare expenses.²¹

The aim of study is to compare between the hospital based supervised exercise and home based exercise in early rehabilitation of patients stroke patients.

Materials and methods

This Prospective comparative study was conducted in the Department of Physical Medicine and Rehabilitation, Dhaka Medical College Hospital, Dhaka, over a period of six months from January 1 to June 30, 2014. The aim of this study was to compare the functional outcomes of home-based rehabilitation delivered by trained family caregivers with those of hospital-based supervised rehabilitation in patients with first-ever stroke, using the Functional Independence Measure (FIM). The study population included all patients presenting with a first-ever stroke within four weeks of onset. A total of 78 patients meeting the inclusion and exclusion criteria were enrolled using randomized sampling and randomly divided equally into two groups (n = 39 each). After obtaining written informed consent in accordance with the Declaration of Helsinki (1964) a detailed history and clinical examination were conducted, and relevant data were recorded. Functional assessment was performed using the Functional Independence Measure (FIM) which evaluates 18 items across six domains: self-care, sphincter control, mobility, locomotion, communication and social cognition. Each item is scored on a 7-level scale, ranging from complete dependence to complete independence. Group A received a home-based exercise program administered by family caregivers who were trained by a physiotherapist, with follow-up hospital visits every two weeks. Group B underwent hospital-based supervised exercise therapy conducted by physiotherapists, consisting of three sessions per week, each lasting two hours, over a two-week period. Exercises were prescribed based on muscle power, with 6–10 repetitions advised at least twice daily. After 12

weeks, FIM gain scores were recorded and compared between the two groups. Data were analyzed using SPSS version 15.0. Continuous variables were expressed as mean $\pm$ SD and categorical variables as frequency and percentage. Baseline characteristics were compared using the independent samples t-test or Chi-square test, as appropriate. Within-group changes in FIM scores from baseline to 12 weeks were analyzed using the paired t-test, while between-group differences in FIM gain scores were compared using the independent samples t-test. A p-value <0.05 was considered statistically significant. Ethical considerations were strictly maintained, including confidentiality, voluntary participation and the right to withdraw at any stage without penalty.

Results

A total 78 patients with stroke were included in the study. Out of these 78 patients, 45 (57.7%) were male and 33(42.3%) were female. (Table I). Male, female ratio is 1.36:1. Mean age of the patients were 54.71 years with the mean age of male patients was 55.87 years and female patients was 56.50 years. Among the patients, 47(60.3%) had been suffering from ischemic stroke and 33(42.3%) had been suffering from hemorrhagic stroke. (Table I) Among the study patients 22(28.21%) had right sided hemiplegia and 56(71.79%) had left sided hemiplegia. All patients were 78(100%) were right handedness (Table I).

Table I Demographic and stroke characteristics of Group-A and Group-B patients

Parameters	Group-A	Group-B	Total no (%)
Age (Years, mean $\pm$ SD)			
Male	56.75years	55.16	55.87 years
Female	54.89	50.71	53.12 years
Gender			
Male	20(25.64%)	19(24.35%)	45(57.7%)
Female	25(32.06%)	14(17.95%)	33 (42.3%)
Stroke type			
Ischemic	27(34.64%)	20 (25.66%)	47(60.3%)
Hemorrhagic			
Side of hemiplegia	15(19.20)	16(20.49%)	31(39.7%)
Right	12(15.38%)	10(12.82%)	22(28.21%)
Left	30(38.46%)	26(33.33%)	56(71.79%)
Handedness			
Right	39(50%)	39(50%)	78(100%)
Left	0	0	0

Table II Major risk factors among study patients

Risk Factors	Group-A	Group-B	Total (Percentage)
Diabetes mellitus	8 (10.3%)	17 (21.8%)	25 (32.1%)
Hypertension	25 (32.1%)	26 (33.3%)	51 (65.4%)
Dyslipidemia	16 (20.5%)	20 (25.6%)	36 (46.2%)
Ischemic heart disease	2 (2.6%)	1 (1.3%)	3 (3.8%)
Smoking	10 (12.8%)	19 (24.4%)	29 (37.2%)
Obesity	13 (16.7%)	10 (12.8%)	23 (29.5%)
Family history of stroke	4 (5.1%)	2 (2.6%)	6 (7.7%)

The most common risk factor among the study participants was hypertension, observed in a total of 51 patients—25 (32.1%) in Group-A and 26 (33.3%) in Group-B. The second most frequent risk factor was dyslipidemia, present in 36 patients, including 16 (20.5%) from Group-A and 20 (25.6%) from Group-B. Smoking was the third most prevalent risk factor, found in 29 patients—10 (12.8%) in Group-A and 19 (24.4%) in Group-B (Table II).

Table III FIM score on admission, at discharge and FIM gain in study patients

FIM item	FIM admission score (Mean)		FIM discharge (Mean)		FIM Gain (Mean)	
	Group-A	Group-B	Group-A	Group-B	Group-A	Group-B
Self-care	13.1	14.72	27.41	28.59	14.31	13.87
Sphincter Control	5.33	5.82	10.10	10.97	4.77	5.15
Mobility	7.10	7.74	13.77	14.23	6.67	6.49
Locomotion	3.05	3.92	8.10	8.15	5.05	5.77
Communication	6.9	7.95	12.54	12.59	5.64	4.64
Social cognition	11.79	11.62	18.77	19.13	6.98	7.51
Total	42.69	47.90	80.67	96.46	37.98	48.59

FIM admission score was both groups 45.29 ± 25.28 . In Group-A study patient was 42.69 ± 20.74 and in Group-B was 47.90 ± 29.18 out of total 126 (max). In Group-A stroke patients FIM admission score was highest in the self-care domain and was lowest in the locomotion and sphincter control. In Group-B stroke patients FIM admission score was highest in the self-care domain and was lowest in the locomotion and sphincter control (Table III). In Group-A stroke patients FIM gain was maximum in the self-care domain and was lowest in the sphincter control and locomotion. In Group-B stroke patients FIM gain was maximum in the self-care domain and was lowest in communication and sphincter control (Table III) .

Table IV FIM gain in different age group of study patients

Age in years	No. of patients	FIM admission (Mean)		FIM discharge (Mean)		FIM gain (Mean)	
		Group-A	Group-B	Group-A	Group-B	Group-A	Group-B
45-49	18	37	43.92	76.33	90	39.33	46.08
50-54	19	51.42	26.86	87.50	89.86	36.08	63
55-59	14	58.50	55.50	70	103.5	18.5	48
60-64	27	37.32	60.88	78.11	101.38	40.79	40.50

In Group-A of patients FIM admission score was highest in the 55-59 years age group and was lowest in the 45-49 years age group. Mean FIM gain was maximum 40.79, found among age group of 60-64 years and was lowest 18.5 among the 55-59 years. In Group-B patients FIM admission score was 60.88, found among age group of 60-64 years and lowest was 26.86 among the age group 50-54 years. FIM discharge score in Group-A was 87.50 in between the age group 50-54 years and lowest was 70 among the age group 55-59 years. In Group-B, FIM discharge score was 103.5 among the age group 55-59 years and lowest 89.86 between age group 50-54 years.

Maximum FIM gain in Group-A was 40.79 among age group 60-64 years and Group-B was 63 among age group 50-54 years (Table IV).

Table V Mean FIM gain in total patients in two groups

Group	FIM adm score (Mean $\pm$ SD)	FIM discharge score (Mean $\pm$ SD)	FIM gain (Mean $\pm$ SD)	p-value
Group-A	42.69 $\pm$ 20.74	80.67 $\pm$ 19.6	37.97 $\pm$ 17.52	
Group-B	47.90 $\pm$ 29.18	96.46 $\pm$ 16.02	48.56 $\pm$ 21.22	p<0.019 (<0.05)
Both groups (78)	45.29 $\pm$ 25.28	88.56 $\pm$ 19.48	43.27 $\pm$ 20.06	

Mean FIM gain in both groups was 43.27 ± 20.06 . In Group-A FIM gain (Mean) was

37.97 ± 17.52 and in Group-B FIM gain (Mean) was 48.56 ± 21.22 . (Table V). Mean FIM gain in Group-A (Home based exercise) was significantly higher (37.97 ± 17.52 vs 48.56 ± 21.22) (p<0.05) than that of Group-B patients (Table V).

Discussions

Recent studies have demonstrated that exercise can improve mobility and balance in stroke patients.^{22,23} A review of all types of home-based stroke rehabilitation however, concluded that home-based stroke rehabilitation per se appears to improve independence in personal activities and extended daily livings activities and minimizes the chances of deterioration or death.²¹ In addition, there is a lack of home-based studies demonstrating the long-term influences on functional level where they are more feasible and cost-effective than supervised training.¹⁸

It was observed that in the current study mean age of the patients were 54.71 years with the mean age of male patients was 55.87 years and female patients was 56.50 years. Highest number of patients 27(34.6%) was within the 60-64 years age group, followed by 19(24.4%) in 50-54 age group and 18 (23.1%) the age group 45-49 years. In the other age groups the numbers of the patients were considerably low.

Nessa J, found mean age of stroke patients was 57.81 years in her study.²⁰ A study by Hossain MS conducted with 62 patients of stroke in Chittagong Medical College Hospital found that mean age of the patients were 54.48 years.²⁴ This study also revealed mean age of the patients was 54.71 years which is agreement with the current study.

Yavuzer et al found mean age of stroke was 60.04 ± 11.8 yrs in their study.²⁵ Inouye et al found mean age was 64 ± 11 yrs.²⁶

Difference in age incidence in the current study from international studies was probably due to smaller size in this study and also lower life expectancy of people of developing country like ours.

A total 78 patients with stroke were included in the study. Out of these 78 patients, it was observed that 45 (57.7%) were male and 33(42.3%) were female. Male female ratio was 1.36:1. Nessa J found that in her study conducted with 48 stroke, 30 (62.50%) were male and 18(37.50%) were female. The male: female ratio was 1.66:1.²⁰ Nahar S found 2.33:1 and Hossain MS found the ratio 2.1:1.^{24,27} The result of the current study correlates with the national and international studies indicating males suffer from stroke more than women worldwide. There was no significant difference in the sex distribution between these two groups of patients.

In this current study it was observed that among 78 patients 22(28.21%) had right sided hemiparesis and 56(71.79%) had left sided hemiparesis. All patients (78,100%) were right handedness. Hossain MS found that Among 62 patients 66% had left side involvement and 34% had right side involvement. Nessa J found among 48 patients 31 (64.58%) had left side involvement and 17(35.41%) had right side involvement.^{24,20} Ozdemir et al. found 67.4% had left sided (Right hemisphere) involvement and (32.6%) patients had right sided (Left hemisphere) involvement.²⁸ Current study correlates with the above national and international studies findings.

In current study it was observed Hypertension total 51 patients, 26(33.3%) patients in Group-A and 25(32.1%) patients in Group-B was the most prevalent risk factors. The next common was Dyslipidemia total 38 patients (21.8%) patients in Group-A and (26.9%) patients in Group-B, third common was Smoking, 30 patients (11.6%) patients in Group-A and (26.9%) patients in Group-B. Then diabetes mellitus 9% in Group-A and 24.4% in Group-B.

Hossain MS also found hypertension was the most common (67.7%) risk factors among 62 patients.²⁴ Qari FA shown in his study hypertension was the most common risk factor for both ischemic, as well as hemorrhagic stroke. Diabetes, smoking, ischemic heart disease, hyperlipidemia and atrial fibrillation were other common risk factors in that order of frequency.²⁹ These findings are consistent with the current study.

FIM score at the time of first attending the rehabilitation unit was considered as FIM admission score. The current study showed mean FIM admission score was both groups 45.29 ± 25.28 (Group-A 42.69 ± 20.74 and Group-B 47.90 ± 29.18). Hossain MS found that among 62 patients mean FIM admission score was 36.5 ± 2.7 .²⁴

Inouye et al. found FIM admission score was 57 ± 29 , Fiedler et al. 47 found FIM admission score 63.1 in USA and Lew et al. found FIM admission score 70.5 in their studies.^{30,31} Our findings are in agreement with the national study but the discrepancy with the international study was probably due to inclusion of only first episode stroke patients of acute onset. So naturally disability was more and FIM score was less in the current study.

The current study was done on an outpatient basis and the FIM score taken after 12 weeks i.e. 96 days, was considered as FIM discharge score. In this study FIM discharge score after 12 weeks of rehabilitation was 88.56 ± 19.48 (Group-A 80.67 ± 19.6 and Group-B 96.46 ± 16.02). Hossain MS found that among 62 patients mean FIM discharge score was 85.35 ± 2.9 after 8 weeks.²⁴ Yazuver et al. found FIM discharge score was 86.7 ± 24.2 after 14 weeks.²⁵ Inouye et al. found FIM discharge score was 87 ± 30 after 17 weeks of inpatient rehabilitation.³⁰ The present study was agreement with national and international studies.

In the current study there was significant difference in FIM total score at discharge between Group-A (Home based exercise) 80.67 ± 19.6 and Group-B (Hospital based exercise) 96.46 ± 16.02 .

This finding is in consistent with that Oleney et al. who also found supervised exercise programs showed trends to greater improvements in self-reported gains.³² Studenski et al. also found in their study benefits of supervised exercise for daily functioning and quality of life after stroke.³³

FIM gain was measured by subtracting the FIM admission score from FIM discharge score. (In this study FIM score after 12 weeks.) The current study showed mean FIM gain was 43.27 ± 20.06 in the total number of patients. Hossain MS and Nessa J found in their study mean FIM gain 48.85 ± 12.8 and 47.12 ± 19.33 which is agreement in our studies.^{24,20}

Inouye et al. found FIM gain 29 ± 18 , Fiedler et al 47 found FIM gain 23.14 in USA and Lew et al. found FIM gain 22.9 ± 11.9 in their studies.^{30,31}

The discrepancy in the present study was due to variation of FIM admission and FIM discharge score.

Considering mean FIM gain in different age groups, maximum mean FIM gain in Group-A was 40.79, found among age group of 60-64 years. Group-B was 63, found among age group of 50-54 years. Minimum mean FIM gain in Group-A was 18.5 among age group 55-59 and Group-B was 40.50 among age group 60-64 years. Hossain MS found maximum FIM gain was 63.5 and 76 (Ischemic vs. Hemorrhagic) found age group 31-40 years followed by 56 and 58 (Ischemic vs. Hemorrhagic) in 41-50 years of age group and minimum FIM gain was 26 and 41.5 (Ischemic vs. Hemorrhagic) in the > 70 years of age group 26. This study slight correlates with our study.²⁴

In the current study mean FIM gain in Group-B (Hospital based supervised exercise) after 12 weeks of rehabilitation was significantly higher (48.56 ± 21.22 vs. 37.97 ± 17.52) ($p < .005$) than that of Group-A (Hospital based supervised exercise.)

In Group-A stroke patients FIM admission score was highest in the self-care domain and was lowest in the locomotion and sphincter control. In Group-B FIM admission score was highest in the self-care domain and was lowest in the locomotion and sphincter control.

In Group-A stroke patients FIM gain was maximum in the self-care domain and was lowest in the sphincter control and locomotion. In Group-B stroke patients FIM gain was maximum in the self-care domain and was lowest in communication and sphincter control. These findings are in consistent with that of Hossain MS study who also found same things.²⁴

Conclusion

Stroke being one of the most common cerebrovascular diseases and leading cause of death and disability, has drawn attention of researchers all over the world. It is crystal clear that, this devastating condition not only affects the patient but also their family. The number of study population was small, so no firm conclusion could be made from this current study. The information collected needs verification by larger studies. By the knowledge gathered from this study, it could be concluded that hospital based supervised exercise is superior than home based exercise within 4 weeks of stroke in early rehabilitation of stroke patients. There is inadequate facilities for inpatient rehabilitation in our country and also lack of qualified personnel for domiciliary treatment. If we increase the resource for domiciliary rehabilitation, the short hospital stay will be an advantage for quicker turnover of patients of the hospital. More new patients will have the chance to have hospital based rehabilitation which will eventually facilitate home based rehabilitation in stroke patients.

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Acute Peritoneal Dialysis in Children: A Single Center Experience in Chattogram, Bangladesh

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Abstract

Background: As an effective treatment modality, Acute Peritoneal Dialysis (APD) is preferred for Acute Kidney Injury (AKI) in low resource settings and may be readily applied to infants and children. To evaluate the single center experience regarding APD in children including Indications, complication and outcome.

Materials and methods: A retrospective analysis was carried out in pediatric Nephrology Dept. of Chittagong Medical College Hospital from September, 2023 to August, 2024 including 31 children who had APD due to AKI for different causes.

Results: Among 31 children, maximum (51.6%) age incidence was >5 years age group. AKI on Chronic Kidney Disease (19.4%) Hemolytic Uremic Syndrome (16.1%) Acute Gastroenteritis (12.9%) septicemia (9.7%) were the common causes of AKI. Indication of APD were azotemia (45%) severe electrolyte imbalance (26%) anuria (19%) and uremic encephalopathy (10%). Complications occurred in 41.9% patients and 58.1% had no complications. Catheter leakage (9.7%) and outflow obstruction (9.7%) were the common catheter related complications. Regarding outcome, 25 were

survived and 6 were dead among 31 patient with APD. 64% patients were discharged with advice, 20% transferred for hemodialysis, 12% referred to Pediatric Surgery ward and 4% referred to higher center for further management. Survival rate was 100% in patients with no complications.

Conclusion: In poor resource set up accompanied with economical constraints, APD is a good option for emergency management of AKI.

Key words: Acute Peritoneal Dialysis; Acute Kidney Injury; Children; NSAID.

Introduction

Dialysis is an important choice of option for renal replacement therapy in both acute and chronic renal disease. Intermittent Peritoneal Dialysis (IPD) Hemodialysis (HD) continuous hemofiltration or hemodiafiltration are the available varieties of dialysis modalities in case of Acute Kidney Injury (AKI). The choice of dialysis is influenced by several factors including the etiology of the underlying disease, the age or weight of the patient, hemodynamic stability, goals of dialysis, previous abdominal surgeries, presence or absence of peritoneal defects and availability of dependable vascular access.¹ Continuous Renal Replacement Therapy (CRRT) is commonly used in the management of pediatric AKI in resource-rich countries and although it may have some advantages in the hemodynamically unstable patient, it is rarely used in the management of AKI in resource poor settings. Because it is expensive and requires both sophisticated technology and consumables that are generally unavailable in developing countries.² In young children, HD is not only technically challenging, lack of age-appropriate vascular catheters, pediatric blood lines, size of dialyzers, combined with the cost of treatment, challenges in obtaining vascular access and a need for specialized staffs are additional obstacles in maintenance of proper HD.³ Furthermore, young children may not tolerate the volume shifts that occurs during HD.⁴

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A significant advantage of PD over HD is its cheaper cost. It bypasses the need for vascular access that can be troublesome in young infants. Other advantages include the relative ease of inserting PD catheters in the smallest infants, the availability of a wide range of Acute Peritoneal Dialysis (APD) catheters and the suitability in haemodynamically unstable patients because of the gradual ultrafiltration and solute clearance in PD.⁵ So, a good number of centers in developing countries are successfully adapting APD specially IPD in the management of their pediatric patients with AKI due to varieties of facilities.⁶ Complication may arise in any invasive procedure. Despite of many advantages of PD, there are some complications which are commonly noticed in PD in children. Malposition of PD catheter, bleeding, outflow obstruction, catheter occlusion by omentum, leakage of PD fluid, abdominal pain, blood-stained dialysate are noninfectious adverse events while exit site infection or peritonitis are infectious complications in IPD procedure.⁷ Infants less than one year of age are at particularly high risk for catheter related complications compared to older children.⁸ In Bangladesh, very few renal centers offer hemodialysis only in major city based centers for children with AKI. Regarding this, IPD may be the better option. As a resource poor country, it is important to increase our knowledge about the necessity and outcomes of IPD in the treatment of children with various causes. In this study, our objective was to evaluate indications, complications and outcomes of all pediatric patients who underwent IPD as an option of APD in a single tertiary care center in Bangladesh.

Materials and methods

A retrospective study was performed in the Pediatric Nephrology department of Chittagong Medical College Hospital and study period was September 2023 to August, 2024. Consecutive 31 patients with AKI due to various indications who were managed by IPD are included in this study. AKI was defined according to the modified pediatric RIFLE (Risk, injury, failure, loss, end-stage renal disease) criteria.⁹ All the patients were at the Failure stage during the time of the decision to start PD. An elaborate history was taken and every patient was gone through the proper clinical examination. A complete blood count with peripheral blood smear, blood urea, serum creatinine, electrolytes, calcium, phosphate, arterial

blood gases, electrocardiogram, and chest radiograph were obtained for every patient. After starting dialysis, blood urea, serum creatinine and serum electrolyte measurements were repeated every day for 3 consecutive days. Urinalysis and cultures were performed in the patients who passed urine. Renal ultrasonography, blood culture, prothrombin time or activated partial thromboplastin time were obtained as clinically indicated. Initially proper counseling about procedure with indication was conveyed and informed written consent was taken from legal guardian. The urinary bladder was emptied before catheter insert. The site for insertion of catheter in all cases was selected in middle of rectus sheath just below the umbilicus. The total procedure was done under aseptic technique. PD fluids were warmed, and prophylactic antibiotic was given into it. Heparin (500 IU/L) was added to prevent blood clots that may block PD effluent. A set of PD lines was prepared, and the patency of fluid channel was checked. The area was cleaned with povidone iodine and the patient was draped. Then, the area was infiltrated with lignocaine for local anesthesia. For young children additional I/V sedation was needed. A commercially available disposable pediatric-size semi-rigid PD catheter was used to perform every PD. Maintaining strict aseptic conditions, the catheter was placed percutaneously with the help of a trocar and connected to the PD set with bags containing PD fluid. At the beginning 1 - 2 cycles with 15-20 ml/kg PD fluid was given, observed for discomfort cardiorespiratory changes or leakage at catheter site. Thereafter, the fill volume was increased up to a maximum of 40 ml/kg. Subsequent each cycle usually lasted 45-60 minutes, 5-10 minutes to instill (Depending on exchange volume), 30 minutes dwell, 10-15 minutes to drain (Depending on exchange volume). Most of the time the procedure was continued for 72 hours. As a dialysis fluid, commercially available 1.5% dextrose were used. Then watched for hyperglycemia. In few cases of poor outflow, higher concentration of glucose with dialysis fluid were used to increased drainage of fluid. If hypokalemia (Serum K⁺ < 4 mmol/l) was found in any case, 3 ml of potassium chloride [1 g (13 mmol) in 10 mls] was added in every liter dialysate of that specific patient. Complications (Noninfectious and infectious) outcome of patients and PD procedure of each case were observed meticulously. All complications were noted, and management was

given accordingly. Heart rate, blood pressure, oxygen saturation, 24 hours urine output was monitored during whole PD time. Peritonitis was diagnosed according to presence of abdominal pain, diffuse tenderness and cloudy effluent. The study was ethically permitted by hospital authority and informed consent was taken from parents.

Data of all patients were entered into a computerized software and a database was made, then transferred into a Statistical Package for Social Sciences (SPSS) software for windows, version 18, USA. Descriptive statistics were presented as mean $\pm$ standard deviation for continuous variable and as frequencies (Number) and percentages for categorical variables. The chi-square (χ^2) tests were used for analysis of proportions. A p value of less than 0.05 was considered significant.

Results

The study included 31 children, of whom 15 (48.4%) were male and 16 (51.6%) were female in Table I.

Table I Socio-demographic profile of the patients (n=31)

Variables	Frequencies	Percentage (%)
Age		
1—12 months	7	22.6
1—5 years	8	25.8
5- 12 years	16	51.6
Gender		
Male	15	48.4
Female	16	51.6

Table II Causes of AKI of the patients (n=31)

Causes of AKI	Frequency	Percentage (%)
Septicemia	3	9.7
Hemolytic Uremic Syndrome (HUS)	5	16.1
Acute Gastroenteritis (AGE)	6	19.4
Rapidly Progressive		
Glomerulonephritis (RPGN)	4	12.9
AKI on CKD	4	12.9
Insect Bite	2	6.5
AKI due to Covid +	1	3.2
AKI due to Dengue fever	1	3.2
Lupus Nephritis	1	3.2
Enteric Encephalopathy	1	3.2
KAKUT	1	3.2
Obstructive Uropathy	2	6.2

Table II showed causes of AKI. 6 (19.4%) patients had Acute gastroenteritis, 5 (16.1%) had hemolytic uremic syndrome, AKI on CKD were among 4 (12.9%) patients and rapidly progressive glomerulonephritis was also found among 4 (12.9%) patients. Regarding indication of APD, 14 (45.2%) patients had azotemia, 8 (25.8%) had severe electrolyte imbalance, 6 (19.4%) patients had anuria and 3 (9.7%) patients had uremic encephalopathy (Figure 1) out of 31 patient.

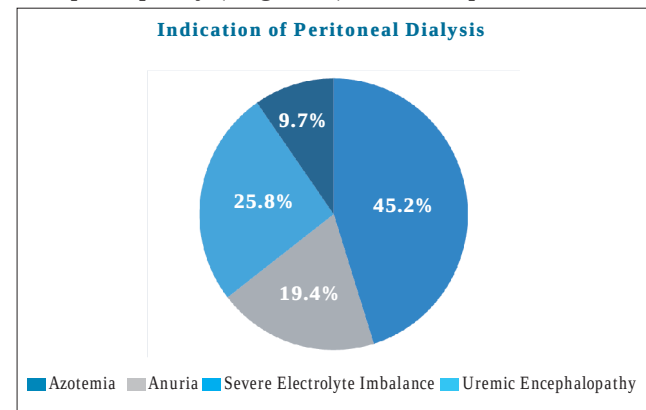


Figure 1 Indications of Acute Peritoneal dialysis (APD)

Table III Complications of Peritoneal Dialysis (n=31)

Complications of APD	Frequency	Percentage (%)
Complications (Absent)	18	58.1
Complications (Present)	13	41.9
Catheter Leakage	3	9.7
Outflow Obstruction	3	9.7
Occlusion of Omentum	1	3.2
Reinsertion of Catheter	0	0
Peritonitis	2	6.5
Hemorrhage	1	3.2
Multiple Complications		
Hemorrhage + outflow obstruction	1	3.2
Hemorrhage+ outflow obstruction & Reinsertion of catheter	1	3.2
Hemorrhage + peritonitis	1	3.2

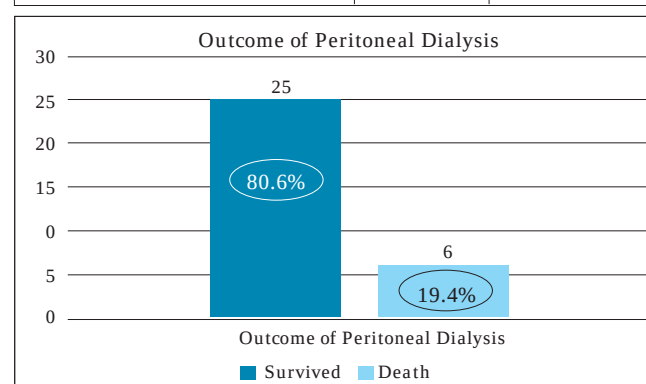


Figure 2 Outcome of Peritoneal Dialysis (n=31)

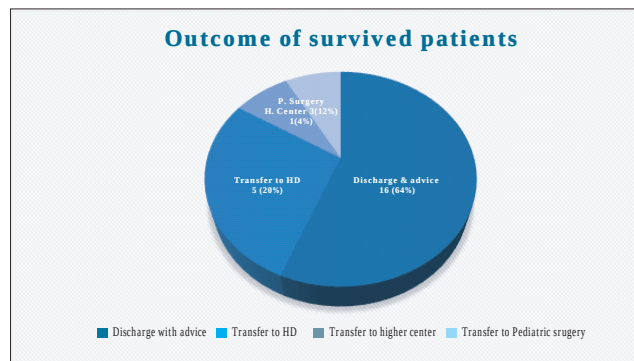


Figure 3 Outcome of survived patients (n=25)

Maximum patients (58.1%) had no complication. Catheter leakage and outflow obstruction were found among 3 (9.7%) patients in both cases and 2 (6.5%) patients had peritonitis. Hemorrhage and occlusion of omentum were found in 1 patients (3.2%) respectively (Table III). Combined complications were also occurred in few patients. Among 31 patients, 25 (80.6%) patients was survived and 6 (19.4%) patients were expired (Fig 2). 16 (64%) patients was discharged with advice, 5 (20%) patients were transferred for hemodialysis, 3 patients (12%) referred to pediatric surgery ward and 1 (4%) patients referred to higher center for further management with in 25 survived patients. (Figure 3) Table IV showed association of age with outcome of the study patients, it was observed that differences of outcome regarding age was statistically not significant ($p < 0.05$) among the outcome groups. Table V showed association of complication with outcome of the patients.

Table IV Association between age and outcome of the patients (n=31)

Age	Outcome		p value
	Survived	Death	
1—12 months	6 (24%)	1 (3.2%)	0.868
1—5 years	6 (24%)	2 (6.5%)	
>5 years	13 (52%)	3 (9.7%)	

Table V Association between complication and outcome of the patients (n=31)

Complication	Outcome		p value
	Survived	Death	
Yes (13)	7 (53.8%)	6 (46.15%)	0.001
No (18)	18 (100%)	0 (0%)	

All the 18 (100%) patients who had not experienced any complications were survived. But among 13 patients who had complications, 7 (53.8%) patients were survived and 6 (46.2%) patients were dead. These differences were statistically highly significant ($p = 0.001$) among the outcome groups.

Discussion

Dialysis is one of the better option as a treatment of AKI. But application of different continuous dialysis modalities is more difficult in children than adults because of lack of varying sizes in dialyzer, specialized blood pumps or blood lines according to age and weight of patients. In addition, experienced and trained nursing staffs are mandatory for continuing this complex therapy. Financial cost and total dependences over specialized machinery supports are other drawbacks of continuous dialysis therapy. In these aspect IPD has been used to treat AKI for long time in children and this modality of dialysis is more popular for acute management of AKI in Bangladesh, a poor resource country of the world. Decreased renal perfusion due to acute gastroenteritis, vomiting, sepsis, NSAID are the common prerenal causes of AKI. Glomerulopathies including hemolytic uremic syndrome, rapidly progressive glomerulonephritis and all kinds of glomerulonephritis often accompany AKI in children.¹⁰

In our study, common causes of AKI were acute gastroenteritis (19.4%) hemolytic uremic syndrome (16.1%) AKI on CKD (12.9%) rapidly progressive glomerulonephritis-RPGN (12.9%) septicemia (9.7%) Insect bite (6.7%). Another study among children of Dhaka shishu Hospital, Bangladesh showed the common causes of AKI were sepsis (25.6%) hypovolemia (25.6%) acute glomerulonephritis (11.6%) Insect bite (9.3%) HUS (7.0%) in which the causes of AKI were almost same as our study.³ But study among Pakistani children showed highest cause of AKI in children was urolithiasis -85.7% then sepsis 72.7%, Post Infectious Glomerulonephritis (PIGN) 35.1%, envenomation 10.8%, liver related disease 9.1%, malarial nephropathy 8.1% and these causes were deferent from our study.¹¹ One study of Eastern India revealed that etiology of AKI in children included sepsis (46%) PIGN (13.79%) snake bite (11%) HUS (3.4%) nephrolithiasis (0.86%).¹² One study from Bosnia and Herzegovina showed the most common cause of AKI in children was

HUS (25.6%) than glomerulonephritis (7.7%) and leucosis (5.2%) respectively.¹³ Regarding indication of APD, this study showed azotemia(45%) electrolyte imbalance (26%) anuria (19%) and uremic encephalopathy (10%). In a Nigerian study, the major indications were azotemia (64.5%) inborn error of metabolism (19.3%) obstructive uropathy (8.1%) congenital nephrotic syndrome (3.2%).¹⁴ One study among children of Iraq showed common indications of APD were azotemia (40%) Refractory acidosis (15%) uremic encephalopathy (12%) and anuria (12%) which was similar to this study.¹⁵

Complications can arise in any invasive procedure like IPD. In current study, complications were absent (Table 3) in 58.1% but developed in 49.8% patients. Catheter leakage (9.7%), outflow obstruction 9.7%), peritonitis (6.5%), hemorrhage (3.2%)were notified as single complications. Multiple complications included hemorrhage along with outflow obstruction and reinsertion of catheter (3.2%). PD fluid leakage (7%) catheter malposition (5%) abdominal wall edema (3%) peritonitis (1%) are found similarly as common IPD related complications in a Nigerian study.¹⁶ But Nariman F A was found the IPD related complications in only 18.6% patients in his study and those were exit site bleeding (27%) catheter malfunction (45%) peritonitis (9%) trauma of internal organ ((9%).¹⁷ This results agreed with another study conducted in Bagdad, Iraq in where catheter blockage (20.3%) bleeding (15.2%), Leakage (6.7%), peritonitis (5%) perforation of internal organ (1.6%) were notified as complication.¹⁸

As an outcome, 25 (80.6%) patient were survived but 6 (19.4%) patient were died in present study. Mishra et al showed 63.15% were survivors and 36.84% were non-survivors after APD for AKI in their study.¹⁹ But another study informed high mortality rate (71.4%) after APD due to several causes of AKI as the median age at catheter placement was 39 days (Range 2–2,286) and the median body weight was 3.53 kg (Range 1.2–48.8) in that study.²⁰ Among 25 survived patients in current study, 64% was discharged to home with advice, 20% had changed the modality to HD, 12% and 4% patients were transferred to pediatric surgery and higher center respectively for further management. But reverse result was found in one of the study that among 78 children of AKI due to different causes who needed APD, 19 children (24.3%) expired during the course of illness. 36

(46.1%) children had progression of the illness with 11 children (30.55%) requiring CAPD for maintenance therapy.²¹ Presence of complications were significantly associated with the outcome in our study. 100 % patients were survived who had no complication but 46.15% were died and 53.8% were survived among patient with single or multiple complications after IPD. One Nigerian study showed, use of APD was associated with relatively high survival despite poor socio-economic conditions, but complication rates were high in children.²² But one study from Taiwan reported some factors like sepsis, cardiac failure and multisystem organ failures were associated with outcome of APD due to AKI which were different from this study.²³ Special attention in preventing complications after APD can increase survival rate with better outcome in case of IPD according to current study.

Limitation

Few number of patients were included in this article have limited statistical analyses to a simple description. Secondly it was a single center study.

Conclusion

As a simple, safe and inexpensive procedure, APD may be better lifesaving short-term dialysis support in children. It is a good option for the emergency management of AKI due to different causes with poor resource settings. Absence of complications after APD are highly associated with good survival rate and outcome of this kind of treatment modality.

Disclosure

All the authors declared no conflict of interest.

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Anthropometric Assessment of Upper Arm Length, Hand Length and Hand Breadth Between Children with Autism Spectrum Disorder and Normal Children of Bangladesh: A Comparative Study

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Abstract

Background: Anthropometric measurements are useful indicators of physical growth and development. Autism Spectrum Disorder (ASD), a neurodevelopmental condition characterized by social and behavioural impairments, is increasingly associated with motor and growth abnormalities. However, data on upper limb anthropometry in Bangladeshi children with ASD remain limited. To compare upper arm length, hand length and hand breadth between children with ASD and typically developing children.

Materials and methods: This cross-sectional observational study was conducted in the Department of Anatomy, Chittagong Medical College, from July 2018 to June 2019. A total of 200 children aged 2–18 years were included, comprising 100 normal children (Group A) and 100 children with ASD (Group B). Measurements of upper arm length, hand length, and hand breadth were taken using standard techniques. Data were analysed using SPSS (Version 22) and comparisons were made using the unpaired Student's t-test.

Results: Children with ASD had significantly lower mean upper arm length (25.89 ± 5.03 cm vs. 31.24 ± 5.38 cm, $p < 0.001$) and hand length (14.06 ± 2.25 cm vs. 15.90 ± 1.88 cm, $p < 0.001$) compared

to normal children. No significant difference was observed in hand breadth ($p > 0.05$).

Conclusion: Upper arm length and hand length are significantly reduced in children with ASD, suggesting altered growth and motor development. Anthropometric assessment may serve as a useful adjunct in the clinical evaluation of children with ASD.

Key words: Autism Spectrum Disorder (ASD); Anthropometry; Breadth of Hand; Length of Hand; Motor development; Upper arm length.

Introduction

The term anthropology, derived from the Greek words *Anthropos* (Human) and *logia* (Study) refers to the scientific study of humans and their variations. It encompasses several subfields, including biological anthropology, which focuses on human growth, development and physical variation.¹ Anthropometric measurements are widely used to assess such variations, which are influenced by multiple factors including genetics, nutrition, environment, age and gender.²

Autism Spectrum Disorder (ASD) is a rapidly increasing neurodevelopmental disorder characterized by impairments in social communication, behavior and interaction. Symptoms typically appear in early childhood and vary widely in severity, reflecting its "Spectrum" nature.^{3,4} Globally, the prevalence of ASD has shown a rising trend, with estimates indicating approximately 1 in 59 children in the United States and 1 in 66 in Canada.⁵ In Bangladesh, although comprehensive national data remain limited, available studies suggest a gradual increase in prevalence, particularly in urban areas. A community-based study reported that ASD affects a notable proportion of children, highlighting the growing burden of this condition in both urban and rural settings.⁶ Additionally, recent studies in Bangladesh have explored associated factors such as sleep disorders, lifestyle

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patterns, and caregiver awareness, emphasizing the multifactorial nature of ASD in this population.⁷

Beyond behavioral features, emerging evidence highlights the importance of physical growth and body composition in children with ASD. Factors such as nutrition, muscle mass, and physical activity significantly influence motor development and overall health.⁸ Anthropometric assessment provides a useful approach to evaluate these differences. Therefore, examining parameters such as upper arm length, hand length and hand breadth may offer valuable insights into growth patterns and motor function in children with ASD. Despite these findings, limited research has focused on upper limb anthropometric parameters in Bangladeshi children with ASD. Therefore, the present study aims to address this gap by evaluating upper arm length, hand length and hand breadth and exploring their potential association with motor development in children with ASD.

Materials and methods

It was cross-sectional and observational study with some analytical components, carried out in the Department of Anatomy, Chittagong Medical College, Chattogram, during the study period of July, 2018 to June, 2019. The study population was divided into two groups. Group A was 100 normal Bangladeshi children and Group B was 100 Bangladeshi children with Autism spectrum disorder aged between 02 and 18 years collected by convenient sampling. Those having any skeletal disease/deformity, mixed in origin, Rickets or kidney diseases, craniofacial reconstructive surgery and tribal people were excluded from the study. Ethical clearance for doing the research was obtained from the Institutional Review Board /Ethical Review Board (E.R.B) of Chittagong Medical College.

Three variables namely upper arm length, length of hand and breadth of hand were analyzed in this study.

Operational Definitions

Upper arm length:

It measures from upper edge of the posterior border of the acromion process of the scapula to the posterior surface of the arm to the tip of the olecranon process.⁹

Length of hand:

It is the linear distance between the mid-point of the distal wrist crease and the tip of the most anterior projecting point (tip of the middle finger).¹⁰

Breadth of hand:

It is measured as the distance between the most lateral point on the head of the second metacarpal bone and the most medial point on the head of the fifth metacarpal bone¹¹.

Normal children were recruited from Zaman Anwar Institute and Islami Somaj Kallan Porishad High School as the control group (Group A). Children with Autism Spectrum Disorder (ASD) were selected from Nishpap Autism School and Seher Autism Center as the case group (Group B).

All children in Group A were verified using student ID cards or birth certificates, while children in Group B were identified and evaluated at their respective centers. Prior to data collection, parents, teachers, or legal guardians were informed about the purpose and nature of the study and written informed consent was obtained.

A structured checklist was developed by the researcher to collect relevant information, including age, sex, parental background, and criteria related to inclusion and exclusion. Parents or teachers assisted in positioning the children during measurement when necessary.

To minimize technical and inter-observer error, all measurements were taken by the same observer using the same instruments. Each parameter was measured twice, and the average of the two readings was considered the final value. If there was a significant discrepancy between the first two readings, a third measurement was taken, and the two closest values were averaged.

Measurement Techniques

Upper Arm Length: Upper arm length was measured with the child standing erect, feet together, and the right arm flexed at 90 degrees at the elbow with the palm facing upward. The observer stood behind the child. The uppermost point of the posterior border of the acromion process of the scapula was identified and marked. A measuring tape was placed at this point and extended along the posterior aspect of the arm to the tip of the olecranon process. The measurement was then recorded.¹⁰

Length of Hand: Hand length was measured as the linear distance from the midpoint of the distal wrist crease to the tip of the middle finger. A digital sliding caliper was used for accurate measurement.¹⁰

Breadth of Hand: Hand breadth was measured as the linear distance between the most lateral point of the head of the second metacarpal and the most medial point of the head of the fifth metacarpal. The measurement was taken at the level of the knuckles using a digital sliding caliper.¹⁰

The range mean and standard deviation of values of the variables were calculated using computer-based programs Statistical Package for Social Science (SPSS version-22). Unpaired Student's 't' test was done.

Results

Table 1 and Figure 1 presents the comparison of mean $\pm$ standard deviation of upper arm length, hand length and hand breadth between normal children and children with Autism Spectrum Disorder (ASD). The mean upper arm length was significantly lower in children with ASD (25.89 ± 5.03 cm) compared to normal children (31.24 ± 5.38 cm) and this difference was statistically highly significant ($t = 7.27$, $p < 0.001$). Similarly, the mean hand length was also significantly reduced in children with ASD (14.06 ± 2.25 cm) compared to normal children (15.90 ± 1.88 cm) showing a highly significant difference ($t = 6.3$, $p < 0.001$).

However, the mean hand breadth did not differ significantly between the two groups, with values of 6.69 ± 0.95 cm in children with ASD and 6.86 ± 0.85 cm in normal children ($t = 1.4$, $p > 0.05$). These findings indicate that while upper arm length and hand length are significantly reduced in children with ASD, Hand breadth between the groups was not statistically significant

Table 1 Comparison of upper arm length, hand length and hand breadth of study subjects

Variables	Normal children Mean $\pm$ SD (n=100)	Children with Autism spectrum disorder Mean $\pm$ SD (n=100)	p value
Upper arm length	31.24 $\pm$ 5.38	25.89 $\pm$ 5.03	< 0.001***
Length of hand	15.90 $\pm$ 1.88	14.06 $\pm$ 2.25	< 0.001***
Breadth of hand	6.86 $\pm$ 0.85	6.69 $\pm$ 0.95	>0.05

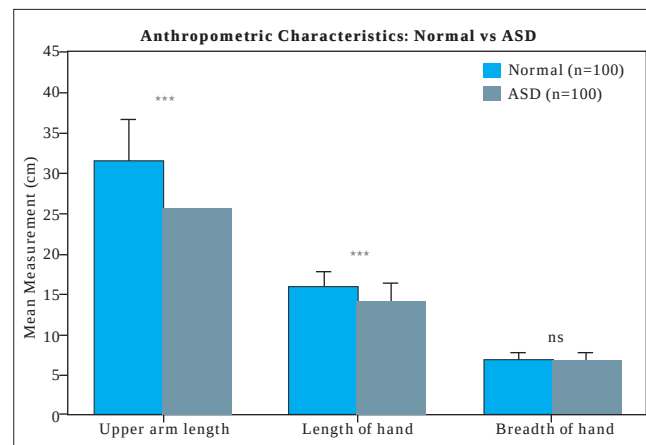


Figure 1 Comparison of upper arm length, length of hand and breadth of hand of study subjects.

Discussions

Autism spectrum disorder is diagnosed using DSM 5 criteria.⁵ Although these criteria are useful for final confirmation, examination of the anthropometric variables by physical procedure will be also useful technique in the clinical assessment. Several studies on anthropometric variables of children with Autism spectrum disorder in different racial origins were reported, but there is no such report yet on the Bangladesh.

The present study demonstrated that children with ASD had significantly (p value < 0.001) shorter upper arm length and hand length compared to typically developing children. These findings suggest potential growth differences and may reflect reduced motor activity and altered neuromuscular development in children with ASD. Although hand breadth showed less consistent variation, it remains an important anthropometric parameter in understanding overall limb development.

Motor impairments in ASD have traditionally been considered secondary or "Associated" features rather than core diagnostic criteria. However, increasing evidence indicates that motor dysfunction plays a substantial role in the overall clinical profile of ASD.¹² Hypotonia, poor coordination and deficits in motor planning are frequently reported and may influence physical growth and activity levels.

The findings of this study are consistent with previous research reporting motor abnormalities in children with ASD. Ming et al. identified hypotonia as one of the most common motor impairments in

ASD which may contribute to reduced muscle strength and limited physical activity.¹² Similarly, Shetreat-Klein et al. reported abnormalities in gait and joint mobility, indicating impaired motor development.¹³

The wide variation in reported prevalence of motor deficits (Ranging from 21% to 100%) highlights the heterogeneity of ASD.^{14,15} Lee and Bo emphasized that motor impairments are significant yet variable, suggesting that individual differences in motor ability may influence physical development.¹⁶

Furthermore, Hsu et al. reported that altered body composition—characterized by increased fat mass and decreased muscle mass—is associated with reduced motor performance in children with ASD.¹⁷ These physiological differences may contribute to the observed reductions in upper limb measurements in the present study.

Although previous studies have examined motor function and body composition, there is limited research focusing specifically on anthropometric parameters such as upper arm length and hand dimensions in children with ASD. Therefore, the findings of this study provide additional evidence supporting the relationship between motor function and physical growth in this population.

Conclusion

This cross-sectional study of 200 children demonstrates that those with Autism Spectrum Disorder have significantly reduced upper arm length and hand length compared to typically developing peers, indicating differences in growth and motor development. Hand breadth showed comparatively smaller variation. These findings support the role of motor impairment as an important component of ASD and highlight the relevance of anthropometric assessment in clinical evaluation. Incorporating simple upper limb measurements may aid early identification of motor deficits and guide intervention strategies. Further longitudinal studies are needed to clarify causal relationships and their impact on functional outcomes.

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Disclosure

All the authors declared no competing interest.

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Pattern of Dry Eye Disease after Cataract Surgery and Its Determinants and Risk Factors at a Tertiary Hospital of Bangladesh

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Abstract

Background: Cataract surgery is one of the most frequently performed ophthalmic procedures worldwide in restoring vision. However, postoperative Dry Eye Disease (DED) can affect visual comfort and patient satisfaction. The aim of the study is to evaluate the pattern, severity, and determinants of dry eye disease following cataract surgery among patients attending a tertiary hospital in Bangladesh.

Materials and methods: A prospective observational study was conducted at the Department of Ophthalmology, Chittagong Medical College Hospital, from January 2022 to June 2023. A total of 113 patients aged 40 years undergoing age-related cataract surgery were included after excluding those with pre-existing DED or other ocular pathologies. Dry eye parameters were assessed preoperatively and at postoperative day 7, day 30 and day 90 using the Ocular Surface Disease Index (OSDI) Tear Film Break-Up Time (TBUT) and Schirmer's Test-1 (ST-1). Data were analyzed using SPSS version 25.

Results: The mean age of participants was 57.7 ± 9.0 years. The incidence of DED peaked on the 7th postoperative day (51.3% by OSDI, 53.1% by TBUT, and 49.6% by ST-1) and declined markedly by day 90 (8–9.7%). Most early postoperative cases were mild and resolved within three months. Microscopic light exposure time was significantly associated with postoperative DED ($p = 0.016$) while surgery type, incision length, and cumulative dissipated energy showed no significant relationship.

Conclusion: Cataract surgery induces a transient but clinically significant reduction in tear film stability, which largely resolves within three months. Preoperative counseling and early postoperative lubrication therapy are recommended to enhance comfort and satisfaction.

Key words: Cataract surgery; Dry eye disease; Ocular Surface Disease Index (OSDI); Postoperative complications; Schirmer's test, Tear Film Break-Up Time (TBUT).

Introduction

The emergence of visually symptomatic cataract is prevalent, and it is the leading cause of treatable blindness worldwide.¹ Cataract surgery is a widely performed procedure globally, and advances in intraocular lens implant technology are increasing the effectiveness of cataract surgical techniques. Cataract surgery may be considered among the most successful treatments in all of medicine.²

Despite scientific advances in cataract surgery have enhanced the Quality of Life (QOL) of millions of individuals worldwide over the last half-century, there are possible challenges that can be both sight and non-sight threatening.³ While the majority of scientific, clinical, and technical advancements are aimed at preventing vision-threatening conditions it is crucial not to overlook the avoidance and mitigation of non-sight-threatening side effects, which can have a significant impact on patient QOL. One such example is Dry Eye Disease (DED).⁴

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Patients with DED experience a variety of symptoms, potentially affecting their QOL, with more difficulties in daily tasks like reading, driving and work-related activities.⁵ A utility assessment study was carried out to measure the effect of DED on QOL and discovered that utility scores in DED were equal to those of angina patients or people who regularly receive dialysis.⁶ Another study also revealed that, in comparison to controls, patients with DED have greater rates of anxiety and depression.⁷

In addition to the conventional risk factors for DED, it has been observed that several surgical procedures involving the anterior segment, such as cataract surgery, can either result in DED or exacerbate existing symptoms of dry eye. Factors that are responsible for development of dry eye after cataract surgeries include immediate preoperative use of povidone iodine and topical anesthetics, type of surgery, the site of the incision, incision length, repeated intraoperative ocular surface drying and irrigation, phototoxicity by operating microscope and postoperative prolong use of antibiotic-steroid eye drops.⁸⁻¹¹ Surgical procedures like cataract surgery cause denervation of the cornea, which results in impaired epithelial wound healing, increased epithelial permeability, decreased epithelial metabolic activity, and loss of cytoskeletal structures associated with cellular adhesion.¹²

The incidence of dry eye after cataract surgery without preexisting DED has been reported to vary widely, from 9.8% to 91.7%.^{4,13} Explain potential reasons for this, such as differences in patient populations, varying diagnostic criteria for dry eye, or different surgical techniques and technologies used. However, the follow-up of dry eye symptoms after cataract surgery and analysis of correlating risk factors has not been undertaken adequately in Bangladesh. To fill this knowledge gap, the study was carried out with an aim to assess the frequency and severity of DED and its determinants and risk factors among patients undergoing cataract surgery at a tertiary care hospital in Bangladesh.

Materials and methods

This was a prospective observational study conducted at the Department of Ophthalmology of Chittagong Medical College Hospital (CMCH) Chattogram, Bangladesh, from January 2022 to June 2023.

The study population included patients aged 40 years and older who were admitted for age-related cataract surgery and were consecutively enrolled after being screened for eligibility. Patients were

excluded for pre-existing dry eye disease, use of certain topical or systemic medications known to cause dry eye, concurrent ocular pathologies affecting the surface, a history of ocular surgery on the operative eye within the previous six months, other ocular pathologies besides age-related cataract in the operative eye and a history of specific systemic diseases associated with dry eye. Patients who experienced intraoperative or postoperative complications or refused to participate were also excluded from the study.

Data were collected via a structured questionnaire after obtaining informed written consent. The study defined Dry Eye Disease (DED) based on both subjective and objective measures: the Ocular Surface Disease Index (OSDI) questionnaire for symptoms, and Schirmer's Test-1 (ST-1) and Tear Film Break-Up Time (TBUT) for objective analysis. The pre-validated OSDI, scaled from 0 to 100, assessed symptoms, vision-related function, and environmental factors over the past week, with a score of ≥ 13 defining DED. To mitigate postoperative visual acuity bias, the OSDI calculation formula—(Sum of all answered questions $\times 100$) / (Total answered questions $\times 4$)—was modified by excluding two vision-related questions.⁴ TBUT measured tear film stability (The time between the last blink and the first dry spot appearance after fluorescein application), with 10 seconds indicating dry eye. ST-1, using Whatman No. 41 paper for 5 minutes, assessed basal and reflex tear secretion, with wetting of 10 mm considered dry eye.¹⁴ The severity of DED based on OSDI, TBUT, and ST-1 was further graded as mild, moderate, or severe.¹³ For the OSDI score, mild is 13-22, moderate is 23-32 and severe is 33-100. TBUT is categorized as mild at 6.1-10 seconds, moderate at 3.1-6 seconds, and severe at 0-3 seconds. Finally, ST-1 wetting is considered mild at 5-10 mm, moderate at 3-4 mm, and severe at 0-2 mm.

Preoperative ST-1, TBUT and OSDI were used to exclude patients with pre-existing DED. Patients underwent either SICS (With a 6-8 mm scleral tunnel incision) or phacoemulsification (With a 2.8 mm clear corneal incision) with multiple experience surgeons. Postoperatively, the dry eye tests were performed and recorded at 1 week, 1 month and 3 months to assess post-surgical DED status.

Data were analyzed using SPSS version 25.0. Continuous variables were expressed as mean $\pm$ SD, and categorical variables as frequency and percentage. Group comparisons used Chi-square test for categorical data, and independent sample t-test for continuous data. A p-value < 0.05 was considered significant.

Ethical approval was taken before starting the study from the Ethical Review Committee of Chittagong Medical College (Memo no. CMC/PG/2022/819 Dated 10/02/2022).

Results

Table I Age and Sex distribution (n=113)

Variables		Frequency	Percentage
Age	40-49	22	19.5
	50-59	37	32.7
	60-69	39	34.5
	70-79	14	12.4
	80-89	1	.9
	Mean $\pm$ SD years	57.7 $\pm$ 9.0 years	
	Range	41-80 years	
Gender	Male	59	52.2
	Female	54	47.8

Data were expressed as frequency and percent if not mentioned otherwise. SD: Standard Deviation.

In the present study age ranged between 41-80 years, with the mean age of 57.7 $\pm$ 9.0 years. After age grouping, the maximum number of the cases (34.5%) were in the age group of 60-69 years. Among the 113 cases in this study, 59 (52.21%) were males and 54 (47.79%) were females, with a male to female ratio of 1.09:1.

Table II Presenting Visual symptoms

Symptoms	Frequency	Percentage
FB sensation	33	29.2
Photophobia	33	29.2
Watering	14	12.4
Burning sensation	12	10.6
Discharge from eye	6	5.3
Itching	6	5.3
Lid heaviness	6	5.3
Eye pain	6	5.3
Redness of eyes	3	2.7

FB: Foreign Body, Data were expressed as frequency and percent if not mentioned otherwise. The most common visual symptoms were FB sensation (29.2%) and Photophobia (29.2%) followed by watering (12.4%) burning sensation (10.6%) discharge from eye (5.3%) itching (5.3%) lid heaviness (5.3%) eye pain (5.3%) and redness of eyes (2.7%).

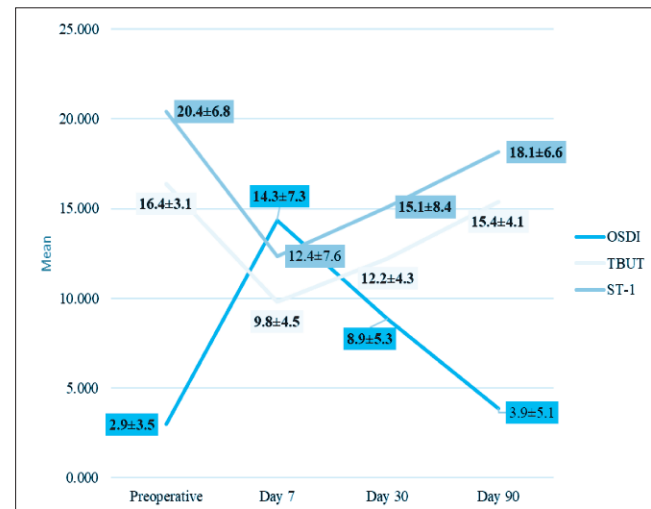


Figure 1 Pattern of dry eye after cataract surgery

The line diagram shows mean OSDI score, TBUT and ST-1 values at preoperatively and different postoperative period. The mean OSDI scores, TBUT and ST-1 values at day 7 postoperatively were 14.3 $\pm$ 7.3, 9.8 $\pm$ 4.5 sec. and 12.4 $\pm$ 7.6 mm respectively. The line diagram showing worsening of OSDI score, TBUT (In seconds) and ST-1 (In mm) at in early postoperative period (Day7) with gradual improvement in subsequent follow-ups.

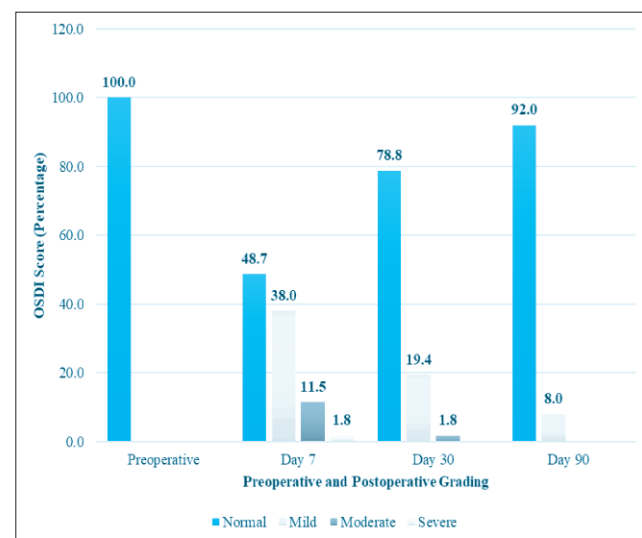


Figure 2 Distribution of OSDI Severity grading during preoperative and postoperative period

During the first follow-up at day 7, 43 (38.0%) patients had mild dry eye, 13 (11.5%) had moderate dry eye, and only 2 (1.8%) patients had severe dry eye, while the remaining 48.6% patients had no dry eye. There were decreased cases of mild and moderate dry eye as well as no cases of severe dry eye on successive follow-ups.

Table III Incidence of dry eye after Cataract Surgery (n=113)

Test	Day 7	Day 30	Day 90
OSDI	51.3 %	21.2 %	8 %
TBUT	53.1 %	28.3 %	9.7 %
ST-1	49.6 %	31.9 %	9.7 %

OSDI: Ocular Surface Disease Index, TBUT: Tear Break-Up Time, ST-1: Schirmer's Test-1

Table III shows the incidence of dry eye at 7th postoperative was 51.3%, 53.1% and 49.6% according to OSDI score, TBUT and ST-1 respectively. After 30 and 90 days of cataract surgery, incidence was dramatically decreased in all dry eye tests.

Table IV Association of Dry eye with surgical parameters in this study

Variables		Dry Eye		p value
		Absent (n=55)	Present (n=58)	
Type of surgery	SICS	38 (69.1)	40 (69.0)	.575*
	Phacoemulsification	17 (30.9)	18 (31.0)	
Incision Length (mm)	5.7±2.0	5±2.0	.972†	
Microscopic light exposure time (min)	20.4±3.2	22.0±3.8	.016†	
CDE (%)		17.7±3.8	19.7±5.1	.200†

*Chi-Square test, †Independent sample t test, SICS: Small Incision Cataract Surgery, CDE: Cumulative Dissipated Energy.

The analysis of surgical parameters showed that neither the Type of surgery (p=0.575) Incision Length (p=0.972) nor Cumulative Dissipated Energy (CDE) (p=0.200) were significantly associated with the presence of dry eye. However, the Microscopic light exposure time was significantly longer in the dry eye group (22.0±3.8 minutes) compared to the group without dry eye (20.4±3.2 minutes), with a statistically significant p-value of 0.016.

Discussion

A total of 225 patients were initially screened for eligibility. Of these, 129 met the pre-defined inclusion and exclusion criteria and were enrolled. A significant limiting factor for the final sample size was the high prevalence of age-related cataract associated with a history of diabetes among the admitted patient population. Following

enrollment, eight patients were excluded from the study due to surgery-related complications. The remaining 121 operated patients were included in the follow-up assessment for dry eye disease. Subsequently, a total of eight patients were lost to follow-up (one at the Day 30 assessment and seven at the Day 90 assessment). Consequently, the final analysis was performed on 113 patients.

Out of 113 patients studied, those 60-69 years old formed the largest age group (34.5%), followed by those 50-59 years old (32.7%), with a mean age of 57.7 ± 9.0 years. The Beaver Dam eye research found a higher frequency of dry eyes and a connection with advancing age.¹⁵ The study population's sex distribution was male 59 (52.21%) and female 54 (47.79%) with a ratio of 1.09:1. The relationship between female sex and dry eye disease is well-established in the literature.^{16,17} The widely documented association between female sex and dry eye disease is often explained by the influence of sex hormones. Specifically, the differential effect of androgens is implicated as a potential hormonal mechanism driving the higher prevalence of dry eye symptoms observed in women.^{18,19}

Preoperatively, the majority of patients reported FB sensation (29.2%) and photophobia (29.2%), with watering (12.4%) and burning sensation (10.6%) following, while all dry eye test results were within normal limits. Photophobia and itching were also noted as complaints by Garg et al.¹³ Additionally, Szakáts et al. discovered that patient-reported visual functionality, dry eye symptoms and health anxiety are more closely related to postoperative satisfaction than objective clinical assessments of visual acuity or indicators of dry eye.²⁰ When diagnosing dry eye, patients' symptoms and clinical signs are equally significant, as some patients with mild disease may have severe symptoms, while others with severe dry eye may have limited symptoms. This can result in patient dissatisfaction with the postoperative outcome.

According to this study's findings about the pattern of change in several dry eye parameters, the mean OSDI scores on day 7, 30 and 90 postoperatively were 14.3 ± 7.3 , 8.9 ± 5.3 and 3.9 ± 5.1 , respectively. Mean TBUT value were 9.8 ± 4.5 , 12.2 ± 4.3 , and 15.4 ± 4.1 seconds, at postoperative 1 week, 1 month and 3 months, respectively. At the same time

points, mean Schirmer's test result was 12.4 ± 7.6 , 15.1 ± 8.4 and 18.1 ± 6.6 mm respectively. The distribution of severity grading based on OSDI across the study period revealed a pronounced, yet transient, exacerbation of dry eye following the surgical intervention. On first week following surgery, Mild dry eye was observed in 38.0%, Moderate in 11.5%, and Severe in 1.8% of the cohort. A robust recovery was observed thereafter: by Day 30, 78.8% of the cohort had returned to the Normal state. By three months post-surgery, the cohort had largely returned to its preoperative, asymptomatic state. 92.0% of patients were classified as Normal, with only 8.0% reporting Mild symptoms. Importantly, Moderate and Severe dry eye symptoms were entirely absent by Day 90. This trend confirms that the surgical effect on subjective dry eye symptoms is primarily acute and resolves significantly by three months postoperatively. Several studies showed varying persistence of DED and ocular surface abnormalities ranging from 1 week to 12 months after cataract surgery^{4,11,21–23}. Similarly, most previous studies also reported a predominance of mild dry eye (53.32% by Venugopal and Krishnaraj, 85.8% by Kasetsuwan et al.^{4,24}). However, Jayshree et al. reported a predominance of severe dry eye (61.72%).²⁵

Among the study population, the incidence of dry eye at 7th postoperative period of cataract surgery was 51.3%, 53.1%, and 49.6% according to OSDI score, TBUT, and ST-1 respectively. The lack of a gold standard test makes determining dry eye a challenge. The OSDI questionnaire is a valid representation of dry eye for the purposes of this study and has also been selected in different studies.^{13,21} The incidence of dry eye after cataract surgery without preexisting DED has been reported to vary widely, from 9.8% to 91.7%.^{4,13} The fact that the study population experienced visual complaints even prior to cataract surgery, even though all dry eye tests were within normal limits, may have contributed to the substantially higher burden of dry eye incidence in our study.

The type of surgery (SICS or Phacoemulsification) did not show a statistically significant association with the presence of dry eye ($p = .575$). Specifically, 69.1% of patients without dry eye underwent SICS, which is nearly identical to the 69.0% of patients with dry eye who underwent SICS.

Correspondingly, 30.1% and 31.0% underwent Phacoemulsification in the 'Absent' and 'Present' dry eye groups, respectively. In a previous study, DED was noted in both types of surgeries (89.1% in SICS and 92.2% in phacoemulsification at day 7).¹³ Similarly, the incision length was statistically comparable between the two groups, with means of 5.7 ± 2.0 mm for the dry eye 'Absent' group and 5.7 ± 2.0 mm for the 'Present' group ($p = .972$). However, a statistically significant association was found between microscopic light exposure time and the presence of dry eye ($p = .016$). The mean microscopic light exposure time was notably longer for patients who developed dry eye (22.0 ± 3.8 min) compared to those who did not (20.4 ± 3.2 min). Long microscopic light exposure durations have been shown to negatively impact dry eye test results in previous studies.¹⁰ Finally, the CDE was numerically higher in the dry eye 'Present' group ($19.7 \pm 5.1\%$) compared to the 'Absent' group ($17.7 \pm 3.8\%$) but this difference was not statistically significant ($p = .200$). Although CDE trended higher in the DED group, the lack of significance indicates that ultrasound energy alone may not meaningfully contribute when modern phaco settings are used. These results suggest that minimizing surgical trauma, by adopting smaller incision techniques and optimizing operative efficiency, may help reduce the risk of postoperative DED.

Dry eye after cataract surgery could be due to a number of factors. The first is the transection of corneal nerves, which happens when creating the corneoscleral tunnel and usually heals with time.²⁶ Second, the surgery's infliction of ocular trauma—including cutting the conjunctiva, scraping the sclera, and fixing the limbus with toothed forceps—may prompt the release of inflammatory mediators that might hasten and exacerbate the development of dry eye.²⁴ These inflammatory mediators tend to subside over time. Thirdly, topical medications like steroids with inherent preservatives are used at a much higher dosage in the first week of surgery and tapered over the following weeks.⁸

A key strength of this study is its prospective design with multiple postoperative assessment points, enabling detailed monitoring of the evolution of DED. Clinically, the findings highlight that cataract surgery causes a marked but temporary reduction in tear film stability and tear

secretion during the early postoperative period. This underscores the importance of preoperative patient counseling and proactive postoperative management of dry eye symptoms, particularly within the first week to month after surgery.

Limitations

One notable limitation was the constrained sample size, primarily due to the high prevalence of diabetes among admitted patients with age-related cataract. The single-center design and surgeries were done by multiple surgeons.

Conclusion

Cataract surgery is highly successful at restoring vision, but some patients may experience dry eye symptoms that can affect their daily lives for months after the procedure. This is because the surgery induces a significant but largely reversible reduction in tear film stability. The findings emphasize that adopting surgical practices that minimize trauma, such as smaller incision techniques and optimized operative efficiency, can contribute to a lower incidence of postoperative DED.

Recommendations

Given the significant incidence of dry eye after cataract surgery, we recommend that we assure each and every patient preoperatively in terms of post-operative worsening of dry eye symptoms. If necessary, apply a suitable lubricant during postoperative recovery for 2 to 3 months after cataract surgery in order to prevent dry eye-related complications and give patients symptomatic relief. Surgeons should be aware and take appropriate measures about operative procedures to reduce post-operative dry eye. Furthermore, the investigation into the long-term persistent dry eye after cataract surgery is necessary.

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Disclosure

The author declared to have no conflicts of interest.

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Current Thalassemia Situation in Chattogram Region: A Hospital-Based Cross-sectional Study

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Abstract

Background: Hemoglobinopathies are roughly divided into two groups, namely, the structural hemoglobin variants (Abnormal Hb) and the thalassemias. Worldwide, thalassemias are the most common autosomal recessive disorder. Generally, thalassemias are classified into two pivotal groups, alpha-thalassemia and beta-thalassemia depending on their genetic background. Because of remarkable success in the reduction of childhood mortality and morbidity by controlling infectious diseases in developing countries, diseases like thalassemias are likely to be a major public health concern in the coming decades in South Asia including Bangladesh as it lies in the world's thalassemia belt. The information on different aspects of thalassemia including epidemiology, clinical course, mortality, complication and treatment outcomes is lacking. Hence, it is necessary to have extensive knowledge and well-spread awareness about the existing thalassemia situation. This study aimed to

evaluate the current thalassemia situation and to identify the prevailing types of thalassemia in Chattogram region. And to find out which blood groups are more prone to thalassemia.

Materials and methods: The present cross-sectional study had been carried out in three tertiary care hospitals of Chattogram region, three district sadar hospitals and one voluntary thalassemia center at Fatikchari, Chattogram. This collaborative research work was conducted with patients admitted for blood transfusion and other supportive treatment. Data were recorded in a pre-structured questionnaire. A total of 307 patients' relevant informations were collected from all the above mentioned centers from the patient's pre-recorded hospital data and patient's and parents' interviews respectively.

Results: This study assessed several sociodemographic variables of the participants and parents. Moreover, information on blood group status (Patients' and parents') were also recorded. All the hospitals provided data on 307 patients. Out of them 279 patients had adequate information. Among 279 patients, 270 had documented diagnosis of thalassemia and 9 patients were under evaluation. Findings revealed that HbE β -thalassemia (55.6%) to be the most prevalent type, followed by α -thalassemia major (25.9%) and β -thalassemia trait (8.9%). Furthermore, a unique case of diagnosis at the age of 59 was also found. Another crucial finding is that we found no Alpha-thalassemia patients in Chattogram region.

Conclusion: This comprehensive study on thalassemia in Chattogram region of Bangladesh has provided valuable insights into the demographics and current thalassemia situation. The study revealed that HbE α -thalassemia is the dominant variant in this region.

Key words: Alpha-thalassemia; ABO blood group; Autosomal recessive; Beta-thalassemia; Hemoglobinopathy.

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Introduction

Hemoglobin defects may be due to qualitative (Hemoglobinopathies) and quantitative (Thalassemia syndrome) abnormalities.¹ Hemoglobin (Hb) disorders are recognized as one of the most prevalent genetic disorders worldwide.² These disorders are roughly divided into two groups, namely, the structural hemoglobin variants (Abnormal Hb) and the thalassemias.^{3,4} Worldwide, thalassemias are the most common autosomal recessive disorder.⁵ Generally, thalassemias are classified into two pivotal groups, alpha-thalassemia and beta-thalassemia depending on their genetic background and clinical manifestations⁶. In such disorders, the erythroid precursor's additional chains do not pair together, causing an imbalanced Hb chain synthesis, leading to the lysis of red blood cell precursors in the bone marrow or in peripheral blood. Thus, anemia, hemolysis, ineffective erythropoiesis, splenomegaly and bone marrow hyperplasia are the pathophysiological outcomes of all patients with thalassemia.^{3,7,8,9} Because of remarkable success in the reduction of childhood mortality and morbidity by controlling infectious diseases in developing countries, diseases like thalassemias are likely to be a major public health concern in the coming decades in South Asia including Bangladesh. Thus, thalassemia has become an important socio-demographic and economic burden on the healthcare system of many countries in the Mediterranean area, the Middle Eastern and North African (MENA) region, Transcaucasia, Central Asia, the Indian subcontinent and Southeast Asia.^{10,11} Most conservative estimates suggest that at least 5.2% of the world population (Over 360 million) carry a significant hemoglobin variant and the most frequent single-gene disorders globally are inherited beta thalassemias, sickle cell anemia and Hemoglobin E (Hb E) disorders.¹² Bangladesh, has achieved an appreciable reduction in infant and under-5 mortality rate by combating malnutrition and infectious diseases. However, hereditary disorders like thalassemia have received little attention yet in this country. So, it is presumed that within the near future thalassemia might appear as a huge national threat in health sector of Bangladesh.¹³ It is presumed that approximately 6,000 thalassemic children are born each year in Bangladesh.^{5,14} Though Bangladesh lies in the world's thalassemia

belt, the information on different aspects of thalassemia including epidemiology, clinical course, mortality, complication and treatment outcomes is lacking.¹⁴ A conservative data published by WHO estimates that 3% are carriers of beta-thalassemia and 4% are carriers of Hb E in Bangladesh indicating that there are 3.6 million carriers of beta-thalassemia and 4.8 million carriers of Hb E.¹⁵ After being diagnosed, some patients receive treatment which usually consists of blood transfusions at different intervals depending on the severity of anemia and associated conditions along with supportive treatment throughout their life. The ABO blood group system is the most clinically significant blood group system and the ABO-incompatible transfusions are potentially fatal for the patients. So, the hospital blood bank and the development of transfusion policies both depend extensively on knowledge about the prevalence and distribution of thalassemia and blood groups. Few published data from India have been found.¹⁶ However, there has been no known data on the distribution pattern and the frequency of the ABO blood group in thalassemia patients in Bangladesh. Hence, it is necessary to have extensive knowledge and well-spread awareness about the existing thalassemia situation. That's why thalassemia prevention programs should be carried out according to the government policy in coordination with the country's local structures, social values, religious laws, and cultural traditions.⁹ Due to considerable variation of thalassemias even within a population, micro mapping is essential to calculate the actual burden of thalassemia in Bangladesh.¹⁷ Though different studies have been carried out in some areas of our country to determine the prevalence of thalassemia, there is no definite information regarding the existing thalassemia situation in Chattogram region. This cross-sectional study aims to depict the current thalassemia situation in Chattogram region by sharing the experiences from the three tertiary care hospitals of Chattogram region, three district sadar hospitals and one voluntary thalassemia center at Fatikchari, Chattogram. This study also aimed at providing information on the distribution pattern of ABO blood groups in the diagnosed patients and their parents.

Materials and methods

The present cross-sectional study had been carried out in three tertiary care hospitals of Chattogram

region, viz. Chattogram Medical College Hospital (CMCH) Chattogram Maa Shishu O General Hospital (CMSOGH) and Cox's Bazar Medical College Hospital and three district sadar hospitals, viz. Rangamati Sadar Hospital, Khagrachari Sadar Hospital and Bandarban Sadar Hospital and one voluntary center "Momena-Anowar Mohori Thalassemia center" at Fatikchari, Chattogram, from January 2023 to June 2025.

This cross-sectional collaborative research work was conducted with patients admitted for blood transfusion and other supportive treatment. Also the patients admitted for having early symptoms and signs, who were at risk of having thalassemia and under evaluation were also included based on the clinical expertise of the doctors.

Inclusion criteria of the patients under this study were the patients admitted for blood transfusion and other supportive management. Based on Hb electrophoresis test profiles different types of thalassemia were classified.

The data were recorded in a pre-structured questionnaire based on patients' and parents' interviews, patient's pre-recorded hospital data, prescriptions and laboratory test results. Information about the patients' demographic characteristics were also recorded. A total of 307 patients' relevant informations were collected.

This research work was conducted in accordance with the Helsinki declaration. Written approval was taken from the appropriate authorities of the hospitals. Ethical clearance was obtained from the ethical review committee of CVASU.

The collected data were organized and arranged using MS Excel 2010 and further analyzed and represented in tabular form. Statistical Package for Social Science (SPSS Inc., Chicago, IL) version 26 was used for data analysis. Descriptive statistics (Frequencies, percentages, minimum, maximum, mean, and standard deviation) were performed to analyze the sociodemographic and health profiles of the patients. A p-value of <0.05 was considered statistically significant.

Results

Table I Demographic characteristics of the patients (n= Total number of patients (n= total number of respondents))

Characteristics	Parameters	Number	Percentage
Gender (N=307)	Male	168	54.7
	Female	139	45.3
Education (n=166)	Primary	134	80.7
	Secondary	29	17.5
	Graduate	2	1.2
	Postgraduate	1	0.6
Community (n=221)	Non-tribe	210	95.0
	Tribe	11	5.0
Parental consanguinity (n=210)	Yes	20	9.5
	No	190	90.5
Regional distribution of patients (N=307)	CMSOGH	50	16.3
	CMCH	82	26.7
	Fatikchari	95	30.9
	Bandarban	13	4.2
	Rangamati	13	4.2
	Cox's Bazar	45	14.7
	Khagrachari	9	2.9

Table I shows among the patients 54.7% were male and 45.3% were female (N=307). Regarding educational status of the patients, majority of them had primary education (80.7%) followed by secondary level (17.5%) (n=166). Collected data shows 95.0% patients were non-tribe and 5.0% were tribe (n=221). Only 9.5% parents had history of consanguineous marriage (n=210). It also shows the regional distribution or residential information of the patients.

Table II Occupation of patients (n=97)

Occupation	Number	Percentage
Student	86	88.7
Driver	1	1.0
Child	4	4.1
Service	2	2.1
Housewife	1	1.0
Monk	1	1.0
Business	1	1.0
Auto driver	1	1.0

Table II shows the patients' occupational status. Among the respondents majority of them are students.

Table III Age range of the patients (n=304)

Patients Age Range (Years)	n(%)	Min-Max	Mean±SD	95% CI
0.5-10	166(54.6)	.25-10	4.80±2.77	4.38~5.23
>10-20	75(24.7)	11-20	14.46±2.77	13.82~15.10
>20-30	40(13.2)	21-30	24.43±3.14	23.42~25.43
>30-40	17(5.6)	31-40	36.00±2.65	34.64~37.36
>40-50	4(1.3)	41-50	45.50±3.70	39.62~51.38
>50-60	2(0.7)	51-59	58.50±7.1	52.15~64.85

Table III shows the age range of the thalassemic patients. We found minimum age of the patient was 0.5 years and maximum age was 59 years. But majority (79.3%) were between 1 and 20 years, followed by the age group between 21 and 40 years (18.8%). Only 2% were between 41 and 59 years of age.

Table IV Types of thalassemia among the patients (n=270)

Types of patients	No. of patients	Percentage
Test Given/under evaluation	9	
Beta Thalassemia Major	70	25.9
Beta Thalassemia Trait	24	8.9
Hb-E Beta Thalassemia	150	55.6
Hb-E Trait	18	6.7
Hb-E Disease	8	3.0

Among 270 patients, most prevailing type was Hb E beta-thalassemia (55.6%) followed by beta-thalassemia major (25.9%) beta-thalassemia trait (8.9%) and Hb E trait (6.7%) respectively.

Table V Demographic characteristics of the parents (n= total number of respondents)

Characteristics	Parameters	Number	Percentage
Occupation of father (n=150)	Employee/service	54	36.0
	Worker/labourer	27	18.0
	Business/shopkeeper	25	16.7
	Farmer	20	13.3
	Driver	9	6.0
	Immigrant	5	3.3
	Fisherman	2	1.3
	Teacher	1	0.7
	Barber	1	0.7
	Mason	2	1.3
	Garments worker	1	0.7
	Sanitary worker	1	0.7
	Mechanic	1	0.7
	Astrologer	1	0.7

Characteristics	Parameters	Number	Percentage
Occupation of mother (n=159)	Housewife	154	96.9
	Garments worker	1	0.6
	Health worker	1	0.6
	Teacher	1	0.6
	Tailor	1	0.6
	Farmer	1	0.6
Whether parents are aware of thalassemia? (n=201)	Yes	95	47.3
	No	106	52.7
Whether parents are suffering from thalassemia? (n=188)	Yes	96	51.1
	No	84	44.7
	Not tested	6	3.2
	Test report pending	2	1.1
Types of thalassemia in parents (n=96)	Beta Thalassemia Major	6	6.3
	Beta Thalassemia Trait	81	84.4
	HbE β-thalassemia	7	7.3
	Hb E disease	2	2.1

Here we found 14 types of occupation among the patient's fathers. Significant number of them were employee (36.0%) followed by worker (18.0%) businessman (16.7%) farmer (13.3) and driver (6.0%) (n=150). Majority of the mothers were housewives (96.9%) (n=159). Collected data shows almost half (47.3%) of the parents had prior knowledge (Awareness) about thalassemia and about half (52.7%) of them were unaware of the disease (n=201). Regarding family history 51.1% of the parents (Respondents) had been suffering from thalassemia (n=188). Majority (84.4%) of the parents were suffering from Beta-thalassemia trait (n= 96).

Table VI Distribution of ABO blood group among patients and their parents

Blood group	Patient (n=261)	Father (n=147)	Mother (n=157)
A+ve	28.0%	19.7%	28.7 %
A-ve	0.4%	2.7%	3.8%
B+ve	31.8%	36.8%	24.8%
B-ve	--	0.7%	--
O+ve	33.7%	36.7%	35.6%
O-ve	0.8%	--	1.9%
AB+ve	5.4%	2.8%	3.9%
AB-ve	--	0.7%	1.2%

Study shows that most prevalent blood group among the patients were O+ve (33.7%), followed by B+ve (31.8%) and A+ve (28.0%) respectively. No patients belonging to B-ve and AB-ve blood group were found. It also shows that most prevalent blood group among the fathers were B+ve (36.8%) and O+ve (36.7%) having almost equal percentage followed by A+ve (19.7%) respectively. No father belonging to O-ve blood group were found. Study also shows that most prevalent blood group among the mothers were O+ve (35.6%) followed by A+ve (28.7%) and B+ve (24.8%) respectively. No mother belonging to B-ve blood group were found.

Discussion

In this study a comprehensive data from 307 thalassemic patients were collected from the above mentioned hospitals. Study revealed a significant prevalence of HbE β -thalassemia among the patients of this region, accounting for 55.6% of the total cases followed by β -thalassemia major (25.9%). Studies done in Dhaka and Dinajpur also found that HbE β -thalassemia as the most common type.^{1,20} We found minimum age of the patient was 0.5 years and maximum age was 59 years. But majority (79.3%) were between 1 and 20 years, followed by the age group between 21 and 40 years (18.8%). This statistics may reflect the life expectancy of the thalassemic patients. Here we noticed that more than 92% thalassemic patients were below 30 years of age. Only 2.% were between 41 and 59 years of age. The study also shows that most prevalent blood group among the patients were O+ve (33.7%) followed by B+ve (31.8%) and A+ve (28.0%) respectively. Moreover, no significant correlation between the blood groups of patients and that of their parents were found. Demographic characteristics of the patients shows that 54.7% were male and 45.3% were female (N=307). The percentage is slightly higher in the males than the females, which coincides with an earlier study.¹⁸ Regarding educational status of the patients, majority of them had primary education (80.7%) followed by secondary level (17.5%) (n=166). Collected data shows 95.0% patients were non-tribe and 5.0% were tribe (n=211) which signals that prevalence of thalassemia might be higher in tribes. Only 9.5% parents had history of consanguineous marriage (n=210). Studies now suggest that the disorder manifests even when consanguinity is not a defining factor.¹⁹ Rather,

when both parents carry mutated α or β globin genes, irrespective of their marriage being consanguineous or not, their offspring face a heightened risk of inheriting thalassemia.⁵ Regarding occupation of the parents, we found 14 types of occupation among the patient's father. Significant number of them were employee (36.0%) followed by worker (18.0%) businessman (16.7%), farmer (13.3%) and driver (6.0%) (n=150). Majority of the mother were housewives (96.9%) (n=159). Collected data shows almost half (47.3%) of the parents had prior knowledge (Awareness) about thalassemia and about half (52.7%) of them were unaware of the disease (n=201). Regarding family history 51.1% of the parents (Respondents) had been suffering from thalassemia (n=188). Majority (84.4%) of the parents were suffering from Beta-thalassemia trait followed by HbE β -thalassemia (7.3%) and β -thalassemia major (6.3%) (n= 96).

The study also revealed that patients with O+ve and B+ve blood groups had the highest frequencies of thalassemia, registering at 33.7% and 31.8%, respectively. A+ blood group was found in 28.0% and AB+ was found in 5.4% of the patients. Similar results were seen in previous studies of the distribution of ABO blood groups in β -thalassemia patients where the most common blood group was O+.^{16,18,21} The ABO blood group system is determined by the presence or absence of specific antigens (A and B antigens) on the surface of red blood cells, and the Rh factor (Positive or negative) is another important component. These genetic factors are inherited from parents. As the distribution of blood groups is largely determined by genetic factors, a higher prevalence of blood group O+ among thalassemic patients in the Chattogram region could be due to the genetic makeup of the population in this specific area. Besides, certain blood groups may be more common in certain ethnic or regional populations due to historical and environmental factors. Moreover, there might be other factors such as cultural or social practices, that could influence the distribution of blood groups in a particular region.²² This study also revealed the age range and age distribution among the total patients of different types of thalassemia. Thalassemia has become a major health burden all over the world and so it is necessary to gather information about the status of this disorder to spread awareness as much as possible. The findings of the current study provide

valuable insights into the epidemiology and prevalence of thalassemia in Chattogram region. In this study Hb E beta-thalassemia was the most prevalent type, and O+ was the most common blood group among patients. Furthermore, a unique case of diagnosis at the age of 59 was also found. Another crucial finding is that we found no Alpha-thalassemia patients in Chattogram region. The study also challenges some misconceptions like parental consanguinity to be the root cause for the disorder to occur. Rather it suggests the significance of pre-marital screening because the primary cause of thalassemia is the carrier status of both parents with mutated genes. So by promoting awareness through health education, counselling, premarital screening, other public approaches and mass screening, thalassemia cases could potentially be reduced.

Limitation

The primary limitation is the relatively small sample size. However, it is essential to note that a single study in a specific region may not be sufficient to draw definitive conclusions.

Conclusion

This comprehensive study on thalassemia in Chattogram region of Bangladesh has provided valuable insights into the demographics and current thalassemia situation. The insights gained from this research may serve as a valuable data for future research in the field of thalassemia management.

Recommendation

In order to address thalassemia, it is essential to prioritize pre-marital genetic counseling and early screening. Implementing nationwide newborn and prenatal screening programs can identify thalassemia cases in their early stages, allowing for prompt intervention and improved patient outcomes. Public awareness campaigns can provide emotional support and educate the general population about thalassemia prevention and early diagnosis.

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Disclosure

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Diagnostic Performance of NT-proBNP in Predicting Preeclampsia and Its Severity in Third Trimester Pregnancy

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Abstract

Background: Preeclampsia is a major cause of maternal and perinatal morbidity and mortality, particularly in low-resource settings. Early identification of preeclampsia and its severity remains challenging. N-terminal pro-B-type natriuretic peptide (NT-proBNP) a marker of cardiac strain, has recently been explored as a potential biomarker for predicting preeclampsia and its complications. To evaluate the role of NT-proBNP in predicting preeclampsia and its severity among third-trimester pregnant women.

Materials and methods: This analytical cross-sectional study was conducted in the Department of Obstetrics and Gynecology, Chittagong Medical College Hospital, Bangladesh from July 2024 to June 2025. A total of 80 third-trimester pregnant women were enrolled, including 40 patients with preeclampsia and 40 normotensive controls. Serum NT-proBNP levels were measured using electrochemiluminescence immunoassay. Receiver Operating Characteristic (ROC) curve analysis was performed to determine optimal cut-off values and diagnostic performance.

Results: The mean ages of the preeclampsia and control groups were comparable (25.4 ± 4.9 vs 25.6 ± 5.4 years, $p=0.88$). Among preeclamptic

patients, 65% had severe disease. Median NT-proBNP levels were significantly higher in the preeclampsia group [437.20 (179.95–780.50) pg/mL] vs. [63.23 (79.30–107.40) pg/mL] and in severe preeclampsia compared to non-severe cases [648.70 (433.70–1159.00) vs. [165.75 (120.60–228.50) pg/mL]. For predicting preeclampsia, a cut-off value of ≥ 130 pg/mL yielded an AUC of 0.937 (95% CI: 0.878–0.995, $p<0.001$) with 90% sensitivity and 87.5% specificity. For predicting severe preeclampsia, a cut-off value of ≥ 285.4 pg/mL showed an AUC of 0.945 (95% CI: 0.881–1.00, $p<0.001$) with 88.5% sensitivity and 78.6% specificity.

Conclusion: NT-proBNP is significantly elevated in preeclampsia and correlates with disease severity. It demonstrates excellent diagnostic performance for predicting both preeclampsia and severe preeclampsia, suggesting its potential utility as a non-invasive biomarker for early detection and risk stratification in clinical practice.

Key words: Biomarker; NT-proBNP; Preeclampsia; Pregnancy; ROC curve; Severe preeclampsia.

Introduction

Preeclampsia is a multisystem disorder of pregnancy characterized by new-onset hypertension and proteinuria or end-organ dysfunction after 20 weeks of gestation, and it remains a leading cause of maternal and perinatal morbidity and mortality worldwide.¹⁻⁴ The burden is particularly high in low- and middle-income countries, including Bangladesh, where delayed diagnosis and limited access to advanced diagnostic tools contribute to adverse outcomes.^{4,5} Early identification of preeclampsia and its severity is crucial for timely intervention and improved maternal-fetal prognosis.

The pathophysiology of preeclampsia is complex and involves abnormal placentation, endothelial dysfunction and systemic inflammatory responses.⁶

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These processes lead to widespread vasoconstriction, increased vascular permeability, and multiorgan involvement. In severe cases, cardiac stress and subclinical myocardial dysfunction may occur due to increased hemodynamic load and vascular resistance.⁷ Therefore, biomarkers reflecting cardiovascular strain may provide additional insights into disease progression and severity.

N-terminal pro-B-type natriuretic peptide (NT-proBNP) is a well-established biomarker released from ventricular myocardium in response to increased wall stress and volume overload.⁸ It has been widely used in the diagnosis and management of heart failure and other cardiovascular conditions. Recent studies have suggested that NT-proBNP levels may be elevated in preeclampsia due to increased cardiac workload and endothelial dysfunction.⁹ This elevation may reflect subclinical cardiac involvement and correlate with disease severity.

Several studies have reported significantly higher NT-proBNP levels in patients with preeclampsia compared to normotensive pregnant women, with further elevation observed in severe cases. Moreover, NT-proBNP has demonstrated promising diagnostic performance in predicting preeclampsia and its complications, with acceptable sensitivity and specificity in different populations.^{10,11} However, there remains variability in reported cut-off values and diagnostic accuracy across studies, likely due to differences in study design, population characteristics, and assay methods.

Despite growing interest in NT-proBNP as a biomarker in hypertensive disorders of pregnancy, data from South Asian populations, particularly Bangladesh, remain limited. Given the high burden of preeclampsia and resource constraints in this region, identification of a reliable, non-invasive, and easily measurable biomarker is of significant clinical importance. Therefore, the present study was conducted to evaluate the role of NT-proBNP in predicting preeclampsia and its severity among third-trimester pregnant women in a tertiary care hospital in Bangladesh.

Materials and methods

This analytical cross-sectional study was conducted in the Department of Obstetrics and Gynecology, Chittagong Medical College Hospital, Chattogram,

Bangladesh, from July 2024 to June 2025. The study protocol was approved by the Ethical Review Committee of Chittagong Medical College (Memo no: 59.27.0000.013.19.PG.009.2023/977) and written informed consent was obtained from all participants prior to enrollment.

A total of 80 pregnant women in their third trimester were consecutively included in the study. Among them, 40 patients diagnosed with preeclampsia constituted the case group, while 40 normotensive pregnant women without preeclampsia served as the control group. Preeclampsia was diagnosed based on standard clinical criteria, including new-onset hypertension (blood pressure $\geq 140/90$ mmHg) after 20 weeks of gestation with or without proteinuria or evidence of end-organ dysfunction.¹² Patients with preeclampsia were further categorized into severe and non-severe groups according to established clinical guidelines.¹²

Demographic characteristics and relevant obstetric history were recorded using a structured case record form. Upon admission, venous blood samples were collected from all participants under aseptic conditions. Serum NT-proBNP levels were measured using a standardized electrochemiluminescence immunoassay method. NT-proBNP levels were interpreted according to age-specific reference values, with levels considered elevated if ≥ 125 pg/mL for individuals aged < 54 years.¹³

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 27.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean $\pm$ standard deviation or median (Interquartile range), and categorical variables were presented as frequencies and percentages. Comparisons between groups were performed using the independent sample t-test or Mann-Whitney U test for continuous variables and the chi-square test for categorical variables. ROC curve analysis was conducted to determine the optimal cut-off values of NT-proBNP for predicting preeclampsia and severe preeclampsia, and diagnostic accuracy was evaluated by calculating sensitivity, specificity, Positive Predictive Value (PPV) Negative Predictive Value (NPV) and overall accuracy. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 80 third-trimester pregnant women were included, comprising 40 patients with preeclampsia and 40 normotensive controls. Among the preeclampsia cases, 26 (65%) were classified as severe and 14 (35%) as non-severe. Table I summarizes the baseline characteristics of the study participants. The mean age was comparable between preeclamptic and normotensive women (25.4 ± 4.9 vs 25.6 ± 5.4 years, $p=0.880$). Body mass index was significantly higher in the preeclampsia group (34.7 ± 5.3 kg/m²) compared to controls (24.8 ± 3.3 kg/m², $p<0.001$). The distribution of gravida did not differ significantly between groups, with primigravida accounting for 45% in the preeclampsia group and 35% in controls ($p=0.149$). In contrast, gestational age distribution showed a significant difference, with half of the preeclamptic women presenting between 31–37 weeks, whereas all normotensive women were 38 weeks gestation ($p<0.001$).

Table I Baseline Characteristics of Study Participants

Variable	Preeclamptic Women (n=40)	Normotensive Women (n=40)	p-value
Age (Years)	25.4 ± 4.9 (18–40)	25.6 ± 5.4 (13–35)	0.880*
BMI (kg/m ²)	34.7 ± 5.3	24.8 ± 3.3	<0.001*
Gravida			
Primigravida	18 (45.0%)	14 (35.0%)	0.149†
Multigravida	22 (55.0%)	26 (65.0%)	
Gestational Age (Weeks)			
31–37 weeks	20 (50.0%)	0 (0.0%)	<0.001†
≥38 weeks	20 (50.0%)	40 (100.0%)	

Data are expressed as mean $\pm$ standard deviation or frequency (Percentage).

*Independent sample t-test †Chi-square test

Table II shows the distribution and levels of serum NT-proBNP among the study groups. A significantly higher proportion of preeclamptic women had elevated NT-proBNP levels compared to normotensive controls (90.0% vs 12.5%, $p<0.001$). The median NT-proBNP level was also markedly higher in the preeclampsia group [437.20 (179.95–780.50) pg/mL] compared to the control group [63.23 (79.30–107.40) pg/mL] and the difference was statistically significant ($p<0.001$).

Table II Distribution and Levels of Serum NT-proBNP Among Study Participants

NT-proBNP Level (pg/mL)	Preeclamptic Women (n=40)	Normotensive Women (n=40)	p-value
High	36 (90.0%)	5 (12.5%)	<0.001*
Low	4 (10.0%)	35 (87.5%)	
Median (IQR) (pg/mL)	437.20 (179.95–780.50)	63.23 (79.30–107.40)	<0.001**

Data are expressed as frequency (Percentage) or median (interquartile range).

*Chi-square test; **Mann–Whitney U test.

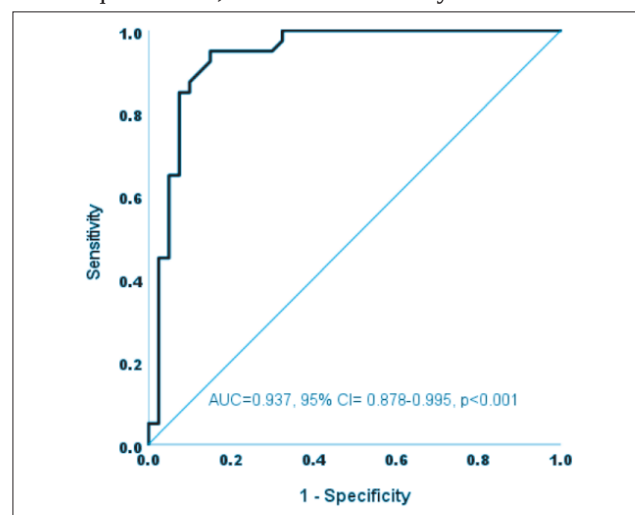


Figure 1 Receiver Operating Characteristic (ROC) curve of NT-proBNP for predicting preeclampsia among third-trimester pregnant women

Figure 1 demonstrates the ROC curve of NT-proBNP for predicting preeclampsia. NT-proBNP showed excellent discriminatory ability with an AUC of 0.937 (95% CI: 0.878–0.995; $p<0.001$). A cut-off value of ≥ 130 pg/mL yielded 90% sensitivity and 87.5% specificity, with a positive predictive value of 87.8%, negative predictive value of 89.7% and overall diagnostic accuracy of 88.8%.

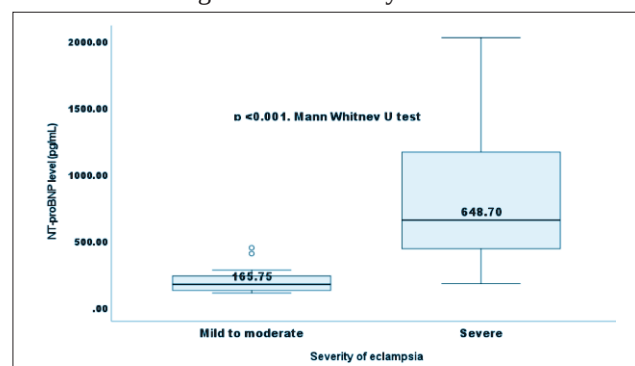


Figure 2 Boxplot showing the distribution of serum NT-proBNP levels according to severity of preeclampsia among affected pregnant women

Figure 2 illustrates the distribution of NT-proBNP levels across severity groups of preeclampsia. The median NT-proBNP level was markedly higher in the severe group [648.70 (433.70–1159.00) pg/mL] compared to the mild-to-moderate group [165.75 (120.60–228.50) pg/mL] and this difference was statistically significant ($p < 0.001$).

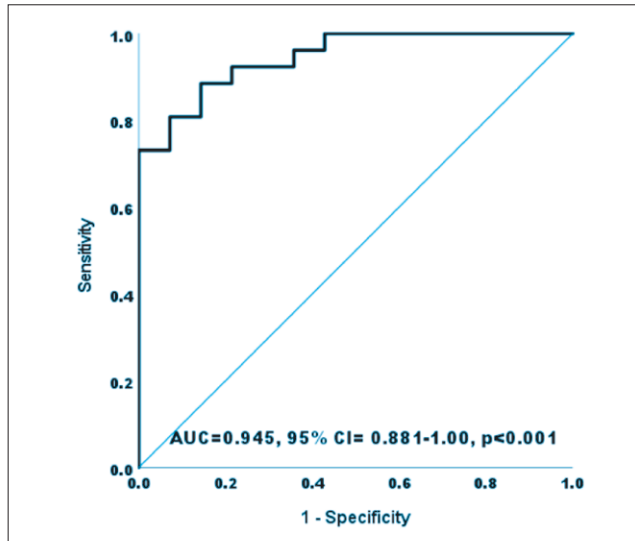


Figure 3 Receiver operating characteristic (ROC) curve of NT-proBNP for predicting severe preeclampsia among third-trimester pregnant women.

Figure 3 demonstrates the ROC curve of NT-proBNP for predicting severe preeclampsia. NT-proBNP showed excellent discriminatory ability with an AUC of 0.945 (95% CI: 0.881–1.00; $p < 0.001$). A cut-off value of ≥ 285.4 pg/mL yielded 88.5% sensitivity and 78.6% specificity, with a positive predictive value of 85.0%, negative predictive value of 78.6% and overall diagnostic accuracy of 82.7%.

Discussion

The present study demonstrated that serum NT-proBNP levels were significantly elevated in preeclamptic women compared to normotensive controls, with further marked elevation observed in severe preeclampsia. Additionally, NT-proBNP showed excellent diagnostic performance for predicting both preeclampsia and its severity, as reflected by high AUC values and favorable sensitivity and specificity at defined cut-off points. These findings are strongly supported by existing literature. A recent systematic review and meta-analysis reported consistently higher NT-proBNP levels in women with preeclampsia compared to healthy pregnancies, with significant differences

also observed between early-onset and late-onset disease.¹¹ Similarly, Kumari et al. documented significantly elevated NT-proBNP levels in preeclamptic women compared to controls (439.47 ± 431.99 vs 99.40 ± 37.89 pg/mL, $p < 0.001$) highlighting its role as a marker of maternal complications.¹⁴ The findings of the present study are in close agreement with these reports, reinforcing the reliability of NT-proBNP as a biomarker in hypertensive disorders of pregnancy. Furthermore, the observed increase in NT-proBNP with disease severity is consistent with previous studies demonstrating a graded relationship between biomarker levels and clinical severity. Moghbeli et al. reported a progressive rise in NT-proBNP levels from gestational hypertension to mild and severe preeclampsia, indicating its ability to discriminate between disease subtypes.¹⁵ Likewise, Nguyen et al. found significantly higher NT-proBNP levels in severe preeclampsia compared to non-severe cases (725.32 ± 290.46 vs 349.12 ± 93.51 pg/mL, $p < 0.05$).¹⁰ These findings align with the current study, where significantly higher NT-proBNP levels were observed in severe cases, supporting its role as a marker of disease progression.

The strong diagnostic performance of NT-proBNP observed in this study is also consistent with previous research. Resnik et al. demonstrated that BNP, a related natriuretic peptide, could effectively discriminate preeclampsia with good sensitivity and specificity, reflecting its diagnostic utility.¹⁶ In the present study, NT-proBNP showed even higher discriminatory ability, with AUC values exceeding 0.90, indicating excellent predictive accuracy. This suggests that NT-proBNP may serve as a superior biomarker due to its longer half-life and greater stability compared to BNP.

The pathophysiological basis for elevated NT-proBNP in preeclampsia is well established. NT-proBNP is released from cardiac myocytes in response to increased myocardial wall stress, volume overload and pressure changes. In preeclampsia, systemic vasoconstriction and endothelial dysfunction lead to increased afterload and impaired cardiac function, resulting in elevated NT-proBNP levels.¹⁴ Additionally, abnormal vascular adaptation and increased left ventricular filling pressures further contribute to cardiac strain, particularly in severe disease.¹⁰ These mechanisms explain the progressive rise in

NT-proBNP observed with increasing disease severity.

From a clinical perspective, the findings of this study have important implications. Early identification of preeclampsia and its severity remains a major challenge, particularly in resource-limited settings. NT-proBNP offers a non-invasive, reproducible, and relatively accessible biomarker that can aid in early diagnosis and risk stratification. The high sensitivity and specificity observed in this study suggest that NT-proBNP could be incorporated into routine clinical assessment to identify high-risk patients and guide timely intervention.

The present study has several strengths, including a well-defined study population, standardized measurement techniques, and robust statistical analysis using ROC curve methodology.

Limitation

However, certain limitations should be acknowledged. The study was conducted in a single center with a relatively small sample size, which may limit generalizability. Additionally, the cross-sectional design precludes assessment of longitudinal changes and predictive value over time.

Conclusion

In conclusion, the present study confirms that NT-proBNP is significantly elevated in preeclampsia and increases with disease severity. It demonstrates excellent diagnostic performance for predicting both preeclampsia and severe preeclampsia. These findings support the potential role of NT-proBNP as a reliable biomarker for early detection, severity assessment and clinical decision-making in hypertensive disorders of pregnancy.

Recommendation

Future multicenter and longitudinal studies are recommended to validate these findings and establish standardized cut-off values.

Disclosure

All the authors declared no conflict of interest.

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Ozone Therapy in Modern Medicine: Mechanisms, Clinical Applications and Emerging Evidence : A Comprehensive Review

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Abstract

Background: Ozone therapy has been employed in clinical medicine for well over a century, yet it continues to generate more controversy than its evidence base perhaps warrants. Widely used in Europe, Cuba and Russia, it remains either unregulated or frankly marginalised in much of the English-speaking world—a discrepancy that reflects geopolitics and institutional inertia as much as science. This review critically examines the biochemical mechanisms, clinical evidence, safety considerations and future research priorities of medical ozone therapy, with the aim of providing clinicians and researchers with an honest appraisal of where the field genuinely stands.

Methodology: A narrative review was conducted using PubMed, Scopus, and Web of Science. Peer-reviewed clinical trials, systematic reviews, mechanistic studies and international clinical guidelines published through 2024 were included and critically appraised.

Conclusions: The biochemistry of medical ozone is well characterised, and clinical evidence for several applications—particularly wound healing, lumbar disc disease and dental disinfection—is substantive enough to demand serious attention. The field's primary liability is not lack of efficacy but lack of methodological rigour and regulatory

harmonisation. Addressing this is not optional, it is existential for the discipline's future.

Key words: Autohemotherapy; Immunomodulation; Medical ozone; Musculoskeletal medicine; Oxidative stress; Ozone therapy; Wound healing.

Introduction

Ozone therapy is genuinely difficult to evaluate fairly. It sits at an uncomfortable intersection — embraced enthusiastically by integrative medicine practitioners, dismissed reflexively by much of academic medicine and studied with inconsistent rigour by researchers caught somewhere in between. That discomfort, however, is no excuse for intellectual laziness in either direction. The molecule deserves to be judged on its chemistry and its clinical data, not on its associations.

Ozone (O₃) is a triatomic allotrope of oxygen that has been used in medicine since at least the 1850s, when it was first applied as a wound disinfectant. Its antimicrobial potency was never seriously questioned — ozone destroys bacteria, fungi, and viruses with a completeness that most conventional antiseptics cannot match.¹ The more contentious question has always been whether its systemic applications, introduced progressively through the twentieth century, carry genuine therapeutic value or merely reflect the optimism of practitioners working outside randomised trial culture.

Today, medical ozone is administered through a range of routes — autohemotherapy, rectal insufflation, periarticular injection, topical application, dental delivery — and is used across specialties including orthopaedics, dermatology, dentistry, infectious disease and oncology.^{2,3} International bodies such as the International Scientific Committee of Ozone Therapy (ISCO3) and the World Federation of Ozone Therapy (WFOT) have published evidence-based guidelines that reflect decades of clinical refinement.⁴

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Meanwhile, the volume of peer-reviewed research has grown substantially, with mechanistic studies now providing molecular-level explanations for effects that were, for a long time, described only empirically.⁵

This review does not aim to be an advertisement for ozone therapy, nor a dismissal of it. It aims to provide a rigorous, readable synthesis of what is actually known — and to be honest about what is not.

Search Strategy

A systematic literature search was conducted across three electronic databases—PubMed, Scopus, and Web of Science—covering publications from inception through December 2024. The following search string was applied across title, abstract, and keyword fields:

("ozone therapy" OR "medical ozone" OR "ozonotherapy" OR "autohemotherapy") AND ("mechanism of action" OR "oxidative stress" OR "immunomodulation" OR "wound healing" OR "musculoskeletal" OR "dentistry" OR "infectious disease" OR "oncology" OR "safety" OR "adverse effects" OR "clinical trial").

Inclusion criteria were: peer-reviewed clinical trials, randomised controlled trials, systematic reviews, meta-analyses, mechanistic studies, and international clinical guidelines published in English. Grey literature, conference abstracts, and non-peer-reviewed sources were excluded, with the exception of formally published international guidelines from ISCO3 and WFOT, which were included on account of their direct clinical relevance. No restriction on study population or geographic region was applied. Reference lists of retrieved articles were manually screened for additional relevant sources. Study selection and data extraction were performed independently by two reviewers, with disagreements resolved by consensus.

Discussion

Historical Background

The story of ozone in medicine is older than most people in the field realize. In 1856, only two decades after Christian Friedrich Schönbein first isolated and named the molecule, ozone was already being used to sterilise operating theatres in Europe.³ By the 1870s, reports of its use in blood purification were circulating in the German medical literature—remarkable, given that germ theory itself was still being debated.

The First World War provided ozone with its first large-scale clinical test. German military surgeons applied it to infected battlefield wounds and gangrenous injuries, reporting healing rates that impressed field observers.³ These accounts were not rigorous by modern standards, but they were consistent enough to sustain interest in the decades that followed.

The figure who most shaped modern ozone therapy is Hans Wolff, the German physician who, in the 1950s and 1960s, developed and systematised major autohemotherapy — the technique of withdrawing venous blood, ozonating it *ex vivo*, and re-infusing it — and who trained a generation of practitioners in its application.⁶ Wolff's work established ozone therapy as a coherent clinical discipline rather than a collection of anecdotal practices, and the founding of the Deutsche Gesellschaft für Ozontherapie in 1972 gave the field its first formal institutional home.³

What followed over the next five decades was a gradual expansion into new specialties and new indications, driven more by clinical observation than by controlled trials. This is a pattern that characterises much of the field's history, and it explains both its richness of clinical experience and its vulnerability to methodological criticism. The founding of ISCO3 in 2011 and the subsequent Madrid Declaration on Ozone Therapy represented a genuine effort to reorient the field toward evidence-based practice — an effort that continues, with uneven success, today.^{4,7}

Mechanisms of Action

One of the most important intellectual developments in ozone therapy research over the past two decades has been the shift from phenomenological description to mechanistic explanation. We no longer need to say simply that ozone 'seems to help' — we can, in increasing detail, explain why.

The Ozone Paradox and Redox Modulation

The most common objection to ozone as a therapeutic agent is also the most intuitive one: ozone is an oxidant, and oxidative stress causes disease. Why would anyone deliberately administer an oxidising agent to a sick person? The answer, now well established in the literature, is that this objection conflates dose with effect.⁸

At the concentrations used in clinical practice — typically between 10 and 80 micrograms per millilitre — ozone does not cause net oxidative damage. Instead, it provokes a mild, transient, and carefully calibrated oxidative challenge that activates the body's own antioxidant machinery. The key transcription factor here is Nrf2 (Nuclear factor erythroid 2-related factor 2), which, when activated by low-level oxidative stress, upregulates a suite of cytoprotective enzymes: superoxide dismutase, catalase, glutathione peroxidase and haem oxygenase-1.^{9,10} The net result is not oxidative injury but oxidative preconditioning — a phenomenon well recognised in cardioprotection and increasingly appreciated in other tissues.¹¹

The immediate chemical products of ozone's reaction with biological fluids — hydrogen peroxide, lipid hydroperoxides and alkenals, collectively termed Lipid Ozonation Products (LOPs) — serve as the molecular messengers that carry this signal into cells [8]. Hydrogen peroxide, in particular, acts as a second messenger activating redox-sensitive signalling cascades at concentrations far below those that would cause cytotoxicity. It is a subtle but important distinction and one that critics of ozone therapy sometimes overlook.

Immunomodulation: The Bidirectional Effect

Perhaps the most clinically significant — and the most underappreciated — property of ozone therapy is its capacity to modulate immune function in opposite directions depending on the immunological context. This is not a contradiction; it is a hallmark of a genuine immunomodulatory agent, as opposed to a simple immunosuppressant or immunostimulant.

In states of immune deficiency or chronic infection, ozone stimulates the production of interferon-gamma, interleukin-2, and tumour necrosis factor-alpha, enhancing immune surveillance and antimicrobial activity.^{12,13} In states of excessive inflammation — as seen in autoimmune conditions, chronic wounds, or post-ischaemic injury — it suppresses interleukin-1 β , interleukin-6, and nuclear factor-kappa B (NF- κ B) activity, attenuating the inflammatory cascade.¹⁴ How a single agent achieves both effects in different biological environments is not fully resolved, but the prevailing explanation invokes the dose-dependent and context-dependent activation of competing redox-sensitive transcription factors —

Nrf2 driving cytoprotection and anti-inflammation at low doses, NF- κ B amplifying inflammation at higher, non-therapeutic doses.¹⁰

For the clinician, the practical implication is straightforward: ozone is not simply anti-inflammatory. It normalises immune tone, which is precisely what many chronic diseases require.

Haematological and Oxygen Metabolism Effects

Tissue hypoxia is a common denominator in an unexpectedly wide range of clinical conditions — from diabetic foot ulcers to ischaemic heart disease to chronic fatigue. Ozone therapy addresses this through several complementary haematological mechanisms that, taken together, meaningfully improve oxygen delivery to peripheral tissues.

Red blood cell membrane fluidity increases following ozone exposure, reducing the tendency for erythrocytes to aggregate in the microvasculature.¹⁵ Simultaneously, ozone stimulates the production of 2,3-diphosphoglycerate (2,3-DPG) an allosteric regulator that shifts the oxygen-haemoglobin dissociation curve rightward, prompting haemoglobin to release its oxygen more readily in peripheral tissues — exactly where it is needed most.¹⁵ Platelet activation induced by ozone also triggers the release of Platelet-Derived Growth Factor (PDGF) and vascular endothelial growth factor (VEGF) initiating angiogenesis and tissue repair.¹⁶ These are not marginal effects. In a patient with a chronic non-healing wound or peripheral arterial disease, they may be the difference between recovery and amputation.

Antimicrobial Properties

This is where ozone's credentials are most unambiguous. Ozone kills bacteria, fungi and viruses through the non-selective oxidation of their cell walls, membrane lipids, proteins, and nucleic acids [17,18]. The mechanism does not depend on a specific receptor interaction, which means resistance — in the conventional microbiological sense — does not develop. An organism cannot mutate its way out of the path of a molecule that simply oxidises everything it contacts.

This property has enormous contemporary relevance. In an era defined by the crisis of antimicrobial resistance, ozone's activity against Methicillin-Resistant *Staphylococcus Aureus* (MRSA) *Pseudomonas aeruginosa*, *Candida* species, and polymicrobial biofilms is not a historical

curiosity — it is a genuinely important clinical asset.¹⁷ The challenge lies in delivering ozone to infected tissues at concentrations that are microbicidal without being damaging to surrounding host tissue, a challenge that has driven considerable innovation in delivery devices and formulations over the past decade.

Clinical Applications

Wound Care and Dermatology

If ozone therapy has a flagship application — the one where the evidence is deepest, the clinical experience is richest, and the biological rationale is most persuasive — it is chronic wound management. Diabetic foot ulcers, in particular, represent a global health burden of staggering proportions and their management remains stubbornly unsatisfactory with conventional approaches alone. In this context, ozone therapy has earned its place.

Multiple mechanisms converge on wound healing: ozone kills the polymicrobial communities that colonise chronic wounds, it stimulates fibroblast proliferation and collagen synthesis; it promotes angiogenesis through VEGF upregulation; and it reduces the chronic inflammatory milieu that prevents wounds from progressing through normal healing phases.^{16,18} The clinical evidence reflects this mechanistic plausibility. A well-conducted randomised controlled trial by Wainstein et al. demonstrated significantly higher rates of complete wound closure in diabetic patients treated with ozone compared to standard of care.¹⁹ Zhang et al. in a study that also measured growth factor concentrations, confirmed that ozone-treated wounds showed measurably higher levels of PDGF and VEGF — a direct window into the mechanism.²⁰

Topical delivery — ozonated oils, ozonated water, sealed bag insufflation — allows high local concentrations to be achieved without systemic exposure, making wound care one of the safest and most practical ozone applications available to clinicians.

Musculoskeletal Disorders

The injection of oxygen–ozone mixtures into spinal and paravertebral tissues and peripheral joints has generated a substantial body of clinical literature, and the findings are, on balance, more compelling than the therapy's detractors acknowledge. For

lumbar disc herniation — a condition that causes enormous suffering and drives enormous healthcare expenditure—paravertebral intramuscular and periradicular ozone injection offers a minimally invasive alternative to surgery that, in appropriately selected patients, produces outcomes that rival more invasive procedures.

The mechanism involves local anti-inflammatory and analgesic effects on neural structures, reduction of prostaglandin and bradykinin release and indirect decompressive effects through ozone-induced modulation of proteoglycan content in the nucleus pulposus.²¹ Paoloni et al.'s multicentre randomised trial — perhaps the most rigorous study in this space — found that intramuscular oxygen–ozone injection produced outcomes statistically equivalent to periradicular corticosteroid injection at six months, with a superior safety profile.²¹ That finding alone warrants more clinical attention than it has received.

In knee osteoarthritis, the picture is similarly encouraging. Several randomised trials and a recent systematic review have compared intra-articular ozone injection to hyaluronic acid and corticosteroids, finding comparable or superior pain reduction and functional improvement at short-to-medium-term follow-up.^{22,23} Ozone does not regenerate cartilage — nothing does, at present — but its ability to reduce synovial inflammation, modulate pain signalling and slow the degenerative cycle makes it a rational and cost-effective option in a condition for which we otherwise have few good long-term solutions.

Dentistry

Dentistry may be the field where ozone therapy has been most thoroughly integrated into mainstream practice, at least in parts of Europe. The reasons are intuitive: dental caries and periodontal disease are fundamentally microbial problems, and ozone is a superlative antimicrobial agent. The delivery challenges that complicate systemic applications largely disappear when the target tissue is directly accessible in the oral cavity.

Gaseous ozone delivered through a specially designed probe has been shown to arrest and reverse early non-cavitated carious lesions by eliminating *Streptococcus mutans* and other cariogenic organisms — without drilling, without anaesthesia and without the anxiety that dental

intervention provokes in a substantial proportion of patients.²⁴ For anxious patients, particularly children, this is not a trivial advantage. In periodontics, adjunctive ozone irrigation during scaling and root planing consistently produces greater reductions in pocket depth and clinical attachment gain compared to mechanical debridement alone, reflecting its efficacy against the biofilm-embedded organisms that drive periodontal destruction.²⁵

Root canal disinfection, peri-implant infection management and treatment of recurrent aphthous ulcers are additional applications supported by clinical evidence, making ozone arguably the most versatile antimicrobial tool available to the modern dentist.^{24,25}

Infectious Diseases

The use of ozone in systemic infectious diseases is where the evidence becomes thinner and the claims sometimes become larger than the data can support. We should be honest about that. The antiviral properties of ozone are well established in vitro and there is a plausible mechanistic basis for benefit in chronic viral infections — ozone-induced interferon production, enhanced NK cell activity and direct viral inactivation all operate in the right direction.²⁶ But robust randomised controlled trial data in this area remain limited.

The COVID-19 pandemic provided an urgent, if scientifically imperfect, test of ozone therapy in an acute viral illness. Early clinical reports from Spain and Italy described improvements in oxygenation and reductions in inflammatory markers — notably CRP, ferritin and IL-6 — in hospitalised patients treated with rectal ozone insufflation as an adjunct to standard care.²⁷ These findings are biologically plausible, given ozone's capacity to simultaneously enhance tissue oxygenation and temper cytokine-mediated inflammation. They are also preliminary and they should be treated as hypothesis-generating rather than practice-changing until adequately powered trials are completed.

Oncology

Oncology is perhaps the frontier where ozone therapy's potential is most intriguing and its evidence most embryonic. The rationale is compelling: many tumour cells have severely impaired antioxidant defences relative to normal tissues, making them selectively vulnerable to oxidative challenge. If ozone can simultaneously

sensitise tumour cells to the oxidative mechanisms of chemotherapy and radiotherapy while activating Nrf2-mediated cytoprotection in healthy surrounding tissue, it would constitute a genuinely useful adjunct — not a cure, but a tool that makes existing treatments more effective and less toxic.

Preclinical data support this model across multiple cancer cell lines. Clinical evidence is more limited, though Clavo et al. reported long-term control of radiation proctitis in patients treated with ozone and early pilot studies have documented improvements in tumour oxygenation and reductions in treatment-related immunosuppression in cancer patients receiving ozone alongside conventional therapy.^{28,29} The oncology application needs serious, well-designed clinical trials. It has not had them yet. That is the honest answer.

Safety Profile and Adverse Effects

One of the persistent myths about ozone therapy is that it is inherently dangerous. This requires examination. When administered by trained practitioners, using appropriate equipment, at concentrations within established therapeutic ranges, ozone therapy has an excellent safety record that compares favourably to many widely accepted interventions.⁷ The evidence base here is not just anecdotal — it includes large observational registries and multicentre audits from Italy and Germany spanning tens of thousands of patients.

The most common adverse effects are minor: transient fatigue following systemic autohemotherapy, mild local discomfort at injection sites and occasional Herxheimer-like reactions in patients with heavy microbial burden.⁴ These are predictable, manageable and self-limiting. Serious adverse events — haemolysis, embolic phenomena, pulmonary irritation — are rare and almost invariably attributable to protocol deviations: Excessive concentrations, inappropriate routes of administration, or inadequate training.⁷

The most historically cited risk — air embolism from direct intravenous ozone injection — is worth addressing directly: This technique has been abandoned by responsible practitioners and is explicitly prohibited in current international guidelines. Modern systemic ozone therapy is delivered through extracorporeal autohemotherapy, a technique with a well-characterised safety profile.⁴ The contraindications are few but absolute: Glucose-6-Phosphate Dehydrogenase (G6PD)

deficiency, active haemorrhage, severe thrombocytopaenia, hyperthyroidism and pregnancy.^{4,7} Within these boundaries, ozone is a safe intervention. The safety problem is not with the molecule — it is with practitioners who operate outside established protocols, a problem the field's governing bodies continue to work hard to address.

Emerging Evidence and Future Directions

The mechanistic frontier of ozone research is moving rapidly and some of what is emerging is genuinely exciting. The Nrf2–Keap1 signalling axis — the molecular hinge on which ozone's cytoprotective effects pivot — is now one of the most intensively studied targets in oxidative medicine, and ozone represents a physiological activator of this pathway with therapeutic implications far beyond its current clinical applications.^{10,11}

In neurology, animal model studies and early human data suggest that ozone therapy may attenuate neuroinflammation following ischaemic stroke and traumatic brain injury. The proposed mechanisms — enhanced cerebral oxygen delivery, suppression of microglial activation, and reduction of excitotoxic cascades through redox modulation — are biologically coherent and deserve systematic clinical investigation.³⁰ The possibility that a relatively simple, low-cost intervention could improve outcomes in stroke — a condition where the therapeutic window is narrow and treatment options remain limited — is worth pursuing with urgency.

The intersection of ozone therapy with regenerative medicine is another area of genuine promise. The combination of ozone with Platelet-Rich Plasma (PRP) in musculoskeletal applications is already being explored clinically, with the hypothesis that ozone's anti-inflammatory and growth factor-stimulating properties may synergise with PRP's regenerative potential. Similarly, the potential role of ozone in modulating the gut microbiome — administered via rectal insufflation — is an intriguing but entirely underdeveloped area that may have implications for inflammatory bowel disease, systemic immune conditions, and metabolic syndrome.

What the field most needs, however, is not more interesting hypotheses. It is rigorous clinical trials. The methodological challenges are real — blinding in ozone studies is genuinely difficult given the molecule's distinct physicochemical properties —

but they are not insurmountable. Sham procedures, placebo-controlled designs, and consensus outcome measures have all been proposed and partially implemented in existing trials. The field needs to commit to this standard of evidence, not as an external imposition, but as an internal imperative.

Challenges to Mainstream Adoption

It would be intellectually dishonest to write a comprehensive review of ozone therapy without addressing, plainly, why a treatment with a century of clinical use and a growing evidence base remains peripheral to mainstream medicine in much of the world. The reasons are multiple, and not all of them are scientific.

Regulatory fragmentation is perhaps the most structurally damaging barrier. Ozone-generating medical devices are approved and regulated in Germany, Italy, Cuba and Russia; they occupy a legal grey area in many other countries, and they are effectively prohibited or unrecognised in the United States and the United Kingdom.^{4,31} This is not primarily a reflection of differential evidence evaluation — it reflects historical regulatory trajectories, pharmaceutical industry interests, and the institutional momentum of medical education systems that were built around pharmacological rather than oxidative medicine. None of these are arguments against ozone therapy's efficacy, but they powerfully constrain the research investment and clinical adoption that could test and refine it.

The protocol standardisation problem is internal to the field and the field must own it. The lack of consensus on ozone concentration, volume, route, frequency and duration across different indications makes it genuinely difficult to compare studies, pool data or write guidelines that practitioners can confidently follow.⁵ This is not insurmountable — the WFOT and ISCO3 have made progress — but progress has been slower than the evidence base warrants.⁷

Finally, there is the cultural problem. Ozone therapy has been enthusiastically adopted by practitioners who are sometimes disinclined toward the rigour of evidence-based medicine, and who have occasionally made claims that the data cannot support. This has damaged the field's credibility in academic circles and created a perception that ozone therapy is the province of alternative medicine rather than clinical science. Correcting that perception requires the field to hold itself to the standards it is asking mainstream medicine to apply to it — and to be willing to say, clearly and publicly, when the evidence is insufficient.

Conclusion

Ozone therapy is not a panacea, and it is not a fraud. It is a clinically and biochemically coherent intervention with well-characterised mechanisms, a substantial body of clinical evidence in specific applications, and a safety profile that, within established protocols, compares favourably with many commonly used medical treatments. The evidence base for wound care, lumbar disc disease, knee osteoarthritis, and dental applications is strong enough — right now, today — to justify serious clinical consideration in appropriate patients. The emerging evidence in neurology, oncology and infectious disease is intriguing enough to justify urgent and rigorous clinical investigation.

What ozone therapy lacks is not biological plausibility or clinical signal. What it lacks is the institutional investment, methodological rigour, and regulatory coherence that would allow that signal to be heard clearly. Addressing this is, frankly, the responsibility of everyone in the field — researchers, clinicians, governing bodies, and the international medical community that has, for too long, dismissed ozone therapy without examining it carefully enough. The molecule has earned a fair hearing. It is time to give it one.

Disclosure

All the authors declared no conflict of interest.

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Coexistence of Spinal Tuberculosis and Hansen's Disease in a Patient with Substance Use Disorder: A Case Report

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Abstract

Background: The coexistence of Pott's disease (Spinal tuberculosis) and leprosy in the same patient is rare and presents a significant diagnostic challenge because of overlapping clinical manifestations and histopathological features. Both diseases are caused by mycobacterial organisms and may share immunological pathways, particularly in immunocompromised individuals.

Case Presentation: We report a 34-year-old man with a history of substance use disorder who presented with low back pain and papular skin lesions. MRI of the lumbosacral spine revealed spondylodiscitis consistent with Pott's disease, while Slit-Skin Smear (SSS) for AFB yielded a bacterial index of 3+, confirming lepromatous leprosy. He was managed with Anti-Tubercular Therapy (ATT) and Multidrug Therapy (MDT-MB) for 12 months.

Conclusion: This case highlights the possibility of concurrent mycobacterial infections in a patient with a history of substance use disorder. A high index of suspicion and comprehensive microbiological and histopathological evaluation are essential for accurate diagnosis and effective management.

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Introduction

Tuberculosis (TB) and leprosy, caused by *Mycobacterium tuberculosis* and *Mycobacterium leprae* respectively, are not only infectious diseases but also conditions deeply intertwined with poverty, stigma, and social vulnerability. Although both remain endemic in many parts of the world, their coexistence in a single individual is rarely reported and often reflects underlying inequities in healthcare access and living conditions.^{1,2}

Pott's disease or spinal tuberculosis, represents one of the most severe forms of extrapulmonary TB, accounting for approximately 1–2% of all TB cases.^{3,4} It frequently leads to long-term disability, loss of livelihood and social isolation if not diagnosed and treated early.^{3,5}

Leprosy, a chronic granulomatous disease primarily affecting the skin and peripheral nerves, continues to persist in South Asia, including Bangladesh.^{1,6} The lepromatous form, associated with a high bacterial load and impaired cell-mediated immunity, reflects the complex interaction between host immunity and social determinants of health.^{1,7}

Substance Use Disorder (SUD) is increasingly recognized as an important contributor to tuberculosis through a combination of biological and social mechanisms. Individuals with SUD often experience malnutrition, poor living conditions, delayed healthcare seeking, treatment interruption and impaired immune function, all of which increase susceptibility to tuberculosis and other chronic infections.^{8,9,10} Although evidence directly linking SUD with leprosy remains limited, the associated immune dysregulation and social vulnerability may contribute to delayed diagnosis and coexistence of chronic mycobacterial diseases.^{1,7}

This case highlights the coexistence of Pott's disease and lepromatous leprosy in a patient with a history of substance use disorder—an uncommon clinical occurrence that underscores the biological interplay of infections together with the broader human context of vulnerability, stigma, and the need for compassionate, integrated care.^{2,8,9,10}

Case Presentation

A 34-year-old man, was admitted to the Department of Physical Medicine and Rehabilitation at Chittagong Medical College Hospital, Bangladesh, with a 6-month history of low back pain that had markedly worsened over the preceding week. He also described papular skin lesions over his face and hands, along with episodes of low-grade intermittent fever.

His medical history revealed a prolonged period of substance use disorder spanning 10–12 years, including heroin and injectable sedatives. He had successfully discontinued substance use 5–6 years prior to presentation. He was an active smoker. There was no prior documented history of tuberculosis; however, he reported close contact with a friend previously diagnosed with pulmonary tuberculosis.

On general examination, he appeared febrile and pale, suggestive of an underlying chronic illness. Multiple papular lesions were observed over the face and dorsum of both hands. Musculoskeletal examination revealed restricted lumbar spine mobility with localized tenderness over the lower lumbar region.

Neurological assessment demonstrated:

- Straight Leg Raising (SLR): 60° on the right, 90° on the left
- Deep Tendon Reflexes (DTR): ++ bilaterally
- Extensor Hallucis Longus (EHL) power: 5/5 bilaterally

MRI of the lumbosacral spine (T1 and T2 weighted sequences) demonstrated features consistent with spondylodiscitis at L4–L5, with involvement of adjacent vertebral endplates, reduction in disc height and surrounding paravertebral soft tissue shadowing — findings characteristic of Pott's disease.

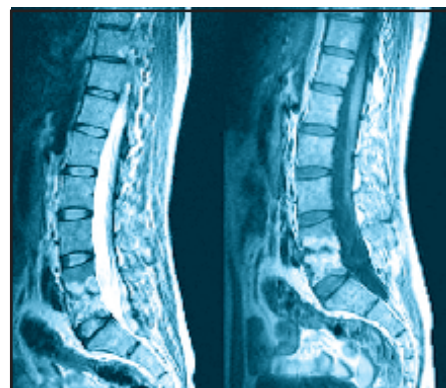


Figure 1 MRI Lumbosacral Spine — showing spondylodiscitis (L4–L5) with vertebral endplate destruction and reduced disc space, consistent with Pott's Disease (Spinal Tuberculosis)

Multiple papulonodular skin lesions were identified over the dorsum of both hands and over the face. The distribution was bilaterally symmetric, consistent with lepromatous (Multibacillary) leprosy.

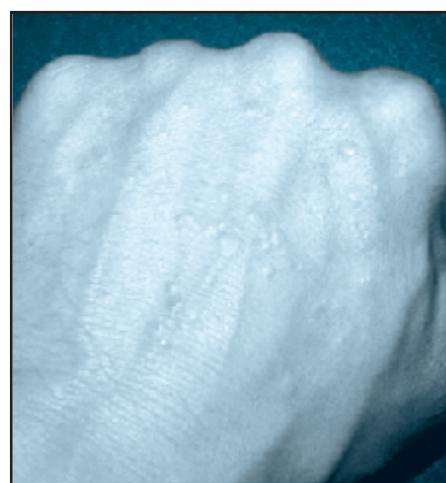


Figure 2 Papulonodular lesions on dorsum of hands

Laboratory and Radiological Findings

Investigation	Result	Reference Range	Interpretation
Haemoglobin (Hb)	10 g/dL	13–17 g/dL	Low — Anaemia of chronic disease
ESR (1st hour)	35 mm/hr	0–15 mm/hr	Elevated — Active inflammation
Liver Function Tests	Normal	—	No hepatic involvement
Renal Function Tests	Normal	—	No renal involvement
Chest X-ray (PA view)	Normal	—	No pulmonary TB
MRI Lumbosacral Spine	Spondylodiscitis (L4–L5)	—	Consistent with Pott's Disease
Slit-Skin Smear (SSS) AFB	Positive; Bacterial Index 3+	Negative	Multibacillary Leprosy confirmed

Final Diagnoses

Condition	Diagnostic Basis	Classification
Pott's Disease (Spinal TB)	MRI: Spondylodiscitis L4–L5 + clinical picture	Extrapulmonary TB
Lepromatous Leprosy	SSS AFB 3+	Multibacillary

Treatment Protocol

Following confirmation of both spinal tuberculosis and multibacillary leprosy, a coordinated patient-centered treatment plan was initiated:

- Anti-Tubercular Therapy (ATT): Standard first-line regimen (RHEZ) for 12 months for skeletal TB.
- Multidrug therapy (MDT-MB): Initiated for 12 months. The monthly supervised rifampicin dose in MDT-MB was omitted to avoid duplication as rifampicin was already included in ATT.
- Analgesics and physiotherapy: For pain relief and preservation of lumbar mobility.
- Nutritional supplementation and counseling: Addressing malnutrition and psychosocial support.

Follow-up at One Month

Parameter	At Presentation	At 1 Month
Back Pain (VAS)	8/10	4/10 (50% improvement)
Skin Lesions	Multiple active nodules	Partial regression noted
General Well-being	Febrile, pale, unwell	Afebrile, improved energy
Drug Tolerability	—	No significant adverse effects

Discussion

The coexistence of Pott's disease and lepromatous leprosy in a single individual is exceedingly rare and highlights the intersection of infectious disease with social and immunological vulnerability.² Both *Mycobacterium tuberculosis* and *Mycobacterium leprae* are intracellular pathogens whose control depends largely on effective cell-mediated immunity.^{1,7} This patient had a prolonged history of substance use disorder involving heroin and injectable sedatives. Substance use disorder is associated with impaired immune function, malnutrition, unstable socioeconomic conditions, delayed healthcare seeking and an increased risk of tuberculosis.^{8,9,10} Although direct evidence linking substance use disorder to leprosy is limited, these biological and social factors may have contributed to the concurrent occurrence and delayed recognition of both mycobacterial infections in this patient.

Pott's disease typically presents insidiously, with chronic back pain and constitutional symptoms, and may progress to neurological compromise if untreated.^{3,4} The MRI findings in this patient were characteristic, despite the absence of pulmonary involvement, underscoring the importance of considering extrapulmonary TB even when chest imaging is normal.^{3,4}

Lepromatous leprosy, representing the multibacillary end of the disease spectrum, is associated with high bacterial load and inadequate immune response.^{1,7} The positive slit-skin smear with bacterial index 3+ in this patient confirmed multibacillary disease according to WHO classification criteria.⁶

Beyond biological mechanisms, substance use disorder is frequently accompanied by stigma, poor access to healthcare, treatment interruption and reduced adherence to medical care, all of which adversely affect the diagnosis and management of chronic infectious diseases.⁹ In the present case, although the patient had discontinued substance use several years before presentation, the long-term health consequences of previous substance use, together with continued smoking and prior tuberculosis exposure, may have increased his overall vulnerability to infection.

Managing dual mycobacterial infections presents practical challenges, particularly due to overlapping pharmacotherapy. Rifampicin, a cornerstone drug for both conditions, required careful consideration to avoid duplication.⁶ The decision to omit the MDT rifampicin component while continuing it within ATT reflects a pragmatic, patient-centered approach.^{2,5}

Conclusion

This case underscores the importance of looking beyond isolated diagnoses and considering the broader clinical and social context of the patient. The rare coexistence of Pott's disease and multibacillary leprosy in a patient with a history of substance use disorder highlights the need for a comprehensive evaluation of patients presenting with multisystem involvement. Early recognition, integrated management, and appropriate adaptation of treatment regimens can lead to favorable clinical outcomes. Equally important is the need to address stigma, improve access to healthcare and ensure continuity of care.

Consent

Informed consent was obtained from the patient for publication of this case report.

Disclosure

All the authors declared no conflict of interest.

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