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INFORMATION TO AUTHORS

Focus

Chattagram International Medical College (CIMC) established on 2013 is one of the famous and reputed Medical College among the Private Medical Colleges in Bangladesh as reflected by the performances of students in examinations of Chittagong Medical University. A very good number of academicians and researchers are performing in this institute.

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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Manuscript (Papers) are submitted to the Editor-In-Chief or authorised persons at any time. Papers accepted for publication are subjected to peer review and editorial revision. With full title (Title should be concise and informative) two copies of papers (Along with CD) accompanied by a covering letter signed by Principal and Co-authors including name, academic degrees, designation, the departmental and institutional affiliation. Complete address, Cell number including Email address of Corresponding author should be mentioned. Not more than 7 (Seven) authors will be accepted for all manuscripts.

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Applications of Artificial Intelligence in Electrocardiography

Abu Tarek Iqbal^{1*}

The term Artificial Intelligence (AI) was first introduced by American scientist John McCarthy in 1955, who is also regarded as one of the co-founders of the field. AI refers to systems or agents capable of performing tasks that typically require human intelligence. As a branch of computer science, it involves developing intelligent machines and software that can think, learn, and respond like humans. AI is reshaping many aspects of human life, including healthcare and is expected to contribute to making the world a better place in the future.

Artificial Intelligence is a rapidly advancing technology with immense potential in the field of cardiovascular medicine. Currently, diagnosing Cardiovascular Diseases (CVDs) requires a thorough patient assessment, including medical history reviews, biomarker analysis, physical examinations and specialized tests. The expertise and experience of medical professionals are essential for interpreting test results, which guide the development of appropriate treatment plans. With AI-driven advancements, this diagnostic process is becoming more efficient, improving patient care and medical outcomes.

Applications of Artificial Intelligence (AI) in Electrocardiography (ECG) are summarised in this paper as follows:

Electrocardiography (ECG) is a basic and non-invasive assessment that is an important part of cardiovascular care. Several studies have shown that ML models outperform humans in detecting ECG-based diseases including long QT and atrial fibrillation.^{1,2} The use of AI for automated ECG

analysis allows for the early detection of various arrhythmias and ST-segment anomalies, allowing primary care physicians and non-cardiologists to make confident and timely decisions regarding specialized cardiac treatment.³ In addition, AI in ECG interpretation has yielded promising results, augmenting the ability to detect various ECG abnormalities such as arrhythmias, QT prolongation and others.⁴ AI can detect myocardial hypertrophy and left ventricular systolic dysfunction, left ventricular hypertrophy and diastolic dysfunction hypertension, cardiac amyloidosis, structural heart disease and significant cases of aortic stenosis and mitral regurgitation among other structural heart diseases.⁵⁻¹⁰ Moreover, previous studies have shown that AI algorithms can left ventricular systolic dysfunction using not just 12-lead ECG but also with single-lead ECG acquired from smart watches.¹¹⁻¹²

In Figure 1 illustrates the role of AI in decision-making and its capacity to assist clinicians quickly in selecting the most effective treatment strategy and Table I provides some examples of AI applications in ECG.

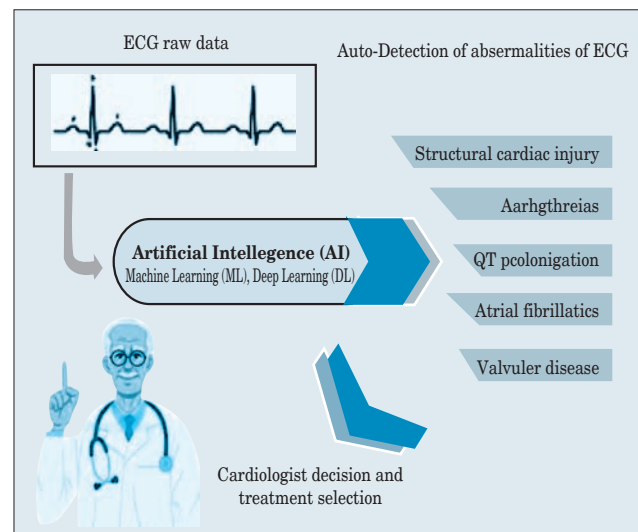


Figure 1 The role of AI in assisting clinicians with ECG signal-based decision making

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Table I Some recent examples of AI applications in ECG

AI Model []	Objective []	Dataset []	Performance[]	Reference
DL network (DNN) [] [] []	Detect ventricular[] tachyarrhythmia[] [] []	Data were taken from two[] database (CUDB[] and VFDB) and comprises 57 records.	99.20% (Accuracy)[]	13
Deep CNN [] [] [] [] [] [] [] []	Detect individuals who are[] at a high risk for seven[] different types of structural[] heart diseases (Aortic/mitral [] stenosis and regurgitation, mitral stenosis, reduced left ventricle ejection fraction, and increased thickness of interventricular septum).	2,232,130 ECGs[] from 484,765 adults[] (Between 1984 and 2021)	0.91 (AUROC) [] []	8
Implementation of three[] ML algorithms[] i. Decision tree ii. K-means iii. Back propagation neural network)	Identifying left[] ventricular hypertrophy[]	952 individuals including[] 173 LVH cases[]	96.10% (Accuracy)[] []	14
GoogLeNet method[] [] [] [] [] [] [] [] []	Assess the signal quality of[] wearable dynamic ECG[] [] [] [] [] [] [] []	1000 12-leads ECG sginals[] from PhysioNet Challenge[] 2011 (773 acceptable, 225[] unacceptable and[] 2 indeterminate) 9941 single-lead ECG signals (9941 acceptable and 2059 unacceptable).	Accuracies of 98.04%[] and 98.55% for 12-leads[] and single-lead ECGs dataset, respectively.	15

In conclusion with the help of Artificial Intelligence, data from ECG, could be instantly analyzed and given a more in-depth meaning. These methodologies might aid in the identification and management of cardiovascular disorders.

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A Study on Current Clinical Profile of Invasive Carcin of Cervix

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Abstract

Background: There is wide range of geographical variation in the incidence of major genital malignancies. In most of the developed countries cancer of the breast is top of the in female malignancies, where in the developing countries like Bangladesh genital malignancies is in top of the list. Of them cervical carcinoma has a great value. So aims of the study was to find the clinical profiles of invasive cervical cancer in our context.

Materials and methods: This is a descriptive type of observational study conducted during a six months study period from January 2008 to June 2008 in the Oncology Unit of Obstetrics and Gynaecology of Bangladesh Medical University (BMU) and Dhaka Medical College among 30 patients of diagnosed ca cervix patients. After confirmation histologically as a carcinoma of cervix at all ages patients were included and All cases other than clinically confirmed carcinoma of cervix, patients with intraepithelial Carcinoma of Cervix (CIN) were excluded. There patients data were collected from the patients. Biopsy was taken for histopathological evaluation. According to the decision of the board patients were treated. Finally they were discharged with advice. After collection data were compiled and analyzed by Microsoft Excel 2007.

Results: Among the patients enrolled in the study most of the patients, 33.33% were between 31-40 years age group. 90% were housewives, 100% were married with 36.67% from lower socio-economic group. Most common presentation was post coital bleeding 63.33%. Early age of 1st intercourse, 63.33% was the most identifiable risk factors. Early marriage and multiparty were 63.33% and 60% respectively. 16% patients had early menarche and 10% had late menopause. 93.33% patients had squamous cell carcinoma. Remainder were adenocarcinoma. Two patients have liver and lung metastasis. 1 patients were treated surgically or by chemo-radiation according to their staging. Most were in advanced stage.

Conclusions: From the above discussion an observation of the situation we find that the financial condition of almost all the patient is precarious. Illiteracy, superstitions, lack of cleanliness and malnutrition has totally covered the whole womenfolk in the rural areas of the country. Consequently they fail to understand the early sign and symptoms of carcinoma of cervix in their body and they after neglect the catastrophe. As a result majority of cases are diagnosed at an advanced stage.

Key words: Cancer; Cervix; Profile.

Introduction

Cancer of the cervix is the 3rd most common cancer of the gynecological cancer in women.¹ In some less developed countries like Bangladesh it is the commonest cancer in women. This situation is compounded by the fact that, in under developed countries 75% with an advanced stage, which the converse is of presentations in the developed countries where 75% early and cure can be realistically expected.² The highest risk for cervical cancer is found in women who are exposed sexually early with multiple partners to HPV (Type 16 to 18) heavy smoking etc.¹

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The most cervical cancer occurs in women between 35 and 55 years of age. 85% to 90% of cervical cancers are squamous cell carcinomas, 12% adenocarcinoma and 3% adenosquamous cell carcinoma.³ To complicate the picture, there are three grading types of squamous cell carcinoma: a well-differentiated a moderately differentiated and a poorly differentiated. Each of them has a different grade of malignancy, with the most mature cell type having the best long term survival worst survival.

In very early stage, invasive cervical carcinoma causes no symptoms and is only diagnosed accidentally or as a result of routine search. Abnormal vaginal bleeding or discharge is the most common symptom of invasive carcinoma; first episode of bleeding commonly follows coitus, straining at stool or any circumstance which exposes the cervix and may be slight later the loss alarmingly heavy. The discharge is at first creamy or white but subsequently dirty brown and of a particular offensive odour.⁴⁻⁶ In advanced stage, patient may complain of pelvic pain, frequency of micturition, dysuria, incontinence, rectal pain, low backache, oedema of the leg, weight loss and anorexia. On examination, in early stage cervical carcinoma may appear normal, eroded or chronically infected; hardness, irregularity, bleeds on touch is suggestive signs. Infiltrative carcinoma produce enlargement, irregularity and firm consistency of the cervix eventually involved the adjacent parametria. The cardinal signs are hardness, friability, fixation and bleeds on touch. Now a days in some aspects carcinoma cervix even in advance stages, clinically are presenting with minor symptoms, like watery vaginal discharge or only heaviness in lower abdomen. So, patients do not pay heed to these problems. It is very disgraceful for these people, because in the meantime disease has already spreader locally or distally. Doctors can get limited scope for treatment.⁷

World wide, cervical cancer accounts for about 500,000 new cases diagnosed and 250,000 deaths. The sad part is, if all these women had gone for a yearly pap test, almost none of them would have died. Of the new cases, 80% occurs in the less developed countries.⁸ This situation is compounded by the fact that in underdeveloped countries 75% with an advanced stage, which is converse of

presentations in the developed countries where 75% present early and cure can be realistically expected.² This is partly due to education and empowerment of women, and lack of vaccination and screening facilities so they present early because of symptoms for cervical cancer. The prime object of the study was to find the clinical profiles of invasive cervical cancer in our context.

Materials and methods

This is a descriptive type of observational study conducted during a six months study period from January 2008 to June 2008. The study was conducted in Oncology Unit of Obstetrics and Gynaecology of the Bangladesh Medical University (BMU) and Dhaka Medical College among : 30 patients after admission, patients who were diagnosed as a case of carcinoma of cervix. Regarding inclusion criteria of the study after confirmation histologically as a carcinoma of cervix at all ages patients were included and All cases other than clinically confirmed carcinoma of cervix, patients with intraepithelial Carcinoma of Cervix (CIN) were excluded. Patients who were attended in Out Patient Department (OPD) of BMU or Dhaka Medical College Hospital with the complaints of irregular pervaginal bleeding, post coital bleeding, excessive vaginal discharge etc were admitted in gynae indoor. Their patients data were collected from the patients. In the mean time examination under anesthesia of them were performed for staging. Then a board was made, which was consisted of gynaecologist, Oncologist, radiotherapist and pathologist. Thirty (30) patients of carcinoma cervix were studied in the series. After taking history, thorough clinical examination as well as EUA and staging was done. Biopsy was taken for histopathological evaluation. The results of analysis of clinical presentations, presentation with different stages, duration of symptoms, risk factors, distribution of age, occupation, marital status, socio-economic status, menstrual status, examination findings, time taken for reporting diagnosis and investigation findings all are tabulated separately. According to the decision of the board patients were treated. Finally they were discharged with advice. After collection data were compiled and analyzed by Microsoft Excel 2007.

Results

Table I Distribution of age and marital status of the patients (n=30)

SL#	Age Groups (Years)	Number of Cases	Percentage (%)
01	20-30	2	6.67
02	31-40	10	33.33
03	41-50	9	30.00
04	51-60	4	13.33
05	61-70	5	16.67
SL#	Marital Status	Number of Cases	Percentage
01	Married	30	100
02	Unmarried	0	0
03	Widow	2	6.67

This Table shows distribution of different age groups in the series. Females of 31-40 years age group was predominated in the series (33.33%). Age range was 20-70 years. Mean age is 45 years. Among all thirty (30) patients are married, Two (2) were widow (Table I).

Table II Mode of presentations and pattern of menstrual disturbances (n=30)

SL#	Presentation	Number of Cases	Percentage (%)
01	Blood stained P/V discharge	12	40
02	Post coital bleeding	19	63.33
03	Foul smelling P/V discharge	14	46.67
04	Difficulty in micturition	12	40
05	Difficulty in defecation	5	16.67
06	Back pain	22	73.33
07	Post menopausal bleeding	2	6.67
08	Menorrhagia	8	26.67
09	Metrorrhagia	4	13.33
10	Spotting	4	13.33
11	Dysmenorrhoea	6	20

This Table shows the most (63.33%) of the patients presented with post coital bleeding. Significant number of patient presented with foul smelling vaginal discharge (46.67%) and blood stained vaginal discharge. Back pain is presented by highest number of patients. Difficulty in micturition and defecation present in advance cases. This data also shows that most of the patient of this suffering from menorrhagia (Table II).

Table III Risk factors in the study population (n=30)

SL#	Risk factors	Number of Cases	Percentage (%)
01	Age of first inter course	19	63.33
02	Multi parity (More than-4)	18	60
03	Early marriage (Before 15 years)	19	63.33
04	Low socio-economic group	17	56.67
05	High risk male partner	05	16.67
06	Oral contraceptive pill	13	43.33
07	Early menarche	02	6.67
08	Late menopause	0	0
09	Smoking	04	13.33
10	Sexually transmitted disease	05	16.6

Among the 30 patients, age of first intercourse (63.33) is the most commonly identified risk factor followed by multiparity, many of them from low socio-economic group (56.67). Few of them have STD and high risk male partner (Table III).

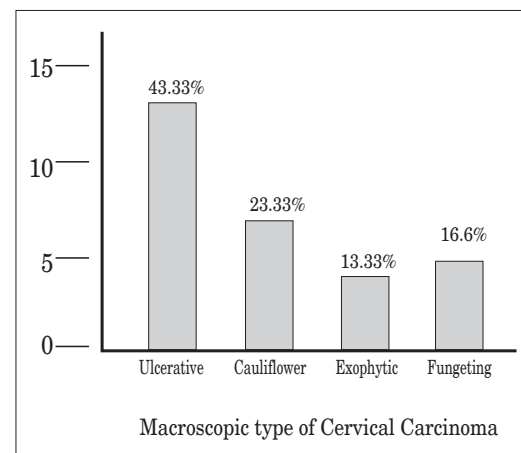


Figure 1 Macroscopic type of cervical carcinoma in study population

This Figure shows most of the patients had ulcerative lesion in the cervix (Figure 1)

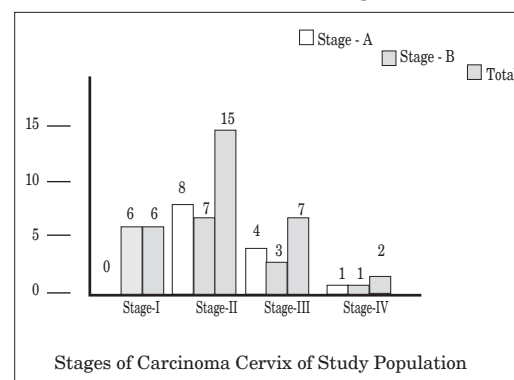


Figure 2 Stages of carcinoma cervix of study population

This figure shows most of the patient presented in stage II.

Table IV Histological type and grading of carcinoma cervix and causes of delayed diagnosis

SL#	Type of carcinoma cervix	Number of Cases	Percentage (%)
01	Squamous cell carcinoma	28	93.33
02	Adenocarcinoma	02	6.67
SL#	Grading of cervical carcinoma	Number	Percentage
01	Well differentiated	05	16.67
02	Moderately differentiated	09	30.00
03	Poorly differentiated	16	53.33
SL#	Causes of delayed diagnosis	Number of Cases	Percentage
01	Negligence of the patient and her relatives	14	46.67
02	Economical crisis	03	10
03	False negativity of the screening test	04	13.33
04	Taking kabiraji or homeopathic treatment	04	13.33
05	Failure of the doctor to diagnose early	02	6.67
06	Malpractice of the doctor	01	3.33

Table IV shows 93.33% of the patients have squamous cell carcinoma and only 6.67% has adenocarcinoma. Data also shows most of the cancer cervix of this study are poorly differentiated. In this study negligence was found to be main cause in diagnosis and treating the Cervix.

Discussion

This study shows presentations of cervical cancer cases were very variable. Most common presentation in the series was post coital bleeding, which is about 63.33%. It was about 30% in a study done by Banu L.A and 61% in the study by Fauzia.^{9,10} Blood stained per vaginal discharge were also noted in 40% of patients in this series which was about 30% in the study conducted by Banu L. A.⁹ Besides these, 46.67% patients presented with foul smelling per-vaginal discharge, 26.67% with menorrhagia, 13.33% metrorrhagia, 73.33% with backache, difficulty in micturition (40%) difficulty in defecation (16.67%) and post menopausal bleeding (6.67%).

This study shows 50% patients sought medical advice within one year of appearance of symptoms. 30% presented between 1-2 year and 20% presented after 2 years of appearance of symptoms. These figures were 90%, 10%, 0% respectively in Banu L. A. study.⁹

Among the 30 patients studied in this series early age of 1ST intercourse was the most common identified risk factor. 63.33% patients had 1ST intercourse before 15 years of age. 10% patients had between 15 to 20 years. Early age at 1st intercourse was identified as directly related factor in the occurrence of carcinoma cervix by Fauzia and Brinton L. A et al.^{10,11}

Nineteen patients had their marriage before 15 years. It was about 60% in Banu L. A series, and 47% were in Roy N. N prime series. Early age at 1st marriage was also identified as risk factor by Fauzia.^{9,12,10} Seventeen patients 56.67% came from low socio-economic class, 33.33% from middle class and 6.67% from higher class. It was 30%, 60% and 10% respectively in Banu L. A series.⁹ High prevalence of carcinoma cervix in lower socio-economic group may be due to less availability of medical facilities to poor patients as well as their ignorance illiteracy about health. Low socio-economic condition and poor personal hygiene were also identified as the risk factor by Fauzia.¹⁰

Thirteen patients 43.33% had history of intake of steroid Oral Contraceptive Pill (OCP). Though role of OCP in the causation of cervical carcinoma is debatable, a review study on the role of steroid contraceptive hormones in the pathogenesis of invasive cervical cancer, Durban, showed steroid contraception has been postulated to be mechanism whereby HPV exerts its tumorigenic effect on cervical tissue. Steroids are thought to bind to specific DNA sequence within the transcriptional regulatory regions on the HPV DNA to either increase or suppress transcription of various genes. The role of steroids was further enhanced by the discover of hormone receptors in cervical tissue. Similar finding were also evident from other work, including Royal College and the WHO.

Exposure to HPV and HIV were not studied in this series due to lack of facilities. But there is increased risk in patients infected with HPV and HIV. There is a higher rate of persistent HPV infections in HIV positive patients, especially with oncogenic virus subtypes. Persistence of high-risk virus is necessary for the development of dysplastic lesion; therefore, there is a higher incidence of Cervical Intra-epithelial Neoplasia (CIN) and cervical cancers in HIV positive patients.

Although human papillomavirus cause essentially all cervical carcinoma, cofactors may differ by cancer histological type. This is further supported by the fact that all HPV infected woman do not develop invasive cervical cancer. In a study on "Comparison of human papillomavirus genotypes, sexual and reproductive risk factors of cervical adenocarcinoma and squamous cell carcinoma", Bethesda, USA showed the relative importance of human papillomavirus genotypes 16 and 18 and the reproductive co-factor differences suggest distinct causes for cervical adenocarcinoma and squamous cell carcinoma.

In the series 90% patients were anaemic, which correlate with Banu L.⁹ A series. Significant weight loss were noted in 50% patients which is as usual with other malignancies. Owing to liver metastasis 13.33% patients had jaundice. Fifteen patient had clinically palpable lymphadenopathy.

During abdominal examination, mass were found in 6.67% patients, which indirectly indicates advanced disease. 13.33% patients had ascites and jaundice each, which are also the signs of advanced stage of the disease. Advanced stage of cervical carcinoma at presentation were also shown by Banu L. A and Eun TZ their series.^{9,12} 43.33% growth was ulcerative, 13.33% were exophytic and cauliflower was 23.33%. It was 40%, 38% and 18% respectively in the series by Fauzia.¹⁰ Ulcerative lesion was 50% in Banu L.A series.⁹ There was no significant 9 growth in 3.33% patients. During per vaginal examination bleeding were noted in 40% patients and foul smelling discharge in 46.67% patients, which were 100% and 50% respectively in Banu L.A series.⁹

Cervical biopsy of the patients showed 93.33% had squamous cell carcinoma of different grades and 6.67% had adenocarcinoma. No other histological types were found. Squamous cell carcinoma were 91% in the study conducted by Fauzia.¹⁰ In Banu L. A series of 10 patients 100% were squamous cell carcinoma.⁹

Twenty one patients (70%) were diagnosed clinically after first reporting, within six months. All these cases then confirmed histopathologically within short interval. After confirmation of diagnosis most of the patient underwent treatment within any delay.

Causes of delay in diagnose of the disease were negligence of the patient and for relatives (46.67%) false negativity of the screening test (13.33%) economical crises (10%), taking homeopathic and kabiraji treatment (13.33%) etc. Failure of the doctor in easily diagnosis also increases the stage of the disease. Causes of delay in treatment of the disease were patients were not fit for operation or therapy (10%) taking of kabiraji as homeopathic (10%) and economical crisis of the patient. One case was maltreated by doctor.

Conclusion

This study analyzed the various clinical presentations, interval between symptom and clinical diagnosis, that of clinical and confirm diagnosis, that of confirm diagnosis and treatment. This study also analyzed the various causes of delay in presentation in the hospital. It was found that most of the patents presented within six (6) months of symptom production and they were also treated within six (6) months. Financial problem was one of the common cause of delay in starting treatment.

Limitations

Small sample size and single center study.

Recommendations

A multicenter study with nationally representative sample will enrich the issue in our context.

Disclosure

Authors declared no compelling interest.

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Evaluating Hip Circumference and Waist-hip Ratio as Predictive Markers for Type 2 Diabetes in Chattogram, Bangladesh

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Abstract

Background: Emerging clinical evidence indicates that central obesity has a stronger association with Type 2 Diabetes Mellitus (T2DM) than generalized obesity. This study aims to evaluate the association between these anthropometric measures and Type 2 diabetes in the Bangladeshi population of Chattogram district, to inform more targeted screening and prevention strategies.

Materials and methods: This cross-sectional analytical study was conducted to evaluate and compare Hip Circumference (HC) and Waist-to-Hip Ratio (WHR) between individuals with T2DM and Non-Diabetic (ND) controls. The study was carried out in the Department of Anatomy, Chittagong Medical College, Chattogram, from March 2019 to March 2020, involving 100 T2DM patients and 100 age- and sex-matched ND individuals. Anthropometric measurements-including height, weight, waist circumference and hip circumference were obtained using standardized techniques and recorded in a structured case record form. Data were analyzed using SPSS version 26.0. Descriptive statistics were expressed as mean $\pm$ standard deviation, and intergroup comparisons

were performed using the unpaired Student's t-test. A p-value of <0.05 was considered statistically significant at a 95% confidence level.

Results: Significant differences were observed in both HC ($p<0.001$) and WHR ($p<0.001$) between the T2DM and ND groups. Additionally, T2DM participants demonstrated higher body weight and waist circumference, indicating a greater degree of central obesity.

Conclusion: These findings underscore notable anthropometric disparities between diabetic and non-diabetic individuals and highlight the importance of central obesity as a marker in T2DM risk assessment.

Key words: Anthropometry; Hip Circumference (HC); Type 2 Diabetes Mellitus (T2DM); Waist to Hip Ratio (WHR).

Introduction

Type 2 Diabetes Mellitus (T2DM) has become a major global health concern, with rapidly rising prevalence (6.1%), particularly in Low- and Middle-Income Countries (LMICs). It is also the leading cause of death and disability worldwide.¹ Developing countries in South Asia are experiencing a sharp increase in diabetes cases due to urbanization, lifestyle changes, and demographic shifts.² By 2035, the number of people affected by T2DM is projected to reach 592 million worldwide.²⁻⁴

Diabetes has become the seventh leading contributor to the disease burden in South Asian nations.⁵ Currently, 80% of adults living with diabetes reside in LMICs. Once considered a condition primarily affecting the affluent, diabetes has now emerged as a major public health challenge in these regions. The increasing prevalence of non-communicable diseases, particularly diabetes, is placing significant strain on already fragile healthcare systems in low-income countries, both in terms of cost and care demands.^{6,7,8} Clinically, visceral fat is recognized for producing substances that contribute to the development of diabetes and may offer more

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diagnostic insight than overall body fat.⁵ In epidemiological research, these clinical insights are often reflected using anthropometric indicators. Hip circumference and Waist hip ratio are commonly used to assess central obesity (associated with visceral fat), while Body Mass Index (BMI) serves as a measure of overall obesity⁶. Studies have consistently shown that central obesity is more strongly linked to diabetes than general obesity.^{6,7} Over recent decades, a global rise in obesity rates has paralleled an increase in the number of individuals diagnosed with T2DM. Data emerging over the past decades reported a global increase in the prevalence of obesity⁸ which has resulted in a similar increase in the number of persons leaving with type 2 DM.⁹

Bangladesh has seen a significant increase in diabetes prevalence, rising from 4% in 1990 to 10% in 2011, with projections indicating it could reach 13% by 2030.¹⁰ The highest age-adjusted rates have been observed in the southeastern areas, specifically Chattogram (12.4%) and Barisal (11.6%) followed by central (Dhaka, 10.2%) middle-western (Rajshahi, 10.2%) eastern (Sylhet, 10.0%) northwestern (Rangpur, 8.0%) and western (Khulna, 6.4%) regions.¹¹ These regional disparities highlight the urgent need for more focused research on diabetes in these parts of the country.

Anthropometry is a practical, affordable and non-invasive approach to assess body size, shape and composition. Common measures like HC and WHR, derived from basic metrics such as height, weight, and waist size, are widely used in clinical settings to evaluate disease risk. These measurements can also support cross-sectional research on the link between obesity and diabetes risk.¹²⁻¹⁴

One meta-analysis found a substantial correlation between three key obesity markers and the prevalence of T2DM like HR and WHR.¹⁵ According to another meta-analysis, utilizing the WHR rather than the BMI may assist predicting a number of cardiometabolic risk variables, notably in diabetes.¹⁶

Despite their clinical relevance, there is a scarcity of population-specific data in Bangladesh exploring the predictive value of HC and WHR for T2DM.

This study aims to evaluate the association between these anthropometric measures and Type 2 diabetes in the Bangladeshi population of Chattogram district, to inform more targeted screening and prevention strategies.

Materials and methods

This cross-sectional analytical study was carried out from March 2019 to March 2020 in the Departments of Anatomy and Endocrinology at Chittagong Medical College Hospital, Chattogram. Ethical approval was obtained prior to enrollment. The study included 100 Type 2 diabetes patients (Diagnosed for at least five years without major comorbidities) and 100 non-diabetic individuals (Random blood glucose <7.8 mmol/L) all aged 30 years or older, selected through convenience sampling. Pregnant women and those on medications other than oral hypoglycemics were excluded.

Anthropometric measurements-height, weight, Waist Circumference (WC) and Hip Circumference (HC) were taken by trained staff following WHO guidelines.¹⁷ Height and weight were measured to the nearest 0.1 cm and 0.1 kg, respectively, using standardized equipment. WC and HC were recorded using anatomical landmarks with a non-stretchable tape. Waist-to-Hip Ratio (WHR) was calculated accordingly. All data were recorded in a structured case form, and informed written consent was obtained from all participants.

Data were analyzed by SPSS (version 26.0). Measurements were presented as frequency, percentage, mean $\pm$ SD and compared by unpaired student's t test. Finally the results were presented by using table and figure and p value was considered significant if it was < 0.05 at 95% level of confidence.

Results

A total of two hundred participants were enlisted in the study, which included both Type 2 diabetics (Case group) and non-diabetic individuals (Control group). Figure 1 demonstrates total number of participants according to their gender distribution. In non-diabetic individuals, the male to female ratio was 1.38:1, while among Type 2 diabetic patients, the ratio was 2.70:1. The age range was 31 to 68 years, with a mean age of 44.22 $\pm$ 6.54 years for Type 2 diabetic patients and 41.82 $\pm$ 8.70 years for non-diabetic individuals.

Table I Comparisons of various anthropometric measurements in non-diabetic (control group) and Type 2 diabetic group (Case)

Variable	Non-diabetic subjects Mean±SD (n=100)	Type 2 diabetic patients Mean±SD (n=100)	p-value
Height	163.92 ± 9.246	162.97 ± 8.378	0.448
Weight	64.14 ± 6.864	68.26 ± 7.647	<0.001***
Waist circumference	74.23 ± 5.209	90.14 ± 5.726	<0.001***
Hip circumference	88.641 ± 6.920	103.437 ± 7.084	<0.001***
Waist hip ratio	0.827 ± 0.046	0.867 ± 0.039	<0.001***

*** means highly significant.

Table I demonstrates that, although the mean height of non-diabetic individuals was greater than that of participants with Type 2 diabetes, this difference was not statistically significant ($p = 0.448$). Conversely, individuals with Type 2 diabetes exhibited a significantly higher weight compared to their non-diabetic counterparts ($p < 0.001$). Table I also revealed that Type 2 diabetic patients had a significantly greater ($p < 0.001$) hip circumference and waist hip ratio ($p < 0.001$) than non-diabetic subjects.

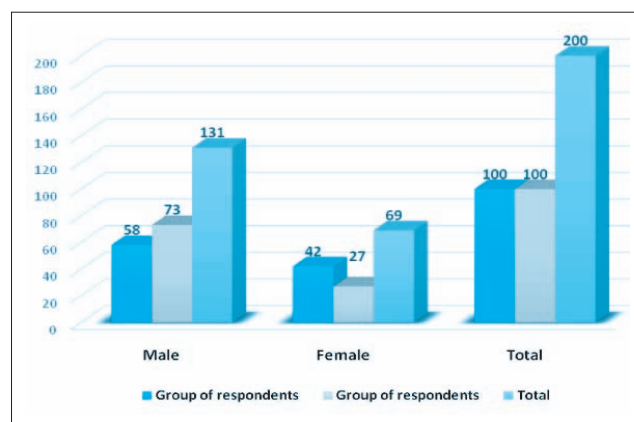


Figure 1 Clustered Bar diagram showing gender distribution among two groups

Discussion

This study explored the predictive value of Hip Circumference (HC) and Waist-Hip Ratio (WHR) for Type 2 Diabetes Mellitus (T2DM) and found both variables to be statistically significant across non-diabetic and diabetic groups. These findings reinforce the growing body of evidence that anthropometric measures, particularly those related to fat distribution, are critical indicators of metabolic risk.

While abdominal obesity is a well-established risk factor for Type 2 Diabetic, recent research suggests that larger HC may confer a protective effect. In the present study, in non-diabetic persons mean $\pm$ SD HC was 88.64 ± 6.920 (range: 66.20–99.05) cm and in Type 2 diabetic patients mean $\pm$ SD HC was 103.44 ± 7.085 (Range: 90.15–120.35) cm. Mean $\pm$ SD HC was statistically very highly significant according to p value ($p < 0.001$) between the study groups. A study conducted by Ting et al. observed that, mean $\pm$ SD HC (cm) was 96.6 ± 6.2 in control group and 98.5 ± 6.6 in Type 2 diabetic patients ($p < 0.0001$).¹⁸ Present results agree with these findings. Liu et al. also observed mean $\pm$ SD Hip (cm) was 96.6 ± 8.2 in diabetic patients and 92.1 ± 5.7 in non-diabetic people ($p < 0.001$).¹⁹

WHR has long been recognized as a reliable marker of central obesity, which is closely associated with insulin resistance and T2DM risk. In the present study, in non-diabetic persons mean $\pm$ SD WHR was 0.82 ± 0.046 (Range: 0.73–0.93) and in Type 2 diabetic patients mean $\pm$ SD WHR was 0.86 ± 0.039 (Range: 0.80–0.98). Mean $\pm$ SD WHR was statistically very highly significant according to p value ($p < 0.001$) between the study groups. Marcadent et al. found that, average mean $\pm$ SD WHR was 0.93 ± 0.07 . Mean $\pm$ SD WHR was 0.96 ± 0.07 in diabetes mellitus patients and 0.92 ± 0.07 in non-diabetes mellitus people ($p < 0.001$).²⁰ In the study of Liu et al. (2013) the mean $\pm$ SD WHR was 0.88 ± 0.05 in diabetic patients and 0.83 ± 0.06 in non-diabetic people ($p < 0.001$).¹⁹ These findings underscore the importance of WHR as a simple, cost-effective measure for assessing diabetes risk, particularly in resource-limited settings where advanced imaging techniques are unavailable.

The combined assessment of HC and WHR provides a more nuanced understanding of an individual's metabolic risk. While WHR effectively identifies central obesity and associated risks, HC may offer insights into protective fat distribution patterns. Incorporating both measurements into routine clinical assessments could enhance early detection and risk stratification for Type 2 Diabetic patient, facilitating timely interventions.

Limitations

This study's cross-sectional design limits the ability to establish causal relationships between HC, WHR, and T2DM. Additionally, variations in sex, age and ethnicity may influence the observed associations. Future longitudinal studies are needed to validate these findings and explore the underlying mechanisms linking body fat distribution to T2DM risk.

Conclusion

The findings of this study indicate that both hip circumference and waist-to-hip ratio are significantly higher in Type 2 diabetic patients compared to non-diabetic individuals. These findings underscore the potential contribution of obesity to the pathophysiology of diabetes. Monitoring anthropometric indices such as hip circumference and waist-to-hip ratio might better predict glycemic control in diabetic patients than relying solely on BMI. Incorporating these anthropometric measures into routine clinical assessment may aid in identifying individuals at higher risk for diabetes.

Recommendation

To create a larger sample size and acquire more reliable data, a multicenter, nationwide study that includes the indigenous people of the nation should be taken into consideration. In future studies, more extensive anthropometry may be done using computerized non-contact methods such as laser scanning, stereo-photogrammetry, ultrasound, infrared imaging, computed tomography and MRI to increase the reliability.

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Disclosure

The author declared to have no conflicts of interest.

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Factors Predicting Severity of Periodontal Disease in Chronic Kidney Disease Patients

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Abstract

Background: Periodontal disease is a chronic infection that can result in the destruction of tooth supporting structures and eventual tooth loss. The aim of the study was to evaluate the factors determining the severity of periodontal disease in the chronic kidney disease patients.

Materials and methods: This cross sectional study was carried out on 88 patients with CKD over a period of one year from February, 2021 to January, 2022 at Nephrology Department of Chittagong Medical College Hospital (CMCH), Chattogram. A periodontal examination was performed. Relevant laboratory investigations for biochemical parameters were done and report was recorded. Data were analyzed and reviewed and expressed as frequency and simple percentage.

Results: Out of 88 CKD patients, majority 72(81.8%) patients had CKD stage 5. More than

three fourth (78.4%) patients had moderate periodontitis, 9(10.2%) had severe periodontitis 10(11.4%) were no/mild periodontitis. DI-S, OHI-S and MGI were statistically significant ($p < 0.05$) when compared with periodontal status. Significant positive correlation ($r = 0.578$; $p = 0.001$) was found between CRP level with IL-6 in moderate/severe periodontitis patients. In multivariate analysis, age (> 40 years) and abnormal IL-6 were found to be independent predictors for moderate/severe periodontitis.

Conclusion: Among the inflammatory markers IL-6 demonstrated significant correlation with periodontal disease in CKD. Among other factors higher age, DM, glomerulonephritis were also found to be associated with moderate to severe periodontitis.

Keywords: CKD; CRP; IL-6; Inflammatory markers; Periodontal disease.

Introduction

Periodontal diseases have been recognized as the common inflammatory diseases.¹ About half of adult people around the world suffer from severe periodontitis, which will finally lead to tooth loss.² According to data from the National Health and Nutrition Examination Survey (NHANES) cycle, almost fifty percent of adults have periodontal diseases.² Periodontal diseases comprises of a group of inflammatory diseases affecting the supporting tissues of the teeth resulting from a complex interplay between specific gram-negative micro organisms, their by products and the host-tissue response. This results in progressive destruction of the periodontal ligament and alveolar bone. Earlier, periodontitis had been considered as a disease confined to the oral cavity. However, in the past several years, substantial scientific data have emerged to indicate that the localized infections characteristic of periodontitis can have a significant effect on the systemic health.³⁻⁵

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Patients on hemodialysis neglect their oral hygiene due to several factors which include the stress they are undergoing and prolong therapy session, so high periodontal destruction is expected to be viewed in such patients taking in consideration the various medications and supplements they are on such as erythropoietin and cholecalciferol. Recent studies revealed, the correlation between CPR and IL-6 is more evident with periodontitis.⁶

Periodontitis affects approximately half of the adult population worldwide and it is the one of the eminent cause of tooth loss in the middle-aged and older people.² Prevalence of periodontal disease approaches 14% over a wide age span, including younger and elderly people.⁷ Prevalence of periodontal disease in CKD patients is also increasing, and the prevalence of chronic periodontitis is nearly 40% in CKD patients.⁸ A study has shown that 58.9% of patients with renal failure have moderate to severe periodontitis.⁹ Tawfig et al. conducted a cross sectional comparative study in Riyadh, Saudi Arabia to assess the periodontal disease severity among patients at different stages of chronic kidney disease. The study showed that mild gingival inflammation was found in highest percent age in the haemodialysis patients. Severe form of gingival inflammation in dialysis patient was lowest. The clinical attachment loss was higher in the dialysis group. The prevalence of moderate and severe periodontitis increased step wise across CKD stages.¹⁰

Efforts have been made to identify the factors or causes that increase progression of periodontal disease in ESRD patients. But risk factors of developing periodontitis in CKD patients is still under investigation. Neglected oral care may be a silent provocation to influence the progression pattern and impact of CKD. So, identification of risk factors of periodontal disease in CKD patients may help in preventing further progression of disease, improve quality of life and overall decrease the financial burden. Therefore, the aim of this study was to evaluate the factors determining the severity of periodontal disease in the CKD patients.

Materials and methods

This was across sectional study was carried out in Department of Nephrology, Chittagong Medical College Hospital (CMCH) Chattogram during the

period of February, 2021 to January, 2022. A total of 88 known case of CKD with or without dialysis aged 18-65 were included according to inclusion and exclusion criteria by convenient sampling. Associated disease (Stroke, malignancy), extra oral infection, patients having less than 6 teeth Pregnant and lactating women and all contagious diseases were excluded from the study. Then the patients were divided into different stages according to GFR. GFR was measured by MDRD formula. Aims, objectives, procedures, risks and benefits of the study were explained to the patients. They were encouraged for voluntary participation. They were also assured about the secrecy of information and records. Written informed consent was taken from each patient. A detailed history was obtained. A periodontal examination was performed. Then relevant laboratory investigations to evaluate the biochemical parameters (CBC, Creatinine CRP, IL-6) were done and reports were recorded.

Oral and dental examination

The dental and periodontal examination in all subjects was carried by a single trained dental surgeon. The dental status was examined by visual examination under direct and indirect illumination, using a plane dental mirror and a dental explorer. The periodontal examination was carried out with calibrated periodontal probes with Williams markings. The periodontal status was determined using measurements of Probing Pocket Depth (PPD) Gingival recession and Clinical Attachment Level (CAL) measurements from four sites on each tooth (Buccal, Mesial, lingual/palatal, distal). Gingival inflammation, Debris status, calculus status and oral hygiene status were assessed using Modified Gingival Index (Category), Debris Index Simplified method (Category), Calculus Index Simplified method (Category) and Oral Hygiene Index Simplified method (Category) respectively.

All the subjects was categorized in to three groups.¹¹

Mild or no periodontitis Moderate periodontitis Severe periodontitis based on PPD, CAL, measurements, using the criteria proposed by the joint working group of the center for disease control and prevention in collaboration with the American Academy of periodontology in 2003.

Biochemical Parameters

Area over the antecubital fossa was disinfected to with draw blood. 10 ml of blood was obtained and the samples were evaluated for biochemical parameters. This included CBC, CRP, IL-6 and serum creatinine. All laboratory values were obtained by automated and standardized methods in laboratory. Serum creatinine was done by enzymatic method with the help of Dimension exl 200 Siemens machine. The white blood cell differential count was determined as part of complete blood count testing. ESR was measured by modified Westergren method, Volume conductivity scatter method was used for measurement of complete blood count. Three ml of blood was drawn into tube containing ethylene diamine tetra acetic acid (EDTA) and the tube was rotated for 5 min, then the blood sample was put in Siemens sysmexn 1000 machine and result was drawn. NLR was constructed by dividing neutrophil count to lymphocyte. Serum IL-6 concentrations were measured using the commercially available human IL-6 enzyme-linked immunosorbent assay (ELISA) (ADVIA Centaur IL-6 assay) according to the manufacturer's instructions with help of Conveys EL-Reader 96X (Germany). Blood sample for IL-6 was centrifused and was freezed at -20 degree Celcius. High sensitivity C reactive protein (CRP) was measured by nephelometry method with helpo f Atellica NEPH 630.

Descriptive statistics was used to assess frequencies, measurements of central tendency and dispersion measurements related to the clinical, demographic, and laboratorial characteristics of the patients. The categorical variables were expressed as the absolute number (Valid percentage) and the quantitative variables were expressed as the means and standard deviations in cases of normal distribution. The quantitative variables with non-Gaussian distribution were expressed as the medians. Chi-square test was used for categorical variables. Unpaired t-test, Mann-Whitney Utest, ANOVA test and Kruskal Wallis Test were used for continuous variables. Multi variate logistic regression analysis was used for prediction of periodontitis patients. Pearson's correlation coefficient was used between CRP level with IL-6 in periodontitis patients. SPSS (Statistical Package for Social Science) for Windows version 23 software was used for the analyses. Statistical significance was defined as $p < 0.05$ and confidence interval was set at 95% level.

Results

In this study out of 88 patients with CKD, majority 27(30.7%) patients belonged to age group 41-50 years. More than two third patients were male and the rest were female. Regarding stages of CKD, majority 72(81.8%) patients had CKD G 5 followed by 9(10.2%) had G 4, 6(6.8%) had G 3 and 1(1.1%) had G 2. More than three fourth (78.4%) patients had moderate periodontitis, 9 (10.2%) had severe periodontitis 10(11.4%) had no periodontitis. The mean age was significantly higher in moderate/severe periodontitis group than no/mild periodontitis group (47.59 ± 12.03 vs 37.3 ± 11.13 years). However, gender, occupation, education level and residence type were not statistically significant when compared with periodontal status ($p > 0.05$). History of DM was significantly higher in moderate/severe periodontitis patients than no/mild periodontitis (97.1% vs 2.9%). History of glomerulonephritis was significantly higher in moderate/severe periodontitis patients (80.9%) than no/mild periodontitis patients (19.1%). However, history of HTN and smoking habit were not statistically significant when compared with periodontal status ($p > 0.05$) (Table I). OHI-S and MGI were statistically significant ($p < 0.05$) when compared with periodontal status. However, CI-S was not statistically significant ($p > 0.05$) compared with periodontal status (Table-II). The mean IL-6 was significantly higher in moderate/severe periodontitis group than no/mild periodontitis (11.52 ± 9.57 vs 2.50 ± 1.97). However, blood ESR level, NLR in blood and CRP were not statistically significant ($p > 0.05$) when compared with periodontal status (Table III). Significant positive correlation ($r = 0.578$, $p = 0.001$) between CRP level with IL-6 in moderate/severe periodontitis patients (Figure 1). Based on the Receiver-Operator Characteristic (ROC) curves IL-6 level had area under curve 0.899. Receiver-Operator Characteristic (ROC) was constructed by using IL-6 level, which gave a cut off value 3.0 pg/ml, with 91.0% sensitivity and 80.0% specificity for prediction of moderate/severe periodontitis (Figure 2). In multivariate analysis, age (> 40 years) and abnormal IL-6 were found to be independent predictors for moderate/severe periodontitis. However, history of DM, poor DI-S, poor OHI-S and moderate/severe gingivitis were not found to be independent predictors for moderate/severe periodontitis patients (Table IV).

Table I Association of socio-demographic variables with periodontal status (n=88)

Socio-demographic variables		Periodontal status		p-value
		No/Mild periodontitis	Moderate/ Severe Periodontitis	
Mean age (Years)		37.3±11.13	47.59 ±12.03	0.012
Gender	Male	7(11.9%)	52(88.1%)	0.570
	Female	3(10.3%)	26(89.7%)	
Occupation	Business	2(18.2%)	9(81.8%)	0.736
	House wife	2(7.4%)	25(92.6%)	
	Service	1(7.7%)	12(92.3%)	
	Unemployed	5(13.5%)	32(86.5%)	
Education level	Below SSC	6(9.8%)	55(90.2%)	0.587
	SSC & HSC	3(18.8%)	13(81.3%)	
	Graduate & above	1(9.1%)	10(90.9%)	
Residence type	Rural	6(10.2%)	53(89.8%)	0.430
	Urban	4(13.8%)	25(86.2%)	
HTN	Yes	9(12.5%)	63(87.5%)	0.421
	No	1(6.3%)	15(93.7%)	
DM	Yes	1(2.9%)	33(97.1%)	0.045
	No	9(16.7%)	45(83.3%)	
Glomerulonephritis	Yes	9(19.1%)	38(80.9%)	0.014
	No	1(2.4%)	40(97.6%)	
Smoking habit	Current	0(0.0%)	6(100.0%)	0.090
	Never	9(17.6%)	42(82.4%)	
	Past	1(3.2%)	30(96.8%)	

Table II Association DI-S, CI-S, OHI-S and MGI (Category) with periodontal status (n=88)

Variables		Periodontal status		p-value
		No/ Mild periodontitis	Moderate/ Severe Periodontitis	
DI-S (Category)	Fair	4(28.6%)	10(71.4%)	0.049
	Poor	6(8.1%)	68(91.9%)	
CI-S (Category)	Fair	10(12.5%)	70(87.5%)	0.365
	Poor	0(0.0%)	8(100.0%)	
OHI-S (Category)	Fair	4(33.3%)	8(66.7%)	0.027
	Poor	6(7.9%)	70(92.1%)	
MGI (Category)	Mild gingivitis	6(14.0%)	37(86.0%)	0.009
	Moderate gingivitis	2(7.1%)	26(92.9%)	
	No gingivitis	2(66.7%)	1(33.3%)	
	Severe gingivitis	0(0.0%)	14(100.0%)	

Table III Association among inflammatory markers with periodontal status (n=88)

Parameters	Periodontal status		t value	p-value
	No/Mild Periodontitis (n=10)	Moderate/ Severe Periodontitis (n=78)		
Blood ESR level (mm/hr.)	40.70±22.43	58.96±27.87	1.99	0.050
NLR in blood	3.81±1.51	4.22±2.12	0.59	0.555
IL-6 (pg/ml)	2.50±1.97	11.52±9.57	2.95	0.004
Median CRP (IQR)	6.33 (3.6-14.3)	8.43 (3.2-29.0)	0.895	

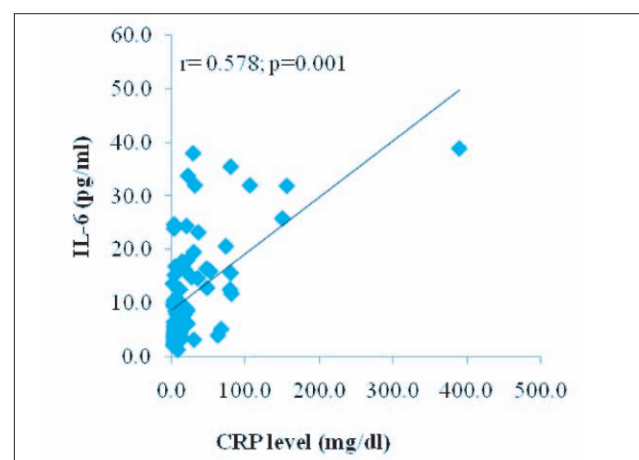
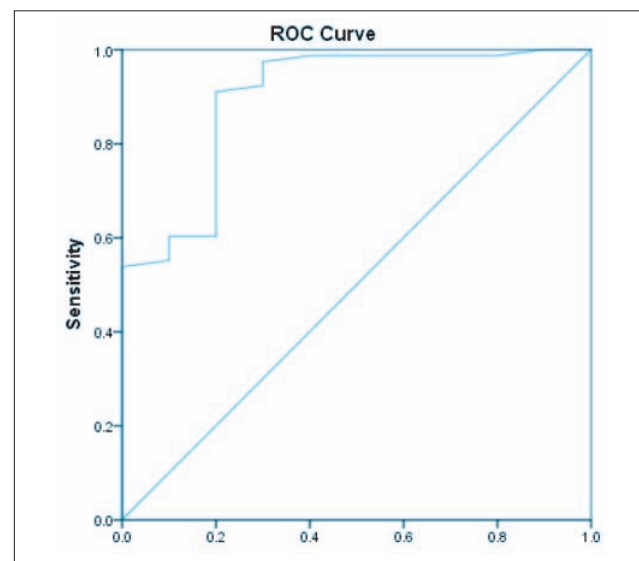
**Figure 1** Scatter diagram showing significant positive correlation ($r=0.578$, $p=0.001$) between CRP level with IL-6 in moderate/severe periodontitis patients.**Figure 2** Receiver-operator characteristic curves of IL-6 level for prediction of moderate/severe periodontitis

Table IV Multivariate logistic regression analysis prediction for moderate/severe periodontitis patients

Parameters	Adjusted OR	95% CI for OR		p-value
		Lower	Upper	
Age (>40 years)	11.503	1.430	92.558	0.022
History of DM	1.713	0.130	22.568	0.683
Poor DI-S	1.508	0.044	52.202	0.820
Poor OHI-S	0.010	0.001	12.980	0.998
Moderate/severe gingivitis	4.664	0.642	33.835	0.128
Abnormal IL-6 (>4.4 pg/ml)	8.214	1.274	52.955	0.027

Discussion

In this study it was observed that majority 27(30.7%) patients belonged to age group 41-50 years. The mean age was found 46.3 ± 12.5 years. In a study done by Joseph et al. they found mean age was 40 ± 7.92 years. Asavarungnirum et al. reported that mean age was 61 ± 11 years.¹² In this present study it was observed that mean age was significantly higher in moderate/severe periodontitis group than no/mild periodontitis group (p value-0.0012) which was supported by Cholewa et al. Ioannidou et al. and Grubbs et al.¹³⁻¹⁵

In this present study it was observed that more than two third patients were male and the rest were female. This study finding was similar with the other studies with male predominance done by Tawfig et al.¹⁰ and Chang et al.¹⁶ which showed that, male were 55.8% and 55.3% accordingly, a significant number of patients were unemployed because most of the patients were in G5 stage. However, gender, religion, occupation, education level and residence type were not statistically significant when compared with periodontal status (p>0.05). A study done by Kshirsagar et al. also showed no difference between sex¹⁶, but Grubbs et al. showed that male, less educated and poor were associated with moderate or severe periodontitis.¹⁵

Regarding stages of CKD, majority 72(81.8%) patients had CKD G 5 followed by 9(10.2%) had G 4, 6(6.8%) had G 3 and 1(1.1%) had G 2. Most of the patients belonged to G 5 because due COVID-19 situation, less outdoor patients were included as COVID-19 test could not be done for all outdoor patients.

In this study it was observed that more than three fourth (78.4%) patients had moderate periodontitis, 9(10.2%) had severe periodontitis 10(11.4%) had no

periodontitis. This was supported by Joseph et al. who found that 92.3% of the cases had moderate to severe periodontitis and the remaining 7.7% belonged to the category of mild/no periodontitis.¹² Schmalz et al. also found similar results.¹⁸ However, Naugle et al. reported most of the cases belonged to mild category.¹⁹

In this present study it was observed that DI-S, OHI-S and MGI were statistically significant (p-0.049, 0.027 and 0.009) when compared with periodontal status. However, CI-S was not statistically significant (p-0.365) compared with periodontal status. This was supported by Chhokra et al. who showed that higher GI and OHI-S were associated with progression of periodontal disease.²⁰ Davidovich et al. also showed that progression of periodontal disease was correlated with bad oral hygiene.⁶

This study showed mean IL-6 was significantly higher in moderate/severe periodontitis group than no/mild periodontitis (11.52 ± 9.57 vs 2.50 ± 1.97 , p value-0.027). This was consistent with the findings reported by Bretz et al.²¹

In our study, patients with moderate/severe periodontitis had higher median CRP level (8.43, IQR-3.2-29.0mg/dl) than no/mild periodontitis people (6.33, IQR-3.6-14.3), but this difference was not significant. This finding was supported by Chowdhury et al.²² Panichi et al. also showed that CRP levels were raised in CKD patients. However, ESR NLR were increased in moderate/severe periodontitis group but were not statistically significant.²³ Sirin et al. showed that significantly higher NLR in grade 3 apical periodontitis.²⁴

This study showed that significant positive correlation (r=0.578, p=0.001) was found between CRP level with IL-6 in moderate/severe periodontitis patients. In a study of Choudhury et al. found in their study that, significant positive correlation (r=0.450, p=0.041) was between CRP level with IL-6 in periodontitis patients.²² Panichi et al. reported that IL-6 and CRP levels were highly correlated (r=0.63, p <0.001).²⁴ Their study findings were similar with my study.

Bokhari et al. showed that aging was associated with increased incidents of periodontal disease.²⁵ Lertpimonchai et al. found DM to be a significant (p<0.001) predictor of periodontal disease.²⁶ Current study found in multi variate logistic regression that age and raised IL-6 (p=0.022 and

$p=0.027$ respectively $OR=11.503$ and $OR= 8.214$ accordingly) were significant independent predictor to moderate/severe periodontitis but not history of DM ($p=0.234$), poor DIS, poor OHI-S, moderate/severe gingivitis.

So, severity of periodontal disease was not related to stages of CKD in our population, but increased age, history of DM, history of GN and increased IL-06 were related to severity of periodontal disease in CKD patients in our population.

Limitations

The study population was selected from one selected hospital in Chattogram city, so that the results of the study may not reflect the exact picture of the country. The present study was conducted over very short period of time. As it was a hospital based study, so most of the patients were presented with advanced stages of CKD.

Conclusion

Among all available inflammatory marker, IL-6 had got only significant correlation with severity of periodontal disease in CKD patients. Among the socio-demographic factors increased age, history of GN were also found to be associated with moderate to severe periodontitis in CKD patients.

Recommendation

Further large-scale, longitudinal studies are needed to make any conclusion regarding a cause and effect relationship between periodontal disease and systemic inflammation in CKD patients.

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Finding

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Disclosure

All the authors declared no competing interest.

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Efficacy and Safety of Subarachnoid Block among the Pediatric Patients

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Abstract

Background: Subarachnoid Block (SAB) has been practicing as pediatric anesthesia from the very beginning but still not popular in Bangladesh. There are all lots of fallacies regarding efficacy and safety of SAB in pediatric age group. Current study was carried out to assess the efficacy and safety of SAB among the pediatric patients.

Materials and methods: This retrospective observational study was conducted at the Institute of Applied Health Sciences (IAHS) Chattogram from October 2024 to March 2025 by analyzing data of 32 patients (8-14 years) of American Society of Anesthesiologists (ASA) grading I who underwent different lower abdominal and lower extremity surgeries under SAB. All the patients were evaluated following standard protocol in pre anesthetic checkup room. Children were sedated with Inj. Ketamine 10 mg I/V along with Inj. midazolam 1mg I/V. SAB was given with 25G spinocaine needle at the level of L4/L5 with 0.5% Bupivacaine hyperbaric 1.5 ml (7.5 mg) following local anesthetic (Lidocaine 1% 1 ml) infiltration at the site of SAB in left lateral position. Demographic characteristics, type of surgery, duration of surgery, outcome of SAB, perioperative vital parameters (Pulse rate, systolic blood pressure, diastolic blood pressure, SPO₂, ECG) characteristics of sensory and motor block, duration upto first pain complain and complication were recorded as study data by analyzing anesthesia documents and postoperative records.

Results: Mean age of the study population was 10.00 ± 2.02 years, 53.13% patients were male and

all the pediatric patients were from ASA grading I. Mean operative time for surgeries was 33.59± 11.23 minutes. Circumcision (40.63%) was the commonest procedure. Success rate of SAB was 100%. Onset and duration of sensory block was 5± 2.0 minutes and 120.23± 12.34 minutes respectively. Onset of motor block could not be assessed as patients were sedated. And duration of motor block was 112.19± 12.76 minutes. Time duration for first complain of pain was 150.31± 14.64 minutes. Vital parameters of studied population were stable in perioperative period. There was not a single incidence of complication like nausea, vomiting, itching, chest pain, restlessness, shivering, urinary retention, neurological complications, Post Dural Puncture Headache (PDPH).

Conclusion: Subarachnoid block could be an effective and safe alternative for the anesthetic management of pediatric patients while performed by experienced anesthesiologist.

Key words: Complications; Children; Pediatric anesthesia; Spinal anesthesia Subarachnoid block.

Introduction

Spinal anesthesia or Subarachnoid Block (SAB) the first major regional technique evolved accidentally at the end of 19th century, remains one of the most popular forms of anesthesia.¹ SAB in children was first studied by August Bier in 1899 and became popular because of its safety and efficacy compared with the practice of general anesthesia of that era.^{2,3} With introduction of various skeletal muscle relaxants and inhalational anesthetics, methods of general anesthesia improved and some potential complications of SAB surfaced those reduced the use of SAB in children for a while.⁴ In early 1980s, it was reintroduced as an alternative to General Anesthesia (GA) especially in high-risk and preterm infants.⁵

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Spinal anesthesia is in common use for surgical procedures involving the lower abdomen, pelvis, perineal and lower extremities; it is beneficial for procedures below the umbilicus and for short procedures.^{6,7,8} SAB could be preferred as an alternative to GA, particularly in patients with chronic respiratory disease, difficult intubation, and malignant hyperthermia. Studies found that SAB is linked with less incidence of hypotension, bradycardia, hypoxia and postoperative apnea in infants with higher risk of cardiovascular and respiratory instability while compared with GA.^{9,10,11} A considerably large dose of local anesthetic (Typically bupivacaine) is required in pediatric age group compared with adults. The duration of block is age-dependent and relatively shorter than in adults.^{11,12} Various adjuvants are added with local anesthetics to prolong the duration of action.^{11,13} In case of children, one important issue is whether SAB affects behavioral and cognitive function in long term and studies found no correlation between SAB and neurocognitive problems rather SAB was better in preservation of intraoperative blood pressure in children.^{11,14} SAB could be a safer alternative to GA in resource constraint countries as it is cost-effective.^{12,15}

Although there is positive evidence, still some controversies in practicing SAB in younger children.^{11,13} The main barrier is experienced anesthesiologist is required for successful outcome of spinal anesthesia in children.¹⁶ Recently with the advancement of regional anesthetic techniques in children along with trained personals, many healthcare facilities advocate the use of SAB not only in children where GA is contraindicated but also in most lower abdominal and lower extremity surgeries.^{12,13} In Bangladesh, few studies were conducted in this aspect.^{17, 18, 19, 20} In this backdrop, current study was carried out to assess the efficacy and safety of SAB in pediatric patients.

Material and methods

This was a retrospective observational study, conducted at the Institute of Applied Health Sciences (IAHS) Chattogram from October 2024 to March 2025 by analyzing data of Pediatric patients (Age 08-14 years old), who underwent different lower abdominal and lower extremity surgeries under SAB at IAHS. Demographic data, such as age, gender, weight, ASA (American Society of

Anesthesiologists) grading, name of operations, diagnoses of patients were recorded from the preoperative anesthesia evaluation form. Patients having ASA grading I, otherwise healthy children were included in the study. Data of total 32 patients were analyzed.

All the patients were evaluated following standard protocol in pre anesthetic checkup room and written informed consent was taken from parents. They were kept fasting for 06 hours before procedure. In preoperative room, 20G intravenous (I/V) cannulation was done, followed by premedication inj. Ondansetron (0.1mg/kg body weight) I/V was given. Patients were sedated with Inj. Ketamine 10 mg I/V along with Inj. midazolam 1mg I/V. Oxygen supplementation was given through facemask. SAB was given with 25G spinocaine needle at the level of L4/L5 with 0.5% Bupivacaine hyperbaric 1.5 ml (7.5 mg) following local anesthetic (Lidocaine 1% 1 ml) infiltration at the site of SAB in left lateral position. Sensory blockade was assessed with skin prick test. As patients were sedated, onset of motor blockade could not be assessed. Patients were asked to move great toe after they were awake and time duration was recorded. Duration upto first pain complain was also recorded and Inj. Pethidine 0.5 mg/kg body weight I/V was given for analgesia. Vital parameters (Pulse, SPO₂, blood pressure, temperature, ECG) were monitored in regular interval. Patients were monitored whether there was any a side effect or complication like nausea, vomiting, itching, chest pain, restlessness, shivering, urinary retention, neurological complications, Post Dural Puncture Headache (PDPH) etc. Patients were visited at OPD after 07 days of procedure and were asked about PDPH. Anesthesia documents and postoperative records were examined retrospectively and duration of surgery, duration of motor blockade, incidence of complications were recorded as study data.

Data was compiled, presented and results are expressed as mean $\pm$ SD and percentage.

Results

Total 32 Pediatric patients were included in this study. Mean age of the study population was 10.00 $\pm$ 2.02 years, 53.13% patients were male and all the patients were from ASA grading I. Mean operative time for surgeries was 33.59 $\pm$ 11.23 minutes (Table I).

Table I Demographic data (n= 32)

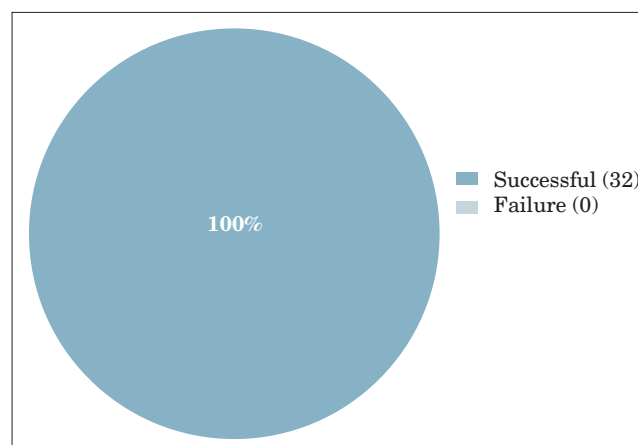
Age (Year)	(Mean $\pm$ SD)	
	10.00 $\pm$ 2.02	
Weight (Kg)	28.56 $\pm$ 4.93	
Operative time for surgeries (Minutes)	33.59 $\pm$ 11.23	
Gender	Frequency	Percentage
Male	17	53.13%
Female	15	46.88%
ASA grading		
I	32	100.00%
II	00	0.0%
III	00	0.0%
IV	00	0.0%

Patients underwent different types of lower abdominal and orthopedic procedures, among which circumcision (40.63%) was the commonest procedure (Table II).

Table II Types of Surgeries (n= 32)

Types of surgeries	Frequency	Percentage
Circumcision	13	40.63%
Herniotomy	02	6.25%
Urethroplasty	02	6.25%
Incision and drainage of perianal abscess	02	6.25%
Incision and drainage of thigh abscess	02	6.25%
Rectal polypectomy	02	6.25%
Herniorrhaphy	01	3.13%
Cystoscopy	01	3.13%
Incision of imperforated vagina	01	3.13%
Vaginal polypectomy	01	3.13%
Examination Under Anesthesia (EUA) of vagina	01	3.13%
Curettage of osteosarcoma	01	3.13%
K-wire insertion in great toe	01	3.13%
Repair of club foot	01	3.13%
Hydrocelectomy	01	3.13%

Success rate of SAB was 100% (Figure 1). Vital parameters (Heart rate, systolic blood pressure, diastolic blood pressure, SPO₂, ECG) were stable in perioperative period (Table III).

**Figure 1** Outcome of SAB (n= 32)**Table III** Perioperative vital parameters (n= 32)

Time	Heart rate/min (Mean $\pm$ SD)	Systolic Blood Pressure (mm Hg) (Mean $\pm$ SD)	Diastolic Blood Pressure (mm Hg) (Mean $\pm$ SD)	SPO ₂ (%) (Mean $\pm$ SD)	ECG
Baseline	90 $\pm$ 5.7	85 $\pm$ 6.2	50 $\pm$ 4.4	100 $\pm$ 0.2	Sinus rhythm
Immediately after SAB	110 $\pm$ 4.9	85 $\pm$ 4.5	45 $\pm$ 5.8	100 $\pm$ 0.4	Sinus rhythm
10 minutes after SAB	112 $\pm$ 6.1	80 $\pm$ 7.6	50 $\pm$ 6.7	100 $\pm$ 0.2	Sinus rhythm
20 minutes after SAB	112 $\pm$ 5.3	85 $\pm$ 6.6	55 $\pm$ 4.1	100 $\pm$ 0.6	Sinus rhythm
30 minutes after SAB	105 $\pm$ 7.2	85 $\pm$ 5.4	60 $\pm$ 5.4	100 $\pm$ 0.4	Sinus rhythm
40 minutes after SAB	107 $\pm$ 8.1	80 $\pm$ 4.7	55 $\pm$ 6.3	100 $\pm$ 0.2	Sinus rhythm
50 minutes after SAB	102 $\pm$ 5.7	85 $\pm$ 8.2	55 $\pm$ 7.2	100 $\pm$ 0.4	Sinus rhythm
60 minutes after SAB	97 $\pm$ 4.8	85 $\pm$ 5.8	55 $\pm$ 5.9	100 $\pm$ 0.2	Sinus rhythm

Table IV showed that onset and duration of sensory block was 5 $\pm$ 2.0 minutes and 120.23 $\pm$ 12.34 minutes respectively. Onset of motor block could not be assessed as patients were sedated. And duration of motor block was 112.19 $\pm$ 12.76 minutes. Time duration for first complain of pain was 150.31 $\pm$ 14.64 minutes.

Table IV Characteristics of block and first complain of pain (n= 32)

Type of block	Sensory block	Onset of block (Minutes) (Mean $\pm$ SD)	
			5 $\pm$ 2.0
		Duration of block (Minutes) (Mean $\pm$ SD)	
			120.23 $\pm$ 12.34
	Motor block	Onset of block (Minutes) (Mean $\pm$ SD)	
			Could not be assessed
		Duration of block (Minutes) (Mean $\pm$ SD)	
			112.19 $\pm$ 12.76
First complain of pain block (Minutes) (Mean $\pm$ SD)			150.31 $\pm$ 14.64 minutes

There was not a single incidence of complication like nausea, vomiting, itching, chest pain, restlessness, shivering, urinary retention, neurological complications, PDPH (Figure 2).

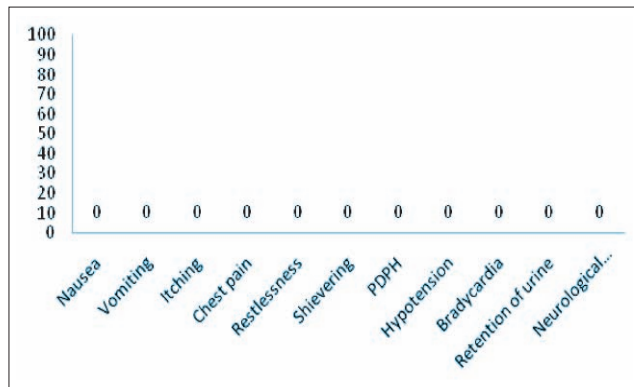


Figure 2 Complications of SAB (n= 32)

Discussion

Pediatric spinal anesthesia is still under utilized in our country. Current study was conducted to analyze efficacy and safety of SAB among children of 8-14 years and revealed that SAB could be an alternative of GA for lower abdominal and lower extremity surgeries.

Mean age of study population was 10.00 ± 2.02 years. Previously conducted study regarding this aspect was done in more younger.^{18,19, 20, 21} And 53.13% patients were male which was similar to previous literatures.^{17- 21} Circumcision (40.63%) was the commonest procedure that was concurrent with studies but other studies found inguinal hernia was more prevalent.¹⁷⁻²¹

Success rate of SAB was 100% in current study and 96.1% and 97.1% success rate was observed in two related studies.^{18,21} Hyperbaric bupivacaine was used for SAB in this study. Researchers found that higher success rate of SAB when hyperbaric bupivacaine is used in comparison with plain bupivacaine.^{18,21,22} Children are apprehensive from the fear of parental separation, pain of surgery, and use of needles. Older children require some premedication (Midazolam, atropine, ketamine alone or in combination) for provision of sedation and anxiolysis.²³ Performing spinal puncture in a struggling, agitated child may injure delicate neurovascular structures and should be avoided. Most children require additional sedation for performing spinal infiltration and surgical procedure.²⁴ In this study, Inj. Ketamine 10 mg I/V along with Inj. Midazolam 1mg I/V were used for

procedural sedation. Another fact is unique anatomical features make SAB in children challenging. Bloody tap and difficulty in aspiration are associated with failure of SAB.¹³ Lumbar puncture in this age group must be performed below the 4th or 5th lumbar vertebrae (L4-L5 or L5-S1 interspace) for additional safety due to the risk of reaching the spinal cord with the needle.²⁵ In this study spinal block was performed either L4-L5. Technical difficulties and failure may thus be a matter of individual skill and experience so it was recommended to perform the spinal infiltration by experienced anesthesiologist which was done in our study.¹⁶

SAB in adults are frequently associated with fall of systolic blood pressure that often requires medical intervention. However, children undergoing SAB usually do not show significant hemodynamic instability because of smaller peripheral blood pool, immature sympathetic autonomic system, and compensatory reduction in vagal efferent activity.^{11, 12, 13} In current study, no remarkable changes were observed in vital parameters in perioperative period and it was concordance with published findings.^{17, 18, 20, 22}

After SAB there are dense sensory and motor blockade following sympathetic blocks. Sensory block is expected to be up to T6 (Thoracic 6) level. A block above T5 is associated with several complications like hypotension. Hypotension following SAB is compensated by tachycardia in children. A pin prick test is usually used to assess sensory block. Motor block correspond with spinal nerves block of those same segment. Bromage test is used for assessment for motor block.^{12, 13} In this study, onset and duration of sensory block was 5 ± 2.0 minutes and 120.23 ± 12.34 minutes respectively and that was concordance with previous studies.^{17,21} Onset of motor block could not be assessed as patients were sedated. And duration of motor block was 112.19 ± 12.76 minutes and that was similar to one study conducted in India.²¹

Complications of SAB in children are usually minor and infrequent. Hypotension and desaturation are rare in children. If at all, it is usually due to high block or use of sedatives. PDPH is the most common complication in children. There was not a single incidence of complication like nausea, vomiting, itching, chest pain, restlessness, shivering, urinary retention, neurological complications, PDPH

in current study. Similar type of safety profile of pediatric spinal anesthesia was observed in related studies.^{10, 18, 21}

SAB provides all components of balanced anesthesia with minimum cardiorespiratory depression and postoperative nausea, vomiting, early ambulation and rapid return of appetite. Endotracheal intubation and respiratory effects of GA can be avoided in high-risk children with limited respiratory reserve.^{11, 26} The effect of SAB lasts for a couple of hours so there is less requirement for opioid analgesics.¹³ In this research, duration upto first pain complain was 150.31 ± 14.64 minutes. It could be a cheaper alternative in countries with limited resources, due to rapid recovery, shortened hospitalstay and more procedures performed on day care basis.^{13, 15, 16}

Conclusions

SAB could be an essential tool for the anesthetic management of pediatric patients. Current study found it as effective and safe technique for performing lower abdominal and lower extremity surgeries among pediatrics patients. As pediatric patients are different in their anatomy and physiology, experienced anesthesiologists should be performing SAB.

Disclosure

The author declared to have no conflicts of interest.

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A Comparative Study of Left Ventricular Mass in Chronic Kidney Disease Patients with or without Chronic Periodontitis

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Abstract

Background: Left ventricular mass is the weight of the left ventricle, typically estimated through echocardiography and represents the cumulative effect of blood pressure on the heart. The aim of the study is to compare the left ventricular mass in chronic kidney disease patients with or without chronic periodontitis.

Materials and methods: This cross sectional comparative study was carried out on 101 patients with Chronic Kidney Disease (CKD) out of which 33 patients with no chronic periodontitis as group A and 68 patients with chronic periodontitis as group B and over a period of one year at Nephrology Department of Chittagong Medical College Hospital (CMCH) Chattogram. Patients

were assessed clinically, biochemically and echocardiography was done to ascertain the mean Left Ventricular Mass (LVM) and Left Ventricular Mass Index (LVMI). Data were analyzed and reviewed and expressed as frequency and simple percentage.

Results: In periodontitis group (Group B) the mean LVM and LVMI were increased of 212.0 ± 55.3 gm and 140.6 ± 28.8 gm/m² respectively as compared to no periodontitis group (Group A) of 173.3 ± 46.0 gm and 118.5 ± 27.5 gm/m². The percentage of poor Oral hygiene index score (OHI-S) was more 94.1% (Mean OHI score 3.94 ± 0.53 mm) in group B than group A 72.7% (mean OHI score 3.40 ± 0.61 mm). In multivariate analysis, high CRP and periodontitis were found statistically ($p=0.036$ & $p=0.044$) and clinically (95% CI=1.08-11.49 & 95% CI=1.02-9.43) significant for increased Left Ventricular Mass Index LVMI.

Conclusion: Periodontal disease in CKD patients was associated with increase in LVM and LVMI.

Key words: Chronic periodontitis; CKD; CRP; LVM; LVMI.

Introduction

Patients with Chronic Kidney Disease (CKD) are more likely to die from a CVD-related cause than to progress to End Stage Renal Disease (ESRD).¹ Among the all cardiovascular diseases coronary artery disease, congestive cardiac failure, arrhythmias and sudden cardiac death represent the main causes of cardiovascular morbidity and mortality in-patients with CKD.² One of the leading prognostic signs in cardiovascular events is the Left Ventricular Hypertrophy (LVH) which is caused by an increase in the mass of the left ventricle and is secondary to an increase in wall thickness and/or an increase in cavity size. LVH and cardiac fibrosis have been well described as a frequent component of CKD for many decades. The prevalence of LVH is estimated to be between

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16 and 31% in individuals with CKD before initiation of dialysis; it increases to 90% after initiation of dialysis.³

LVH is clearly and strongly associated with poor outcomes in patients both with and without CKD.⁴ However classical risk factors are not sufficient to explain the increasing death risk and high prevalence rate of cardiovascular disease. Therefore, non-classical risk factors have also been extensively investigated to determine the cause of these situation and chronic inflammation is found to be one of most prevalent risk factors for cardiovascular diseases among all non-classical risk factors.⁵ So, poor oral health may contribute to increased morbidity and mortality in CKD patients because of chronic systemic inflammation caused by oral and dental infections.⁶

Periodontitis is a chronic inflammatory disease caused by the interaction between gram-negative periodontal pathogen activity and host response. Periodontitis affects approximately half of the adult population worldwide.^{7,8} Prevalence of periodontal disease approaches 14% over a wide age span, including different age group.⁹ Prevalence of periodontal disease in CKD patients is also increasing, and the prevalence of chronic periodontitis is nearly 40% in CKD hemodialysis (CKDH) patients.¹⁰ Periodontitis begins with a loss of alveolar bone and subsequent formation of a pocket around the tooth, the final stage being tooth mobility and loss. Preliminary investigations reveal that periodontal diseases may have a direct or indirect association with an increased Left Ventricular Mass (LVM).¹¹

Periodontitis may be used as an important predictor of cardiovascular event and death. There is significant increase in left ventricular mass in patients with chronic kidney disease in chronic gingivitis and chronic periodontitis.¹²

If we detect periodontitis in early stage of CKD, it will help us to find out the changes in LVM by doing meticulous follow up and that will help us to prevent cardiovascular morbidity and mortality and prolong the survival period. This approach will also be cost effective both for patients and physicians. As not much is known regarding LVM in CKD patient with periodontal disease. Hence, this study was done to assess the LVM in patients with CKD with or without chronic periodontitis in Bangladesh.

Materials and methods

This cross sectional comparative study was carried out in Department of Nephrology, Chittagong Medical college Hospital (CMCH) Chattogram during the period of February 2021 to January 2022. A total of 101 patients with CKD aged 18-65 years, out of which 33 patients with no chronic periodontitis as group A and 68 patients with chronic periodontitis as group B were included in the study. All the patients diagnosed with CKD with or without on hemodialysis therapy. Pregnant or lactating mothers, patients with symptoms of extraoral infection, patients having less than 6 teeth, known case of COVID-19 and MI, congenital heart disease, valvular heart disease, patients with abnormal calcium, phosphate, PTH and uric acid level were excluded from the study. Aims, objectives, procedures, risks and benefits of the study were explained to the patients. They were encouraged for voluntary participation. They were also assured about the secrecy of information and records. Written informed consent was taken from each patient. A detailed history was obtained including the history of Diabetes mellitus and history of hypertension. The clinical examination included measurement of height and weight to calculate BMI. BMI was calculated using the formula weight in kilogram divided by height in meter square (kg/m^2). Then relevant laboratory investigations were done to evaluate the biochemical parameters, ECG was done, Echocardiography was done to ascertain the mean LVM and LVMI according to American Society of Echo-cardiography and reports were recorded.

Oral and Dental Examination

The dental and periodontal examination in all subjects was carried by a dental surgeon in nephrology OPD with all necessary dental equipment's. The dental status was examined by visual examination under direct and indirect illumination, using a plane dental mirror and a dental explorer. The periodontal examination was carried out with calibrated periodontal probes with Williams markings. The periodontal status was determined using measurements of Probing Pocket Depth (PPD) Gingival recession and Clinical Attachment Level (CAL) measurements from four sites on each tooth (Buccal, Mesial, lingual/palatal, distal). PPD was taken as the distance from the gingival margin to the base of the gingival sulcus/periodontal pocket. Gingival recession was

measured as the distance from the cemento-enamel junction to the gingival margin. These scores were then added up to indirectly obtain the values for CAL. Gingival inflammation, debris status, calculus status and oral hygiene status were also assessed by using Modified Gingival Index, Debris Index Simplified method, Calculus Index Simplified method and Oral Hygiene Index Simplified method respectively.

Biochemical Parameters

Area over the antecubital fossa was disinfected to withdraw blood. 8ml of blood was obtained for evaluation of biochemical parameters. This included CBC, CRP and serum creatinine. All laboratory values were obtained by automated and standardized methods in laboratory. Serum creatinine was done by enzymatic method with the help of Dimension exl200 siemens machine (USA). The white blood cell differential count was determined as part of complete blood count testing. ESR was determined as a part of CBC by modified Westergren method. Volume conductivity scatter method was used for measurement of complete blood count. Three ml of blood was drawn into tube containing ethylene diamine tetra acetic acid and the tube was rotated for 5 min, then the blood sample was put in Siemens sysmex xn1000 machine (USA) and result was drawn. NLR was constructed by dividing neutrophil count to lymphocyte. High sensitivity C Reactive Protein (CRP) was measured by nephelometry method with help of Atellica NEPH 630 (USA).

Echocardiographic Parameters

Dimensions of the left ventricle were assessed with two-dimensional echocardiography. The procedure involve use of a VIVID S60n, a portable 20 USG system and 5 MHz cardiac probe which was operated by a cardiologist. To exclude atherosclerotic plaques and endocardial vegetation, B – mode presentation was applied and M – mode presentation was used to calculate LVM according to the Devereux formula. These readings were obtained for every patient and each result was calculated as a mean value from three measurements.

The results were drawn based on the following formula:¹³

$$\text{LVM corrected} = 0.8 \times (1.04 [(LVIDD + PWTD + IVSTD)^3 - (LVIDD)^3]) + 0.6 \text{ g}$$
 (LVIDD- Left Ventricular Internal Diameter in Diastole,

PWTD- Posterior Wall Thickness in Diastole, IVSTD-Inter Ventricular Septal Thickness in Diastole.

LVM index (LVMI) was obtained by dividing the LVM corrected by the body surface area in m^2 and expressed as g/m^2 .

Body surface area was calculated by Mosteller square root method.¹⁴ The square root of product of the weight in kg times the height in cm divided by 3600.

$$\text{BSA (m}^2\text{)} = \sqrt{\text{height (cm)} \times \text{weight (kg)} / 3600}.$$

Descriptive statistics was used to assess frequencies, measurements of central tendency and dispersion measurements related to the clinical, demographic and laboratorial characteristics of the patients. The categorical variables were expressed as the absolute number (Valid percentage) and the quantitative variables were expressed as the means and standard deviations in cases of normal distribution. The quantitative variables with non-Gaussian distribution were expressed as the medians. Chi-square test was used for categorical variable. Unpaired t-test and Mann-Whitney U test was used for continuous variables. Multivariate logistic regression analysis was used for prediction of LVMI. SPSS (Statistical Package for Social Science) for Windows version 23 software was used for the analyses. Statistical significance was defined as $p < 0.05$ and confidence interval was set at 95% level.

Results

Among them 101 patients, 33 patients without periodontitis as group A and 68 chronic periodontitis patients as group B.

Table I Socio-demographic and clinical characteristics of study patients (n=101)

Variables (unit)		Group A (n=33)	Group B (n=68)	p value
Age group (Years)		38.1±12.4	50.9±10.1	0.001*
Gender	Male	22 (66.7)	46 (67.6)	0.922 [†]
	Female	11 (33.3)	22 (32.4)	
SBP (mm of Hg)		140.0±17.45	143.0±23.09	0.513*
DBP (mm of Hg)		87.2±10.97	86.2±11.75	0.659*
Comorbidities	HTN	31 (93.9)	52 (76.5)	0.031 [†]
	DM	8 (24.2)	33 (48.5)	0.020 [†]
Smoking habit	Current	2 (6.1)	7 (10.3)	0.404 [†]
	Never	23 (69.7)	38 (55.9)	
	Past	8 (24.2)	23 (33.8)	

Data were presented as mean $\pm$ SD, frequency (Percentage). *Independent t test, **Mann-Whitney U test, $\dagger$ Chi square test.

The mean age was higher in group B and that was significant between two groups. Other socio-demographic characteristics were not statistically significant when compared between two groups (Table I).

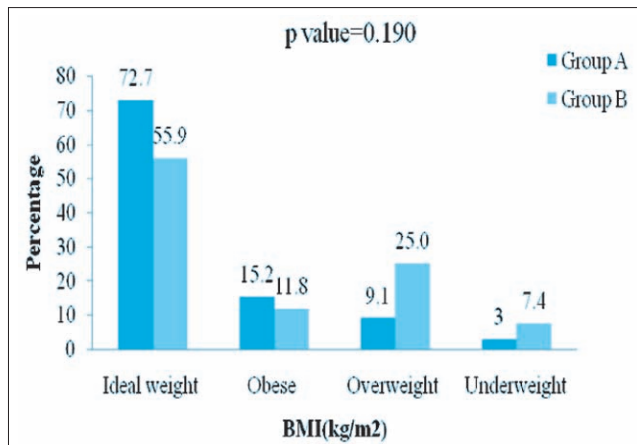


Figure 1 Bar diagram showing BMI of the study patients (n=110)

p value reached from chi square test.

5(15.2%) patients were obese in group A and 8(11.8%) in group B. The difference was not statistically significant ($p>0.05$) between two groups (Figure 1).

Table II Dental (Debris, Calculus, Oral hygiene, Gingival category), Relevant Laboratory and Echocardiography parameters in study patients between two groups (n=101)

Variables (Unit)	Group A (n=33)	Group B (n=68)	p value
Debris category*			0.028 $\dagger$
Fair	9 (27.3)	7 (10.3)	
Poor	24 (72.7)	61 (89.7)	
Calculus category*			0.303 $\dagger$
Fair	31 (93.9)	60 (88.2)	
Poor	2 (6.1)	8 (11.8)	
Oral hygiene category**			0.004 $\dagger$
Fair	9 (27.3)	4 (5.9)	
Poor	24 (72.7)	64 (94.1)	
Gingival category			0.018 $\dagger$
Mild gingivitis	23 (69.7)	29 (42.6)	
Moderate gingivitis	4 (12.1)	25 (36.8)	
Severe gingivitis	4 (12.1)	13 (19.1)	
No gingivitis	2 (6.1)	1 (1.5)	

Data were presented as frequency (Percentage).

$\dagger$ Chi square test.

* DI-S and CI-S-(Greene, 1967)

□ Good- 0.0 - 0.6, Fair- 0.7 - 1.8 ; Poor- 1.9 - 3.0

** □ OHI-S-(Greene, 1967)

□ Good- 0.0 –1.2, Fair- 1.3 - 3.0, Poor- 3.0 - 6.0

Poor debris index and poor oral hygiene index were more in group B. Severe gingivitis were more in group B. (Table II).

Table III Relevant Laboratory and Echocardiography parameters in study patients between two groups (n=101)

Laboratory parameters	Group A (n=33) Mean $\pm$ SD	Group B (n=68) Mean $\pm$ SD	p value
Hemoglobin (mg/dl)	9.35 $\pm$ 2.16	9.37 $\pm$ 1.50	0.135 $\dagger\dagger$
ESR (mm/hr.)	43.21 $\pm$ 23.73	62.88 $\pm$ 26.95	0.287 $\dagger\dagger$
NLR	3.84 $\pm$ 1.79	4.53 $\pm$ 2.39	0.080 $\dagger\dagger$
S. Creatinine (mg/dl)	9.19 $\pm$ 4.65	8.32 $\pm$ 4.39	0.715 $\dagger\dagger$
hs-CRP (IQR)	3.94 (2.98-8.1)	9.03 (4.0-27.9)	0.002 $\ddagger$
Echocardiography parameters			
LVMI (gm/mm)	118.5 $\pm$ 27.5	140.6 $\pm$ 28.8	0.001 $\dagger\dagger$
LVM (gm)	173.3 $\pm$ 46.0	212.0 $\pm$ 55.3	0.001 $\dagger\dagger$

Data were presented as mean $\pm$ standard deviation, median (Interquartile range), $\dagger\dagger$ Student's t test, $\ddagger$ Mann-Whitney U test

The median CRP was increased in group B, which were statistically significant between two groups. Mean LVMI and LVM were significantly higher in group B (With Chronic Periodontitis) than group A (Without chronic periodontitis) (Table III).

Table IV Association between different variables with LVMI status (n=101)

Variables (Unit)		LVMI status		p value*
		Increased (n=80)	Normal (n=21)	
Age group (Years)	>40	57 (71.25)	12 (57.1)	0.216
	<40	23 (28.75)	9 (42.9)	
SBP (mmHg)	High (>140 mmHg)	54 (67.5)	9 (42.9)	0.038
	Normal	26 (32.5)	12 (57.1)	
DBP (mmHg)	High (>90 mmHg)	44 (55.0)	9 (42.9)	0.321
	Normal	36 (45.0)	12 (57.1)	
History of DM	Yes	35 (43.75)	6 (28.6)	0.080
	No	45 (56.25)	15 (71.4)	

Variables (Unit)		LVHI status		p value*
		Increased (n=80)	Normal (n=21)	
Debris category	Poor	68 (85.0)	19 (90.5)	0.518
	Fair	12 (15.0)	2 (9.5)	
Calculus category	Poor	9 (11.25)	1 (4.8)	0.376
	Fair	71 (88.75)	20 (95.2)	
Oral hygiene category	Poor	69 (86.25)	19 (90.5)	0.607
	Fair	11 (13.75)	2 (9.5)	
Gingivitis	Yes	37 (46.3)	5 (23.8)	0.063
	No	43 (53.8)	16 (76.2)	
CRP (mg/l)	High	49 (61.25)	5 (23.8)	0.002
	Normal	31 (38.75)	16 (76.2)	
Periodontitis status	Periodontitis	60 (75.0)	8 (38.1)	0.001
	No periodontitis	20 (25.0)	13 (61.9)	

Data were presented as frequency (Percentage)

*Chi square test.

High SBP, high CRP and periodontitis were significantly higher in increased LVMI patients than normal LVMI patients (Table IV).

Table V Multivariate logistic regression analysis for prediction of increased LVMI

Parameters	Adjusted OR	95% CI for OR		p value
		Lower	Upper	
High SBP	2.43	0.83	7.07	0.103
High CRP	3.52	1.08	11.49	0.036
Periodontitis	3.11	1.02	9.43	0.044

p-value reached from multivariate analysis by binary logistic regression analysis.

OR=Odd's Ratio.

In multivariate analysis, high CRP and periodontitis were found statistically ($p=0.036$ & $p=0.044$) and clinically (95% CI=1.08-11.49 & 95% CI=1.02-9.43) significant for increased LVMI (Table V).

Discussion

In this study, In group A mean age was 38.1 ± 12.4 years and In group B mean was 50.9 ± 10.1 years. The mean age was statistically significant (p value 0.001) between two groups. In a study done by Kolte et al. observed that mean age was 50.25 ± 8.12 years in group I (Healthy periodontitis) and 52.15 ± 11.02 years in group III (Chronic periodontitis).¹² Franek et al. described that mean age was 58.6 ± 6.5 years in healthy periodontitis

group and 60.3 ± 6.3 years in chronic periodontitis group.¹³ Another study done by Loos et al. showed that mean age was 41.8 ± 13.1 years in control group and 42.3 ± 9.8 years in generalized periodontitis group.¹⁶ These study findings were similar with the current study.

Other socio-demographic parameters of both group were not statistically significant. These signified that allocated patients of both group were nearly similar in their socio-demographic parameters. Most of the patients were male, married and CKD stage-5. These study findings almost similar with the previous studies.¹³⁻¹⁶

Regarding co-morbidities, this study found 24.2% had DM in group A and 48.5% patient had history of DM in group B, and this finding was statistically significant ($p=0.020$) between two groups. This result was supported by previous study Ioannidou et al.¹⁶ And 31 (93.9%) patients had hypertension in group A and 52 (76.5%) patients had hypertension in group B, which was statistically significant ($p=0.031$) between two groups. This result was consistent with previous studies Franek et al. where they reported that hypertension was 93.0% in healthy periodontitis group and 91% in chronic periodontitis group.¹³ Loos et al. also found history of hypertension were 8% in control group and 6% in generalized periodontitis group.¹⁴

Franek et al. found poor oral hygiene in advanced chronic periodontitis group (CPITN score 3-4) and mean approximal plaque index percentage (Index of oral hygiene) were increased from 48 ± 25 in no or moderate periodontitis group to 57 ± 24 in advanced chronic periodontitis group.¹⁷ Kolte et al. also found poor oral hygiene in chronic periodontitis group, where mean plaque index was increased from 0.96 ± 0.33 in healthy periodontitis to 2.38 ± 0.31 in chronic periodontitis group.¹² In another study conducted by Joseph et al. observed that poor oral hygiene in chronic periodontitis group where mean OHI-S were 2.49 ± 0.57 in case group and 1.37 ± 0.48 in control group.¹⁵ In this present study it was also found that poor oral hygiene was more in group B (Chronic periodontitis) and mean OHI-S increased from 3.40 ± 0.61 in group A to 3.94 ± 0.53 in group B. The difference was statistically significant ($p < 0.05$) between two groups.

In present study, the frequency of severe gingivitis was more in group B than group A (19.1% and

12.1% accordingly). The difference was statistically significant ($p=0.018$) between two groups. This finding was consistent with previous studies Kolte et al. where they found increased gingival index in group III (Chronic periodontitis group I (Healthy periodontium)).¹²

In current study, mean systolic and diastolic blood pressure were not statistically significant ($p=0.513$ and $p=0.659$) between periodontitis and no periodontitis group. This finding was similar to previous studies.^{12,18}

In current study the median CRP levels was found to be increased from IQR 3.94(2.98-8.1) mg/L in group A to IQR 9.03(4.0-27.9) mg/L in group B. The difference was statistically significant ($p=0.002$) between two groups. This finding was consistent with Franek et al. where they reported patients with CKD and advanced periodontitis had higher serum CRP concentration (13.2 ± 11.4 vs 10.4 ± 14.4 , $p<0.05$) than CKD patients without periodontitis.¹⁰ Franek et al. also found increased mean CRP level (3.55 ± 2.78) in BGI-P group than BGI-H group (1.64 ± 1.68).¹³ Kolte et al. also reported increased mean CRP level in group III (Chronic periodontitis) than group I (Healthy periodontium) (0.61 ± 0.69 and 4.3 ± 3.52 respectively).¹²

Kolte et al. reported that the mean LVM was 200.35 ± 65.04 gm in group III (Chronic periodontitis). The LVMI values also revealed an increase from 45.99 ± 11 gm/m² in group I (No periodontitis) to 57.83 ± 19.94 gm/m² in group III (Chronic periodontitis group).¹² Sarda et al. also found increased mean LVMI in periodontitis group, where the mean values of LVM in Group I (Without periodontitis) and Group III (with generalized severe periodontitis) were 149.35 ± 35.51 g, and 156.36 ± 36.57 g, respectively and for LVMI, the mean values were 43.61 ± 12.16 g/m² (Group I), and 46.34 ± 12.55 g/m² (Group III).¹¹ Franek et al. also reported, BGI-P (Periodontitis) and BGI-G (Gingivitis) subjects, respectively, had higher (mean; 95% CI) LVM (238.6 g, 206.6 – 267.4 and 222.8 g, 207.0 – 238.2) versus BGI-H subjects (170.3 g, 125.5 – 217.8). (2) BGI-P and BGI-G subjects respectively, had higher (Mean, 95% CI) LVMI (95.2 g/m²).¹⁵ In present study, similar result was found where mean LVM was 173.3 ± 46 gm in group A and 212.0 ± 55.3 gm in group B. LVMI was 118.0 ± 27.5 gm/m² in group A

and 140.6 ± 28.8 gm/m² in group B. These differences were significantly ($p=0.001$) higher in chronic periodontitis group.

Franek et al. reported that in the multiple regression model, LVMI was dependent on Community Periodontal Index of Treatment Needs (CPITN) ($p<0.001$) HS-CRP ($p<0.05$) serum cholesterol ($p<0.05$) and creatinine concentration ($p<0.005$).¹⁸ Franek et al. also found that in multivariate analysis, LVM and LVMI were significantly independently associated with the Offenbacher periodontal disease score.¹³ In present study, in multivariate analysis it was observed that high CRP and chronic periodontitis were found to be independently associated with increased LVMI. So, chronic periodontitis may be an important non traditional risk factor for increasing LVM and LVMI in chronic kidney disease patients.

Limitations

As the design of the study was cross-sectional, so cause effect relationship between variables could not be established. Despite careful adjustments in statistical analysis, it was not possible to rule out all confounding factors. Relevant inflammatory markers couldn't be evaluated.

Conclusion

This study showed that periodontal disease in CKD patients was associated with increase in LVM and LVMI.

Recommendation

Routine and periodic screening of periodontal disease is vital to reduce the cardiovascular morbidity and mortality in CKD patients. Multicenter large study is required to determine the cause-effect relationship.

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Disclosure

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Frequency of Hypomagnesemia among the Prolong Proton Pump Inhibitor (PPI) Users of Southern Region of Bangladesh: A Cross-Sectional Study

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Abstract

Background: Proton Pump Inhibitors (PPIs) are often used for acid-related gastrointestinal disorders and are frequently continued for prolonged durations. Recent studies have linked long-term use of PPIs with hypomagnesemia, an electrolyte imbalance that can lead to significant clinical consequences. The goal of this study was to find out the prevalence of hypomagnesemia in chronic PPI consumers in southern Bangladesh.

Materials and Methods: This descriptive cross-sectional study was conducted at Chittagong Medical College Hospital and Chattagram Maa Shishu O General Hospital. A sample of 100 patients above 18 years of age with history of more than six months of proton pump inhibitor use were included by purposive sampling in this study. A detailed history, clinical data and data regarding biochemical parameters (Serum magnesium, calcium, albumin, and creatinine) were recorded. Serum magnesium <1.8 mg/dL was defined as hypomagnesemia.

Results: The prevalence of hypomagnesemia was 41% out of 100. Nearly half of the hypomagnesemia

occurred among esomeprazole users (48.8%). Regular use and high-dose (20mg bid) PPIs were associated with significant hypomagnesemia ($p < 0.05$). Furthermore, a negative association was found between length of PPI Use and serum magnesium levels.

Conclusion: Hypomagnesemia occurred in a significant minority of long-term PPI users. The risk was dose-dependent and with the duration of the therapy. Regular measurement of serum magnesium is desirable for long-term PPI users to avoid complications.

Key word: Hypomagnesemia; Proton pump inhibitors; Proton pump inhibitor users.

Introduction

Proton Pump Inhibitors (PPIs) are one of the most frequently prescribed classes of drugs in the world because of their high level of efficacy with low toxicity.¹ In fact, they are the most potent drugs available to reduce gastric acid secretion among patients with gastroesophageal reflux disease.² PPIs selectively and irreversibly inhibit the gastric H⁺/K⁺ ATPase. As this is the final step of acid secretion, this drug class has proved to be more effective than other anti-secretory drugs.³

In Bangladesh, PPI use is prevalent among the general population. Although specified guidelines are set for the proper prescription of PPIs, many patients attending both outpatient and inpatient departments of the hospital receive regular PPI treatment for poorly defined reasons or for conditions where PPIs have not been shown to be useful. Such unapproved or inappropriate indications include nonspecific abdominal symptoms without acid-related features or receiving a long-term repeat prescription for a previous problem, which had since resolved.⁴ Current evidence suggests PPIs are often overused.⁵ One study reported that 10% of all

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patients on long-term acid suppression therapy were on PPIs. Furthermore, up to one-third of them took their drugs on a self-determined regimen rather than regularly.⁶

PPIs use is associated with various side effects such as diarrhoea and headache and studies have linked their use with an increased risk of community-acquired pneumonia, *Clostridium difficile* diarrhoea and *Campylobacter jejuni* gastroenteritis.⁷ However, recently multiple studies have also reported an association between PPI use and magnesium deficiency.^{8,9,10}

Magnesium is an important electrolyte and a key part of many reactions that occur in the human body, affecting cellular function, nerve conduction, and other needs¹¹. It is essential for the function of over 300 cellular enzymes, and its deficiency can be accompanied by other electrolyte imbalances such as hypocalcaemia and hypokalemia, as well as serious neuromuscular and cardiovascular problems¹². Although there are various causes of hypomagnesemia, few studies have recently linked it to prolonged PPI use. Hence, this study aims to find the frequency of hypomagnesemia among the local population with long-term use of proton pump inhibitors.

Materials and methods

This was a cross-sectional analytical study conducted over a period of one year (September 2022 to August 2023) in the Department of Medicine, Chittagong Medical College Hospital and Chattagram Maa-O-Shishu General Hospital in collaboration with Department of Biochemistry of Chittagong Medical College.

The study population included adult patients (Aged ≥ 18 years) with a history of Proton Pump Inhibitor (PPI) use for more than six months who attended the Medicine departments of the aforementioned hospitals during the study period. A purposive sampling technique was used. Patients were eligible for inclusion if they were 18 years of age or older and had been using PPIs continuously for more than six months. Patients were excluded if they were under 18 years of age, had Chronic Kidney Disease (CKD) had used PPIs for less than six months, or had a history of chronic diarrhea or intestinal disorders. Additionally, patients who used H₂ receptor antagonists or other drugs known to affect magnesium levels (Such as loop diuretics, amphotericin B, cyclosporine or cisplatin) or those who did not provide informed consent, were also excluded from the study.

Ethical approval was obtained from the Institutional Review Board of both Chittagong Medical College and Chattagram Maa-O-Shishu General Hospital. Informed written consent was obtained from all participants after explaining the aim, procedure, and potential benefits of the study in the local language.

Participants were enrolled according to the inclusion and exclusion criteria. Data were collected by the principal investigator using a pre-tested, structured questionnaire. Medical history, physical examination, and socio-demographic data (Age, sex, occupation) were recorded. From each participant, 7 mL of venous blood was collected following standard phlebotomy technique. Serum was separated by centrifugation and sent immediately to the biochemistry laboratory for analysis of serum magnesium, calcium, albumin, and creatinine. All laboratory tests were performed by trained professionals.

Collected data were initially entered in Microsoft Excel and analyzed using SPSS version 26.0. Continuous variables were expressed as mean $\pm$ Standard Deviation (SD) or median with interquartile range, depending on data distribution. Categorical variables were presented as frequencies and percentages. The frequency of hypomagnesemia (Defined as serum magnesium <1.8 mg/dl) was calculated among the study population. Chi-square test was used to compare proportions between groups with and without hypomagnesemia. Logistic regression analysis was performed to assess the association between magnesium level and related symptoms and results were expressed as Odds Ratios (OR) with 95% confidence intervals (CI). Correlation analysis was used to evaluate the relationship between duration of PPI use and serum magnesium levels. A p-value <0.05 was considered statistically significant. Results were presented in appropriate tables, bar diagrams and pie charts as required.

Results

A total of 100 patients with a history of GERD and chronic use of proton pump inhibitors (PPI) were enrolled in this study. Among the respondents, there were 58 (58%) males and 42 (42%) females making a male: female ratio of 1.38:(Figure1). The mean age of the respondents was 45.27 ± 11.85 years with a minimum age of 22 years and a maximum age of 75 years. The most common age group among the study population was between 31-40 years (33%) (Figure 2).

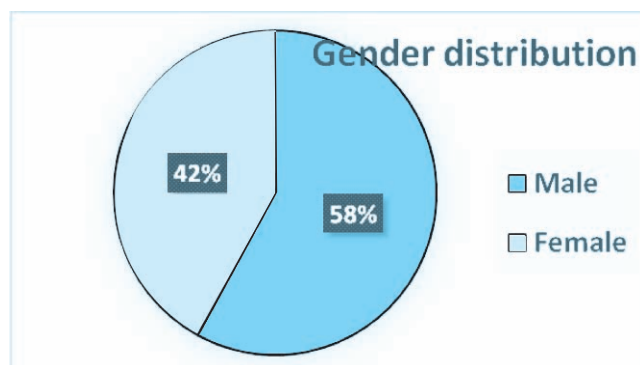


Figure 1 Frequency distribution of gender among the study population (n=100)

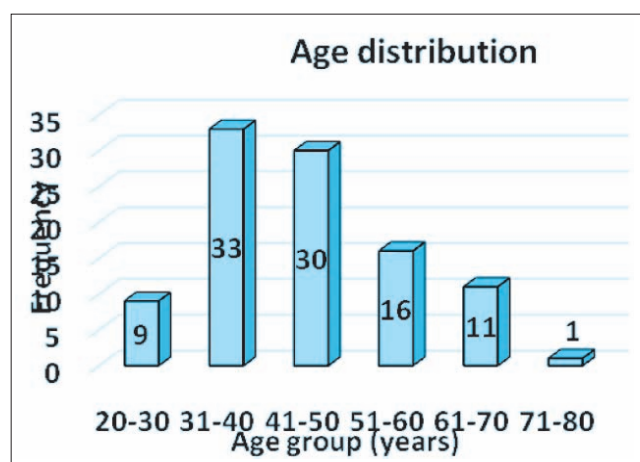


Figure 2 Frequency distribution of Age among the study population (n=100)

Out of 100 patients evaluated for proton pump inhibitor (PPI) usage and hypomagnesemia, esomeprazole was the most commonly used PPI (41%) followed by omeprazole (31%) pantoprazole (14%) and rabeprazole (10%). Data on the particular type of PPI was not available in 4% of cases.

There was a prevalence of 41% of hypomagnesemia in the entire sample. Of esomeprazole users, 48.8% (n = 20 of 41) had hypomagnesemia compared with 35.5% of omeprazole user (n = 11 of 31). Among those on pantoprazole and rabeprazole users, the rate of hypomagnesemia was less prevalent at 28.6% (4 of 14) and 50% (5 of 10) respectively. Only one case of hypomagnesemia and only among patients with unspecified use of PPI.

Although the association between the type of PPI used and the presence of hypomagnesemia was not statistically significant (p = 0.546) hypomagnesemia appeared to be more frequently observed among patients taking esomeprazole or rabeprazole compared to other PPIs (Table I).

Table I Frequency of types of PPI used with hypomagnesemia (n=100)

PPI	Hypomagnesemia			Chi square value	p value
	Present	Absent	Total		
Omeprazole	11	20	31	3.07	0.546
Esomeprazole	20	21	41		
Pantoprazole	4	10	14		
Rabeprazole	5	5	10		
Not specific	1	3	4		
Total	41	59	100		

There was a statistically significant relationship with the dose of PPI and the occurrence of hypomagnesemia (p < 0.05). Hypomagnesemia was observed in 50% (30/60) of patients who were given dose level 20 mg twice daily. In contrast, only 11 out of 40 (27.5%) of patients receiving 20 mg once daily had hypomagnesemia. This implies that treating with larger dosages of PPI lead to hypomagnesemia risk (Table II).

Table II Association of hypomagnesemia with the dosage of PPI (n=100)

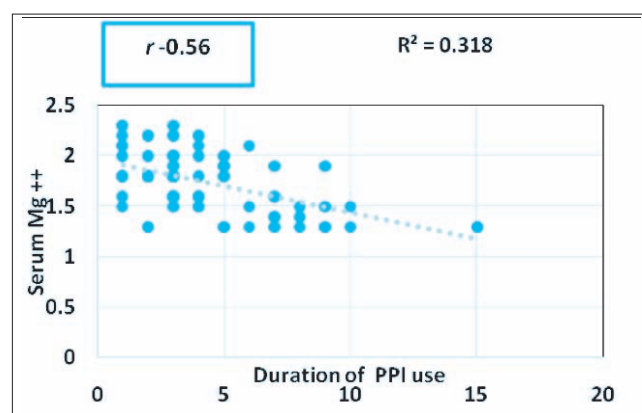
Dosage of PPI	Total	Hypomagnesemia		Chi square value	p value
		Present	Absent		
20 mg/bd	60	30	30	4.13	0.042* (<0.05)
20 mg/day	40	11	29		
Total	100	41	59		

A statistically significant association was found between the pattern of PPI intake and the presence of hypomagnesemia (p < 0.05). Among patients with hypomagnesemia, 25 (61.0%) reported taking PPIs regularly without skipping doses, whereas only 15 (36.6%) took them regularly but skipped doses and 1 (2.4%) used them irregularly. In contrast, among those with normal serum magnesium levels, the majority (38, 64.4%) took PPIs regularly but skipped doses, while 20 (33.9%) took them consistently without skipping and 1 (1.7%) used them irregularly. These findings suggest that strict, regular PPI intake is more frequently associated with hypomagnesemia compared to irregular or inconsistent use (Table III).

Table III Association between hypomagnesemia and frequency of pattern of PPI use (n=100)

Frequency of intake of PPI	Hypomagnesemia		Total	Chi square value	p value
	Yes	No			
Regularly	25	20	45	7.54	0.023*(<0.05)
Regularly but skip dose	15	38	53		
Irregularly	01	01	02		
Total	41	59	100		

There was a moderate negative correlation with a significance level of less than 0.01 between the duration of PPI use and the levels of serum magnesium ($r = -0.56$, $p < 0.01$). Results of the exported scatter plot showed a declining trend of serum magnesium concentrations based on the duration of PPI therapy. The adjusted coefficient of determination ($R^2 = 0.3182$), (30) had shown that nearly 31.8% of the variability in serum magnesium levels could be explained by the duration of PPI use. These results are consistent with longer-term treatment with PPIs lowering serum magnesium levels (Figure 3).

**Figure 3** Scatter distribution of duration of PPI use and its correlation with serum Mg^{++} (n=100).

Discussion

The present study found 41 subjects out of 100 had hypomagnesemia. The findings in this study are consistent with the findings of study done in the USA.¹³ Among the types of PPI used, the majority used esomeprazole (41%), followed by omeprazole (31%), Pantoprazole (14%) and Rabeprazole (10%). Another study by Gau et al. where the most common PPI used among hypomagnesemia patients was omeprazole (31%), followed by lansoprazole (23%) and esomeprazole (16%).¹⁴

A study done in India suggested that the mean serum levels were comparatively high for esomeprazole users as compared to omeprazole or pantoprazole.¹⁵ The present study found a significant association of hypomagnesemia with the pattern of PPI users who have taken PPI regularly. This is similar to the findings of a study done in Japan.¹⁶ There was a significant ($p < 0.01$) negative correlation $r = -0.56$ of hypomagnesemia with duration of PPI use. Hughes, J. et al. found similar findings.¹⁷ There was a trend of decreasing serum Mg^{++} levels with the duration of PPI use. This is seen in the results of Sharara, A. I. et al.¹⁸

Limitation

First, none of the patients had their serum magnesium levels documented before treatment with PPI for the GERD. As a result, long-term PPI use cannot be definitely implicated as a cause of hypomagnesemia. Second, our patients were against a background of long-term PPI usage, a case-control design in which the true controls were not PPI users would have entitled stronger basis of comparison and causation. Third, the collection of data on PPI use was based on patient reports and prescriptions were not cross-checked. Because patients may not accurately record their prior medication or may have not strictly followed their prescribed regimen, this raises the risk of recall bias.

Conclusion

Our cross-sectional study revealed that significantly lower serum Mg levels were observed in patients receiving PPI therapy for prolonged period. And it implies that long-term use of PPIs could be associated with sub-clinical Mg insufficiency or deficiency status. Thus, we conclude that patients receiving PPIs are at increased risk of developing hypomagnesaemia, which could be asymptomatic in the initial stages but may turn symptomatic on the long run. Hence routine monitoring of serum Mg levels is essential for the patients who are on long term PPI therapy to prevent the risk of developing proton pump induced hypomagnesemia.

Recommendation

Based on the understanding of the research problems and considering the experience gained from the present study, the following suggestions can be made:

- Serum Magnesium baseline and routine monitoring should be taken into account in patients starting PPI therapy or receiving long-term treatment.
- Other antisecretory drugs or alternate antacid therapy should be taken under consideration.
- It is important to assess the use and effectiveness of magnesium supplementation in those with hypomagnesemia while taking a PPI.

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Disclosure

All authors declared no competing interest.

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Functional Capacity among Tribal Elderly: Assessing Limitations and Enhancing Daily Living

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Abstract

Background: The functional capacity of elderly individuals is a critical determinant of their ability to perform daily activities independently, influencing their quality of life. Tribal elderly populations in Bangladesh face unique challenges due to sociocultural and environmental factors, necessitating context-specific insights. This study focuses on evaluating the functional capacity of tribal elderly to understand their limitations and explore strategies to improve their daily living experiences.

Materials and methods: This cross-sectional study was conducted from January to December 2019 in Kutukchari Union, Rangamati Sadar Upazila. A total of 275 tribal elderly individuals aged 60 years and above, primarily from the Chakma community, were selected through cluster sampling. Functional capacity was assessed using the Katz Index of Activities of Daily Living (ADL). Data on socio-demographic characteristics, health conditions and comorbidities were collected through face-to-face interviews. Descriptive statistics and inferential analyses, including chi-square and logistic regression, were used to determine associations between functional capacity and variables such as age, gender and occupation.

Results: The majority (97.5%) of participants were fully functional, while 2.5% exhibited moderate functional impairment. Functional impairment was significantly associated with age and occupation ($p < 0.05$). Among participants aged 80 years and above, 16% had moderate impairment compared to 0.5% in the 60–69 age group. Unemployed individuals showed the highest rate of impairment (33.3%). Chronic illnesses were present in 40.7% of participants, with osteoarthritis (55.4%) and hypertension (44.6%) being the most common. Among those seeking treatment (62.8%), allopathic methods were predominant (66.2%), but 47.9% reported persistent health problems.

Conclusions: The functional capacity of tribal elderly individuals in Rangamati is relatively high, yet age and unemployment are associated with functional impairments. Chronic illnesses, particularly osteoarthritis and hypertension, remain prevalent. Interventions focused on promoting active lifestyles and addressing chronic health conditions are crucial for enhancing the quality of life in this population.

Key words: Comorbidities; Functional capacity; Katz index; Socio-demographic factors; Tribal elderly.

Introduction

The aging process is inevitable for human life. With the increased lifestyle and developed health facilities, the elderly population is escalating. According to projections by the United Nations, by the year 2025, Bangladesh together with China, India, Pakistan and Indonesia, will account for 44% of the world's elderly population. Currently, older people account for 7% of the country's population. Meanwhile, about 1% of the total population of Bangladesh is tribal. About 60,835 are ethnic population of Rangamati Sadar Upazila and 6,891 are elderly.¹ The primary census report

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of 2011 gives the number of ethnic population groups of Bangladesh as 27. The first is Chakma, consisting of 444,748 people while the Marma, the second largest ethnic group compares with 202,974 persons. Bangladesh's tribal population was enumerated at 897,828 in the 1981 census. These tribes are concentrated in the Chittagong Hill Tracts and around Mymensingh Sylhet and Rajshahi.² With increasing age, many changes occur to human health that affect daily life. These changes can be measured by various tools, one of which is functional capacity.

Functional capacity is considered, as the basis of an efficient geriatric assessment, giving a broad and interdisciplinary approach to health status. Thus, the various dimensions that affect the lives of the elderly are included, such as their health status, social relationships, the physical environment, and demographic, socioeconomic, cultural, and psychological conditions. These individuals are incorporated, in a context in which public health is gradually understood in a holistic and interdisciplinary approach. The assessment of functional capacity in the elderly should still consider the gradual decline with age, designating the importance of using a hierarchical scale, not observed in clinical practice and other studies related to the topic.³

Through a parameter for assessment of functional capacity in the elderly, it is possible to implement data collection so that municipal and state policymakers of the Unified Health System promote the construction of local health initiatives, aimed at maintaining functional capacity, guidelines from the current National Health Policy for the Elderly, for promoting an active and healthy aging.⁴ This study focuses on evaluating the functional capacity of tribal elderly to understand their limitations and explore strategies to improve their daily living experiences.

Materials and methods

This cross-sectional study was conducted in Kutukchari Union, Rangamati Sadar Upazila, over one year from January to December 2019. The study population included tribal elderly individuals aged 60 years and above from indigenous communities such as Chakma, Marma, Tripura, and others. Inclusion criteria required written informed consent, while individuals who were severely ill or unable to communicate were excluded. The sample size was calculated using the

formula $n = \frac{z^2pq}{d^2n} = \frac{z^2pq}{d^2}$, yielding a required sample size of 379, adjusted to 417 with a 10% non-response rate. Due to participant availability, the final sample size was 275. A cluster sampling technique was used, selecting two random clusters from the union's 18 villages. Data was collected using the Katz Index of Activities of Daily Living (ADL) and a semi-structured questionnaire covering socio-demographic and health-related variables. Face-to-face interviews were conducted after obtaining informed written consent. Data was cleaned, coded, and analyzed using IBM SPSS software, applying descriptive statistics and inferential analyses such as chi-square and logistic regression. Ethical approval was obtained from the Institutional Review Board (IRB) of NIPSOM. Participant confidentiality and rights were ensured, with no invasive procedures conducted.

Results

Table 1 Sociodemographic characteristics of the participants

Category	Subcategory	Frequency	Percentage	Statistics
Gender	Male	132	48.0	
	Female	143	52.0	
Age Distribution	60-69 years	193	70.2	Mean $\pm$ SD = 67.59 $\pm$ 6.663 Minimum = 60, Maximum = 89
	70-79 years	57	20.7	
	80-89 years	25	9.1	
Educational	Illiterate	229	83.3	
Qualification	Class I-V	24	8.7	
	Class VI-X	12	4.4	
	SSC/equivalent	10	3.6	
Occupation	Unemployed/unable	9	3.3	Mean $\pm$ SD = 6.63 $\pm$ 2.105 Minimum = 2, Maximum = 13
	Business	19	6.9	
	Farmer	111	40.4	
	Day laborer	8	2.9	
	Retired	60	21.8	
	Homemaker	68	24.7	
Marital Status	Married	-	73.8	
	Widow/Widower	-	26.2	
Family Type	Joint Family	222	80.7	Mean $\pm$ SD = 9756.36 $\pm$ 2710.265 Minimum = 5000, Maximum = 19000
	Nuclear Family	53	19.3	
Total Family	1-5 members	82	29.8	
Members	6-10 members	181	65.8	
	11-15 members	12	4.4	
Monthly Family	5000-9000	137	49.8	
Income (Taka)	10000-14000	110	40.0	
	15000-19000	28	10.2	

Category	Subcategory	Frequency	Percentage	Statistics
Household Type	Kancha	212	77.1	
	Semi-pucca	63	22.9	
Personal Room	Yes	85	30.9	
	No	190	69.1	
Electricity Supply	Present	270	98.2	
	Absent	5	1.8	
Source of Drinking Water	Pipe Water	67	24.4	
	Tube Well	133	48.4	
	Well	75	27.3	
Place of Drinking Water	Household Supply	67	24.4	
	Household Tube Well	75	27.3	
	Far from Home	133	48.4	
Latrine Placement	At Home	60	21.8	
	Near Home	215	78.2	

Table I describes that the majority of tribal elderly are in the 60-69 age group (70.2%), with 20.7% in the 70-79 age group and 9.1% in the 80-89 age group. Most (83.3%) are illiterate, and 40.4% are farmers, followed by 24.7% homemakers. Regarding family structure, 65.8% live in households with 6-10 members, and 49.8% have a monthly family income between 5000-9000 taka. Most (77.1%) live in kancha houses, 69.1% do not have a personal room, and 98.2% have electricity. For drinking water, 48.4% use tube wells and 78.2% place their latrines near their homes.

Table II Distribution of the respondents by functional capacity

Functional capacity	Frequency	Percentage (%)
Full functional	268	97.5
Moderate functional impairment	7	2.5
Total	275	100.0

Table II shows, regarding functional capacity, 7(2.5%) respondents had moderate functional impairment while rest i.e. 268(97.5%) were fully functional.

Table III Distribution of tribal elderly by comorbid conditions

Attributes		Frequency	Percentage (%)
Suffering from chronic illness	Yes	112	40.7
	No	163	59.3
	Total	275	100
Type of chronic illness	Hypertension	50	44.6
	Osteoarthritis	62	55.4
	Total	112	100
Duration of suffering (Years)	1-5	36	32.1
	6-10	66	58.9
	11-15	10	8.9
	Total	112	100
Seek treatment	Yes	71	62.8
	No	42	37.2
	Total	113	100
Types of treatment	Allopathic	47	66.2
	Homeopathic	18	25.4
	Traditional medicine	6	8.5
	Total	71	100
Post-treatment health status	Healthy	37	52.1
	Not healthy	34	47.9
	Total	71	100
Type of problem	Vertigo	12	35.3
	Not improved	22	64.7
	Total	34	100
Assistive device use	Yes	39	14.2
	No	236	85.8
	Total	275	100

Table III illustrates regarding comorbid conditions, 112(40.7%) tribal elderly was suffering from chronic illness like hypertension {50(44.6%)} and osteoarthritis {62(55.4%)}. Among them 71(62.8%) seek treatment and 42(37.2%) did not. Majority i.e. 47(66.2%) received allopathic treatment and 37(52.1%) were healthy. But 22(64.7%) respondents complain of not improving their condition despite receiving treatment. 39(14.2%) tribal elderly use walking sticks as assistive devices.

Table IV Association between gender and functional capacity

Attribute		Functional capacity f(%)		Total	Significance
		Fully functional	Moderate impairment		
Gender	Male	128(97.0)	4(3.0)	132(100)	$\chi^2 = 0.241$ df=1 p=0.714
	Female	140(97.9)	3(2.1)	143(100)	
Total		268(97.5)	7(2.5)	275(100)	

In Table IV, regarding the association between gender and functional capacity, out of 132 males 128(97.0%) were fully functional and 4(3.0%) were suffering moderate impairment. Among 143 females 140(97.9%) were fully functional and rest i.e. 3(2.1%) were suffering from moderate impairment. The association was not statistically significant. (p>0.05)

Table V Association between age and functional capacity

Attribute		Functional capacity f (%)		Total	Significance
		Fully functional	Moderate impairment		
Age	60-69	192(99.5)	1(0.5)	193(100)	$\chi^2 = 21.655$ df=2 p=0.000
	70-79	55(96.5)	2(3.5)	57(100)	
	80≥	21(84.0)	4(16.0)	25(100)	
Total		268(97.5)	7(2.5)	275(100)	

In Table V, regarding association between age and functional capacity, out of 193 tribal elderlies of 60-69 years' age group 192(99.5%) were fully functional and only 1(0.5%) were suffering from moderate impairment. Among more than 80 years' age group out of 25 respondents 21(84.0%) were fully functional and rest i.e. 4(16.0%) were suffering from moderate impairment. The association was statistically significant. (p<0.05)

Table VI Association between occupation and functional capacity

Attribute		Functional capacity f(%)		Total	Significance
		Fully functional	Moderate impairment		
Occupation	Unemployed	6(66.7)	3(33.3)	9(100)	Fisher exact=21.040 p=0.000
	Business	19(100)	0(0)	19(100)	
	Farmer	111(100)	0(0)	111(100)	
	Day laborer	8(100)	0(0)	8(100)	
	Retired	56(93.3)	4(6.7)	60(100)	
	Homemaker	68(100)	0(0)	68(100)	
Total		268(97.5)	7(2.5)	275(100)	

In Table VI, regarding occupation out of 9 unemployed tribal elderlies 3(33.3%) were suffering from moderate impairment. Among 60 retired tribal elderlies 4(6.75%) were suffering from moderate impairment of functional capacity. The association was statistically significant. (p<0.05)

Discussion

In the case of functional capacity, 7(2.5%) respondents had moderate functional impairment while the rest i.e. 268(97.5%) were fully functional. The functional status category of the respondents indicated that 38 participants' score was 6 which indicated full function, 56 participants' score was 4 which indicated moderate impairment, 40 participants had severe functional impairment (Score 2 or less) and 10 participants had their score 0. Regarding the functional level according to the age group, 50% (65-70 years) of respondents had moderate impairment where (Whereas) only 20% were dependent in this age group. On the other hand, 58% of the respondents from 60-64 years age group were independent, while 25% had severe impairment. This information differs from the current study because the population of the current study place was physically stronger and more active than general people.⁵

Considering comorbid conditions, 40.7% of tribal elderly were suffering from chronic illnesses like hypertension 44.6% and osteoarthritis 55.4%. Among them, 62.8% sought treatment and 37.2% did not. The majority i.e. 66.2% received allopathic treatment and 52.1% were healthy. However, 64.7% of respondents complain of not improving their condition despite receiving treatment. 39(14.2%) tribal elderly use walking sticks as assistive devices. In another study, it was reported that 40.3% of respondents complained of suffering from different health conditions like diabetes, hypertension, and musculoskeletal disorders.⁶

Regarding the association between gender and functional capacity, out of 132 males 128(97.0%) were fully functional and 4(3.0%) were suffering moderate impairment. Among 143 females 140(97.9%) were fully functional and the rest i.e. 3(2.1%) were suffering from moderate impairment. The association was not statistically significant. (p>0.05) It reflects gender does not influence functional capacity.

Concerning the association between age and functional capacity, out of 193 tribal elderlies of 60-69 years age group, 99.5% were fully functional and only 0.5% were suffering from moderate impairment. Among the more than 80 years age group out of 25 respondents, 84.0% were fully functional, and the rest i.e. 16.0% were suffering from moderate impairment. The association was statistically significant. ($p < 0.05$) It reflects age influences functional capacity.

In the case of educational qualification, 97.4% were fully functional and the rest (2.6%) were suffering from moderate impairment of functional capacity. The association was not statistically significant. ($p > 0.05$) It shows that educational qualification does not influence functional capacity. Regarding occupation, 33.3% were suffering from moderate impairment. Among 60 retired tribal elderlies, 6.75% were suffering from moderate impairment of functional capacity. The association was statistically significant. ($p < 0.05$) It shows the influence of occupation on functional capacity is present. Considering the association between marital status and functional capacity 6.9% were suffering from moderate impairment and 1.0% were suffering from moderate impairment. The association was statistically significant. ($p < 0.05$). It indicates marital status influences functional capacity.

In the case of monthly family income, out of 28 respondents of the 15000-19000 tk income group 25(89.3%) were fully functional and 3(10.7%) were suffering from moderate functional impairment. Among 110 respondents from the 10000-14000 tk income group 2(1.8%) were suffering from moderate functional impairment. The association was statistically significant. ($p < 0.05$) In respect of the association between functional capacity and unintentional injury 268 tribal elderlies were fully functional. Among them 30(11.2%) respondents suffered from unintentional injury. 7 respondents were suffering from moderate functional impairment but they did not suffer from unintentional injury. The association was not statistically significant. ($p > 0.05$) It indicates functional capacity and unintentional injury is not associated. Regarding age, total family members, monthly family income and duration of chronic illness functional capacity shows a negative correlation, i.e. with the increase of age, total

family members, monthly family income and duration of chronic illness total score of functional capacity decreases. The correlation of age and monthly family income with the total score of functional capacity is found significant. ($p = 0.000$ and $p = 0.036$)

Conclusion

This study highlights that while most tribal elderly in Kutukchari Union maintain full functional capacity, a significant portion face moderate impairment, influenced by age, unemployment, and chronic illnesses like hypertension and osteoarthritis. Gaps in healthcare access, dissatisfaction with treatment, and limited use of assistive devices emphasize the need for targeted interventions. Strengthening healthcare services and promoting preventive care can enhance their quality of life and well-being.

Disclosure

All the authors declared to have no conflicts of interest.

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Efficacy of Empirical Antibiotics in Acute Watery Diarrhea in Children: A Randomized Controlled Trial

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Abstract

Background: Acute Watery Diarrhea (AWD) is a leading cause of morbidity and mortality among children under five, especially in low-resource settings. Despite WHO and IMCI guidelines recommending Oral Rehydration Therapy (ORT) and zinc supplementation, empirical antibiotic use remains common. This study evaluates the efficacy of antibiotics in AWD cases without confirmed bacterial etiology and compares outcomes with standard ORT-based management.

Materials and methods: This Randomized Controlled Trial (RCT) enrolled 200 children aged 6 months to 5 years presenting with AWD at BGC Trust Medical College Hospital from January 2021 to December 2023. Participants were randomized into two groups: Group A (ORT, zinc and IV fluids) and Group B (Empirical antibiotics—ciprofloxacin, azithromycin or metronidazole—in addition to ORT, zinc and IV fluids). The primary outcome was the duration of diarrhea, while secondary outcomes included hospitalization rates and complications.

Results: The mean duration of diarrhea in Group A was 2.3 ± 0.7 days, significantly shorter than 8.6 ± 1.2 days in Group B ($p < 0.001$). Hospitalization rates were higher in the antibiotic group (95% vs. 20%, $p < 0.01$), and complications such as electrolyte imbalance were significantly higher in Group B (20% vs. 5%, $p = 0.02$).

Conclusion: Empirical antibiotic use in AWD without confirmed bacterial etiology prolongs illness duration, increases hospitalization rates, and poses unnecessary risks. Our findings reinforce current guidelines advocating ORT and zinc as the primary treatment, reserving antibiotics for confirmed bacterial infections.

Key words: Acute watery diarrhoea, antibiotics, oral rehydration therapy, zinc supplementation, pediatric infections.

Introduction

Acute Watery Diarrhea (AWD) is a major public health concern, contributing significantly to childhood morbidity and mortality worldwide, particularly in developing countries.¹ While viral pathogens like rotavirus account for most cases, bacterial pathogens such as *Vibrio cholerae* and enterotoxigenic *Escherichia coli* (ETEC) are implicated in severe cases.² Despite WHO guidelines recommending ORT and zinc supplementation, empirical antibiotic use persists due to diagnostic limitations and clinical urgency.³ Inadequate water, sanitation, and hygiene practices further exacerbate the global burden of AWD in low-resource settings.⁴ According to the WHO, diarrheal diseases are the second leading cause of death among children under five, responsible for approximately 500,000 deaths annually.⁵

Current WHO and IMCI guidelines recommend ORT and zinc supplementation as the mainstay of AWD treatment, irrespective of the causative pathogen.⁶ Antibiotics are only indicated in cases of dysentery, cholera, or protozoal infections such as giardiasis or amoebiasis.⁷ However, empirical antibiotic use remains widespread due to parental pressure, physician habits, and poor adherence to treatment protocols.⁸ Misuse of antibiotics in AWD is associated with adverse effects, including prolonged illness duration, increased antibiotic resistance, and complications such as electrolyte imbalances.⁹ Studies show that inappropriate antibiotic use disrupts gut microbiota, leading to prolonged diarrhea and secondary infections.¹⁰ The economic burden of prolonged hospital stays and

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additional treatment costs further highlights the need to re-examine antibiotic use in AWD.¹¹

The gastrointestinal tract hosts a complex community of microorganisms essential for maintaining gut health. Antibiotics, while targeting pathogenic bacteria, can disrupt this balance, leading to dysbiosis. Dysbiosis delays recovery from diarrheal illnesses by impairing mucosal healing and nutrient absorption.¹² Evidence suggests that changes in gut microbiota due to antibiotics can cause persistent inflammation and reduce resistance to opportunistic pathogens.¹³

This study hypothesizes that empirical antibiotics do not provide clinical benefits in AWD without confirmed bacterial etiology and may instead prolong diarrhea, increase hospitalization rates, and lead to complications. The objectives were: (1) To compare recovery times between children treated with standard therapy (ORT, zinc, IV fluids) and those receiving additional empirical antibiotics and (2) To evaluate secondary outcomes, including hospitalization rates and complications.

This study aims to assess the efficacy of antibiotics in AWD when bacterial pathogens are not confirmed. By comparing antibiotic-treated cases with those managed solely with ORT and zinc, we seek to determine whether antibiotics confer any benefit or, conversely, prolong recovery and increase complications. This trial evaluates the impact of empirical antibiotics on clinical outcomes in children with AWD in a high-burden setting.

Materials and methods

This hospital-based randomized controlled trial was conducted at BGC Trust Medical College Hospital, Chattogram, Bangladesh, from January 2021 to December 2023. The study included children aged 6 months to 5 years presenting with AWD. Ethical approval was obtained (IRB No: BGCTMC/2021/IDA-01) and written informed consent was obtained from parents or guardians. Participants were randomized into two groups: Group A (standard treatment with ORT, zinc and IV fluids) and Group B (Standard treatment plus empirical antibiotics-ciprofloxacin, azithromycin, metronidazole, or nitazoxanide).

Inclusion criteria

- Children aged 6 months to 5 years with AWD (≥ 3 loose stools per day lasting < 14 days)
- Dehydration (Some or severe, per IMCI guidelines)
- No signs of dysentery (Bloody stools).

Exclusion criteria

- Bloody stools (Suggestive of dysentery or amoebiasis)
- Rice-water stools (suggestive of cholera)
- Foul-smelling, frothy or greasy stools (Suggestive of giardiasis)
- Severe malnutrition requiring hospitalization.

Data were collected via structured questionnaires and clinical examinations. Statistical analyses were performed using SPSS v 26.0. Independent t-tests were used for continuous variables, and chi-square tests were used for categorical data, with $p < 0.05$ considered significant. Kaplan-Meier survival curves and log-rank tests were used to compare recovery times.

Primary outcome: Duration of diarrhea (In days). Secondary outcomes: Hospitalization rates and complications (e.g. electrolyte imbalances).

Results

The majority of participants were male (60%), 90% were underweight, and 85% had stunting. There were no significant differences between groups in age, sex distribution or nutritional status (Table I)

Table I Demographic Characteristics of Study Participants

Variable	ORS + Zinc Group (n=100)	Antibiotic Group (n=100)
Mean Age (Months)	24.6 $\pm$ 6.2	25.1 $\pm$ 7.0
Male: Female Ratio	1.5:1	1.6:1
Underweight (%)	90%	88%
Stunting (%)	85%	84%

Data were analyzed using independent t-tests for continuous variables and chi-square tests for categorical variables.

Before admission, 80% of Group A and 40% of Group B had some dehydration, while 20% of Group A and 60% of Group B had severe dehydration. Fever and vomiting were more common in Group B (Table II).

Table II Clinical Presentation Before Admission

Parameter	Group A (ORS + Zinc Group) (n=100)	Group B (Antibiotic Group) (n=100)	p-value
Dehydration Level	Some (80%), Severe (20%)	Some (40%), Severe (60%)	< 0.01
Fever (%)	20%	40%	< 0.01
Vomiting (%)	10%	40%	< 0.01
Stools per Day	5-10 (80%)	10-20 (90%)	< 0.01
Reduced Urine Output (%)	20%	80%	< 0.01

Chi-square tests were used for categorical variables.

Children treated with ORS and zinc at home had a significantly shorter duration of diarrhea (2.8 ± 0.9 days) compared to those treated with antibiotics (6.2 ± 1.4 days, $p < 0.001$). Hospitalization rates were lower in the ORS group (20% vs. 95%, $p < 0.001$) and complications were significantly higher in the antibiotic group (40% vs. 10%, $p < 0.001$) (Table III).

Table III Outcomes in Home-Treated Patients ((Subgroup Analysis)

Home Treatment	Group A (ORS + Zinc Group) (n=50)	Group B (Antibiotic Group) (n=50)	p-value
Diarrhea duration (days)	2.8 ± 0.9	6.2 ± 1.4	<0.001
Hospitalization (%)	20	95	<0.001
Complications (%)	10	40	<0.001

Independent t-tests were used for continuous variables, and chi-square tests were used for categorical variables.

The mean duration of diarrhea in Group A was 2.3 ± 0.7 days, significantly shorter than 8.6 ± 1.2 days in Group B ($p < 0.001$). Hospitalization rates were higher in the antibiotic group (95% vs. 20%, $p < 0.01$) and complications such as electrolyte imbalance were more frequent in Group B (20% vs. 5%, $p = 0.02$) (Table IV).

Table IV Primary and Secondary Outcomes of hospitalized patients

Outcome	ORS + Zinc Group (n=100)	Antibiotic Group (n=100)	p-value
Mean Duration of Diarrhea (Days)	2.3 ± 0.7 (95% CI: 2.1–2.5)	8.6 ± 1.2 (95% CI: 8.3–8.9)	<0.001
Hospitalization Rate (%)	20% (95% CI: 12.7–29.3)	95% (95% CI: 89.2–98.3)	<0.01
Electrolyte Imbalance (%)	5% (95% CI: 1.6–11.3)	20% (95% CI: 13.1–28.9)	0.02

Independent t-tests were used for continuous variables, and chi-square tests were used for categorical variables.

Discussion

Our study demonstrates that empirical antibiotics in AWD without confirmed bacterial infection prolong illness duration, increase hospitalization rates, and lead to more complications. Children in the antibiotic group experienced diarrhea for 7–10 days, compared to 2–3 days in the ORT group. Our findings align with systematic reviews showing empirical antibiotics prolong duration and severity of diarrhea in non-bacterial AWD [10,13]. For instance, a 2024 meta-analysis reported

antibiotics reduced diarrhea duration by 24.9 hours but emphasized low certainty of evidence due to small sample sizes and single-country studies.¹⁴ In contrast, our study found a 6.3-day increase in diarrhea duration with antibiotics, highlighting their potential harm. Zinc supplementation, however, reduced antibiotic misuse by 3.8% in multi-country trials, reinforcing its role as first-line therapy.¹⁵

Antibiotic-induced dysbiosis likely explains prolonged diarrhea in Group B. Disruption of gut microbiota impairs mucosal healing and increases susceptibility to opportunistic pathogens.¹⁶ Short-term antibiotic use can lead to incomplete recovery of gut flora, delaying recovery and increasing complications.⁷ This disruption of the gut microbiome not only delays recovery but also compromises the gut's ability to resist secondary infections, which aligns with our findings of prolonged diarrhea and higher complication rates in the antibiotic group.

Furthermore, alterations in gut motility and absorption following antibiotic administration may exacerbate diarrheal symptoms.¹⁷ This mechanism is consistent with our observation of higher electrolyte imbalances (20% vs. 5%) in antibiotic-treated children, likely due to altered ion transport and prolonged fluid loss. The gut's ability to regulate fluid and electrolyte balance is compromised when the microbiota is disrupted, leading to increased severity and duration of diarrhea.

Empirical antibiotic use also contributes to the emergence of resistant strains, making subsequent infections more difficult to treat. Laxminarayan et al. have documented the global crisis of antibiotic resistance, emphasizing that unnecessary antibiotic exposure is a major contributing factor.⁸ Our findings of increased hospitalization and complications in the antibiotic group likely reflect these multifaceted adverse effects, including the development of resistance and the broader impact on gut health.

Overuse of antibiotics in AWD remains widespread, with 55.9% of prescriptions deemed inappropriate in Thailand.¹⁸ Our findings suggest avoiding empirical antibiotics could prevent 6.3 additional days of diarrhea and 75 excess hospitalizations per 100 cases. This aligns with WHO's antimicrobial stewardship goals, which prioritize ORT and zinc to reduce resistance and healthcare costs.¹⁹

The prolonged illness in antibiotic-treated children translates to significant socioeconomic burdens. For example, in Bangladesh, a 6-day delay in recovery risks malnutrition and secondary infections,

increasing hospitalization costs by 300%.²⁰ Adherence to guidelines could avert 4.2 million unnecessary antibiotic courses annually in low-income countries.²¹

Limitations

Despite the strengths, there are several limitations to our study and these include the absence of stool cultures, single-center setting, and short follow-up period.

Recommendations

Future studies should incorporate rapid diagnostic tests, implement antibiotic stewardship programs, and investigate the long-term effects of antibiotics on gut microbiota.

Conclusion

Empirical antibiotic use in AWD without confirmed bacterial etiology prolongs illness, increases hospitalization rates, and leads to complications. Our findings support current guidelines advocating ORT and zinc as the primary treatment and highlight the need for judicious antibiotic use to reduce antimicrobial resistance.

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Disclosure

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Outcome of Ilizarov Method for the Management of Long Defect of Tibia: A Hospital-Based Study

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Abstract

Background: Patients with open fracture Gustillo-Anderson grade 3 had undergone several surgical procedures, but still ended up with exposed long dead bone or infected. Ilizarov method was used to address long bone and soft tissue defect after re-debridement with radical resection of long dead bone or infected segment. The aim of this study was to find out the outcome of Ilizarov methods for long Tibial bone defect management.

Materials and methods: The hospital-based prospective study was conducted at East-West Medical College and Hospital, from December 2022 to December 2023. The research aimed to find out the outcome of ilizarov method for management of tibial bone defect. A total of 20 patients treated for tibial bone defect were included in the study. Clinical, radiological data were collected and evaluated. The inclusion criterion was non-union tibial fracture with exposed long dead bone or infected bone segment with minimal defect 4 cm and poor soft tissue coverage, that had been confirmed clinically and by X-ray. Patients with non-trauma cases (e.g. Pathological fracture) any

additional pathology and loss of follow up were excluded from the study. All patients were treated initially by ilizarov method after radiological diagnosis. Functional outcome according to the Functional Ankle Disability Index (FADI) Score was used to find out the functional ability after Ilizarov method.

Results: The prevalence long bone defect mainly Tibial bone among male 60% and female were 40%. The prevalence is varied by the age group where 30% within aged 31-40 years, 25% in aged 20-30 years, 20% in aged 41-50 years, 15% were in aged 51-60 years and 10% were >60 years aged. According to educational status 25% were illiterate and 75% were literate. Among all respondents 45% were service holder, 20% were businessmen, 15% were homemaker and 20% were other professions. According to economic status 25% belongs low economic status, 45% from middle income and 30% from high income status. According to nutritional status 15% from Underweight (BMI < 18.5), 40% from Normal weight (BMI 18.5-24.9) and 45% from Overweight/Obese (BMI ≥ 25). In response of personal habit 60% were smoker and 40% were non-smoker. Among all respondents most of the patients had DM which was 40%, HTN were 25%, and 35% were normal. Most of the patients 70% had motor vehicle accidents, 15%, and another 15% had history of fall from height and sports injury accordingly. On radiological findings about bone exposed before Ilizarov procedure where mean bone defect was 14.2 cm which indicated for bone transport procedure. Mean Leg Length Discrepancy (LLD) were 2.05cm, mean docking time were 4.5 months and mean union time were 7.75 months. To find out the Functional outcome, Functional Ankle Disability Index (FADI) score was used. Ilizarov method was performed to all subjects. All patients had good result with bone transport, soft tissue covered and no recurrence of infection. Four subjects had Leg Length Discrepancy (LLD) of 1 cm, whereas the others had

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zero discrepancy. We did not perform any bone grafting at docking site. All subjects obtained union as well as consolidation of distraction callus. Mean docking period of bone transport was 4.5 months. No significant pain was observed and 4 patients had ankle stiffness. Mean Foot and Ankle Disability Index (FADI) score was 85.75%.

Conclusion: This study highlights the effectiveness of Ilizarov methods of tibial bone defect management in tertiary level hospital which may reduce the surgical burden and patient regain their functional ability.

Key words: FADI; Ilizarov; LLD; Long tibial bone defect; Non-union fracture of tibia.

Introduction

Fracture of the tibia is one of the most common in long bone fracture with the incidence of open fracture is 25%.¹ Tibia is subcutaneous and easily loses its soft tissue cover in trauma. As such, open fractures frequently occur. Managing tibial open fracture requires advanced planning to reconstruct the bone with sufficient tissue coverage. Thus, the rate of complications associated with open tibial fractures is high, infection, non-union and limb loss are the major causes of morbidity.^{1,2,3} Defect can be produced after massive debridement in the management of infected open fracture in the case of infected. Major soft-tissue defect of the muscles, tendons, and joints restricts the functional outcome of the leg. Treatment progression for the defect should be evaluated not only the defect closure physically but also the functional outcome.⁴ The incidence of infected non-union of open fracture is increasing, and more than 50% of cases occur after internal fixation.⁵ In contrast to other methods, the Ilizarov technique is reported to address not only the bone defect but also the associated problems of shortening, deformity, soft-tissue loss, and joint contractures proving it as the best method as a limb salvage reconstruction method following a devastating trauma to the tibia. The Ilizarov fixator has revolutionized the treatment of infected tibial nonunions.⁶ A meta-analysis by Peng Yin et al. concludes that the Ilizarov method is a good choice for the treatment of infected non-union of the tibia.⁷ In a meta-analysis of lower limb segmental defects treated by bone transport, the overall union rate was 95 % (range, 60–100%).^{8,9} The research aimed to find out the outcome of ilizarov method for management of tibial bone defect.

Materials and methods

The hospital-based prospective study was conducted at East-west medical college and Hospital, from December 2022 to December 2023. A total of 20 patients treated for tibial bone defect were included in the study. Clinical, radiological data were collected and evaluated. The inclusion criterion was non-union tibial fracture with exposed long dead bone or infected bone segment with minimal defect 4 cm and poor soft tissue coverage, that had been confirmed clinically and by X-ray. Patients with non-trauma cases (e.g. Pathological fracture) any additional pathology and loss of follow up were excluded from the study. All patients were treated initially by ilizarov method after radiological diagnosis. Functional outcome according to the Functional Ankle Disability Index (FADI) Score was used to find out the functional ability after Ilizarov method.

Results

Table 1 Distribution according to characteristics of Sociodemographic, socioeconomic and personal habit

Variable	Frequency (n)	Percentage (%)
Total respondent	20	100
Gender		
Female	8	40
Male	12	60
Age Group		
20- 30 years	5	25
31- 40 years	6	30
41-50 years	4	20
51- 60 years	3	15
>60 years	2	10
Education		
Illiterate	5	25
Literate	15	75
Occupation		
Service holder	9	45
Businessman	4	20
Homemakers	3	15
Others	4	20
Socio-Economic Status		
Low	5	25
Middle	9	45
High	6	30
Nutritional Status (BMI)		
Underweight (BMI < 18.5)	3	15
Normal weight (BMI 18.5-24.9)	8	40
Overweight/Obese (BMI ≥ 25)	9	45
Personal habit		
Smoker	12	60
Non smoker	8	40

Table I describes the prevalence long bone defect mainly Tibial bone among male 60% and female were 40%. The prevalence is varied by the age group where 30% within aged 31-40 years, 25% in aged 20- 30 years, 20% in aged 41-50 years, 15% were in aged 51-60 years and 10% were >60 years aged. According to educational status 25% were illiterate and 75% were literate. Among all respondents 45% were service holder, 20% were businessmen, 15% were homemaker and 20% were other professions. According to economic status 25% belongs low economic status, 45% from middle income and 30% from high income status. According to nutritional status 15% from Underweight (BMI < 18.5), 40% from Normal weight (BMI 18.5-24.9) and 45% from Overweight/ Obese (BMI ≥ 25). In response of personal habit 60% were smoker and 40 % were non-smoker.

Table II Presence of Comorbidities

Traits	Present (n)	Percentage (%)
DM	8	40
HTN	5	25
Normal	7	35

Table II represent that among all respondents most of the patients had DM which was 40%, HTN were 25% and 35% were normal.

Table III Causes of tibial bone defect

Traits	Present (n)	Percentage (%)
Motor vehicle accident	14	70
Fall from height	3	15
Sports injury	3	15

Table III represent that among all respondents most of the patients 70% had motor vehicle accidents, 15%, and another 15% had history of fall from height and sports injury accordingly.

Table IV Radiological findings

Bone exposed	Bone defect (cm)	Mean Bone defect (cm)	Previous LLD (cm)	Mean LLD (cm)	Docking time (Months)	Mean Docking time (Months)	Union time (Months)	Mean union time (Months)
3 x 4	11	14.2	1	2.05	3	4.5	6	7.75
2 x 5	10		2		4		6	
2 x 3	23		1		9		13	
3 x 5	12		3		3		7	
3 x 4	22		1		6.5		10	
2 x 5	12		3		3		8	
3 x 5	15		2		4.5		8	
4 x 5	13		4		3		7	
3 x 4	13		1		4		7	
4 x 5	19		2		4.5		9	
2 x 5	10		3		3		6	
2 x 4	13		1		3.5		6	
3 x 5	12		1		4		7	
4 x 5	12		2		3		8	
2 x 5	10		4		3		6	
4 x 5	13		3		4.5		7	
2 x 3	15		1		6		8	
2 x 4	12		2		4.5		7	
4 x 5	15		3		6		8	
3 x 4	22		1		7.5		11	

Table IV represents the radiological findings about bone exposed before Ilizarov procedure where mean bone defect was 14.2 cm which indicated for bone transport procedure. Mean Leg Length Discrepancy (LLD) were 2.05cm, mean docking time were 4.5 months, and mean union time were 7.75 months.

Ilizarov frame was utilized for bone transport procedure that started one week after the installation of the frame with the speed 1 mm/day divided into four times. Near the end of the transport the skin become infolded into docking site, we then surgically intervened to facilitate the docking by skin fold soft tissue reconstruction and did compression at the docking site. No bone grafting performed at the beginning nor the end of the procedure. The patients were encouraged to undergo partial weight-bearing 4 weeks after operation. Bone lengthening then performed to correct the limb length discrepancy. After the

length was achieved, patients underwent Full Weight-bearing 2–3 months after Illizarov frame removal. Post-operative evaluation was performed using Foot and Ankle Disability Index (FADI) score.

Table V Functional outcome

Union / consolidation per months	Mean consolidation/ union per months	LLD (Leg Length Discrepancy) (cm)	FADI Score (%)	Mean FADI score (%)
8	8.79	0	85	85.75
9.5		0	90	
9		0	86	
8		0	95	
8.5		0	90	
10		1	75	
12		1	75	
8		0	90	
9		0	85	
9.5		0	90	
9		0	90	
8		0	71	
8.5		0	86	
10		1	75	
9		0	85	
9.5		0	90	
8		0	86	
9		0	85	
9.5		0	90	
11		1	96	

Table V describes the Functional outcome according to Functional Ankle Disability Index (FADI) score. Illizarov method was performed to all subjects. All patients had good result with bone transport, soft tissue covered and no recurrence of infection. Four subjects had Leg Length Discrepancy (LLD) of 1 cm, whereas the others had zero discrepancy. We did not perform any bone grafting at docking site. All subjects obtained union as well as consolidation of distraction callus. Mean docking period of bone transport was 4.5 months. No significant pain was observed and 4 patients had ankle stiffness. Mean Foot and Ankle Disability Index (FADI) score was 85.75%.

Discussion

Illizarov method was effective in securing infection-free union in the most difficult cases, with long defects and poor soft tissues.¹⁰ In this study we explored the outcome of Ilizarov method for long tibial bone management. The prevalence long bone defect mainly Tibial bone among male 60% and female were 40%. The prevalence is varied by the age group where 30% within aged 31-40 years, 25% in aged 20- 30 years, 20% in aged 41-50 years, 15% were in aged 51-60 years and 10% were >60 years aged. In another study revealed that among 14 patients, 12 males and 2 females, age ranging from 12 to 47 years (Mean age of 30.86 years).¹¹ According to educational status 25% were illiterate and 75% were literate. Among all respondents 45% were service holder, 20% were businessmen, 15% were homemaker and 20% were other professions. According to economic status 25% belongs low economic status, 45% from middle income and 30% from high income status. According to nutritional status 15% from Underweight (BMI < 18.5), 40% from Normal weight (BMI 18.5-24.9) and 45% from Overweight/Obese (BMI ≥ 25). In response of personal habit 60% were smoker and 40% were non-smoker. Among all respondents most of the patients had DM which was 40%, HTN were 25% and 35% were normal. Most of the patients 70% had motor vehicle accidents, 15% and another 15% had history of fall from height and sports injury accordingly. On radiological findings about bone exposed before Ilizarov procedure where mean bone defect was 14.2 cm which indicated for bone transport procedure. Mean Leg Length Discrepancy (LLD) were 2.05cm, mean docking time were 4.5 months, and mean union time were 7.75 months. Findings of another study was all of the patients had 6.5 cm–15 cm bone defect (mean 14.07 ± 4.37 cm). The mean of the defect gap was 14.07 ± 4.37 (6–15) cm, correlated with the docking time. The longer the gap, the more time required for docking time.¹¹ To find out the Functional outcome, Functional Ankle Disability Index (FADI) score was used. Illizarov method was performed to all subjects. All patients had good result with bone transport, soft tissue covered and no recurrence of infection. Four subjects had Leg Length Discrepancy (LLD) of 1 cm, whereas the others had zero discrepancy. We did not perform any bone grafting at docking site. All subjects obtained union as well as consolidation of

distraction callus. Mean docking period of bone transport was 4.5 months. No significant pain was observed, and 4 patients had ankle stiffness. Mean Foot and Ankle Disability Index (FADI) score was 85.75%. In another study we found that three subjects had Leg Length Discrepancy (LLD) of 1 cm, whereas the others had zero discrepancy. Mean docking period of bone transport was 4.96 ± 1.69 months and Mean Foot and Ankle Disability Index (FADI) score was 84.85 ± 8.59 .¹¹

Conclusion

The Ilizarov method is very important invention in the field of orthopaedic to treat various bone disease and shortening. It can permit tension stress that provides adequate blood supply, stimulates tissue biosynthetic activity and callus formation, corrects gradual length, and early limb function and load.

Disclosure

All the authors declared to have no conflicts of interest.

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Factors Associated with Cerebral Palsy of Under-Five Children in Patiya Upazila, Chattogram

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Abstract

Background: Cerebral Palsy (CP) is a leading cause of childhood disability, especially in low- and middle-income countries. Understanding local risk factors is critical for developing effective prevention strategies. To identify factors associated with CP in children under five in an Upazila of Chattogram, Bangladesh.

Materials and methods: This case-control study involved 50 children diagnosed with CP and 100 age- and sex-matched controls from Patiya Upazila. Data were gathered through interviews with caregivers and review of medical records, using a pre-tested structured questionnaire. Analysis was conducted using SPSS version 23.

Results: Of the CP cases, 74% were male (Male: female ratio 2.9:1). Consanguinity was reported in 20% of CP cases versus 4% in controls. Home deliveries occurred in 46% of CP cases compared to 3% of controls. Prematurity was significantly associated with CP (66% in cases vs. 1% in controls) with a 12.12-fold increased risk. Low birth weight was found in 38% of CP cases compared to 3% in controls.

Conclusion: Most CP cases were linked to modifiable risk factors. Enhancing maternal and newborn care could substantially reduce CP incidence in such settings.

Key words: Cerebral palsy; Consanguinity; Low birth weight; prematurity; Risk factors.

Introduction

Cerebral Palsy (CP) is a group of early-onset, non-progressive neurological disorders caused by lesions or abnormalities in the developing brain. It typically presents in infancy or early childhood and results in permanent impairments in movement, muscle coordination, and balance.^{1,2} The motor disorders of Cerebral Palsy (CP) are frequently accompanied by disturbances in sensation, perception, cognition, communication and behavior, as well as epilepsy and secondary musculoskeletal complications.³ The underlying etiologic events typically occur during early fetal or infant brain development, with a global prevalence ranging from 1.5 to over 4 per 1,000 live births.⁴ Additionally, some cases of CP result from acquired brain injuries during infancy or early childhood, such as those due to meningoencephalitis or traumatic brain injury.⁵

The epidemiology of Cerebral Palsy (CP) has been well-documented in High-Income Countries (HICs) but there remains a significant gap in population-based data from Low and Middle-Income countries (LMICs). A systematic review and meta-analysis that included 49 studies found that 46 were conducted in HICs, highlighting this disparity.⁶ In LMICs, most CP studies are based on hospital or clinic-based high-risk samples, which may not reflect the broader population.⁷ However, a recent population-based study in Bangladesh, using a surveillance registry, reported a CP prevalence of 3.4 per 1,000 children-translating to an estimated 233,514 affected children nationwide.⁸ Children with chronic limitations and potential long-term dependence, such as those with Cerebral Palsy (CP) require substantial support. The mother frequently assumes the primary burden of caregiving, often with little or no social support. In Bangladeshi families, mothers typically take on

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the sole responsibility of caring for children with disabilities and are likely to be the family members most affected by the situation.¹ Though little is known about the impact of caregiving on Health-Related Quality of Life (HRQOL) among mothers of children with CP in Bangladesh, studies from developed countries show significantly low HRQOL in these mothers.^{11,12} Recently, Power et al. observed that caregivers of adolescents with CP in rural Bangladesh are at high risk of depression and stress.¹⁰

Certain risk factors increase the likelihood of a baby developing CP, although not all babies with these risk factors will develop the condition. The clinical characteristics and risk factors for CP in Low and Middle-Income Countries (LMICs) may differ from those in High-Income Countries (HICs) though this has not been extensively investigated.¹³

In Bangladesh, a typical low- and middle-income country (LMIC), the burden of Cerebral Palsy (CP) is high and diagnoses are often delayed, limiting opportunities for early intervention during a critical period of brain plasticity. Furthermore, rehabilitation services are scarce and not easily accessible. Identifying potentially modifiable risk factors for CP in Bangladesh could enable the development of effective preventive programs focused on these factors. In this context, the present study aimed to determine the factors associated with CP among children under 5 years of age in the Patiya Upazila of Chattogram.

Materials and methods

This case-control study was conducted at the Patiya Upazila Health Complex in Chattogram to identify factors associated with Cerebral Palsy (CP) among under-5 children. The study included 50 children with CP, diagnosed by physicians or documented in records, and 100 age- and sex-matched controls without CP or other congenital anomalies. The study population comprised children with CP and their mothers attending the physiotherapy center of the health complex. Conducted between January and June 2021, data collection took place over a one-month period within this timeframe. The sample size was determined using the standard formula for qualitative variables in case-control studies. 50 children with CP and 100 controls were included in the study.

Data were collected through face-to-face interviews with the mothers of the children using a structured questionnaire and by reviewing available medical records. The measurement tools included a structured questionnaire, validated by senior faculty members from the Pediatrics and Community Medicine Departments of CMCH and CMC, respectively, hospital discharge papers after delivery; and physician's prescriptions during pregnancy and for the child with CP. Following expert validation, a pilot study was conducted on ten CP cases to ensure clarity and understanding. Data collection was done personally by the researcher at the Patiya Upazila Health Complex. Children attending the physiotherapy center who met the inclusion and exclusion criteria were enrolled as cases, while two age- and sex-matched controls per case were selected from the IMCI corner and pediatric outpatient services. Informed consent was obtained from all respondents before interviews, which were conducted in Bangla. Socio-demographic, economic, personal, obstetric, and child-related information was collected through memory recall and record reviews. Data were entered into Microsoft Excel and analyzed using IBM SPSS version 23. Continuous variables were summarized using means and standard deviations ($\pm$ SD) or medians and interquartile ranges, with comparisons made using Student's t-test or the Mann-Whitney U test as appropriate. Categorical variables were expressed as frequencies and proportions, compared using chi-square or Fisher's exact test. Odds ratios with 95% confidence intervals were calculated and a p value of <0.05 was considered statistically significant.

The inclusion criteria for the case group consisted of children diagnosed with Cerebral Palsy (CP) either by a physician or recorded under the "Promoting Inclusive Health & Rehabilitation Service (PIHRS)" project by the Disabled Rehabilitation and Research Association (DRRA) a local NGO. These children were attending the physiotherapy center of Patiya Upazila Health Complex, Chattogram. Eligible children were aged between 1 to 5 years, born in Patiya, Chattogram, and had mothers who consented to provide information. For the control group, children without cerebral palsy who visited the IMCI corner or the pediatric consultant of the same health complex were included. Controls were matched with cases by age and sex, had to be born in Patiya,

Chattogram, and their mothers had to be willing to give information.

The exclusion criteria for the case group included children younger than 1 year or older than 5 years, those not born in Patiya, Chattogram, and those whose mothers refused to participate. For the control group, children with any congenital anomalies other than cerebral palsy, those not born in Patiya, and those whose mothers were unwilling to provide information were excluded from the study.

Results

The present study was conducted to determine the factors associated with CP in under-5 children of the Patiya Upazila of Chattogram with a case-control design. For this purpose, 50 diagnosed under-5 children with CP and 100 healthy children without CP were included. Different maternal, antenatal, perinatal, postnatal and neonatal factors were compared between these two groups. The results and observations were presented in the following tables and graphs.

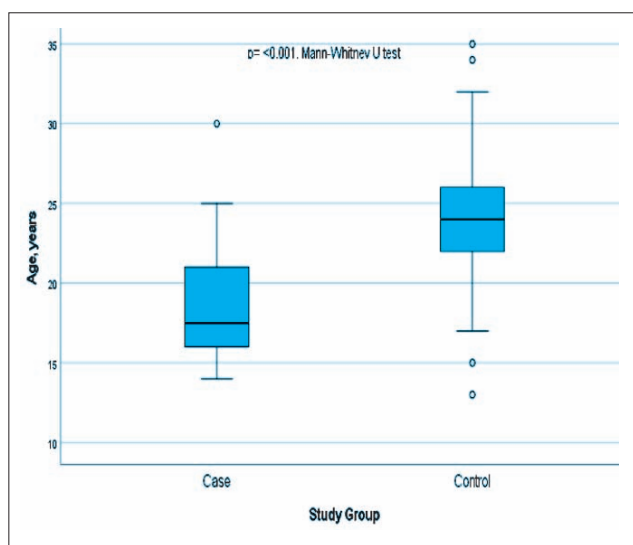


Figure 1 Comparison of the age of the mother at the time of delivery between two groups

In the case and control group, the median maternal age at delivery was 17.5 (16.0-21.0) years and 24.0 (22.0-26.0) years, respectively. Figure 1 shows that this difference was statistically significant, indicating that early age at delivery was significant for CP.

Table 1 Association of maternal smoking and cerebral palsy, dried fish taking habit by mother and cerebral palsy, premature rupture of membrane and cerebral palsy, maternal complication in the antenatal period and cerebral palsy, birth weight and cerebral palsy

Smoking 		Study Group		Odds ratio (95% CI) 	p value*
		Case (n=50)	Control (n=100)		
Yes	Count	9	3	7.02	0.002
	% within Group	18.0%	3.0%		
No	Count	41	97	(1.80-27.21)	0.002
	% within Group	82.0%	97.0%		
Take dried fish					
Yes	Count	48	85	4.24	0.062
	% within Group	96.0%	85.0%		
No	Count	2	15	(0.92-19.31)	0.062
	% within Group	4.0%	15.0%		
Premature rupture of membrane					
Yes	Count	37	0	8.15	0.001
	% within Group	74.0%	0.0%		
No	Count	13	100	(5.12-14.74)	<0.001
	% within Group	26.0%	100.0%		
Antenatal complication					
Yes	Count	23	0	4.01	0.001
	% within Group	46.0%	0.0%		
No	Count	27	100	(3.01-6.12)	<0.001
	% within Group	54.0%	100.0%		
Birth weight					
<2500 gm	Count	19	3	19.45	0.001
	% within Group	38.0%	3.0%		
≥2500 gm	Count	31	97	(5.01-75.47)	<0.001
	% within Group	62.0%	97.0%		

*Chi-square test, CI: Confidence Interval.

Table I displayed that out of 50 cerebral palsy cases, 9 had a history of maternal smoking, whereas out of 100 controls, only 3 had similar exposure to maternal smoking. The significant 'p' value reveals that maternal smoking was one of the associated risk factors for CP. By univariate

logistic regression, a significantly higher rate of CP was found in the mother with a smoking history (OR = 7.02 [95% CI 1.80-27.21]).

Out of 50 cerebral palsy cases, 48 had a history of the maternal dried fish-eating habit compared to 85 out of 100 controls. The non-significant 'p' value reveals that maternal dried fish-eating habit had no association with CP.

The data regarding premature rupture of membrane, and 37 children had a history of PROM out of 50 children in cases and none out of 100 had similar events in controls. The significant 'p' value reveals that PROM was one of the associated risk factors for CP.

It was noticed that out of 50 cases, 23 children had complications in their antenatal period, and none of the control children had any complications during the antenatal period, which denotes that antenatal complication was associated with CP in the study.

Out of 50 cerebral palsy cases, 19 (38%) of them had LBW, whereas out of 100 controls, 3 (6%) had LBW. The observed 'p' value is highly significant to reveal LBW as an associated factor of CP.

Table II Association of consanguinity of marriage and cerebral palsy, maternal parity during pregnancy and cerebral palsy, multiple gestation and cerebral palsy, preterm and cerebral palsy, maternal disease during pregnancy and cerebral palsy

Consanguinity of Marriage		Study Group		Odds ratio (95% CI)	p value*
		Case (n=50)	Control (n=100)		
Yes	Count	10	4	7.00 (1.78-20.21)	0.002
	% within Group	20.0%	4.0%		
No	Count	40	96		
	% within Group	80.0%	96.0%		
Parity					
Prim	Count	34	12	15.58 (6.68-35.32)	<0.001
	% within Group	68.0%	12.0%		
Multi	Count	16	88		
	% within Group	32.0%	88.0%		
Multiple gestation					
Yes	Count	4	0	3.17 (2.45-4.03)	0.004
	% within Group	8.0%	0.0%		
No	Count	46	100		
	% within Group	92.0%	100.0%		

Consanguinity of Marriage		Study Group		Odds ratio (95% CI)	p value*
		Case (n=50)	Control (n=100)		
Gestational age at delivery					
<37 weeks	Count	33	1	12.12 (5.23-25.21)	0
	% within Group	66.0%	1.0%		
≥37 weeks	Count	17	99	(5.23-25.21)	<0.001
	% within Group	34.0%	99.0%		
Maternal disease during pregnancy					
Yes	Count	22	4	18.01 (5.45-59.21)	0
	% within Group	44.0%	4.0%		
No	Count	28	96	(5.45-59.21)	<0.001
	% within Group	56.0%	96.0%		

*Chi-square test, CI: Confidence Interval.

Table II displayed out of 50 cerebral palsy cases, 10 of them had a history of consanguinity of marriage in their parents. In contrast, out of 100 controls, only 4 of them had a similar history of consanguinity of marriage. The significant 'p' value reveals that the consanguinity of marriage was one of the associated risk factors for CP. By univariate logistic regression, a significantly higher rate of CP was found in the mother with consanguinity of marriage history (OR = 7.00 [95% CI 1.78-20.21]). Out of 50 cerebral palsy cases, 34 of their mothers were primipara during the index pregnancy, whereas out of 100 controls, only 12 were primipara. The significant 'p' value reveals that primiparity was one of the associated risk factors for CP. By univariate logistic regression, a significantly higher rate of CP was found in the primi paramother (OR = 15.58.00 [95% CI 6.68-35.32]).

It was noticed that out of 50 cases, four children had a positive history of multiple gestations during pregnancy, and none of the control children had a similar history of multiple gestations, which denotes that multiple gestations were also one of the associated risk factors for CP in the study.

Out of 50 cerebral palsy cases, 33 are preterm babies, whereas out of 100 controls, only 1 of them are preterm babies. The significant 'p' value reveals that preterm is one of the associated risk factors for CP.

Maternal diseases like hypertension, anemia, infection were associated with a higher risk of CP in the study.

Table III Association of maternal history of miscarriage and cerebral palsy, mode of delivery and cerebral palsy, place of delivery and cerebral palsy, malpresentation and cerebral palsy, neonatal complication and cerebral palsy

H/O Previous miscarriage		Study Group		Odds ratio (95% CI)	p value*
		Case (n=50)	Control (n=100)		
Present	Count	1	0	3.04 (2.41-3.82)	0.156
	% within Group	2.0%	0.0%		
Absent	Count	49	100		
	% within Group	98.0%	100.0%		
Mode of delivery					
Normal vaginal delivery	Count	23	48	0.92 (0.46-1.82)	0.817
	% within Group	46.0%	48.0%		
Others*	Count	27	52		
	% within Group	54.0%	52.0%		
Place of delivery					
Home	Count	23	3	27.51 (7.45-98.21)	<0.001
	% within Group	46.0%	3.0%		
Institution*	Count	27	97		
	% within Group	54.0%	97.0%		
Malpresentation					
Yes	Count	26	9	10.01 (4.51-26.11)	<0.001
	% within Group	52.0%	9.0%		
No	Count	24	91		
	% within Group	48.0%	91.0%		
History of neonatal complication after delivery					
Yes	Count	49	1	451.00 (27.10-7206.14)	<0.001
	% within Group	98.0%	1.0%		
No	Count	1	99		
	% within Group	2.0%	99.0%		

*CS, instrumental. *Chi-square test, CI: Confidence Interval.

Table III depicted the history of previous miscarriage data, and one child had a positive history out of 50 children in cases- none had in controls. The observed 'p' value is not significant enough to reveal that history of miscarriage was not an associated factor of CP.

Out of 50 cerebral palsy cases, 23 (46%) were delivered through normal vaginal delivery, whereas out of 100 controls, 48 (48%) of them were delivered through normal vaginal delivery. The observed 'p' value is not significant to reveal the mode of delivery was not an associated factor of CP.

The data regarding the place of delivery, and 23 children were delivered at home out of 50 children in cases- and only 3 out of 100 delivered at home in controls. The significant 'p' value reveals that home delivery was one of the associated risk factors for CP. By univariate logistic regression, a significantly higher rate of CP was found in the child with home delivery.

It was noticed that out of 50 cases, 26 children have had an abnormal presentation during delivery, and 09 of the control children had a similar presentation, which denotes that malpresentation was also one of the associated risk factors for CP in the study.

Out of 50 cerebral palsy cases, 49 (98%) of them had a difficult neonatal period, whereas out of 100 controls, only 1 (2%) of them had complications in their neonatal period. The observed 'p' value is highly significant to reveal neonatal complication as an associated factor of CP.

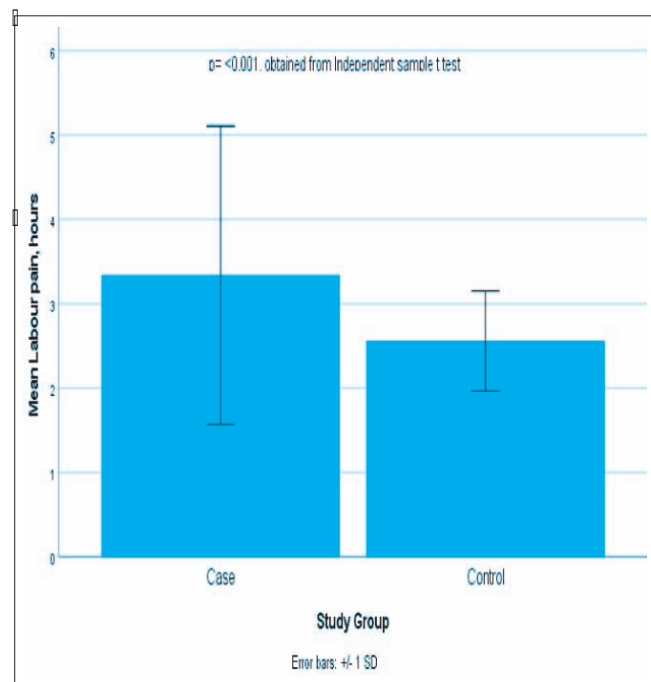


Figure 3 Comparison of the duration of labor pain time of delivery between two groups

The mean $\pm$ SD duration of labor pain was significantly higher in cases than in the control group (3.34 ± 1.77 hours and 2.56 ± 0.59 hours respectively, $p < 0.001$).

Table IV Association of history of infectious diseases in children within 2 years of life and cerebral palsy, history of head injury within 2 years of life and cerebral palsy, history of seizure disorder within 2 years of life and cerebral palsy

History of infectious diseases within 2 years of life		Study Group		Odds ratio (95% CI)	p value*
		Case (n=50)	Control (n=100)		
Yes	Count	35	5	44.33 (14.99-131.04)	<0.001
	% within Group	70.0%	5.0%		
No	Count	15	95		
	% within Group	30.0%	95.0%		
History of head injury within 2 years of life					
Yes	Count	4	0	3.17 (2.49-4.03)	0.011
	% within Group	8.0%	0.0%		
No	Count	46	100		
	% within Group	92.0%	100.0%		
History of seizure disorder within 2 years of life					
Yes	Count	48	0	51.12 (12.41-201.41)	<0.001
	% within Group	96.0%	0.0%		
No	Count	2	100		
	% within Group	4.0%	100.0%		

*Chi-square test, CI: Confidence Interval.

Table IV displayed significantly higher proportions of children with CP who had infectious diseases in children within 2 years of life than those without CP.

It displayed significantly higher proportions of children with CP who had head injury within the first 2 years of life than children without CP.

It displayed significantly higher proportions of children with CP who had seizure disorder in children within 2 years of life than those without CP.

Discussion

Cerebral Palsy (CP) is a major childhood neurological disorder that places a significant burden on families and society, requiring continuous care and substantial financial resources.¹⁴ The literature indicates that CP has multiple causes, with risk factors arising during the antenatal, perinatal, and postnatal periods. This study aimed to assess the association between various maternal and neonatal risk factors and CP among under-5 children in Patiya Upazila of Chattogram. Fifty children with CP (Cases) and

100 age- and sex-matched children without CP (Controls) were recruited. Data on risk factors were collected through a semi-structured questionnaire and analyzed using the Chi-square test and logistic regression.

In this study, a significantly higher proportion of male children (74%) compared to female children (26%) was observed among the 50 Cerebral Palsy (CP) cases, indicating a male predominance in CP risk. This finding aligns with Hagberg et al. who reported a lower risk of CP in females.¹⁵ Similar trends were observed in studies from both Bangladesh and India. Hai et al. found that male children were nearly four times more likely to develop CP than females (OR = 3.986, 95% CI: 1.913–8.306).¹⁶ Hemachithra et al. also reported a male predominance, with males comprising 53% of 70 CP cases.¹⁷

Among the socio-demographic aspects, the present study demonstrated a significantly lower age at delivery among the mother of the CP cases than the mother of healthy controls. However, another study that found opposite results argues that older women are highly vulnerable to obesity, gestational diabetes, gestational hypertension and other conditions that increase the risk of preterm birth, low birth weight, fetal distress, SGA and other abnormal perinatal outcomes.¹⁸

In the current study, the monthly family incomes were similar in cases and controls. This was in agreement with the findings of Hai et al. who reported CP is found across all socioeconomic classes.¹⁶ But there is a controversy regarding the existence of a socioeconomic gradient for cerebral palsy, according to literature.^{13,19,20}

There was more than a two-and-a-half-fold increased risk of developing cerebral palsy among children born to parents with a history of consanguineous marriage [OR: 7.00 (95% CI: 1.78–20.21)]. This finding is consistent with the study by Hai et al. which also reported an elevated risk (OR = 2.634, 95% CI: 0.954–7.274).¹⁶ Consanguineous marriage was identified as one of the top-ranked risk factors for CP in Turkish children compared to other populations.²¹

A significant association between gestational age and the development of CP was also observed. Among the study population, 66% of CP cases were born preterm, compared to only 1% among controls, suggesting that prematurity may lead to perinatal brain damage and subsequent development of CP.

Similar associations were reported by Hai et al. and Hemachithra et al.^{16,17}

Furthermore, a strong association between low birth weight and CP development was noted. Birth weight is a critical predictor of an infant's survival and neurological outcomes. Literature has consistently shown that the lower the birth weight, the higher the risk of infant mortality and neurological impairments. This association was well supported by earlier studies conducted by Wilcox et al. and Johnson, who found a significantly higher rate of CP among low birth weight infants.^{22,23}

Various neonatal complications were significantly associated with Cerebral Palsy (CP) in the present study. Birth asphyxia emerged as one of the key perinatal risk factors. This finding aligns with the study by Hemachithra et al., in which 34 out of 70 CP cases had a history of birth asphyxia compared to only six in the control group, indicating an independent association with CP development.¹⁷ In the current study, 49 out of 50 CP cases had a history of seizures in the neonatal period, while no such history was reported among the controls, highlighting a strong association between neonatal epilepsy and CP. This observation is consistent with findings from recent studies, including that of Hemachithra et al.¹⁷ Furthermore, a significant relationship was found between postnatal complications within the first two years of life and the risk of developing CP. Hai et al. similarly reported a strong association between early postnatal illnesses and CP.¹⁶ Severe infections such as meningitis and encephalitis during this period can cause lasting brain damage, leading to a spectrum of disabilities including hearing loss, intellectual disability and cerebral palsy.²⁴

Limitations

This study has several limitations. A major constraint was the reliance on parental recall and the unavailability of complete medical records, which may have introduced recall bias. The relatively small sample size also limits the generalizability of the findings. Being a hospital-based study, it included only children with cerebral palsy who attended the outpatient department, potentially missing undiagnosed cases in the community. As a retrospective case-control design, it could not establish a temporal relationship between risk factors and outcomes. Additionally,

data collection was based on binary responses (e.g. Yes/no, present/absent) which limited the ability to assess the severity or grade of complications, particularly for neonatal issues such as seizures.

Conclusion

This study concluded that children of the male sex had a higher chance of developing CP than female children. The risk factors such as consanguinity, maternal smoking, home delivery are potentially preventable. The neonatal and postneonatal factors like preterm, low birth weight, neonatal complications and neonatal seizures are mostly manageable by enhancing neonatal care services.

Recommendation

The present study further suggests that the role of government and non-governmental organizations in the prevention of the development of cerebral palsy is also very important.

Disclosure

The author declared to have no conflicts of interest.

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