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Original Article

Comparative Analysis of One-Stage versus Two-Stage Brachio-Basilic Arteriovenous Fistulas

Saklayen SMG¹, Nuzhat R², Polash WA³, Zahan LA⁴, Talukdar P⁵, Eva KR⁶

Abstract

Brachio-basilic arteriovenous fistulas (BBAVFs) are a preferred vascular access option for hemodialysis in patients with end-stage renal disease (ESRD) when the cephalic vein is unsuitable. Both the one-stage and two-stage BBAVF techniques offer distinct advantages and are widely practiced, but their comparative outcomes remain under debate. This study aims to compare the clinical outcomes of one-stage versus two-stage BBAVF creation in patients with ESRD. This prospective, randomized interventional study was conducted at the Vascular Surgery Department of Ibrahim Cardiac Hospital & Research Institute, Dhaka, from January 2021 and June 2024. A total of 64 ESRD patients who met the inclusion criteria were randomly assigned into two equal groups (n = 32 each) to undergo either one-stage or two-stage BBAVF creation. Preoperative evaluations included clinical assessment, laboratory tests, and duplex ultrasonography. The outcomes assessed included primary and secondary patency, complication rates, early postoperative discomfort, and vascular parameters, with consideration of baseline characteristics. Baseline characteristics were comparable between the two groups. The two-stage group demonstrated

significantly higher primary patency (96.9% vs. 81.3%; $p = 0.045$), while secondary patency rates were identical (90.6%) in both groups. However, the two-stage technique was associated with significantly higher rates of venous hypertension ($p = 0.020$) and steal syndrome ($p = 0.039$). Early postoperative pain was significantly lower in the one-stage group ($p = 0.001$). No significant differences were found between the groups regarding postoperative vein diameter, depth, or volume flow. Although the two-stage BBAVF technique offers superior primary patency, it carries a higher risk of complications. In contrast, the one-stage approach provides comparable long-term outcomes with less early postoperative pain. These findings highlight the need to individualize the choice of technique based on patient anatomy, comorbidities, and surgical expertise.

Keywords: One-stage, two-stage, brachio-basilic arteriovenous fistula, end-stage renal disease

INTRODUCTION

An arteriovenous fistula (AVF) is a surgically created connection between an artery and a vein, commonly used for vascular access in hemodialysis patients. The concept of AVFs dates back to the early 20th century,^{1,2,3} with their clinical use for dialysis first introduced in 1960 by Belding Scribner and Wayne Quinton.^{2,3} Since then, AVFs have become the preferred method of vascular access due to their superior long-term patency and lower complication rates compared to other options such as grafts or central venous catheters.⁴

Over recent decades, advances in AVF techniques and surgical strategies have significantly improved the safety, effectiveness, and durability of hemodialysis access.¹⁻⁷ These developments have contributed not only to better patient outcomes in nephrology but have also influenced broader applications in vascular surgery and revascularization procedures.^{1,5}

AVFs can be created at either distal or proximal sites of the body.^{5,6} Proximal AVFs, such as the brachio-basilic arteriovenous fistula (BBAVF), are often used when superficial veins are unsuitable or have been exhausted. BBAVF creation can be performed via two main approaches: the one-stage and the two-stage technique. However, the optimal method remains a subject of ongoing debate.^{3,4,7}

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The brachiobasilic arteriovenous fistula (BB-AVF) is currently a primary method for establishing AVFs in dialysis patients.⁸ The BB-AVF procedure can be performed using either a one-stage or two-stage technique.⁹ However, the choice between these techniques remains debated.

The one-stage method is criticized for its long incision and extended operation time, which may increase the risk of wound-related complications.^{11,12} Conversely, the two-stage technique is considered less complex, offering higher vascular patency rates and fewer complications around the wound.^{9,12,13} The debate over brachiobasilic arteriovenous fistulas (BB-AVF) often centers on the choice between one-stage and two-stage techniques.

The one-stage procedure involves creating a fistula between the basilic vein and the brachial artery in a single operation.^{9,11,13,14} This requires a long incision to access and mobilize the basilic vein, ensuring the anastomosis is not under tension and that no significant proximal stenosis is present. The main advantage of the one-stage technique is the shorter wait time for cannulation and the cost-effectiveness, as it involves only one hospital visit.¹⁴⁻¹⁸ However, the technique's drawbacks include a lengthy incision that takes longer to heal and a higher risk of wound-related complications, as well as a more complex procedure. Additionally, a study by Anaya-Ayala et al. found that only 66% of patients have a "normal" basilic vein, with the remaining 34% having an "abnormal" variant that could negatively affect the fistula's maturation.^{14,17,19}

The two-stage procedure allows the basilic vein to undergo arterialization, making it more resistant to torque and easier to mobilize in the subsequent operation as it becomes a larger, stronger structure. This approach aims to reduce operative difficulty and complications while improving patency rates.^{20,21}

Previous studies have produced conflicting results regarding the comparative efficacy and safety of these two techniques. Some suggest higher primary patency and fewer wound complications with the two-stage approach, while others highlight the cost-effectiveness and faster usability of the one-stage method. Additionally, anatomical variations in the basilic vein may impact fistula maturation, as noted by Anaya-Ayala et al., who found that approximately one-third of patients may have aberrant vein anatomy, complicating the outcome.¹⁷

Given the ongoing uncertainty, this prospective study was designed to compare the one-stage and two-stage BBAVF techniques with respect to primary patency, secondary patency, complication rates, and early postoperative outcomes, aiming to provide clearer evidence to guide surgical decision-making in patients requiring durable hemodialysis access.

MATERIALS AND METHODS

This prospective, randomized, interventional analytical study included patients with end-stage renal disease (ESRD) who underwent brachio-basilic arteriovenous fistula (BBAVF) creation using either a one-stage or two-stage technique. The study was conducted in the Department of Vascular Surgery at Ibrahim Cardiac Hospital & Research Institute, Dhaka, from January 2021 to June 2024. Inclusion criteria consisted of all ESRD patients undergoing BBAVF creation by either the one-stage or two-stage technique. Exclusion criteria were: (i) presence of a suitable cephalic vein for arteriovenous fistula creation, (ii) brachial artery diameter <3 mm as assessed by duplex ultrasonography (DUS), (iii) evidence of brachial artery disease on DUS, and (iv) basilic vein diameter <3 mm on DUS. All patients underwent a comprehensive preoperative assessment, including medical history (age, sex, comorbidities such as diabetes, hypertension, and cardiovascular disease), smoking status, chronic kidney disease (CKD) stage, and previous dialysis access.

A detailed clinical examination was performed, including assessment of both upper limbs for visible basilic veins and chest wall veins (suggestive of central venous stenosis or occlusion), and evaluation for signs of arterial insufficiency. Neurological status (motor and sensory) was also assessed. The examination further included evaluation for upper limb edema, dermatological lesions, surgical scars, aneurysms or pseudoaneurysms, and musculoskeletal abnormalities. Laboratory investigations included complete blood count, international normalized ratio (INR), serum sodium and potassium, urea and creatinine levels, and viral serology. Preoperative duplex ultrasonography (DUS) was used to assess: (i) Patency, diameter, depth, and length of the basilic vein (ii) Presence of basilic vein confluence with brachial vena comitans or axillary vein (iii) Distance between the basilic vein and brachial artery (iv) Patency and diameter of the brachial artery (v) Arterial flow velocity and waveform characteristics and (vi) Patency of the ipsilateral internal jugular and subclavian veins.

Patients were randomized into two groups using computer-generated random numbers. **Group I –**

One-Stage BBAVF (n = 32): Patients received local anesthesia, supraclavicular nerve block, or general anesthesia. A longitudinal incision was made from the antecubital fossa to the axilla. The basilic vein was dissected, and all tributaries were ligated using 3-0 or 4-0 Vicryl ties. After adequate mobilization, the distal end of the basilic vein was ligated and transected at the antecubital fossa. A subcutaneous tunnel was created laterally, and the vein was transposed without sharp angulation or torsion. After systemic heparinization, the brachial artery and basilic vein were clamped. End-to-side anastomosis was performed, and a suction drain was placed before layered wound closure. **Group II – Two-Stage BBAVF (n = 32):** This group underwent two-stage BBAVF, performed in two distinct surgical phases. In the **first stage**, under local anesthesia, a longitudinal or transverse incision was made at the antecubital fossa. The basilic vein and brachial artery were dissected and mobilized. Tributaries were ligated, the basilic vein was transected distally, and an end-to-side anastomosis with the brachial artery was performed after heparinization. The skin incision was then closed. After six weeks, the **second stage** involved superficialization of the basilic vein. A longitudinal incision was made from the antecubital fossa to the axilla, and the basilic vein was dissected along its entire course. Tributaries were ligated with 3-0 or 4-0 Vicryl. The medial cutaneous nerve of the forearm was sacrificed if it crossed the vein. The vein was elevated into a surgically created flap between the deep fascia and subcutaneous tissue. A suction drain was inserted, and layered closure was performed.

Postoperative Protocol: All patients were advised to perform handgrip exercises using a rubber ball to enhance fistula maturation. Patients were instructed to avoid blood pressure measurement, intravenous cannulation, and central venous catheter placement in the ipsilateral limb. Weekly clinical follow-ups and a duplex scan at 6 weeks postoperatively were scheduled to assess fistula maturation.

Study Endpoints: *Primary endpoints* included (i) Maturation of the basilic vein at 6 weeks postoperatively (in one-stage group) assessed by DUS (ii) Suitability of the vein for hemodialysis (iii) Maturation after the first stage in the two-stage group (iv) Primary failure rate and (v) Primary and secondary patency rates over a 6-month period. *Secondary endpoints* included complications such as bleeding, infection, thrombosis, aneurysm formation, distal limb ischemia, and venous hypertension.

Statistical Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 25.0 (SPSS Inc., Chicago, IL,

USA). Results were expressed as mean $\pm$ standard deviation (SD). A **P-value ≤ 0.05** was considered statistically significant; **P ≤ 0.001** was considered highly significant; **P > 0.05** was considered not significant.

Operational Definitions

Primary fistula failure: Failure within 72 hours of surgery

Primary patency: Time from access creation to first thrombosis or intervention to restore flow

Assisted primary patency: Time from access creation to thrombosis with or without intervention

Secondary patency: Time from access creation to access abandonment, including all interventions

RESULTS

Table I presents the baseline demographic and clinical characteristics of patients in the one-stage (n = 32) and two-stage (n = 32) BBAVF groups. No statistically significant differences were found between the groups in terms of age, sex distribution, presence of diabetes mellitus, hypertension, smoking status, cardiac disease, limb side, or vascular measurements (basilic vein diameter, brachial artery diameter, and blood flow velocity). This indicates that the groups were comparable at baseline.

Table- I: Baseline demographic and clinical characteristics of patients (n = 64)

Variables	One Stage (n=32)	Two Stages (n=32)	P value
Age in years (Mean $\pm$ SD)	49.31 $\pm$ 14.62	50.62 $\pm$ 17.11	0.743
Sex	Male	18(56.2%)	17(53.1%)
	Female	14(43.8%)	15(46.9%)
DM	10(31.3%)	8(28.1%)	0.784
HTN	14(43.8%)	16(50%)	0.616
Smoking	6(18.8%)	2(6.3%)	0.131
Cardiac Disease	10(31.3%)	13(40.6%)	0.434
Side of the upper limb			
Right	18(56.3%)	15(46.9%)	0.211
Left	14(43.8%)	17(53.1%)	
Diameter of Basilic Vein (mm)	3.56 $\pm$ 0.25	3.45 $\pm$ 0.23	0.058
Diameter of Brachial Artery (mm)	4.28 $\pm$ 0.31	4.19 $\pm$ 0.27	0.238
Velocity of Blood in Brachial Artery (cm/s)	54.84 $\pm$ 3.13	54.56 $\pm$ 2.79	0.706

Table II summarizes the postoperative vascular parameters of the basilic vein. While the one-stage group showed slightly higher mean vein diameter and lower depth from the skin, these differences were not statistically significant. Similarly, there was no significant difference in the volume flow of blood through the basilic vein between the two groups.

Table- II: Postoperative Characteristics of the Basilic Vein (n = 64)

Variables	One Stage (n=32)	Two Stages (n=32)	P value
Diameter of Basilic Vein (mm)	7.13±0.51	6.90±0.46	0.058
Depth of the basilic vein from the skin(mm)	4.12±0.33	4.38±0.32	0.297
Volume flow of blood within basilic vein (ml/min)	757.78±55.49	737.78±56.84	0.173

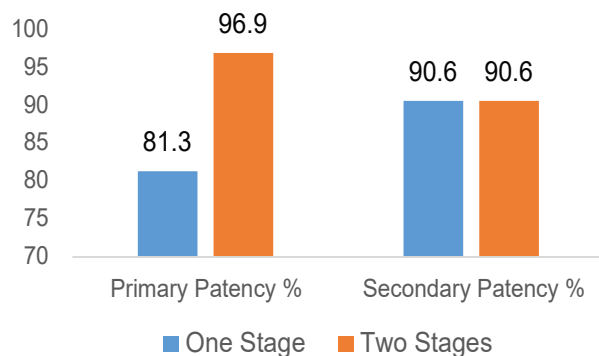


Figure- 1: Primary and secondary patency among both groups (n=64)

Figure 1 illustrates a comparison of primary and secondary patency rates between the one-stage and two-stage groups. The two-stage group demonstrated higher primary patency, whereas secondary patency rates were identical in both groups. The visual presentation supports the quantitative findings detailed in the results section.

Table III outlines postoperative complications observed in both groups. Although the overall complication rate was higher in the two-stage group, the difference was not statistically significant. Notably, the incidence of steal syndrome ($p = 0.039$) and venous hypertension ($p = 0.020$) was significantly higher in the two-stage group. Other

complications such as bleeding, infection, thrombosis, and pseudoaneurysm formation did not differ significantly between groups.

Table- III: Complications among both groups (n=64)

Variables	One Stage (n=32)	Two Stages (n=32)	P value
Complication overall	13(40.6%)	17(53.1%)	0.316
Bleeding	3(9.4%)	7(21.9%)	0.391
Infection	2(6.3%)	4(12.5%)	0.391
Thrombosis	5(15.6%)	2(6.3%)	0.230
Pseudoaneurysm formation	3(9.4%)	5(15.6%)	0.450
Steal Syndrome	0(00)	4(12.5%)	0.039
Venous Hypertension	0(00)	5(15.6%)	0.020

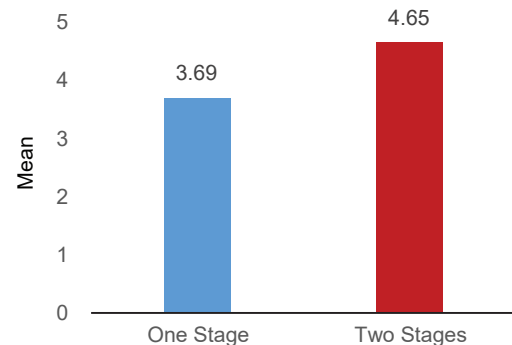


Figure- 2: Comparison between both groups according to early post-operative pain (n=64)

Figure 2 displays the comparative levels of early postoperative pain between the one-stage and two-stage groups, as assessed using a visual analog scale. The one-stage group reported significantly lower pain scores ($p = 0.001$), suggesting a clinical advantage in terms of early postoperative comfort.

DISCUSSION

Brachio basilic AVF (BBAVF) can be established using two primary techniques: the transposition technique, where the entire length of the basilic vein is mobilized and repositioned anterolaterally under a subcutaneous flap, or the elevation technique, where the vein is elevated superficially without full mobilization into the surgically recreated deep fascia and subcutaneous tissue on the medial arm. BBAVF creation typically follows one of two approaches: a one-stage or a two-stage operation. The

one-stage procedure involves creating an anastomosis between the basilic vein and brachial artery, followed by vein elevation or transposition within a single surgery, which may reduce infection and anesthetic risks but involves extensive dissection, potentially posing higher risks for patients with immature fistulas. The two-stage procedure, on the other hand, allows for vein maturation before further intervention, resulting in a more palpable and less vulnerable vein that is easier to superficialize, though it increases costs and may elevate the risks of infection and anesthesia due to requiring two surgeries. Additionally, the assumption that the fistula has matured before the second stage is uncertain, as maturity can only be confirmed through cannulation.²³

This study shows the average age was 49.31 ± 14.62 years in one stage and 50.62 ± 17.11 years in two stage. Maximum 35 patients were male and 29 were female. This findings consistent with previous studies Lebda et al.¹⁸ Similar study Ozcan et al.²⁴ conducted a nonrandomized retrospective study involving 96 patients with end-stage renal disease, with an average age of 43.6 ± 14 years. The study included 54 male and 42 female patients, who underwent either a one-stage or two-stage technique for BBAVF creation.

This study found no statistically significant difference between both groups regarding age, sex, smoking, diabetes, hypertension, and cardiac condition ($P > 0.05$). These findings are well agreement with other study.¹⁸ Another study Ozcan et al.²⁴ reported no statistically significant differences between the two groups in terms of age, sex, and the number of previously performed fistulae. Additionally, there were no significant differences between the groups concerning risk factors such as smoking, diabetes, hypertension, cardiac diseases, and peripheral vascular diseases.

In terms of the side of the limb, our study found no statistically significant difference between the two groups ($P = 0.211$), which aligns with the findings of Tan et al.²⁵ who reported similar results ($P = 0.915$). Another study¹⁸ also concluded that there was no statistically significant difference between the groups regarding the limb side ($P = 0.284$).

This study found no statistically significant difference in overall complication rates between the two groups (40.6% vs. 50%, $P = 0.316$), a finding consistent with other research. Hosny²⁶ reported a significantly higher complication rate in the two-stage elevation group

compared to the one-stage transposition group (71.4% vs. 28.6%, $P < 0.001$), while Kakkos et al.²⁷ observed the opposite, with a higher complication rate in the one-stage group compared to the two-stage group (43% vs. 11%, $P < 0.001$). Vrakas et al.²⁸ also found no statistically significant difference in complication rates between the two groups ($P = 0.715$).

Ozcan et al.¹⁸ identified a statistically significant difference between the two groups concerning bleeding. However, in this study, no statistically significant difference was observed between the groups regarding postoperative bleeding ($P = 1.000$).

Dilege et al.²⁹ reported an infection rate of 7%, which is consistent with the findings of this study, where the postoperative infection rate was 7.1% in both groups.

Ozcan et al.²⁴ found that the aneurysm formation rate was 4% in the one-stage group and 5% in the two-stage group, with no significant difference between them. In contrast, this study reported a pseudoaneurysm formation rate of 9.4% in the first group and 15.6% in the second group, also with no statistically significant difference between the two groups.

Ozcan et al.²⁴ reported that the rate of steal syndrome was 8% in the one-stage group and 11% in the two-stage group, with no statistically significant difference. In contrast, this study found no cases of steal syndrome in the first group, while the rate was 12.5% in the second group, which was also statistically insignificant.

In this study, the thrombosis rate was 15.6% in the first group and 6.3% in the second group, with no statistically significant difference found. These results align with previous findings. Ozcan et al.²⁴ reported a thrombosis rate of 34% in the one-stage group and 23% in the two-stage group, which was statistically significant. Vrakas et al.²⁸ found that the two-stage technique had a significantly higher primary patency rate compared to the one-stage technique at both 1 year (71% vs. 87%, $P = 0.034$) and 2 years (53% vs. 75%, $P = 0.034$). They also observed that the two-stage technique had a notably better secondary patency rate at 1 year (79% vs. 95%, $P = 0.026$) and 2 years (57% vs. 77%, $P = 0.026$).

This study found that the two-stage group had a higher primary patency rate (96.9%) compared to the one-stage group (82.6%) at the 6-month mark, though this difference was not statistically significant ($P = 0.084$). However, both groups had identical secondary patency rates of 92.9% after 6 months ($P = 1.00$).

This study observed that the average time to first use was 45.7 ± 1.24 days for the one-stage technique and 57.16 ± 1.76 days for the two-stage technique, with no statistically significant difference found ($P=0.0648$). In contrast, Kakkos et al.²⁷ reported a significantly shorter mean time to first cannulation for the one-stage technique (68 days) compared to the two-stage technique (132 days) ($P=0.001$).

Kakkos et al.²⁷ found that only one patient in the two-stage group developed ischemic monomelic neuropathy, which necessitated fistula ligation prior to the completion of the second stage.

In this study, the mean visual analog score for early postoperative pain was 3.69 ± 1.09 in the one-stage group and 4.65 ± 1.07 in the two-stage group, with no statistically significant difference ($P=0.001$). Similarly, Lebda et al.¹⁸ reported a mean visual analog score of 3.6 ± 1.4 for the one-stage group and 4.75 ± 1.2 for the two-stage group, also finding no statistically significant difference ($P=0.428$).

Limitations of the study

One strength of this study is its prospective, randomized design; however, the relatively modest sample size may limit the generalizability of the findings. Additionally, while the short-term follow-up provides valuable early outcome data, a longer follow-up period would be beneficial to more comprehensively assess long-term patency and complication rates. Future studies with larger cohorts and extended observation periods are recommended to validate and expand upon these findings.

CONCLUSION

This study reveals that the two-stage BBAVF technique demonstrated superior primary patency; however, it also exhibits a higher occurrence of certain complications and delayed usability. In contrast, the one-stage technique, despite slightly lower patency rates, leads to reduced early postoperative pain and a quicker time to initial use. Both techniques yielded similar results regarding secondary patency and overall complication rates suggesting that the choice of approach should be customized according to patient risk factors, surgical expertise, and institutional preferences.

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Original Article

Comparative study between USG and CT scan in the diagnosis of renal stones

*Rahman S¹, Hossain F², Chowdhory MA³, Rahman MH⁴

Abstract

There is no consensus on which imaging method is more appropriate for people with suspected nephrolithiasis, computed tomography (CT) or ultrasound. In regular clinical practice, ultrasonography can be a useful alternative of CT for evaluating suspected nephrolithiasis, as suggested by the new study. Despite not being as sensitive as CT, USG provides equivalent accuracy while exposing patients to less cumulative radiation and reducing the number of high-risk diagnoses with consequences. This cross-sectional analytical study was carried out from May 2022 to May 2023 in the Department of Urology in collaboration with Department of Radiology and Imaging at Bangabandhu Sheikh Mujib Medical University (BSMMU), Bangladesh to compare the USG and CT scan methods in the diagnosis of renal stone. In this study a total of 206 suspected cases of nephrolithiasis were enrolled initially from outpatient department (OPD), among them 160 cases were primarily diagnosed with renal stones and 46 without renal stones by physical examinations and x-ray. Then 206 suspected cases were scheduled for USG and CT scans to confirm the stone after obtaining consent. A data collection questionnaire was used to record the detailed history of these patients, including USG and CT scan reports. The statistical package for social sciences (SPSS) version 21.0 were used to analyze the data. Study found that male-female ratio was 1.61:1; where male was 61.7%. More than half (54.4%) patients were young/ early adults (21–40 years) and 45.6% of them was in middle age group (41–60 years). Calcium oxalate was the most prevalent type of stone, followed by calcium phosphate (38.1%), cysteine (5.6%), and uric acid (3.8%). Out of 206 suspected cases, 160 patients were

accurately diagnosed with renal stones and 46 diagnosed without renal stone. Among the diagnosed renal stone patients 138 were positive and 22 were negative in the USG, with 138 being true positive and 22 being false negative. In 46 patients who were diagnosed without renal stone, 36 were found to be negative and 10 were found to be positive in USG, with these cases being true negative and false positive respectively. Out of the 160 patients diagnosed with renal stones, 148 were diagnosed positive and 12 were negative on CT scan, these were true positive and false negative cases. In 46 patients who were diagnosed without renal stone, 37 were labeled as negative and 9 were labeled as positive on CT scan, these were true negative and false positive cases respectively. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy of USG in diagnosis of renal stone were 86.3%, 78.3%, 93.2%, 62.1% and 84.5% respectively. Whereas sensitivity, specificity, PPV, NPV and accuracy of CT scan in diagnosis renal stone were 92.5%, 80.4%, 94.3%, 75.5% and 89.8% respectively. The study found that both imaging modalities USG and CT scan were effective in diagnosing renal stones. However, CT scan results were better, so USG should be considered if CT is not available.

Keywords: Renal stone, CT scan and ultrasonography.

INTRODUCTION

Renal calculi are a prevalent issue globally. Its rising prevalence is exerting a substantial economic burden on both emerging and industrialized countries. Renal stone formation is typically attributed to the crystallization of minerals in urine, which serve as a nucleus for further sedimentation and ultimately lead to the development of a kidney stone.¹ Calculi result from the aberrant accumulation of specific substances such as oxalate, phosphate, and uric acid. These calculi may be located in the kidney, urethra, or urinary bladder. Renal stones have been linked to systemic disorders such as Type 2 diabetes mellitus, obesity, dyslipidaemia, and hypertension.² Lifestyle and environmental variables play a substantial role in their development. The presentation of renal colic is prevalent; hence treatment is administered promptly. In the absence of preventive interventions, almost 50% of renal stones may recur.³

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Individuals with renal calculi often necessitate immediate or emergency medical attention due to intense pain.⁴ The preliminary assessment often includes laboratory tests to evaluate renal function and diagnostic imaging. The predominant imaging technique in the emergency department is non-contrast CT,⁵ favored for adults with suspected renal stones because of its detailed cross-sectional anatomy and superior sensitivity and specificity.⁶ Despite ultrasound's inferior sensitivity and specificity compared to CT,⁷ it effectively detects clinically significant stones and is the preferred initial imaging technique.⁸ A recent randomized experiment investigated clinical outcomes when renal ultrasound was employed as the primary imaging technique for stable patients with suspected renal stones and no clinical signs of sepsis.⁹ The initial renal ultrasound decreased the average radiation exposure by over 50% without any rise in adverse events or alternative high-risk diagnoses compared to CT. A significant proportion of individuals who received initial ultrasonography subsequently underwent CT; yet, the average total expenditures remained lower for those assigned to ultrasonography. This work emphasizes a critical research inquiry: which initial imaging modality was most suitable? Utilizing clinical decision rules, such as the sex, timing, origin, nausea, erythrocytes (STONE) score, to assess the likelihood of symptomatic ureteral stones may diminish unnecessary imaging and radiation exposure from CT in high-risk patients, while allowing for ultrasound or omitting imaging in low-risk patients.¹⁰

Ultrasonography (USG) is a readily available, cost-effective imaging technique that does not involve the dangers associated with ionizing radiation present in CT scans. Denton et al.¹¹ established the ability to detect stones as small as 2 mm using ultrasonic imaging in a porcine model over 30 years ago. Ultrasound can efficiently depict radiopaque and radiolucent calculi, hydronephrosis, renal inflammation, ruptured fornices, ureteric jets, and resistive index, hence providing substantial clinical insights.¹²

Despite the broader accessibility of ultrasound (US) units and heightened bedside application, the nationwide utilization of USG for renal colic remained largely unchanged from 2000 to 2008, whilst the employment of CT scans surged considerably.¹³ A CT scan can evaluate the size and location of the stone as well as the overall health of the kidney, and the stone's density in Hounsfield units can predict its chemical composition.¹⁴ The present study was conducted to compare USG and CT scan in diagnosis of renal stones.

MATERIALS AND METHODS

This cross-sectional analytical study was conducted in the Department of Urology in collaboration with Department of Radiology and Imaging, BSMMU to compare the USG and CT scan methods in the diagnosis of renal stone.

In this study a total of 206 suspected cases of renal stones were enrolled initially from outpatient department (OPD), among them 160 cases were primarily diagnosed with renal stones and 46 without renal stones by physical examinations and x-ray. Then 206 suspected cases were scheduled for USG and CT scans to confirm the stone after obtaining consent. Ethical approval was taken from the institutional review board, and it was in accordance with the Declaration of Helsinki. All patients were informed regarding the study and written consent was taken from each patients. After enrollment in this study, general information such as name, age, gender etc. were recorded. A thorough clinical examination was done. USG Scan and CT scan was done for each patient. All information was recorded in a predesigned questionnaire and later on were feed into computer using SPSS software.

Statistical analyses were performed using SPSS 20.0 software (SPSS, Chicago, IL, USA). Data presented on categorical scale were expressed as frequency and corresponding percentages and were compared between groups using Chi-square test, while data presented on continuous scale were expressed as mean and standard deviation and were compared between groups by using Student's t-Test and p value < 0.05 was taken as statistically significant. Sensitivity, specificity, positive predictive value, negative predictive value of USG and CT scan were calculated.

CT machine

The CT images had been conducted using (TOSHIBA aquilion 64 slices) CT scanner. The scan parameter (3mm slice, 120 kvp, 225 MAS) with using the electronic caliper within the scanner the following diameters were measured. The features of CT scanner are: 256 slices in one rotation with .5mm slice thickness Coverage of 13cm in patient axis direction Advanced Sure Workflow software with PhaseXact, largest couch capacity in the industry – 180cm long by 47cm wide 40% dose reduction compared to previous models.

CT KUB technique

CT KUB (non-contrast enhanced CT of kidney, ureter and bladder) is useful to determine the number and

location of urinary tract calculi. The patient will lie supine on CT scanner table. Scout view will be obtained. A low radiation dose technique will be used to scan from the top of the kidney to the bladder base with slice thickness of 5 mm or less as determine by CT scanner.

USG Machine

GE medical system LOQIC 5 Expert, made by yocogama medical systems. LTD –JAPAN – model 2302650, serial number 1028924, manufactured April 2005, Choice of transducer: -Use 3.5 MHz for adults, curvilinear probe, 5 MHz for children and thin adults. Setting the correct gain: -Start by placing the transducer longitudinal central and at the top of the abdomen (the xiphoid angle). Ask the patient to take a deep breath and hold it in. Angle the transducer beam towards the right side of the patient.

Abdomen USG technique

Patient will be advised not to take anything by mouth for 8 hours preceding the examination. In case of dehydration, only water should be given.

RESULTS

Table I shows demographic characteristics of the study subjects, here male to female ratio was 1.61:1 and male was 61.7%. According to the age distribution; 72 (35.0%) were in age group 31–40 years followed by 52 (25.2%), 42 (20.4%) and 40 (19.4%) were in the age groups of 41–50 years, 51–60 years and 21–30 years respectively. Mean age of the study subjects was 45.28 ± 8.30 years.

Table I: Demographic characteristics of the study subjects (N=206)

	Frequency (n)	Percentage (%)
Age (years)		
21 - 30	40	19.4
31 - 40	72	35.0
41 - 50	52	25.2
51 - 60	42	20.4
Mean $\pm$ SD	40.24 ± 10.48	
Gender		
Male	127	61.7
Female	79	38.3

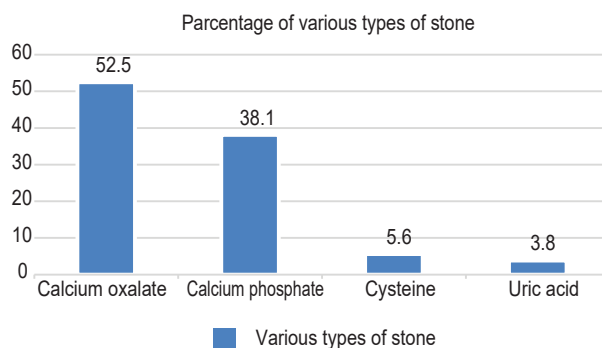


Figure- 1: Various types of stone (N=160)

Figure 1 displays the different types of stones take out from the patients were calcium oxalate (52.5%), calcium phosphate (38.1%), cysteine (5.6%) and uric acid (3.8%)

Table II represents the detection of renal stone by ultrasound imaging; among 160 diagnosed renal stone patients 138 were diagnosed positive and 22 were diagnosed negative in USG, they were true positive and false negative respectively. Among 46 diagnosed without renal stone cases 36 were diagnosed negative and 10 were diagnosed positive in USG, they were true negative and false positive respectively.

Table II: Detection of renal stone by ultrasound imaging (N=206)

Diagnosis of renal stone by USG	Renal stone			
	Present	Absent	Total	p-value
Present	138 (86.3)	10 (21.7)	148 (71.8)	<0.001
Absent	22 (13.8)	36 (78.3)	58 (28.2)	
	160	46	206 (100.0)	

Table III displays the detection of renal stone by imaging with CT scan; among 160 diagnosed renal stone patients 148 were diagnosed positive and 12 were diagnosed negative in CT scan, they were true positive and false negative respectively. Among 46 diagnosed without renal stone cases 37 were diagnosed negative and 9 were diagnosed positive in CT scan, they were true negative and false positive respectively (Table 4).

Table III: Detection of renal stone by imaging with CT scan (N=206)

Diagnosis of renal stone by CT scan	Renal stone			
	Present	Absent	Total	p-value
Positive	148 (92.5)	9 (19.6)	148 (71.8)	<0.001
Negative	12 (7.5)	37 (80.4)	58 (28.2)	
Total	160	46	206 (100.0)	

Table IV contains diagnostic efficacy of USG and CT scan for renal stone sensitivity, specificity, PPV, NPV and accuracy of USG in diagnosis renal stone were 86.3%, 78.3%, 93.2%, 62.1% and 84.5% respectively. Whereas sensitivity, specificity, PPV, NPV and accuracy of USG in diagnosis renal stone were 92.5%, 80.4%, 94.3%, 75.5% and 89.8% respectively

Table IV: Diagnostic efficacy of USG and CT scan for renal stone (N=206)

	USG	CT scant
Sensitivity	86.3	92.5
Specificity	78.3	80.4
Positive predictive value	93.2	94.3
Negative predictive value	62.1	75.5
Accuracy	84.5	89.8

DISCUSSION

In this study, maximum patients were in age group 31 – 40 years (35.0) followed by 41 – 50 years (25.2%), 51 – 60 years (20.4%) and 21 – 30 years (19.4%). Mean age was 45.28 ± 8.30 years. Rajesh and Akhtar¹⁵ revealed that 46.1% patients were in age group 31-40 years followed by 21-30 years (31.6%), 11 – 20 years (15.8%) and >40 years (6.5%).

In this study, maximum study subjects were male 61.7% and 38.3% were female. Male to female ratio was 1.61:1. Similar finding also observed in the study of Rajesh and Akhtar¹⁵ they found males were 57.9% and females were 42.1%. Almost similar finding also observed in the study of Shams et al.¹⁶

Types of stone were calcium oxalate (52.5%), calcium phosphate (38.1%), cysteine (5.6%) and uric acid (3.8%) in this study. Calcium oxalate was prevalent in the study of Rajesh and Akhtar¹⁵, they found calcium oxalate in 43, calcium phosphate in 8, cystine in 21 and uric acid in 4 cases.

In this study, sensitivity, specificity, PPV, NPV and accuracy of USG in diagnosis renal stone were 86.3%, 78.3%, 93.2%, 62.1% and 84.5% respectively. Whereas sensitivity, specificity, PPV, NPV and accuracy of USG in diagnosis renal stone were 92.5%, 80.4%, 94.3%, 75.5% and 89.8% respectively.

The sensitivity of the CT scan was determined to be 95%, whereas the ultrasound exhibited a sensitivity of 92%. The specificity of ultrasound was 91%, while that of computed

tomography was 87% (Rajseh and Akhtar, 2019).¹⁵ Bonigala and Varusai¹⁷ determined that the sensitivity and specificity of ultrasound imaging were 54.0% and 91.0%, respectively. The sensitivity of ultrasound (USG) compared to computed tomography of the kidneys, ureters, and bladder (CT KUB) was 83.7%, while the specificity was 100%.¹⁸ Fowler et al. (2002) noted diminished diagnostic accuracy with sonography, reporting a sensitivity of 24% and a specificity of 90%. The total accuracy of sonography in identifying a stone in the right kidney by radiologists 1 and 2 was 67% and 77%, respectively. The accuracy scores for the left kidney were 53% and 54%, respectively.¹⁹ The sensitivity, specificity, positive predictive value, negative predictive values and diagnostic accuracy of ultrasonography in detecting renal calculi was 74.47%, 96.36%, 94.59%, 81.54% and 86.27% respectively.¹⁶

CONCLUSIONS

According to this study, CT scan show up as preferred imaging modality for urolithiasis over ultrasound because of its higher sensitivity and accuracy than USG in identifying renal and ureteral stones. However, USG is a readily available, cost-effective imaging technique that does not involve the dangers associated with ionizing radiation present in CT scans. CT resulted in better results and hence USG should be considered if CT is not present.

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Original Article

Pneumatic Lithotripsy Versus Laser Lithotripsy in the Endoscopic Treatment of Ureteral Calculi

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Abstract

Ureteroscopy (URS) is a precise, minimally invasive surgical procedure that have emerged as the standard approach for treating large ureteral stones in many medical facilities, owing to their comparatively low complication rates and high success in achieving stone-free outcomes. In the context of ureteroscopic lithotripsy, various types of lithotripters are available, including electrohydraulic, ultrasonic, pneumatic, and laser options. Among these, laser lithotripsy (LL) and pneumatic lithotripsy (PL) are the most commonly utilized methods. The aim of this cross-sectional analytical study was carried out to compare the outcome of LL and PL in the management of ureteric calculi. Over the course of a year (from November 2022 to October 2023), this study was conducted among 96 patients with ureteral calculi in the Department of Urology at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. Following the acquisition of both verbal and written consent from every patient, participants were enrolled in this study. The patients were categorized into two groups: Group A and Group B. Those who underwent procedure LL were placed in Group A, whereas those who received PL were assigned to Group B. A questionnaire was developed to gather data. Each patient was interviewed regarding their medical history and clinical characteristics, which included outcome variables such as the size of the stone, its location, the stone clearance rate, the duration of the procedure, the necessity for the Double J (DJ) method, the length of hospital stay, complications, the frequency of stone retrieval instrument usage, the rate of proximal fragment migration, and the requirement for Extracorporeal Shock Wave Lithotripsy (ESWL). The outcomes of the two procedures

were compared in terms of stone clearance rate, duration of the procedure, requirement for DJ, length of hospital stay, complications, frequency of stone retrieval instrument usage, rate of proximal fragment migration, and necessity for ESWL. The data were analyzed using the statistical package for social sciences (SPSS) version 23.0. The mean age of participants in the LL group was 38.94 ± 9.47 years (range: 21-55), while in the PL group it was 36.46 ± 8.72 years (range: 23-50), with no significant difference ($p > 0.05$). There was a predominance of males in both groups ($p > 0.05$). The LL group had more right-sided stones while the PL group had more bilateral instances ($p > 0.05$). Laser lithotripsy demonstrated less stone migration and DJ stenting, a higher stone-free rate, and shorter operative times compared to pneumatic lithotripsy. Both modalities were effective and safe for proximal ureteric calculus management. The mean size of stones was almost similar in both the LL and PL groups, with no significant difference observed. The stone size measured 10.37 ± 2.45 (ranging from 7.25 to 19.0) mm in the LL group, while it was 9.98 ± 2.26 (ranging from 7 to 17) mm in the PL group. The operative time was significantly short in the LL group compared to the PL group, recorded at 43.35 ± 3.86 minutes versus 55.08 ± 3.79 minutes; $p < 0.05$. The immediate stone-free rate was significantly greater in the LL group (95.8%) compared to the PL group (79.2%). Additionally, stone migration was significantly less in the LL group than in the PL group. The rate of DJ stenting was also significantly lower in the LL group (33.3%) compared to the pneumatic group (54.2%). Although the complication rate was lower in the LL group (2.1%) than in the PL group (12.5%), this difference was not statistically significant. LL exhibited reduced stone migration and DJ stenting, a higher stone-free rate, and shorter operative times when compared to PL. Both procedures proved to be effective and safe for the management of proximal ureteric calculi.

Keywords: Ureteral calculi, laser lithotripsy, pneumatic lithotripsy, DJ stenting.

INTRODUCTION

Urinary tract stones impact a considerable segment of the population. Although men are typically more prone to developing these stones, recent years have shown that the

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occurrence of urinary tract stones in women is approaching that of men. Individuals suffering from urolithiasis often present with comorbid conditions or systemic disorders that facilitate the formation of stones.¹ For example, obesity and chronic diseases such as diabetes are linked to a heightened risk of developing urinary tract stones.² The most prevalent symptom reported by patients is renal colic, commonly referred to as flank pain. This intense pain is often accompanied by nausea and vomiting.³

Renal obstruction may result from ureteral calculi; thus, it is essential to prevent irreversible kidney damage. Conservative management might be considered if the stone measures less than 5 mm in diameter. Conversely, the likelihood of spontaneous passage is considerably reduced for larger and more proximal stones, necessitating intervention. The decisions regarding treatment for ureteral calculi are based on the size of the stone and the associated symptoms. In recent decades, the approach to treating ureteral calculi has evolved significantly, shifting from open ureterolithotomy to less invasive methods such as extracorporeal shock wave lithotripsy, ureteroscopic lithotripsy, and laparoscopic lithotripsy.⁴

Ureteroscopic lithotripsy presents the least number of contraindications, except for severe ureteral strictures that obstruct the effective passage of the scope.⁵ Ureteroscopic procedures have emerged as the standard treatment for large ureteral stones in various centers, attributed to their relatively low complication rates and high stone-free rates. For ureteroscopic lithotripsy, various lithotripters such as electrohydraulic, ultrasonic, pneumatic, and laser are available. Among these, laser lithotripsy (LL) and pneumatic lithotripsy (PL) are the most commonly utilized methods.⁶ There is a growing preference for LL due to its advantages in flexibility and fragmentation.⁷ Conversely, some authors have argued that PL is comparable to LL regarding fragmentation efficiency, with the added benefits of lower costs and ease of installation.⁸ The data comparing the efficacy and safety of LL and PL over the last decade has yielded inconclusive results.⁸⁻¹⁰ In their meta-analysis, Yin et al.¹¹ found that LL exhibited a higher rate of maintaining JJ catheters, a lower migration rate, and a superior stone-free rate compared to PL. LL has been endorsed as a safe, effective, and powerful treatment option for distal ureteral stones. Since 2012, three randomized controlled trials (RCTs) have been published, each featuring a larger sample size and additional insights into complications. Additionally, another RCT on the same subject, published in 2008 by Manohar et al.¹⁰, was identified through a

comprehensive search. The reliability of the findings in the 2013 assessment by Yin et al. when comparing the efficacy and safety of LL and PL was affected by a relatively small patient cohort and the loss of usable data in many of the included studies.

The purpose of this research is to compare the effectiveness of laser lithotripsy (LL) with pneumatic lithotripsy (PL) in the treatment of ureteric calculi.

MATERIALS AND METHODS

Ethical approval was obtained from the institutional review board, adhering to the principles outlined in the Declaration of Helsinki. This study included patients of both genders who had a single ureteral stone measuring between 7-20mm and were aged 18 years or older. Patients who lacked a stone analysis report, had renal failure, presented with multiple stones, experienced difficulties during ureteroscopy, or did not provide consent to participate were excluded from the study.

This study was a cross-sectional analytical study carried out in the Department of Urology at BSMMU, Dhaka, over the course of one year from November 2022 to October 2023. A total of 96 patients with ureteral calculi participated in this research work after providing written consent. Subsequently, the patients were categorized into two groups. Patients in Group A underwent the LL procedure, while those in Group B underwent the PL procedure. Each patient was interviewed to gather their medical history and clinical characteristics. Detailed information was collected from each patient regarding the size and location of the stone, stone clearance rate, duration of the procedure, necessity for DJ stenting, length of hospital stay, complications, rate of use of stone retrieval instruments, rate of proximal migration of fragments, and the requirement for ESWL.

Method of laser lithotripsy:

The preoperative workup included urinalysis, a plain radiograph of kidneys, ureters and bladder (KUB) and ultrasonography (US) of KUB were done. An intravenous urogram (IVU) and non-contrast CT (NCCT) of abdomen was obtained in every patient. Renal parameters were reviewed in all patients. Prophylactic antibiotic (Tab ciprofloxacin/levofloxacin) was given in all patients. All procedures were performed with fluoroscopic guidance. The ureteroscope (8 Fr Karl Storz), fluoroscopy, video monitors and irrigation devices were the same.

After proper position and thorough preparation and under spinal /epidural anesthesia, initial cystoscopy was done using a 20F sheath with passage of a 0.035 guide wire. A 8 Fr Storz rigid ureteroscope was placed through the urethra. When the stone was clearly visible, the laser fiber was advanced through the working channel, directly to the surface of the stone which was facilitated by the red helium- neon tracer light. Holmium: YAG lithotripsy was performed using a LISA Sphinx (LISA laser OHG, Kaltenburg, Germany) Holmium laser unit having a power output range of 1 – 80 watt. A 365 micro meter percu end firing fiber was used with laser settings of a maximum of 1.2 joule and a frequency of not more than 15 Hz. Low frequency setup was helpful for preventing the migration of stone/fragments. Initially a cavity was created on the surface of the stone which was be enlarged using an up-and-down motion. Stone cones or baskets will not be used to prevent stone migration. Sometimes forceps will be used for removal of remaining fragments. A 6Fr (25 cm) D-J stent was kept in situ. After completion of the procedure stone clearance was confirmed by fluoroscopy. Patients with migrated stones or incomplete clearance was undergone ESWL later on. Urethral catheter was removed on 1st POD routinely except few cases who had gross haematuria. In those cases catheter was removed when urine became clear. Injectable antibiotics was given to all the patients then oral antibiotics was continued up to 7th POD. X-ray was done on the 1st POD and after one month of the procedure during the removal of the stent.

Method of Pneumatic lithotripsy (Swiss lithoclast, SLC):

The preoperative workup included urinalysis, a plain radiograph of kidneys, ureters and bladder (KUB) and ultrasonography (US) was done. An intravenous urogram (IVU) and non-contrast CT (NCCT) was done. Renal parameters were reviewed in all patients. Prophylactic antibiotic (Tab ciprofloxacin/levofloxacin) was given to all patients. All procedures were performed with fluoroscopic guidance. After proper position and through preparation and under

spinal /epidural anesthesia, initial cystoscopy was done using a 20F sheath with passage of a 0.035 guide wire. A 8Fr Storz rigid ureteroscope was placed through the urethra. The 0.8mm EMS Swiss lithoclast 2 probe was advanced through the working channel of the ureteroscope and then was fastened with the handle and connected to the air compressor. Air pressure (0-3 bar) will be used and frequency (2-12 Hz) to propel the metal projectile within the hand piece. Forceps/dormia baskets was used for the retrieval of stone fragments. A 6Fr (25 cm) D-J stent was kept in situ. After completion of the procedure fluoroscopy was done to confirm stone clearance. Patients with migrated stones or incomplete clearance was undergone ESWL later on. Urethral catheter was removed on 1st POD routinely or when urine was become clear. Injectable antibiotics was given to all the patients then oral antibiotics up to 7th POD. X-ray was done on the 1st POD and after 1 month of the procedure during the removal of the stent.

Statistical analyses were performed using SPSS 20.0 software (SPSS, Chicago, IL, USA). Numerical data was presented as mean & SD and categorical data was presented as frequency with percentage. Numerical data was analyzed using unpaired t test or Mann Whitney U test and categorical data was analyzed using Chi-Square test or Fisher's exact test. Statistical significance will be considered as $P \leq 0.05$

RESULTS

Table I states the demographic profile of the study subjects; the mean age of the participants was 38.94 ± 9.47 years (ranging 21 to 55 years) in the LL group, while in the PL group it was 36.46 ± 8.72 years (ranging 23 to 50 years). The age difference between the two procedures was not statistically significant. There were 67 males (69.79%) and 29 females (30.21%), resulting in a male-to-female ratio of 2.31:1. In the LL group, there were 32 males (66.7%) and 16 females (33.3%), whereas in the PL group, there were 35 males (72.9%) and 13 females (27.1%). However, the sex differences between the two procedures were not statistically significant.

Table- I: Demographic profile of the study subjects (N=96)

		Total	Laser lithotripsy (n=48)	Pneumatic lithotripsy (n=48)	p-value
Age (years)	Mean $\pm$ SD		38.94 ± 9.47	36.46 ± 8.72	0.185
	Min - max		21 - 55	23 - 52	
Gender	Male	67 (69.79%)	32 (66.7%)	35 (72.9%)	0.505
	Female	29 (30.21%)	16 (33.3%)	13 (27.1%)	

* Unpaired t test and Chi-Square test was done

The patients' stone laterality is shown in Table II; in this case, the PL group had 4 bilateral stones (8.3%) while the LL group had 2 (4.2%). The LL group had 22 (45.8%) and 24 (50.0%) left-sided stones, while the PL group had 23 (47.9%) and 21 (43.8%). Nevertheless, it was not statistically significant.

Table- II: CStone laterality of the study subjects (N=96)

Stone laterality	Laser lithotripsy (n=48)	Pneumatic lithotripsy (n=48)	p-value
Bilateral	2 (4.2%)	4 (8.3%)	0.641
Left	22 (45.8%)	23 (47.9%)	
Right	24 (50.0%)	21 (43.8%)	

* Chi-Square test was done

According to Table III, the mean stone size in the two procedures was 10.37 ± 2.45 (range 7.25-19.0) mm in the LL group and 9.98 ± 2.26 (range 7-17) mm in the PL group; however, there was no discernible difference.

Table- III: Stone size in the two procedure (N=96)

Stone size (mm)	Laser lithotripsy (n=48)	Pneumatic lithotripsy (n=48)	p-value
Mean $\pm$ SD	10.37 ± 2.45	9.98 ± 2.26	0.414
Min - max	7.25 - 19.0	7 - 17	

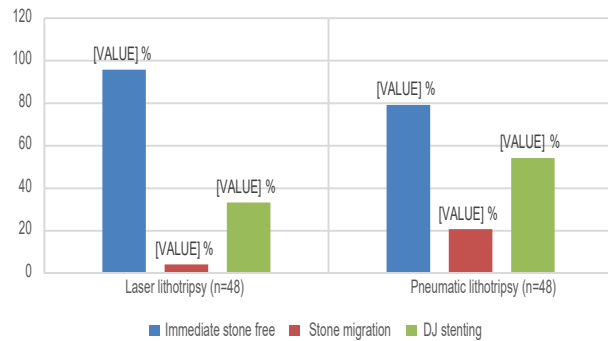
* Unpaired t test was done

The operating time required for the two procedures is shown in Table IV. The mean operative time for the LL procedure was 43.35 ± 3.86 (range 30 to 50) minutes, and for the PL, it was 55.08 ± 3.79 (range 50 to 60) minutes. Operative time was significantly shorter in LL than PL group.

Table- IV: Operating time required in the two procedure (N=96)

Operative time (min)	Laser lithotripsy (n=48)	Pneumatic lithotripsy (n=48)	p-value
Mean $\pm$ SD	43.35 ± 3.86	55.08 ± 3.79	<0.001
Minimum - maximum	30 - 50	50 - 60	

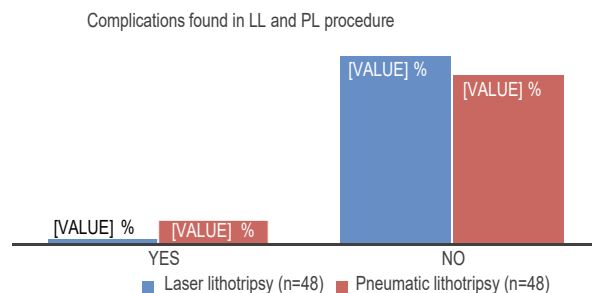
* Unpaired t test was done



* Chi-Square test was done

Figure- 1: Stone free rate in the two procedure (N=96)

Figure 1 depicts the stone-free rate for the two procedures, showing immediate stone-free rates, stone migration, and DJ stenting observed in 95.8%, 4.2%, and 33.3% of patients in the LL group, compared to 79.2%, 20.8%, and 54.2% in the PL group respectively. The stone migration rate was considerably lower in the LL group compared to the PL group. The DJ stenting rate in the LL group was significantly lower compared to the PL group (54.2%).



* Chi-Square test was done

* Chi-Square test was done

Figure- 2: Complications in the two procedure (N=96)

Figure 2 shows the complications in the two procedure; 2.1% of the patients were experienced complication in LL and 12.5% in PL group, but the difference was not statistically significant.

DISCUSSION

Urinary calculus is a common occurrence in the surgical outpatient department. The treatment of ureteric calculus is contingent upon the location, size, density, and obstructive features. A variety of treatment modalities are available. Medical expulsion therapy with alpha-1 antagonists is effective for stones that are less than five millimeters in size. Soft proximal ureteric stones that are less than one

centimeter in size can be treated non-invasively using extracorporeal shockwave therapy.¹² As medical science has advanced, the treatment of urolithiasis has witnessed substantial changes.¹³ Endoluminal surgery is employed to address urolithiasis. In endoluminal surgery, a diverse array of energy sources is employed to crush stones. Pneumatic lithotripsy does have certain limitations, including the migration of stones, notably in the presence of proximal ureteric calculus, despite its affordability and safety.¹⁴ Holmium lasers are the optimal treatment for proximal calculus, as they produce a mild shock wave that impedes calculus migration. It is a consistent source of lithotripter, regardless of the calculus's density and composition.¹⁵ LL is a preferable alternative to PL in terms of SFR, stone migration, DJ stenting, and complication, as our study has shown.

This study demonstrated that the immediate stone-free rate was significantly greater in the laser group (95.8%) compared to the pneumatic group (79.2%). Additionally, stone migration was significantly lower in the laser group (4.2%) relative to the pneumatic group (20.8%). The rate of DJ stenting was also significantly lower in the laser group (33.3%) than in the pneumatic group (54.2%). Furthermore, complications were less frequent in the laser group (2.1%) compared to the pneumatic group (12.5%). Koju et al.¹⁶ demonstrated that laser lithotripsy outperformed pneumatic lithotripsy for immediate stone-free rate (99.05% vs 76.19%; $p < 0.001$), stone migration rate (0.95% vs 14.29%; $p < 0.001$), DJ stenting (69.52% vs 87.62%; $p < 0.001$), and complications (1.90% vs 9.52%; $p < 0.017$). Islam et al.¹⁷ (2021) disclosed nearly identical findings. Razzaghi and Razi¹⁴ documented a 100% instantaneous stone-free rate in the LL arm ($N=12$) and a 42.9% rate in the PL arm ($N=14$), $p=0.001$; there was no migration in the LL arm, while migration occurred in 57.1% of cases in the PL arm for upper ureteric calculus.

Bapat et al.¹⁸ documented a superior stone-free rate in the LL arm (97.01% versus 86.01%) and a reduced incidence of auxiliary procedures in the LL arm (1.99% versus 13.98%) for proximal ureteric calculi. Garg et al.¹⁹ observed a significantly greater immediate stone-free rate in the LL arm ($p=0.001$) alongside a notable stone migration rate in the PL arm (16%). The findings of these investigations aligned with this study. Akdeniz et al.⁸ documented an 89.9% success rate in the PL group and an 87.9% success rate in the LL group, $p=0.791$. Irer et al.²⁰ showed comparable complication rates in the PL and LL groups; however, there was a higher incidence of proximal

migration in the PL group. Rabani et al.²¹ documented a stone-free rate of 79.31% in the LL arm and 77.96% in the PL arm, $p=0.52$.

In this study operative time also shorter in laser group than pneumatic group (43.35 ± 3.86 vs 55.08 ± 3.79 ; $p < 0.001$). Similar finding also observed in the study of Islam et al.¹⁷ (2021), Guzel et al.²² (2015) and Sun et al.²³ (2001).

CONCLUSION:

The Laser Lithotripsy group had less stone migration, decreased need for DJ stenting, and a higher stone-free rate compared to the Pneumatic Lithotripsy group. The operative duration was shorter in the laser group compared to the pneumatic group. Both techniques were successful and safe for the therapy of proximal ureteric calculi.

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Original Article

Associated Factors of Thalassemia and Thyroid Status of Thalassemic Patients

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Abstract

Thyroid dysfunction in thalassemia leads to the production of insufficient thyroid hormone which is responsible for various complications. Therefore, this study aimed to investigate the thalassemia related variables and thyroid status in the thalassemic patients. Data were collected from 138 thalassemia patients by using the questionnaire formulated after a detailed review of formerly published relevant literature. Statistical analysis was performed by using SPSS (v20, Inc., Chicago). An alpha level of 0.05 or less was considered as significant at 95% confidence interval. Around 76.1% of the patients were Hb E β -thalassemia patients including β -thalassemia major patient, β -thalassemia trait and Hb E trait and others (12.3%, 5.8%, and 2.9% respectively). History of blood transfusion had in 92% of patients. About 88% of these transfused respondents got frequent blood transfusion for the last 6 months. Iron chelator was prescribed in 58% patients either deferasirox (28.3%) or deferiprone (29.7%). Patients had the mean serum ferritin and hemoglobin level of 1682.43 ($\pm$ 1752.61) ng/dl and 7.81($\pm$ 1.52) g/dl respectively. We found a strong correlation of transfusion dependency, interval between blood transfusions, iron chelator using and serum ferritin control with the thyroid status. The study also revealed that non-transfusion dependent and iron chelator independent respondents were less likely to develop hypothyroidism ($\chi^2 = 9.81$; $p = 0.002$ and $\chi^2 = 8.424$; $p = 0.004$, respectively). Hypothyroidism was more common in respondents with frequent blood transfusion compared with that of others ($\chi^2 = 11.276$; $p = 0.003$) and in respondent with bad control of serum ferritin than the respondents with good control ($\chi^2 = 13.929$; $p < 0.001$). The present study explored various thalassemia related factors including transfusion dependency, interval between blood transfusions, iron chelator using and serum ferritin control with the thyroid status. Further study is required to support our findings.

Keywords: *Thyroid status, thalassemia, hypothyroidism.*

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INTRODUCTION

Thalassemia is the most common monogenic blood disorder in the world.¹ It represents a group of recessively inherited hemoglobin disorders characterized by deficient synthesis of hemoglobin chains.² About 330000 babies are estimated to born each year with clinically significant hemoglobin disorder, 60000-70000 with severe form of thalassemia. Nearly 80% of these births occur in developing countries. Annually over 9 million carriers become pregnant, among which 1.7 million pregnancies both partners are carrier. As a result, 1.33 million pregnancies are at risk for a thalassemia major condition. In Southeast Asian region about 23000 conceptions are annually affected with thalassemia.³ Bangladesh lies in the world's thalassemia belt but the information on epidemiology, mortality, complication and treatment outcome of thalassemia is lacking. The only published report on the prevalence of thalassemia showed 4.1% β thalassemia trait and 6.1% Hb-E trait among school children in Bangladesh. According to this study annually 1040 baby with β thalassemia and 6443 babies with E-beta thalassemia are born in our country.⁴

During this prolonged life thalassemic patients are suffering from various complication mainly caused by iron overload. Iron overload, if not treated properly, can lead to the most common thyroid gland complications.⁵ The commonest form of thyroid dysfunction found in thalassemia is primary hypothyroidism which leads to insufficient production of thyroid hormone.⁶ Thyroid hormones, thyroxine (T4) and triiodothyronine (T3) are the key regulator of metabolism and development of different organs, particularly of bone and central nervous system. They also help the regulation of lipids and protein breakdown in muscle, increase absorption of carbohydrate from intestine and increase dissociation of oxygen from hemoglobin. The hormone, mainly T3, regulates virtually every anatomic and physiologic component of cardiovascular system and acts on liver, adipose tissue, skeletal muscle and pancreas, influence plasma glucose level, insulin sensitivity and carbohydrate metabolism.⁷

Patients with optimally treated thalassemia can now enjoy a near-normal life and lifestyle and experience regular

physical and emotional development from childhood to adulthood. Leading a normal life is an often-expressed priority for patients. This includes social integration, connecting and interacting with people and contributing to society, despite counter forces that the disease and its treatment bring, which can lead to isolation and in some society's stigmatization. Global public health efforts alongside advances in medical management surely translated into prolonged survival and lower morbidity in patients with thalassemia. Despite these favorable effects, the burden of regular therapy poses a negative impact on patients' health-related quality of life.⁸

MATERIALS AND METHODS

Study design and study population

This cross-sectional study was conducted to find out the thyroid status among the thalassemic patients between January 2019 and December 2019. The total participants were 138 thalassemic patients. All the participants willingly joined in this study providing written consent and the study protocol was permitted by the department of Epidemiology, National Institute of Preventive and Social Medicine (NIPSOM), Banghobandhu Sheikh Mojibur Rahman Medical University [NIPSOM/IRB/2019/111].

Design and formulation of questionnaire

The questionnaire was designed after a detailed review of formerly published relevant literature. In accordance with the study objectives, some novel questions were developed. The questionnaire consisted of three sections which cover adequate information regarding demographic and socio-economic information, thyroid status, and thalassemia related problems.

Data collection

Data were collected by face to face interview, observation and record review. Socio demographic information, history of diagnosis and blood transfusion, some physical symptoms related to thyroid disorder were collected by face to face interview in the presence of expert physician. Data about current medication was collected from prescription. Data of serum ferritin, TSH and hemoglobin were collected by reviewing medical report. Height and weight were measured by measuring tape calibrated in centimeter and carry manual weighing scale respectively. During interview, privacy of the respondents was maintained as far as possible. All data were collected in the presence of

physicians and nurses. Hospital record files were also checked to clarify the collected data. The patient who were willing to participate and fulfilled the selection criteria were taken as samples. Patients from both male and female who were at least 8 years of old were included in the study. However, mentally disabled and severely ill patients were excluded from the study.

Inclusion and exclusion criteria

Patients with thalassemia having thyroid problems were included in the present study. The patient who were willing to participate and fulfilled the selection criteria were taken as samples. Patients from both male and female who were at least 8 years of old were included in the study. However, mentally disabled and severely ill patients were excluded from the study.

Statistical analysis

All data obtained were entered into a Microsoft Office Excel 2010 spreadsheet and exported for analysis using SPSS software version 20.0 (SPSS Inc., Chicago, IL., USA). The p values were calculated by chi-square test. An alpha level of 0.05 or less was considered as significant at 95% confidence interval.

RESULTS

Socio-demographic profile

Table I depicts the socio-demographic profile of all volunteers. Mean age of all participants was 20.98 (± 9.09) years and age range was 8 - 58 years. Here 6.5% respondents were at or below 10 years, 44.9% between 11 and 18 years and rest were 19 years or above; where 51.4% of the participated patients were male and the rest were female. In religion Muslims was 94.2% and the rest 5.8% was Hindus. Among the respondents pre-primary level of education was found in 18.1%, 31.2% had completed primary level, 22.5% secondary level, 10% respondents had completed higher secondary of education. More than 10.1% higher secondary level, 6.5% post-graduation, 8.7% can sign only and 3.1% were illiterate or others. Among the respondents 47.1% were students. The rest were service holder (11.6%), businessman (6.5%), unemployed (19.6%) and 15.2% was housewife. In case of marital status, 73.2% was unmarried and 26.8% of the respondents was married. Among the respondents 94.9% had no history of consanguineous marriage of parents and others 5.1% had positive history of such marriages.

Table- I: Socio-demographic profile of thalassemic patients

Variables	Options	Thalassemic patients	
		Number (N = 138)	Percentage (%)
Age (Years)	≤10	9	6.5
	11 to 18	62	44.9
	≥19	67	48.6
Sex	Male	71	51.4
	Female	67	48.6
Religion	Muslim	130	94.2
	Hindu	8	5.8
Education (N = 108)	Pre-primary	25	18.1
	Primary completed	13	31.2
	Secondary completed	31	22.5
	Higher secondary completed	14	10.1
	Graduated/post graduated	9	6.5
	Sign only	12	8.7
	Illiterate & others	4	3.1
Occupation	Student	65	47.1
	Service holder	16	11.6
	Businessman	9	6.5
	Unemployed	27	19.6
	Others	21	15.2
Marital status	Married	37	26.8
	unmarried	101	73.2
Consanguineous marriage	Present	7	5.1
	Absent	131	94.9

Thalassemia related factors

Table II demonstrates the variables related to the thalassemia; here 76.1% of the patients were Hb E β -thalassemia patients including β -thalassemia major, β -thalassemia trait, Hb E trait and others (12.3%, 5.8%, 2.9% and 2.9%, respectively). Among them 73.2% were diagnosed at or before 10 years of age and rest were diagnosed after 10 years. The mean age of first blood transfusion was 9.18($\pm$ 8.41) year and history of blood transfusion was recorded from 92% of patients. Among the transfused respondents 89% of them got frequent blood transfusion for the last 6 months (> 4weeks interval). Others got less frequent transfusion where interval between 2 successive blood transfusions was more than 4 weeks.

Iron chelator was prescribed in 58% patients either deferasirox (28.3%) or deferiprone (29.7%). Among the 138 respondents, 72 were transfusion dependent and the rest 66 were non-transfusion dependent. Thyroid status was divided into euthyroid and hypothyroid; where 79.7% of the patients had the euthyroid condition of the thyroid function. The mean body mass index (BMI) of the respondent was 19.68 ($\pm$ 4.08) kg/m² and 44.2% were underweight, 46.4% normal, 5.8% respondents were overweight, 3.6% were obese. The lowest BMI was 13.02 and highest BMI was 33.78 kg/m. Patients had the mean serum ferritin level 1682.43 ($\pm$ 1752.61) ng/dl. The highest ferritin was 8318 ng/dl and lowest was 8 ng/dl. The mean hemoglobin of the respondent was 7.81($\pm$ 1.52) g/dl ranged from 4.1 g/dl and maximum level was 11.9 g/dl.

Table- II: Distribution of thalassemia related factors.

Variables	Options	Thalassemic patients	
		Number (N = 138)	Percentage (%)
Type of thalassemia	β -Thalassemia major	17	12.3
	β -thalassemia trait	8	5.8
	Hb E β -thalassemia	105	76.1
	Hb E trait	4	2.9
	Others	4	2.9
Interval of transfusion (N = 127)	2-4 weeks	14	11
	> 4weeks	113	89
Iron chelation	Deferasirox	39	28.3
	Deferiprone	41	29.7
	No	58	42
Transfusion dependency	Transfusion dependent	72	52.2
	Non-transfusion dependent	66	47.8
Body mass index (BMI)	Underweight	61	44.2
	Normal	64	46.4
	Overweight	8	5.8
	Obese	5	3.6
Thyroid status	Euthyroid	110	79.7
	Hypothyroid	28	20.3
Ferritin control	Good control	63	45.7
	Bad control	75	54.3
Serum ferritin (ng/ml)	Mean = 1682.43 ($\pm$ 1752.61) ng/dl; Max = 8318 ng/dl and Max = 8 ng/dl		
Serum Hemoglobin (g/dl)	Mean + 7.81($\pm$ 1.52) g/dl; Max = 11.9 g/dl and 4.1 g/dl		

Association of socio-demographic and thalassemia related factors with thyroid status

Table III represents the association of socio-demographic profile with the thyroid status; euthyroid and hypothyroid. The here no statistically significant linkage of the socio-

demographic characteristics including age ($p = 0.557$), sex ($p = 0.059$), religion ($p = 0.205$), education status ($p = 0.062$) and occupation ($p = 0.352$) with thyroid status of thalassemia patients.

Table- III: Socio-demographic characteristics and thyroid status of the respondents

Character	Variety	Thyroid status Euthyroid n (%)	Test statistic Hypothyroid n (%)
Sex	Female	58(86.6)	9(13.4)
	Male	52(73.2)	19(26.8)
Age	≤ 10	7(77.8)	2(22.2)
	11-18	52(83.9)	10(16.1)
	≥ 19	51(76.1)	16(23.9)
Religion	Islam	105(80.8)	25(19.2)
	Hinduism	5(62.5)	3(37.5)
Education	Preprimary & Primary completed	59(86.8)	9(13.2)
	Secondary completed to graduation	41(75.9)	13(24.1)
	Others	10(62.5)	6(37.5)
Occupation	Students	55(84.6)	10(15.4)
	Businessman & service holder	18(72)	7(28)
	Unemployed & others	37(77.1)	11(22.9)

Table IV presents the relationship between thalassemia-related factors and thyroid status. Thyroid status was categorized into euthyroid and hypothyroid; among those whose diagnosis and initial blood transfusion occurred at ≤ 10 years, the rates were 79% and 22% respectively. In contrast, for those diagnosed after the age of 10, the rates of euthyroid and hypothyroid were 31% and 6% respectively. However, this difference was not statistically significant ($p > .05$). However, this study found a strong relationship between transfusion dependency, the interval between blood transfusions, the use of iron chelators, and serum ferritin management with thyroid status. The study showed that non-transfusion dependent respondents were less likely to develop hypothyroidism ($\chi^2 = 9.81$; $p = 0.002$). Additionally, respondents not using iron chelators were also less likely to develop hypothyroidism compared to those who did use iron chelators ($\chi^2 = 8.424$; $p = 0.004$). Hypothyroidism was found to be more prevalent among respondents who received frequent blood transfusions compared to those who received them less frequently ($\chi^2 = 11.276$; $p = 0.003$), and among respondents with poor serum ferritin control compared to those with good control ($\chi^2 = 13.929$; $p < 0.001$).

Table- IV: Association between the thalassemia related factors and thyroid status

Character	Variety	Thyroid status		χ^2	p-value
		Euthyroid n (%)	Hypothyroid n (%)		
Age at the time of diagnosis	Diagnosis at ≤ 10 yrs	79	22	0.519	0.471
	Diagnosis after 10 yrs	31	6		
Age at the time of first blood transfusion	≤ 10	77	20	0.488	0.463
	After 10	22	8		
Interval between blood transfusions	Frequent	6	8	11.276	0.003
	Less frequent	93	20		
Use iron chelator	Yes	57	23	8.424	0.004
	No	53	5		
Transfusion dependency	Yes	50	22	9.81	0.002
	No	60	6		
Serum ferritin	Good control	59	4	13.929	< 0.001
	Bad control	51	24		
BMI	Underweight	48	13	0.346	0.862
	Normal	52	12		
	Overweight and obese	10	3		

DISCUSSION

Mean age of the respondents was 20.98 (± 9.09) years ranged from 8-58 years. A previous study also recoded the mean age 26.01 years with age range from 12 to 60 years⁹. Most of the respondents (94.2%) were Muslims and rests were Hindus. About half of the respondents (51.4%) were male. Another study conducted on thyroid function of thalassemia patients in Pakistan showed 67% male and 33% female¹⁰. A large number of the respondents were students. The rest were service holder, businessman, unemployed and housewife. Majority of the respondent had no history of consanguineous marriage between parents. A review on global consanguinity showed North Africa, much of West, Central, and South Asia 20 to over 50% of current marriages are consanguineous¹¹.

In this study more than three fourth of the respondents (76.1%) were Hb E β -thalassemia patient. β -thalassemia major patient was 12.3%, β -thalassemia trait 5.8%, Hb E trait 2.9% and others 2.9%. Other study conducted on thalassemia patients showed 23.33% patients were with Hb E β -thalassemia, 41.67% Hb E trait, 30% Hb E disease, 3.33% β -thalassemia trait⁹. HbE-b-Thalassemia is also reported as the commonest form of Thalassemia in previous studies conducted by Rahman et al. and Mohanty et al^{12,13}.

Around 73.2% of thalassemia were diagnosed at or before 10 years of age. Another study found that 85% were diagnosed at or before the age of 8 years¹². About 88% patients got frequent blood transfusion for the last 6

months (2-4 weeks interval). However, Malik et al. reported this percentage as 100% in the Pakistani patients¹⁰. The present study explored that iron chelator was prescribed to 58% patients. More than half (52.17%) of the respondents were transfusion dependent. However, no studies were found to support our findings. The mean body mass index (BMI) of the respondent participated in the study was $19.68(\pm 4.08)$ kg/m². But a previous work depicted the mean BMI of thalassemia patients was $23.2(\pm 4.3)$ ¹⁴. About one-fifth (20.3%) of the respondents were found hypothyroid on the basis of TSH level obtained from medical record in this study. Others (79.7%) found euthyroid. The Lahore study on β -thalassemia showed 25.7% patient was primary hypothyroid¹⁰. Besides, a study conducted on 130 thalassemia patients in Iran demonstrated excess TSH in thalassemia patients¹⁵. Another study in India conducted among 100 thalassemic patients showed 10% patients were hypothyroid¹⁶.

A detailed retrospective cross-sectional study in Ferrara, Italy showed pre-transfusion hemoglobin was $9.3(\pm 0.3)$ mg/dl in thalassemic patients. Respondents had the mean serum ferritin level $1682.43(\pm 1752.61)$ ng/dl. The highest ferritin was 8318 ng/dl and lowest was 8 ng/dl. Other study in Ferrara showed mean serum ferritin $777.1(\pm 595.3)$ ng/ml¹⁶. These patients were all long lived and regularly followed since childhood that might be the cause of difference in mean serum ferritin level.

We did not find any significance differences of thyroid status by gender and age group. Smiler outcomes were recorded in previous studies conducted in Pakistan and India^{10,16}. However, opposite scenario was observed in another study carried out by Salim et al.¹⁷. In this study hypothyroidism was found more common in respondents who got frequent blood transfusion (57.1%) than those who got less frequent blood transfusion (17.7%). Other study in India showed no significant relation between TSH and transfusion frequency¹⁸.

Hypothyroidism was more common among transfusion dependent respondents (30.6%) than non-transfusion dependent respondents (9.1%). Guideline for the management of non-transfusion dependent Thalassemia (NTDT) showed that endocrinopathies are less common in non-transfusion dependent thalassemia. The present study revealed no statistically significant linkage of age, gender, religion, education status and occupation with thyroid status of thalassemia patients in Bangladesh. However, the strong correlation of transfusion dependency, interval

between blood transfusions, iron chelator using and serum ferritin control was found in the present study. Similarly, other study in Lahore showed significant difference between hypothyroidism and serum ferritin¹⁰.

The study had some limitations that must be addressed. The demographic and thalassemia related data were insufficient due to the shortage of time and the available time of patients. If we collected data on a large number of variables, it would be fruitful to represent the better scenario of the thyroid status of the Bangladeshi thalassemic patients. It was also difficult to get all information from patients due to their unfavorable condition. Besides, the finding of the study couldn't be generalized for all thalassemia patient as conducted on few patients who had the 3 medical tests within last 3 months. Furthermore, hypothyroidism was diagnosed on the basis of TSH level only so primary or subclinical hypothyroidism couldn't be differentiated.

CONCLUSIONS

This study explored various thalassemia related factors including transfusion dependency, interval between blood transfusions, iron chelator using and serum ferritin control with the thyroid status. Non-transfusion dependent respondents and respondents who were not taking iron chelator were less likely to develop hypothyroidism. Hypothyroidism was found more common in respondents got frequent blood transfusion than those who got less frequent blood transfusion and in respondent with bad control of serum ferritin. Further study is required to support these findings.

Conflict of Interest

Authors have no conflict of interest and no fund was received from any sources.

Ethical Clearance

The study was approved by the department of Epidemiology, National Institute of Preventive and Social Medicine (NIPSOM), Banghobandhu Sheikh Mojibur Rahman Medical University [NIPSOM/IRB/2019/111]

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Original Article

Clinical Presentation of Leukemia in Children

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Abstract

A thorough medical history, physical examination, and clinical presentation are crucial diagnostic processes for leukemia diagnosis. As a result, fatigue, irritability, and anorexia are common non-specific leukemia symptoms. Fever, pallor, lassitude, purpuric lesions, and bleeding are often the most common clinical observations and symptoms, which are usually indicators of the underlying thrombocytopenia, neutropenia, and anemia. This study aimed to evaluate the clinical presentation of leukemia in pediatric patients. This cross sectional study was conducted in the Department of Hemato-Oncology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, for a period of 6 months from 1st September 2010 to 31st March 2011. A total of 80 diagnosed cases of leukemia among children aged 0 to 15 years who attended the study site were included in the study. The data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 15. The most prevalent (58.8%) age group among the 80 patients was ≤5 years, followed by 30.0% and 11.2% in age group of 5-10 and >10 years respectively. Regarding sex, the male to female ratio was 1.67:1, consisting of 62.5% males. The most frequent clinical symptom observed was fever, occurring in 95.0% of cases, followed by progressive pallor at 43.8%. Other notable clinical presentations included bone pain, lymph node enlargement, and haemorrhagic symptoms, with frequencies of 31.3%, 38.8%, and 25.0%, respectively. Additionally, headache (3.8%), vomiting (3.8%), abdominal distention (16.3%), a history of sore throat (1.3%), weight loss (2.5%), anorexia (3.8%), weakness (2.5%), and proptosis (1.3%)

were also reported as presenting complaints. The presence of fever, which is then succeeded by increasing pallor, could be essential in the diagnostic procedures for leukemia.

Keywords: *Leukemia, clinical symptoms, thrombocytopenia, paediatric patients.*

INTRODUCTION

Leukemia is the most frequent malignancy that occurs during childhood and comprises approximately 30% of all childhood cancers.¹ ALL represents about 75% of all leukemia cases in children.² Acute lymphocytic leukemia (ALL) is a disorder characterized by the uncontrolled growth and proliferation of immature lymphoid cells. It is the most common malignancy of childhood. The dramatic advances in its treatment over the past three decades have changed what was essentially a universally fatal but current long-term event-free survival rates are nearly 80%.³ Many initial clinical manifestations of leukemia (eg, pallor, fever, purpura) are a consequence of decreased production of normal red blood cells, white blood cells, and platelets.¹ The presenting signs and symptoms reflect the degree of bone marrow infiltration with leukemic cells and the extent of extramedullary disease spread.

Leukemia generally presents with non-specific signs and symptoms, including anorexia, fatigue, and irritability. The most common symptoms and clinical findings are usually indicative of the underlying anemia, thrombocytopenia, and neutropenia. Fever, pallor, lassitude, purpuric lesions, and bleeding are frequently observed. As the condition progresses, symptoms such as pallor, a tendency to bleed, hepatosplenomegaly, and localized or generalized lymphadenopathy may arise. Central nervous system symptoms, which signify extramedullary leukemic spread, may also be accompanied by bedsores, vomiting, papilledema, sixth nerve palsy, cranial nerve palsies, and convulsions. However, it is rare for joint pain, proptosis, abdominal pain, melena, diarrhea, dysphagia, etc., to be recognized as initial manifestations, which can confuse both clinicians and pathologists⁴. Mostly, children present with pallor, bleeding manifestations, and hepatosplenomegaly. However, there are instances when the manifestations can be atypical, complicating the attribution to leukemia².

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Historically, leukemia was classified initially in four groups based on clinical presentation and morphologic appearance of the malignant cells: ALL, acute nonlymphocytic leukemia (ANLL), chronic myelogenous leukemia (CML) and chronic lymphocytic leukemia (CLL). Subsequent research investigations which evaluated the morphologic, immunologic, growth regulation, cytogenetic and molecular abnormalities in leukemia cells, further established that the leukemia represent a much more heterogeneous group of malignancies than initially suggested by the four-group classification. However, the designations of the initial classification still are used clinically and it remains useful to consider how the classification pertains to childhood leukemia.¹

Results of various investigations are decisive for the diagnosis of leukemia. However, a thorough history taking and physical examination are valuable tools in the diagnosis of any disease. Hence, one should remember both the common as well as uncommon signs and symptoms of leukemia for rapid and appropriate diagnosis and management. The objective of this research was to determine the clinical manifestations of leukemia in pediatric patients.

MATERIALS AND METHODS:

This descriptive study, which was cross-sectional in nature, involved 80 diagnosed cases of leukemia in children aged 0-15 years, regardless of sex, and was carried out in the Department of Paediatric Hemato-Oncology at Bangabandhu Sheikh Mujib Medical University (BSMMU) in Dhaka from September 1, 2010, to March 31, 2011. Children who were critically ill and required ICU support were excluded from the study, and a purposive sampling technique was employed to select the participants. In consultation with the parents or legal guardians and after reviewing previously published literature, a questionnaire was developed for the study. Before data collection commenced, the parents of the children were informed about the study's purpose, and their informed written consent was obtained. Subsequently, the data clinical presentations of the leukemic children were recorded and evaluated.

Statistical analysis:

A window-based computer program called Statistical Packages for Social Sciences (SPSS-15) (SPSS Inc., Chicago, IL, USA) was used to perform statistical analysis on the data. Frequencies were distributed for each of the variables as shown in the tabular and graphical results of the data analysis.

Ethical consideration

Prior to initiate this study, the research protocol was approved by the ethical committee of the Bangladesh College of Physicians and Surgeons in Dhaka. The study's aims, objectives, procedures, alternative methods, risks, and benefits were communicated to the patient's parent/legal guardian in a clear and comprehensible local language. Subsequently, written informed consent was obtained from the patients or their parents. It was guaranteed that all information and records would remain confidential, and the procedure would assist both attending physicians and patients in making management decisions.

RESULTS:

Table I provides an overview of the age distribution among the patients. Mean age $\pm$ SD was 5.78 ± 3.37 years and age range was 1.5 to 14.00 years. From the total of 80 patients, 47 (58.8%) belonged to the age group of ≤ 5 years, 24 (30.0%) were in the 5 to 10 years, and 9 (11.2%) were in >10 years of age group.

Table- I: Age distribution of the patients (n=80).

Age (in year)	Frequency	Percentage
≤ 5	47	58.8%
5-10	24	30.0%
>10	09	11.3%
Total	80	100.0%

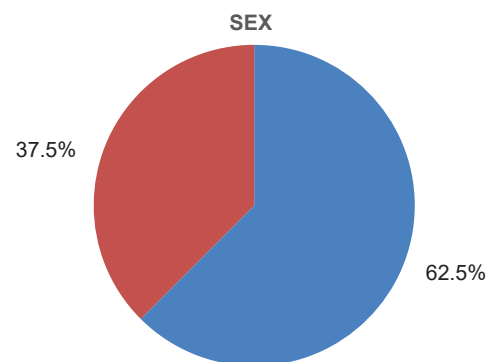


Figure- 1: Distribution of sex of the patients (n= 80)

Figure 1 illustrates the sex distribution of 80 patients, with 50 (62.5%) were male and 30 (37.5%) were female, and male-to-female ratio was 1.67:1.

Table II details the distribution of patients who came forward with complaints. Among these individuals, fever was noticed in 76 cases (95.0%), followed by progressive pallor in 35 (43.8%), bone pain in 25 (31.3%), lymph node enlargement in 31 (38.8%), and haemorrhagic manifestations in 20 (25.0%). Furthermore, abdominal distention was reported in 13 patients (16.3%), headache in 3 (3.8%), vomiting in 3 (3.8%), a history of sore throat in 1 (1.3%), weight loss in 2 (2.5%), anorexia in 3 (3.8%), weakness in 2 (2.5%), and proptosis in 1 (1.3%) as presenting complaints.

Table-II: Distribution of patients presented with complaints (n=80).

Presenting complaints	Frequency*	Percent
Fever	76	95.0
Progressive Pallor	35	43.8
Haemorrhagic manifestations	20	25.0
Abdominal distention	13	16.3
Headache	03	03.8
Vomiting	03	03.8
Sore throat	01	01.3
Bone/Joint pain	25	31.3
Lymph node enlargement	31	38.8
Weight loss	02	02.5
Anorexia	03	03.8
Weakness	02	02.5
Proptosis	01	01.3

*Multiple responses

Table III states the distribution of findings from the physical examination. Among the patients, pallor was observed in 62 individuals (77.5%), followed closely by hepatomegaly in 61 patients (76.3%). Additional findings from the physical examination included lymphadenopathy in 44 patients (55.0%), splenomegaly also in 44 patients (55.0%), bony tenderness in 29 patients (36.3%), and petechiae, purpura, or bruises in 21 patients (26.3%). Proptosis and abnormalities in the respiratory system examination were noted in 1 patient (1.3%) each.

Table- III: Distribution of the findings of physical examination

Physical examination	Frequency	Percent
Pallor	62	77.5
Petechiae, purpura, bruises	21	26.3
Lymphadenopathy	44	55.0
Bony/Joint tenderness	29	36.3
Hepatomegaly	61	76.3
Splenomegaly	44	55.0
Any abnormalities in respiratory system examination	01	01.3
Proptosis	01	01.3

Table IV presents the distribution of results from laboratory tests. The Mean $\pm$ SD values for Neutrophil (N) and Lymphocyte (L) counts were found to be 10.79 $\pm$ 7.47% and 35.16 $\pm$ 28.89%, respectively. The Mean $\pm$ SD for blast cell count was 54.54 $\pm$ 30.46%, with a range of 5.00- 100.00cmm. The Mean $\pm$ SD for platelet count was 25556.25 $\pm$ 19691.84/cmm, with a range of 3000.00- 90000.00/cmm.

Table- IV: Distribution of results from laboratory tests (DC of WBC and Platelet count)

	Mean $\pm$ SD	Range
N	10.79 $\pm$ 7.47	.00-40.00
L	35.16 $\pm$ 28.89	.00-100.00
Blast cell	54.54 $\pm$ 30.46	5.00-100.00
Platelet count	25556.25 $\pm$ 19691.84	3000.00-90000.00

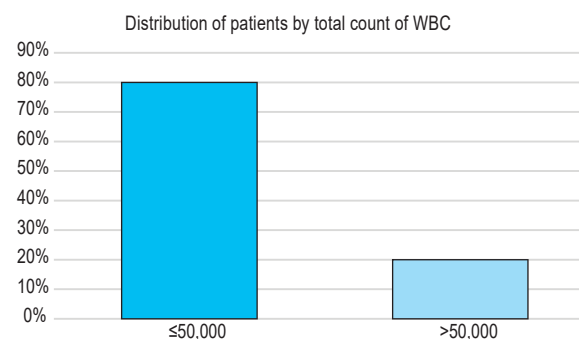


Figure- 2: Distribution of patients based on the total white blood cell (WBC) count.

Figure 2 depicts the distribution of patients based on the total white blood cell (WBC) count. Among the 80 patients, 64 (80.0%) exhibited a total WBC count of $\leq$

50,000/cmm, while 16 (20.0%) had a total WBC count $\leq$ 50,000/cmm. The mean $\pm$ standard deviation (SD) of the total WBC count was 32052.96 ± 34085.35 /cmm, with a range spanning from 2100.00 to 258640.00/cmm.

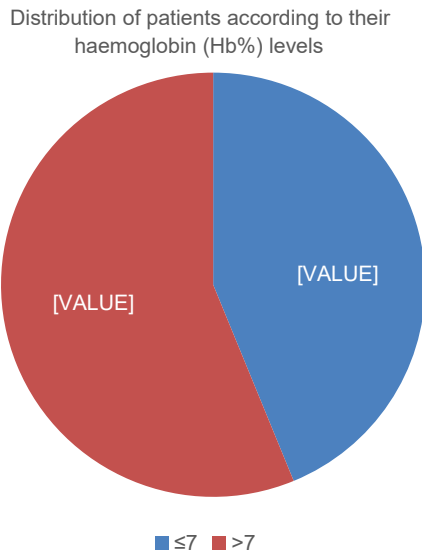


Figure-3: Distribution of patients according to their haemoglobin levels

Figure 3 illustrates the distribution of patients based on their haemoglobin (Hb) levels. Among the 80 patients, 35 (43.8%) exhibited a Hb level of ≤ 7 gm/dl, while 45 (56.2%) had a Hb level exceeding 7 gm/dl. The mean $\pm$ SD for the haemoglobin level was 7.48 ± 2.65 gm/dl, with a range of 2.80 - 17.80 gm/dl.

Table V details the distribution of diagnoses for the patients. Of the 80 respondents, 73 (91.2%) were diagnosed with Acute Lymphoblastic Leukemia (ALL), whereas 7 (8.8%) were diagnosed with Acute Myeloid Leukemia (AML).

Table- V: Distribution of diagnosis of the patients

Diagnosis	Frequency	Percent
ALL	73	91.2
AML	07	08.8
Total	80	100.0

DISCUSSION:

Out of 80 patients, most common age group was ≤ 5 years (58.8%) followed by 5 to 10 years (30.0%). Rest of the patients was > 10 years old (11.2%) (Table 1). The

incidence of acute lymphoblastic leukemia peaks in children aged 2-5 years and subsequently decreases with age.⁵ Among the patients 50 (62.5%) were male and 30 (37.5%) were female. Male to female ratio was 1.67: 1. Acute lymphoblastic leukemia occurs slightly more frequently in boys than in girls.⁵

Fever is the most common clinical presentation (95.0%) followed by progressive pallor (43.8%). Other common clinical presentation bone pain, lymph node enlargement and haemorrhagic manifestations were 31.3%, 38.8% and 25.0% respectively. Abdominal distention (16.3%), headache (3.8%), vomiting (3.8%), sore throat (1.3%), weight loss (2.5%), anorexia (3.8%), weakness (2.5%), and proptosis (1.3%) also found the as presenting complaints (Table 2). Leukaemia is a systemic disease and involves all organs and tissues of the body.⁶ Common constitutional symptoms include fever (60%), fatigue (50%), pallor (25%), and weight loss (26%).^{6,7}

The clinical presentation of acute leukemias is quite variable.⁸ Children with ALL develop symptoms related to infiltration of blasts in the bone marrow, lymphoid system, and extramedullary sites, such as the central nervous system (CNS).⁷ Infiltration of blast cells in the marrow cavity and periosteum often lead to bone pain (23%) and disruption of normal hematopoiesis.⁷ Infiltration of the lymphoid system may cause lymphadenopathy and hepatosplenomegaly. CNS involvement is found in less than 5% of children at presentation. When present, the signs and symptoms include headache, vomiting, papilledema and sixth- nerve palsy.⁹⁻¹¹

Thrombocytopenia with platelet counts less than 100,000 are seen in about 75% of patients. Approximately 40% of patients with childhood ALL present with hemoglobin levels less than 7 g/dL.⁷ In the present study the mean $\pm$ SD of neutrophil and lymphocyte count were $10.79 \pm 7.47\%$ and $35.16 \pm 28.89\%$ respectively. Mean $\pm$ SD of blast cell was 54.54 ± 30.46 with a range of 5.00-100.00%. Mean $\pm$ SD of platelet count was 25556.25 ± 19691.84 with a range of 3000.00-90000.00/cmm (Table 6). In the present study 35 (43.8%) had haemoglobin level ≤ 7 gm/dl and 45 (56.2%) had haemoglobin level > 7 gm/dl. Mean $\pm$ SD of haemoglobin level was 7.48 ± 2.65 with a range of 2.80-17.80 gm/dl (Table 7). Bashir et al. (2010) studied to assess the hematological and clinical presentation where they found all patients were anemic at the time of diagnosis their hemoglobin level was 2.8 -12 g /dl. The TLC was quite variable ranged from < 4000 /cmm to $> 6,30,000$ /mm³. Similarly the platelet count was $< 10,000$ to > 100000 /mm.⁸

Although leukocyte counts greater than 50,000/mm³ occur in 20% of cases, neutropenia defined as an absolute neutrophil count less than 500 is common at presentation and is associated with an increased risk of infection.^{12, 13} Sixty four (80.0%) patients had total count of WBC ≤ 50,000 cmm and 16 (20.0%) had total count of WBC >50,000 cmm. Mean ± SD of total count of WBC was 32052.96 ± 34085.35 with a range of 2100.00-258640.00.

In the present study 73 (91.2%) were diagnosed as cases of ALL and 7 (8.8%) were diagnosed as cases of AML. Study showed that in children, acute lymphoblastic leukemia (ALL) is significantly more prevalent than acute myeloid leukemia (AML). ALL accounts for approximately 80% of childhood leukemia cases, while AML represents about 15-20%.¹⁴

CONCLUSIONS:

In the study, fever is identified as the predominant clinical manifestation, succeeded by progressive pallor. Additional prevalent clinical presentations included bone pain, lymphadenopathy, and hemorrhagic symptoms. Furthermore, patients exhibited vomiting, petechiae, abdominal swelling, sore throat, joint discomfort, fatigue, loss of appetite, and weight reduction.

LIMITATIONS

The present study has some limitations. The study conducted in a single centre in Dhaka city on small sample size which may not be representative for the whole country.

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Review Article

Existing Scenario, Thorough Evaluation and SWOT Review of e-Health Services in Bangladesh

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Abstract

In recent years, Bangladesh has made considerable progress in digitizing its healthcare system through the introduction of e-Health services. These services leverage information and communication technology (ICT) to improve healthcare delivery, particularly in rural and underserved regions where access to medical professionals is limited. The Government of Bangladesh, in partnership with non-governmental organizations (NGOs) and private stakeholders, has initiated several programs including telemedicine services, mobile health (mHealth), electronic health records (EHRs), and digital health portals. Notable government-led initiatives include the deployment of telemedicine centers at Upazila Health Complexes, SMS-based health advisories, and the “Health Call Center” (16263), which offers 24/7 medical consultation. Additionally, private sector platforms like Doctorola, Maya, and Tonic have gained popularity for providing remote consultations, mental health support, and digital prescriptions. However, despite these promising developments, e-Health in Bangladesh is still in a transitional phase. Challenges such as low digital literacy, inadequate internet connectivity in rural areas, shortage of trained personnel, and lack of interoperability among systems have limited its full potential.

Key words: SWOT, e-Health, ICT, Bangladesh

1. Current Landscape of eHealth in Bangladesh

- **Various initiatives are active**, including telemedicine platforms, mobile-based consultation services operated by telecoms (e.g., GrameenPhone’s “789” helpline), startups like Praava Health, Neeramoy, Arogga, and NGO-supported mobile outreach programs. Yet these remain **fragmented** and unevenly scaled.^{1, 2}

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- **Telemedicine usage is limited.** Only a small fraction (~7%) of households with mobile phones actually use them for health services—with low uptake among poorer, less educated, or rural individuals.²
- Although **mobile coverage is nearly universal**, fewer than 30% of rural households have **reliable internet**, creating a digital divide that hampers equitable access to eHealth services.³

2. Key Challenges & Critical Gaps

Governance & Coordination

- Lack of a **unified national strategy** and regulatory framework leads to overlap, inefficiency, and donor reliance. Over 70% of projects are externally funded.³
- Absence of a **National Digital Health Act** or a central authority (e.g., Central Digital Health Authority) means no standard rules on telemedicine licensure, data protection, or interoperability.³

Infrastructure & Access

- **Interoperable Electronic Health Records (EHRs)** are rare or siloed; digital health platforms rarely integrate with public and private providers. Many systems are pilot projects without scale.³
- Infrastructure gaps—especially at rural clinics—limit system reliability and continuity of care.³

Human Capacity & Training

- Over **85% of health workers are digitally illiterate**; medical curricula lack digital health competencies like AI, informatics, or electronic clinical workflows. Teaching staff shortages further reduce practical training.^{4,8}

Usability & Trust

- Many health apps suffer from **poor UI/UX**, with catastrophic or major usability issues — hampering adoption even among smartphone users.^{5,7}
- Low **awareness and trust**: users often don’t know about telehealth services, find health promotions confusing, or don’t trust providers they can’t see in

person. Privacy, cost, and discomfort are common concerns.²

Financial & Equity Concerns

- Out-of-pocket healthcare spending accounts for ~73–74% of total health costs, which makes digital or telehealth unaffordable to many.⁶
- Digital literacy and smartphone ownership are lower in rural areas and among women (only ~22% of rural women own smartphones) – creating inequality in access.³

3. Broader Systemic Context

- Bangladesh suffers from a **lack of health financing**, healthcare professional shortages (about 7 doctors per 10,000 people vs. WHO target of ~22.8), and high patient volumes—making access to quality care difficult even physically.⁶
- Corruption and weak regulation further undermine public trust, including in digital initiatives.⁴
- In humanitarian settings—such as in Cox’s Bazar—chronic disease care remains severely inadequate, and digital health outreach is limited or absent altogether⁷.

SWOT Review of the Current e-Health and Telemedicine Services in Bangladesh

The analytical findings of this SWOT (Strengths, Weaknesses, Opportunities, and Threats) study on the current e-health and telemedicine services in Bangladesh were derived from a review of various articles and program works conducted over the past 10 years.¹

Strengths

1. Government Support and Policy Initiatives

- o The Government of Bangladesh has integrated e-Health into the national Digital Health Strategy and Vision 2041.
- o DGHS (Directorate General of Health Services) supports digitalization, including telemedicine and health information systems.

2. Growing Mobile and Internet Penetration

- o High mobile phone ownership and increasing 4G/5G internet access in rural and urban areas enable wide telemedicine reach.

3. Low-Cost Consultation Models

- o Affordable or free services via mobile operators and public hospitals (e.g., 16263 helpline, *Shastho Batayon*).

4. Public-Private Partnerships

- o Collaboration with private telehealth platforms (e.g., *Tonic*, *Praava Health*, *CMED*, *Doctor Koi*, *Maya*) enhances service accessibility.

5. COVID-19 Acceleration Effect

- o Pandemic increased awareness, funding, and adoption of telemedicine and remote healthcare.

Weaknesses

1. Digital Literacy Gap

- o A significant portion of the rural population, especially the elderly, lacks digital skills to use telehealth services.

4. In-Depth Critique Summary

Area	Critical Issue
Fragmentation & Donor Dependence	Projects often lack sustainability, overlap, or lack coordination.
Regulatory Vacuum	No central oversight, standardization, or legal framework; patient data standards are inconsistent.
Digital Divide & Equity Gaps	Services primarily benefit urban, educated users; many are excluded.
Workforce Unpreparedness	Digital literacy among health workers is poor and curricula are outdated.
Trust, Usability & Cultural Barriers	Poor app design, mistrust of remote care, embarrassment around sensitive health topics.
Sustainability & Funding	Heavy reliance on external funding; government spending on digital health remains low.

2. Infrastructure Challenges

- Inadequate internet connectivity and power reliability in remote areas hinder seamless access.

3. Lack of Standardization & Regulation

- No comprehensive national telemedicine regulation. Licensing, quality assurance, and patient data protection need formal frameworks.

4. Limited Integration with Health Systems

- e-Health platforms often operate in silos and are not fully integrated with national Electronic Health Record (EHR) systems.

5. Shortage of Trained Professionals

- Insufficient number of trained doctors and telemedicine support staff familiar with digital platforms.

Opportunities

1. AI and Data-Driven Health Innovations

- Opportunity to implement AI for diagnostics, chatbots, predictive analytics, and personalized care.

2. Expansion in Rural Healthcare

- Huge potential to serve the underserved rural population with mobile-based telehealth services.

3. Foreign Investment and Donor Funding

- Support from organizations like WHO, World Bank, and ADB can scale projects and infrastructure.

4. mHealth (Mobile Health) Potential

- Growing app ecosystem and SMS-based solutions can provide health education, reminders, and maternal care support.⁷

5. Cross-Border Health Services

- Potential to collaborate with India and Southeast Asian telemedicine hubs for specialist care and knowledge exchange.

Threats

1. Cybersecurity and Privacy Risks

- Increasing risk of data breaches and lack of stringent legal protection of patient health data.

2. Cultural and Social Barriers

- Preference for face-to-face consultations, lack of trust in remote diagnoses, and gender-related barriers to women accessing e-health.

3. Economic Constraints

- Poverty and affordability issues may prevent the poorest from accessing or trusting digital health services.

4. Digital Divide

- Risk of worsening inequality between urban and rural populations if infrastructure gaps persist.

5. Resistance from Traditional Healthcare Providers

- Some healthcare professionals view telemedicine as a threat to traditional practice or job security.

Next Steps for Improvement:

- Essential to adopt the necessary policies and strategies to integrate digital solutions into the Universal Health Coverage (UHC)
- Finalize and enforce national e-Health regulation.
- Expand rural internet and power coverage.
- Train healthcare workers in digital tools.
- Promote public trust through awareness and success stories.
- Ensure ethical data use and patient privacy protection.

CONCLUSION

e-Health and telemedicine in Bangladesh have evolved rapidly, driven by government vision, mobile connectivity, and pandemic-driven needs. e-Health and telemedicine in Bangladesh have also made promising strides, especially post-COVID-19, backed by government and private sector efforts. However, the system requires greater policy clarity, integration, and investment in digital infrastructure and capacity-building to be sustainable and equitable.

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Obituary news May-2024

BMA would like to express deep condolence on deaths of the following notable physicians in recent past:

Sl. No.	Name	Date of Death
1	Dr. Md. Mominul Alam Momin	03/12/2023
2	Professor Dr. Shahanara Begum	03/12/2023
3	National Professor Rtd. Brig. Gen. Dr. Abdul Malik	05/12/2023
4	Dr. Md. Abdul Baki	07/12/2023
5	Dr. Hasina Iqbal	10/12/2023
6	Dr. Fakhrul Islam Chowdhury	19/12/2023
7	Dr. Tauhidur Rashid Chowdhury	26/12/2023
8	Professor Dr. Md. Salehuddin	26/12/2023
9	Dr. Shakil Ahmed	27/12/2023

May Allah bless the departed souls.

Our heartiest commiseration to the deceased's family, our prayers are with them during this difficult moment of their life.

Call for paper

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With a view to increase the bondage with the readers, we encourage to write letters to the editor. Letters may include original research presented in a research letter format or case reports or series. Alternatively, readers may express their ideas, opinions on important national or international issues related to doctors, medical science or medical profession.

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Doctors are encouraged and advised to share their sweet, bitter, sad, memorable & illuminating experiences as a professional doctor in the hospital and private chamber.

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