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Original Article

Short Term Outcome of Image Guided (USG) Percutaneous Pigtail Catheter Drainage of Intra-abdominal Abscess

*Polash WA¹, Immul R², Nuzhat R³, Saklayen SMG⁴, Zahan LA⁵, Islam MS⁶

Abstract

In surgical practice, it is common and important to deal with intra-abdominal abscesses. Incision and drainage through laparotomy has traditionally been used to manage abdominal abscesses. Percutaneous catheter drainage is favorable due to avoiding of laparotomy, general anesthesia, easier postoperative care, less patients' complaints, shortened hospital stay and less cost. However, the advance technology of ultrasonography helps for precise localization of abscesses to place the catheter percutaneous for effective, adequate and definitive drainage. This hospital based prospective observational study was carried out among the patients of intra-abdominal abscess and the aim was to measure the short-term outcomes of drainage of intra-abdominal abscesses with an image-guided percutaneous pigtail catheter. Study subjects were selected from patients with intra-abdominal abscess and were enrolled as per selection criteria. Data were connected to intra-abdominal abscess derived from the pan-procedure was collected on or after the follow-up sheet and also from post-procedure investigation reports. The questionnaire was finalized following pretesting. Collected data were checked daily and edited (if needed). Data were processed and analyzed using computer software SPSS (Statistical Package for Social Sciences) version 20.

Quantitative data were expressed as mean and standard deviation. Qualitative data were expressed as frequency and percentage; and comparison was done by fisher exact test. A probability value (p) of less than 0.05 was considered as statistical significance. This study finds that maximum patients (30%) were in the age group of 41-50 years and males were predominant (65%). Most of the (85%) pig-tail catheters were used for intra-abdominal abscess were 14Fr size. All most all (95%) of the intra-abdominal abscess were single abscess and a few of those (5%) were multiple abscess. More than half (55%) of the abscess were appendicular, 10% were liver abscess, one-fourth (25%) of those were sub-hepatic and 10% were sub phrenic abscess. It was observed that 95% required single drainage and 5% required multiple drainage. All most all of the patients (95%) were given local anesthesia and only 1 patient (5%) needed conversion (open surgery). Nearly two-third (65%) patients were needed hospital stay for 6 to 10 days. Most of them (90%) were success and failures were minimum (10%). The average (Mean $\pm$ SD) catheter removal was 6.90 ± 1.87 days and most of the patients (90%) had no complications. It was observed that 60% organism were escherchia coli, 25% were staph. aureus, 5% were pseudomonas and 10% were streptococcus spp. Using an image-guided percutaneous pigtail catheter for drainage of intra-abdominal abscesses is easily applicable, well-tolerated procedure that doesn't require general anesthesia with high success rates and low complications. The practice of this method can reform the treatment policy for drainage of intra-abdominal abscesses.

Keywords: Image guided (ultrasonography), percutaneous pigtail catheter, drainage of intra-abdominal abscess.

INTRODUCTION

An abscess is a localized collection of purulent materials, lined by a pyogenic membrane. Which can have a significant impact on the clinical outcome of a patient. Intra-abdominal abscess formation can be a life-altering event and an important cause of morbidity and mortality.¹⁻⁴ Intra-abdominal abscesses are like Organ specific abscess (liver, spleen and appendix) or abscesses in abdominal recesses (eg: paracolic, subdiaphragmatic, pelvic etc.).^{5,6} Intra-abdominal abscesses were treated with operative drainage that was associated with significant morbidity and mortality.¹

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Advances in image-guided percutaneous drainage have provided a safe and effective alternative to operative drainage. Presently, most clinician would consider image-guided percutaneous abscess drainage as the treatment of choice because it offers a relatively simple, minimally invasive procedure with the goal of averting the development of sepsis, reducing length of hospital stay and reducing the cost of treatment.^{4,7}

Percutaneously inserted catheter drainage is an accepted treatment modality for large abscess. Complications that can arise are; secondary infection, bleeding into the abscess cavity and rupture of abscess with spillage into the peritoneal cavity.⁸⁻¹¹

Poor accessibility is another major concern in the management of many abdominal abscesses.^{9,10} Post-operative abdominal abscess may be challenging due to an anatomical distortions secondary to surgery. Percutaneous access to some of these lesions may often necessitate invasive transgressions of surrounding organs (e.g. Stomach, liver and pleura) rather than straight forward access. In some cases, even with such second-line access routes, abscesses are inaccessible and eventually necessitate open surgical drainage.⁸

In recent years the indications for percutaneous catheter drainage have expanded significantly. The result of percutaneous drainage procedure has been so good and so widely accepted that the indications and applications have been continued to expand. Ultrasound guided percutaneous catheter drainage permit effective drainage of abscesses in the abdomen.⁶ Percutaneous pigtail catheters are now used extensively for abscess drainage.⁷

Intra-abdominal abscesses may complicate many illnesses including diverticulitis, pancreatitis, and appendicitis, or they may occur during the postoperative period. As new methods of imaging are developed that provide additional information on patients with these abscesses, earlier and more accurate diagnoses can be made, allowing for prompt intervention. With the advent of these new imaging methods, techniques for treatment of abscesses by percutaneous drainage have been developed.

Ultrasound is extremely sensitive in detecting fluid collection in the abdomen. Ultrasound allows a rapid searching of intra-abdominal collections even in extremely ill patients.^{2,6} This study was therefore aimed at evaluating the short-term outcome of image guided (USG)

percutaneous pigtail catheter drainage of intra-abdominal abscess in Enam Medical College and Hospital.

MATERIALS AND METHODS

It was a prospective observational study carried out Department of Surgery, Enam Medical College & Hospital (EMCH). During the period December 2017 to May 2018. A total number of 20 cases undergoing percutaneous pigtail catheter drainage of intra-abdominal abscess guided by ultrasonography was considered as study population. Study populations were selected from General surgery department of Enam Medical College Hospital (EMCH). Inclusion criteria are all the intra-abdominal abscess cases like: organ specific abscess (liver, spleen, appendix, the mesentery and pancreatic), post laparotomy residual abscess, abscesses in abdominal recesses (eg: paracolic, subdiaphragmatic, pelvic etc.).

Duration of data collection was approximately 3(three) months. Data was collected from patient's clinical history-physical examination-follow up sheet and investigations of the patients. Patient was monitored from admission to discharge and follow up at outpatient department (two weakly for one month). After collection, data editing and clearing was done manually and prepared for data entry and analysis by using computer (by using SPSS).

RESULTS

This prospective observational study was carried out among 20 patients with intra-abdominal abscess who undergone percutaneous pigtail catheter drainage guided by ultrasonography. The aim of this study was to measure the short-term outcomes and success rate of drainage of intra-abdominal abscesses with an image-guided (USG) percutaneous pigtail catheter. Here Total number of 20 cases underwent percutaneous pigtail catheter drainage intended for intra-abdominal abscess guided by USG was considered as study population.

Table I contains the demographic characteristics of the patients with intra-abdominal abscess; here, 55% patients were in age group of 31-50 years. Others 25%, 15% and 5% were in age group of 11-30, 51-70 and >70 years respectively. The mean age (Mean $\pm$ SD) of the patients was 40.35 $\pm$ 15 years and male female ratio was 1.8: 1.

Table-I: Demographic characteristics of the patients (n=20)

Characteristics		Frequency	%
Age group	11-30	5	25
	31-50	11	55
	51-70	3	15
	>70	1	5
Mean $\pm$ SD		40.35 $\pm$ 15.80	
Age range		12-71	
Sex	Male	13	65
	Female	7	35
Male- Female ratio		1.8:1	

Table II labels the extent of pus drained and quantity of drains were required; here, ≤ 500 ml, 501-1000 ml and >1000 ml volume of pus were drained from 55%, 35% and 10% patients respectively. Single drainage were required in 95% patients and multiple drainage in only 5%. Size of the catheter used in 85% was 14 Fr and other was 12 Fr.

Table-II: Volume of pus drained, quantity of drains and required size of catheter (n=20)

Total Volume of pus drained (ml)		Frequency	(%)
	≤ 500	11	55.0
	501-1000	7	35.0
	>1000	2	10.0
Quantity of drain required			
	Single	19	95.0
	Multiple	1	5.0
Size of catheter used			
	12 Fr	3	15
	14 Fr	17	85

Table III shows that the duration of hospital stay of 65%, 25% and 10% patients were 6 to 10, 1 to 5 and >10 days respectively. Here, 70% catheters removed within 6-10 days; 25% and 5% within 1-5 days and >10 days respectively. The average catheters removal date 6.90 $\pm$ 1.87 days.

Table-III: Duration of hospital stay and time of removal of pigtail catheter of patients (n=20)

		Frequency	Percentage
Hospital stay	1-5 days	5	25.0
	6-10 days	13	65.0
	>10 days	2	10.0
Time of removal of pigtail catheter			
	1-5 days	5	25.0
	6-10 days	14	70.0
	>10 days	1	5.0
Mean $\pm$ SD		6.90 $\pm$ 1.87	

Figure 1 illustrates the success rate of the procedure. Here, 90% success rate were achieved and 10% were failure.

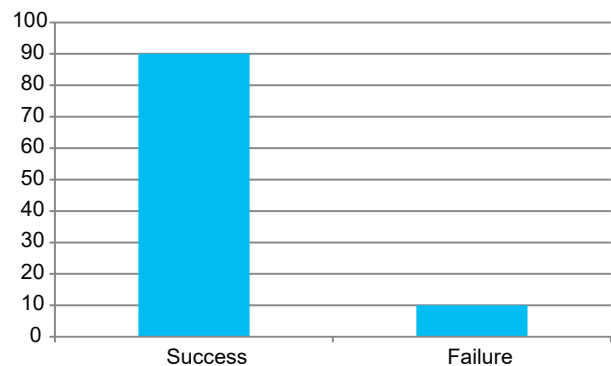
**Figure- 1: Result of success rate of the procedure (n=20)**

Table IV states the post drainage complications of patients; here, 90% of the patients didn't developed any complications.

Table- IV: Post drainage complications (n=20)

Complications	Frequency	Percentage (%)
Wound Infection	1	5.0
Peritonitis	1	5.0

Table V displays the causative micro-organisms of intra-abdominal abscesses by pus analysis; here, Escherchia coli was detected in 60% cases. Staph aureus, Streptococcus and Pseudomonas were found in 25%, 10% and 5% of patients.

Table- V: causative micro-organisms of intra-abdominal abscesses by pus analysis (n=20)

Organism	Number	Percentage (%)
Escherichia coli	12	60.0
Staph aureus	5	25.0
Pseudomonas	1	5.0
Streptococcus	2	10.0

DISCUSSION

The approach to managing intra-abdominal abscesses is increasingly favoring nonsurgical methods, though many surgeons still opt for surgical intervention in some institutions. Many experts recommend percutaneous catheter drainage and antibiotic therapy as the preferred treatment for most abdominal and pelvic abscesses when surgery is not immediately required, as this approach minimizes the risks associated with general anesthesia and surgical procedures. Abscess treatment relies on two primary principles: evacuation and sustained drainage. While aspiration and continuous drainage have been explored for liver abscesses, catheter drainage (CD) remains the most commonly applied technique for abdominal and pelvic abscess collections.¹

This study was a hospital based study among the patients of intra-abdominal abscess to see the short term outcome of image guided (USG) percutaneous pigtail catheter drainage of intra-abdominal abscess.

The age incidence in this study ranged from 12 years to 71 years. Among them 55% was in between 31-50 years age group. The mean age was 40.35 ± 15.80 years. The youngest patient was 12 years and oldest was 71 years. Similar study Singh et al.¹² found the age of the patients ranged from 18 years to 65 years with majority of the patients falling within the age range from 40 to 50 years ($n = 28$). The second most common age group was 31–40 years ($n = 15$ patients) that was followed by 21–30 years ($n = 10$ patients).

In this study out of 20 patients, 13(65%) were males and 7(35%) were females. The female to male ratio was 1.8:1. This findings consistent with Dhurve et al.¹³ they found 73 males (60.8%) and 47 females (39.2%). Thus, the male: female ratio was 1.5:1. Another study Singh et al.¹² the found majority of the patients were males ($n = 55$) with females accounting for only minority of the participants.

This study finds that most of the catheter size was 14Fr (85%) and 15% were catheter size 12Fr. Similar study Raj

et al.¹⁴ reported 3.2% were catheter size was 8Fr, 54.8% were catheter size 10Fr, 35.5% were catheter size 12Fr and 6.5% were catheter size 14Fr.

In this study most of the number of abscesses cavities were single abscess cavities (95%) and 1 patients (5%) had multiple number abscess cavities. Therefore, the findings of the study are in well agreement with the findings of the other research works¹⁴ they found 77.4% were single number of abscess cavities and 22.6% were multiple number of abscess cavities.

This study shows the most common were appendicular abscess (55%) then sub-hepatic (25%) and Sub-phrenic (10%). Several reports also have found that majority of the liver abscesses.^{5,7,9,11,15,16}

This study shows 95% were single drained required and 5% were multiple drained required. Therefore, the findings of the study are in well agreement with the findings of the other research works¹⁴ they found 22.6% were single drained required and 77.4% were multiple drained required. A Wani et al.¹⁷ study 87.5% were done with local anesthesia. Only 3 of the patients got general anesthesia due to patients interested. They were unwilling to go through any procedure under local anesthesia.

In this study found complication rate was 10%. Anbumani et al.¹⁸ recorded the same findings with no complications recorded. Another study Bayomi et al.¹⁹ reported complication rate was 10.6%.

This study shows 65% patients were needed 6-10 days hospital stay is similar to the findings of previous studies.¹⁹ The same results were proved by Dhurve et al.¹³ who reported hospital stay (7.5 days) with drainage.

In our study, the overall success rate of the percutaneous drainage procedure for all types and locations of intra-abdominal abscess was 90%. This finding is in sync with similar previous studies thereby adding greater credibility to image guided PCD as a treatment modality.^{14,15,18,20-23} Previous studies percentage of success (94%) was achieved by Saxena et al.²⁴ with only (6%) failure rate. Also (94%) of cases studied by Abusedera et al.¹ showed complete resolution by percutaneous, only (6%) of cases failed. The success rate of image guided PCD ranges widely from 70%-97% for single / late onset abscess and about 80% in cases of multiple/ early onset abscesses.^{13,25,26} The success rate in the present series is approximately 89.2%.¹⁵

In this study shows 25% were catheter removal 1-5 days, 70% were catheter 6-10 days and 10% were catheter

removal >10 days. The average day of catheter removal was 6.90 ± 1.87 days. Therefore, the findings of the study are in well agreement with the findings of the other research works¹⁵ they reported after about 7 days after catheter withdrawal.

In this shows the most common strain cultured was *Escherichia coli* found in 60% of the cases. Therefore, the findings of the study are in well agreement with the findings of the other research works¹³ they reported the most common strain cultured was *Escherichia coli* (25%) which is comparable with study reported by Aeder (23%) and WA. Joseph (21.42%).^{6,7} However based on these findings, image guided percutaneous pigtail catheterization of intra-abdominal abscesses can be applied as the first line of treatment for uncomplicated intra-abdominal abscess. Furthermore the technique can be easily learned and the service can be provided at OPD in case of residual abscesses. However, where catheter drainage failed open drainage still has a role.

The limitations of the studies were as study was conducted in only one centre, sample size was small and study period was short and long term effects could not be assessed.

CONCLUSION

Image guided (USG) percutaneous pigtail catheter drainage is an easy, safe, effective and relatively atraumatic procedure for draining intra-abdominal abscess. It reduces post-operative morbidity and hospital stay. Practicing this method can reform the treatment policy of intra-abdominal abscess. Further studies are needed to address the effect of catheter type and technical success rate for abscess drainage.

REFERENCES

1. Abusedera MA, Khalil M, Ayman MA, Elsani A, Hassan MA. Percutaneous image-guided aspiration versus catheter drainage of abdominal and pelvic collections. *The Egyptian Journal of Radiology and Nuclear Medicine* 2013; 44(Issue 2): 223-230.
2. Exarhos DN, Lazarioti FG, Testembasi E, Chondros D. Drainage of Post-Operative Abdominal and Pelvic Abscesses Under the Guidance of Computed Tomography. *Department of Computed Tomography and Magnetic Resonance Imaging, Evagelismos Hospital, Athens, Greece. Hospital Chronicles* 2012;7(1): 48-54.
3. Zerem E, Hadzic A. Sonographically Guided Percutaneous Catheter Drainage Versus Needle Aspiration in the Management of Pyogenic Liver Abscess. *AJR* September 2007;wl 38- w142.
4. Charles HW. Abscess Drainage. *Seminars in Interventional Radiology*. 2012; 29(4): 325-336.
5. Kapadia S, Duttaroy D, Ghodgaonkar P, Maru S. Percutaneous Catheter Drainage of Liver Abscesses. *Indian Journal of Surgery* 2002;64(6): 516-5 19.
6. Saremi F. Percutaneous drainage of abdominal abscesses and fluid collections. *Medical journal of Islamic republic of Iran*. 1990;4:75-80.
7. Macha DB, Thomas J, Nelson RC. Pigtail Catheters Used for Percutaneous Fluid Drainage: Comparison of Performance Characteristics. *Department of Radiology, Duke University Medical Center, final version accepted September 6*.
8. Kim YJ, Han JK, Lee JM. Percutaneous Drainage of Postoperative Abdominal Abscess with Limited Accessibility: Preexisting Surgical Drains as Alternative Access Route. *From the Department of Diagnostic Radiology and Institute of Radiation Medicine, Seoul National University Hospital final version accepted August 2*.
9. Maher MM, Gervais DA, Kaira MK. The inaccessible or undrainable abscess: how to drain it. *RadioGraphics* 2004;24: 717-735.
10. Laganà D, Carrafiello G, Mangini M, Ianniello A, Giorgianni A, Nicotera P. Image-guided percutaneous treatment of abdominal-pelvic abscesses: a 5-year experience. *Radiol med* 2008;113:999-1000.
11. Sharma N, Kaur H, Katra N, Bhafla A, Kumar S, Singh V. Complications of Catheter Drainage for Amoebic Liver Abscess. *J Clin Exp Hepatol*. 2015; 5(3): 256-258.
12. Singh P, Tapasvi C, Kaur R, Aggarwal S, Nagpal N, Kaur R. Prospective randomized comparison of ultrasoundguided percutaneous needle aspiration with percutaneous catheter drainage of liver abscesses. *J Med Sci* 2019;39:67-73.
13. Dhurve AS, Bodade RM, Bugga RR, Nandu VV, Meshram MM. Clinical study of intra-abdominal abscess and its management by percutaneous USG guided drainage. *Int Surg J* 2018;5:2211-6.
14. Raj R, Singh G, Banerjee JK, Bharathi RS. Image Guided Percutaneous Drainage of Intra-Abdominal

- Collections. Surgical Case Reports. 2020; 3(8): 2-6
15. Anita S, Senthil Anbumani. Study of technique, advantages and effectiveness of percutaneous drainage of intra-abdominal abscesses. IAIM, 2017; 4(3): 30-36.
16. Dulku G, Mohan G, Samuelson S, Ferguson J, Tibballs J. Percutaneous aspiration versus catheter drainage of liver abscess: A retrospective review. AMJ 2015;8(1):7-18.
17. Wani RA, Digra NC, Gupta K. Image-Guided Percutaneous Drainage of Intra Abdominal Fluid Collections and Abscesses: A Hospital Based Prospective Study. World J Surg Surgical Res. 2020; 3: 1-5.
18. Anbumani S, Soundarapandian A. A Study of ultrasound and CT guided therapeutic drainage of intra-abdominal collections and abscesses. International Journal of Contemporary Medicine Surgery and Radiology. 2018;3(3):C126-C130.
19. Bayomi, M., Alkilany, M., Israel, J. Percutaneous Versus Open Surgical Drainage of Intra-Abdominal Abscesses. Zagazig University Medical Journal 2019;26 (Issue 4): 649-653.
20. Kassi F, Dohan A, Soyer P, Vicaut E, Boudiaf M. Predictive factors for failure of percutaneous drainage of postoperative abscess after abdominal surgery. Am J Surg 2014;207: 915-921.
21. Bua-ngam C, Waeosak P, Wedsart B, Treesit T, Chansanti O. Predicting factors for failure of percutaneous drainage of postoperative intra-abdominal collection. J Med Assoc Thai 2017;100: 111-118.
22. Gerzof SG, Robbins AH, Birkett SH, Johnson WC. Percutaneous catheter of abdominal abscess guided by ultrasound and computed tomography. AJR Am J Roentgenol 2019; 133: 18.
23. Gerzof SG, Robbins AH, Birkett SH, Johnson WC. Percutaneous catheter drainage of abdominal abscesses: a five year experience. NEJM, 2011; 305: 653-657.
24. Saxena AK, Singhal J, Gupta A, Rai AK. Comparison of USG Guided Pigtail Catheterisation Vs Open Drainage in the Management of Liver Abscess. Int J Med Res Prof. 2016; 2(2); 346-49.
25. Okita Y, Mohri Y, Kobayashi M, Araki T, Tanaka K, Inoue Y. Factors influencing the outcome of image-guided percutaneous drainage of intra-abdominal abscess after gastrointestinal surgery. Surg Today 2013;43:1095–1102.
26. Chowdhary SK, Sarangal KR. A prospective study comparing pigtail catheter drainage vs repeated needle aspirations in treatment of intraabdominal abscesses. International Journal of Surgery and Surgical Sciences (IJSSS) 2016;4(3): 325-330.

Original Article

The Impact of Chronic Kidney Disease on Iron Metabolism and Hemoglobin Parameter in Patients with and without Diabetes Mellitus

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Abstract

Chronic kidney disease (CKD) is one of the most common public health concerns around the world with numerous adverse outcomes such as cardiovascular disease (CVD), end stage renal disease (ESRD) and premature death. The progression of the CKD leads to an increase in the development of hematological alterations, such as low hemoglobin levels and iron deficiency. Diabetes mellitus is the most common cause of CKD, leading to ESRD and therefore, is also the most common cause of renal anemia. The aim of this study was to find out the influence of Iron Metabolism and Hemoglobin parameter among CKD patients with and without diabetes mellitus by determining iron profile and hemoglobin level. This cross-sectional analytical study was carried out in the department of Nephrology, Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM) General Hospital, Dhaka over a period of one year July 2022 to June 2023. A total of 100 CKD patients were included in this study as respondents and divided them in to two halves; 50 CKD patients with DM were selected as group- I and other 50 CKD patients without DM as group II. After taking written informed consents, data were

taken from patients by using a structured questionnaire. Data was analyzed by Statistical Package for Social Sciences (SPSS), version- 26. In this study serum iron was found significantly lower in group- I (Mean $\pm$ SD: 6.16 $\pm$ 2.36) than group- II (Mean $\pm$ SD: 12.73 $\pm$ 7.36), which was statistically significant. Group- I also represents 56% absolute iron deficiency, 18% functional iron deficiency and 26% normal iron status, Group- II represents 18% absolute iron deficiency, 38% functional iron deficiency and 44% normal iron status respectively. These differences between two groups were statistically significant (p value: <0.001.). Hb level as mean $\pm$ SD was, 8.5 $\pm$ 1.83 in group- I and 12.89 $\pm$ 2.54 in group- II respectively and statistically differences were significant. Among the study subjects, frequency of anemia was higher in group- I. In correlation analysis, variables of all study subjects with eGFR showed significant positive correlation with serum iron and Hb level. This study showed that serum iron and Hb level were significantly lower in diabetic chronic kidney disease patients than non-diabetic CKD patients. The findings also revealed that absolute iron deficiency was more common in diabetic CKD patients.

Key words: Chronic kidney disease, diabetes mellitus, serum iron, hemoglobin

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INTRODUCTION

Chronic kidney disease (CKD) has been identified as a major public health issue worldwide with increasing prevalence & mortality.¹ the national kidney foundation defines CKD as damage or a glomerular filtration rate (GFR) of less than 60ml/min/1.73 m² of body surface area for longer 3 months.² the prevalence of CKD was 22.48% in Bangladeshi population.³ Diabetes mellitus (DM) contributes to a major cause of CKD & end stage renal disease (ESRD). DM affects more than 422 million people worldwide, with 40% of those affected developing CKD.⁴ A recent systematic review found that overall prevalence of CKD among type 2 diabetic patients in Bangladesh is 21.3%.¹

The progression of CKD to ESRD, as well as development of other complications related to impaired renal function, are the most common consequences of CKD. Anaemia is

the most common complication of CKD. Anaemia due to iron deficiency is a typical consequence of CKD.⁵ Both absolute and functional iron deficiency affects CKD patients. Low transferrin saturation (TAST) <20% combined with low serum ferritin < 100 is diagnostic of absolute iron deficiency in CKD patients. Functional iron deficiency is diagnosed by a low transferrin saturation (TAST) <20% paired with a normal or high serum ferritin level (≥ 100). The decline in erythropoietin production and dysregulated iron homeostasis plays a key role in the development of anaemia in CKD.⁶ The most common test for diagnosis of iron deficiency anaemia is serum iron and serum ferritin.⁶

Approximately 40% of patients with type 2 Diabetes mellitus develop CKD which causes albuminuria, reduced glomerular filtration rate or both.⁷ Dysregulation of iron homeostasis is also a crucial cause in the development of anaemia in CKD with type 2 diabetic patients.⁸

Anaemia is a common consequence in people with CKD. A gradual and progressive decline of hemoglobin level is noted when renal function deteriorates, and as the estimated glomerular filtration rate falls, its prevalence grows.⁹ The World Health Organization (WHO) defines renal anaemia when hemoglobin level < 13 gm/dl in men and < 12 gm/dl in women, is an important complication of CKD. Idris et al. studied when CKD patients with type 2 DM were compared to those without type 2 DM, the prevalence of anaemia was shown to be higher.¹⁰ Many factors have been proposed as contributing to the anemia etiology in the patients. In case of diabetic neuropathy, erythropoietin insufficiency can be caused by efferent sympathetic denervation of the kidney.¹¹ Chronic inflammatory reaction resulting in functional iron shortage and erythropoietin loss due to non-selective urinary protein loss.⁵ In addition, anemia has also been found to be a significant independent factor for progression of CKD to ESRD in type 2 diabetic patients.¹⁰

However, a direct comparison between diabetic and non-diabetic CKD patients with regards to anemia has not done yet in Bangladesh. So, the aim of this study is to compare iron profile and Hb level among CKD patients from stages (3-5) with or without type 2 DM.

MATERIALS AND METHODS

This cross-sectional analytical study was conducted in the Department of Nephrology at BIRDEM General Hospital during the period over one year. A total of 100 CKD patients from stage 3 to 5 were included in this study as study population. All of them were divided into Group- I

as CKD (stage 3 to 5) patients with type 2 DM and Group II as CKD (stage 3 to 5) patients without type 2 DM. CKD patients on hemodialysis, patients of known hematological disorder, patients taking iron supplement and pregnant women were excluded. A structured questionnaire and a data sheet were designed with a view to collect data from the respondents. With all aseptic precautions venous blood was drawn for laboratory work up for estimation of fasting blood glucose, serum iron and serum ferritin. After counselling, informed written consent was taken from each patient.

STATISTICAL ANALYSIS

Statistical analyses were performed using the Statistical Program for Social Sciences (SPSS) software (version 26.0; SPSS, Inc.). Categorical variables were presented as frequencies and percentages in tables and graphs; continuous variables were expressed as means and standard deviation. Correlations were assessed with Pearson's coefficient correlation. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Among 100 CKD patients, 50 patients included into Group- I, who were diagnosed as CKD with type 2 DM. On the other hand, Group II included 50 patients diagnosed with CKD without type 2 DM.

Table I contains the important baseline characteristics including sex, stages of CKD & duration of DM. Among the total study subjects 56 % were male & 44% were female. The majority of the respondents, about 56% were in stage 4, 27% were in stage 3 and 17% were in stage 5. 78% of the respondents were anemic and 41% had absolute iron deficiency.

Table- I: Important baseline characteristics (sex, stages of CKD, Type of iron deficiency) of overall study subjects

Characteristics		Frequency (n=100)
Sex	Male	56
	Female	44
Stage of CKD	Stage-3	27
	Stage-4	56
	Stage-5	17
Type of Iron deficiency	Normal	33
	Functional	26
	Absolute	41
Presence of anaemia	Yes	78
	No	22

Table II showed no significant difference of Mean value of serum creatinine and eGFR between 2 groups. Statistical analysis was done by independent t- test to compare among groups.

Table- II: Comparison of glycemic and renal status between 2 groups

Variables	Group I (CKD with DM) (n=50) Mean± SD	Group II (CKD without DM) (n=50) Mean± SD	p value
FBS (mmol/L)	12.24±4.98	4.71±0.67	0.000
HbA1c (%)	8.77±1.82	5.39±0.46	0.000
Serum Creatinine (mg/dl)	3.01±1.55	3.27±1.69	0.455
eGFR (ml/min/m ²)	24.33±11.50	24.58±11.70	0.532

Values are expressed as the mean± SD.

= significant ($p \leq 0.05$, ** $p < 0.01$, *** $p < 0.001$).

Table III showed that serum iron and Hb level were significantly lower in diabetic CKD group than non-diabetic CKD group. Serum ferritin was found increased in both groups. Statistical analysis was done by independent t test to compare between two groups. Values are expressed as the mean± SD.

Table- III: Comparison of serum iron, serum ferritin and Hb level between 2 groups

Variables	Group I (CKD with DM) (n=50) Mean± SD	Group II (CKD without DM) (n=50) Mean± SD	p value
Serum Iron (μmol/L)	6.16±2.36	12.73±7.36	0.000
Serum Ferritin (ng/ml)	256.47±21.47	146.17±15.32	0.015
Hb (%)	8.5±1.83	12.89±2.54	0.019

= significant ($p \leq 0.05$, ** $p < 0.01$, *** $p < 0.001$).

Comparison was done by Chi-Square Test of Independence

= significant ($p \leq 0.05$, ** $p < 0.01$, *** $p < 0.001$).

Figure I showed that 84% of the group I were anaemic and only 16% were non anaemic. Furthermore, group II showed 68% were anaemic and 32% were non anaemic. These differences between 2 groups were statistically significant.

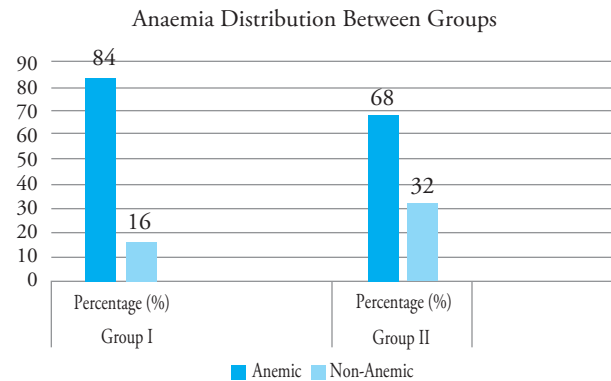


Figure- I: Frequency distribution of anaemia among the study subjects

Table IV showed group I represented 56% absolute iron deficiency, 18% functional iron deficiency and 26% showed normal iron status. And group II showed 18% absolute iron deficiency, 38% functional iron deficiency and 44% showed normal iron status. Comparison was done by Chi-Square Test of Independence

Table- IV: Frequency distribution of iron deficiency between 2 groups

Types of Iron deficiency	Group I (CKD with DM) F n=50		Group II (CKD without DM) F n=50		P- value
		%		%	
Normal	13	26.0	22	44.0	
Functional	9	18.0	19	33.8	
Absolute	28	56.0	9	18.0	0.001

= significant ($p \leq 0.05$, ** $p < 0.01$, *** $p < 0.001$).

Table V represents the correlation of eGFR with serum iron, ferritin and Hb. Pearson correlation was used for statistical analysis. Here positive correlation of eGFR with serum iron and Hb level as well as eGFR showed negative correlation with serum ferritin.

Table- V: Correlation of eGFR with serum iron, ferritin, Hb

Variables	R	p-value
Iron	0.314	.041
Ferritin	-.226	.025
Hb	0.465	.000

R, Pearson correlation coefficient

= significant ($p \leq 0.05$, ** $p < 0.01$, *** $p < 0.001$).

DISCUSSION

The hallmark of chronic kidney disease is anaemia. The majority of people with advanced CKD suffer from the complications of anaemia, which is typically caused by reduced production of erythropoietin. Over 2 million individuals globally suffer from iron deficiency¹², and iron deficiency anaemia continues to be the most common form of anaemia, with the largest incidence being seen in West Africa and South Asia.

The most common cause of chronic kidney disease is diabetes mellitus. It was recently found that anaemia occurs more commonly in CKD patients with diabetes than in those without the condition.

This current cross-sectional study was carried out over a period of one year in the Nephrology department of the BIRDEM General Hospital in Dhaka. According to inclusion criteria, the 100 study population was divided into two groups. Among them 50 were CKD with DM and another 50 subjects were non-diabetic CKD patients.

Of the study participants, 44% were female and 56% were male. The gender distribution of this study aligns with the epidemiology of chronic kidney disease, and the USRDs 2021 annual data report indicates that the incidence of ESRD was 60.6% higher for male.¹³

The iron profile and haemoglobin level of the two groups were compared in this study. The mean serum iron level in the diabetic group was significantly different from the value for the non-diabetic CKD group.

Specifically, the serum iron levels in groups I and II were 6.16 ± 2.36 and 12.73 ± 7.36 , respectively, where $p < 0.001$, which was significantly low in group I. Similar result was also seen in other studies conducted by Robles NR et al., which also showed statistically significant results.¹⁴

A high prevalence of iron deficiency among diabetic CKD subjects was linked to our study's finding that anaemia was more common in these patients. According to the National Health and Nutrition Examination Survey Iv, up to 50% of patients with CKD stages 3-5 have either absolute or relative iron deficiency.¹⁵

According to this study, absolute iron deficiency was higher in the diabetic CKD group than in the non-diabetic CKD group (56 % and 18 %, respectively), while the functional iron deficiency was higher in the non-diabetic CKD group (38 % and 18 % respectively). These

differences between the two groups are statistically significant.

We have found serum ferritin level increased in both groups. The mean value of serum ferritin was 256.47 ± 21.47 and 146.17 ± 15.32 in group I and group II respectively. Other authors also found similar results in their studies.

Means serum Hb level in group I and group II were found 8.5 ± 1.83 and 12.89 ± 2.54 . The results of this study demonstrate that diabetic patients with CKD stage 3-5 have Hb levels significantly lower than non-diabetic patients at the same stages of CKD. Similar results have been observed in the other studies.¹⁵

We have also found the frequency of anemia higher in Diabetic CKD patients which was 84% as compared with non-diabetic CKD patients which was 68%. This result is similar to other study done by M Uzma et al., 2009 which showed anemia prevalence was up to 10-fold higher among diabetic patients with CKD.¹⁶ Thus, patients with diabetes mellitus and renal insufficiency have a higher risk of developing anemia.

In correlation analysis, hemoglobin level had significant positive correlation with e GFR. This result reflects the similar result of the study carried out by Loutradis et al., 2016.⁵

LIMITATIONS

- The sample size of the study was limited.
- All patients were collected from a single tertiary level hospital which does not reflect the whole country.
- Furthermore, underlying inflammation could not be completely ruled out in these patients which could have affected the serum ferritin level.

CONCLUSION

This study demonstrated that serum iron and hemoglobin levels were significantly lower in diabetic chronic kidney disease (CKD) patients compared to their non-diabetic counterparts. It was also observed that anemia was prevalent among CKD patients, with a higher frequency in diabetic CKD patients than in non-diabetic ones. Additionally, the findings revealed that absolute iron deficiency was more common in diabetic CKD patients, while functional iron deficiency was more prevalent in non-diabetic CKD patients. Consequently, routine screening for anemia in type 2 diabetes mellitus (T2DM) patients with CKD is recommended. This could facilitate

early treatment and enhance the overall management of CKD in T2DM patients, ultimately reducing mortality, morbidity, treatment costs, and complications associated with the condition.

REFERENCES

- Islam, S.M. *et al.* (2021) 'Factors associated with chronic kidney disease in patients with type 2 diabetes in Bangladesh', *International Journal of Environmental Research and Public Health*, 18(23), p. 12277. doi:10.3390/ijerph182312277.
- Bhattacharjee, K. *et al.* (2015a) 'A study on hematological profile in patients of chronic renal failure with special reference to Serum Iron Profile', *Journal of Evidence Based Medicine and Healthcare*, 2(46), pp. 8212–8219. doi:10.18410/jebmh/2015/1107.
- Banik, S. and Ghosh, A. (2020) 'Prevalence of chronic kidney disease in Bangladesh: a systematic review and meta-analysis', *International Urology and Nephrology*, 53(4), pp. 713–718.
- Alemu, H., Hailu, W. and Adane, A. (2020) 'Prevalence of Chronic Kidney Disease and Associated Factors among Patients with Diabetes in Northwest Ethiopia: A Hospital-Based Cross-Sectional Study', *Current Therapeutic Research*, 92, p. 100578. doi: 10.1016/j.curtheres.2020.100578.
- Loutradis, C., Skodra, A., Georgianos, P., Tolika, P., Alexandrou, D., Aydelidou, A. and Sarafidis, P. (2016) 'Diabetes mellitus increases the prevalence of anemia in patients with chronic kidney disease: A nested case-control study', *World Journal of Nephrology*, 5(4), p. 358.
- Usui, T. (2020) 'Serum total iron-binding capacity and iron status in patients with non- dialysis-dependent chronic kidney disease', *Asia Pacific Journal of Clinical Nutrition*, 29(1), pp. 48–54.
- Jairoun, A.A., Ping, C.C. and Ibrahim, B. (2024) 'Predictors of chronic kidney disease survival in type 2 diabetes: a 12-year retrospective cohort study utilizing estimated glomerular filtration rate', *Scientific Reports*, 14, p. 9014.
- Zapora-Kurel, A., Kuźma, Ł., Zakrzewska, M., Żórawski, M., Dobrzycki, S., Twardowska-Kawalec, M. and Małyżko, J. (2021) 'Novel iron parameters in patients with type 2 diabetes mellitus in relation to kidney function', *Journal of Clinical Medicine*, 10(16), p. 3732.
- Belurkar, S. and Shastry, I. (2019) 'The spectrum of red blood cell parameters in chronic kidney disease: A study of 300 cases', *Journal of Applied Hematology*, 10(2), p. 61. doi: 10.4103/joah.joah_13_19.
- Idris, L., Tohid, H., Muhammad, N., Rashid, M.A., Ahad, A.M., Ali, N., Sharifuddin, N. and Aris, J. (2018) 'Anaemia among primary care patients with type 2 diabetes mellitus (T2DM) and chronic kidney disease (CKD): A multicentred cross-sectional study', *BMJ Open*, 8(12), p. e025125.
- Sabbatini, M., D'Apolito, M., Di Sole, F., Petruzzelli, R., Huynh, T., Lalli, E. and Svelto, M. (2008) 'Nuclear transcription factor CREB mediates arginine vasopressin regulation of aquaporin-2 transcription in renal cells', *American Journal of Physiology-Renal Physiology*, 295(2), pp. F299–F311. doi: 10.1152/ajprenal.00267.2007.
- Hentze, M.W., Muckenthaler, M.U., Galy, B. and Camaschella, C. (2010) 'Two to tango: Regulation of mammalian iron metabolism', *Cold Spring Harbor Perspectives in Biology*, 2(12), p. a011866. doi: 10.1101/cshperspect.a011866.
- Bello, A.K., Okpechi, I.G., Levin, A., Ye, F., Damster, S., Arruebo, S., Donner, J.-A., Caskey, F.J., Cho, Y., Davids, M.R., Davison, S.N., Htay, H., Jha, V., Lalji, R., Malik, C., Nangaku, M., See, E., Sozio, S.M., Tonelli, M. and Wainstein, M. (2024). An update on the global disparities in kidney disease burden and care across world countries and regions. *The Lancet Global Health*, [online] 12(3), pp.e382–e395. doi:https://doi.org/10.1016/S2214-109X(23)00570-3.
- Robles, N.R., Ramos, J.L., Chavez, E., Gonzalez Candia, B., Bayo, M.A., Cidoncha, A., Gomez, J.L. and Cubero, J.J. (2018) 'Iron deficiency in chronic kidney disease patients with diabetes mellitus', *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 12(6), pp. 933–937. doi: 10.1016/j.dsx.2018.05.018.
- Wong, M.M. *et al.* (2019) 'Anemia and iron deficiency among chronic kidney disease stages 3–5ND patients in the chronic kidney disease outcomes and practice patterns study: Often unmeasured, variably treated', *Clinical Kidney Journal*, 13(4), pp. 613–624. doi: 10.1093/ckj/sfz091.
- Mehdi, U. and Toto, R.D. (2009) 'Anemia, diabetes, and chronic kidney disease', *Diabetes Care*, 32(7), pp. 1320–1326. doi: 10.2337/dc08-0779.

Original Article

Stone Attenuation and Skin-to-Stone Distance on Computed Tomography Predict the Performance of Shock Wave Lithotripsy in Renal Stone Disease

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Abstract

Shock wave lithotripsy (SWL) is a noninvasive, safe, and effective method of treating renal stones. The overall stone-free rate (SFR) varies greatly depending on stone location and size. Failure to disintegrate the stone results in unnecessary exposure to shock waves and radiation, as well as the need for alternative treatment procedures, which raises medical costs. Prior to treatment, it is critical to identify predictors of treatment success or failure in patients who are potential candidates for SWL. The purpose of this study is to determine if stone attenuation and skin-to-stone distance in computed tomography have the ability to predict the success of shock wave lithotripsy in renal stone disease. This prospective observational study was carried out in the Department of Urology at Bangabandhu Sheikh Mujib Medical University (BSMMU) in collaboration with the Department of Radiology and Imaging from January to December 2023. Patients with renal stones who were scheduled for shock wave lithotripsy (SWL) were enrolled in this study after obtaining their consent. The history of these patients, including their drug and dietary histories, was recorded in detail. Each patient was given computed tomography to evaluate stone attenuation and skin-to-stone distance. After SWL, Stone clearance rate was compared with stone attenuation and skin-to-stone distance. The statistical package for social sciences (SPSS) version 20.0 was used to analyze the data. Males were more prevalent than females, but the stone-free rate was higher in females, though this difference was not statistically significant. Younger patients experienced a higher stone-free rate, and patients with low BMI had better outcomes than those with high BMI. Stones were most abundant in the lower pole, followed by the pelvis, central, and upper pole. The stone-free rate was highest in the pelvis, followed by the

central, lower pole, and upper pole. Stone-free status was more common among patients with smaller stones and lower stone attenuation, though these differences were not statistically significant. Patients with a shorter skin-to-stone distance had a significantly higher rate of stone extraction. Skin-to-stone distance more effectively predicts the success of SWL in renal stone disease than stone attenuation.

Keywords: CT scan, SWL and renal stone.

INTRODUCTION

Shock wave lithotripsy (SWL) remains a widely accepted, noninvasive, safe, and effective treatment option for renal stone, despite a wide range of current success rates (46%-91%; efficiency quotient 0.36-0.67).^{1,2} The size and location of the stone play a significant role in patient selection. Stone attenuation, skin-to-stone distance (SSD) on non-contrast computed tomography (NCCT), and body mass index (BMI) are emerging as predictors of SWL fragmentation.^{3,4} Such factors could help to streamline stone disease care and reduce unnecessary treatments. A major criticism of measuring stone attenuation is the volume averaging that occurs for smaller stones, resulting in fictitious low attenuation values that can confuse its association with the SWL outcome.^{5,6}

Failure to disintegrate the stone results in unnecessary exposure to shock waves and radiation, additional patient suffering, and the need for alternative treatment procedures, which raises medical costs.⁷ Prior to treatment, it is critical to identify predictors of treatment success or failure in patients who are potential candidates for SWL.

A radiographic examination of the stone is required to determine the best treatment. Non-contrast computed tomography (NCCT) is now recommended as the standard diagnostic tool in urinary stone disease because it provides reliable information on stone location, size, number, and total stone burden.^{6,7} Furthermore, several studies have found an effect of mean attenuation value (MAV) on the success of SWL treatment in kidney stones, leading to corresponding guideline recommendations.⁸ Despite its widespread use, the impact of additional information provided by NCCT, such as skin-to-stone distance (SSD)

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and MAV, on stone fragmentation in renal stone disease has received little attention.⁹⁻¹¹ Furthermore, three of the four studies reported on so far covered only one SWL session, regardless of whether disintegration occurred or not, and treatment success was evaluated in all four studies at the earliest 2 weeks after SWL. Ng et al. (2009) also only included proximal renal stones, and no real-time fluoroscopic screening was done during treatment.¹⁰

Failure of stone breakdown causes unnecessary exposure to radiation and shock waves, increased patient suffering, and the need for alternative treatment methods, all of which raise medical expenses. Determining treatment success or failure predictors in patients who may be candidates for SWL is crucial before starting treatment. This is why we decided to conduct a study to see if stone attenuation and skin-to-stone distance in computed tomography can predict shock wave lithotripsy performance in renal stone disease. The purpose of this study was to determine if SWL performance in renal stone disease can be predicted by CT stone attenuation and skin-to-stone distance.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Radiology and Imaging and Department of Urology, BSMMU, Dhaka over a period of one years from 01.01.2023 to 31.12.2023. Diagnosed adult patients of renal stone referred for SWL to the Department Urology, BSMMU, Dhaka during study period were enrolled as the study population. Severely ill patients were excluded from this study.

Procedure

Prior to the study, ethical approval was taken from the Institutional Review Board, and the study was conducted in accordance with the Declaration of Helsinki. The present study was conducted on 73 adult patients of both sexes with renal stones in the Department of Radiology, BSMMU. All patients were informed regarding the study and written consent was taken from each patients. Adult patients with renal stones who were referred for SWL were enrolled in this study. After enrollment in this study, general information such as name, age, gender etc. were recorded. A thorough clinical examination was done. CT scan was done for each patient to find out stone volume, location and skin-to-stone distance. If tolerated by the patient, up to 4,000 shocks (60–90/ min) with an energy level of up to 8 according to the manufacturer's scale was delivered during each SWL session. The energy level 8 corresponded to 16.4 kV with the precise focus and 12.8

kV with the extended focus. In patients with pain resistant to analgesic treatment, the energy and number of shocks were reduced according to the patient's tolerance. Stones were targeted and fragmentation was monitored by biplanar fluoroscopy at regular intervals during treatment. Patients were further evaluated by kidney, ureter, and bladder (KUB) film, renal ultrasound, and sieving of urine to assess fragmentation, the presence of renal dilatation and expulsion of renal stones the day after the respective session. In cases of missing or inadequate disintegration in KUB, SWL was repeated once or twice at intervals of 1 day. The clinical outcome was defined as successful (visible stone fragmentation on KUB) or failed (absent fragmentation on KUB) immediately after the last SWL session.

A predesigned questionnaire was used to record all the information which was then fed into the computer using Statistical Package for the Social Sciences (SPSS) software. Statistical analyses 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 will be taken as statistically significant. Sensitivity, specificity, positive predictive value, negative predictive value of stone volume and skin-to-stone distance will be calculated to predict success rate of stone clearance.

RESULTS

This prospective observational study was conducted among 73 adult patients of both sexes with renal stones and the aim of this study was to determine if SWL performance in renal stone disease can be predicted by CT stone attenuation and skin-to-stone distance.

Table I displays the demographic profile of the study subjects; according to sex here 43 (58.90%) were males and 30 (41.10%) females. The mean age of stone free group was 49.16 ± 8.50 years and 52.76 ± 9.57 in residual fragment group. Stone-free outcomes were more prevalent in younger individuals

Here, males exhibited a higher frequency than females, however, the stone-free rate was higher in females compared to males, but this difference was not statistically significant.

Table- I : Demographic profile of the study subjects according to the success of shock wave lithotripsy in renal stone disease (N=73)

	Frequency (%)	Stone free	Residual fragment	p-value
Gender				
Male	43 (58.90%)	31 (72.1)	12 (27.9)	0.264
Female	30 (41.10%)	25 (83.3)	5 (16.7)	
Age (years)		49.16 ± 8.50	52.76 ± 9.57	0.141

Figure 1 illustrates success rate of SWL. Stone-free rate was 77% (56) and residual fragment rate was 23% (17).

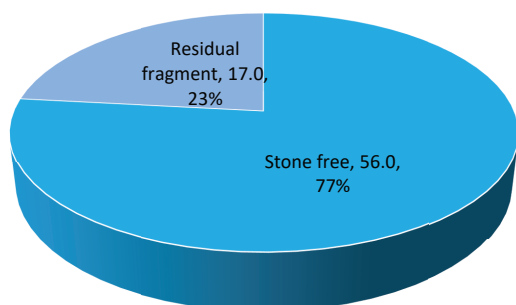
**Figure- 1:** Success rate of SWL

Table II shows the stone location of the study subjects; residual fragment rates were 3 (14.3%), 4 (57.1%), 2 (15.4%) and 8 (25.8%) in the location of pelvis, upper pole, central and lower pole respectively. The stone-free rate was maximum 18 (85.7%) in the pelvis, followed by the central 11 (84.6%), lower pole 24 (75.0%), and upper pole 3 (42.9%).

Table- II: Stone location of the study subjects (N=73)

	Stone free	Residual fragment	p-value
Pelvis	18 (85.7)	3 (14.3)	0.141
Upper pole	3 (42.9)	4 (57.1)	
Central	11 (84.6)	2 (15.4)	
Lower pole	24 (75.0)	8 (25.8)	

Table III demonstrates the stone characteristics and shocks delivered to the study subjects. Stone-free rate was higher in patients with smaller, lower attenuation stones, although these differences were not statistically significant. However, stone clearance was significantly greater in patients with shorter skin-to-stone distances.

Table- III: Stone characteristics and shocks delivered to the study subjects (N=73)

	Stone free (n=56)	Residual fragment (n=17)	p-value
Size volume (mm ³)	1718±1319	2387±1617	0.087
Skin to stone distance (mm)	73.96±7.85	87.24 ± 8.17	0.001
Stone attenuation (HU)	782.14±272.76	882.35±220.04	0.171
Shocks delivered (n)	2962.50±372.98	3076.47±253.79	0.243

Table IV states the multivariate analysis of variables predicting the stone-free rate by logistic regression analysis. Binary logistic regression was performed to assess the impact of several factors on stone-free rate in the shock wave lithotripsy in renal stone disease. The model contained four independent variables (Age, stone volume, stone-to-skin distance, and stone attenuation). The strongest predictor of stone-free was stone-to-skin distance, reporting an odds ratio of 1.4. This indicated that respondents who had stone-to-skin distance less were over 1.4 times more likely to have free stone.

Table- IV: Multivariate analysis of variables predicting the stone-free rate by logistic regression analysis (N=73)

	p-value	OR	95.0% CI of OR	
			Min	Max
Age	0.860	0.988	0.867	1.126
Stone volume	0.146	1.001	1.000	1.001
Skin-to-stone distance	0.000	1.400	1.172	1.673
Stone attenuation	0.066	1.005	1.000	1.010

Figure 2 expresses the receiver operating characteristic (ROC) curve for stone attenuation and skin-to-stone distance. The receiver operating characteristic (ROC) curve for stone attenuation and skin-to-stone distance using CT predicts shock wave lithotripsy performance in renal stone disease. The area under the curve for stone attenuation was 0.603 (95% CI 0.464 – 0.742), while for skin-to-stone distance, it was 0.901 (95% CI 0.801–1.000).

The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of stone attenuation in predicting the effectiveness of shock wave lithotripsy in renal stone disease at a cut-off point of 637.5 were 33.9%, 88.2%, 90.5%, and 28.8% respectively. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of skin-to-stone distance in predicting the effectiveness of shock wave lithotripsy for renal stone disease were 78.6%, 94.1%, 97.8%, and 57.1%, respectively, using a cut-off point of 80.5.

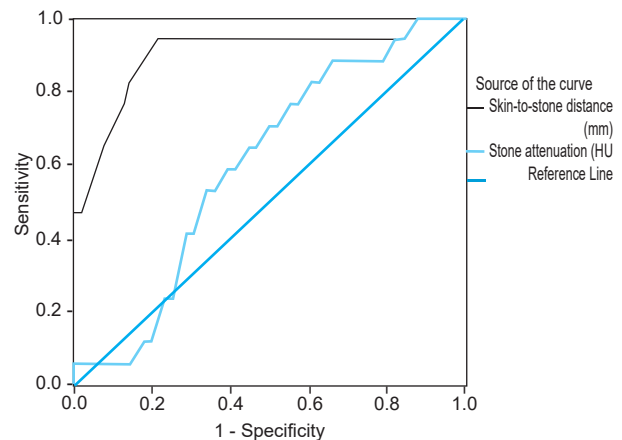


Figure- 2: The receiver operating characteristic (ROC) curve for stone attenuation and skin-to-stone distance

Table V explains the diagnosis efficacy of stone attenuation and skin-to-stone distance using CT in predicting the performance of shock wave lithotripsy in renal stone disease. Cut off, Sensitivity, Specificity, PPV, NPV, Accuracy of Stone attenuation presented 637.5, 33.9, 88.2, 90.5, 28.8, 44.6 and Skin-to-stone distance presented 80.5, 78.6, 94.1, 97.8, 57.1, 82.2 respectively.

Table- V: Diagnosis efficacy of stone attenuation and skin-to-stone distance using CT in predicting the performance of shock wave lithotripsy in renal stone disease.

	Cut off	Sensitivity	Specificity	PPV	NPV	Accuracy
Stone attenuation	637.5	33.9	88.2	90.5	28.8	44.6
Skin-to-stone distance	80.5	78.6	94.1	97.8	57.1	82.2

DISCUSSION

In this study, males were predominant than females but stone free rate was higher in female than male but not statistically significant. Similar finding was observed in the study of Müllhaupt et al. where male was prevalent than female but successful disintegration was found prevalent in male.¹² In Bangladesh, Pakistan, India, Thailand, Saudi Arabia, and Japan, the male-female ratio of stone burden is 2:1¹³. Similarly, Khan et al. reported the same ratio in their study of 60 symptomatic children.¹⁴ Trinchieri affirmed that renal stones are more common in men.¹⁵ In Western countries, kidney stone prevalence varies significantly by location, with rates ranging from 8% to 19% in men and 3% to 5% in women. A comprehensive 2010 study in Taiwan found the age-adjusted prevalence of urolithiasis to be 9.01% in males, 5.79% in females, and 7.38% overall.¹⁶

Stone free was occurred more in younger patients. Successful disintegration was observed among the younger patients.¹²

The stone was most commonly detected in the lower pole, followed by the pelvis, central region, and upper pole. The stone-free rate was most common in the pelvis, followed by the central, lower pole, and higher pole.

Patients with smaller, lower attenuation stones had higher rates of stone-free outcomes, though these differences were not statistically significant in this study. El-Nahas et al. found that patients with small stones were more likely to achieve successful shock wave lithotripsy (SWL) than those with larger stones, but stone attenuation did not significantly differ between successful and failed SWL.⁷ In successful SWL, stone attenuation was notably lower compared to failures.^{4,17,18} Additionally, patients with shorter skin-to-stone distances experienced much higher

stone clearance in this study. Those with successful disintegration had significantly shorter skin-to-stone distances than those without success.¹² Furthermore, successful SWL patients had a markedly reduced skin-to-stone distance compared to those who failed.⁷

Gupta et al. concluded that the worst outcome was in patients with calculus density >750 HU and stone diameter of >1.1 cm, as 77% of those patients needed more than three sessions of SWL and the clearance rate was 60%.¹⁹ Wang et al.²⁰ concluded that stone density >900 HU and volume >700 mm³ were significant predictors of SWL failure. Comparable results were observed in their study, in which larger stone volume and higher stone density were significant predictors of the need for more than three sessions, and stone density >1000 HU was a significant predictor for failure of disintegration. The differences in the cut-off values that predicted extracorporeal SWL failure may be due to different inclusion criteria, use of different CT protocols, or measurement of different endpoints (eg, failure of disintegration, the need for multiple sessions, or rate of residual stones) in these studies. In contrast to Pareek et al., we found that SSD was a significant predictor.¹⁸

Binary logistic regression analysis was conducted to evaluate the effect of various parameters on the stone-free rate in shock wave lithotripsy for renal stone disease. The four independent variables in the model were stone attenuation, age, stone volume, and stone-to-skin distance. Stone-to-skin distance emerged as the strongest predictor of being stone-free, with an odds ratio of 1.4, indicating that responders with a lower stone-to-skin distance were nearly 1.4 times more likely to be free of stones.

Shock wave lithotripsy efficacy for renal stone disease can be predicted by the receiver operating characteristic (ROC) curve based on stone attenuation and skin-to-stone distance from CT scans. The area under the curve for skin-to-stone distance was 0.901 (95% CI 0.801–1.000), compared to 0.603 (95% CI 0.464–0.742) for stone attenuation. At a cut-off of 637.5, stone attenuation yielded a sensitivity of 33.9%, specificity of 88.2%, positive predictive value (PPV) of 90.5%, and negative predictive value (NPV) of 28.8% in predicting the effectiveness of shock wave lithotripsy. With an 80.5 mm cut-off point, our study found that the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of skin-to-stone in predicting the effectiveness of shock wave lithotripsy for renal stone

disease were 78.6%, 94.1%, 97.8%, and 57.1%, respectively. These findings indicate that skin-to-distance is a more reliable predictor of shock wave lithotripsy's success in removing renal stones.

In a study comprising 94 patients with upper ureteral stones, Ng et al. found a considerably lower threshold of 593 HU as a predictor of therapeutic success.¹⁰ Pareek et al. advocated a cut-off of 900 HU based on their analysis of 30 ureteral stones.¹⁷ Despite the fact that research indicates that the stone to skin distance (SSD) for renal stones strongly influences the result of the SWL. SSD has been examined separately in two trials,^{9,10} both of which have confirmed its importance as a predictor of SWL success in ureteral stones. Ng et al. only considered upper ureteral stones when they proposed an SSD cut-off of 9.2 cm for predicting SWL failure.¹⁰ However, SSD at a 90° angle was found by Müllhaupt et al. to be a more reliable indicator of SWL failure than mean SSD, with a cut-off of 11.9 cm.¹²

CONCLUSION

Efficacy of skin-to-stone distance is better than stone attenuation in predicting the success of SWL in renal stone disease.

References

1. Abe T, Akakura K, Kawaguchi M, Ueda T, Ichikawa T, Ito H, Nozumi K, Suzuki K. Outcomes of shockwave lithotripsy for upper urinary-tract stones: a large-scale study at a single institution. *Journal of Endourology*. 2005; 19(7):768-73.
2. White W, Klein F. Five-year clinical experience with the Dornier Delta lithotriptor. *Urology*. 2006; 68(1):28-32.
3. Pace KT, Ghiculete D, Harju M, Honey RJ, University of Toronto Lithotripsy Associates. Shock wave lithotripsy at 60 or 120 shocks per minute: a randomized, double-blind trial. *The Journal of urology*. 2005; 174(2):595-9.
4. Joseph P, Mandal AK, Singh SK, Mandal P, Sankhwar SN, Sharma SK. Computerized tomography attenuation value of renal calculus: can it predict successful fragmentation of the calculus by extracorporeal shock wave lithotripsy? A preliminary study. *The Journal of urology*. 2002;167(5):1968-71.
5. Perks AE, Gotto G, Teichman JM. Shock wave lithotripsy correlates with stone density on

- preoperative computerized tomography. *The Journal of urology*. 2007;178(3):912-5.
6. Williams Jr JC, Kim SC, Zarse CA, Mcateer JA, Lingeman JE. Progress in the use of helical CT for imaging urinary calculi. *Journal of endourology*. 2004;18(10):937-41.
 7. El-Nahas AR, El-Assmy AM, Mansour O, Sheir KZ. 1311: A Prospective Multivariate Analysis of Factors Predicting Stone Disintegration by Extracorporeal Shock Wave Lithotripsy (SWL): Value of High Resolution Noncontrast Computed Tomography (NCCT). *The Journal of Urology*. 2007;177(4S):431.
 8. Preminger GM, Tiselius HG, Assimos DG, Alken P, Buck C, Gallucci M, Knoll T, Lingeman JE, Nakada SY, Pearle MS, Sarica K. 2007 guideline for the management of ureteral calculi. *The Journal of urology*. 2007;178(6):2418-34.
 9. Wiesenthal JD, Ghiculete D, John D'A Honey R, Pace KT. Evaluating the importance of mean stone density and skin-to-stone distance in predicting successful shock wave lithotripsy of renal and ureteric calculi. *Urological research*. 2010;38:307-13.
 10. Ng CF, Siu DY, Wong A, Goggins W, Chan ES, Wong KT. Development of a scoring system from noncontrast computerized tomography measurements to improve the selection of upper ureteral stone for extracorporeal shock wave lithotripsy. *The Journal of urology*. 2009;181(3):1151-7.
 11. Celik S, Bozkurt O, Kaya FG, Egriboyun S, Demir O, Secil M, Celebi I. Evaluation of computed tomography findings for success prediction after extracorporeal shock wave lithotripsy for urinary tract stone disease. *International urology and nephrology*. 2015;47:69-73.
 12. Müllhaupt G, Engeler DS, Schmid HP, Abt D. How do stone attenuation and skin-to-stone distance in computed tomography influence the performance of shock wave lithotripsy in ureteral stone disease?. *BMC urology*. 2015 Dec;15:1-8.
 13. Rizvi SA, Naqvi SA, Hussain Z, Hashmi A, Hussain M, Zafar MN, Mehdi H, Khalid R. The management of stone disease. *BJU international*. 2002;89(s 1):62-8.
 14. Khan AM, Hussain MS, Moorani KN, Khan KM. Urolithiasis associated morbidity in children. *J Rawalpindi Med Coll*. 2014;18:73-4.
 15. Trinchieri A. Epidemiology of urolithiasis: an update. *Clinical cases in mineral and bone metabolism*. 2008;5(2):101.
 16. Huang WY, Chen YF, Carter S, Chang HC, Lan CF, Huang KH. Epidemiology of upper urinary tract stone disease in a Taiwanese population: a nationwide, population based study. *The Journal of urology*. 2013;189(6):2158-63.
 17. Pareek G, Armenakas NA, Fracchia JA. Hounsfield units on computerized tomography predict stone-free rates after extracorporeal shock wave lithotripsy. *The Journal of urology*. 2003;169(5):1679-81.
 18. Pareek G, Hedican SP, Lee Jr FT, Nakada SY. Shock wave lithotripsy success determined by skin-to-stone distance on computed tomography. *Urology*. 2005; 66(5):941-4.
 19. Gupta NP, Ansari MS, Kesarvani P, Kapoor A, Mukhopadhyay S. Role of computed tomography with no contrast medium enhancement in predicting the outcome of extracorporeal shockwave lithotripsy for urinary calculi. *BJU Int* 2005;95:1285-8.
 20. Wang LJ, Wong YC, Chuang CK, Chu SH, Chen CS, See LC, Chiang YJ. Predictions of outcomes of renal stones after extracorporeal shock wave lithotripsy from stone characteristics determined by unenhanced helical computed tomography: a multivariate analysis. *European Radiology*. 2005;15:2238-43.

Original Article

Pattern of Semen Parameters of Sub-fertile Males Attending an Infertility Clinic at a Tertiary Level Hospital in Bangladesh

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ABSTRACT

Sub-fertility is an upsetting situation for childless couples who are experiencing a lot of physical, mental, social, and economic trauma. Many women go to an infertility clinic or gynecologist without their husbands because it is still considered a female issue, but male factors play a significant role in its etiology. Semen analysis is the most fundamental, useful and inexpensive means of assessing male factor infertility. This descriptive cross-sectional study was directed among sub-fertile males of infertile couples visiting the CARE (Centre for Assisted Reproduction) in Department of Obstetrics and Gynaecology of BIRDEM, Dhaka. The study was conducted among 126 males who were sub-fertile and aimed to evaluate the patterns of sperm parameters using semen analysis. After receiving informed consent and meeting eligibility criteria, participants were interviewed and semen analysis reports were obtained. Semen from the male partners were analyzed in the laboratory using the World Health Organization (WHO) 2021 criteria for human semen characteristics. Data were analyzed by using

SPSS- 22. A total of 126 participants' semen analysis and background characteristics were evaluated by using WHO standard for semen normality criteria, 2021. The WHO standard for semen normality criteria, 2021 was used to evaluate the semen analysis and background characteristics of 126 participants. The mean age (Mean±SD) of the study subjects was 34.92±6 years with their age range 21 – 52 years; among these respondents most of them (84.10%) were in the most productive fertile age group 21-40 years. In this study primary sub-fertility was observed in 68.3% of men and maximum of them (43.7%) were demanding to conceive over 3-5 years. Study found the following normal parameters of semen analysis; those are, 4.76% of the men had <1.4 ml semen volume per ejaculation, nearly one-fourth (22.22%) of men had sperm concentration <16 million/ml, more than half (55.56%) of the men's total sperm motility was <42% and 17.46% of them were found abnormal morphology of sperm (teratospermia). The mean (Mean±SD) of semen volume was 2.59±0.99 ml, pH was 7.27±0.69, sperm concentration was 59.38±52.34 million/ml and the mean of total motility of the sperm was 36.70±24.71%; however mean of immotile sperm was 51.99±28.04% and normal morphology of sperm was 35.52±24.49%. An abnormal patterns of semen parameters were seen in majority (58.73%) of men; among them more than one-third (34.9%) of them were asthenozoospermia, 11.1% was azoospermia, Oligoasthenoteratozoospermia was 7.1%, Oligospermia 8% and Oligoasthenozoospermia 4.8%. According to age-wise distribution maximum cases of asthenospermia (20.6%) were observed between the age group of 31-40 years. Single-factor abnormalities was observed in 47.6% cases and 11.11% had combined factor abnormalities. This study found that asthenozoospermia was the main single factor abnormality or sub-fertile state, followed by azoospermia. Male partners of sub-fertile couples attending infertility clinics consistently have abnormal semen parameters, which are prevalent with primary sub-fertility. This study similarly found that asthenozoospermia and azoospermia were common abnormalities in male partners.

Keywords: Sub-fertility, male infertility, sperm (semen) parameters, male partners of couples.

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INTRODUCTION

Sub-fertility is a universal health concern affecting millions of people of reproductive age worldwide. It is a disease of the male or female reproductive system defined by the failure to achieve a pregnancy after 12 months or more of regular unprotected sexual intercourse.³⁰ Sub-fertility is still considered to be a female issue and very sensitive matter in question in country with patriarchal society like Bangladesh.¹⁰

The prevalence of infertility in the general population is 15% - 20%; among these, male factor is responsible for 20% - 40%²⁴ and female factors contribute 30% - 40% while, both factors and unexplained causes account for 20% - 40% each.⁸ According to WHO data more than 180 million couples in developing countries suffer from primary or secondary sub-fertility, another study revealed that more than 186 million people are infertile worldwide.¹¹ The actual rate of infertility in Bangladesh is still unknown but World Infertility Survey in South Asian Country revealed that sub-fertility is 4% in Bangladesh.^{27,29} Prevalence of male partner sub-fertility according to semen analysis WHO criteria 2010 was evident 62% in infertility clinic of BIRDEM in Bangladesh.²¹ Sub-fertility is an underlying pathology with female factors contributing 30-40% of causes, male factors about 30-40% while both factors and unexplained infertility account for 20-40% of causes.² Sub-fertility affects around one in eight couples of reproductive age, with a male factor being exclusively responsible in 20% and contributory in an additional 30% of cases.¹⁸ The total fluid volume depends on the secretory activity of accessory sex glands. The nature of spermatozoa (concentration, vitality, motility and morphology) and the composition of seminal fluid are essential for sperm function. Semen analysis is the study of semen parameters namely volume, pH, sperm count, sperm motility and sperm morphology. It is a keystone, inexpensive, noninvasive and readily available investigation in a sub-fertile couple to evaluate male infertility.⁹ The semen parameters are essential determining factor to figure out the functional capability of the spermatozoa to fertilize ova. Identifiable abnormalities on semen analysis are low sperm concentration, poor sperm motility, and/or abnormal morphology. Vigilant evaluation of the semen parameters may denote the possible causes of male infertility.²⁵

The accumulated data from 12 countries and five continents has established lower reference values for semen parameters for fertile men that are more comprehensive, more geographically representative, and globally

applicable. (Campbell et al 2020). WHO endorsed the 95% confidence interval for the 5th centile values of semen parameters from this study and made it available in the WHO laboratory manual for human semen examination and treatment in 2021. This manual not only facilitate the interpretation of the results of semen analysis but also give a guideline for clinical decisions as the choice of treatment modalities for male factor infertility.

Routine semen analysis still remains the gold standard in the search for male factor infertility. Most studies on semen pattern had been done based on the WHO 2010 criteria for human values for semen characteristics. Bangladesh is a patriarchal society where women are obliged being treated for subfertility for a long time without assessing her male partner's fertility status on most the occasions. Unfortunately, in our country there is no sufficient literature and research, epidemiological study and statistical data regarding male factor infertility. The goal of this study was to draw the patterns of semen parameters in male partner of sub-fertile couples for holistic management of subfertility.

MATERIALS AND METHODS:

This descriptive type of cross-sectional study aimed to analyze seminal fluid of sub-fertile males for the founding of pattern of sperm parameters to address infertility. This study was carried out during July 2021 to Dec 2022 among male partners of couples attending at CARE (Centre for Assisted Reproduction) in the Department of Obstetrics and Gynaecology, BIRDEM, Dhaka. Ethical approval was obtained from Institutional Review Board (IRB) of BIRDEM and participants were enrolled in the study after taking written informed consent. Samples were selected purposively according to the availability of the respondent who fulfilled the inclusion and exclusion criteria. Total 126 sub-fertile males, age > 18 years, married for at least 12 months having regular unprotected intercourse and were able to provide semen sample were included in this study as participants.

Specimen collection:

The sub-fertile males were adequately counseled and given instructions on how to collect the semen samples. All the participants were abstained from sexual intercourse or masturbation for a period of 3 - 5 days. Semen collection was done mainly by masturbation after washing their

hands in a dedicated room in the laboratory. Spilled samples were avoided. All samples were collected into sterile screw capped plastic universal containers. The semen analysis was done by the same laboratory scientist to avoid inter-laboratory variation, within 1 hour of collection. The sample was assessed for volume, appearance, liquefaction, concentration, motility, morphology, viability and presence of pus cells. The semen volume was measured using a graduated disposable pipette and pH was checked with pH paper. After liquefaction, the semen specimen was thoroughly mixed using a pipette and a thin drop of specimen was spread on a glass slide by placing a cover slip on it. Sperm motility was assessed using an Olympus binocular microscope, magnification .100, while the sperm concentration was counted in millions per mL using the Meckler counting chamber and categorized in accordance with WHO normal and pathological ranges in 2021.

[Safety precaution: Universal precaution was obtained. Semen samples might contain dangerous infectious agents (e.g. human immuno deficiency virus (HIV), hepatitis viruses or herpes simplex virus) and should therefore be handled as a biohazard. Gloves, lab coat, and safety glasses was worn when handling body fluid products. Disposable plastic, glass, paper and gloves that contact semen was placed in a biohazard bag. Non-disposable material at the end of working day was disinfected. Washing hands thoroughly was done after removal of personal protective devices used in handling specimens and kit reagents].

Data Collection: At first participants were interviewed and semen analysis report was recorded. A semi structured questionnaire and a chick list were developed to record information from the participants and semen analysis. It was contained the socio demographic characteristics of the participants in terms of age, educational status, religion, occupation, income status, type of infertility and duration of infertility. The semen analysis report was collected and interpreted

Data presentation and analysis: Statistical analyses were carried out by using Windows based Statistical Package for Social Sciences (SPSS), Version- 22. Descriptive statistics of the study was presented in tables, figures or suitable graphs, frequency, percentage, mean $\pm$ SD as per the requirement of qualitative and quantitative variables. Quantitative data were expressed as mean and standard deviation. Qualitative

data were expressed as frequency, distribution, percentage and 95% confidence limit was taken.

RESULT

The hospital based descriptive cross-sectional study was carried out to evaluate the semen patterns in male partners of infertile couples attending infertility clinic, CARE, in the Department of Obstetrics and Gynecology of BIRDEM General Hospital, Dhaka. A total of 126 study subjects were selected according to selection criteria. The mean age of participants was 34.92 $\pm$ 6 years and age range was 23 to 52 years; here, 84.1% of them was in 21 to 40 years age group and rest of them were 41 to >50 years. Muslim participants were 95.24% and rest were Hindu. Among the participants 48.4% was service holder; additionally business 20.6%, migrant worker 9.5%, agriculture 1.6% and others 19.8%. According to their income status; middle income (31 - 60k) was 62.70%, lower income (1 -30k) was 30.95% and upper income (>60k) was 6.35%. According to educational status, 50% of the participants had completed tertiary level of education, moreover secondary education 34.92%, primary 10.32% and non-formal 4.76%. Results related to pattern of sperm parameters following semen analysis of sub-fertile males are presented by graphs and tables.

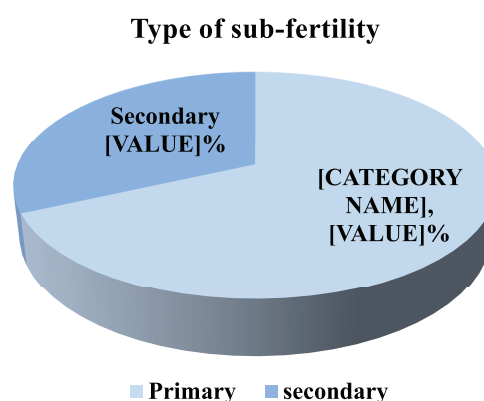


Figure-1: Distribution of participants according to type of sub-fertility (n=126)

Figure1 appears the distribution of participants according to type of sub-fertility; a total of 86 (68.3%) participants were investigated as a case of primary infertility while 40 (31.7%) were secondary infertility.

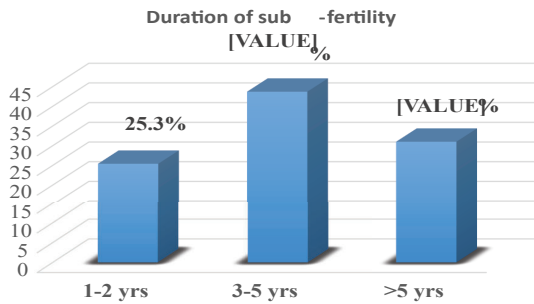


Figure- 2: Distribution of participants according to duration of sub-fertility (n=126)

Figure 2 illustrates the distribution of participants according to duration of sub-fertility, where we found 43.7 % of the respondents were trying to conceive for 3-5 years, 31% for >5 years and 25,3% for 1-2 years.

SEMEN PROFILE FOLLOWING SEMEN ANALYSIS

Table-I demonstrates the semen parameters of participants; study found abnormal parameter of semen volume, sperm concentration, total motility and morphology of sperms below the cut off value (teratospermia) were 4.76%, 22.22%, 55.56% and 17.46% respectively in study participants.

Table II contains the physiochemical characteristics of semen of the participants; the characteristics includes appearance, liquefac-

tion, consistency and WBC count ($<1 \times 10^6$ /ml in all samples) of semen were normal in all study subjects. Mean of semen volume and pH was 2.59 ± 0.99 ml and 7.27 ± 0.69 respectively.

Table- I: Semen parameters of participants (n=126)

Characteristics	Frequency	Percentages
Semen volume		
Volume < 1.4 ml	6	4.76%
Volume > 1.4 ml	120	95.24%
Total	126	100
Sperm concentration		
<16 million /ml	28	22.22%
>16 million /ml	98	77.78%
Total	126	100
Total motility		
Motility < 42%	70	55.56%
Motility > 42%	56	44.44%
Total	126	100
Morphology		
Teratospermia (> 4% abnormal sperm)	22	17.46%
Normal morphology	104	82.54%
Total	126	100

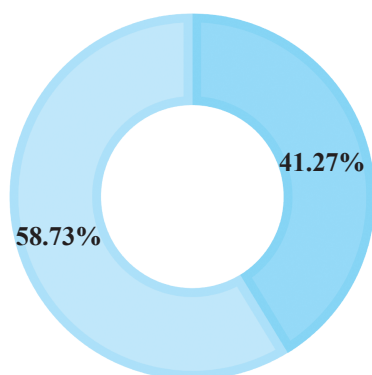
Table- II: Physiochemical characteristics of semen of the participants (n=126)

Physiochemical properties	Mean	Std. Deviation	Minimum	Maximum	Range
Appearance			Normal		
Liquefaction			Normal		
Consistency			Normal		
Volume(ml)	2.59	0.99	1	6	5
pH	7.27	0.69	0	7.80	7.80
WBC count	$<1 \times 10^6$ /ml in all samples				
Agglutination	No agglutination in all samples				

Table III shows the features of sperm investigation; study found mean sperm concentration were 59.38 ± 52.34 million/ml. Mean percentage of total motile and immotile sperm was $36.70 \pm 24.71\%$ and $51.99 \pm 28.04\%$ respectively while the proportion of normal morphology of sperm was $35.52 \pm 24.49\%$.

Table- III: Features of sperm investigation (n=126)

Sperm characteristics	Mean	Std. Deviation	Minimum	Maximum
Concentration	59.38	52.34	0	230
Total motility	36.70	24.71	0	75
Rapid progression	13.67	11.25	0	70
Slow progression	17.74	12.78	0	40
Non progressive	6.06	4.65	0	30
Immotile	51.99	28.04	0	100
Normal morphology	35.52	24.49	0	85



■ Normal ■ Abnormal

Figure- 3: Normal and abnormal parameters among participants (n=126)

Figure- 3 displays normal and abnormal semen parameter; here abnormal semen parameter of sub-fertile men was 58.73%.

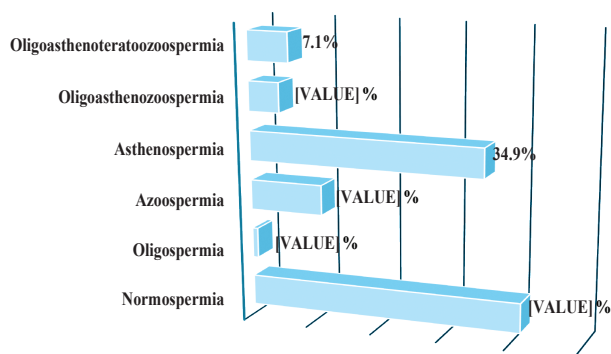


Figure- 4: Outcome features sperm following semen analysis (n=126)

Figure 4 exhibits the outcome features sperm following semen analysis; at this point asthenospermia 34.9%, azoospermia 11.11%, oligoasthenozoospermia (4.8%), oligoasthenoteratozoospermia (7.1%) are main features of abnormal semen parameter.

Table- IV: Distribution of semen parameters by age groups (n=126)

Age group	Pattern of semen analysis						Total
	Normospermia	Oligospermia	Azoospermia	Asthenospermia	Oligoasthenozoospermia	Oligoasthenoteratozoospermia	
21 to 30	15	0	3	10	1	1	30
31 to 40	28	1	10	25	5	7	76
41-50	9	0	1	7	0	1	18
>50	0	0	0	2	0	0	2
Total	52	1	14	45	6	8	126

DISCUSSION

This cross sectional study was carried out to determine the pattern of semen parameters in male partner of infertile couples attending outpatient clinic of BIRDEM General Hospital. A total of 126 male partner of infertile couples attending CARE of Obstetrics and Gynaecology department of BIRDEM General Hospital who fulfill the inclusion and exclusion criteria were included in this study.

In this study majority (60.3%) of the respondents were 31-40 years of age and only 2 (1.6%) respondents were more than 50 years of age. Mean age of respondents were 34.92 ± 6.005 years. In this study 95.24 % of respondents were Muslim and only 4.76 % were Hindu. Majority of respondents (48.4%) in this study were service holder and 20.6% were business man. In present study majority

(50%) of respondents completed their tertiary level of education and only 4.76 % were non-formally educated. In a similar study carried out by²¹ in BIRDEM found that majority 63% respondents were 30-40 years age and mean age was 35.5 years, There majority of respondents were Muslim (88.5%), Over 50.3% completed their tertiary level of education and only 11.3% had primary level of education.²¹ Noted that, 45.6% participants were service holder which was almost similar to my current study as both the study was carried out in the same place.

This study finds that 68.3% of the study population had primary infertility and 31.7% had secondary infertility. In a similar study carried out by¹² in Nepal showed that primary infertility was 78.5% and secondary infertility was 21.5%. There was slight disparity of finding because my study was

on male partners of infertile couples attending the infertility clinic while the index study selected infertile male partners of couples attending both gynaecology and urology clinics. Here majority of the respondents (43.7%) were trying to conceive for 3-5 years. Similar findings were observed in study conducted by Abrari et al. and Bodal et al.

The study search for the characteristics of abnormal semen parameters among male partners, semen volume <1.5 ml was 4.76%, sperm concentration <16 million/ml was 23.8%, sperm motility <42% was 55.56% and abnormal sperm morphology >4% was found in 17.46% study participants. In a retrospective study, Patan hospital in Nepal noted semen volume < 1.5 ml was 8.6% and sperm concentration <16 million/ml was 19.3%.⁷ These findings similar to my current study. There are multiple studies where shows, There is a trend of declining sperm concentration in men around the world.^{15,16}

Low sperm count plays significant role in male sub-fertility.

This research showed that appearance, liquefaction and consistency of semen was normal in all subjects. Mean Semen volume was $2.59 \pm .99$ ml, PH was $7.26 \pm .69$ and semen concentration was $(59.37 \pm 52.33) \times 106 // \text{ml}$. In a similar study carried out by¹² in Nepal showed that Mean volume of semen was 2.48 ± 0.91 ml, PH was $7.26 \pm .32$, Mean semen concentration was $(35.45 \pm 26.68) \times 106 / \text{ml}$. In another study carried out by Sarkar A, 2015 were showed that the sperm volume was less 1.5 ml in 7.45% of cases.

This study investigated that the mean motility of sperm was 36.70% and among them 13.67% was rapid progressive, 17.73% was slow progressive, and 6.06% was non progressive. Average 51.99% sperm was immotile among study participants. Furthermore, Normospermia was 41.3%, Asthenospermia 34.9%, Azoospermia 11.1% and Oligoasthenozoospermia 4.8% and OAT 7.1%. These all were the major factors for contributing abnormal semen. In another study,¹² 2021 in Nepal reported that Asthenospermia 39.30%, Azoospermia 28.8% and oligoasthenozoospermia 17.9%, Oligozoospermia 8.7%, OAT 3.5% and teratozoospermia 1.8%. This slight dissimilarity was due to demography and ethnicity difference of study subjects. In this study, all age group had abnormal semen parameters but Asthenospermia was highly prevalent in all age group. In a similar study carried out by³ showed that Oligozoospermia was prevalent

among them. This dissimilarity was due to ethnicity different among the study subject.

The prevalence of abnormal semen parameters according to WHO guideline 2021 was 58.73% in this study. Several other studies showed the prevalence of male factors infertility which was similar to current study like⁷ all three studies showed the prevalence of abnormal semen parameters were 56% , 62% and 66.2% respectively. This higher prevalence of male infertility could be mainly due to this study area being a referral center from the primary and secondary institutions for sub-fertility. Another study, demonstrates abnormal semen quality is up to 75.4% of the male partners of couples seeking medical attention for their inability to conceive in.^{2,27} Enrolled patients' conditions, Social, Ethnic, Geographical, Environmental, Socioeconomic and Psychological factors among the study participants may play a role in these dissimilarities. Which need further detailed analysis and evaluation.

CONCLUSION

Abnormal semen parameters remain markedly high in male partners of sub-fertile couples and was more common with primary subfertility. Asthenozoospermia and azoospermia were frequent abnormalities in study participants. The present study only illustrates an abnormal pattern of seminal fluid analysis of male factors. The presumptive causative factors/ risk factors account for these aberrant semen patterns, which were not discussed in this study. As a result, further research is needed to understand the causes of male factor infertility, which will eventually aid in the management of male infertility situation

Limitations of the Study

Hospital based, small sample, purposive sampling merely institute a cross-sectional study and never represent the general population.

RECOMMENDATIONS

Community based or multiple hospital (infertility centre) based systematic large sample would provide authentic parameters following semen analysis of sub-fertile males. Qualitative study would be encouraged to identify risk factors related to male sub-fertility. Need necessary awareness and a simple semen analysis test as a screening tool among sub-fertile couples at community level.

REFERENCES

1. Akhter, A., Chowdury, L., Akhter, M. and Haque, S. (2019). Risk Factors Analysis for Abnormal Semen

- Characteristics in Sub-Fertile Male. *Medicine Today*, 31(1), pp.31–35. doi:10.3329/medtoday.v31i1.40319.
2. AO, P. and AP, T. (2016). Pattern of Semen Parameters and Factors Associated with Infertility in Male Partners of Infertile Couples in Nigeria. *Andrology-Open Access*, 05(01). doi:10.4172/2167-0250.1000161.
3. Aduloju Olusola Peter¹, Adegun Patrick Temi^{2*}, Areo Peter Olufemi³, Odimayo Michael Simidele⁴, Atiba Samuel Adeniran⁵ and Idowu Ademola Amos⁵Peter, et al., *Andrology (Los Angel)* 2016, 5:1 DOI: 10.4172/2167-0250.1000161
4. Brian R, Thomas JW. The epidemiology of male infertility, *Urologic Clinics of North America*. 2014; 41:195-04
5. Casale, P. (2015). Editorial Comment for Silay et al. *Journal of Endourology*, 29(8), pp.867–867. doi:10.1089/end.2015.0214.
6. Gangel EK (2002) American Urological Association I, American Society for Reproductive M. AUA and ASRM produce recommendations for male infertility
7. Gautam, D., Shrestha, M. and K.C., S.R. (2021). Pattern of seminal fluid analysis in a male partner of infertile couple presented in infertility clinic of Patan hospital. *Journal of Pathology of Nepal*, 11(2), pp.1813–1816. doi:10.3126/jpn.v11i2.41391.
8. Hamilton, M. (2012). Infertility. *Dewhurst's Textbook of Obstetrics & Gynaecology*, pp.565–579. doi:10.1002/9781119979449.ch45.
9. Hanoom H. Selected reproductive health elements and interventions. *editorial BIRPERHT* 1997;1:77-9.
10. Haxton MJ & Black WP. The aetiology of infertility in 1162 investigated couples. *Clin Exp Obstet Gynecol* 1987;14(2):75-9
11. Inhorn, M.C. and Patrizio, P. (2015). Infertility around the globe: new thinking on gender, reproductive technologies and global movements in the 21st century. *Human Reproduction Update*, 21(4), pp.411–426. doi:10.1093/humupd/dmv016.
12. Koju, S., Tamrakar, S.R. and Shankhadev,
13. R. (2021). Study of Semen Analysis Patterns in Male Partner of Infertile Couple Attending Tertiary Level Hospital of Nepal. *Nepal Journal of Obstetrics and Gynaecology*, 16(1). doi:10.3126/njog.v16i1.37520.
14. Kulkarni, S. and V.Kulkarni, N. (2015). Study of semen parameters in male partners among infertile couples. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*, pp.1016–1019. doi:10.18203/2320-1770.ijrcog.20150418.
15. Kumar, N. and Singh, A. (2015). Trends of male factor infertility, an important cause of infertility: A review of literature. *Journal of Human Reproductive Sciences*, [online] 8(4), p.191. doi:10.4103/0974-1208.170370.
16. Kumar D (2007) Prevalence of female infertility and its socioeconomic factors in Tribal communities of Central India. *Rural Remote Health* 7: 456.
17. McLachlan, R.I. (2013). Approach to the Patient With Oligozoospermia. *The Journal of Clinical Endocrinology & Metabolism*, [online] 98(3), pp.873–880. doi:10.1210/jc.2012-3650.
18. Olajubu, F.A., Mope, D.-A., Osinupebi, O.A. and Jagun, O.E. (2013). Seminal Fluid Characteristics of Men Attending Infertility Clinic of a Teaching Hospital. *Open Journal of Medical Microbiology*, 03(01), pp.1–4. doi:10.4236/ojmm.2013.31001.
19. Patel, A.S.; Leong, J.Y.; Ramasamy, R. Prediction of male infertility by the World Health Organization laboratory manual for assessment of semen analysis: A systematic review. *Arab. J. Urol.* 2018, 16, 96–102.
20. Pourmalek, F., Abdi, H. and Black, P.C. (2016). Re: Daniel P. Nguyen, Bashir Al Hussein Al Awamlh, Xian Wu, et al. Recurrence Patterns After Open and Robot-assisted Radical Cystectomy for Bladder Cancer. *Eur Urol* 2015;68:399–405.
21. *European Urology*, 69(3), p.e35. doi:10.1016/j.eururo.2015.06.048.
22. Rahman, F., Rahman, M., Mahmud, N., Ahsan, G. and Islam, M.I. (2018). Prevalence of Male Infertility among the Infertile Couples Attended at BIRDEM General Hospital, Dhaka. *Ibrahim Cardiac Medical Journal*, 6(1-2), pp.25–32. doi:10.3329/icmj.v6i1-2.53754.
23. Рыкова, О.В. (2016). Insufficient luteal phase: laboratory diagnostic aspects. *Opinion of Practice Committee of the American Society for Reproductive Medicine. Reproductive Endocrinology*, 0(27), p.106. doi:10.18370/2309-4117.2016.27.106-110.

24. Sarkar, A. (2015a). Abnormalities in semen analysis among male partners of infertile couples: A study in a Tertiary Care Level Hospital of West Bengal, India. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*, p.1. doi:10. 5455/2320-1770.ijrcog20150219.
25. The Sixth Edition of the WHO Manual for Human Semen Analysis: A Critical Review and SWOT Analysis
26. Tilahun, T., Oljira, R. and Getahun, A. (2022). Pattern of semen analysis in male partners of infertile couples in Western Ethiopia: Retrospective cross-sectional study. *SAGE Open Medicine*, 10, p.205031212210881. doi:10.1177/ 20503121221088100.
27. Umar, A.G., Panti, A.A., Mbakwe, M., Ahmed, Y., Garba, J.A. and Nnadi, D.C. (2020). The Pattern of Seminal Fluid Analysis among Male Partners Attending an Infertility Clinic in a Nigerian Tertiary Health Institution. *Open Journal of Obstetrics and Gynecology*, 10(07), pp.957–967. doi:10.4236/ojog.2020.1070090.
28. Vaessen, M. and Tabutin, D. (1984). *La Collecte des Donnees en Demographie. Methodes, Organisation et Exploitation*. *Population Studies*, 38(3), p.525. doi:10.2307/2174150.
29. Marcia CI and Pasquale P (2015) Infertility around the globe: new thinking on gender. *Reproductive technologies and global movements in the 21st century*. *Human Reproduction Update* 21:411-426
30. Vaessen M (1984) Childlessness and infecundity WFS Comparative Studies. Series 31. Voorburg, The Netherlands: Cross national Summaries.
31. World health organization (WHO), international classification of disease, 11th revision (ICD-11) Geneva, WHO2018

Original Article

Evaluating the Accuracy of Recent Type 2 Diabetes Diagnoses in Relation to Glycated Hemoglobin Levels

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Abstract

Worldwide, the incidence of diabetes mellitus (DM) is rising alarmingly. In 2019, according to International Diabetic Federation (IDF) atlas, Bangladesh was in the 10th position with an estimated 8.4 million diabetic subjects and 56% of them were undiagnosed. If the prevailing situation persists, the number will be increased to 11.4 million in 2030 (and 15.0 million in 2045, occupying the 9th position among countries with high diabetic populations). Early and correct diagnosis with proper management can save people from immense sufferings of DM and its complications. Glycated Hemoglobin (Hemoglobin A1c or HbA1c) level, is a well-recognized marker in the diagnosis and treatment of diabetes. In this study, the cut-off level for HbA1c determined in relation to their fasting venous plasma glucose levels of individuals with diabetes and pre-diabetes. This cross-sectional observational study was conducted among 139 newly diagnosed, untreated type 2 diabetic and pre-diabetic individuals who attended Outpatient Departments (OPDs) of Bangabandhu Sheikh Mujib Medical University (BSMMU) and Sir Salimullah Medical College Mitford Hospital (SSMC and MH). Type 1 diabetic, patients receiving or received any treatment for diabetes, taking steroids, pregnant, having anemia were excluded from this study. Sensitivity, specificity and the area under the Receiver Operating Characteristic (ROC) curve for HbA1c, using different cut-off values, were calculated considering venous plasma glucose the gold standard test for diagnosis of Diabetes Mellitus. According to the findings of

this study, the optimal diagnostic cut-off level of HbA1c was 6.8% with sensitivity 69.81%, specificity 72.73%, positive predictive value 89.02%, negative predictive value 43.21% and accuracy 70.51%. Based on the findings of this study, a larger study involving normoglycemic, newly diagnosed prediabetic and diabetic population, will hopefully determine the cut-off level of HbA1c more accurately to diagnose diabetes and decide the targeted HbA1c in treating diabetes in this population group. This may help diabetic subject, their families and will have a positive impact on society and the country.

Keywords: Type2 diabetes, glycated hemoglobin.

INTRODUCTION

The incidence of diabetes is rising alarmingly. In 2019, an estimated 463 million people of 20 to 79 age group suffered from diabetes worldwide. This number is projected to increase to 578 million by 2030 and 700 million by 2045.¹ In 2019, the prevalence of diabetes in adults was 8.8(7.1-11.1) % in South East Asia (SEA).¹ Bangladesh was in 10th position with an estimated 8.4(7.0-10.7) million diabetic subjects and if the prevailing situation persists, the number will be increased to 11.4(9.4 to 14.4) million in 2030 and 15.0(12.4-18.9) million in 2045 occupying 9th position among diabetic population in the world¹. Type 2 diabetes mellitus (T2DM) is the predominant form of diabetes worldwide, accounting for 90% of cases globally.² It is characterized by relative insulin deficiency and insulin resistance that varies in different degrees in different persons. Obesity and physical inactivity are among the important contributing factors in the development of type 2 diabetes. Prevalence is also high in several ethnic groups, such as South Asians, Polynesians, immigrants to developed countries from underdeveloped countries, and in the Arab world. As Bangladesh is among the countries with high prevalence of diabetes, early diagnosis and proper management is essential to reduce its complications.

Most expert committees have adopted HbA1c in the diagnosis and management of diabetes, and it is now a well-recognized marker of diabetes related complications. HbA1c 6.5% or more are recognized as one of the criteria

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for the diagnosis diabetes.³ A number of factors can affect HbA1c, race/ethnicity is one of them. Even in the absence of hemoglobin variants, A1c may vary with race/ethnicity independently of glycemia.⁴⁻⁸ For example, African Americans may have higher A1c levels than non-Hispanic Whites with similar fasting and post glucose load glucose levels.⁹

The United Kingdom Prospective Diabetes Study (UKPDS), which included 3867 newly diagnosed type 2 diabetic patients and followed over ten years, showed that intensive treatment with mean HbA1c levels of 7%, decreased the risk of microvascular complications in comparison to conventional therapy which achieved mean HbA1c level 7.9%.¹⁰ HbA1c < 7% is the target recommended by American Diabetic Association (ADA) for many non-pregnant adults with diabetes as a marker of good glycemic control.¹¹ But there are questions whether the target HbA1c level should be the same for all diabetic subjects. As mentioned before, a number of studies have shown that there are racial and ethnic differences in HbA1c and ethnicity appears to be an influential factor for the variability of HbA1c threshold values. So, it looks very rational that the influence of ethnicity, in addition to other factors, on HbA1c should be taken into consideration in deciding the diagnostic cut-off levels and the management targets of DM. No fixed level of HbA1c should be considered universal for all ethnic populations.

This study, in addition to finding the socio-demographic features of newly detected type 2 diabetic and pre-diabetic Bangladeshi subjects, aimed to find out the most appropriate cut-off in making a future plan in fixing a HbA1c level in the diagnosis of DM in Bangladeshi population and also in deciding target HbA1c levels to prevent long term complications of poorly controlled DM.

MATERIALS AND METHODS

This cross-sectional observational study was done among 139 newly diagnosed pre-diabetic and type 2 diabetic individuals who attended different Outpatient Departments (OPDs) of Bangabandhu Sheikh Mujib Medical University (BSMMU) and Endocrine OPD of Sir Salimullah Medical College and Mitford Hospital (SSMC & MH), Dhaka. Protocol of the study was approved by the Institutional Review Board (IRB) of Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. Newly diagnosed diabetic and pre-diabetic subjects who met the selection criteria were selected purposively after taking informed written consent. Patients receiving or

received any treatment for DM, diagnosed type 1 diabetic, taking steroids, pregnant and having anemia were excluded from the study. Data were recorded in a preformed questionnaire. Socio-demographic data, individual and family history of hypertension were taken. Detail history of diabetes including symptoms with duration were taken. Symptoms included polyuria, polydipsia, increased appetite with weight loss. Height in meter, weight in kilograms and sitting blood pressure were measured. Body mass index (BMI) were calculated by dividing weight (kilograms) by the square of height (meter²). Two sample oral glucose tolerance test (OGTT) was done using 75g glucose abiding standard OGTT protocol. Venous blood samples, fasting and 2 hours after 75g glucose were collected in the biochemistry laboratory. Blood samples were centrifuged, separated and stored at 4°C until analysis. Venous plasma glucose was measured by glucose oxidase method.¹² HbA1c were measured in blood samples by high performance liquid chromatography (HPLC) using National Glycohemoglobin Standardization program (NGSP) certificate method.¹³ All the findings from history, physical examinations and laboratory tests were recorded in the questionnaire sheet. Diabetes was diagnosed if any of the values met the diagnostic criteria (fasting plasma glucose ≥ 7.0 mmol/L, 2h plasma glucose ≥ 11.1 mmol/L, HbA1c $\geq 6.5\%$), pre-diabetic was diagnosed if one or more values were in the pre-diabetic range (fasting 5.6 to 6.9 mmol/L, 2h value 7.8 to 11.0 mmol/L or HbA1c 5.7 to 6.4%, but no value in the range of DM). These diagnostic criteria are selected as per the guideline of American Diabetes Association (ADA).³ Sensitivity, specificity, positive predictive value, negative predictive value and the area under the receiver operating characteristic (ROC) curve (AUC) for HbA1c using different cut-off values were calculated considering fasting venous plasma glucose (FPG) level as the gold standard for the diagnosis of DM. Statistical analysis was performed using Stata 14.0 (Stata Corp. 2015. Stata Statistical Software: Release 14. College Station, TX: Stata Crop LP), PASW Statistics 18 and MS Excel.

The study findings will be useful in creating a more logical approach for establishing an HbA1c level in the diagnosis and treatment of DM in Bangladeshi community.

RESULTS

Data of all 139 participants were available for analysis.

Table 1 shows the sex distribution of the participants; among them, 124 (89.2%) was diagnosed as overt diabetic

and 15 (10.8%) as pre-diabetic. Among the study subjects 52 (37.41%) of them were male and 87 (62.59%) were female. Female and male ratio was about 1.7:1.

Table- I: Sex distribution of the participants (n=139)

Sex	n	%
Male	52	37.41
Female	87	62.59
Total	139	100

Table 2 displays the age distribution of the participants; here 66 (47.48%) were in age group of 45 and above, where 50 (35.97%), 22 (15.83%) and only 1(0.7%) were in age group of 35-44 years, 25-35 years and 15-24 years.

Table- II: Age distribution of the participants (n=139)

Age group	n	%
15-24	1	0.72
25-34	22	15.83
35-44	50	35.97
≥45	66	47.48
Total	139	100

Table 3 exhibits information regarding mean and $\pm$ SD of anthropometric measurements, fasting venous plasma glucose and HbA1c% of participants. Mean height and $\pm$ SD of the participants was 157.67 ± 8.20 cm and weight 63.93 ± 9.78 kg. The mean $\pm$ SD of calculated BMI was 25.96 ± 3.43 . Mean $\pm$ SD fasting venous plasma glucose was 9.31 ± 5.44 mmol/L and HbA1c was $7.30 \pm 1.94\%$, HbA1c results showed that the mean $\pm$ SD HbA1c of the participants was $7.30 \pm 1.94\%$, with a range of HbA1c from 5.3% to 19.3%.

Table- III: Mean $\pm$ SD of anthropometric measurements, fasting venous plasma glucose and HbA1c% of participants (n=139)

Characteristics	Mean	$\pm$ SD
Height	157.6739	8.196637
Weight	63.93116	9.784016
BMI	25.96436	3.430014
Fasting venous plasma glucose	9.307698	5.443753
HbA1c%	7.305108	1.942224
Range of HbA1c	5.3% to 19.3%	

Figure 1 displays the distribution of BMI of the participants; where 70%, 29% and 1% of newly detected diabetic and pre-diabetic subjects were found within the range of obese, overweight and underweight respectively. Normal weight individuals were found in 29% subjects.

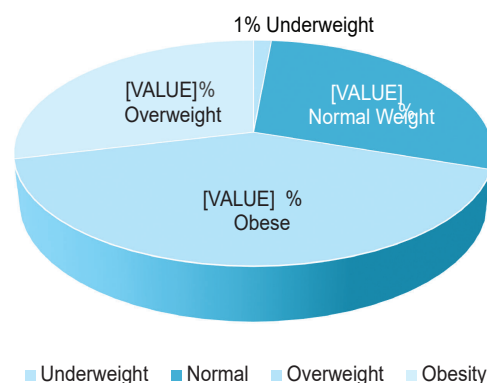


Figure-1: Distribution of BMI of the participants (n=139)

Figure 2 illustrates the HbA1c receiver operating characteristics (ROC) curves including area under the curve (AUC) for diabetes using fasting venous plasma glucose as a reference.

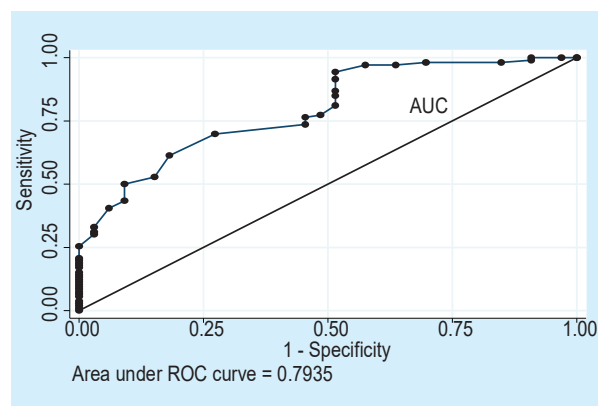


Figure- 2: ROC curve using fasting venous plasma glucose as reference.

Figure 3 demonstrates the percentage of subjects falling in different ranges of HbA1c (%). HbA1c results showed that the mean $\pm$ SD of HbA1c of the participants was $7.30 \pm 1.94\%$. The ranges of HbA1c had 6.5 to 7.4% in 64 (46%) participants, $\leq 6\%$ in 42 (30%), 7.5 to 8.3% in 14 (10%), $> 9.5\%$ in 12 (9%) and 8.5 to 89.4% in 7 (5%) participants.

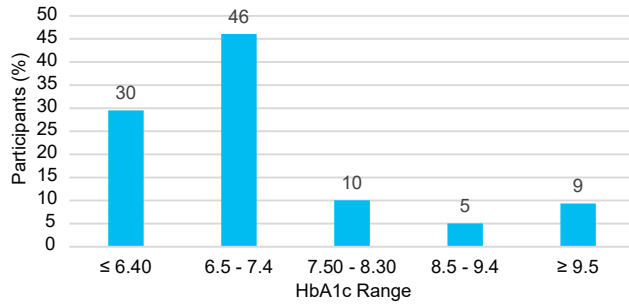


Figure- 3: Percentage of subjects falling in different ranges of HbA1c (%)

Table IV displays the different cut-off values of sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and area under the curve (AUC) using Fasting Plasma Glucose to diagnose diabetes. Area under the curve (AUC) was 0.793 (95% confidence interval, 0.709-0.877), and with the largest Youden index of 0.425 the optimal cut off for HbA1c was 6.8% with sensitivity of 69.8%, specificity of 72.73%, PPV of 89.02%, NPV of 43.21% and accuracy 70.51% (Also in Figure 2, 3 & and 4).

Table- IV: The effect of different cut-off values of sensitivity, specificity, PPV, NPV and area under ROC curves using Fasting Plasma Glucose to diagnose diabetes (cut-off value ≥ 6.8 unit)

HbA1c	Sensitivity	Specificity	PPV	NPV	Accuracy
5.3	1	0.0303	0.765567	1	0.767272
5.4	1	0.0909	0.77695	1	0.781816
5.5	0.9906	0.0909	0.775309	0.753315	0.774672
5.6	0.9811	0.1515	0.785479	0.71682	0.781996
5.7	0.9811	0.303	0.816763	0.835056	0.818356
5.8	0.9717	0.3636	0.828623	0.802265	0.825756
5.9	0.9717	0.4242	0.84237	0.825586	0.8403
6	0.9434	0.4848	0.852911	0.730084	0.833336
6.1	0.9151	0.4848	0.849048	0.643269	0.811828
6.2	0.8679	0.4848	0.842135	0.536808	0.775956
6.3	0.8491	0.4848	0.839202	0.50361	0.761668
6.4	0.8113	0.4848	0.832961	0.447914	0.73294
6.5	0.7736	0.5152	0.834795	0.418137	0.711584
6.6	0.7642	0.5455	0.841884	0.422148	0.711712
6.7	0.7358	0.5455	0.836777	0.39468	0.690128
6.8	0.6981	0.7273	0.890189	0.432064	0.705108
6.9	0.6132	0.8182	0.914391	0.400476	0.6624
7	0.5283	0.8485	0.916961	0.362264	0.605148
7.1	0.5	0.9091	0.945706	0.364744	0.598184
7.2	0.434	0.9091	0.937962	0.336525	0.548024
7.3	0.4057	0.9394	0.954955	0.332961	0.533788
7.4	0.3302	0.9697	0.971838	0.313744	0.48368
7.41	0.3113	0.9697	0.97018	0.307784	0.469316
7.5	0.3019	0.9697	0.96928	0.304904	0.462172
7.6	0.2547	1	1	0.297609	0.433572
8.1	0.2075	1	1	0.284934	0.3977
8.3	0.1981	1	1	0.282538	0.390556

Table- IV: The effect of different cut-off values of sensitivity, specificity, PPV, NPV and area under ROC curves using Fasting Plasma Glucose to diagnose diabetes (cut-off value ≥ 6.8 unit) (Cont'd)

HbA1c	Sensitivity	Specificity	PPV	NPV	Accuracy
8.7	0.1887	1	1	0.280181	0.383412
8.9	0.1792	1	1	0.27784	0.376192
9.1	0.1698	1	1	0.275561	0.369048
9.2	0.1509	1	1	0.27109	0.354684
9.3	0.1415	1	1	0.26892	0.34754
9.4	0.1321	1	1	0.266784	0.340396
9.5	0.1226	1	1	0.26466	0.333176
9.7	0.1132	1	1	0.262591	0.326032
9.8	0.1038	1	1	0.260555	0.318888
9.9	0.0943	1	1	0.258528	0.311668
11.2	0.0849	1	1	0.256554	0.304524
11.3	0.0755	1	1	0.254609	0.29738
11.9	0.066	1	1	0.252674	0.29016
12.1	0.0566	1	1	0.250788	0.283016
12.8	0.0377	1	1	0.247079	0.268652
14.4	0.0283	1	1	0.245275	0.261508
14.5	0.0189	1	1	0.243498	0.254364
19.3	0.0094	1	1	0.241727	0.247144

Figure 4 illustrate the distribution of the respondents according to True Positive (TP), False Positive (FP), False Negative (FN), True Negative (TN)/HbA1c values

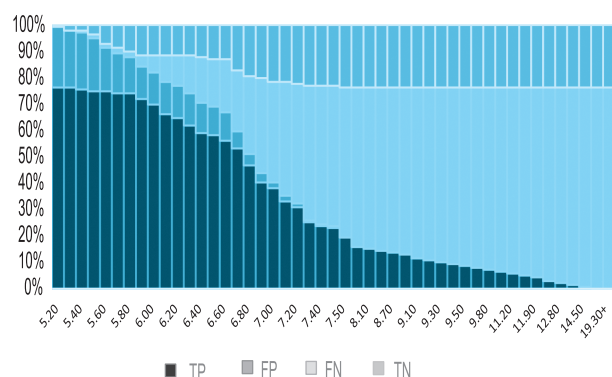
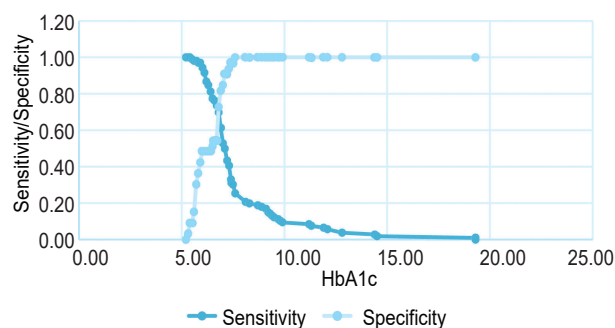
**Figure- 4 distribution of the respondents according to TP, FP, FN, TN/ HbA1c values**

Figure 5 appears the distribution of patients according to Sensitivity and Specificity HbA1c values of the participants.

**Figure-5: Distribution of patients according to Sensitivity and Specificity/ HbA1c values (n=139)**

DISCUSSION

Diabetes mellitus a major global health problem. Not only are the numbers increasing alarmingly, but also DM related complications are leading to immense sufferings to the patients, their families and the country. These sufferings are physical, psychological, social and financial. Proper diagnosis and appropriate management plan are necessary to combat this threat. HbA1c is a recognized

marker to predict diabetes related complications with higher levels predicting poor diabetes related long term outcomes like micro and macro-vascular complications. Its role in the diagnosis of DM is also recognized since a decade. An international expert committee with members appointed by the American Diabetic Association, the European Association for the Study of Diabetes and the International Diabetes Federation was convened in 2008 to consider HbA1c as one of the diagnostic criteria of diabetes in non-pregnant individuals.¹⁵ According to the recommendation, HbA1c threshold 6.5% is considered as the diagnostic cut off value in diagnosing DM. On the other hand, venous plasma glucose is a well-recognized diagnostic tool for DM, and its fasting value of 7.0 mmol/L is the cut off level for the diagnosis of diabetes. In this study, the finding of HbA1c cut-off value is 6.8% using FPG as a reference, which is a little higher than the recommended value by most of the recognized organizations. Ethnicity might be considered as a confounding factor for this difference. In a similar study, involving 573 newly diagnosed type 2 diabetic Arab subjects, considering FPG as a gold standard test, cut-off value of HbA1c was found to be 7.9%.¹⁶ Ethnic factor might be one of the important contributing factors of these differences. Differences in HbA1c cut-off values to diagnose DM have been demonstrated in various studies within different ethnic groups. In two population-based studies in Japan¹⁷ and New Zealand¹⁸, cut-off values for predicting type 2 DM was reported to be 5.5% and 6.7% respectively. While an Australian based study suggested HbA1c 7.0%¹⁹ to predict the presence of type 2 DM. Two Chinese studies recommended cut-off values of HbA1c for detecting diabetes as 6.0%²⁰ and 6.3%²¹ respectively. These differences indicate that racial and ethnic variations of HbA1c should be taken into consideration both in the diagnosis of DM and setting treatment targets in different populations.

CONCLUSIONS

HbA1c is an important marker both in the diagnosis and treatment targets in diabetes. But 'one size fits all' is not a rational approach in making scientific management plans. Influence of ethnicity on HbA1c levels is supported by a number of studies and different diagnostic cut-off levels have been accepted in different countries. In our study, involving 139 Bangladeshi type 2 diabetic and prediabetic subjects, using fasting venous plasma glucose 7.0 mmol/L as the diagnostic cut-off value in the diagnosis of DM,

HbA1c level 6.8% showed the highest degree of Sensitivity, Specificity, Positive predictive value and Accuracy in this population. A larger study with a large sample size, including normoglycemic, prediabetic and diabetic subjects, and comparing venous plasma glucose, both fasting and 2 hours after 75g glucose, are likely to produce a more authentic result that may help in selecting more appropriate HbA1c levels as diagnostic cut-off value and treatment targets in Bangladeshi populations.

Funding Agency: University Grants Commission.

Ethical Consideration:

Ethical clearance was taken from the Institutional Review Board (IRB) of BSMMU. An informed written consent was taken stating the information that the confidentiality about the stated information would be strictly maintained. This information was only used in research purpose and there was no risk of physical and psychological trauma.

REFERENCES

1. IDF DIABETES ATLAS 9th edition. Brussels Belgium: International Diabetes Federation; 2019.
2. Shaw JE, Sicree RA, Zimmet PZ. Global estimates of the prevalence of Diabetes for 2010 and 2030. *Diabetes Res Clin Prac.* 2010; 87: 4-14.
3. Classification and diagnosis of Diabetes: Standards of Medical Care in Diabetes – 2021. *Diabetes Care* 2021;44(Suppl. 1):S15-S33[[https:// doi.org/10.2337/dc21-S002](https://doi.org/10.2337/dc21-S002)].
4. Ziemer DC, Kolm P, Weintraub WS, et al. Glucose Independent, black-white differences in HbA1c levels: A Cross-Sectional Analysis of 2 studies. *Ann Intern Med* 2010; 152: 770 – 77.
5. Kumar PR, Brasali A, Ravikrim M et al. Utility of glycated hemoglobin in diagnosing type 2 diabetes mellitus: a community-based study. *J Clin Endocrinol Metab* 2010; 95: 2832-35.
6. Herman WH. Are there clinical implications of racial difference in HbA1c? Yes, to not consider can do greater harm! *Diabetes care* 2016;39:1458-1461.
7. Selvin E, Steffes MW. Racial Differences in Glycemic Markers: A Cross-Sectional Analysis of Community-Based Data. *Ann Intern Medicine* 2011;154(5): 303-8.

8. Wolffenbuttel BHR, Herman WH. Ethnic Difference in Glycemic Markers in Patients with Type 2 Diabetes. *Diabetes Care* 2013; 36: 2931- 36.
9. Herman WH, Ma Y, Uwaifo G, et al.; Diabetes Prevention Program Research Group. Differences I A1C by race and ethnicity among patients with impaired glucose tolerance in the Diabetes Prevention Program. *Diabetes Care* 2007;30:2453-2457.
10. Masharani U, German MS. Pancreatic Hormones and Diabetes Mellitus. *Greenspan's Basic and Clinical Endocrinology*. New York McGraw-Hill 2011. <http://www.libreriasaulamedia.com/Greenspan's-Bsaic--Clinical-Endocrinology-9ed>
11. Glycemic Targets: Standards of Medical Care in Diabetes – 2021. *Diabetes Care* 2021;44(Suppl. 1):S73-S84 | <https://doi.org/10.2337/dc21-S006>.
12. Banker SB, Blue MV, Singhal RS, Ananthanarayan L. Glucose Oxidase – An overview. *Biotechnology Advances* 2009;27(4):489-501.
13. Little RR. Glycated hemoglobin standardization – National Glycohemoglobin Standardization Program (NGSP) Perspective. *Clin Chem Lab Med* 2003; 41(9): 1191-98.
14. Hossain MM, Chowdhury RS, Amin MR, Mohiuddin SM, Gupta PK. Body Mass Index (BMI) of Newly Diagnosed Type 2 Diabetic Subjects and it's correlations with Venous Plasma Glucose – A Study in the Endocrine Out Patient Department (OPD) of A Tertiary Care Hospital, Dhaka. *Dinajpur Medical College Journal*, 2018 January; 11(1): 92-99.
15. International Expert Committee Report on the role of A1c Assay in the Diagnosis of Diabetes. *Diabetes Care* 2009;32(7):1327-34.
16. Mir Mosarraf Hossain, Tahseen Mahmood, Rehena Akhter, Bushra Zaman, Mir Mahmud Hossain. Influence of ethnicity o glycated hemoglobin (HbA1c): a cross-sectional study among newly diagnosed type 2 diabetic Arab population. *South East Asia Journal of Public Health* 2016;6(2):42-47.
17. Mukai N, Doi Y, Ninomiya T, Hata J, Hirakawa Y, et al. Cut-off values of fasting and post-load plasma glucose and HbA1c for predicting Type 2 diabetes in community-dwelling Japanese subjects: the Hisayama Study. *Diabet Med* 2012; 29: 99-106.
18. Braatvedt GD, Cundy T, Crooke M, Florkowski C, Mann JI, Lunt H, et al. Understanding the new HbA1c units for the diagnosis of Type 2 diabetes. *N Z Med J*. 2012; 125:70-80.
19. Lu ZX, Walker KZ, O'Dea K, Sikaris KA, Shaw JE. A1c for screening and diagnosis of Type 2 diabetes in routine clinical practice. *Diabetes Care* 2010; 33: 817-19.
20. Ma H, Gao X, Lin HD, Hu Y, Li XM, et al. Glycated Hemoglobin in Diagnosis of Diabetes Mellitus and Pre-Diabetes among middle aged and Elderly Population: Shanghai Changfeng Study. *Biomed Environ Sci* 2013; 26: 155-62.
21. Yuqian Bao, Xiaojing Ma, Hauting Li, Mi Zhou, Cheng Hu et al. Glycated hemoglobin A1c for diagnosing diabetes in Chinese population: cross sectional epidemiological survey. *BMJ* 2010; 340: c2249.

Original Article

Early Gallbladder Carcinoma: Demographic Features, Associated Factors and Surgical Outcomes in Tertiary Care Hospitals of Bangladesh

*Hassan MR¹, Sultana R², Tanvir AHM Ahmed³, Arefin MS⁴, Raihan HMS⁵, Rashid MM⁶

Abstract

Gall bladder carcinoma is the most prevalent biliary tract malignancy worldwide. It has no specific symptoms. Symptoms begin with the advancement of disease, and it terminates the life rapidly. Therefore, early diagnosis and intervention lead to positive results, and better outcomes could be assured following surgery. This cross sectional descriptive study was conducted among admitted patients, in the Department of Hepato-Biliary-Pancreatic Surgery and Liver Transplant (HBPS and LT) of BIRDEM General Hospital, Ibn Sina Specialized hospital and Crescent Gastro Liver and General Hospital in Dhaka City from January 2022 to June 2024, over a period of 2 years and 6 months. Most of the data (90%) were obtained from BIRDEM and rest 10% from above mentioned hospitals. The initial estimated sample size was 86; however, after applying the inclusion and exclusion criteria, only 40 cases were included due to data limitations. The study included all histopathologically verified early gallbladder carcinoma cases, but excluded those with signs of advanced

malignancy. Cases were selected irrespective of age or sex, anatomical distribution, clinical features, risk factors, histological type, and surgical outcomes. After receiving ethical approval from the Ethical Committee and verbal consent from the patients, data were collected through face-to-face interviews and observations using a pre-testing questionnaire and check list specifically designed for the study by the researcher. The peak incidence of gallbladder carcinoma was observed in 5th and 6th decades of life with the mean age of the cases being 58.12±7.75 years and their age range was 35 to 80 years. Female was predominance; where, male female ratio was 1:2.34. Gall stone (80%) was the most common associated factor and mostly diagnosed incidentally (92.5%). Mostly done procedure was laparoscopic cholecystectomy and it was about 90%. Tumor involve fundus of the gallbladder in 55% cases and most of these were adenocarcinoma (90%). After surgery, wound infection rate was 7.5% and port site hernia was 5%, however there was no recurrence and survivability was 97.5% within the duration of study periods. Early surgical intervention brings good result in the management of early gallbladder carcinoma.

Keywords: Early gallbladder carcinoma; risk factors; treatment outcome.

INTRODUCTION

Early gallbladder carcinoma (EGBC) is defined as cancer confined to the mucosa (pT1a) or muscularis (pT1b) according to the TNM classification. The incidence of gallbladder carcinoma in Bangladesh is 5.3%^{1,2}. Clinical symptoms of EGBC can be non-specific and symptoms begin with the advancement of the diseases with a very gloomy outcome. It is unlikely many other malignancy of the body, this tumour does not respond well to the conventional chemo-radiotherapy and surgery is the only treatment option in early cases.

MATERIALS AND METHODS

This cross-sectional descriptive study was carried out in the Department of Hepato-Biliary-Pancreatic surgery and Liver Transplant (HBPS & LT_x) in Bangladesh Institute of Diabetes, Endocrine and Metabolic Disorders (BIRDEM)

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*Md. Rafiqul Hassan and Razia Sultana had equal contributions and will be considered as principal authors.

*For Correspondence

Hospital, Ibn Sina Specialized hospital and Crescent Gastro Liver and General hospital, from January 2022 to June 2024. Data were collected by using a questionnaire devised for the study by researcher himself. 90% data were obtained from BIRDEM and 10% from above mentioned hospital. Data processing and analysis were done using SPSS (statistical package for social sciences), version 26. The test statistics used to analyze the data were descriptive statistics

RESULT

Total patients of this study were 40 (male 12, female 28) and male female ratio was 1:2.34.

Table I states the distribution of the patients by their demographic characteristics; here, 70% of the patients were in age group 56-65 years and 15% were in age group 66-75 years. Mean age of the patients was 58.12 ± 7.75 years.

Table- I: Distribution of the patients by their demographic characteristics (n=40)

Sex	Male	Female
No of cases	12 (30%)	28 (70%)
Frequency in age group (Years)		
35-45	0	1 (2.5%)
46-55	0	3 (7.5%)
56-65	10 (25%)	18 (45%)
66-75	1 (2.5%)	5 (12.5%)
>76	1 (2.5%)	1 (2.5%)
Mean age (Years)	58.12	
Standard deviation	7.75	

Table II shows the associated factors of gall bladder carcinoma; among the associated disease, 36 (90%) had cholelithiasis, other associated factors were obesity and gall bladder polyp 2 (5%) cases each; choledochal cyst with anomalous pancreatobiliary maljunction and positive family history 1 (2.5%) case each.

Table- II: Associated factors of gall bladder carcinoma (n=40)

Factors	Frequency	Percentage
Gall stone	36	90
Silent /asymptomatic+symptomatic	29+7	80.6+19.4
Obesity	2	5
Gall bladder polyp	2	5
Choledochal cyst with anomalous pancreatobiliary maljunction	1	2.5
Family history	1	2.5

Table III contains the time of diagnosis of gall bladder carcinoma in relation with operation EGBC; study finds that 37 (92.5%) diagnosed incidentally after surgical procedure (post-operative diagnosis) and preoperative suspicious was possible only in 7.5% cases.

Table- III: Time of diagnosis of gall bladder carcinoma in relation with operation (n=40)

Time of diagnosis	No of cases	Percentage
Pre-operative diagnosis (Suspicion on imaging)	3	7.5
Gall bladder polyp (size >2cm)	2	5
Cholecystitis (irregular wall thickening)	1	2.5
Post-operative diagnosis		
(Specimen showed malignancy)	37	92.5
Cholelithiasis with cholecystitis	36	90
Choledochal cyst with Pancreatobiliary maljunction	1	2.5

Table IV describes the types of surgical procedures performed prior to diagnosis of gall bladder carcinoma; here four types of surgical intervention was done and 36 (90%) surgical interventions were done by laparoscopic cholecystectomy. Others 4 (10%) surgical interventions were open procedure. Among the open procedure 2 (5%) cases underwent laparoscopic cholecystectomy followed by frozen section biopsy, 1 (2.5%) case underwent limited hepatic bisegmentectomy (frozen section facility not available) and 1 (2.5%) case underwent cholecystectomy and total excision of choledochal cyst with Roux-en-Y hepatico-jejunostomy.

Table- IV: Types of procedure performed prior to diagnosis of gall bladder carcinoma (n=40)

Types of procedure	No of cases	Percentage
Laparoscopic procedure (lap. Cholecystectomy)	36	90
Open procedure	4	10
Frozen section biopsy	2	5
Hepatic bisegmentectomy (frozen section facility not available)	1	2.5
Cholecystectomy with total excision of choledochal cyst with Roux-en-Y hepatico-jejunostomy	1	2.5

Figure 1 illustrates the site of origin of tumour in gall bladder; here 22 (55%) cases carcinoma originate from the fundus, 12 (30%) cases from body, and 6 (15%) cases from neck.

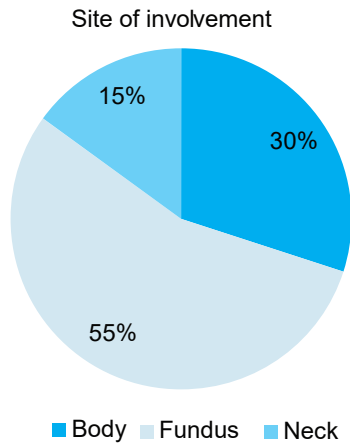


Figure- 1: Pie chart of involving site of carcinoma in the gallbladder (n=40)

Table V exhibits the histopathological variant of gall bladder carcinoma; among the various histological variant adenocarcinoma was found in 36 (90%) cases, others were mucinous adenocarcinoma 2 (5%) cases; papillary adenocarcinoma and adeno-squamous cell carcinoma 1 (2.5%) case each.

Table- V: Histopathological variant of gall bladder carcinoma (n=40)

Histological type	No of cases	Percentage (%)
Adenocarcinoma	36	90
Mucinous adenocarcinoma	2	5
Papillary adenocarcinoma	1	2.5
Adeno squamous cell carcinoma	1	2.5

Table VI states the relation of tumor markers CA19-9 and CEA with gallbladder carcinoma; CA19-9 (cut off value 37 U/mL) and CEA (cut off value 10 ng/mL) were done before surgery in 7 cases and 4 cases respectively and after surgery these level were done in every cases and these level were below normal in every cases.

Table- VI: Relation of tumor markers CA19-9 and CEA with gallbladder carcinoma (n=40)

	CA 19-9		
	No of cases	Level >37 U/mL	Level <37 U/mL
Pre-operative	7	2	5
Post-operative	39	0	39
	CEA		
	No of cases	Level >10 ng/mL	Level <10 ng/mL
Pre-operative	3	1	2
Post-operative	39	0	39

Table VII displays the subsequent follow up and radiology showed no further evidence of recurrence; here, 3 (7.5%) patients had experienced wound infection, 2 (5%) patients had port site hernia and survivability was 97.5% within 2.5 years of the study period.

Table- VII: Outcome of 40 cases of early gallbladder carcinoma managed surgically (n=40)

Surgical out comes	Frequency	Percentage (%)
Wound infection	3	7.5
Open procedure	2	5
Laparoscopic cholecystectomy	1	2.5
Hernia (port site)	2	5
Recurrence	0	0
Survivability	39	97.5

DISCUSSION

In this study, the mean age at diagnosis was 58.12 ± 7.75 years and female were diagnosed more and male-to- female ratio was 1:2.34. In an Indian study, conducted by Dutta U, Bush N, Kalsi D, Popli P, Kapoor VK et al. showed that the mean age of presentation of GBC in Indian subcontinent is younger than their counterparts in the USA and western European countries^{2,3}. In their study, they also mentioned that women of this region are exposed to higher levels of estrogen and progesterone during their lifetime which promotes benign and malignant diseases of gallbladder^{2,3}. Here, gall stone was the most common (90%) associated factors others were obesity (5%), gall bladder polyp (5%), anomalous pancreato-biliary maljunction (2.5%) and positive family history of gall

bladder carcinoma (2.5%). A study conducted in Germany, in 2019, by Søreide K, Guest RV, Harrison EM, Kendall TJ, Garden OJ, Wigmore SJ et al. showed that 70 to 90% of GBC patients have cholelithiasis and it is presumed that chronic mucosal irritation by calculi leads to dysplasia and eventually develop carcinoma³. The Cancer Prevention Study II Nutrition Cohort, the relative risk of gallbladder cancer was 1.8 (95% confidence interval [CI], 1.1 to 2.9) in obese men with a BMI of 30.0 to 34.9 compared to men with a normal BMI (18.5 to 24.9)³. Alvi AR et al. showed in his study that several factors are signs of potential malignant growth of polyp: polyps greater than 10 mm, rapidly increasing polyps, solitary or sessile polyps, association with gallstones, patients over 50 years of age.⁴ In his study he also evaluated the risk of anomalous pancreato-biliary maljunction with carcinoma of gallbladder and describe the pathological changes in anomalous junction.⁵ Anomalous pancreato-biliary maljunction potentially allowing pancreatic secretions to regurgitate into the biliary system and gallbladder, and so leading to malignant changes in the mucosa.⁵ The histological subtype in such cases is usually a papillary carcinoma.⁹ Our study was correspond to this international study^{4,5} In current study, most of the cases (92.5%) were diagnosed incidentally and suspicious cases underwent open procedure. A similar finding was reported by some other researchers in patient with GBC⁸. According to Blumgart's Surgery of the Liver, Biliary Tract and Pancreases, authors advocate when a EBGC suspected pre-operatively, it is contraindicated to do a laparoscopic cholecystectomy to prevent perforation of the gallbladder wall and the spillage of bile into the abdominal cavity (15-45% of patients) which tends to result in dissemination and significantly worsens the prognosis^{16,17}. In this current study, majority (55%) of the carcinoma originate from the fundus and most common (90%) histological variant was adenocarcinoma which are similar to other international study^{9,12}. In current study, CA 19-9 and CEA were used to assess the residual diseases and recurrence after surgery. Ashish Sachan, Sundeep Singh Saluja, Phani Kumar Nekarakanti et al. conducted a study in Department of Gastrointestinal Surgery, Govind Ballabh Pant Institute of Post Graduate Medical Education and Research, Jawahar Lal Nehru Marg, New Delhi, 2020, India to evaluate the role of tumor markers-carbohydrate antigen 19-9 (CA19-9) and carcinoma embryonic antigen (CEA) in patients with GBC. They included 176 patients in their study they advocate that higher levels of CA 19-9 and CEA, may not

mean that anyone have carcinoma, conditions other than cancer can cause higher level. These conditions include an infection or inflammation in pancreases, liver disease, gall stone and cystic fibrosis¹⁴. In this study wound infection rate in laparoscopic procedure was 2.5% and in open procedure 5%. Agaba EA, Rainville H, Wemulapali P et al reported in their study that the incidence of SSI rates ranged from 2.5% to 41.9%¹⁸. In this study, port site hernia was 5% (2 cases). We didn't observe any hernia in open procedure. Hernias at the port insertion site have been reported in many papers with the incidence between 0.14% and 22¹⁸. Study period was 18 months and there was no recurrence observed during this period. Patients were assessed clinically and biochemically including liver function test and tumor marker and USG of whole abdomen at 3 months interval during first 3 months and 6 months interval in later years. Recurrence depends on tumor size, tumor morphology resection margin, hepatic versus peritoneal side involvement and portal vein involvement²⁰. According to Blumgart's Surgery of the Liver, Biliary Tract and Pancreases, authors report that in case of T1a tumor, simple cholecystectomy is appropriate and curative in 90% cases and 1 year OS of 100% for patient with T1a tumours^{16,17}. In current study, out of 40 cases, 1 patient died due to sudden myocardial infraction on 4th post-operative day, following laparoscopic cholecystectomy and this patient was already discharged from hospital. In this study 1 year survivability was 97.5%. The study period was short to follow up the survivability of early gall bladder carcinoma. In this study another observation was, follow up period was short to be significant. According to international study, there is a cumulative survival rate by stage. T1a stage cancers (infiltration limited to the mucosa) require only a cholecystectomy, provided that the margin of the cystic duct is free from cancer¹⁸. The prognosis for this group of patients is very good and according to some reports a 5-year survival reaches 100%^{18,19}. Prognosis depends mainly on the stage of the disease and the possibility of R0 resection²⁰. The tumor biology seems to play a key role and it largely determines the course of the disease²⁰. The least advanced cancers (T1a) allow for almost a 100% 5-year survival after only laparoscopic cholecystectomy²¹. Therefore, patients with incidentally detected cancer have significantly better prognosis²¹. In this study most of the cases were incidentally diagnosed and their prognosis were good.

Having summarized the above mentioned discussion, it is evident that early-stage gallbladder carcinoma is most

commonly an incidental finding in patients who have undergone cholecystectomy for inflammatory disease of the gallbladder. However, if detected early in young patient with early stage (T1a tumor), has better overall 5 years survival rates.

CONCLUSIONS

This study finds that early gallbladder carcinoma was detected more frequently in female; where male female ratio was 1:2.34 and highest incidence (70%) was found in age group 56-65 years. Time of diagnosis of in relation with operation EGBC; Most of the (92.5%) gall bladder carcinoma diagnosed incidentally after surgical procedure. The only challenge is early diagnosis of gall bladder carcinoma prior to surgical intervention.

REFERENCES

1. Dutta U, Bush N, Kalsi D, Popli P, Kapoor VK. Epidemiology of gallbladder cancer in India. *Chinese clinical oncology*. 2019 Aug;8(4):33-
2. Dwivedi AN, Jain S, Dixit R Gall bladder carcinoma: aggressive malignancy with protean loco-regional and distant spread. *World J Clin Cases* 2015;3(3):231
3. Søreide K, Guest RV, Harrison EM, Kendall TJ, Garden OJ, Wigmore SJ Systematic review of management of incidental gall bladder cancer after cholecystectomy. *Br J Surg*. 2019; 106(1):32–45
4. Alvi AR, Siddiqui NA, Zafar H. Risk factors of gallbladder cancer in Karachi-a case-control study. *World J Surg Oncol* 2011;9:164.
5. Kanthan R, Penger JL, Lhmed S, Kanthan SC Gall bladder cancer in the 21st century
6. Lammert F, Neubrand MW, Bittner R, Feussner H, Greiner L, Hagenmüller F, Kiehne KH, Ludwig K, Neuhaus H, Paumgartner G, Riemann JF, Sauerbruch T. [S3-guidelines for diagnosis and treatment of gallstones. German Society for Digestive and Metabolic Diseases and German Society for Surgery of the Alimentary Tract]. *Z Gastroenterol* 2007; 45: 971-1001 [PMID: 17874360 DOI: 10.1055/s-2007-963437]
7. Roa I, de Aretxabala X, Morgan R, Molina R, Araya JC, Roa J, Ibañaca G. [Clinicopathological features of gallbladder polyps and adenomas]. *Rev Med Chil* 2004; 132: 673-679 [PMID: 15332368]
8. Coimbra FJE, Torres OJM, Alikhanov R, et al.: Brazilian consensus on incidental gallbladder carcinoma. *Arq Bras Cir Dig*. 2020, 33:e1496. 10.1590/0102-672020190001e1496
9. Yadav R, Sagar M, Kumar S, Maurya SK. Incidental gallbladder carcinoma in north Indian population: importance of routine histopathological examination of all benign gallbladder specimens. *Cureus*. 2021 Jul 4;13(7).
10. Munshi S, Pal S, Ray D, Sarkar N, Chowdhury D: Incidental gallbladder carcinoma in patients undergoing cholecystectomy for cholelithiasis; a clinicopathological study. *J Surg Arts*. 2015, 8:41-7.
11. Emmett CD, Barrett P, Gilliam AD, Mitchell AI: Routine versus selective histological examination after cholecystectomy to exclude incidental gallbladder carcinoma. *Ann R Coll Surg Engl*. 2015, 97:526-9. 10.1308/rcsann.2015.0013
12. Patkar S, Shinde RS, Kurunkar SR, Niyogi D, Shetty NS, Ramadwar M, Goel M Radiological diagnosis alone risks overtreatment of benign disease in suspected gall bladder cancer: a word of caution in an era of radical surgery. *Indian J Cancer* 2017; 54(4): 681
13. Goetze T.O. Gallbladder carcinoma: prognostic factors and therapeutic options. *World J Gastroenterol* 2015 November 21; 21(43): 12211- 12217.
14. Sachan A, Saluja SS, Nekarakanti PK, Nimisha, Mahajan B, Nag HH, Mishra PK. Raised CA19–9 and CEA have prognostic relevance in gallbladder carcinoma. *Bmc Cancer*. 2020 Dec;20:1-8.
15. Liu F, Hu HJ, Ma WJ, Yang Q, Wang JK, Li FY. Prognostic significance Of neutrophil- lymphocyte ratio and carbohydrate antigen 19-9 in patients With gallbladder carcinoma. *Medicine (Baltimore)*. 2019 Feb;98(8):e14550.
16. Apanga S, Adda J, Issahaku M, Amofa J, Mawufemor KRA and Bugr S (2014). Post operative surgical site infection in a surgical ward of a tertiary care hospital in Northern Ghana. *International Journal of Research in Health Science*, 2(1): 207-212
17. Radunovic M, Lazovic R, Popovic N, Magdelinic M, Bulajic M, Radunovic L, Vukovic M, Radunovic M. Complications of laparoscopic cholecystectomy: our experience from a retrospective analysis. Open access

- Macedonian journal of medical sciences. 2016 Dec 12;4(4):641
18. Agaba EA, Rainville H, Wemulapali P. Incidence of port-site incisional hernia after single-incisional surgery. JSLS. 2014;18:204-10.
 19. Butte JM, Kingham TP, Gönen M, D'Angelica MI, Allen PJ, Fong Y, DeMatteo RP, Jarnagin WR. Residual disease predicts outcomes after definitive resection for incidental gallbladder cancer. Journal of the American College of Surgeons. 2014 Sep
 20. Peng DZ, Nie GL, Li B, Cai YL, Lu J, Xiong XZ, Cheng NS. Prediction of early recurrence after R0 resection for gallbladder carcinoma of stage T1b–T3. Cancer Management and Research. 2022 Jan 3:37-47.
 21. Barreto SG, Pawar S, Shah S et al.: Patterns of failure and determinants of outcomes following radical re-resection for incidental gall-bladder cancer. World J Surg 2014 Feb; 38(2): 484-489.

Original Article

Assessment of Perception of Sexually Transmitted Infections among Urban Women: A Cross-Sectional Study

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Abstract

Public health concerns about sexually transmitted infections (STIs) are becoming more widespread, particularly in developing countries with dense populations and high rates of population mobility. Their prevalence rises with widespread exposure to risk factors. Promoting knowledge and comprehension of STI prevention is essential to shielding women of reproductive age groups (15-45 years) from its harmful effects. This household-based cross-sectional study was directed to assess the level of perception of sexually transmitted infections among 273 purposively selected urban women residing in Moghbazar, Malibagh, and Shantibagh areas of Dhaka South City Corporation, Bangladesh. Data were collected using a pre-tested semi-structured questionnaire based on participants' convenience. The participants had a mean age of 32.8±4.2 years, ranging from 18 to 45 years, with the maximum (40.3%) of them were in age group 31-40 years. In terms of education, over half (54.6%) had completed secondary education, mostly similar to their partners (52.7%) and their average monthly household income was 18765.2±3262.8 BDT. The mean age at marriage was 19.8±2.1 years, with 10.3% marrying before 18. The average duration of marriage was 9.2±6.3 years. The most commonly used contraceptive methods were oral pills (60.4%) and condoms (41.0%). Majority of the women (51.3%) had a poor perception of STIs, while more than one-third (36.1%)

had an average perception, and 12.6% had a good perception. The level of STIs perception among women was significantly associated with age, education, spouse's education, and marital duration ($p<0.05$). The survey uncovered that most women in the selected urban regions had a poor to average perception of STIs, with only one in ten having a good perception. Implementing comprehensive sexual and reproductive health education can reduce the current and future burden of STIs.

Keywords: Sexually transmitted infections, perception's level, urban women, Bangladesh

INTRODUCTION

Sexually transmitted infections (STIs) are a significant health issue, primarily affecting young people in both developing and developed countries.¹ It is rapidly increasing due to economic, social, and demographic factors.²⁻⁴ The spread of STIs is driven by various factors, including emerging pathogens, antibiotic resistance, inadequate health education, low income, and evolving sexual behaviors. These behaviors include frequent unprotected sex with multiple partners, increased demand for prostitution, and a declining average age of sexual initiation.^{5,6} STIs affect both men and women, but their health consequences are often more severe for women.⁷ In pregnant women, STIs also lead to serious health complications for the baby.⁸

Reproductive health problems accounts for one-third of all health issues among women of reproductive age in developing countries and one-fifth of global health concerns.⁹ STIs contributing to 8.9% of diseases affecting women.¹⁰ STIs remain a substantial global health concern, with approximately 1.0 million new infections occurring daily.¹¹ In 2016, more than 490 million people had genital herpes, while around 300 million women had HPV, which causes cervical and anal cancer. To address this, WHO developed the worldwide Health Sector Strategy on STIs (2016-2021), which aims to reduce congenital syphilis to fewer than 50 cases per 100,000 live births, and both syphilis and gonorrhoea infections by 90% between 2018 and 2030.¹² WHO estimated 374 million new infections with chlamydia (129 million), gonorrhea (82 million), syphilis (7.1 million), and trichomoniasis (156 million) in

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2020. In 2022, WHO projected that 254 million people had hepatitis B.^{12,13}

STIs are mainly spread through unprotected sexual contact through sexual contact (vaginal, oral, or anal sex) but can also be conveyed during pregnancy, childbirth, breastfeeding, or through infected blood.¹⁴ Over 30 microbes (bacteria, viruses, and parasites) are transmitted through sexual contact. Eight pathogens cause most STIs: four curable (syphilis, gonorrhea, chlamydia, trichomoniasis) and four viral (hepatitis B, HSV, HIV, HPV). The most prevalent and curable STIs are increasing antimicrobial resistance poses a growing threat to treatment. Viral STIs such as HIV, genital herpes, hepatitis B, HPV, and HTLV-1 have limited treatment options. HIV, HSV, and HTLV-1 are lifelong infections with no cures, though treatments can suppress HIV and HSV.¹³

Knowledge and awareness of STIs have become urgent issues, as they pose significant risks to health security and are influenced by key socioeconomic factors. STIs are most common among marginalized populations with fractional access to healthcare. Providing effective interventions to these groups is challenging but offers significant public health benefits.^{12,15} To accomplish the Sustainable Development Goals, STI prevention and control should be an essential component of comprehensive sexual and reproductive health services. This study aimed to assess perceptions of STIs among women in Dhaka, the capital city, where STIs cases have been rising over the past few decades.

MATERIALS AND METHODS

Study design and settings

A household-based cross-sectional study was conducted to assess the level of perceptions on sexually transmitted infections among urban women in the purposively selected areas of Moghbazar, Malibagh, and Shantibagh in Dhaka South City Corporation, Bangladesh.

Sample selection criteria

A total of 273 married women, aged 18-45 years and homemakers, were purposively selected for the study. Women engaged in occupations other than homemaking were excluded. The sample size was calculated based on the knowledge of STDs among women in Dhaka (77.2%), with a 95% confidence interval (CI) and a 5% relative precision.¹⁵

Data collection procedures

The data collection was carried out by using a pre-tested semi-structured questionnaire through face-to-face

interview after obtaining informed written consent from each participant during the period January to December, 2018. Pretested done with 35 women resided in Mirpur 10, Dhaka. The questionnaire was divided into three sections: the socio-demographic profile of women, reproductive health information, and their perceptions of STIs.

Scoring measures

To ensure accurate responses, the questionnaire used a binary 'yes' or 'no' format. Perception was measured by assigning '1' point for each correct answer and '0' for incorrect ones, with scores ranging from 0 (all incorrect) to 48 (all correct), indicating STI knowledge levels. Participants scoring ≥ 38 ($\geq 80\%$) were classified as having 'Good Knowledge,' those scoring ≥ 28 (60-79%) as having 'Average Knowledge,' and those scoring < 28 ($< 60\%$) as having 'Poor Knowledge.' The utmost score achieved in this study was 48.

Statistical analysis

Data were entered and analyzed using IBM SPSS Version 25 (New York, USA). Descriptive statistics were presented as frequencies (percentages) for categorical data and means ($\pm$ SD) for continuous data. The Chi-square (χ^2) test and Fisher exact test were used to assess associations. A p-value < 0.05 at a 95% confidence interval was considered statistically significant.

Ethical approval

The questionnaire included a detailed explanation of the study's purpose and a consent form. Participation was entirely voluntary, and privacy and data security were strictly maintained following IRB guidelines and the ethical standards of the 1964 Declaration of Helsinki and its subsequent amendments or equivalent ethical standards. Ethical approval was granted by the Institutional Review Board of National Institute of Preventive and Social Medicine, Dhaka 1212, Bangladesh. (Reference: NIPSOM/IRB/2017/250)

RESULTS

Table I represents the socio-demographic profile of women. The respondents' mean age was 32.8 ± 4.2 years, ranging from 18 to 45 years, with the majority (40.3%) in the 31-40 age group. Most were Muslim (80.6%) and lived in nuclear families (72.5%). Regarding education, over half (54.6%) had completed secondary level, compared to 52.7% of their partners. Nearly half of the partners (49.5%) were day laborers. The average monthly household income was $18,765.2 \pm 3,262.8$ BDT, with the majority (87.2%) belonging to low-income families earning $\leq 20,000$ BDT per month.

Table-I: Socio-demographic outlines of women (n=273)

Variables		Frequency (n)	Percent (%)
Age groups (in years)			
	18-24	42	15.4
	25-30	75	27.5
	31-40	110	40.3
	>40	46	16.9
Mean±SD		32.8±4.2	
Religion			
	Muslim	220	80.6
	Hinduism	40	14.7
	Christianity	13	4.7
Education			
	Illiterate	31	11.4
	Primary	65	23.8
	Secondary	149	54.6
	Higher secondary and above	28	10.3
Spouse's education			
	Illiterate	38	13.9
	Primary	31	11.4
	Secondary	144	52.7
	Higher secondary and above	60	22.0
Spouse's occupation			
	Day laborer	135	49.5
	Businessmen	68	24.9
	Service holders	54	19.8
	Others (Unemployed, retired etc.)	16	5.9
Family type			
	Nuclear	198	72.5
	Joint/ extended	75	27.5
Monthly household incomes (Bangladeshi taka)			
	≤15000	98	35.9
	15001-20000	140	51.3
	>20000	35	12.8
Mean±SD		18765.2±3262.8	

Table II states the reproductive health information of the participants. The mean age at menarche was 14.9±1.4 years, and the mean age at marriage was 19.8±2.1 years, with 10.3% marrying before the age of 18. The average duration of marriage was 9.2±6.3 years. Regarding conception, 88.3% of women conceived during their marriage, with the mean age at first conception being 20.3±1.8 years. The mean number of living children was 2.2±0.8, and 21.2% had more than two children. The most commonly used contraceptive methods were oral pills (60.4%) and condoms (41.0%).

Table-II: Women's reproductive health related information (n=273)

Variables		Frequency (n)	Percent (%)
Age at menarche (in years)			
	<14	68	24.9
	≥14	205	75.1
	Mean±SD	14.9±1.4	
Age at marriage (in years)			
	<18	28	10.3
	≥18	245	89.7
	Mean±SD	19.8±2.1	
Duration of marital age (in years)			
	<5	67	24.5
	≥5	206	75.5
	Mean±SD	9.2±6.3	
Conception history			
	Conceived	241	88.3
	Never conceived	32	11.7
Age at first conception (in years) (n=241)			
	<18	4	1.7
	≥18	237	98.3
	Mean±SD	20.3±1.8	
Number of living children (n=241)			
	≤2	215	78.8
	>2	58	21.2
	Mean±SD	2.2±0.8	
Use of contraceptive methods			
	Oral pills	165	60.4
	Condom	112	41.0
	Injectables	31	11.4
	Others (IUD and implant)	11	4.0

*Multiple responses

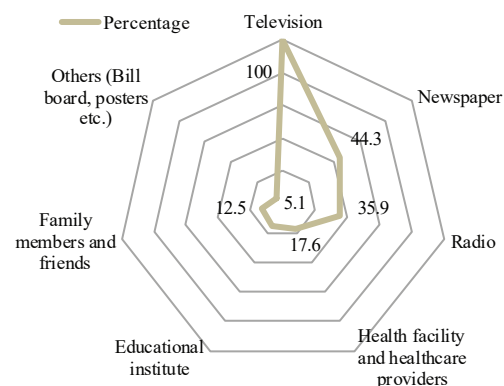
**Figure 1: Sources of information on STIs (n=273)**

Figure 1 shows the sources of information about STIs. The majority of respondents received STI-related information from mass media, including television (100%), newspapers (44.3%), and radio (35.9%). In contrast, a smaller proportion received information from health facilities and healthcare providers (17.6%) or educational institutions (15.0%).

Table III contains the perceptions of the women about STIs. Most respondents were unaware that STIs are caused by bacteria (84.2%) and fungi (96.0%). None mentioned chlamydia, genital herpes, trichomoniasis, or genital candidiasis. However, most (92.2%) knew about HIV/AIDS, and about a third (30.4%) were aware of Hepatitis B. Most respondents (85.0%) understood that STIs could be transmitted through sexual intercourse, but many (84.2%, 80.2%) did not know that STIs could be spread through blood transfusion or shared needles. Regarding risk factors, the majority (56%, 64.1%) knew that unprotected sex and multiple partners were major risks for contracting STIs. Common STI symptoms recognized included blood in urine (86.4%), weakness (75.8%), genital itching (80.2%), and genital ulcers (50.9%). However, most respondents (92.3%) did not know that pain during intercourse could be a symptom of STIs. Most respondents were unaware that STIs could lead to premature birth (100%), ectopic pregnancy (99.6%), infertility (71.8%), or stillbirth (65.9%), although 83.9% knew that STIs could cause cervical cancer. Many did not know that STIs could be prevented by vaccination (91.9%) or by consistent condom use (85.0%). About half of the respondents were aware that reducing the number of sexual partners or having a single partner could prevent STIs. The majority (67.0%) knew that some STIs could be treated with antibiotics, and 15.0% were aware that viral STIs cannot be cured but their symptoms can be managed with medication.

Table-III: Perceptions of women about STIs (n=273)

Perceptions related variables	Yes	No
Causative agents of STIs	n(%)	n(%)
Bacteria	43(15.8)	230(84.2)
Virus	123(45.1)	150(54.9)
Fungus	11(4.0)	262(96.0)
Name of common STIs		
Syphilis	14(5.1)	259(94.9)
Gonorrhea	38(13.9)	235(86.1)
HIV/AIDS	252(92.2)	21(7.8)
Hepatitis B	83(30.4)	190(69.6)
Hepatitis C	23(8.4)	250(91.6)
HPV infection	5(1.8)	268(98.2)
Chlamydial infection	0(0)	273(100)
Genital herpes	0(0)	273(100)
Trichomoniasis	0(0)	273(100)
Genital candidiasis	0(0)	273(100)

Table-III: Perceptions of women about STIs (n=273)

Perceptions related variables	Yes	No
Causative agents of STIs	n(%)	n(%)
Mode of transmission of STIs		
Sexual intercourse	232(85.0)	41(15.1)
Blood transfusion	43(15.8)	230(84.2)
Sharing needles	54(19.8)	219(80.2)
Vertical transmission	14(5.1)	259(94.9)
Risk factors of getting STIs		
Sex without condom	153(56.0)	120(44.0)
Multiple partners	175(64.1)	98(35.9)
Drug abusers share needles during exchange	66(24.2)	207(75.8)
Pregnancy	65(23.8)	208(76.2)
Blood transfusion	144(52.7)	129(47.3)
Sign and symptoms of STIs		
Abdominal pain	3(1.1)	270(98.9)
Discharge from penis/vulva	38(13.9)	235(86.1)
Itching in genitalia	219(80.2)	54(19.8)
Burning pain on urination	70(25.6)	203(74.4)
Pain during intercourse	21(7.7)	252(92.3)
Genital ulcers	139(50.9)	134(49.1)
Swelling in genitalia	90(33.0)	183(67.0)
Blood in urine	236(86.4)	37(13.6)
Failure to urinate	8(2.9)	265(97.1)
Loss of weight	129(47.3)	144(52.7)
Weakness	207(75.8)	66(24.2)
Asymptomatic	8(2.9)	265(97.1)
Complications of STIs		
Infertility	77(28.2)	196(71.8)
Permanent damage of reproductive system	154(56.4)	119(43.6)
Premature birth	0(0)	273(100)
Stillbirth	93(34.1)	180(65.9)
Ectopic pregnancy	1(0.4)	272(99.6)
Miscarriage	103(37.7)	170(62.3)
Cancer of cervix	229(83.9)	54(16.1)
Ways to prevent STIs		
Most reliable way of avoiding infection is not having sex	41(15.1)	232(85.0)
Vaccines	22(8.1)	251(91.9)
Reducing the number of sex partners	122(44.7)	151(55.3)
Keeping a sexual relationship with only one person	132(48.4)	141(51.6)
Correct and consistent use of the condom	32(11.7)	241(88.3)
Ways to treat STIs		
Some STIs can be treated with antibiotics	183(67.0)	90(33.0)
Viral STIs cannot be cured, but their symptoms can be managed with drugs	41(15.0)	232(85.0)

Figure 2 illustrates that more than half of the women (51.3%) had poor perception of STIs, 36.1% had average perception, and 12.6% had good perception.

Table IV shows that the level of perception of women regarding STIs was significantly associated with their age ($p=0.06$), education ($p=0.000$), spouse's education ($p=0.001$), and duration of marital age ($p=0.023$).

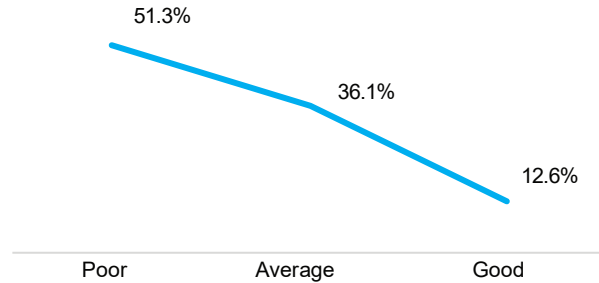


Figure 2: Level of perceptions on STIs (n=273)

Table IV: Association with different variables with level of perceptions on STIs (n=273)

Variables	Categories	Level of perceptions				χ^2 value	p-value
		N n(%)	Good n(%)	Average n(%)	Poor		
Age groups	18-24 years	42	5(11.9)	14(33.3)	23(54.8)	13.926	0.016
	25-30 years	75	9(12.0)	35(46.7)	31(41.3)		
	31-40 years	110	13(11.8)	32(29.1)	65(59.1)		
	>40 years	46	3(6.5)	14(30.4)	29(63.0)		
Education	Illiterate	31	0(0.0)	6(19.4)	25(80.6)	46.321 (FT value)	0.000
	Primary	65	2(3.1)	15(23.1)	48(73.8)		
	Secondary	149	13(8.7)	51(34.2)	85(57.1)		
	HS & above	28	4(14.3)	10(35.7)	14(50.0)		
Spouse's education	Illiterate	38	1(2.6)	7(18.4)	30(78.9)	48.542 (FT value)	0.001
	Primary	31	2(6.5)	5(16.1)	24(77.4)		
	Secondary	144	23(16.0)	46(31.9)	75(52.1)		
	HS & above	60	12(2.0)	28(46.7)	20(33.3)		
Duration of marital age	<5 years	67	13(19.4)	23(34.3)	31(46.3)	8.965	0.023
	≥5 years	206	11(5.3)	70(34.0)	125(60.7)		

Chi-square and Fisher exact test done, $p<0.05$ considered as statistically significant value

DISCUSSION

This study found that the mean age of the women was 32.8 ± 4.2 years, with 42.9% being under the age of 30. A similar age distribution was observed in a study conducted in Rajshahi, Bangladesh.¹⁶ Regarding education, more than half (54.6%) had completed secondary school, compared to 52.7% of their partners. Nearly half of the partners (49.5%) were day laborers. The average monthly household income was $18,765.2 \pm 3,262.8$ BDT, with the majority (87.2%) belonging to low-income families earning $\leq 20,000$ BDT per month. According to the BBS 2022 reports, the literacy rate was relatively high in this study.¹⁷

In this study, the mean age at marriage was 19.8 ± 2.1 years, with 10.3% marrying before the age of 18. Child marriage

is more common in rural areas, where girls are married before the age of 18, compared to urban areas.¹⁸ The mean duration of marriage was 9.2 ± 6.3 years. The length of marital life influenced the perception of STIs, a finding also observed in the study.¹⁹ Of the women, 88.3% conceived during marriage, with the average age at first conception being 20.3 ± 1.8 years. The most common contraceptive methods were oral pills (60.4%) and condoms (41.0%). According to a survey by NIPORT in 2021, condoms and oral pills are the most commonly used contraceptive methods in the country.²⁰

The study found that most women were unaware that STIs are caused by bacteria (84.2%) and fungi (96.0%), and none mentioned chlamydia, genital herpes, trichomoniasis, or genital candidiasis. However, the

majority (92.2%) were aware of HIV/AIDS, and about a third (30.4%) knew about Hepatitis B. Most respondents (85.0%) understood that STIs could be transmitted through sexual intercourse, but many (84.2%, 80.2%) were unaware that STIs could be spread through blood transfusions or shared needles. Regarding risk factors, most women (56%, 64.1%) recognized that unprotected sex and multiple partners are major risks for contracting STIs. Common STI symptoms such as blood in urine (86.4%), weakness (75.8%), genital itching (80.2%), and genital ulcers (50.9%) were identified, but 92.3% did not know that pain during intercourse could also be a symptom. Many were unaware that STIs could lead to premature birth (100%), ectopic pregnancy (99.6%), infertility (71.8%), or stillbirth (65.9%), although 83.9% knew that STIs could cause cervical cancer. Most women did not know that STIs could be prevented by vaccination (91.9%) or by consistent condom use (85.0%), but about half were aware that reducing the number of sexual partners or having only one partner could prevent STIs. The majority (67.0%) knew that some STIs could be treated with antibiotics, and 15.0% understood that viral STIs cannot be cured but their symptoms can be managed with medication. These findings are consistent with studies on the knowledge, awareness, and perception of sexually transmitted diseases or infections among various groups of women.²¹⁻²⁶

The current study found that over half of the women (51.3%) had poor perception of STIs, 36.1% had an average perception, and 12.6% had a good perception. Poor perception or knowledge level among the women also found in the studies.^{4,10,27,28} The level of perception of women regarding STIs was significantly associated with their age, education, spouse's education, and marital duration ($p < 0.05$). Several studies have demonstrated a substantial relationship between socio-demographic characteristics and an individual's perception, knowledge, and attitudes towards sexually transmitted infections.^{29,30}

CONCLUSIONS

The study found that most women in the selected urban areas had a poor to average perception of STIs, with merely about one in ten having a good perception. This could be attributed to these families' poor socioeconomic position, which includes criteria such as education, occupation, and income. Urban areas are sometimes given less importance in awareness and education efforts than rural or urban slum communities. To address societal norms causing women's reluctance in urban areas, multi-level interventions are

needed. These can be implemented alongside structural reforms through collaboration with families, cross-sectoral groups, and community health centers.

AUTHOR'S CONTRIBUTIONS:

Conceptualization, methods and literature reviews: Nurunnabi M, Sultana H, and Halim KS; Data collection: Rayhan MG, Eva MM, and Muktadir SMA; Statistical analysis: Nurunnabi M; Preparation of draft manuscript: Nurunnabi M, Sultana H, Rayhan MG, Eva MM, and Halim KS; and Finalization of manuscript: Nurunnabi M, Sultana H, Rayhan MG, Eva MM, Muktadir SMA, and Halim KS. All the authors approved the final manuscript.

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COMPETING INTERESTS:

The authors have declared that they have no competing interests.

REFERENCES

1. Folasayo AT, Oluwasegun AJ, Samsudin S, Saudi SN, Osman M, Hamat RA. Assessing the knowledge level, attitudes, risky behaviors and preventive practices on sexually transmitted diseases among university students as future healthcare providers in the central zone of Malaysia: a cross-sectional study. *International journal of environmental research and public health*. 2017;14(2):159.
2. Grad AI, Senila SC, Cosgarea R, Tataru AD, Vesa SC, Vica ML, Matei HV, Ungureanu L. Sexual behaviour, attitudes and knowledge about sexually transmitted infections: A cross-sectional study in Romania. *Acta dermatovenerologica croatica*. 2018;26(1):25.
3. El-Tholoth HS, Alqahtani FD, Aljabri AA, Alfaryan KH, Alharbi F, Alhowaimil AA, Alkharji A, Alrwaily A, Obied A, Al-Afraa T. Knowledge and attitude about sexually transmitted diseases among youth in Saudi Arabia. *Urology annals*. 2018;10(2):198-202.
4. Zin NM, Ishak I, Manoharan K. Knowledge, attitude and practice towards sexually transmitted diseases amongst the inmates of women shelters homes at Klang Valley. *BMC public health*. 2019;19:1-7.
5. Da Ros CT, da Silva Schmitt C. Global epidemiology of sexually transmitted diseases. *Asian journal of andrology*. 2008;10(1):110-4.

6. Chen FH. Rational behavioral response and the transmission of STDs. *Theoretical population biology*. 2004;66(4):307-16.
7. Shipitsyna E, Krasnoselskikh T, Zolotoverkhaya E, Savicheva A, Krotin P, Domeika M, Unemo M. Sexual behaviours, knowledge and attitudes regarding safe sex, and prevalence of non-viral sexually transmitted infections among attendees of youth clinics in St. Petersburg, Russia. *Journal of the european academy of dermatology and venereology*. 2013;27(1):e75-84.
8. Chen XS, Yin YP, Chen LP, Thuy NT, Zhang GY, Shi MQ, Hu LH, Yu YH. Sexually transmitted infections among pregnant women attending an antenatal clinic in Fuzhou, China. *Sexually transmitted diseases*. 2006;33(5):296-301.
9. Sharma P, Sherkhane MS. Knowledge and attitude about sexually transmitted infections among women in reproductive age group residing in urban slums. *International journal of community medicine and public health*. 2017;4(1):20-4.
10. Masood A, Dwivedi S, Singh G, Gupta S, Mishra P, Hassan MA. Perception of RTIs/STIs including HIV/AIDs among women of reproductive age group in Allahabad. *Indian journal of preventive & social medicine*. 2011;42(1):19-23.
11. Global strategy for the prevention and control of sexually transmitted infections- breaking the chain of transmission: 2006-2015. World Health Organization: 2007. Available from: https://iris.who.int/bitstream/handle/10665/43853/9789241563475_eng.pdf Cited on May 12, 2023)
12. Report on global sexually transmitted infection surveillance, 2018. World Health Organization: 2018. Available from: <https://iris.who.int/bitstream/handle/10665/277258/9789241565691-eng.pdf> (Cited on May 12, 2023)
13. Sexually transmitted infections (STIs): Fact Sheets. World Health Organization: 2024. Available from: [https://www.who.int/news-room/fact-sheets/detail/sexually-transmitted-infections-\(stis\)](https://www.who.int/news-room/fact-sheets/detail/sexually-transmitted-infections-(stis))
14. Nurunnabi M, Islam F, Sultana H, Haque A, Afroz L, Alam MR, Rahman MM, Abbas MG. Stigma on Sexually Transmitted Diseases and the Patients. *Journal of Rangamati Medical College*. 2019; 2(2):4-8.
15. Hossain M, Mani KK, Sidik SM, Shahar HK, Islam R. Knowledge and awareness about STDs among women in Bangladesh. *BMC public health*. 2014;14(1):775
16. Mondal NI, Hossain K, Islam R, Mian AB. Sexual behavior and sexually transmitted diseases in street-based female sex workers in Rajshahi City, Bangladesh. *Brazilian journal of infectious diseases*. 2008;12(4):287-92.
17. Statistical Yearbook Bangladesh 2022. Bangladesh Bureau of Statistics: 2023. Available from: https://bbs.portal.gov.bd/sites/default/files/files/bbs.portal.gov.bd/page/b2db8758_8497_412c_a9ec_6bb299f8b3ab/2023-06-26-09-19-2edf60824b00a7114d8a51ef5d8ddbce.pdf (Cited on July 22, 2023)
18. State of the World's Children. UNICEF: 2016. Available from: <https://www.girlsnotbrides.org/child-marriage/bangladesh> (Cited on July 22, 2023)
19. Lan PT, Faxelid E, Chuc NT, Mogren I, Lundborg CS. Perceptions and attitudes in relation to reproductive tract infections including sexually transmitted infections in rural Vietnam: A qualitative study. *Health policy*. 2008;86(2-3):308-17.
20. Urban Health Survey 2021. National Institute of Population Research and Training (NIPORT): 2022. Available from: https://niport.portal.gov.bd/sites/default/files/files/niport.portal.gov.bd/publications/66c4accd_4c6a_4aab_902c_781a77aa8768/2023-01-30-06-04-9310fc1f3902cdd03884124c600ddc8d.pdf (Cited on July 22, 2023)
21. Gurvey JE, Adler N, Ellen JM. Factors associated with self-risk perception for sexually transmitted diseases among adolescents. *Sexually transmitted diseases*. 2005;32(12):742-4.
22. Ahmad F, Hossain KJ, Ahmed M, Rajia J, Salma U, Haque A, Sultana H, Nurunnabi M, Abbas MG. Health related quality of life and relative attributes among substance users. *Journal of sylhet women's medical college*. 2023;13(1):20-27
23. Olivi M, Santana RG, Mathias TA. Behavior, knowledge and perception of risks about sexually transmitted diseases in a group of people over 50 years old. *Revista latino-americana de enfermagem*. 2008; 16:679-85.

24. Mou SZ, Bhuiya FA, Islam SM. Knowledge and perceptions of sexually transmitted diseases, HIV/AIDS, and reproductive health among female students in Dhaka, Bangladesh. *International Journal of advanced medical and health research*. 2015;2(1):9-15.
25. De Waure C, Mannocci A, Cadeddu C, Gualano MR, Chiaradia G, Vincitorio D, Di Stanislao F, De Vito E, Langiano E, Boccia A, Ricciardi W. Knowledge, attitudes and behaviour about Sexually Transmitted Infections: a survey among Italian university female students. *Epidemiology, biostatistics, and public health*. 2015;12(2).
26. Obiechina NJ, Diwe K, Ikpeze OC. Knowledge, awareness and perception of sexually transmitted diseases among Nigerian adolescent girls. *Journal of obstetrics and gynaecology*. 20021;22(3):302-5.
27. Nguyen SH, Dang AK, Vu GT, Nguyen CT, Le TH, Truong NT, Hoang CL, Tran TT, Tran TH, Pham HQ, Dao NG. Lack of knowledge about sexually transmitted diseases (STDs): Implications for STDs prevention and care among dermatology patients in an urban city in Vietnam. *International journal of environmental research and public health*. 2019; 16(6):1080.
28. Naeem FK, Suror H, Aneed AA. Knowledge and attitude about sexual transmitted disease among women in reproductive age in Al-Nasiriyah Governorate-Iraq. *Indian journal of forensic medicine & toxicology*. 2020;14(4):2662-7.
29. Mutaru AM, Asumah MN, Ibrahim M, Sumaila I, Hallidu M, Mbemah JM, Atakole BA, Zakaria DY. Knowledge on sexually transmitted infections (STIs) and sexual practices among Nursing Trainees in Yendi Municipality, Northern Region of Ghana. *European journal of health sciences*. 2021;6(4):33-47.
30. Winarto H, Habiburrahman M, Kusuma F, Nuryanto KH, Anggraeni TD, Utami TW, Putra AD, Syaharutsa DM. Knowledge, Attitude, and practice towards sexually transmitted infections among women of reproductive age in an urban community health centre in Indonesia. *The open public health journal*. 2023;16(1).

Obituary news January-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. Nishat Abdullah	02/10/2023
2	Dr. Mahmuda Sarwar Babli	03/10/2023
3	Dr. Md. Hafizur Rahman	08/10/2023
4	Prefessor. Dr. Rafiqul Islam	08/10/2023
5	Freedom Fighter Dr. Md. Abdur Razzak Mia	12/10/2023
6	Professor Dr. Ferdous Ara J Jaman	15/10/2023
7	Dr. Sahriar Morshed Saikat	16/10/2023
8	Dr. Tapan Kumar Mondal	22/10/2023
9	Dr. Jahirul Haque	23/10/2023
10	Professor Dr. Riduwanur Rahman	25/10/2023
11	Dr. Mubashir	27/10/2023
12	Professor Dr. Khandaker Md. Sifat Ullah	29/10/2023
13	Dr. Golam Kazem Ali Ahmed	29/10/2023
14	Dr. Shymol Krishna Aich	03/11/2023
15	Dr. Md. Muhammad Rajib Ahsan	07/11/2023
16	Professor Dr. AKM Matiur Rahman	08/11/2023
17	Hafej Dr. Syedul Omam	16/11/2023
18	Dr. SM Khaliduzaman	23/11/2023
19	Dr. Towfique Ahmed Shuvo	27/11/2023

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.

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