

Role of Transabdominal USG in The Evaluation of Urinary Bladder Mass

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Abstract:

Introduction: Among the urinary bladder masses, urinary bladder cancer is the most commonly diagnosed malignancy in patients presenting with haematuria. Early detection is crucial for improving patient prognosis. The diagnostic modalities commonly used to evaluate patients with bladder mass include IVU, transabdominal ultrasonography (USG), computed tomography (CT) and cystoscopy. Of them transabdominal ultrasonography has been proposed as screening test for detection of bladder mass, but its accuracy is still a dispute. **Objective:** The present cross-sectional study is aimed to find the diagnostic accuracy of Trans abdominal USG in differentiating benign from malignant bladder masses. **Methodology:** This cross-sectional study was carried out in the Department of Radiology & Imaging, Dhaka Medical College Hospital, Dhaka between January 2014 to June 2014. 60 adult patients with diagnosis of bladder mass made by intravenous urography or clinically suspected or recurrence case were the study population and were consecutively included in the study. Trans-abdominal ultrasonography was performed in each patient and a ultrasound diagnosis was made. Histopathology was done and using formulae accuracy, sensitivity, specificity, positive and negative predictive values of the trans-abdominal USG in diagnosing bladder masses were done. **Result:** More than 70% of the patients were 55 years old or more with mean age of 58.3 years. A male preponderance was observed in the series. Painless hematuria was the predominant complaint (90%), followed by frequency of micturition (78.3%), urgency (70%), dysuria (63.3%), retention of urine 45% and low-back pain (31.7%). The study demonstrated a high sensitivity (94.5%) and moderate specificity (60%) of trans-abdominal ultrasound in the diagnosis of bladder mass. The overall diagnostic accuracy was appreciably high (91.7%). **Conclusion:** The study concluded that Transabdominal USG can differentiate bladder carcinoma from benign bladder mass with fair degree of accuracy showing results of high sensitivity, high accuracy and a moderate specificity.

Introduction:

The human bladder is a hollow viscus which acts as reservoir of urine after it has been filtered by the kidneys. Pathologic conditions of the bladder can manifest as focal bladder mass or diffuse wall thickening. Focal masses may be neoplastic or may develop secondary to congenital, inflammatory, idiopathic or infectious sources. Diffuse bladder wall thickening can develop secondary to many non-neoplastic conditions, infections with bacteria or adenovirus, schistosomiasis, tuberculosis, inflammatory conditions such as cystitis and exposure to chemotherapy, such as cyclophosphamide or irritation¹.

The incidence of bladder cancer has greatly increased over the last few decades^{2,3} with more than 60000 new cases now diagnosed each year in the United States alone. It now represents the 4th most common malignancy in men and the 10th most common malignancy in women^{4,5}. In western countries, primary bladder neoplasms account for 2-6% of all tumors, with bladder cancer ranked as the most common malignancy. Majority (95%) of bladder neoplasms arise from the epithelium, the most common subtype is urothelial carcinoma (transitional cell carcinoma), which accounts for 90% of cases. Squamous cell carcinoma accounts

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for 2-15%. Adenocarcinoma represents less than 2%. Bladder cancer typically occurs in men aged 50-70 years and is related to smoking or occupational exposure to carcinogens⁶. According to the latest reports from the National Cancer Institute of the United States, the incidence of this pathology is higher in industrialized than in developing countries.⁷

Cystoscopy is the gold standard method for diagnosing bladder cancer^{2,8}. However, it is an invasive and costly procedure^{9,10}. Many imaging modalities have been used in the evaluation of bladder mass including IVU, ultrasonography (USG), computed tomography (CT) and cystoscopy.⁶

USG is a non-invasive, readily available and less costly compared to all other imaging modalities. It is simple, quick, requires no special preparation, can safely be performed in elderly patients and those with renal failure and also is not associated with any complications inherent to urography. Trans-abdominal ultrasonography is recognized as the initial radiological procedure for detection of bladder carcinomas in patients presenting with haematuria.¹¹ It provides images of both upper and lower renal tract. Rafique and Javed found USG as a sensitive tool (96%) in the detection of bladder carcinoma and recommended the use of ultrasonography as the initial radiological investigation for detection of bladder carcinoma in patients presenting with haematuria or suspected bladder mass.¹² Islam showed that sensitivity of USG in respect to bladder tumours is 96.8%.¹³ But Purnel and colleagues held the view that ultrasound performed during the routine investigation of haematuria does not afford significant clinical benefit and may extend unnecessarily examination times.¹⁴ In a meta-analysis by Xinthua et al. the sensitivity of USG in differentiating bladder carcinoma from benign bladder mass was found to be low, while its specificity was high.¹⁵ Moreover, bladder tumours of < 0.5 cm in size and tumours localized in the bladder neck or in dome are difficult to detect and extra vesical extension cannot be assessed accurately with trans-abdominal USG.¹⁶ So this study was conducted in the context of Bangladeshi population to justify the conflicting claims of different investigators regarding the diagnostic validity of USG in the diagnosis of bladder tumors.

Materials & methods:

The study was carried out in the Department of Radiology & Imaging, Dhaka Medical College Hospital, Dhaka, from January 2014 to June 2014.

Data were also collected from two other Institutions named BSMMU (Bangabandhu Sheikh Mujib Medical University) Hospital and NIKDU (National Institute for Kidney Diseases & Urology). Adult patients (18 years and onwards) presenting with haematuria and IVU or clinically suspected or recurrence case of urinary bladder mass referred to the Department of Radiology & Imaging of respective Institutes were included in the study. Patients unwilling for cystoscopy or surgery for removal of mass and non-availability of histopathology reports were the two set criterion for exclusion from the study. Finally 60 patients were enrolled in this cross sectional study. Prior permission was taken for this study from the Ethical Committee of Dhaka medical College, Dhaka, Bangladesh. All patients were informed verbally about the study design, the purpose of the study, and their right to withdraw themselves from the study at any time, for any reason, what so ever. Written consent was also obtained from each subject. All the Demographic, Clinical, USG and Histological variables were noted. Bladder carcinoma was considered when a focal echo-complex hypoechoic or medium echogenicity (to bladder wall) mass with abrupt transition between tumor and normal mucosa characterized by focal wall thickening with an irregular, sessile mass extending into the bladder lumen; with irregular mucosal surface with or without dystrophic mineralization. Metastasis to regional lymph nodes was also evaluated for obstruction of ureters or for involvement of urethra. Histopathological diagnosis of biopsy material taken from the bladder mass was the confirmatory diagnosis. The present study was intended to see the sensitivity, specificity, Positive predictive value and negative predictive value of bladder mass and also determine the accuracy of USG in the diagnosis of urinary bladder masses. Data were processed and analyzed using computer software SPSS (Statistical Package for Social Sciences).

Result:

Nearly half (48.5%) of the patients were between 55 – 65 years, 20% between 65 – 75 years, 16.7% less than 45 years and 11.7% between 45-55 years old. Very few patients were 75 or >75 years (6.6%) old. The mean age of the patients was 58.3 years and youngest and the oldest patients were 39 and 80 years old respectively (Table-I).

Table-I*Distribution of Patients by their age (n=60)*

| Age (Years)* | Frequency | Percentage |
|--------------|-----------|------------|
| <45 | 10 | 16.7 |
| 45- 55 | 07 | 11.7 |
| 55-65 | 27 | 45.0 |
| 65-75 | 12 | 20.0 |
| ≥ 75 | 04 | 6.6 |

*Mean age = (58.3 ± 10.4) years; range = (39 – 80) years

In the study population majority (85%) of the patients was male giving a male to female ratio of 5.7:1

About two-thirds (65%) of the patients were rural resident, 25% urban resident and 10% slum-dweller.

Occupation wise 5% were service-holder, 10% farmer, 25% day labor, 13.3% businessman. Rest 46.7% subjects were engaged in other diverse occupation.

Presenting symptoms are shown in table-II below. Most (90%) of the patients presented with painless haematuria. Followed by frequency of micturition (78.3%), urgency (70%), dysuria (63.3%), retention of urine 45% and low-back pain (31.7%).

Table-II*Distribution of Patients by their presenting symptoms (n=60)*

| Presenting symptoms* | Frequency | Percentage |
|---------------------------------|-----------|------------|
| Types of haematuria | | |
| Painful | 06 | 10 |
| Painless | 54 | 90 |
| Frequency of micturition | | |
| Urgency | 42 | 70 |
| Dysuria | 38 | 63.3 |
| Retention of Urine | 27 | 45 |
| Low-back pain | 19 | 31.7 |
| Anorexia | 32 | 53.3 |
| Weight loss | 24 | 40 |
| Anemia | 26 | 43.3 |
| History of smoking | 09 | 15 |

*Multiple responses

USG findings showed that most of the lesion was in lateral wall 50 cases (83.3%) and in 31 (51.7%) cases it was in base. Two-thirds (66.7%) of the lesion was isoechoic, 53.3% hypoechoic and 30%

hyperechoic. In 16.7% of the patients the lesion extended to perivesical tissue and in 8.3% cases involved the ureter. Of the 60 cases 54 (90%) were diagnosed sonographically as malignant lesion and 06 (10%) as benign. Thirty percent cases had features of hydronephrosis (table III).

Table-III*Distribution of Patients by their USG findings (n=60)*

| USG findings* | Frequency | Percentage |
|----------------------------|-----------|------------|
| Site of Lesion | | |
| Base | 31 | 51.7 |
| Lateral wall | 50 | 83.3 |
| Nature of lesion | | |
| Hypoechoic | 32 | 53.3 |
| Isoechoic | 40 | 66.7 |
| Hyperechoic | 18 | 30 |
| Extension | | |
| Perivesical tissue | 10 | 16.7 |
| Ureter | 05 | 8.3 |
| No extension | 45 | 75 |
| Diagnosis | | |
| Malignant | 54 | 90 |
| Benign | 06 | 10 |
| Presence of hydronephrosis | 18 | 30 |

* Multiple responses

In term of histological variety, 80% were transitional cell carcinoma (TCC), 5% squamous-cell carcinoma (SCC), 6.7% adenocarcinoma and 8.3% chronic cystitis. More than 90% of the lesion was histopathologically confirmed as malignant and rest (8.3%) as benign (Table IV).

Table IV*Distribution of Patients by their histological findings (n=60)*

| Histological findings* | Frequency | Percentage |
|-----------------------------|-----------|------------|
| Histological variety | | |
| TCC | 48 | 80 |
| SCC | 03 | 05 |
| Adenocarcinoma | 04 | 6.7 |
| Chronic cystitis | 05 | 8.3 |
| Diagnosis | | |
| Malignant | 55 | 91.7 |
| Benign | 05 | 8.3 |

* Multiple responses

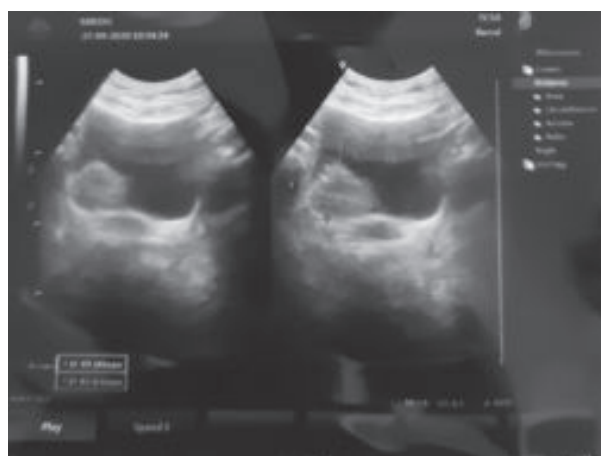
The accuracy of USG diagnosis shows that the Sensitivity of USG in detecting carcinoma was found to be 94.5% and specificity of the test in correctly detecting those who had not carcinoma (benign disease) was 60%. The positive and negative predictive values of the test were 96.3% and 50% respectively, while the percentages of false positive and false negatives were 3.7% and 50% respectively. The overall accuracy of USG in the diagnosis of bladder mass is 91.7% (Table V).

Table V
Validity of USG diagnosis of urinary bladder mass

| USG diagnosis | Histological diagnosis | | Total |
|---------------|------------------------|--------------------|-------|
| | Malignant (n = 55) | Benign (n = 05) | |
| Malignant | 52 | 02 | 54 |
| Benign | 03 | 03 | 06 |
| Total | 55 | 05 | 60 |

Results of validity test:

| | |
|---|---------|
| Sensitivity | = 94.5% |
| Specificity | = 60% |
| Positive predictive value of the test (PPV) | = 96.3% |
| Negative predictive value of the test (NPV) | = 50% |
| Diagnostic accuracy | = 91.7% |



Photograph showing malignant urinary bladder mass (TCC)

Discussion:

In the present study mean age of the patients was 58.3 years and majority (85%) was male with male to female ratio being roughly 6:1. In the UK the

median age at diagnosis is 68 years. Men outnumbered women at a ratio of 3:1 in a study by Jemal et al.¹⁷ which is consistent with the findings of the present study. Horner et al. in another study showed that the median ages of men and women presenting with bladder cancer were 72 and 74 years respectively.¹⁸ Thus, the findings of the present study and other similar studies revealed that advanced age is a risk factor for developing bladder cancer.

In the present study no particular occupation was found to be predominantly at risk of developing bladder carcinoma, although the labour population was higher than the other occupants. In epidemiological studies, occupations with increased exposure to aromatic amines and other groups such autoworkers, truck drivers, metalworkers, paper and rubber manufacturers, foundry workers, dry cleaners, dental technicians, hairdressers, and marine engineers were observed to be at most risk of bladder carcinoma.¹⁹ Another study by Golijanin et al. suggested that bladder cancer from occupational exposures often does not occur until 30 to 50 years after exposure.²⁰

90% of the patients in our study presented with painless haematuria. Followed by frequency of micturition (78.3%), urgency (70%), dysuria (63.3%), retention of urine 45% and low-back pain (31.7%). Kirkali et al.²¹ revealed that almost 85% of patients with TCC presented with hematuria, which is either gross or microscopic and is usually painless and intermittent, the findings are similar in our study too. Painless hematuria usually is the sole presenting symptom in the majority of patients with bladder cancer was shown by Fernandez.²²

USG findings of our study showed that most of the lesion was in lateral wall consisting of 50 cases (83.3%) and in 31 (51.7%) cases it was in base. Two-thirds (66.7%) of the lesion was isoechoic, 53.3% hypoechoic and 30% hyperechoic. In 16.7% of the patients the lesion extended to perivesical tissue and in 8.3% cases involved the ureter. Of the 60 cases 54 (90%) were diagnosed sonographically as malignant lesion and 06 (10%) as benign. Thirty percent cases had features of hydronephrosis.

In our study 54 (90%) were diagnosed sonographically as malignant lesion and 06 (10%)

as benign. Histologically 80% were transitional cell carcinoma (TCC), 5% squamous-cell carcinoma (SCC), 6.7% adenocarcinoma and 8.3% chronic cystitis. More than 90% of the lesion was histopathologically confirmed as malignant and rest (8.3%) as benign. Transitional cell carcinoma is the most common bladder carcinoma and can occur at any age, it is generally a disease of middle age elderly with a mean age of 69 years in male and 71 years in female Lynch et al.²³ Wong-You-Cheong et al. reported that Ninety-five percent of bladder neoplasm are transitional cell carcinoma (TCC) and arises from the transitional epithelium.²⁴ Kabala et al. described that prevalence of TCC, Squamous Cell Carcinoma (SCC) and Adenocarcinoma were 95%, 4% and 1% respectively.²⁵ Similar comparable incidence and results was observed in our study too. In developed countries, about 90% of bladder tumours are transitional cell carcinoma with 5% squamous cell carcinoma.²⁶

Regarding the validity tests this study revealed a high sensitivity of trans-abdominal USG of 94.5% and moderate specificity of 60% in the diagnosis of bladder mass. The PPV and NPV were 96.3% and 50% respectively. The overall diagnostic accuracy was appreciably high 91.7%. In the study of Stamatiou and associates found optimum sensitivity of 87.1%, specificity of 98.1%, positive predictive value of 94.4% and a negative predictive value of 95.4% of USG in the diagnosis of bladder carcinoma.²⁷ The sensitivity and positive predictive values in our study are quite similar with the findings of this study but specificity and negative predictive are low.

Conclusion:

With the study results we conclude that as ultrasound is a non-invasive less expensive and less cumbersome procedure, and can detect bladder mass with fair degree of accuracy, we recommend its routine use for detection of bladder mass.

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