



DIAGNOSTIC ACCURACY OF TRANSABDOMINAL ULTRASONOGRAPHY IN DETECTING MALIGNANT NATURE OF URINARY BLADDER MASS TAKING HISTO-PATHOLOGY AS GOLD STANDARD FOR CORRELATION- A PROSPECTIVE STUDY IN A TERTIARY CARE HOSPITAL OF EASTERN INDIA

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ABSTRACT

Background: Bladder cancer is a highly lethal malignancy and its increasing trend is alarming in India, and thus, there is a strong need to identify and implement effective prevention and treatment strategies.

Objective: To measure parameters of diagnostic accuracy of transabdominal ultrasound in detecting malignant features of urinary bladder masses in respect to histopathology taking it as gold standard.

Methodology: We took 30 patients for transabdominal sonography (TAS) and recorded the findings with corroborating them with histopathological findings prospectively

Results: Mostly affected were male with complaint of haematuria (90%). After corroboration, we found the sensitivity was 96.43% but the specificity was 50%. The association of findings of ultrasound with HPE were statistically significant (p=0.011)

Conclusions: We found transabdominal ultrasonography has an excellent diagnostic accuracy in detecting neoplastic nature of urinary bladder masses.

KEYWORDS : Ultrasonography, Bladder mass

INTRODUCTION:

Approximately 3.0% of all new cancer diagnoses and 2.1% of all cancer deaths are due to urinary bladder cancer¹. Worldwide, the lifetime risk of getting UBC is 1.1% in men, and 0.27% in women². This disorder, however, is most likely to have aggressive/muscle invasive disease among women³. It commonly presents as painless hematuria. Urothelial carcinoma (UC), also called transitional cell carcinoma, is the most common histologic type of bladder cancer, accounting for more than 90% of cases in developed countries⁴. The goal of cancer screening is to detect cancer at an early stage when it is treatable and curable. The major factors influencing prognosis and treatment of bladder tumor are histological cell type, grade of malignancy, tumor size, growth pattern, depth of bladder wall infiltration and the presence of metastases in lymph nodes and blood borne sites. Depth of infiltration refers to the spread of tumour through the layers of the bladder wall and has a major impact on treatment choice⁵. Cystoscopy is the conventional procedure for monitoring the bladder and taking biopsy from the lesion. Cystoscopic evaluation and biopsy reveals the growth pattern, histological cell type and grade of malignancy⁶. Reliable, noninvasive, image-based method has been needed to be established for detection of bladder cancer. USG has proved to be an accurate imaging modality for various cancers⁷.

AIM AND OBJECTIVES:

Many studies were done previously based on ultrasonography and bladder mass. But most of them were retrospective. We did this study as prospective one; only to find out about the diagnostic accuracy of transabdominal ultrasound to detect malignant features of urinary bladder sol and how these results were statistically corroborated with the histopathological findings which were taken as gold standard

MATERIALS AND METHODS:

As most of the studies done in this issue are retrospective in nature, the present study was a hospital based prospective cross sectional study conducted in Nil Ratan Sircar Medical College And Hospital, Kolkata, in patients admitted in urology

ward and OPD. This study was conducted on 30 patients over a period of 1 yr from June 2019 to June 2020 with clinically suspected symptoms of malignant bladder cancer. Institutional review board approval for conducting this study was obtained and informed consent of all those 30 patients were taken. Patients suspected of having bladder cancer who were referred to the hospital for cystoscopy and agreed to participate in the study were included in the inclusion criteria. Patients with symptoms warranting urgent interventions and patients aged less than 40 yrs were excluded from this study. Detailed history taking followed by clinical parameters such as general survey and demographics were recorded. All USG examinations were performed with Logiq P5 GE (General Electronics). The diagnostic value of USG in determining neoplastic nature of urinary bladder mass was determined by calculating sensitivity, specificity, accuracy, positive and negative predictive values.

STATISTICAL ANALYSIS:

Data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS (version 24.0; SPSS Inc., Chicago, IL, USA and Graph Pad Prism version 5). Paired t-tests were a form of blocking and had greater power than unpaired tests. Unpaired proportions were compared by Chi-square test or Fischer's exact test, as appropriate. Correlation was calculated by Pearson correlation analysis. The p-value was considered for statistically significant when less than 0.05 was considered significant.

RESULTS AND ANALYSIS:

We observed that out of 30 patients, 24 were male. 27 participants were in age group of 60 to 70 years. History of smoking was present in 20 out of 30 cases. The predominant chief complaint of these patients was hematuria (27 out of 30 patients) with increased incidence of anemia (24 out of 30), hypogastric tenderness (70%), anorexia (60%) and burning micturition (50%) with variable presence of urgency, frequency and fever. On transabdominal USG, 27 out of 30 cases (84%) had features suggesting of malignant potential in the bladder masses. On histopathology reports, out of 30, 28 had features

diagnosing them to be bladder carcinoma. On USG, in only 10 out of 30 cases, the lesions were hypoechoic in respect to adjacent normal urothelium. Majority lesions had echogenicity virtually inseparable with normal ones (15 out of 30). Most lesions were found to be from lateral wall of urinary bladder (28 out of 30 cases). 50% of all cases of bladder lesion were not confined to the bladder itself rather spread at least in perivesicular tissue. Significant internal vascularity noted in all cases. In 10% of cases, ureteric jet was not visualised near the lesion. 20 of 30 lesions appeared to be pedunculated. Only 5 cases had calcification within the lesion. Out of 28 malignant lesions detected by histology, 27 were found to be transitional cell carcinoma of urinary bladder. In our study, as we took histopathology as gold standard, we found the sensitivity was 96.43% but the specificity was 50%. PPV was 96.43%, but NPV was 50% in terms of diagnostic accuracy parameters of trans abdominal ultrasound. The association of findings of ultrasound with HPE were statistically significant ($p=0.011$) by applying chi square test.

DISCUSSION:

Four layers consist of the bladder wall. The uroepithelium forms the first layer. Neoplasms of bladder derive from one of the four layers⁸; mostly from urothelium.

Urothelial cancers can occur anywhere within the tract where urothelium is present, however they're most typically found in the bladder thanks to its proportionately massive expanse (compared with the renal collecting systems and ureters) Direct prolonged interaction of the bladder urothelium with urine containing excreted carcinogens, primarily from cigarette smoking, is the pathogenesis for urothelial tumors⁹. Typically, men are 4-5 times more likely to be diagnosed with bladder cancer than women¹⁰ as in our study where 80% respondents were male. Most were in age group of 60-70 yrs; as correlating in many demographic studies where it was shown that individuals aged ≥ 65 years had 11 times higher incidence than those younger than 65 years¹¹ In our study, 67% respondents had personal history of smoking; comparable to the study done by Freedman et al¹² where they showed With follow-up occurring between 1995 and 2006, current smoking was associated with a relative risk of 4.06 (95%CI: 3.66-4.50) in men and women combined. Bladder stones, chronic infection (schistosomiasis) and irritation, as well as some medications, are other risk factors. Diverticula tumors are likely to enter peri vesical fat early due to the absence of muscle in their wall. Most urothelial tumors are located at the bladder base¹³. Macroscopic or microscopic hematuria is the presenting symptom in 80-90% of patients with bladder cancers. Irritative symptoms like dysuria, urgency, and frequency are the next most common symptoms; as in our study where 90% patients had hematuria at presentation; as shown in study done by Shephard et al¹⁴, where they showed The risk of cancer was 3.9 percent for a patient aged around 60 years who identified haematuria to his or her GP. Risks increased with symptoms that were multiple and recurring. However, the risk was consistently low in the absence of visible haematuria or dysuria. Endoscopic visualization of bladder tumors is the keystone in diagnosis and treatment. All patients suspected to have bladder tumor should have urine cytology, flexible cystoscopy examination, of lower urinary tract, and imaging of renal tract preferably with a CT scan. Ultrasound scanning (US) is a useful, relatively simple, non-invasive imaging tool for urinary bladder evaluation. A standard three-layer structure with a medium-sized muscle detrusor muscle (muscularis propria) exists as that of the bladder wall. The outer layer has homogeneous echogenicity, whereas the outer layer and the inner layer are hyperechoic¹⁵. The most common method used to scan the urinary bladder is an external, suprapubic, abdominal approach. The patient is usually examined in the supine position with a sufficiently full bladder (200-300ml) The bladder floor, including the distal and

intramural part of the ureter, can be visualized more accurately with a higher frequency ultrasound. To check reverberation artifacts, we can deploy associated harmonic imaging. If we use colour doppler, we can readily identify whether ureteral jets are obstructed. On ultrasound, they appear as a papillary (polypoid) or sessile (plaque with large base) lesions projecting into the lumen, usually quite echogenic and fixed with changes in the patient's position. Some hypoechoic lesions can have internal calcific changes; only that time it can be detected even by plain abdominal radiogram; in our study we also saw only 5 cases had calcific changes noted. In cases of infiltrating lesions, the bladder wall shows an interruption or deformation, and sometimes the bladder tumor extends beyond the bladder¹⁶ as in our study we found 50% lesions to be isoechoic and 67% of all lesions were pedunculated. Smaller lesions on dome of bladder can be missed by TAS. Even normal prostatic median lobe can mimic a lesion at trigone. False-positive results are characterized by endovesical clots, which are typical in macroscopic hematuria cases. Clots occur as hyperechoic masses, generally on the floor of the bladder. Hypertrophy of the wall of the bladder or diverticulosis or trabeculosis may be confused with wall defects. Benign tumors of the bladder are infrequent, about 1% of the bladder neoplasms. The definitive diagnosis, however, is cystoscopic and pathological rather than radiological. Most benign bladder tumors are mesenchymal in origin. Leiomyoma of the bladder is the most common benign tumor of the bladder and is typically found in women between 30 and 50 years of age. This lesion typically occurs in the trigone, but can be found on the side or back wall of the trigone. Acute or chronic cystitis can give false positive result¹⁷ Increasing attention, along with more precise and sensitive markers in recent years, has led to increased understanding of the divergent distinction that is often present in urothelial cancer. Squamous, glandular, sarcomatoid and micropapillary are the most often expressed variants. In bladder cancer, squamous, adenocarcinoma and small cell carcinoma are the most prominent non-urothelial histologies, all of which are frequently present at an advanced stage.¹⁸

In our study, we found all the lesions were found to have internal vascularity; comparable to the study shown by Konstantinos Stamatiou et al¹⁹ where they found detection rates for bladder carcinoma have been increased from 82% to 95% by doppler setting usage. 90% of lesions were found on histology to be transitional cell carcinoma. In our study, as we took histopathology as gold standard, we found the sensitivity was 96.43% but the specificity was 50%. PPV was 96.43%, but NPV was 50% in terms of diagnostic accuracy parameters of trans abdominal ultrasound. A research aimed at investigating the importance of sonography in diagnosing bladder tumors was conducted by Datta et al. They showed that the sensitivity, specificity and positive predictive value of this test were 63%, 99% and 100%, respectively.

CONCLUSION:

Results of the present study indicated that trans abdominal sonography has a high sensitivity but low specificity in diagnosing malignancy in urinary bladder lesion. The bladder is an abdominal organ ideally suited to US for many reasons, including its superficial location and the acoustic properties of the fluid (urine) inside²¹. Though Ultrasound has shown little value in the staging of bladder cancer, availability of ultrasound facilities in most teaching hospitals has led to an increase in its diagnostic application in patients with painless hematuria²².

Foot points

Acknowledgements- None

Declaration of competing interest- None

Abbreviations:

PPV: positive predictive value
 NPV: Negative predictive value
 US: ultrasound;
 CT: computed tomography
 UB: urinary bladder
 VUJ: vesicoureteral junction
 GP: General practitioner
 TAS: transabdominal ultrasound
 OPD: out patient department
 CI: confidence interval
 HPE: histopathological evaluation

Table no 1: Frequency of distribution of sonographic findings in suspected bladder lesions having malignancy nature

Finding in TAS	Frequency	Percentage
Isoechoic	15	50
Hypoechoic	10	33.3
Hyperechoic	5	16.67
Extension outside the bladder	15	50
Internal vascularity	30	100
With calcification	5	16.67
Pedunculated	20	66.67

Table No 2: Comparison Between Trans-abdominal Ultrasonography With Histopathology, Which Was Taken As Gold Standard For Evaluation Of Presence Of Malignancy In Bladder Mass

Detection by USG	Malignancy confirmed on histopathology	Non malignant confirmed on histopathology	Total
(+) malignant feature	27	1	28
(-) Malignant feature	1	1	2
Total	28	2	30

Chi square statistic: 6.46
 P Value: 0.011; statistically significant

Table no 3 Diagnostic parameters of USG for diagnosis of malignant bladder mass considering Histopathology as gold standard test

DIAGNOSTIC PARAMETRES	VALUE(%)
Sensitivity	96.43
Specificity	50
Positive predictive value	96.43
Negative predictive value	50
Accuracy	93.3
Precision	96.43
Recall	96.43
Positive probability	91.84
Negative probability	98.95

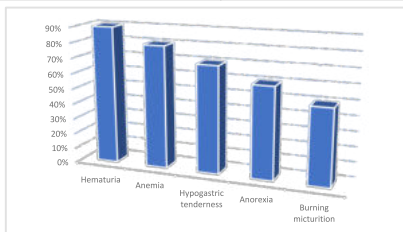


Figure no 1 showing distribution of symptoms in suspected cases of Urinary bladder mass

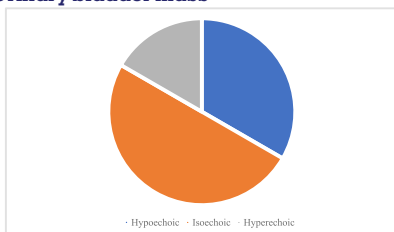


Figure no 2 showing echogenicity of bladder lesions

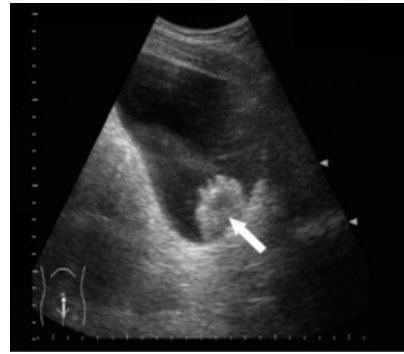


Figure no 3 showing a broad-based soft tissue lesion arising from posterior wall of urinary bladder



Figure no 4 showing Soft tissue lesion in posterior wall of partially distended UB causing right VUJ obstruction

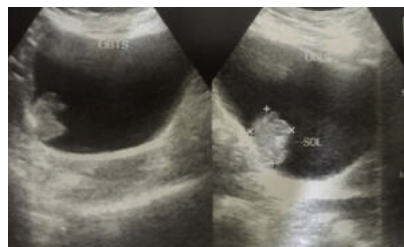


Figure no 5 showing isoechoic pedunculated SOL arising from right lateral wall of UB



Figure no 6 showing hypo to isoechoic lesion with internal cystic changes with peripheral vascularity noted obstructing right VUJ

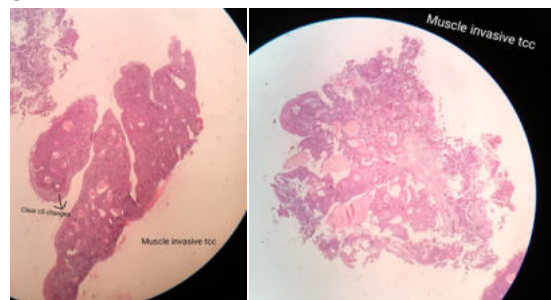


Figure no 7&8 showing histological features of UB SOL having invasive character into muscle plane

MASTER CHART

SL NO	AGE	SEX	SMOKING HISTORY	CHIEF COMPLAINT	TAS REPORT	HISTOPATH REPORT	ECHOGENECITY	SESSILE/PEDUNCULATED	SPREAD OUTSIDE UB	POSITION IN UB	URETERIC JET VISIBLE	CALCIFICATIONS
1	60	M	P	H,A,HT	P	P	ISO	SESSILE	P	TRIGONE	N	P
2	61	M	P	H,A,HT	P	P	ISO	SESSILE	P	TRIGONE	N	P
3	62	M	P	H,A,HT	P	P	ISO	SESSILE	P	LATERAL WALL	N	N
4	65	M	P	H,A,HT	P	P	ISO	SESSILE	P	LATERAL WALL	P	N
5	64	M	P	H,A,HT	P	P	ISO	PEDUNCULATED	P	LATERAL WALL	P	N
6	67	M	P	H,A,HT	P	P	ISO	PEDUNCULATED	P	LATERAL WALL	P	P
7	66	M	P	H,A,HT	P	P	ISO	PEDUNCULATED	P	LATERAL WALL	P	P
8	60	M	P	H,A,HT	P	P	ISO	PEDUNCULATED	P	LATERAL WALL	P	N
9	61	M	P	H,A,HT	P	P	HYPER	PEDUNCULATED	P	LATERAL WALL	P	P
10	60	M	P	H,A,HT	P	P	HYPER	PEDUNCULATED	P	LATERAL WALL	P	N
11	64	M	P	H,A,HT	P	P	HYPER	PEDUNCULATED	P	LATERAL WALL	P	N
12	65	M	P	H,A,HT	P	P	HYPER	PEDUNCULATED	P	LATERAL WALL	P	N
13	66	M	P	H,A,HT,AN	P	P	HYPER	PEDUNCULATED	P	LATERAL WALL	P	N
14	66	M	P	H,AN,A,HT,AN	P	P	HYPO	PEDUNCULATED	P	LATERAL WALL	P	N
15	66	M	P	H,A,AN,HT	P	P	HYPO	PEDUNCULATED	P	LATERAL WALL	P	N
16	60	M	P	,AN,H,A,HT,AN,BM	P	P	HYPO	PEDUNCULATED	P	LATERAL WALL	P	N
17	61	M	P	H,AN,A,HT,AN,BM	P	P	HYPO	PEDUNCULATED	N	LATERAL WALL	P	N
18	62	M	P	H,A,AN,HT,BM	P	P	HYPO	PEDUNCULATED	N	LATERAL WALL	P	N
19	67	M	P	,AN,H,A,H,AN,T,BM	P	P	HYPO	PEDUNCULATED	N	LATERAL WALL	P	N
20	67	M	P	H,AN,A,HT,AN,BM	P	P	HYPO	PEDUNCULATED	N	LATERAL WALL	P	N
21	68	M	N	H,A,AN,HT,AN,BM	P	P	HYPO	PEDUNCULATED	N	LATERAL WALL	P	N
22	66	M	N	H,A,AN,BM	P	P	HYPO	PEDUNCULATED	N	LATERAL WALL	P	N
23	67	M	N	H,A,AN,BM	P	P	HYPO	PEDUNCULATED	N	LATERAL WALL	P	N
24	67	M	N	H,A,AN,BM	P	P	ISO	PEDUNCULATED	N	LATERAL WALL	P	N
25	69	F	N	H,AN,BM	P	P	ISO	SESSILE	N	LATERAL WALL	P	N
26	69	F	N	H,AN,BM	P	P	ISO	SESSILE	N	LATERAL WALL	P	N
27	63	F	N	H,AN,BM	P	P	ISO	SESSILE	N	LATERAL WALL	P	N
28	78	F	N	AN,BM	N	P	ISO	SESSILE	N	LATERAL WALL	P	N
29	55	F	N	AN,BM	N	N	ISO	SESSILE	N	LATERAL WALL	P	N
30	80	F	N	AN,BM	N	N	ISO	SESSILE	N	LATERAL WALL	P	N

Abbreviations in master chart:

h-hematuria

ht-hypogastric tenderness

a-anemia

an-anorexia

bm-burning micturition

p,n-positive,negative

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