

Comparative Evaluation of Urinary Tract Tuberculosis by Ultrasonography and MDCT

Dr. Ashwini Sankhe¹, Dr. Anagha Joshi², Dr. Prasad Raikar³

¹Sr. Assistant Professor, Department of Radiodagnosis, LTMMC & LTMGH, Sion, MUMBAI-22, India

²Professor & Head, Department of Radiodagnosis, LTMMC & LTMCH, Sion, MUMBAI-22, India

³Bonded senior resident, Department of Radiodagnosis, LTMMC & LTMCH, Sion, MUMBAI-22, India

Abstract: ***Purpose:** This article reviews and compares the ultrasonography (USG) and multidetector computed tomography (MDCT) features of urinary tract tuberculosis (UTB). **Materials & Methods:** A prospective and retrospective study of 25 consecutive patients was conducted in patients who presented to the OPD or Emergency department, or who were admitted with suspected urinary tract tuberculosis and underwent imaging tests with USG and MDCT. **Results:** USG in comparison to CT was able to identify 142 features (77 % of the findings) and failed to identify 43 features which were seen on CT (23 % of the findings) of which majority were ureteric changes (48 % of the missed findings) followed by extra renal involvement (37% of the missed findings). **Conclusion:** USG is a readily available and initial technique for demonstrating the various morphologic abnormalities found in urinary tract TB and plays a valuable role in serial monitoring of lesions. However, MDCT is more accurate, it has advantages of being able to better assess the renal parenchyma, the surrounding spaces and extra-renal involvement.*

Keywords: Urinary Tract Tuberculosis, USG & MDCT in TB, Urinary tract infection, lobar calcification, Renal tuberculosis

1. Introduction

Tuberculosis (TB) is a current public health problem, remaining the most common worldwide cause of mortality from infectious disease (1). In India, more than 1000 lives are lost every day due to TB despite the availability of modern diagnostic aids and treatment(2).

The resurgence of TB has been noted in both endemic and non-endemic regions, mainly due to increased migration, the human immunodeficiency virus (HIV) pandemic, and the emergence of drug-resistant strains of Mycobacterium tuberculosis (MTB) (3, 4). A relative increase in extra-pulmonary TB has been reported due to a significant decline in pulmonary tuberculosis (PTB) and an only modest decline in extra-pulmonary TB (5).

The genitourinary tract is a primary target of hematogenous extra-pulmonary TB and is the most common site after tubercular lymphadenitis in endemic countries. Genitourinary tuberculosis (GUTB) shows a more destructive behaviour in developing countries, with kidney being the most common site of GUTB (6, 7).

Tuberculosis can involve both the renal parenchyma and the collecting system (calyces, renal pelvis, ureter, bladder and urethra) and results in different clinical presentations and radiographic appearances. Symptoms of urinary TB are non-specific and are typically that of cystitis, flank pain, back pain and hematuria. However, fever, weight loss and night sweats can also be seen. The definitive diagnosis of urinary TB depends on a positive urine culture, acid fast staining and histological diagnosis.

Imaging plays an important role in the making a timely diagnosis and in the planning of treatment, and thus helps to avoid complications such as renal failure. Imaging of GUTB

still remains a challenge, mainly on account of the dearth of literature.

The goal of this study is to review and compare the imaging findings on the basis of which an accurate early non-invasive diagnosis of renal TB can be made on ultrasonography and computed tomographic scanning.

2. Materials & Methods

A prospective and retrospective study of 25 consecutive patients was conducted in patients who presented to the OPD or Emergency department, or who were admitted with suspected urinary tract tuberculosis and underwent imaging tests with USG and MDCT with due permission from the institutional review board, human ethics committee.

2.1 Inclusion Criteria

- 1) Patients with renal tuberculosis diagnosed on urinary analysis and imaging.
- 2) Patients with history of frequent voiding, dysuria, pyuria, abdominal pain, hematuria, weight loss and anorexia

2.2 Exclusion Criteria

- 1) Patients not consenting for the study
- 2) Patients with claustrophobia
- 3) Pregnancy
- 4) Patients with end stage renal failure (for CECT)
- 5) Patients with known h/o contrast allergy

2.3 Equipments Used

- USG-Toshiba-SSA-660A Xario
- CT- 64 slice Philips CT imager system

Volume 9 Issue 8, August 2020

www.ijsr.net

Licensed Under Creative Commons Attribution CC BY

2.4 Statistical Analysis

Statistical Analysis was carried out after collecting all required data. The current study was done to compare the role of USG & MDCT in the diagnosis of Urinary Tuberculosis.

3. Results

Patients with relevant clinical features and laboratory parameters were taken in Study and subjected to imaging modalities like USG and CT after taking valid consent form. Total of 25 patients were examined and comparison done between all the two modalities.

Observations of study are as follows

3.1 Demographic Profile

Maximum number of patients (36 % of the cases) belonged to age group of 31-40 years followed by 24 % of the cases belonging to the category of 21-30 years. The mean age of our study population was 37.48 years. Out of the study population 14 patients (56 % of the cases) were male and 11 patients (44 % of the cases) were female.

3.2 Symptomatology of Urinary tract TB

In the study population, the most common presenting local symptom was flank pain, present in 19 patients (76 % of cases), followed by frequency of micturition, urgency and dysuria, which was present in (16 % of cases). The most common presenting systemic symptom was weight loss, present in 14 patients (56 % of cases). Weight loss was considered significant when the loss was more than 5 kilograms over or within a period of 6 to 12 months.

3.3 USG features of Urinary tract TB

Table 1: Distribution of cases on USG

Features of UTB on USG	No. of cases (n = 25)	Most common feature	Percentage %
Parenchymal Changes	24	21 (Parenchymal thinning)	84
PCS involvement	23	14 (Asymmetric calyceal dilatation)	56
Ureters	12	7 (urothelial wall thickening)	28
Bladder	11	10 (Bladder wall thickening)	40
Extrarenal Involvement	9	5 (necrotic abdominal lymphadenopathy)	20

Out of the study population of 25 patients having urinary tract tuberculosis, 24 patients showed involvement of the renal parenchyma (96 % of the cases) followed PCS involvement which was seen in 23 patients (92 % of the cases). Ureteric involvement was noted in 12 patients (48 % of the cases) while bladder involvement was seen in 11 patients (44% of the cases). Extra renal involvement was noted in 9 patients (36 % of the cases).

Renal abscesses were seen in 6 patients (24 % of the cases). (Fig 1c)

The most common parenchymal feature on USG was parenchymal thinning which was noted in 21 patients (84 % of the cases) followed by parenchymal scarring which was noted in 19 patients (76 % of the cases). Parenchymal calcifications were seen in 6 patients (24% of the cases.) (Fig 1 b,c&d)

Asymmetric calyceal dilatation was the most common imaging finding involving the PCS which was seen in 14 patients (56% of the cases) with next common being moderate hydronephrosis which was noted in 8 patients (32 % of the cases). Urothelial thickening was seen in 6 patients (24% of the cases). (Fig1a)

Ureteric involvement was most commonly noted in the form of urothelial wall thickening irregularity in 7 patients (28 % of the cases). The ureters could not be evaluated in 6 patients (24 % of the cases).

Bladder wall thickening with irregularity was the most common feature involving the bladder seen in 10 patients (40 % of the cases). The most common extra renal manifestation detected on USG was necrotic abdominal lymphadenopathy which was seen in 5 patients (20 % of the cases).

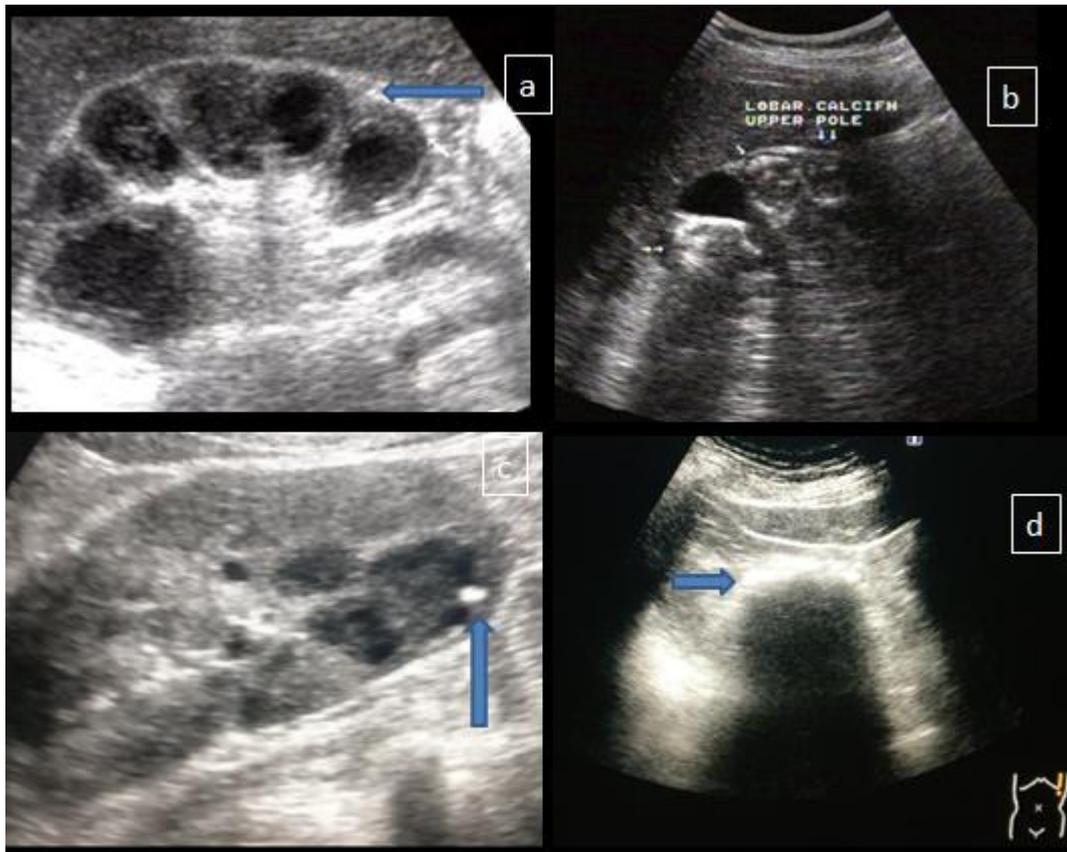


Figure 1: USG images showing- a. Lobar caseation with urothelial thickening (arrow) involving the kidney, b. Urothelial thickening (arrows) with central areas of Caseation and calcification, c. Caseating tuberculous granuloma with peripheral speck of calcification (arrow), d. Calcification involving the entire kidney with maintained contour and posterior acoustic shadowing (arrow) s/o Putty Kidney

3.4 CT features of Urinary tract TB-

Table 2: Distribution of cases on MDCT

Features of UTB on MDCT	No. of cases (n = 25)	Most common feature	Percentage %
Parenchymal Changes	24	19 (parenchymal thinning)	76
PCS involvement	23	12 (Hydronephrosis with asymmetric calyceal dilatation)	48
Ureters	17	15 (urothelial thickening)	60
Bladder	10	9 (Bladder wall thickening)	36
Extrarenal Involvement	15	7 (lung nodules)	28

Out of the study population of 25 patients having urinary tract tuberculosis, 24 patients showed involvement of the renal parenchyma on MDCT (96 % of the cases) followed PCS involvement which was seen in 23.patients (92 % of the cases). Ureteric involvement was noted in 17 patients (68 % of the cases) while bladder involvement was seen in 10 patients (40 % of the cases). Extra renal involvement was noted in 15 patients (60 % of the cases).

The most common parenchymal feature on MDCT was parenchymal thinning with parenchymal scarring which was noted in 19 patients (76 %of the cases) followed by calcification/calculi which were noted in 12 patients (48 % of the cases). (Fig 2 b&d).

Hydronephrosis with asymmetric calyceal dilatation was the most common imaging finding involving the PCS which was seen in 12 patients (48% of the cases) while only hydronephrosis was noted in 8 patients (32 % of the cases). (Fig 2a)

Ureteric involvement was most commonly noted in the form of urothelial thickening in 15 patients (60% of the cases) while periureteric fat stranding was noted in 13 patients (52% of the cases). (Fig2c)

Bladder wall thickening with irregularity was the most common feature involving the bladder seen in 9 patients (36 % of the cases).

The most common extra renal manifestation detected on MDCT were lung nodules which was seen in 7 patients (28 % of the cases) while necrotic lymphadenopathy was seen in 5 patients (20 % of the cases).

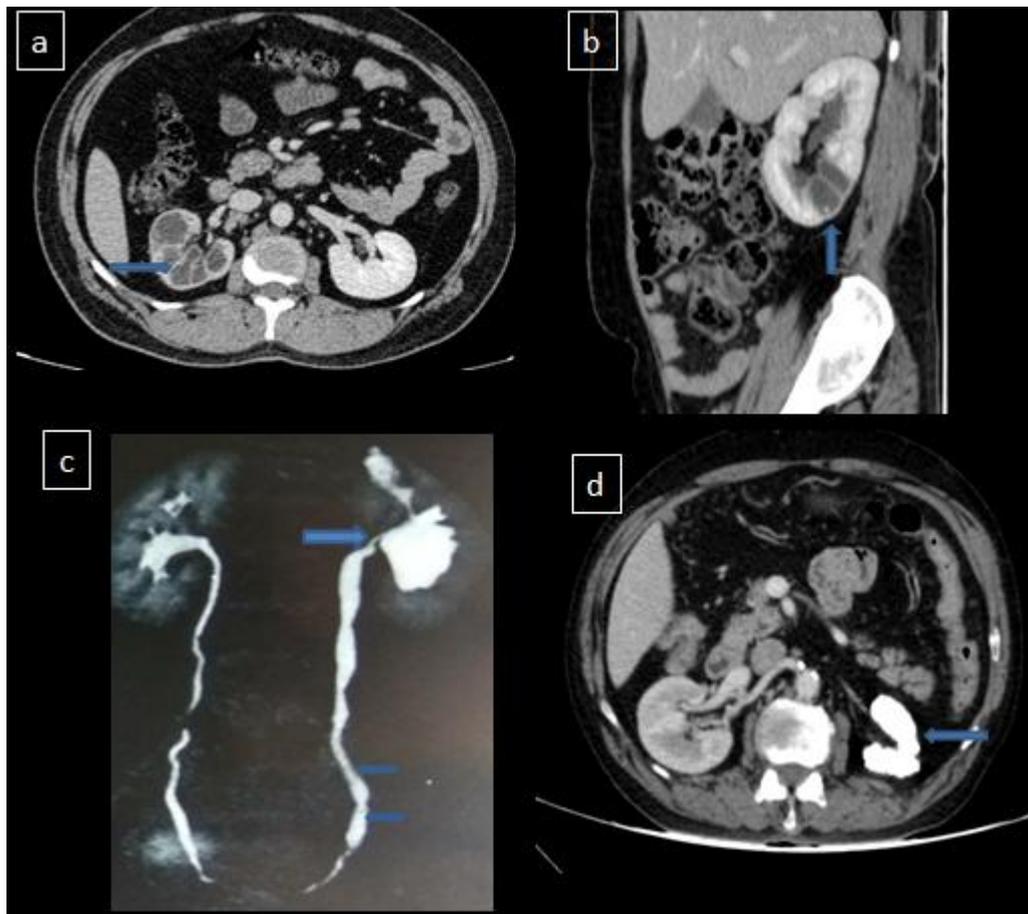


Figure 2: MDCT images showing- a.Moderate dilatation of the calyceal system, severe cortical thinning of renal parenchyma with urothelial thickening (arrow), b. Sagittal image revealing a well-defined hypodense lesion with thick peripheral enhancement in the lower pole of the right kidney with an eccentric focus of calcification, c.Urothelial thickening with abrupt narrowing of left PUJ (arrow) with areas of stricturous narrowing involving the left ureter (arrows), d.Left kidney completely replaced by chunky calcification s/o putty kidney (arrow).

3.5 Comparison of USG and MDCT

Table 3: USG identification of features as compared to CT

Whether features identified on MDCT were detected on USG	Yes	No
Parenchymal Changes		
Thinning	20	0
Scarring	18	1
Abscess	5	0
Calcification	8	4
PCS		
Hydronephrosis	20	0
Asymmetrical Calyces	15	0
Pyonephrosis	3	0
Ureters		
Hydroureter	9	2
Urothelial thickening and fat stranding	7	8
Strictures	1	4
Cannot be evaluated	7	7
Bladder		
Reduced Capacity	5	0
Wall thickening	8	1
Extra-renal		
	16	16
Total	142	43

Out of the study population of 25 patients having urinary tract TB, USG in comparison to CT was able to identify 142 features (77 % of the findings) and failed to identify 43 features which were seen on CT (23 % of the findings) of which majority were ureteric changes (48 % of the missed findings) followed by extra renal involvement (37 % of the missed findings).

4. Discussion & Literature Survey

4.1 Age & gender distribution

In 2010, J.Y.Lee et al (8) conducted a study in Seoul Korea in 101 clinically diagnosed genitourinary tuberculosis patients, the mean age was 45.57 ± 12.55 years (range, 19-81 years). In 2012, in a study conducted by Thaddaeus Zajackowski et al (9) on "Historical and basic science review: past and present the gender distribution" demonstrated GUTB affects more men than women with a ratio of (2:1). Our observations were concordant with the previous studies and also with studies conducted by Chijioke et al (10).

4.2 Profile of symptoms

In a study conducted by Sriramkrishnamoorthy et al (11) in 2017 on the aspects of "Evolving Genito Urinary

Tuberculosis-A Profile of Genito Urinary Tuberculosis (GUTB) in 110 Patients--Loin pain was the most common presentation, seen in 30 patients (27%) followed by lower urinary tract symptoms in 28 patients (25.5%), which is consistent with our study.

4.3 USG

USG of the study population in our study the most common parenchymal feature on USG was parenchymal thinning which was noted 84 % of the cases followed by parenchymal scarring which was noted in 19 patients 76 % of the cases. These findings were in accordance with study conducted by Rui X, Li XD et al (12) in 2008 on "Ultrasonographic diagnosis and typing of renal tuberculosis" in which a total of 258 cases of renal tuberculosis with complete sonographic data were reviewed.

4.4 CT

Our findings were in accordance to the study done by Lu P, Li C, Zhou X et al (13) on the "significance of CT in the diagnosis of renal tuberculosis in 2001" and also with another study done by Lang EK et al (14) in 2003 on the "Improved detection of renal pathologic features on multiphasic helical CT compared with IVU".

4.5 USG vs CT

Out of the study population of 25 patients having urinary TB, USG was able to identify 134 features (78 % of the findings) and failed to identify 38 features which were seen on CT (22 % of the findings) of which majority were ureteric changes (55 % of the missed findings) followed by extra renal involvement (39 % of the missed findings). The findings of our study were in accordance with the study carried out by Premkumar A, Lattimer J, Newhouse JH et al (15) in 1987 on "CT and sonography of advanced urinary tract tuberculosis".

5. Conclusion

USG is a readily available technique for demonstrating the various morphologic abnormalities found in urinary tract TB. USG abdomen has limited value as an initial investigation for detecting urinary tract TB. A mass may be missed if its echogenicity is similar to the renal parenchyma and also the evaluation of the ureters is suboptimal. However it plays a valuable role in serial monitoring of lesions detected by IVP while the patient is receiving treatment. It helps in avoiding repeated radiographic examination.

Multidetector computed tomography can reproduce images comparable with intravenous excretory urography, also it has advantages of being able to better assess the renal parenchyma, the surrounding spaces, extra-renal involvement. It is important in suggesting the diagnosis of renal TB and clinicians should consider including MDCT when investigating patients with recurrent urinary tract infection not responding to usual antimicrobial therapy. Other advantages of MDCT include the use of reformatted images such as multiplanar reconstruction

(MPR), the use of maximum intensity projection (MIP) and three-dimensional (3D) reconstruction, all these technical advances can help optimize the assessment of the renal tract and its complex anatomy as well as help enhance pathology on MDCT.

References

- [1] Muttarak M, ChiangMai WN, Lojanapiwat B. Tuberculosis of the genitourinary tract: imaging features with pathological correlation. Singapore medical journal. 2005 Oct;46(10):568-74; quiz 75. PubMed PMID: 16172781. Epub 2005/09/21. eng.
- [2] Chauhan LS, Tonsing J. Revised national TB control programme in India. Tuberculosis (Edinburgh, Scotland). 2005 Sep-Nov;85(5-6):271-6. PubMed PMID: 16253562. Epub 2005/10/29. eng.
- [3] Craig WD, Wagner BJ, Travis MD. Pyelonephritis: radiologic-pathologic review. Radiographics : a review publication of the Radiological Society of North America, Inc. 2008 Jan-Feb;28(1):255-77; quiz 327-8. PubMed PMID: 18203942. Epub 2008/01/22. eng.
- [4] Merchant S, Bharati A, Merchant N. Tuberculosis of the genitourinary system-Urinary tract tuberculosis: Renal tuberculosis-Part I. The Indian journal of radiology & imaging. 2013 Jan;23(1):46-63. PubMed PMID: 23986618. Pubmed Central PMCID: 3737618.
- [5] Wilberschied LA, Kaye K, Fujiwara PI, Frieden TR. Extrapulmonary tuberculosis among foreign-born patients, New York City, 1995 to 1996. Journal of immigrant health. 1999 Apr;1(2):65-75. PubMed PMID: 16228705. Epub 2005/10/18. eng.
- [6] Wise GJ. Urinary tuberculosis: Modern issues. Current Urology Reports. 2009 July 01;10(4):313-8.
- [7] Engin G, Acunas B, Acunas G, Tunaci M. Imaging of extrapulmonary tuberculosis. Radiographics : a review publication of the Radiological Society of North America, Inc. 2000 Mar-Apr;20(2):471-88; quiz 529-30, 32. PubMed PMID: 10715344. Epub 2000/03/15. eng.
- [8] Lee JY, Park HY, Park SY, Lee SW, Moon HS, Kim YT, et al. Clinical Characteristics of Genitourinary Tuberculosis during a Recent 10-Year Period in One Center. Korean journal of urology. 2011 Mar;52(3):200-5. PubMed PMID: 21461285. Pubmed Central PMCID: PMC3065133. Epub 2011/04/05. eng.
- [9] Zajaczkowski T. Genitourinary tuberculosis: historical and basic science review: past and present. Central European journal of urology. 2012;65(4):182-7. PubMed PMID: 24578959. Pubmed Central PMCID: PMC3921817. Epub 2012/01/01. eng.
- [10] Chijioke A. Current views on epidemiology of renal tuberculosis. West African journal of medicine. 2001 Oct-Dec;20(4):217-9. PubMed PMID: 11885875. Epub 2002/03/12. eng.
- [11] Krishnamoorthy S, Palaniyandi V, Kumaresan N, Govindaraju S, Rajasekaran J, Murugappan I, et al. Aspects of Evolving Genito Urinary Tuberculosis-A Profile of Genito Urinary Tuberculosis (GUTB) in 110 Patients. Journal of clinical and diagnostic research : JCDR. 2017 Sep;11(9):PC01-PC5. PubMed PMID: 29207771. Pubmed Central PMCID: PMC5713793. Epub 2017/12/07. eng.

- [12] Rui X, Li XD, Cai S, Chen G, Cai B. Ultrasonographic diagnosis and typing of renal tuberculosis. *International journal of urology : official journal of the Japanese Urological Association*. 2008 Feb;15(2):135-9. PubMed PMID: 18269447. Epub 2008/02/14. eng.
- [13] Lu P, Li C, Zhou X. [Significance of the CT scan in renal tuberculosis]. *Zhonghua jie he he hu xi za zhi = Zhonghua jiehe he huxi zazhi = Chinese journal of tuberculosis and respiratory diseases*. 2001 Jul;24(7):407-9. PubMed PMID: 11802996. Epub 2002/01/23. chi.
- [14] Lang EK, Macchia RJ, Thomas R, Watson RA, Marberger M, Lechner G, et al. Improved detection of renal pathologic features on multiphasic helical CT compared with IVU in patients presenting with microscopic hematuria. *Urology*. 2003 Mar;61(3):528-32. PubMed PMID: 12639640. Epub 2003/03/18. Eng
- [15] Premkumar A, Lattimer J, Newhouse JH. CT and sonography of advanced urinary tract tuberculosis. *AJR American journal of roentgenology*. 1987 Jan;148(1):65-9. PubMed PMID: 3538835. Epub 1987/01/01. eng.