

RADIOLOGICAL FEATURES OF GENITO-URINARY TUBERCULOSIS-A PICTORIAL ESSAYSujata Patnaik¹, Radhika G²¹Additional Professor, Department of Radiology, Nizam's Institute of Medical Sciences, Hyderabad.²Associate Professor, Department of Obstetrics and Gynaecology, Nizam's Institute of Medical Sciences, Hyderabad.**ABSTRACT****BACKGROUND**

Genitourinary tuberculosis (GUTB) is the most common extra-pulmonary TB accounting for 14-41% of all tubercular affections. Caseation, parenchymal loss, intra-renal scars and strictures at calyceal neck, pelvi-ureteral junction and ureterovesical junction are hall-marks of GUTB. Radiological diagnosis of GUTB is often a challenge due to the variable imaging features it can cause. Varying degrees of calcifications in KUB region is seen 21-44% of cases. High dose IVU is the gold standard for its evaluation. Loss of calyceal sharpness, fuzzy margin, calyceal dilatation, papillary necrosis, cavitation and moth eaten calyces due to erosion are common findings on IVP. There may be stricture at calyceal neck, in pelvis resulting in hydrocalycosis and hydronephrosis or contracted pelvis. Ureteric involvement (typically a beaded, saw tooth or pipe stem appearance) may be seen in 50% of patients. One third of GUTB there is affection of the urinary bladder. 'Thimble bladder' may be a late manifestation. Our own observation of 25 proven cases, showed thimble bladder (n=16) followed by hydronephrosis (n=16), vesico-ureteric reflux (n=5), beaded ureter (n=7), scarred pelvis (n=8), infundibular stenosis (n=9) and non-functioning kidneys (n=4). Though uncommon, putty kidney (3), ghost calyx, granuloma/abscess and urethral diverticula were also observed. The most diagnostic radiological features of GUTB are lobar calcification, diffuse uneven caliectasis without pelvis dilatation, contracted pelvis with or without calcification, urothelial thickening and thimble bladder. Multiplicity of abnormal features in the same patient is very characteristic presentation. Knowledge of IVU features is important as CT Urography depicts the same features as IVU.

KEYWORDS

Genito-urinary Tuberculosis, Putty Kidney, Thimble Bladder.

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BACKGROUND

Genitourinary tuberculosis (GUTB) is the most common extra-pulmonary TB accounting for 14-41% of all tubercular affections.¹ There is an increased incidence of GUTB in recent years, due to widespread prevalence of HIV infection. Worldwide 15% of TB patients are co-infected with HIV. In HIV, endemic areas as many as 75% of with GUTB are affected with HIV infection.² Due to the propensity to spread other organs, GUTB can mimic many other disease entities. Diagnosis of GUTB is often a challenge due to the variable imaging features it can lead to. Hence we are presenting our experience on 25 cases of proven GUTB that were evaluated by imaging methods.

REVIEW OF LITERATURE

GUTB commonly affects the adults in 2 and 3 decades of life and often present after a long latent period of about 5 to 40 years from the pulmonary affection. The kidneys are the most affected site in GUTB and account for 15-20% of tubercular infections outside the lung.³ About 4-8% of patients of pulmonary TB develop GUTB. About 25% of

patients of GUTB have prior pulmonary TB and 25-50% patients will have radiographic evidence of PTB.⁴

Renal tuberculosis results from haematogenous spread of *Mycobacterium tuberculosis* into the glomerular capillary bed from pulmonary site. Small granulomas are formed in cortex bilaterally adjacent to glomeruli. Several granulomas may remain dormant for decades. In some cases capillary rupture leading to delivery of organism to proximal tubules, loop of Henle eventually developing granuloma and papillary necrosis. Granuloma, caseation necrosis and cavitation are the active stages of tuberculosis. Communication of granuloma into collecting system leads to regional spread of bacilli into renal pelvis, ureter, and urinary bladder. Host healing process induces fibrosis, calcium deposition, strictures. Hence Caseation, parenchymal loss, intra-renal scars and strictures at calyceal neck, pelvi-ureteral junction and ureterovesical junction are hall-marks of GUTB. Secondary changes following the obstruction and the parenchymal damage and calcification together lead to variable radiological patterns. With better survival of AIDS patients, the GUTB is increasingly detected. GUTB can present with non-specific, atypical or no symptoms and diagnosis can be delayed. One in 4 patients may present with renal failure. Only 50% show abnormal chest X-ray showing old pulmonary affection.⁵

OUR OBSERVATION RESULTS

A total of 25 consecutive clinically diagnosed and radiologically evaluated cases with Genito-urinary affection of tuberculosis were included for the analysis. Those with uncertain or possible alternate diagnosis and those with

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equivocal or incomplete radiological evaluation were excluded. The kidneys, ureters, urinary bladder and urethra were carefully studied for any radiological changes and taken note of. There were total 25 cases with M: F ratio of 19:6. Maximum were in age group of 21 to 40 years (n=12). Youngest was 15 years and oldest was 62 years. The most common imaging finding was thimble bladder (n=16) followed by hydronephrosis (n=16), vesico-ureteric reflux (VUR) (n=5). Beaded ureter (n=7), scarred pelvis (n=8), infundibular stenosis (n=9) and non-functioning kidneys (n=4). Though uncommon, putty kidney (3), calcification in renal parenchyma and ureteric calcification (1 case), ghost calyx, granuloma/abscess and urethral diverticula were also observed.

IMAGING FEATURES OF GUTB

DISCUSSION

Imaging in a suspected case of GUTB includes high dose IVU which is the gold standard. CT is now more commonly used. Antegrade and retrograde pyelography has limited role. Radio-nuclide scan is done for knowing renal function. MR is reserved for uncertain situations. Plain radiograph of chest and abdomen are the initial examination tools in all cases.

Calcifications in KUB region is seen 21-44% of cases and is a late manifestation. Calcification may be minute to cast of kidney representing calcified caseous homogenous ground glass appearance referred to as putty kidney (Figure 1) as in 3 of our cases (12%). These calcifications may be amorphous, granular, curvilinear, and lobar. Single lobe calcification is more diagnostic of renal TB. According to Prem Kumar et al, the calcification is putty like if area of calcific density is more than 1 cm diameter.⁶ Single lobe calcification is more pathognomonic of renal TB where the rim of calcification outlines a distorted lobe.⁷ Sometimes calcification is seen in renal parenchyma and is referred as pseudo-calculi.⁸ Apperson et al in their series reported renal calculi in 9.3% and parenchymal calcification in 8.7%.⁹ Calcification may extend along the ureter and when it occurs it is virtually diagnostic as lobar calcification. In fact, occurrence of calcification in any part of ureter along with renal calcification is pointer of renal TB. We had a similar case where there is calcification in renal parenchyma and focal ureteric calcification (Figure 2).

About 50% of GUTB will show healed (90%) or active TB (10%) on chest x-ray (Figure 2). Other associated features like pleural effusion, lung involvement, Potts spine /other osseous involvement may be detected on plain radiographs.¹⁰ Calcifications in other organs like lymph node, adrenal, spleen, liver, prostate may also be seen.¹¹

IVU is both morphological and functional study with diagnostic accuracy of 88% in evaluation of GUTB. It may be normal in initial phase and diagnosis is more than 70% when the lesion ulcerates into calyces. In earliest feature is loss of calyceal sharpness, fuzzy margin, calyceal dilatation, papillary necrosis, cavitation, moth eaten calyces due to erosion (Figure 3). Focal or global poor function may also be observed. Localised tissue oedema with vasoconstriction by localised inflammation resulting in focal hypoperfusion.¹²

Cortical scarring with dilation, distortion of adjoining calyces are the initial changes. In late stages, there will be stricture at calyceal neck, in pelvis resulting in hydrocalycosis, hydronephrosis, contracted pelvis (Figure 6). Hydronephrosis is most commonly observed (64%) in our study. Kinking of renal pelvis called Kerr's kink or hiked up pelvis (Figure 3). Fibrosis resulting small kidney and at times virtually absent renal pelvis which is accompanying calcification suggest TB (Figure 4). Completely stenosed infundibulum or calyces causing failure of contrast excretion by involved calyx called Phantom calyx (Figure 3). Tiny infundibular stump due amputated calyx can be observed.¹³ Caseous debris in calyces cause filling defect. Pattern of uneven caliectasis and contracted pelvis favour the diagnosis of renal TB (Figure 3). Ultimately there will be autonephrectomy. Autonephrectomy may be due to granulomatous destruction of kidney with obstructive uropathy or may be due to shrunken fibrotic kidney due to ulcero-cavernous lesion (Figure 4). It appears as non-functioning kidney on IVU (Figure 1).⁵ Non- functioning kidney was observed in 4 out of 25 cases.

Ureteric involvement is seen in 50% of patients with GUTB (Figure 5). We had 16 cases of hydronephrosis and beaded ureter in 7 out of 25 cases. Filling defect due to mucosal granuloma in ureter may give a beaded appearance. Dilatation and ragged appearance are initial sign of GUTB. Ulceration and granuloma along the ureter cause mucosal irregularity appearing as *saw-tooth* ureter. Thickening of ureteral wall and peri inflammatory changes are better demonstrated in CT scan (Figure 4). This thickening leads to fibrosis, shortening of ureter leading to pipe stem ureter and cause vesico-ureteric reflux (Figure 3, 5). Pipe stem ureter does not have any peristalsis. Multiple strictures and dilatation also leads to beaded ureters. Wall calcification though rare can also be seen (Figure 2). Ureteric calcification is intraluminal in TB in contrast to Schistosomiasis where it is intramural.

One third of GUTB there is affection of the urinary bladder. Bladder involvement was more common in our series (64%). Initially there is oedema and large trabeculations; subsequently contracted thick walled urinary bladder with reduced capacity, appearing as thimble bladder (Figure 3, 4, 5). Fibrosis of trigone lead to gapping of VUJ resulting in reflux and 5(20%) of our cases had reflux (Figure 3, 5). Filling defect in urinary bladder may be seen due to granuloma. Calcification though rare can be seen in the bladder lesions. Similar observation was quoted by Mohammed Roza et al in their series of 35 patient of GUTB undergone IVU. Most common findings were ureteral stricture and dilatation (52%), urinary bladder involvement (52%), autonephrectomy (48%) and renal parenchymal calcification (40%).¹⁴ These findings are similar to our results- ureteral and bladder involvement was 64% each, non- functioning kidney in 20% and renal parenchymal calcification in 12% of cases. As all our cases did not have IVU examination the number of non-functioning kidney may be under estimated. Urethral involvement is uncommon. Bulbo-membranous stricture is common. Sometimes

obstruction of Para urethral glands with subsequent rupture leading to diverticulum (Figure 5) as in our only case.¹⁵ Strictures are also observed in bulbar urethra.

Ultrasonography, CT and MRI play important role in displaying the extent of disease (Figure 4) and complications of tuberculosis like perinephric abscess, fistulae, psoas abscess and renal failure. CT urography can be done in high-end MDCT which has potential to detect early tuberculosis that can be observed in IVU. CT also depicts the length of ureteric stricture, adjacent solid organ involvement and retroperitoneal diseases (Figure 5). MRI is especially useful for pediatric patients, pregnant women. Non-contrast MRI is done for patient with renal failure and in cases CT, USG are equivocal. USG also help in guiding FNAC, guiding interventional procedure like PCN, drainage of perinephric abscess. Normal sonogram and non-functioning kidney indicates TB.¹⁰ Sometimes pyocalicosis or parenchymal abscess may perforate into perinephric region to cause perinephric abscess and may extend as psoas abscess.⁹

Transplant kidney when affected by TB, presents as graft rejection or end stage renal disease and represents about 17.8% of all transplants.⁵ Tubular interstitial nephritis can be responsible for graft dysfunction. HIV patients have significant parenchymal involvement. Granuloma and caseation are less common. Stenosis of collecting system or constriction of urinary bladder are also less common.

Male genital seedling is from infected urine or via blood stream. Most common is prostatitis, less common is epididymo orchitis. Prostatitis may lead to cavity or, fistulae. In female hematogenous spread is common and there is strong association of female infertility. Salpingitis is most commonly bilateral. Tubo-ovarian abscess is due to extension of disease to extraperitoneal compartment. In HSG stricture dilatation of fallopian tubes giving beaded appearance, rigid pipe stem tube, bilateral cornual block may be observed. Sometimes shrunken uterine cavity with filling defects and adhesion may be seen.



Figure 1

Figure 1. A, B: 45 M: Plain x-ray, KUB and IVU; A and B reveals putty kidney which is non-functioning and 35F: KUB shows faint ground glass calcification of left kidney suggestive of 'putty kidney'.

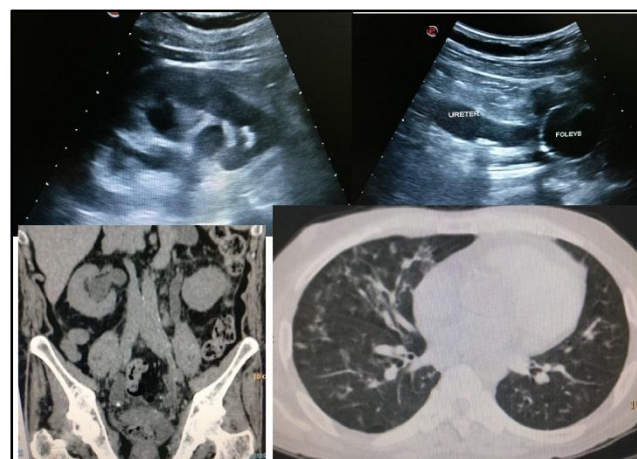


Figure 2

Figure 2. 49M- USG Reveals Parenchymal Calcification in Left Renal Cortex, in Right Ureter. Coronal reformatted Image of same patient KUB Showing Ureteric Calcification. HRCT Chest Showing Infiltrates in Right Lung.

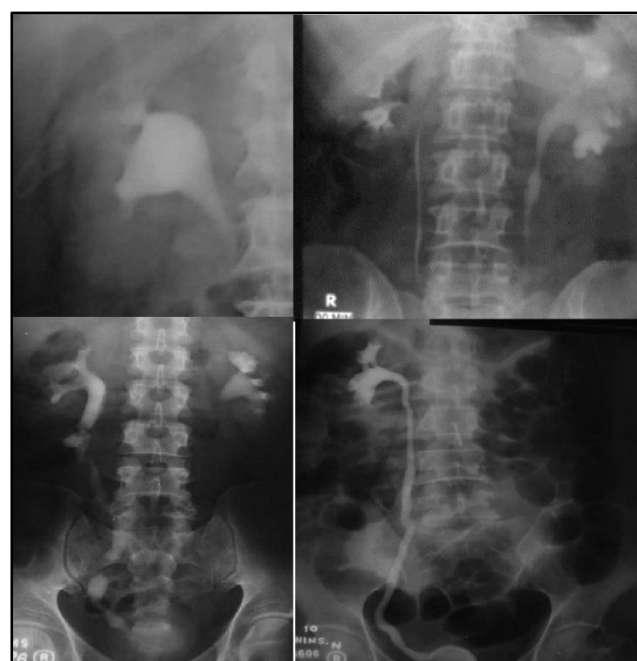


Figure 3

Figure 3. IVU –fuzzy outline of calyces suggestive of early tuberculosis of 40yrs M,

38F: asymmetric caliectasis, right upper pole calyx is not outlined (amputated calyx) contracted renal pelvis on IVU examination. Hiked up ureter on right

55M: asymmetric dilatation of calyces, irregular cavity filled with contrast in left upper pole calyx, beaded appearance of ureter in GUTB

MCUG in 36F shows thimble bladder and right vesico-ureteric reflux.

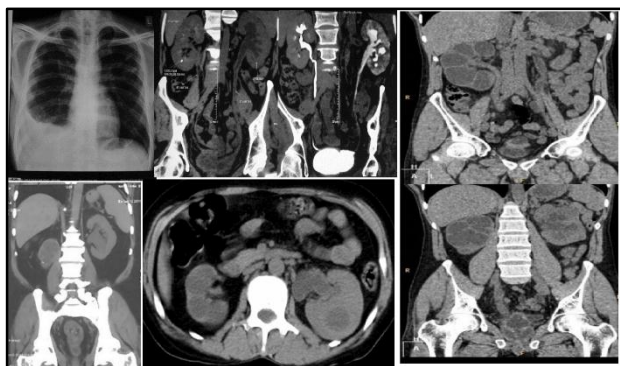


Figure 4

Figure 4. Shows left pleural effusion on chest x-ray and CT Urography of same patient reveals urothelial thickening with stricture ureters and hydroureteronephrosis and asymmetric dilatation of calyces with amputated and phantom calyces.

CT Scan in 23M reveals hydrocalycosis, absent pelvis, small capacity thick walled urinary bladder. Note absent pelvis or contracted renal pelvis is remarkable on right. 52 M: small sized autonephrectomy of right kidney in CT Scan.

NECT axial image reveals Mass in left kidney at mid-cortex representing TB granuloma, caliectasis, fibrosed renal pelvis, thimble bladder in a 40F.



Figure 5

Figure 5. RGP in 20M shows beaded ureter and hydronephrosis.

44M: MCUG shows small capacity bladder and bilateral vesicoureteral reflux, hydronephrosis.

26F: case of SLE with GUT TB depicts bilateral hydrouretero-nephrosis.

Coronal CT Reconstruction reveals renal abscess in right kidney and bilateral psoas abscess in 17-year-old female

52M: Urethral diverticulum in RGU and multiple narrowed segments in bulbar urethra.

CONCLUSION

Imaging plays important role in diagnosis and follow up of patients. Most of the cases present in advanced stage of

disease. The diagnostic radiological features of GUTB are lobar calcification, diffuse uneven caliectasis without pelvis dilatation, contracted pelvis with or without calcification, urothelial thickening and thimble bladder. Multiplicity of abnormal features in the same patient is very characteristic presentation of GUTB. Knowledge of IVU features is important as CT Urography depicts the same features as IVU.

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