Original Article

Role of Imaging in predicting Salvageability of Kidneys in Urinary Tract Tuberculosis

Bobby Viswaroop[1], Ganesh Gopalakrishnan[2], Vishwambhar Nath[3], Nitin S. Kekre[4]
Department of Urology[1-2,4], Christian Medical College, Vellore-632 004, India and Mafruq Hospital[3], UAE.

Abstract

Objective: To study the role of imaging in predicting salvageability of kidneys and the role of early nephrectomy in urinary tract tuberculosis (TB).

Methods: This was a retrospective study of 103 cases managed between 1990 to1998. Intravenous urograms (IVUs) were reviewed and based on the IVU findings. Patients were stratified into three groups. Treatment consisted of immediate surgery, defined as nephrectomy within six weeks of starting anti-TB treatment (ATT) and delayed as nephrectomy done after completion of ATT. Chi square test was applied to find the significance of early nephrectomy. Logistic regression analysis model was used to identify factors predicting salvageabilty of the nephron mass.

Results: Of the 103 cases, 23 had early nephrectomy and all of them achieved cure and had good renal function at follow up. Of the 76 who received only ATT, 43 were cured and the remaining 33 deteriorated symptomatically with high serum creatinine and decreasing GFR. Of the 33 who deteriorated, radiological and biochemical deterioration was seen in 24, two developed flank sinus and one developed multi drug resistant TB.

On sub-grouping of the patients based on IVU, it was found that those with major renal lesion alone (group A) or with bladder involvement (group C) required either early or delayed nephrectomy and those who had minor lesion (group B) or bladder involvement with or without minor lesion (group C) did well on ATT alone.

Logistic regression model showed cavitory lesions, GFR<20ml/min/m^2 and gross hydronephrosis as statistically significant unfavourable factors and ureteric stricture as a favourable factor.

Conclusion: In the era of modern ATT, nephrectomy is still an essential procedure. We recommend early nephrectomy for patients with major renal lesion with or without bladder involvement, gross hydronephrosis and for those who have GFR of <20 ml/min/m^2. Lower ureteric strictures and renal units with GFR of >20 ml/min/m^2 are favourable factors and salvage procedures are successful in these cases. It is likely that nephrectomy removes a large focus of disease and possibly dormant bacteria. With continuance of ATT, this further helps in improved patient outcome (JPMA 56:587;2006).

Introduction

Urinary tuberculosis (TB) is the second most common form of extra pulmonary TB constituting 10-20% of cases in developing countries.[1] In European series urinary tract TB comprised 30% of extra pulmonary TB.[2] Despite excellent chemotherapy tuberculosis has become the leading cause of death from infectious diseases worldwide especially with rising HIV incidence.[3] In contrast to other forms of TB, urinary tract TB poses considerable management problems. Surgery, either as ablative or reconstructive continues to be an essential tool in the management of destructive and advanced lesions of the urinary tract.[4] The role of nephrectomy in the current era of anti tuberculous treatment (ATT) is controversial. The incidence of nephrectomy varies from 15% to 62% in different series.[5,6] While renal reconstructive procedures have been described, in reality there is more destruction of renal parenchyma by the disease process that nephrectomy becomes inevitable. Though the role of surveillance while on ATT and need for stenting or PCN for salvageability are studied,[7,8] the role of initial imaging in predicting the clinical course is not well addressed in the literature. This study tries to address whether initial imaging predicts salvageability and to assess the outcome of medical treatment and counsel the patient regarding the success of salvage procedures.

Patients and Methods

This is a retrospective analysis of 103 cases managed in the urology department of a tertiary care center in South India between 1990-1998. All patients were evaluated with detailed history, physical examination, ESR, complete blood count, urine culture, chest x-ray and imaging. Three consecutive early morning urine samples were subjected to acid fast staining and culture for mycobacterium. The diagnosis of urinary TB was made either on bacteriological and histological evidence or on the basis of strong clinical suspicion with radiological findings in those without bacteriologic evidence.

Ultrasound was used to quantify the renal cortical thickness and 99mTc DTPA scan was done to assess the baseline GFR. IVUs were reviewed and an attempt was made to correlate this with the clinical course of the patients. The plan was to decide if a stratification of the IVU finding at presentation could predict the clinical outcome. With the present ATT regimen, could this predict the need for early intervention? Additionally all patients underwent cystoscopy and bladder biopsy.

On review of the IVUs patients could be stratified into three groups. Group A included calcified (putty) kidney, non-functioning kidney, hydronephrotic kidney with PUJ stricture or multiple infundibular stenosis. These were classified under major renal lesion. Those with irregularity or distortion of one or more calices and mild degree of ureteric narrowing were defined as minor lesion and were included in Group B. Patients who had bladder involvement with or without a major renal lesion were included under Group C.

Treatment consisted of immediate surgery, defined as nephrectomy within six weeks of starting ATT and delayed surgery as nephrectomy done after completion of ATT. Chi square test was applied to find the significance of early nephrectomy. Logistic regression analysis model was used to find out factors predicting salvageabilty of the nephron mass and to calculate scoring system if possible.

Results

Of the 103 cases, 23 had immediate surgery i.e., nephrectomy within six weeks of starting anti tubercular therapy (ATT). All of them achieved cure and had good renal function at follow up. Of the 76 who received only ATT, 43 were cured and the remaining 33 deteriorated symptomatically with high serum creatine and decreasing GFR. Of the 33, who deteriorated radiological and biochemical deterioration was seen in 24, two developed flank sinus and one had multi drug resistant tuberculosis (TB).

Results were further analysed after grouping the patients into Group A, B and C as per the initial IVU findings. Of the 25 in Group A, 14 (56%) had immediate surgery and ATT were cured, whereas 11 (44%) who had ATT alone showed deterioration in renal function requiring nephrectomy.

In Group B, four who had immediate nephrectomy with ATT were cured. Of the eight, in Group B, three had ureteric dilation with ATT, and five had ATT alone. One in the former and three in the latter required nephrectomy. In Group C, all the nine who had immediate nephrectomy and ATT achieved cure while, 18 of the 39 who received ATT alone-required surgical intervention.

Table 1. Comparison of anti tuberculosis treatment (ATT) alone with combination of immediate nephrectomy and ATT.

	Cured	Worsened	Total
Immediate nephrectomy + ATT (I)	27	0	27
ATT alone (II)	43	33	76
Total	70	33	103

Table 2. Outcome of renal units based on initial features on imaging (IVU).

	Cured		Required Surgery	
	I (%)	II (%)	I (%)	II (%)
Group A (n = 25)	14 (56)	0	0	11 (44)
Group B (n = 12)	4 (33.3)	4 (33.3)	0	4 (33.3)
Group C (n = 66)	9 (13.6)	39 (59.1)	0	18 (27.3)
Total (n = 103)	27	43	0	33

Table 3. Univariate analysis showing favourable and unfavourable factors.

Factors	Improved	Worsened	p value
Cavitation	1	6	0.01
Ureteric stricture	24	11	0.002
GFR <20ml/min/m2	0	6	0.03
Gross hydronephrosis	1	9	0.001
Infundibular stricture	2	2	0.86
PUJ stricture	1	2	0.55
Bladder involvement	1	2	0.55
Multiple sites	2	5	0.1
Mean serum creatinine	1.62	1.12	0.07

Irrespective of the group, patients with immediate surgery and ATT did well and had stable renal function. All the 11 patients who had ATT alone in group A required delayed nephrectomy indicating early surgery. In group B, 50% did well and remaining 50% required surgery. Early surgery might have salvaged the kidneys in this situation. Among the three groups, Group C had large number of patients on ATT alone with reasonably good results. Of the 57 on ATT, 18 required delayed nephrectomy and all of them had a major renal lesion with 11 showing deterioration in renal function.

Logistic regression model showed cavitory lesions, GFR<20ml/min/m^2 and gross hydronephrosis as statistically significant unfavorable factors and ureteric stricture as a favorable factor.

Discussion

Despite modern anti tubercular treatment (ATT), surgery is a necessary option either as an effort to preserve

or arrest deterioration in existing renal function and ablative procedure in the form of nephrectomy for non functioning kidney (NFK). The latter is more controversial. Traditionally nephrectomy for NFK is reserved for intractable pain, suspicion of malignancy, failure of chemotherapy, or bleeding.[9] Routine nephrectomy for every NFK was condemned.[10] Others believed that nephrectomy in NFK was beneficial as it reduced the duration of ATT, removed the focus of infection, decreased the risk of urinary fistula, and also reduced the need of anti hypertensive treatment.[11] Though there is increase in prevalence of urinary tract TB, the incidence of nephrectomy has decreased over the years and it varies from 15% - 62%.[5,6] In our series it was 58.2%.

Patients with urinary tract TB can present with nonfunctioning renal units either due to silent destruction of kidney or due to accelerated destruction of kidney following ATT while on observation. In the former salvageability of renal units is very rare and nephrectomy is indicated. In a series of 28 NFKs,[11] only three could be salvaged and remaining required nephrectomy. In the latter group there is no way of knowing which renal unit is salvageable and which will do well with early nephrectomy.

Kerr et al[12] studied the dynamics of progression of the kidneys and recorded their results in an attempt to arrest the pathological process by surgical means. They cited intrarenal scars of the collecting system, ureteral stricture and vesical contracture with or without reflux despite ATT as the causes of renal destruction and advised early diagnosis and close supervision to save kidneys from destructive pathology.

In one series[13] patients were divided into three groups, 1) medical treatment alone 2) medical treatment with ablative procedure and 3) medical treatment followed by reconstructive procedure. Of the 92 patients, 41 (45%) required nephrectomy within one to two months of starting ATT. This study emphasized the role of nephrectomy but the imaging features prompting this grouping was not discussed. In another series[7] of carefully selected tuberculous ureteric stricture (77 were included and 7 with nonfunctioning units were excluded) patients were divided into two groups based on whether the stricture was diagnosed initially or following ATT. The treatment arms of medication alone, medication with stenting and medication with percutaneous drainage were compared with respect to timing of stricture. Overall nephrectomy rate was 51%. The incidence of nephrectomy in the medication alone group was 74% as compared to 34% in those who had either stenting or nephrostomy along with medication. This is despite close surveillance. This paper failed to throw light on the patients who required nephrectomy despite ATT and timely intervention in form of stenting and nephrostomy.

Imaging is essential for diagnosis as well as predicting the severity of the disease process. Some of the staging systems based on imaging like Semb's grading has been suggested to predict salvageabilty.[14] Similarly some use Elke's staging[15] to determine need for secondary nephrectomy. But, factors pointing towards destruction of the renal units despite ATT and close observation are not studied.

In a retrospective study of 41 renal units[8], ten had nephrectomy and eight of the 15 who had PCN for salvaging the renal function subsequently required nephrectomy. The authors concluded that low grade renal involvement, GFR>15ml/min/m^2 and lower ureteric stricture were good factors for renal recovery.[8]

The questions that arise are whether diversion is indicated? Who are the candidates? What are the factors predicting the success of diversion? We can answer few of these questions from our study. Patients who have poorly functioning kidneys at the onset, with GFR of <20 ml/min/m^2 with radiological features of major renal involvement will be better off with nephrectomy. This will avoid the morbidity of nephrostomy or stenting. Skutil and Obstnik[16] recommended early nephrectomy for persistent tuberculous cystitis and O'Flynn[17] stressed that the decision to do nephrectomy depended on extent of renal lesion and persistence of vesical contracture. Our data shows that nephrectomy is warranted for major lesions with bladder involvement. When bladder is involved alone or in association with a minor renal lesion or ureteric stricture, treatment with anti tubercular drugs achieves good response and complex procedures like augmentation can be avoided.

Conclusion

In the era of modern ATT, nephrectomy is still an essential procedure. We recommend early nephrectomy for patients with a major renal lesion with or without bladder involvement, gross hydronephrosis and for those who have GFR of <20 ml/min/m^2. Lower ureteric strictures and renal units with GFR of >20 ml/min/m^2 are favorable factors and salvage procedures are successful in these cases. It is likely that nephrectomy removes a large focus of disease and possibly dormant bacteria. With continuance of ATT, this further helps in improved patient outcome.

References

1. Treatment of Tuberculosis: Guidelines for National Programmes, 3rd ed. WHO, Geneva, 2003 http://www.who.int/docstore/gtb/publications/ttgnp/pdf/2003.313.pdf.
2. Weinberg AC, Boyd SD. Short-course chemotherapy and role of surgery in adult and pediatric genitourinary tuberculosis. Urology 1988; 31: 95-102.
3. Dolin PJ, Raviglione MC, Kochi A. Global tuberculosis incidence and mortality during 1990-2000. Bull World Health Organ 1994; 72: 213-20.

4. Perelman MI. Surgery of tuberculosis: state of the art--introduction. World J Surg 1997; 21: 455-6.
5. Claridge M. Ureteric obstruction in tuberculosis. Br J Urol. 1970; 42: 688-92.
6. Narayana A. Overview of renal tuberculosis. Urology 1982; 19: 231-7.
7. Shin KY, Park HJ, Lee JJ, Park HY, Woo YN, Lee TY. Role of early endourologic management of tuberculous ureteral strictures. J Endourol 2002 ;16:755-8.
8. Ramanathan R, Kumar A, Kapoor R, Bhandari M. Relief of urinary tract obstruction in tuberculosis to improve renal function. Analysis of predictive factors. Br J Urol 1998 ;81:199-205.
9. Flechner SM, Gow JG. Role of nephrectomy in the treatment of non-functioning or very poorly functioning unilateral tuberculous kidney. J Urol 1980 ;123:822-5.
10. Lattimer JK, Wechsler M. Genitourinary tuberculosis. In : Harrison JH, Gittes RF, Perlmutter AD, Stamey TA and Walsh PC. Editors. Campbell's Urology. 4th edn. Philadelphia: Saunders 1978; p. 557.
11. Wong SH, Lau WY. The surgical management of non-functioning tuberculous kidneys. J Urol 1980 ;124:187-91.
12. Kerr WK, Gale GL, Peterson KS. Reconstructive surgery for genitourinary tuberculosis. J Urol 1969 ;101:254-66.
13. Wong SH, Lau WY, Poon GP, Fan ST, Ho KK, Yiu TF, Chan SL. The treatment of urinary tuberculosis. J Urol 1984 ;131:297-301.
14. Gow JG. Genitourinary tuberculosis: a study of short course regimens. J Urol. 1976 ;115:707-11.
15. Elke M, Rutishauser G, Baumann J. Proposal of a simple stage division of tuberculosis of the kidney based on roentgenological and therapeutic viewpoints. Urologe 1967 ;6:40-6.
16. Skutil V, Obsitnik M. Persistent tuberculous cystitis: the most common indication for nephrectomy in the management of urogenital tuberculosis. Eur Urol 1987;13:57-61.
17. O'Flynn D. Surgical treatment of genito-urinary tuberculosis. A report on 762 cases. Br J Urol 1970; 42: 667-71.