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# Extracorporeal Shockwave Lithotripsy for Ureterolithiasis in Patients with Urinary Bilharziasis: Efficacy and Variables That Influence Treatment Outcome

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Key Words
Extracorporeal shockwave lithotripsy · Calculi · Ureter · Lithotripsy · Urinary bilharziasis

Abstract

*Objectives:* Schistosomiasis affecting the ureter is commonly accompanied by ureteric dilatation with or without ureteric stricture and altered ureteric wall motility that can influence extracorporeal shockwave lithotripsy (ESWL) results. This study attempts to identify variables that may influence the outcome of ESWL in the treatment of ureterolithiasis in patients with urinary bilharziasis.

*Patients and Methods:* Forty-three patients with urinary schistosomiasis and ureterolithiasis treated with ESWL were reviewed. The study data include characteristics of patients, stones, urinary tract treated and details of ESWL treatment.

*Results:* Thirty-five patients (81.3%) were stone-free at 3 months. Multivariate analysis with logistic regression identified two significant variables that influenced treatment outcome, namely the presence of ureteric stricture ($p = 0.004$) and the ESWL voltage ($p = 0.003$). Ten ureteric strictures were encountered in 9 patients (21%), the majority of these were diagnosed post-ESWL when patients failed to pass well-fragmented stones in spite of pre-ESWL evaluation.

*Conclusions:* In situ ESWL is a safe and effective first line of treatment for urinary stones in bilharzial ureters. The presence of concomitant bilharzial stricture is a significant variable which affects the treatment outcome. Every effort should be made to rule out and deal with possible complicating factors such as ureteric strictures in the pretreatment period.



## Introduction

Genitourinary schistosomiasis, caused by a blood fluke, is a disease of warm climates and is endemic within vast regions of Africa and Soutwest Asia [1]. The consequent pathological changes are mostly related to the response of tissues to the deposition of ova by the mature female worm [2]. The resultant fibrosis and strictures lead to urinary stasis, infections and obstructive uropathy which may result in renal failure. Although some of these factors may induce

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stone formation [3–5], the relation between urinary bilharziasis and urolithiasis is not clear. Several investigators noted a high incidence of urinary stones in bilharzial patients and attributed this to previous infection with schistosomiasis [3, 6]. On the contrary, other reports that compared both bilharzial and nonbilharzial groups of patients in relation to the prevalence of stones concluded that the high incidence of urolithiasis is unlikely to be the results of schistosomiasis and that bilharzia played little role, if any, in the etiology of stone disease in these patients [4, 7].

The introduction of extracorporeal shockwave lithotripsy (ESWL) to clinical practice has revolutionized the treatment of urolithiasis; becoming the modality of choice for the treatment of symptomatic urinary stones in varying locations of the urinary tract [8, 9]. Bilharzial ureteropathy can potentially complicate shockwave lithotripsy results through its effects on the ureter which include ureteric strictures [10], ureteric dilatation without stricture disease and altered ureteric motility [11]. This review examines the efficacy of ESWL in the management of patients with bilharzial ureteric stones and the various factors encountered in our experience that influenced the treatment outcome.

## Patients and Methods

A total of 53 patients with symptomatic ureteric stones in bilharzial urinary systems were treated by ESWL between 1986 and 1996. Diagnosis of bilharziasis was based on a past history of urinary bilharziasis, radiological features of bilharzial complications or cystoscopic evidence of bilharziasis including sandy patches, nodules or granulomatous polyps. Ten patients were excluded because of incomplete data or follow-up, the remaining 43 patients form the basis of this review. All patients were male; mean age was 36.3±7.8 years (range 21–52). All patients were visiting workers that come from countries where schistosomiasis is endemic. This may explain why no female patients were encountered in this group.

All patients were evaluated prospectively with intravenous urograms. The stone disease was in the right ureter in 14 (32.5%) patients, on the left side in 25 (58.1%) and bilateral in 4 (9.3%) patients. The presenting stone was in the upper ureter in 17, middle ureter in 9 and in the distal ureter in 21 treatments. A single stone was present in 39 ureters, 2 stones in 5 ureters and 3 stones or more in 3 ureters. The stone size was defined as the greatest linear measurement of the stone, the mean stone size was 15±7 mm (range 5–35). The composition of stones in 41 patients was calcium oxalate monohydrate. Bilateral hydroureteronephrosis of varying degree was present in 22 patients.

All patients were treated with the original Dornier HM3 lithotriptor. Epidural anesthesia was used in all patients. Number of ESWL sessions and shockwaves was determined by the response to ESWL. A plain film of the kidneys, ureters and the bladder (KUB) was routinely done on the first day posttreatment to assess the quality of stone fragmentation and the need for further treatment sessions. Treatment was considered complete when adequate fragmentation was accomplished (i.e., fragments $\leq 4$ mm).

Patients with upper ureteric stones were treated in the supine position except for stones that were projecting over the psoas major muscle. Stones projecting over the sacroiliac joint or overlying the psoas major muscle were treated in prone position, fluoroscopic localization was aided by cytoscopically placed ureteric catheters. Patients with distal ureteric stones were treated in a modified sitting position that allowed entry of shockwaves through the pelvic outlet. Four patients presented with JJ stents in situ. One patient with bilateral ureteric obstruction and 1 patient with left upper ureteric stone obstruction required percutaneous nephrostomy tube insertion prior to ESWL treatment. A single session of ESWL was required in 31 patients and 12 patients needed two or more treatment sessions to achieve adequate fragmentation of the stones with an average of 1.29 sessions of ESWL per patient. The mean number of shockwaves was 2,255±1,519 (range 450–6,650), with a mean kilovoltage (kV) of 23±1.9 (range 20–26).

Ten ureteric strictures were identified during the course of management in 9 patients. The stone location in this subset of patients was at the site of the stricture or just proximal to it. The strictures were diagnosed in 3 patients pre-ESWL and were dilated successfully ureteroscopically. The remaining ureteric strictures became evident only after ESWL when patients failed to pass the stone fragments. In 4 of these patients, the presenting ureteric stone was impacted and a pre-ESWL retrograde study for suspected ureteric stricture demonstrated no obvious pathology distal to the site of stone impaction.

Multivariate analysis with logistic regression analysis was performed on coded data to identify variables that had significant impact on the treatment outcome. The variables used as predictors included age, laterality, number and type of stones, mean stone size, maximum kilovoltage and number of shockwaves during ESWL, number of treatment sessions and the presence of ureteric stricture.

## Results

The ESWL treatment was considered successful if the KUB film taken 3 months posttreatment showed complete clearance of all calculus material. Successful outcome was achieved in 35 out of the 43 patients included in this review (81.4%). Three patients required ancillary procedures post-ESWL, in the form of ureteroscopic removal of stone fragments and were rendered stone-free. A further 3 patients were stone-free post-ESWL by ureterolithotomy as an adjunct to ureteric reimplantation by Boari flap (patients 3, 6, 7 in table 1). Five patients continued to have ureteric stones, 2 of these patients had residual fragments $< 4$ mm and continued their follow-up with no complications. The other 3 patients failed ureteroscopic manipulation and refused further urological intervention.

Using logistic regression analysis, the risk of having residual fragments and failing ESWL treatment was significantly associated with the presence of a ureteric stricture ($p = 0.0004$) and the maximum kV used during ESWL ($p = 0.003$).

Table 1. Results of patients with ureteric strictures

| Patient No. | Location of stricture | Preoperative diagnosis | Ancillary procedures | Treatment outcome |
|---|---|---|---|---|
| 1 | Distal | No | PCN, meatotomy and stricture dilatation | RF |
| 2 | Distal | No | No | RF < 3 mm |
| 3 | Middle | No | Boari flap | SF |
| 4 | Middle | No | Ureteroscopy | SF |
| 5 | Upper | Yes | Preoperative stricture dilatation | RF |
| 6 | Middle | Yes | Preoperative stricture dilatation and Boari flap | SF |
| 7 | Upper | No | Boari flap | SF |
| | Distal | No | Boari flap | |
| 8 | Distal | No | No | SF |
| 9 | Middle | Yes | Preoperative stricture dilatation | SF |

RF = Residual fragments; SF = stone-free.

Only 3 out of the 9 patients with ureteric strictures became stone-free following ESWL monotherapy. Patients with ureteric stricture had a risk of having residual fragments and failing ESWL that was 34 times higher than that for patients with no stricture (odds ratio = 34; 95% confidence interval = 3.32–349). Table 1 outlines the treatment outcome for patients with ureteric strictures. An average of 1.29 sessions per patient were required in our series. Patients with repeated sessions of ESWL did not have a better outcome; a stone-free state was achieved in 77% of patients treated with one session compared to 50% of patients who required two or more sessions. Higher voltage requirements at ESWL were also inversely related to stone-free rates. Twenty-one patients were treated with shockwave energy of 20–22 kV and they were all stone-free on follow-up. The stone-free rate in the remaining patients treated with 24–26 kV energy was 53.8% (14/26). Other factors such as the stone size, the location of the stone within the ureter and hydroureteronephrosis did not influence the treatment outcome in this series.

A post-ESWL steinstrasse was encountered in 2 patients with no evidence of obstruction. Both patients were managed conservatively and cleared the stone fragments spontaneously. No other complications were noted in this group of patients.

## Discussion

Endourological management of patients with ureteric stones has been revolutionized in recent years. Various intracorporeal lithotripsy devices used in conjunction with smaller caliber ureteroscopes proved safe and efficacious in the management of symptomatic ureteric stones [12, 13]. ESWL provides an alternative, effective and noninvasive treatment modality for these patients [14–17]. The role of modern endourological techniques and ESWL in the management of stones in bilharzial ureters is not detailed in the urological literature. The treatment of such patients is usually compounded by the associated and well-known sequel of bilharzial ureteropathy, namely the presence of ureteric strictures causing obstructive uropathy. This might dictate intervention to deal with the stricture and the ureteric stones at the same time.

The effectiveness of in situ ESWL for the treatment of stones within the entire length of the ureter has been established [14, 17]. We started applying ESWL to the treatment of ureteric stones in 1986 [18]. All patients with ureteric stones were primarily treated with ESWL because it provides a safe and efficacious modality that is favored by many patients. Ureteroscopic procedures were kept as a second-line management for those who fail ESWL. Patients with urinary schistosomiasis were not excluded but rather carefully evaluated to rule out distal ureteric obstruction that will constitute a clear contraindication to ESWL. We noted ureteric strictures in 21% of our patients, this is in accord with the reported incidence of obstructive uropathy that is noted in up to 30–50% of schistosomiasis cases [5, 19]. However, the majority of the strictures in our group of patients were diagnosed after patients failed to pass stone fragments in spite of careful pre-ESWL evaluation. Strictures in this subset of patients were at the site of impacted stones rather than distal to the stones which might explain our inability to diagnose them prior to shockwave treat-

ment. Atonicity of the ureter with decreased peristalsis is another sequel to bilharzial ureteric disease [11] and may further delay the passage of stone fragments. This however was not noted in our patients, the stone-free state that we achieved post-ESWL in bilharzial ureters at 3 months is comparable to many series describing ESWL outcome for stones in healthy ureters [14–17].

The inverse relation between the level of ESWL voltage and posttreatment stone-free rates has been described previously for stones in other locale of the urinary tract [20]. Adequate pulverization of stones is required to achieve a stone-free state after ESWL. The majority of stones in our group, as expected in schistosomiasis [19], were of calcium oxalate monohydrate. Although, the stone tends to fragment into large pieces rather than into fine sand-like particles when higher levels of voltage are used and hence reflect on the stone-free rates [21]. The probable explanation for the high kV used in some patients is that the energy was increased when the operator found that the stone did not easily break up reflecting on the composition of the stone and its inherent hardness. Other factors that are reported to influence stone-free rates post-ESWL treatment such as the stone burden, location of the stone within the ureter and the presence of hydroureter [14, 22–24] did not seem to influence the treatment outcome in this series.

In conclusion, in situ ESWL is a safe and effective first line of treatment for ureteric stones in bilharzial ureters. Every effort should be made to rule out and deal with possible complicating factors such as ureteric strictures in the pretreatment period. We recommend close follow-up of all patients post-ESWL treatment to identify patients that might require further endourological intervention.

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