ORIGINAL ARTICLE

Treatment of Proximal Ureteric Calculi: Extracorporeal Shockwave Lithotripsy or Ureteroscopic Intracorporeal Lithotripsy: Which is Better ?

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ABSTRACT

Objective: To determine the efficacy of extracorporeal shockwave lithotripsy versus ureteroscopic intracorporeal lithotripsy with lithoclast for the treatment of proximal ureteric calculi.

Subjects and Methods: The study included 87 patients with 8-15 mm proximal ureteric calculi .ESWL was performed in 45 patients and ureteroscopic lithotripsy in 42 patients. ESWL was performed by Storz Modulith lithotripter on out-patient basis. Ureteroscopy plus pneumatic lithotripsy was performed under anesthesia on in-patient basis.

Results: Stone free rate in ESWL group was 64%. Ureteroscopic intracorporeal lithotripsy resulted in stone free rate of 79%. The difference was not considered statistically significant (p>0.1). No major complications were encountered in either group.

Conclusions : In the absence of ancillary aids which prevent stone migration,Ureteroscopic lithotripsy is only marginally better(but statistically insignificant) than ESWL for treating upper ureteric calculi.. In fact these two modalities complement each other.

INTRODUCTION

Urinary stone disease has been a major health problem affecting humans since antiquity. It is a very common problem with an estimated prevalence of 2-3% in western population.[1] In Pakistan, incidence of stone disease ranges from 4.2 to 16.4 (per 100,000). Stone disease is the sixth most common condition requiring surgery in Pakistan.[2] Our country is situated in the " stone belt " area where hot and humid climate is mainly responsible for such a high incidence of stone disease. Besides being very common, it is a recurrent disease, with a life time risk of recurrence of approximately 50%.[3]

Last three decades have witnessed tremendous technological advancements, resulting in proliferation of treatment modalities for stone disease. We have now reached a stage where our ability to treat urinary stones with minimal invasiveness has surpassed our ability to determine its etiology. Consequently, we are now better able to treat urinary stones than to prevent their formation.

Treatment of urinary stones depends upon their size and location in the urinary tract. Ureteric stones become symptomatic earlier than when in other parts of urinary system. This is because of their ability to cause severe pain (ureteric colic) as well as obstruction of the corresponding kidney, with ever present danger of sepsis and impaired renal function. Upper ureteric stones, especially if larger than 6 mm, are more likely to require intervention than stones in mid and lower ureter.[4]

Management of upper ureteral stones ranges from watchful waiting (for spontaneous passage of small stones) to the most invasive method of open ureterolithotomy. In between these two extremes is the bewildering array of modalities like extracorporeal shock wave lithotripsy (ESWL), ureteroscopy plus intracorporeal lithotripsy (UIL), percutaneous nephrolithotomy (PCNL) and laparoscopic ureterolithotomy.

ESWL and ureteroscopic lithotripsy (UIL) have emerged as the most commonly used options for treating upper ureteric stones because of their minimal invasiveness and common availability.[5] However, matter is complicated by the fact that a number of variations exist within each modality. ESWL can be performed in-situ or after push up of stone into renal pelvis, with or without placement of stents. Moreover lithotripters vary in their energy source (electromagnetic, electro-hydraulic or piezo-electric) with varying costs, efficacies and side effects. Similarly, ureteroscopes are rigid, semi-rigid and flexible. In addition, energy source for ureteroscopic lithotripsy ranges from modestly

effective and priced (ultrasonic, electro-hydraulic, pneumatic) to highly effective but very costly Holmium-YAG laser. Which one to choose between them is, however, controversial ? We have tried to answer this question by conducting a prospective study to determine the relative merits and demerits of these two modalities.

SUBJECTS AND METHODS

This study was conducted at the urology department Mayo hospital Lahore in the period from January 2011 to December 2014. Patients who presented with proximal ureteric calculus (size 8 to 15mm) and were seeking active urological intervention were enrolled. Patients were explained the advantages and disadvantages of therapeutic options available, and choice between extracorporeal shock wave lithotripsy (ESWL) and ureteroscpy plus intracorporeal lithotripsy (UIL) was made by the patients.

All patients were evaluated by the digital X-ray of kidney, ureter and bladder (KUB), ultrasound (US), and excretory urogram / CT urogram to determine the stone size, site and function of the kidneys. Upper ureter was defined as the segment between pelviureteric junction and upper border of the sacroiliac joint. Patients with congenital urinary abnormalities, pregnancy, bleeding diathesis and previous urological interventions (open surgery, SWL etc.) were excluded.

ESWL was performed by Strorz modulith SLX F2 lithotripter (energy source electromagnetic). Patients were delivered shock waves on out-patients basis. Injection dicloran 75 mg i/m was administered 15 minutes before the procedure. Energy level and number of shock waves to be delivered was left to the discretion of the treating doctor. Post SWL X-rays were obtained after 2-weeks. If stone fragmentation deemed unsatisfactory, one more session of ESWL was applied.

Ureteroscopy patients were treated under anesthesia (spinal or general) on in-patient basis. Ureteroscopy was performed by Storz semi-rigid 7.5 Fr. Ureteroscope. Intracorporeal lithotripsy was delivered by Swiss pneumatic lithoclast. After treatment, D-J stents was placed if needed i.e. large stone fragments, mucosal injury etc.

Stone free status was determined by digital x-ray KUB at 2-week & 4-weeks in all patients. Any fragment ≤ 4mm was considered insignificant.

RESULTS

Patients age ranged from 18 to 59 years, with average age 38 years. Male to female ratio was approximately 3:1. (Table 1).

ESWL was performed in 47 patients. Mean stone size was 1.33 ±0.08 cm in these patients. 2 patients could not be traced after the first session. Of the remaining 45 patients who completed the study, 23 (51.11%) were stone free after first session. Remaining 22 patients underwent second of ESWL. 6 (13.33%) more patients became stone free after repeat ESWL. In final analysis, 29 (64.44 %) patients achieved stone free status at 4-weeks. 16 remaining patients were treated by ureteroscopic lithotripsy (UIL). Out of these 16 patients, 3 were again treated with ESWL for large fragments which migrated into kidney. There were no major complications.

Table 1:

	No. of Patients	Average Age	Male: Female ratio	Average stone size In CM	Stone Free rate %	
					At 2 weeks	At 4 weeks
ESWL Group	45	39 yrs	34:11	1.33±0.08	23(51%)	29(64%)
Ureteroscopic lithotripsy group	42	37 yrs	32:10	1.41±0.05	31(74%)	33 (79%)
P – Value				P >0.1	P<.05	P > 0.1

Ureteroscopic lithotripsy was performed in 42 patients. Mean stone size was 1.41±0.05 cm. In one patient extreme angulation resulted in failed access, neither D-j stent could be placed. This patient was treated by open ureterolithotomy. In 31 (73.80%) stone was fragmented successfully. In 8 (19.04%) patients, stone broke only partially or slipped entirely into kidney. D-j stent was passed and they were treated by ESWL afterwards. In two patients, ureteroscope could not be passed

because of narrowness of ureter. D-j stent were passed. Successful ureteroscopy was performed after two weeks in these patients.In final analysis, 33 (78.57%) patients achieved stone free status after ureteroscopic lithotripsy. D-j stent was placed in 24 patients because of edema, mucosal injury etc. No major complication requiring intervention was noted.

Chi square test was applied to assess the success of two groups. At 2-weeks, more patients in ureteroscopy group were stone free than in ESWL group ($p < 0.05$). However, after second session of ESWL ,additional patients achieved stone free status. Consequently, on final analysis at 4-weeks, difference between the two groups was statistically insignificant ($p > 0.1$). Results are depicted in table 1.

DISCUSSION

Management of ureteric calculi is influenced by a number of factors, prime being stone size and its location. Other important factors are stone composition, availability of equipment, expertise of surgeon and clinical factors (degree of stone impaction and hydronephrosis of relevant kidney, presence of infection and other co-morbidities in the patient.).

ESWL, being least expensive, is the preferred choice by the majority of patients.[6] Stone clearance after ESWL is variable and depends upon stone size, site and its composition. Reported success for proximal ureteric stones ranges from 57 to 96% with a high retreatment rate of up-to 60%.[7] Higher stone clearance rate tends to occur in those studies with small mean stone size (< 10 mm). Our stone clearance rate is approximately 64%, which is comparable to studies with similar stone size (about 1.26 cm). 16 (35.55%) patients were refractory to ESWL and had to be treated by ureteroscopic disimpaction and fragmentation.

Our success rate is almost 79% for ureteroscopy plus intracorporeal lithotripsy. In 8 (19.04%) patients, large stone fragments migrated into the kidney and necessitated D-j stent placement. These were subsequently treated by ESWL. Our main problem was lack of disposables like stone cones and nitinol baskets which prevent stone migration during intracorporeal lithotripsy. These are very costly items not affordable by patient population attending our public sector hospital. Moreover, pneumatic lithoclast which we used, produces relatively large stone fragments as compared to Holmium laser which pulverizes the stone into dust. However, laser equipment is very costly and has high maintenance cost compared to cheap and sturdy pneumatic lithoclast. At final analysis, difference in stone free rate between two groups is statistically insignificant ($p > 0.1$), albeit this equality was achieved after repeat ESWL session.

Tawfick [8] in 2010 reported results of a non randomized study comparing in-situ ESWL with Ureteroscopy using pneumatic lithoclast for the treatment of proximal ureteric stones. Stone size was similar to our study (up to 1.5cm). Stone free rate (SFR) was 58% in ESWL treated patients, which is somewhat less than our 64.44%. However, SFR was 92% in ureteroscopy group as compared to our SFR of modest 79%. The reason is that they used stone cones to prevent proximal stone migration and nitinol baskets to enhance proximity of stones to lithoclast probe. Moreover, they had access to balloon dilators when ureters were considered narrow for the ureteroscope. None of these costly disposables were available to us.

Nikoobakht et al [9] published results of a non randomized study involving 100 patients with proximal ureteric stones. SFR was approximately 70% in ESWL group as compared to 64% in our study. However, maximum stone size was 10 mm as compared to 15 mm in our study. Increasing stone size does reduce the effectiveness of ESWL.[10] SFR was 77% in their ureteroscopy group which is similar to 79% in our patients. They concluded that all failures in this group were due to upward migration of stones as they did not use any ancillary methods to prevent stone migration.

Ziaee et al [11], in their prospective study of 166 patients having proximal ureteric stones of 10 -15 mm ,also compared these two modalities. As it was a non randomized study, 76% patients chose ESWL as compared to 24% who opted for ureteroscopy. SFR was 78.6% in ESWL group. However it was only 72.5% in ureteroscopy group. This is rather surprising because they used Holmium laser as an energy source which is considered to be the gold standard for fragmenting urinary stones.[12] Other authors have reported SFR of as high as 95% using Holmium laser during ureteroscopy.[13]

It is obvious that ESWL, though minimally invasive, has its limitations. It needs to be repeated frequently, and sometimes it fails entirely in upper ureteric stones. Ureteroscopic lithotripsy,somewhat more invasive, needs expensive disposables to get

maximum stone clearance rate. In the absence of these ancillary aids, as our study demonstrated, its effectiveness is only modest and not much superior to that of ESWL.

CONCLUSION

In the absence of expensive ancillary aids (stone cones, nitinol baskets) which prevent stone migration during ureteroscopic lithotripsy, ESWL is almost as efficacious for treating upper ureteric calculi. ESWL and ureteroscopic lithotripsy, the two most commonly used modalities for the treatment of ureteric stones, are not rivals but they complement each other. Every institution caring for the stone disease patients must have both modalities for the efficient and cost effective treatment with minimal morbidity.

REFERENCES

1. Turney BW, Reynard JM, Nobel JG, Keoghane SR. Trends in urologic stone disease.BJU Int 2011.
2. Talati J, Khan F, Drago H, et al. Epidemiology of urolithiasis in Pakistan. In: Talati J et al. editors. The management of urolithiasis. Kluwer Academic publishers.London. 1997:21-33
3. Bihl G, Mayers A. Recurrent renal stone disease – advances in pathogenesis and clinical management. Lancet 2001;358:651-6
4. Papadoukakis S, Stolzenburg JU, Truss MC. Treatment strategies of ureteral stones. EAU EBU 2006;4:184-190
5. Turk C, Knoll T, Petrik A,et al. Guidelines on urolithiasis. EUA Guidelines 2014.
6. Beduschi R, Wolf JSjr. Current treatment of upper third ureteral stones.Braz J Urol 2001;27(2): 120-127.
7. Pace DT, Weir MJ, Tariq N, Honey JR. Low success rate of repeat shock wave lithotripsy for ureteral stones after failed initial treatment. J Urol.2000;164:1905.
8. Tawfick ER. Treatment of large proximal ureteric stones:extra corporeal shock wave lithotripsy versus semi-rigid ureteroscope with lithoclast.Int Arch Med.2010;3:3
9. Nikoobakht MR, Emamzadeh A, Abedi AR, et al. Transuretersl lithotripsay Versus Extracorporeal shock wave lithotripsy in management of upper ureteric calculi. Urol J. 2007;4:207-211.
10. Rabani S, Moosavizadeh A. Management of large proximal ureteral stones: A comparative clinical trial between transureteral lithotripsy (TUL) and shock wave lithotripsy (SWL). Neph Urol 2012;4(3):556-559.
11. Ziaee SA, Halimisal P, et al. Management of 10-15 mm proximal ureteral stones: ureteroscopy or extracorporeal shockwave lithotripsy? Urology 2008;71(1):28-31.
12. Wu CF, Chen CS, Lin WY, et al. Therapeutic options for proximal ureter stones: extracorporeal shock wave lithotripsy versus semirigid ureteronephroscope with holmium: YAG laser lithotripsy. Urology.2005;65(6):1075-1079.
13. Chiang-fang W, Shee JJ, Lin WY, et al. YAG laser lithotripsy for treating large proximal ureteral stones. J urol.2004: 1899-1902.