The Medical Journal of Tikrit University (2025) 31 (2): 405-412
DOI: http://dx.doi.org/10.25130/mjotu.31.2.32

IRAQI Academic Scientific Journals

ISSN: 1813-1638

The Medical Journal of Tikrit University

Available online at:www.mjotu.com

MJTU

The Medical Journal of Tikrit University

Single Session Ureteroscopic Laser Lithotripsy for Paediatric Ureteral Stones in Mosul: A Prospective Study 2020

Ali AM Attarbashii [(1)]; Ali I. J. Al-Noori [(1)]

[*1] Department of Urology, Al-Jomhory Teaching Hospital, Al-Shifa'a Quarter, Mosul, Iraq.

Keywords: *Pediatric stones, ureteral stone, ureteroscopy, laser lithotripsy.*

ARTICLE INFO

Article history:

Received 01 Jul 2025
Accepted 01 Sep 2025
Available online 31 Dec 2025

Citation:

ABSTRACT

Backgound: The incidence of pediatric urinary stones increased 4% per year during 1984-2008. Hematuria (Gross or microscopic) is seen in 30% to 55% of all pediatric urolithiasis. Nearly, 25-50% of pediatric ureteral stones need surgical intervention like ureteroscopy.

Patients and Methods: In 2020, a prospective clinical study was done over a six months period (June to December) at the department of urology in Mosul Medical City. All children 14 years of age and below of both genders who presented with ureteric stones unpredictable for spontaneous passage were studied while cases with urologic comorbidities that necessitate open surgery were excluded. Abdomino-pelvic ultrasonography, plain abdominal radiography (KUB) and either intravenous urography (IVU) or computed tomography urogram (CTU) were done for all patients to identify stone characteristics (size, diameter, density and impaction) or ureteral state (dilatation or stricture).

Results: seventeen cases of semirigid ureteroscopic Ho:YAG laser lithotripsy procedures were performed. Their average age was (5.64) years, male to female ratio was 12:5. Abdominal pain and fever were the commonest presenting symptoms (76.4%). The overall stone clearance following one session of ureteroscopic laser lithotripsy was 88.2% i.e. clearance was achieved in 15 out of 17 procedures (88.2%) whereas the remaining 2 out of 17 (11.8%); needed retreatment; one case required 2nd session ureteroscopy while the other had stone migration up to renal pelvis which was treated by stenting and later on by SWL. On comparing the stone free rates in relation to their sites in the ureter or to their diameters the P-values were not significant. The post-operative complications were faced in 4 cases only (23.5%), fever in 3 cases (17.6%), while retrograde stone migration was in 1 case (5.9%).

Conclusion: Semi rigid ureteroscopic Ho:YAG laser lithotripsy is safe and effective in treating pediatric age group complaing from ureteral stones of different characteristics with a high clearance rate in single session procedures.

Corresponding author E mail:

INTRODUCTION

The incidence of pediatric urinary stones increased 4% per year during 1984-2008 [1]. Developmental genitourinary anomalies and metabolic abnormalities are known to contribute to stone formation especially in children[2]. Hematuria, flank or abdominal pain and urinary tract infection (UTI) are commonest clinical manifestations. Hematuria (Gross or microscopic) is seen in 30% to 55% of all pediatric urolithiasis [3, 4, 5], and may proceed the stone appearance. Younger children with recurrent UTI or sterile pyuria should raise the possibility of having a stone [5,6,7].

Nearly, 25-50% of pediatric ureteral stones need surgical intervention like ureteroscopy [8]. The first uretroscopy was done by Young in 1912 when he used a cystoscope in a dilated ureter [9]. Ritchey et al pioneered the performance of ureteroscopy in removing pediatric lower ureteral stones in 1988 [10]. Thereafter, other specialists have supported the use of ureteroscopy for treating different levels of pediatric ureteral calculi [11]. The advent of smaller instruments and laser lithotripsy facilitated endourological stone therapy in prepubertal children [12].The indications for ureterorenoscopy in ureteric stone management includes intractable acute pain, obstruction, failed shock wave lithotripsy (SWL) and conditions that may lead to renal failure by stones that cause obstructive uropathy in bilateral obstructed kidneys or a single kidney [13,14] . The European Association of Urology (EAU) guidelines for pediatric ureteral stone therapy recommend SWL or ureteroscopy (URS) [15]. URS is superior to SWL owing to its' ability to treat in a single session through a direct access to the stone and the higher success rate, so reducing the need for re-anesthesia and radiation [16].

The intracorporeal lithotripsy energy sources for ureteral stones are pneumatic, ultrasonic, electrohydraulic and laser lithotripters [17]. The pneumatic and laser ones are the most widely used [18].

The use of Ho:YAG laser is effective in soft tissues due to its wavelength of 2,100 nm that could be absorbed by water and all stone matrials. Beside its Moses effect, we can use it in a "near-contact" mode. Laser energy (20% of the emission) produces a cavitations' bubble at the tip of the laser fiber, conducting a vapor channel through which the ensuing laser beam reach the stone without further absorption [19,20]. The holmium laser has a longer pulse deviation and wavelength that produces a photo-thermal mechanism of disintegration of the stone which means that the stone is literally melted [21]. This thermal effect can be focused on an area a few millimeters from the tip of the laser fiber as long as fluid irrigation is applied allowing a safe powerful stone fragmentation [22].

During Ureteroscopic laser lithotripsy, minor complications such as renal colic, hematuria, fever, and, minimal mucosal injury, stone retropultion to the kidney could happen; major complications like perforation, false passage, extraureteral escape of stones to the retroperitonium, fluid extravasation, ureteral rupture, sepsis, and rarely death may occur [23].

Aim of the study:

To identify the effectiveness of using a single session semi-rigid ureteroscopic Ho:YAG laser lithotripsy for managing

pediatric ureteral stones in Mosul city, by knowing the stone free rate of this procedure and its relation to the different stone sizes and sites in the ureter and evaluating the outcome complications as well.

PATIENTS AND METHODS

In 2020, a prospective clinical study was done over a six months period (June to December) at the department of urology in Mosul Medical City. All children 14 years of age and below of both genders who presented with ureteric stones unpredictable for spontaneous passage were studied. While cases with urologic comorbidities that necessitate open surgery were excluded. After informed consents, all patients underwent pre-operative assessment including a history, physical examination, urinalysis and renal indices. Abdomino-pelvic ultrasonography, plain abdominal radiography (KUB) and either intravenous urography (IVU) or computed tomography urogram (CTU) were done for all patients to identify stone characteristics (size, diameter, density and impaction) or ureteral state (dilatation or stricture).

They had been undergone ureteroscopy using STORZ semi-rigid 8F ureteroscope with Ho:YAG (Auriga XL\ Germany) laser lithotripsy under general anesthesia and in lithotomy position using normal saline irrigation under cover of prophylactic antibiotics (cephalosporines or aminoglycosides). The ureteroscope is advanced up through the ureter over a guide wire being introduced first up to the renal pelvis. Some cases in whom the guide wire failed to pass up due to an impacted ureteral stone, it was inserted after partial lithotripsy of the stone. No active ureteral dilation was used. Laser lithotripsy was performed using fragmentation method by a 600 micrometer fiber. The procedures were usually begun at low initial laser energy and frequency settings (0.6 J / 6 Hz) and were gradually increased till sufficient stone fragmentation is achieved. Stone fragments that resulted from laser lithotripsy are extracted by dormia-basket with ureteral stenting using double J and indwelling Foley's urethral catheters were inserted for 24 hours. All patients were evaluated postoperatively by KUB to assess double J stent position and stone clearance and the double J stents were removed 2 to 6 weeks later by cystoscopy under anesthesia.

RESULTS

A total of 17 cases of semi-rigid ureteroscopic Ho:YAG laser lithotripsy procedures were performed to treat paediatric ureteric calculi. The demographic criteria of the patients are shown in Table 1. The clinical presentations of the patients that were undergone ureteroscopic laser lithotripsy are shown in table: 2, in which the commonest presenting symptoms were abdominal pain and fever. The stone characteristics in the preoperative radiological investigations were shown in table: 3 where the longest stone diameter measured on KUB, Ultrasound or CT scan was taken as the mean stone size.

During ureteroscopic procedures, no active ureteral dilatation was used. Although a total of 3 cases (17.6 %) got distal ureteric stricture; of whom 2 cases could be negotiated by the ureteroscope. Preprocedural stenting was required in the 3rd one (5.9%) to treat distal ureteric stricture in patient with proximal ureteric stone. Post procedure ureteric stents were

inserted in 16 cases (94.1%). Hospital stay was 10-24 hours (mean15.6 hours).

Stone impaction with ureteral mucosal inflammatory reaction during the procedures was seen in 9 cases out of 17 (53%). Only one patient had ipsilateral ureterocele that required laser puncture followed by ureteroscopic Ho:YAG laser lithotripsy. Thirteen out of 17 ureteroscopic laser lithotripsy procedures rendered patients stone free immediately accounting for an immediate stone free rate of about 76.5%. Three out of 17 (17.6%) of the procedures rendered patients stone free after 4 weeks. The remaining one case had migration of the residual stone fragment up to the renal pelvis which was treated by stenting and later on by SWL.

On comparing the stone free rates in relation to their sites in the ureter (proximal or distal) or to their diameters the P-values were not significant (Table:4 and Table:5). The remaining 2 out of 17 (11.8%); needed retreatment; one case required 2nd session ureteroscopy because of incomplete stone fragmentation due to critical clinical condition of the child, the other case had migration of the target stone up to renal pelvis which was treated by stenting and later on by SWL.

The overall stone clearance rate following one session of ureteroscopic laser lithotripsy was 88.2% i.e. clearance was achieved in 15 out of 17 procedures (88.2%) whereas the remaining 2 out of 17 (11.8%); needed retreatment, one case required 2nd session ureteroscopy because of incomplete stone fragmentation due to critical clinical condition of the child (6 mm impacted upper ureteric stone in 2 years old child with fever, rigor and vomiting). The other case had stone migration up to renal pelvis which was treated by stenting and later on by SWL. Three patients had post-operative fever (17.6%), which was treated by antipyretics and antibiotics. The post-operative complications are summarized in table:6

DISCUSSION

In this study, abdominal or flank pain and fever were the commonest presenting symptoms that seen in 76.4% and 70.5% respectively. While in Adanur. S et al. [24] were 56.3% and 28.1% respectively. In the study, no preprocedural ureteral dilatation was used during ureteroscopic laser lithotripsy which was similarly done by Al-bussaidy and Herndon et al as well as Scarpa et al. [25,26,27].

The reported stone free rate for ureteral stone (the complete clearance of any sized fragments on imaging study at three months follow-up) following ureteroscopic lithotripsy is 98-100% [28] whereas in this study, it was 94.1% and with the single use ureteroscopic laser lithotripsy was 88.2%. In Bassiri et al [29], after one session treatment it was 87.9%. In Omran M et al. [30] the immediate stone free rate (after 2 weeks) and that after 1 month were the same which was 97.1%. Raza et al. [31] used semi-rigid URS with holmium laser therapy in 7 patients having 10 mm- sized stone and reported 100% overall stone free rate which is nearly comparable to our study. In this study, post-operative complications were faced in 4 cases only (23.5%); fever in 3 cases (17.6%), while retrograde stone migration was in 1 case (5.9%). Table 7 shows comparism with other studies. In the study, the use of JJ stents was in 16 out of 17 procedures (94.1%), Galal EM et al. [34] revealed that ureteral stent after ureteroscopic

procedures were used at a rate of 60% - 75%.

Retreatment means the re-use of the same procedure or the use of an auxiliary one. In this study, retreatment was needed in 2 cases; one had migration of the residual stone's fragment into the renal pelvis which was treated by stenting and later on by SWL (5.9%). The 2nd case needed another session to get the patient stone free status (critical clinical condition of the child in the first session). In Omran M. et al study [30]; the re-treatment rate in ureteroscopic procedures was 2.9%. Drake et al. [35] reported retreatment up to 18% for ureteroscopic procedures. In the study, there was no detectable laser-induced urothelial injury which is similar to Wollin *et al.* [36]who treated 19 children and Reddy *et al.* [37] who treated 8 children using Holmium laser therapy. The main limitations of our study are the limited number of cases and the absence of a comparison group.

CONCLUSION

Semi rigid ureteroscopic Ho:YAG laser lithotripsy is safe and effective in treating pediatric age group complaing from ureteral stones of different characteristics with a high clearance rate in single session procedures.

REFERENCES

1. Dwyer ME, Krambeck AE, Bergstralh EJ, Milliner DS, Lieske JC, Rule AD. Temporal Trends in Incidence of Kidney Stones Among Children: 25- year Population Based Study. J Urol. 2012; Jul: 188(1):247-252.

2. Cohen TD, Ehreth J, King LR. Pediatric urolithiasis: medical and surgical management. *Urology* 1996; 47: 292–303

3. VanDervoort K, Wiesen J, Frank R, Vento S, Crosby V, Chandra M, Trachtman H. Urolithiasis in pediatric patients: a single center study of incidence, clinical presentation and outcome. J Urol. 2007; 177:2300 –2305.

4. Coward RJ, Peters CJ, Duffy PG, Corry D, Kellett MJ, Choong S, van't Hoff WG. Epidemiology of paediatric renal stone disease in the UK. Arch Dis Child. 2003; 88:962–965.

5. Hoppe B, Kemper MJ. Diagnostic examination of the child with urolithiasis or nephrocalcinosis. PediatrNephrol. 2010; 25:403–413.

6. Spivacow FR, Negri AL, del Valle EE, Calviño I, Fradinger E, Zanchetta JR. Metabolic risk factors in children with kidney stone disease. PediatrNephrol. 2008; 23:1129–1133.

7. Alpay H, Ozen A, Gokce I, Biyikli N. Clinical and metabolic features of urolithiasis and microlithiasis in children. PediatrNephrol. 2009; 24:2203–2209.

8. Minevich E, Defoor W, Reddy P, Nishinaka K, Wacksman J, Sheldon C, et al. Ureteroscopy is Safe and Effective in Prepubertal Children. J Urol. 2005; 174(1):276-9.

9.Young HH, Mckay RW. Congenital Valvular Obstruction of Prostatic Urethra.EurGyne Obstet. 1992; (48):509.

10. Ritchy M, Patterson DE, Kelalis PP, Segura JW. A Case of PaediatricUreteroscopicLasertripsy. J urol. 1988; 139:1272-74.

11. Lim DJ, Walker RD, Ellswroth PI. Newman RC, Cohen MS, Barraza MA,

Stevens PS. Treatment of PaediatricUrolithiasis Between 1984 and 1994. J Urol. 1996;156(2):702-5.

12. Jayanthi VR, Arnold PM, Koff SA. Strategies for managing upper tract calculi in young children. J Urol 1999; 162(3 Pt 2):1234–1237.

13. Ritchey M., Patterson D. E., Kelalis P. P., Segura J. W. A case of pediatric ureteroscopiclasertripsy. *Journal of Urology*. 1988; 139(6): 1272–1274.

14. Thomas R., Ortenberg J., Lee B. R., Harmon E. P. Safety and efficacy of pediatric ureteroscopy for management of calculous disease. *Journal of Urology*. 1993; 149(5):1082–1084.

15. Marchetti KA, Lee T, Raja N, Corona L, Kraft KH, Wan J, et al. Extracorporeal shock wave lithotripsy versus ureteroscopy for management of pediatric nephrolithiasis in upper tract urinary stones: multi-institutional outcomes of efficacy and morbidity. J PediatrUrol 2019; 15:516.e1e8.

16. Drake T, Grivas N, Dabestani S, Knoll T, Lam T, Maclennan S, et al. What are the benefits and harms of ureteroscopy compared with shock-wave lithotripsy in the treatment of upper ureteral stones? A systematic review. Eur Urol 2017; 72: 772e86.

17. Scotland KB, Kroczak T, Pace KT, Chew BH. Stone technology:

intracorporeal lithotripters. World J Urol 2017; 35:1347e51.

18. Abedi AR, Razzaghi MR, Allameh F, Aliakbari F, FallahKarkan M, Ranjbar A. Pneumatic lithotripsy versus laser lithotripsy for ureteral stones. J Laser Med Sci 2018; 9:233e6.

19. Zhong P, Tong HL, Cocks FH, Pearle MS, Preminger GM (1998) Transient cavitation and acoustic emission produced by different laser lithotripters. J Endourol 12(4):371–378

20. Holmium:YAG surgical lasers. Health Devices(1995) 24(3):94–96

21. Delvecchio FC, Preminger GM. Endoscopic management of urologic disease with the Holmium Laser. Current Opinion in Urology 2000, 10:233-237.

22. Grasso M. Experience with the holmium laser as an endoscopic tithotrite. Urology 1996, 48.199-206.

23. Dogan HS, Onal B, Satar N, et al.: Factors affecting complication rates of ureteroscopic lithotripsy in children: results of multi-institutional retrospective analysis by pediatric stone disease study group of Turkish Pediatric Urology. Society J Urol. 2011, 186:1035-1040.

24. SenolAdanur, Hasan Riza Aydin, FatihOzkaya, TevfikZiypak, OzkanPolat, Med Sci Monit, 2014; 20: 2373-2379**.**

25 . Al Busaidy SS, Prem AR, Medhat M, Al Bulushi YH. Ureteric Caliculi in Children. Preliminary Experience with Holmium:YAG Laser Lithotripsy. BJU Int. 2004; Jun 93(9):1318-23.

26. Herndon CD, Viamonte L, Joseph DB. Ureteroscopy in Children: Is there Need for Ureteral Dilation and Post Operative Stenting J Ped Urol. 2006; 2(4):290-3.

27. Scarpa RM, De Lisa A, Porru D, Canetto A. Usai E. Ureterolithotomy in Children. Urology. 1995; 46:859-62.

28. Lingeman JE, Lifshitz DA, Evan AP. Surgical Management of Urinary Lithiasis. In Walsh PC, Retic AB, Vanghan ED, Wein AG, Kavoussi LR, Novik AC, et al, Campbell-Walsh Urology 10th edition. Philadelphia: Saunders: 2012: 3361- 451.

29. Bassiri A, Ahmadnia H, Darabi MR, Yonessi M. Transureteral Lithotripsy in Paediatric Practice. J Endourol. 2002; 16(4):257-60.

30. Mohamed Omran , Ahmed Sakr , Esam A. E. Desoky , Maged M. Ali & Mohamed M. H. Abdalla. Miniature semi-rigid ureteroscopy with holmium-yttrium-aluminiumgarnet laser vs shockwave lithotripsy in the management of upper urinary tract stones >1 cm in children, Arab Journal of Urology, 2020;18:2, 106-111.

31. Raza A, Turna B, Smith G, et al. Pediatric urolithiasis: 15 years of local experience with minimally invasive Endourological management of pediatric calculi. J Urol. 2005; 174(2):682–685.

32. Topaktas R, Aydin C, Altin S, et al. The Efficacy of Ultra-thin Semi-rigid Ureteroscopy with Holmium Laser Lithotripsy in Pediatric Ureteral Stones: A Single-center Experience. Cureus. 2019;11(8): e5496. DOI 10.7759/cureus.5496.

33. Raza A, Smith G, Moussa T, Tolley D. Ureteroscopy in Management of Paediatric Urinary Tract Caliculi. J Endourol. 2005; 19(2):151-8.

34. Doğan HS, Tekgül S, Akdoğan B, Keskin MS, Sahin A: Use of the holmium: YAG laser for ureterolithotripsy in children. BJU Int. 2004, 94:131-133.

35. Drake T, Grivas N, Dabestani S, et al. What are the benefits and harms of ureteroscopy compared with shock-wave lithotripsy in the treatment of upper ureteral stones? A systematic review. Eur Urol. 2017; 72 (5):772–786.

36. Wollin TA, Teichman JM, Rogenes VJ, Razvi HA, Denstedt JD, Grasso M. Holmium:YAG lithotripsy in children. *J Urol*1999;162*:* 177–20.

37. Reddy PP, Barrieras DJ, Bagli DJ, McLorie GA, Khoury AE, Merguerian PA. Initial experience with endoscopic holmium laser lithotripsy for pediatric urolithiasis. *J Urol* 1999; 162: 1714–6.

TABLES

Table 1: Patient's Demography

Patient's Demography	**No. (%)**
Number of the procedures	17
Gender (male: female)	12:5
Age	7months -14 years (mean 5.64 years)

Table 2: Clinical Presentations

Clinical Presentations	**No. (%)**
Abdominal or flank pain (%)	13 (76.4%)
Fever (%)	12 (70.5%)
Hematuria (%)	4 (23.5%)
Extra urinary symptoms: Vomiting (%)	8 (47.1%)
Diarrhea (%)	2 (11.8%)

Table 3: Stone Characteristics

Stone Characteristics	**(N=17)**
Stone side Right (%) Left (%)	 9(52.9%) 8 (47.1%)
Stone diameter (mm)	4-30 mm (mean 9.94 mm)
Stone location (%) Proximal (%) Distal (%)	 4 (23.5%) 13 (76.4%)
Stone opacity: Radiopaque (%) Radiolucent (%)	 12 (70.5%) 5(29.4%)
Stone Impaction:	

Impacted Non Impacted	9(52.9%) 8(47.1%)
Degree of hydronephrosis (%) Grade I (%) Grade II (%) Grade III (%)	 (35.3%)6 (64.7%)11 0(0%)

Table 4: Single session stone free rates in relation to the site of the stone

Stone free rate	***Proximal**	**Distal**	**Total**	**P value**
Immediately	2 (50%)	11 (84.6%)	13 (76.5%)	0.66
4 weeks	0 (0%)	2 (15.4%)	3 (17.6%)	
12 weeks	0 (0%)	0 (0%)	1 (5.9%)	
Total cases	4	13	17	

Table 5: Single session stone free rate in relation to the diameter of the stone

Stone free rate	**≤5 mm**	***6-10mm**	**≥11 mm**	**P value**
Immediately	2(11.8%)	6(35.3%)	5(29.4%)	0.94
4 weeks	0(0%)	1(5.9%)	1(5.9%)	
12 weeks	0(0%)	0(0%)	0(0%)	
Total cases	2	9	6	

Table 6: Post-operative complications

Post-operative complications	**No. (%)**
Fever (%)	3(17.6%)
Retrograde stone migration (%)	1(5.9%)
Total:	4(23.5%)

Table 7: Show the overall post-operative complications in comparism to other studies.

Study	**Overall post-operative complications**
Our study	(23.5%)
Topaktas R. et al [32]	(15.1%)
Dogan HS et al [31]	(18.6%)
Raza et al[33]	(27%)
AL-Bassiri et al. [29]	(23%)