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СРАВНЕНИЕ ЭКСТРАКОРПОРАЛЬНОЙ УДАРНО-ВОЛНОВОЙ ЛИТОТРИПСИИ И УРЕТЕРОСКОПИЧЕСКОЙ ЛАЗЕРНОЙ ЛИТОТРИПСИИ ПРИ КАМНЯХ ПРОКСИМАЛЬНОГО ОТДЕЛА МОЧЕТОЧНИКА РАЗМЕРОМ ОТ 10 ДО 20 ММ: ОДНОЦЕНТРОВЫЙ ОПЫТ

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ЦЕЛЬ. Изучить эффективность экстракорпоральной ударно-волновой литотрипсии (ЭУВЛ) и уретероскопической лазерной литотрипсии (УРС ЛЛ) при лечении камней верхнего отдела мочеточника размером от 10 до 20 мм. С января 2020 по январь 2023 г. 75 пациентов прошли лечение по поводу камней в проксимальном отделе мочеточника с использованием ЭУВЛ (n=40) и УРС ЛЛ (n=35).

МЕТОДЫ И МАТЕРИАЛЫ. Обе группы пациентов, прошедшие лечение по поводу камней проксимального отдела мочеточника диаметром 10-20 мм, сравнивали по времени операции, частоте успешности и осложнениям. В группе УРС ЛЛ наблюдалась более высокая частота полного освобождения от камней по сравнению с группой ЭУВЛ, 31 (88,6 %) пациент против 20 (50,0 %) (p<0,001).

РЕЗУЛЬТАТЫ. УРС ЛЛ сопровождалась более высокой частотой осложнений по сравнению с ЭУВЛ, 9 (25,7 %) против 3 (7,5 %); (p=0,032). Время выполнения УРС ЛЛ было больше по сравнению с ЭУВЛ, медиана (IQR) для УРС ЛЛ и ЭУВЛ составила 78,0 (65,0; 100,0) против 62,0 (48,0; 67,0) мин (p<0,001).

ЗАКЛЮЧЕНИЕ. Мы пришли к выводу, что по сравнению с однократным сеансом ЭУВЛ у УРС ЛЛ более высокая частота полного освобождения от камней в верхнем отделе мочеточника диаметром 10-20 мм, большая частота осложнений, таких как послеоперационная лихорадка и боль.

Ключевые слова: *мочекаменная болезнь, камни проксимального отдела мочеточника, уретероскопия, литотрипсия, экстракорпоральная ударно-волновая литотрипсия*

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EXTRACORPOREAL SHOCKWAVE LITHOTRIPSY VERSUS URETEROSCOPIC LASER LITHOTRIPSY IN PROXIMAL URETERIC CALCULUS OF 10 TO 20 MM IN SIZE: A SINGLE CENTRE EXPERIENCE

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OBJECTIVE. To investigate the efficacy of extracorporeal shockwave lithotripsy (ESWL) and ureteroscopic laser lithotripsy (URS) treatment of upper ureteric stones between 10 to 20 mm in size. From January 2020 to January 2023, 75 patients were treated for proximal ureteric calculus between using ESWL (n=40) & URS (n=35).

METHODS AND MATERIALS. Both groups were compared regarding operative time, success rate and complications who underwent treatment for proximal ureteric calculus of 10–20 mm in diameter. URS group was observed to have higher stone-free rate, compared to the ESWL group, 31 (88.6 %) vs 20 patients (50.0 %) (p<0.001).

RESULTS. URS treatment had a higher complication rate compared to the ESWL, 9 (25.7 %) vs 3(7.5 %) ;(p=0.032). Procedure time for URS was longer, compared to the ESWL, median (IQR) for URS vs ESWL were 78.0 (65.0, 100.0) vs 62.0 (48.0, 67.0) minutes; (p<0.001).

CONCLUSION. We conclude that URS has a better stone-free rate in comparison to a single session of ESWL for upper ureteral calculus of 10–20 mm, with higher complication rates such as post-operative fever and pain.

Keywords: *urolithiasis, proximal ureteric calculus, ureteroscopy, lithotripsy, extracorporeal shockwave lithotripsy*

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Introduction. Urolithiasis is one of the commonest urological conditions with worldwide prevalence ranging between 1.0–19.1 % among Asians [1]. As such, treatment for renal and ureteral calculus has been changing over the decade in the presence of the latest technological developments. There are various treatment options for ureteric calculi depending on stone diameter and location. The spontaneous stone passage rate reduces, as stone diameters are higher. Spontaneous passage rates for stones of 7–9 mm in diameter were 48 % and the rate reduces to 25 % for stones larger than 9 mm in diameter. Spontaneous passage rates were lowest for stones at proximal ureteric calculus, which is 48 %, compared to distal ureteric calculus, which stood at 75 % [2].

Extracorporeal shockwave lithotripsy (ESWL) and ureterorenoscopic laser lithotripsy (URS) remain minimally invasive treatment options of choice [3]. Although multiple comparative studies have been performed before this, none had concluded the best option for the management of proximal ureteric calculus more than 10mm in size. Iqbal et al concluded that the stone-free rate for URS is higher than ESWL. However, the mean stone size of participants was 10.47±3.7 mm in diameter for ESWL and 13.6±6.6 mm in diameter for URS [4–6]. Three prospective studies had concluded that URS has higher stone-free rates compared to ESWL in treating proximal ureteral calculus >1 cm. The studies have included various stone sizes ranging from 6mm to 20 mm and only X-ray KUB or USG KUB was used to confirm post-treatment stone-free status [6–8]. Another prospective study conducted by HN Joshi concluded that both extracorporeal shock wave lithotripsy and ureterorenoscopic lithotripsy are equally effective in the management of upper ureteric calculus with no significant difference in age, male/female ratio, stone diameter, and stone-free ratio [9].

In this study, we aim to compare extracorporeal shockwave lithotripsy and ureterorenoscopic lithotripsy in the management of proximal ureteric calculus of 10 mm to 20 mm in diameter. The outcomes of interest are stone-free rates, complication rate, and association of co-morbidities on the stone-free rate. The proximal ureter is defined as part of the ureter extending from the ureteropelvic junction to the upper border of the pelvic brim [10]. Stone-free rate is defined as post-treatment, residual calculi of less than 5 mm in diameter at the proximal ureter.

Methods and Materials. *Study Design.* This study was conducted as a prospective, non-randomized controlled study. It was performed in Hospital Sultan Abdul Aziz Shah (HSAAS), University Putra Malaysia (UPM). Ethical approval was obtained from the ethical committee at HSAAS under number (JKEUPM-2021-704) and the study was performed according to the 1964 Helsinki declaration. Selection of treatment modality was based on patient's choice after proper treatment counselling and informed consent was taken from every patient.

Patients. Between January 2020 to January 2023, a total of 75 patients (ESWL, n=40) & (URS, n=35) were included in this study. All patients of more than 18 years old with proximal ureteric calculus measuring 10 mm to 20 mm in diameter by plain CT KUB were included in this study. Proximal ureter was defined as from pelvi-ureteric junction till the upper border of the sacroiliac joint. Patients who underwent more than one treatment for the same stone (ESWL and/or URS) was excluded from this study.

Surgical Techniques. Extracorporeal shockwave lithotripsy (ESWL). ESWL was performed using Sonolith-i by Edap TMS at our centre. ESWL was performed at our daycare centre, where patients with no procedural complications were discharged on the same day. All patients were given IV Pethidine 25mg prior to beginning the procedure. Almost all of the proximal ureteric calculus was localized with fluoroscopy alone, with stones in 4 patients localized using a combination of fluoroscopy and ultrasound guidance. High-viscosity acoustic transmission gel was used as coupling medium. Shocks ranging between 12kV to 18kV with maximum shocks limited to 4000 were applied. The presence of residual calculi at proximal ureter from repeat imaging (either X-ray KUB, USG KUB, or CT KUB) done at period of one to three months after treatment was considered failure of treatment.

Ureteroscopic laser lithotripsy (URS). All except 9 patients who underwent ureteroscopic laser lithotripsy were pre-stented. All patients who underwent URS were admitted at least one day before the procedure. Ureteroscopic laser lithotripsy (URS) was performed under general anesthesia using a 7.5Fr semirigid ureteroscope with image intensifier guidance. Laser lithotripsy was performed using a 150W Holmium:YAG laser machine with settings (either dusting or fragmentation) determined by the surgeon according to the complexity of the stone treated. 6Fr 24 cm or 26 cm ureteral stent was placed, if indicated at the end of the procedure, which was removed 2 weeks later in the clinic.

Statistical analysis. Data were analyzed using SPSS version 26.0. The distribution of the continuous variables was explored using skewness, kurtosis, and histogram. Continuous variables were presented with mean±standard deviation (SD), if they were normally distributed, otherwise median (25^{th} percentile, 75^{th} percentile). Categorical variables were presented as frequency and percentage.

Table 1

Perioperative patient's characteristics

Variables	Overall	ESWL (n=40)	URS (n=35)	P value
Age in years, mean±SD	58.03±12.56	55.13±11.95	61.34±12.58	0.031*
Gender, n (%): Female Male	 23 (30.7) 52 (69.3)	 9 (22.5) 31 (77.5)	 14 (40.0) 21 (60.0)	0.101
Comorbidities, n (%): Diabetes mellitus Hypertension Dyslipidemia	 34 (45.3) 47 (62.7) 7 (9.3)	 12 (30.0) 25 (62.5) 1 (2.5)	 22 (62.9) 22 (62.9) 6 (17.1)	0.004*
Laterality, n (%): Left Right	 26 (34.7) 49 (65.3)	 18 (45.0) 22 (55.0)	 8 (22.9) 27 (77.1)	0.044*
Stone size, n (%): 10–15 mm 16–20 mm	 56 (74.7) 19 (25.3)	 31 (77.5) 9 (22.5)	 25 (71.4) 10 (28.6)	0.546
Uric acid, mean±SD	355.52±131.70	359.65±113.34	349.85±155.51	0.771
Hounsfield units, mean±SD	971.51±332.56	971.50±387.89	971.52±258.93	0.950

* – Significant P-value.

Table 2

Perioperative outcomes

Variables	Overall	ESWL (n=40)	URS (n=35)	P value
Duration of procedure in mins, median (IQR)	65.5 (50.0, 83.0)	62.0 (48.0, 67.0)	78.0 (65.0, 100.0)	<0.001*
Stone-free (%)	51 (68)	20 (50.0)	31 (88.6)	<0.001*
Length of hospital stay: <1 day 2–6 days >7 days	 39 (52.0) 30 (40.0) 6 (8.0)	 39 (97.5) 1 (2.5) 0 (0.0)	 0 (0.0) 29 (82.9) 6 (17.1)	<0.001*

* – Significant P-value.

Table 3

Postoperative complications based on Clavien–Dindo grading

Clavien–Dindo grading	ESWL (n=40)	URS (n=35)	P value
Grade 1	1 (2.5 %)	3 (8.5 %)	0.032
Grade 2	2 (5 %)	6 (17 %)	

Comparison of the demographic and clinical characteristics of the patients between ESWL and URS was performed using independent sample T-test , Mann Whitney U test, Pearson chi-squared test and Fisher Exact test. While the comparison of the presence of complications and residual calculi were performed using Pearson chi-squared test and Fisher Exact test. All the tests were two sided and statistical significance was denoted by $p<0.05$.

Results. A total of 75 patients were recruited into the study with a mean age of 58 years old. Majority of them were male (69.3 %), and the most common comorbidities reported were hypertension (62.7 %) and diabetes mellitus (45.3 %).

It was observed that patients who underwent URS were significantly older compared to ESWL group (mean±SD URS vs ESWL: 61.34±12.58 vs 55.13±11.95; p=0.031).

A significantly higher proportion was observed in URS group in comorbidities including diabetes mellitus (p=0.004), IHD (p=0.045) and dyslipidemia (p=0.039) compared to the ESWL group (*Table 1*).

It was observed that URS required longer duration of procedure compared to the ESWL group [median (IQR) URS vs ESWL: 78 minutes (65–100) vs 62 (48–67); $p< 0.001$]. Apart from that, URS required longer duration of hospital stay compared to the ESWL group ($p< 0.001$) where all of them stayed in hospital for at least 2 days while 97.5 % of the ESWL group stayed less than 1 day. URS was observed to have higher stone-free rate, compared to the ESWL, 88.6 % vs 50.0 %; $p<0.001$ (*Table 2*).

Patients who received URS treatment had higher complication rate compared to the ESWL; URS group reported a total of 9 cases of complication, which included 6 cases of fever (Clavien – Dindo 2) and 3 cases of pain (Clavien – Dindo 1). While ESWL reported 3 cases of complications, which included 2 cases of Steinstrasse (Clavien – Dindo 1) with 1 UTI case (Clavien – Dindo 2) (p=0.032) (*Table 3*).

Discussion. Extracorporeal shockwave lithotripsy (ESWL) and ureteroscopic laser lithotripsy

(URS) are the two most common treatment modalities for upper ureteral stones, each with advantages and disadvantages. Although several meta-analyses have shown URS fare better than ESWL for proximal ureteric calculus, none has specifically compared these treatments for stones of 10–20 mm in diameter [11]. Our study demonstrated that URS achieved a higher stone-free rate (SFR) in comparison to ESWL in the treatment of proximal ureteric calculus of 10–20 mm in diameter, which was similar to past studies. URS achieves higher SFR as there is a minimal procedural limitation in comparison to ESWL, which has multiple stone-related and patient-related factors affecting outcomes (such as obesity, and stone density).

Peng Wang et al found that the SFR was equivalent between the SWL and URS groups at one (88.7 % vs. 83.6 %, P =0.114) and three months (96.8 % vs. 98.2 %, P=0.272) in their study. However, the mean diameter of the stone diameter in their study was 10 mm in diameter with all patients in the ESWL group undergoing an early second session. The study included only patients with stone density of <1000HU and patients with BMI less than 31 kg/m^2. Our study results differ from that study, as we have included all patients with stone diameter between 10 to 20 mm in the proximal ureter with no exclusion by stone density or BMI of the patient [12]. In another study, Kumar et al reported that URS has a higher efficacy compared to ESWL despite a 78.4 % of re-treatment rate among the ESWL group for 10–20 mm calculus in the proximal ureter.

The complication rate among our cohort was higher for URS (25 %) compared to ESWL. Although, our findings are like other studies in the past, which have shown higher complication rates with URS in comparison to ESWL. Rate of post-op fever was higher (22 %) among our cohort of patients compared to those in past studies, which ranges between 3.5–7 % [6, 7, 12]. The higher prevalence of diabetes mellitus among our cohort of patients, 62.5 % among URS groups could have attributed to the higher rates of post-op fever in this study. Rates of urinary tract infection after ureteroscopic lithotripsy are known to be high among diabetic patients [13].

Pre-stenting prior to ureteroscopy intervention for proximal ureteric calculus or renal calculus is a common practice to reduce the risk of ureteral injury and increase stone-free rate. However, this added procedure increases patients' hospital visit and financial burden for patients. In our study, 26 of 35 patients were already stented prior to URS. Many of our patients were stented due to acute conditions such as obstructive uropathy or urinary tract infection with proximal calculus obstruction and later underwent URS. Although, primary ureteroscopy with no prior ureteral stenting can be performed safely with a lower rate of complication and similar SFR as cases pre-stented patients, as reported by Mc Kay et al. Their study showcased the benefit in cases with a mean stone diameter of 9 mm [14]. A retrospective review of 550 cases by Lumma et al, showed URS performed in stented patients had a lower complication rate (7.1 % vs 17.2 %) and higher stone-free rate (67.1 % vs 34.5 %) for proximal and mid ureteric calculus [15]. With the scarcity of evidence supporting primary ureteroscopy for proximal ureteral calculus, pre-ureteral stenting may reduce re-treatment rate and complications in URS for proximal ureteric calculus >10 mm diameter.

In our study, the length of hospital stay (LOS) was low (<1 day for all patients except 1) in the ESWL group compared to the URS group where LOS was longer than 1 day. EJ Bromwich et al, have shown URS can be performed safely as a day procedure, however, the cases included in their study were with a mean stone diameter of 9 mm, ASA 2 or less, and anaesthesia time <120 min [16]. Most of our patients were ASA 2 or more with an average home-to-hospital distance farther than 5 km, thus requires admission. Although URS can be performed as a daycare procedure, the limitation of urology facilities in developing countries like ours, render it not a feasible option.

Despite rapid evolvement in technology over the decade since the introduction of ESWL and URS, there were minimal improvements in terms of SFRs and complication rates between these two modalities of treatment. Future development of ESWL should focus on increasing stone-free rate with minimal energy dispersion. Despite having better SFR, other factors such as longer LOS, complication rates, and the need for pre-ureteral stenting to reduce complication rates are drawbacks of URS. Newer technological advancements such as the usage of vacuum suction-incorporated ureteral access sheaths may improve stone-free rates while reducing the need for pre-ureteral stenting and infective complication rates associated with URS [17]. Smaller flexible ureteroscope with higher power laser device may reduce the need for pre-ureteral stenting in URS. Assimilating these changes into practice may make URS better option for upper ureteral calculus of 10–20 mm in diameter.

This is the first comparison study between ESWL vs URS done in Malaysia, which focused solely on upper ureteral calculus of 10–20mm in diameter. Our study had several limitations, which should be addressed in future studies. Firstly, our sample size was smaller compared to other studies performed in the past; our data were collected at the height of the COVID-19 pandemic when procedures were reduced. Second, factors such as skin-to-stone distance and BMI were not accounted for in this study, as it was a common practice in our centre, where the patients with BMI >30 kg/m^2 were not subjected to undergo ESWL. Third, not all patients had CT KUB for stone reassessment. Only X-ray KUB was performed in some cases and the specificity of X-ray for stone <3 mm is low.

Conclusion. In our study, we concluded that ureteroscopic laser lithotripsy (URS) is a good option

of treatment for upper ureteral calculus of 10–20 mm in diameter as it has a higher stone-free rate compared to ESWL. However, it should be notes that URS has higher complication rate (mostly Clavidien – Dindo 1 & 2) compared to ESWL management of upper ureteric stone.

Conflict of interest

The authors declare no conflict of interest.

Compliance with ethical principles

The authors confirm that they respect the rights of the people participated in the study, including obtaining informed consent when it is necessary, and the rules of treatment of animals when they are used in the study. Author Guidelines contains the detailed information.

REFERENCES

1. Liu Y., Chen Y., Liao B. et al. Epidemiology of urolithiasis in Asia // Asian J Urol. 2018;5(4):205–214.
2. Coll D. M., Varanelli M. J., Smith R. C. Relationship of spontaneous passage of ureteral calculi to stone size and location as revealed by unenhanced helical CT // AJR Am J Roentgenol. 2002;178(1):101–3. DOI: 10.2214/ajr.178.1.1780101.
3. Bozkurt Y., Sancaktutar A. A., Bostancı Y. et al. Comparison of extracorporeal shock wave lithotripsy versus ureteroscopic stone extraction in the treatment of ureteral stones // Eur J Gen Med. 2010; 7(1):29–34.
4. Youssef R. F., EL-Nahas A. R., El-Assmy A. M. et al. Shock wave lithotripsy versus semirigid ureteroscopy for proximal ureteral calculi (<20 mm): a comparative matched-pair study // Urology. 2009;73:1184–7.
5. Tauber V., Wohlmuth M., Hochmuth A. et al. Efficacy Management of urolithiasis: flexible ureteroscopy versus extracorporeal shockwave lithotripsy // Urol Int. 2015;95:324–328. DOI: 10.1159/000439356.
6. Iqbal N., Malik Y., Nadeem U. et al. Comparison of ureteroscopic pneumatic lithotripsy and extracorporeal shock wave lithotripsy for the management of proximal ureteral stones: A single center experience // Turk J Urol. 2018;44(3):221–227. DOI: 10.5152/tud.2018.41848. PMID: 29733796; PMCID: PMC5937642.
7. Salem H. K. A prospective randomized study comparing shock wave lithotripsy and semirigid ureteroscopy for the management of proximal ureteral calculi // Urology. 2009;74(6):1216–21. DOI: 10.1016/j.urology.2009.06.076. PMID: 19815264.
8. Kumar A., Nanda B., Kumar N. et al. A prospective randomized comparison between shockwave lithotripsy and semirigid ureteroscopy for upper ureteral stones <2 cm: a single center experience // J Endourol. 2015;29(1):47–51. DOI: 10.1089/end.2012.0493. PMID: 23914770.
9. Khalil M. Management of impacted proximal ureteral stone: Extracorporeal shock wave lithotripsy versus ureteroscopy with holmium: YAG laser lithotripsy // Urol Ann. 2013;5:88–92.
10. Joshi H. N., Shrestha B., Karmacharya R. M. et al. Management of proximal ureteric stones: Extracorporeal Shock Wave Lithotripsy (ESWL) versus Ureterorenoscopic Lithotripsy (URSL) // Kathmandu Univ Med J (KUMJ). 2017;15(60):343–346. PMID: 30580354.
11. Cui X., Ji F., Yan H. et al. Comparison between Extracorporeal Shock Wave Lithotripsy and Ureteroscopic Lithotripsy for treating large proximal ureteral stones: a meta-analysis // Urology. 2015;85(40):748–756.
12. Wang P., Zhan, Y., Li, J. *et al.* Comparison of shock wave lithotripsy and ureteroscopy in patients with proximal ureteral stones under the COVID-19 pandemic // *World J Urol.* 2023;41:797–803. DOI: 10.1007/s00345-023-04307-0.
13. Kazan H. O., Cakici M. C., Efiloglu O. et al. Clinical characteristics of postoperative febrile urinary tract infections after ureteroscopic lithotripsy in diabetics: Impact of glycemic control // Arch Esp Urol. 2020; 73(7):634–642. (In English, Spanish). PMID: 32886078.
14. Mckay A., Somani B. K., Pietropaolo A. et al. Comparison of primary and delayed ureteroscopy for ureteric stones: a prospective non-randomized comparative study // Urol Int. 2021;105(1–2):90–94. DOI: 10.1159/000510213. PMID: 32894854.
15. Lumma P. P., Schneider P., Strauss A. et al. Impact of ureteral stenting prior to ureterorenoscopy on stone-free rates and complications // World J Urol. 2013;31(4):855–9. DOI: 10.1007/s00345-011-0789-6. PMID: 22037634; PMCID: PMC3732763.
16. Bromwich E. J., Lockyer R., Keoghane S. R. Day-case rigid and flexible ureteroscopy // Ann R Coll Surg Engl. 2007;89(5):526–8. DOI: 10.1308/003588407X187676. PMID: 17688729; PMCID: PMC2048604.
17. Wu Z. H., Wang Y. Z., Liu T. Z. et al. Comparison of vacuum suction ureteroscopic laser lithotripsy and traditional ureteroscopic laser lithotripsy for impacted upper ureteral stones // World J Urol. 2022;40:2347–2352. DOI: 10.1007/s00345-022-04075-3.

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