ความปลอดภัยและประสิทธิผลของการรักษานิ่วในท่อไตโดยการผ่าตัดส่องกล้องแบบวันเดียวกลับ

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Safety and Efficacy of Day-case Laser Ureteroscopic Lithotripsy: A Retrospective Descriptive Study

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Abstract

Background: Ureteroscopic lithotripsy (URSL) is a minimally invasive procedure that break ureteric stone by laser and pneumatic via ureteroscope. The procedure has become more popular due to its good outcome, low risk of severe complications and it can be performed as one-day surgery. Objective: To study the safety and efficacy of laser ureteroscopic lithotripsy as day surgery. Method: A Retrospective descriptive study on medical records of patient undergoing day-case laser ureteroscopic lithotripsy in Sakonnakhon Hospital was done. The safety indicators included intraoperative and postoperative complications. The efficacy indicator was stone free rate. Result: A total of 115 patients were included. There are male 58.3% and female 41.7%. Average age was 44.7 years old. Average ureteric stone size was 9.17 mm. The mean procedure time is 23.9 minutes. Average in hospital time was 6 hours. No severe intraoperative complications (shock or ureteral perforation) occurred. Postoperative complications included gross hematuria (40.87%), pain (66.9% with average pain score of 2.27/10), fever (6.08%), immediate admission (5.22%), and re-admission (1.74%). Stone free rate was 97.4%. All complication were safely treated or managed before discharge. Conclusion: Laser ureteroscopic lithotripsy as a day surgery proves to be safe with no serious complications and has great stone free rate outcome.

Keywords: Ureteric stone/calculi, Laser Ureteroscopic lithotripsy, One-day surgery

บทคัดย่อ

ภูมิหลัง: การสลายนิ่วในท่อไตโดยการผ่าตัดส่องกล้อง (Ureteroscopic lithotripsy) เป็นวิธีการส่องกล้องเข้าไปในท่อไตเพื่อทำการกระแทกหรือสลายนิ่ว ถือว่าเป็นวิธีการรักษานิ่วท่อไตที่ได้ผลดีมากโดยวิธีการรักษานี้มีความเสี่ยงต่อการเกิดภาวะแทรกซ้อนน้อย ทั้งยังทำได้ในลักษณะการผ่าตัดแบบวันเดียวกลับจึงได้รับความนิยมมากขึ้น วัตถุประสงค์: เพื่อศึกษาความปลอดภัยและประสิทธิภาพของการรักษานิ่วท่อไตโดยวิธีส่องกล้องท่อไตสลายนิ่วด้วยเลเซอร์ ในการผ่าตัดแบบวันเดียวกลับ วิธีการ: การศึกษาวิจัยย้อนหลังเชิงพรรณนาในผู้ป่วยนิ่วในท่อไตที่รักษาด้วยวิธีการผ่าตัดด้วยการส่องกล้องท่อไตสลายนิ่วด้วยเลเซอร์ 115 ราย ผล: ผู้ป่วยนิ่วในท่อไตที่รักษาด้วยวิธีการผ่าตัดด้วยการส่องกล้องท่อไต 115 ราย, อายุเฉลี่ย 44.77 ปี, เพศ ชาย 58.3% หญิง 41.7%, ขนาดนิ่วเฉลี่ย 9.17 มิลลิเมตร, ค่าเฉลี่ยของเวลาที่ใช้ในการผ่าตัด 23.90 นาที, ค่าเฉลี่ยเวลาพักรักษาตัวในโรงพยาบาล ประมาณ 6 ชั่วโมง, พบภาวะแทรกซ้อนหลังผ่าตัด แต่สามารถจัดการก่อนผู้ป่วยจำหน่าย (ปัสสาวะเป็นเลือด 40.87%, ปวด 66.96%, ไข้ 6.08%, นอนโรงพยาบาลทันที 5.22%, การกลับมานอนโรงพยาบาลซ้ำหลังการผ่าตัดภายใน 30 วัน 1.74%), ค่าเฉลี่ยการปวด 2.27/10 คะแนน, อัตราการขจัดนิ่วได้หมด 97.4% สรุป: การรักษานิ่วในท่อไตโดยการผ่าตัดส่องกล้องท่อไตสลายนิ่วแบบวันเดียวกลับมีความปลอดภัยและประสิทธิภาพ

คำสำคัญ: นิ่วในท่อไต, การผ่าตัดด้วยการส่องกล้องท่อไตสลายนิ่ว, การผ่าตัดแบบวันเดียวกลับ

Introduction

Urinary calculi is one of an important health issues in Thailand, with most prevalent in the northeast region, followed by northern region and less in central and south regions. Location wise, ureteric stones contribute to 28% of all urinary tract stone.[1] Presenting symptoms of ureteric stone include acute and severe flank pain, hematuria and urinary tract infection. In some cases with large-size calculi and prolonged obstruction of ureter, renal function deterioration can be presented. Ureteric stones with a diameter of less than 5 mm. pass spontaneously in 71% to 98% of cases, thus may not require any intervention. The rate of spontaneous passing decreased for ureteric stones with more than 5 mm in diameter and mostly needed further intervention.[2]

Ureteroscopic lithotripsy (URSL) is a minimally invasive procedure used to break ureteric stone by laser or pneumatic via ureteroscope with great results, especially in patients with distal ureteric stone. Lower ureteric stone can be approached via rigid ureteroscope, while upper ureter and renal stone can be approached via flexible ureteroscope. Breaking up stones with laser is prefered to shockwave due to superior outcome.[3]

Ureteroscope offers treatment to both ureteric and renal calculi, with less risk of complications (5-10%) compare to open surgery.[4] Moreover, it can be done as one-day surgery, gaining more popularity as a first line treatment option.

Many studies suggest performing ureteroscopic lithotripsy as a day surgery.[5-8] For example, Bromwich et al.[8] observed a day-surgery URSL with an unplanned admission rate of 8%, but a high stone clearance rate of 96%.

Department of Surgery, Sakhonnakon Hospital has begun operating day-case ureteroscopic lithotripsy since October 2019 but there was no report of the safety and efficacy of this procedure. Therefore, this study was designed to study the safety and efficacy of day- case ureteroscopic lithotripsy and utilize the data for further improving healthcare standard in patients with ureteric stones.

Materials and methods

This study was a retrospective descriptive study on 115 patients with ureteric stone who have undergone day case laser ureteroscopic lithotripsy. This study was approved by Sakonnakhon Hospital HREC committee; license number SKNHREC No. 034/2565. Two main objectives were safety and efficacy. Safety was considered by the rate of complications, intraoperative (ureteral perforation, shock), and postoperative complications (gross hematuria, abdominal or flank pain, fever, and shock) Re-admission within 30 days due to postoperative complications was also considered. Efficacy was gauged by stone free rate. Study population was 115 patients ages between 20-70 years old with ureteric stone and received a day surgery laser URSL from 30 October 2019 to 30 June 2022. Abeni et al. study in 95 patients with ureteric stone undergone one day surgery URSL reported 85% stone free rate.[7] This study was a retrospective descriptive study, therefore the same number of sample size was chosen. Provided that some medical records were to be incomplete and have to be exclude from the study, sample size was increased by 20% and the total number was 115.

The data concerned to be analyzed were age, gender, diagnosis, factors including body mass index (BMI), stone size, underlying disease, duration of operation, complication during operation, in-hospital recovery duration, complication after operation, and stone free.

The inclusion criteria were 1) Ureteric stone patients whose required laser ureteroscopic lithotripsy. 2) Patients evaluated as ASA (American Society of Anesthesiologist) class I or II and fit for a day case surgery (assessed by anesthesiologist). The exclusion criteria were 1) Patients with 70 years of age or older 2) Patients without caretaker before or after surgery 3) Incomplete documentation in medical records. In this study, out of 115 patients treated stone using URSL technique under the setting of one-day surgery, the data were completely gathered without losing any patient's information. Data was analyzed descriptive statistics such as number and percentage for categorical data. Mean and standard deviation were reported for continuous data with normal distribution, and median for continuous data with non-normal distribution. Inferential statistics included chi-square test, Mann-Whitney test, and Fisher's exact test for comparison of data set with a p-value less than .05 is considered significant.

Result

Demographic data of 115 patients (shown in Table 1) consisted of age (average 44.77 years old), sex (male 58.3%, female 41.7%), BMI (average 24.97 kg/m^2), ASA classification (class I 55.7%, class II 44.3%), history of previous calculi removal surgery (no previous surgery 71.3%, ESWL 15.7%, URSL 8.7%, PCNL 4.3%), prior double J stent placement 4.3%, ureteric stone size (average 9.17mm), ureteric stone location (distal 65.2%). Most stones were radio-opaque (53.9%).

Table 1: Patients demographic data (n = 115)

Variables		n	%
Average age (years)	Mean = 47.77 SD = 10.33 Min = 26 Max = 70		
Sex			
Male		67	58.3
Female		48	41.7
Average BMI (kg/m^2)	Mean = 24.97 SD = 3.81 Min = 15.30 Max = 23.70		
ASA classification			
I		64	55.7
II		51	44.3
Previous surgery on ipsilateral urinary tract calculi			
No previous surgery		82	71.3
ESWL		18	15.7
URSL		10	8.7
PCNL		5	4.3
Preoperative double J stent		5	4.3
Average stone diameter: mm.	Mean = 9.17 SD = 3.25 Min = 5 Max = 20		
Diameter ≤10 mm		78	67.8
Diameter >10 mm		37	32.2
Stone location			
Proximal ureter		40	34.78
Distal ureter		75	65.22
Stone opacity			
Yes		62	53.91
No		53	46.09

ASA = American Society of Anesthesiologist, ESWL = Extracorporeal shock wave lithotripsy, URSL = Ureterorenoscopic lithotripsy, PCNL = Percutaneous nephrolithotomy

Table 2: Treatment results (n = 115)

Treatment results	n	%
Average operative time (min)	Mean = 23.90, SD = 13.84, Min = 5, Max = 60	
Length of hospital stay (min)	Mean = 351.07, SD = 289.69, Min = 65, Max = 1,890	
Postoperative double J stent	21	18.3
Intraoperative complication		
Ureteral perforation	0	0
Shock	0	0
Postoperative complication		
Gross hematuria	47	40.87
Pain	77	66.96
Fever (>37.8 ^{0}c)	7	6.08
Admission	6	5.22
Re-admission	2	1.74

Table 2: Treatment results (n = 115) (Continue)

Treatment results	n	%
Stone free: n (%)	112	97.4
Pain score (1-10)	Mean = 2.27, SD = 1.76, Min = 0, Max = 7	

The results of the treatment were shown in Table 2. Mean operative time 23.9 min, Mean length of stay 351.07 min (about 6 hours), postoperative Double J stent 18.13%, no intraoperative complications occurred. Postoperative complications were gross hematuria 40.87%, pain 66.96%, fever 6.08%, unplanned admission 5.22%, re-admission within 30 days 1.74%. The mean pain score was 2.27/10. Stone free rate was 97.4%.

Table 3: Treatment results compared between proximal and distal ureteric stone

Results	Locations		p-value
	Proximal (n=40)	Distal (n=75)	
	Median	Median	
Average stone diameter: (mm)	10.50	9.00	.083
Average operative time (min)	25.00	20.00	.006
Length of hospital stay (min)	372.50	255.00	.009
Pain score (1-10)	3.00	1.00	.001
Postoperative complication: n (%)			
Gross hematuria	22(55.00)	25(33.33)	.024
Pain	31(77.50)	46(61.33)	.079
Fever (>37.8 ^{0}c)	4(10.00)	1(1.33)	.049
Re-admission	1(2.50)	1(1.33)	1.000
Stone free: n (%)	38(95.0)	74(98.7)	.277
Male : Female	24 : 20	43 : 28	

Treatment result based on stone location were shown in Table 3. A rigid ureteroscope were used in all of URSL procedure in this study. Operative and length of hospital stay time for distal ureteric stone were shorter than a proximal ureteric stone with statistically significant. The mean pain score was significantly lesser in distal ureteric stone group than proximal group. But no difference in stone free rate and postoperative complications (pain, fever, re-admission) were observed between the two groups. No intraoperative complications were observed between the two groups.

Table 4: Treatment results based on stone diameter (cut point 10 mm).

Results	Stone sizes		p-value
	≤10 mm. (n=78)	>10 mm. (n=37)	
	Median	Median	
Average operative time (min)	17.50	30.00	<.001
Length of hospital stay (min)	300.00	265.00	.945
Pain score (1-10)	2.00	2.00	.515
Postoperative complication: n (%)			
Gross hematuria	26(33.33)	21(56.76)	.017
Pain	52(66.67)	25(67.57)	.924
Fever (>37.8 ^{0}c)	1(1.28)	4(10.81)	.036
Re-admission	2(2.47)	0(0.00)	1.000
Stone free: n (%)	78(100.0)	34(91.9)	.031

Treatment results based on stone size were shown in Table 4. Operative time for ureteric stone size ≤ 10 mm were shorter than ureteric stone size > 10 mm with statistically significant. Gross hematuria and fever occurred less in stone size ≤ 10 mm group than size >10 mm with statistical significance. The two groups observed no difference in length of stay, mean pain score, stone free rate and postoperative complications (pain, re-admission within 30 days).

Discussion

Ureteroscopic lithotripsy (URSL) offers a minimally invasive treatment option with a low risk of complication (5-10%)[4] for ureteric and renal calculi. Many studies suggested ureteroscopic lithotripsy as a one-day surgery procedure[5]. According to Taylor et al., a day-case ureteroscopic lithotripsy has an admission rate of 26% but a stone clearance rate of 98%[6]. Other studies yielded similar outcomes such as Abeni et al. (admission rate 2.2%, stone clearance rate 85%)[7], Bromwich et al. (admission rate 8%, stone clearance rate 96%).[8]

A study from B.K. Somani et al.[9], included 11, 885 patients with ureteric stones and undergone a day-case ureteroscopic lithotripsy, reported a low rate of complications (hematuria, flank pain, sepsis, ureteral perforation) at 7.4% compared to a stone clearance rate of 85.6%. Murthadha et al.[10] studied 251 day case of ureteroscopic lithotripsy with 10.1% intraoperative complications, 12.4% postoperative complications, and 81.95% stone clearance rate.

Peschel R et al. studied 80 ureteroscopic lithotripsy cases (performed as inpatient cases) with 8.3% complication rate which included hematuria, flank pain, fever and dysuria.[11] In the Abeni et al. study of 87 ureteroscopic lithotripsy cases, an admission rate of 2.2% was due to prostate infection (n = 1), ureteral infection (n = 2), and severe pain after discharge (n = 2).

According to the present study, the most common complication was postoperative pain (66.96%) but only a mean pain score of 2.27/10. Gross hematuria was the second most common complication with 40.87%. Others were fever (6.08%), immediate admission (5.22%), and re-admission within 30 days (1.74%, mostly from urinary tract infection). Although postoperative pain and gross hematuria occurred in most cases, the complication was not severe. Both were the result of ureteral dilatation during ureteroscopic lithotripsy. Gross hematuria could resolved spontaneously and postoperative pain could be controlled by analgesics. With an excellent stone-free rate of 97.4%, the author highly recommend that ureteroscopic lithotripsy could be done as one-day surgery with satisfactory, safety and efficacy.

This study is aimed for less complication following ureteroscopic lithotripsy such as ureter injury and postoperative fever, so we selected samples with no pain and no urinary tract infection in the prior 2 weeks. We also insert a guidewire before entering the scope, adjust water pressure and laser concentration appropriate for the size and sturdiness of the stones, and less than 1 hour of procedures.

Jiaxin Z et al. compared stone clearance rates between proximal and distal ureteric stone and reported a higher chance of success in a distal group (90.1% in distal group vs 80.3% in proximal group).[12] This may be due to the mobility of renal and proximal ureter occurred concurrently with inspiration and expiration. On the other hand, the distal ureter was more of an immobile organ and therefore, easier to operate through ureteroscope. The result observed by Jiaxin Z et al. is consistent with author's outcome which considered both location and size of ureteric stone as a predicting factors of stone clearance. Larger stones also required more operation time, thus decreasing stone clearance rate.

One-day surgery also offers other benefits such as increasing accessibility for patients by reduction of waiting time for treatment and reducing unnecessary expenses for hospitals and patients.[13]

The retrospective design was a limitation of our study. We did neither evaluate stones' Hounsfield units preoperatively to identify its effect on the success rate nor performed Chemical analysis of the stones. There- fore the influence of stone composition on the success of ureteroscopic lithotripsy could not be evaluated. Prospective and randomized studies with larger population are required to better define the role of day-case ureteroscopic lithotripsy.

Conclusion

Our data suggest that laser ureteroscopic lithotripsy for ureteric stone can be done as a one-day surgery with satisfied results in safety and efficacy.

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