ESWL EFFECTIVENESS FOR LOWER POLE KIDNEY STONES

[1]Riza Mazidu Sholihin, [1]Haviv Muris, [1]Soetojo.

[1]Department of Urology, Faculty of Medicine/Universitas Airlangga, Soetomo General Hospital, Surabaya.

ABSTRACT

Objective: *To describe the profile of lower pole kidney stone patients who underwent Extracorporeal Shock Wave Lithotripsy (ESWL) and the clearance rate of ESWL for lower pole kidney stones at Soetomo General Hospital from 2012 to 2016.* ***Material & Methods:*** *This research design was analytical retrospective, lower pole kidney stone patients who underwent ESWL in Soetomo General Hospital from 2012 to 2016 who fulfill inclusion criteria become samples in this research. Samples were divided into two group, stone size <15 mm and 15-20 mm.* ***Results:****Total samples in this study were 128, consist of 81 males and 47 females. The age average was 48 ± 11.124. The stone size average was 9.5 ± 4.5 mm consisted of 109 patients with stone size <15 mm and 19 patients with stone size 15-20 mm. There were 119 single lower pole kidney stones and 9 multiple ones. From all patients, 77 patients (60.2%) were stones free and the rest (39.8%) were not. Stone free rate for lower pole kidney stones was higher in stone size <15 mm compared with 15-20 mm, 65.2% and 31.5% respectively. Statistical analysis with Chi-square showed significant ESWL clearance rate difference between lower pole kidney stone size <15mm group and 15-20 mm (p<0.05).* ***Conclusion:****ESWL was a safe option for lower pole kidney stones with high success rate. There was significant relationship between stone size and stone clearance rate. ESWL was effective for lower pole kidney stones size <15 mm.*

Keywords: *Extracorporeal shock wave lithotripsy, lower pole kidney stone, stone free rate.*

ABSTRAK

Tujuan: *Untuk memberikan informasi mengenai profil pasien batu pole bawah yang dilakukan Extracorporeal Shock Wave Lithotripsy (ESWL) dan efektivitas ESWL untuk batu ginjal pole bawah di RSUD Dr. Soetomo dari tahun 2012 sampai 2016.* ***Bahan & Cara:*** *Rancangan penelitian yang dipergunakan adalah retrospektif analitik. Pasien batu ginjal pole bawah yang menjalani ESWL di RSUD Dr. Soetomo Surabaya dalam jangka waktu bulan Mei 2012 sampai dengan Juni 2016 akan menjadi sampel dalam penelitian ini. Sampel dibagi menjadi 2 kelompok berdasarkan ukuran batu ginjal (<10 mm dan 10-20mm) dan lokasi batu (pole tengah, bawah, dan atas).* ***Hasil:*** *Data yang didapatkan untuk pasien batu ginjal pole bawah yang dilakukan tindakan ESWL dan memenuhi kriteria inklusi di RSUD Dr.Soetomo tahun 2012 sampai 2016 adalah sebanyak 128 pasien dengan rerata umur (tahun) pasien adalah 48 ± 11.124 dengan jenis kelamin laki-laki 81, perempuan 47 orang. Rerata ukuran batu (mm) adalah 9.5 ± 4.5 dengan ukuran <15 mm sebanyak 109 pasien dan ukuran 15-20 mm sebanyak 19 pasien. Sebanyak 119 merupakan batu pole bawah tunggal dengan 9 kasus batu pole bawah multiple. Dari 128 pasien batu ginjal pole bawah yang ditangani dengan ESWL didapatkan 77 pasien (60.2%) bebas batu dan 51 orang lainnya (39.8) tidak bebas batu. Angka bersihan batu ginjal pole bawah lebih tinggi pada batu yang berukuran <15 mm dibandingkan dengan ukuran 15-20 mm yaitu 65.2% dibanding 31.5%. Berdasarkan hasil uji statistik dengan menggunakan uji Chi-square didapatkan perbedaan yang bermakna antara angka keberhasilan ESWL pada batu ginjal pole bawah yang berukuran <15 mm dan 15-20 mm (p<0.05).* ***Simpulan:*** *ESWL merupakan pilihan terapi yang aman untuk batu ginjal pole bawah dengan angka keberhasilan yang tinggi dengan komplikasi paling banyak berupa hematuria paska ESWL. Terdapat hubungan signifikan antara ukuran batu dan angka bersihan batu. ESWL efektif untuk batu ginjal pole bawah ukuran <15 mm.*

Kata kunci: *Extracorporeal shock wave lithotripsy, batu ginjal pole bawah, stone free rate.*

Correspondence: Soetojo, c/o: Department of Urology, Faculty of Medicine/Universitas Airlangga, Soetomo General Hospital. Jl. Mayjend. Prof. Dr. Moestopo 6-8, Surabaya 60286. Phone: +62 31 5501318; Fax: +62 31 5024971. Mobile phone: 0811378609. Email: s.tojowirjopranoto@yahoo.com.

INTRODUCTION

Kidney stones initially formed in kidney tubules and then further accumulated in the calyces. Problems caused by stones are including pain, obstruction and infection. Further renal damage may occur, and if kidney stones affect both kidneys, the condition might results in permanent renal failure. The exact incidence and prevalence rate of the disease can not have not been established yet. Kidney stone disease is the third most prevalence disease in urology after urinary tract infections and benign prostate enlargement.[1] The incidence rate of this disease is various. Approximately, there are 1-12% of people who sufferurinary tract stones.[2] In 1980, the prevalence of urinary tract stones increased by up to 90%.[3]

Urinary tract stones that cause problems need to be removed to prevent more severe complications. Stones may also be removed in socially indicated situations[4] Urinary tract stones can be expulsed medically, crushed by using Extra-corporeal Shock Wave Lithotripsy (ESWL), endo-urological procedure, laparoscopic surgery, or open surgery. The possibility of spontaneous stone passage isconsiderable.[5]

ESWL is the first choice treatment for kidney stone with the size of less than 20mm. Data from Soetomo General Hospital Surabaya from May 2011 to February 2012 showed that ESWL Stone Free Rate (SFR) in kidney and ureter stones was 65.5%.[6] However, the management of lower pole kidney stones continues to be the subject of fierce debate. The efficacy of stone removal by ESWL is same in all renal poles, but the ESWL SFR in lower renal pole is 25-85%.[7] There is no data about the efficacy of ESWL for lower pole kidney stones in Soetomo General Hospital.

OBJECTIVE

This study was aimed to describe the profile of lower pole kidney stone patients who underwent ESWL and the success rate of ESWL for lower pole kidney stones in Soetomo General Hospital from 2012 to 2016.

MATERIAL & METHODS

This study was an analytic retrospective study. The samples used in this study were kidney stone patients who underwent ESWL in Soetomo Hospital in the period of May 2012 to June 2016. The populations of this study were all patients with kidney stones who underwent ESWL in Soetomo Hospital Surabaya. Inclusion criteria were patients with kidney stone size less than <20mm who underwent ESWL in Soetomo Hospital Surabaya, while the exclusion criteria were 1). Patients with lower pole kidney stones who have a history of upper urinary tract surgery, 2).Patients with lower pole kidney stones accompanied by upper or middle pole kidney stones, 3). Incomplete patient medical record data. Diagnosis of kidney stonewas made from anamnesis, physical examination, laboratory test and radiological investigation.

The recorded data were the number of patients, age, sex, diagnosis, stone size, and SFR after ESWL. The sample of this study were divided into groups of patients with stone size less than 10mm and stone size of 10-20 mm.

ESWL procedure was performed according to Standard Operating Procedure in Soetomo Hospital Surabaya. The maximum energy was 13-14 kV and gradually raised, the frequency was 60-120 shock wave/minute (for 60 minutes) and 3000-4000 shot times. Evaluation were performed using plain abdominal imaging or ultrasound images two weeks after ESWL.

The success rate of ESWL will be compared in each group based on ESWL specific SFR criteria. SFR is the absence of residual stone or Clinically Insignificant Residual Fragments (CIRF). CIRF is the remaining 2-5 mm stone fragments, no urinary tract infection and no complaints in patients evaluated three months after ESWL procedure.[5]

Data obtained were analyzed descriptively to find out the profile of patients with kidney stones who underwent ESWL in Soetomo General Hospital and SFR after ESWL. All of the data were statistically analyzed by using Fisher Exact Test to determine the SFR differences for each stone location.

RESULTS

Table 1 showed the data obtained from patients with lower pole kidney stones who underwent ESWL in Soetomo General Hospital from 2012 to 2016 that fulfilled inclusion criteria.

Table 1 showed that most patients were in the age group (age interval) of 51-60 years old There were 127 patients with stone size less than 10mm and 108 patients with stone size of 10-20mm. Most of the stones were located in middle pole. Overall stone

Table 1. Subject characteristics.

Characteristics	Stone size less than 10mm		Stone size 10-20mm	
	N	%	N	%
Stone Location				
Upper pole	11	8.7	6	5.5
Middle pole	81	63.8	69	63.9
Lower pole	35	27.6	33	30.6
Total	127	100.0	108	100.0
Age interval				
11 - 20	0	0	2	1.9
21 - 30	5	3.9	5	4.6
31 - 40	26	20.5	18	16.7
41 - 50	31	24.4	33	30.6
51 - 60	43	33.9	34	31.5
61 - 70	17	13.4	11	10.2
71 - 80	5	3.9	5	4.6
Stone clearance				
Clean	87	68.3	68	63.0
Not clean	40	31.7	40	37.0

Table 2. Stone-Free Rate for stone size less than 10 mm.

Stone location	Stone Clearance				p value*
	Clean		Not Clean		
	N	%	N	%	
Upper pole	9	81.8	2	18.2	0.49
Middle pole	54	66.7	27	33.3	
Upper pole	9	81.8	2	18.2	0.47
Lower pole	24	68.6	11	31.4	
Middle pole	54	66.7	27	33.3	1.00
Lower pole	24	68.6	11	31.4	

Table 3. Stone-Free Rate for stone size of 10-20mm.

Stones Location	Stone Clearance				p value
	Clean		Not Clean		
	N	%	N	%	
Upper pole	5	83.3	1	16.7	1.00
Middle pole	50	72.5	19	27.5	
Upper pole	5	83.3	1	16.7	0.02*
Lower pole	10	30.3	23	69.7	
Middle pole	50	72.5	19	27.5	0.00*
Lower pole	10	30.3	23	69.7	

clearance was better in stone size less than 10mm.

Table 2 showed that there were no difference in SFR for the lower, middle, and upper pole kidney stone with the size of less than 10mm. This data showed that ESWL had the same efficacy with stone size of less than 10 mm despite of different stone locations.

Table 3 showed that there was no different ESWL effectiveness between upper and middle pole kidney stone for stone size of 10-20mm but the efficacy of ESWL was lower in lower pole kidney stones compared to middle pole and upper pole kidney stones.

DISCUSSION

ESWL is an important invention that revolutionized the management of upper urinary tract stones. After being first introduced in 1983, ESWL is widely accepted as first-line treatment for urinary tract stones sizedless than 20mm. As the time went by, ESWL's limitations on SFR became an attention. Further issues should be considered before choosing ESWL procedure so the maximum results can be achieved, such as the size and location of the stone. Further attempts to make ESWL more effective were lowering the shock wave frequency and gradually increasing the power. Treatment after ESWL with Medical Expulsive Therapy (MET) and diuretics also contributed in maximizing SFR.[8,9]

The proportion of ESWL use is not known for sure. The numbers range from 37% (in 2007 in Germany) to 70-80% (2000 in the United States). Approximately 50% of all urinary tract stones cases were treated with ESWL.[10]

Stone location also needs to be considered in the management of urinary tract stones using ESWL. Lower pole kidney stones have smaller Stone-Free Rate compared to upper and and middle pole.[11,12] Lingeman et al., reported the results of a meta-analysis study that showed ESWL SFR for lower pole kidney was 60%, whereas the upper and middle pole ranged between 70-90%.[13]

In this study, the success rate of ESWL in lower pole kidney stones with the size of <less than10 mm was 68.3% while kidney stones sized 10-20mm was 63.0%. These results were consistent with the research conducted by Lingeman et al., with 56% success rate for stone size of 10-20 mm.[13] Study conducted by Aboutaleb in lower pole kidney stones size 10-20mm that underwent ESWL and PNL showed that there were no significant differences between ESWL and PNL with 62.5% and 89.4% respectively.[14]

The size of lower pole kidney stones has significant impact on ESWL failure compared to the other locations. In this research, the ESWL success rates in lower pole kidney stones were 68.6% for stone sized than 10mm and 30.3% for stone sized 10-20mm.

PNL is more superior than ESWL in lower pole kidney stone management, but PNL has higher morbidity rate than ESWL. This made ESWL a more favorable procedure than PNL for the management of lower pole kidney stone with the size of <less than 20mm even though ESWL procedure may need more than 1 session.[15]

ESWL complications include renal colic (40%), gross haematuria (32%), ureter obstruction (30.9%) and renal hematoma (4.6%).[16] In this study we found flank hematome as much as 10.1%, flank pain 28.1% and haematuria 35.9%. Patients with painful complaints after ESWL can be treated with anti-spasmodic or anti-inflammatory. Haematuria was treated with tranexamic acid bed rest and hydration. Patients with ureteric obstruction may be treated with alpha-blockers or by performing DJ stents or URS depending on the size, number and location of the stone.[17,18]

CONCLUSION

ESWL was a safe option for lower pole kidney stones with high success rate. ESWL was effective for kidney stones sized less than 10mm. Lower pole kidney stones with the size of 10-20mm has lower stone free rate compared to middle or upper pole kidney stones. The most common complication was haematuria.

REFERENCES

1. Purnomo BB. Batu saluran kemih. In: Purnomo BB. Dasar-Dasar Urologi, 3rd Ed. Jakarta: Sagung Seto; 2011. p. 85-99.
2. Stoller M, Meng M. Urinary stone disease:the practical guide to medical and surgical management. New Jersey: Humana Press; 2007. p. 27-35.
3. Pearle MS, Antonelli JA, Lotan Y. Urinary lithiasis: etiology, epidemiology and pathogenesis. In: Louis R. Kavoussi, Alan J. Wein, Andrew C. Novick, Alan W. Partin, Craig A. Peters, editor. Campbell Walsh Urology, 11th Ed. Philadelphia: Elsevier Saunders. 2016; 2: 1170-99.
4. Bach C, Karaolides T, Buchholz N. Extracorporeal

shock wave lithotripsy: What is new? Arab Journal of Urology. 2012; 10: 289-95.
5. Indonesian Urological Association. Clinical Practice Guideline (Pedoman Penatalaksanaan Klinik mengenai penatalaksanaan penyakit batu saluran kemih). Jakarta; 2007.
6. Ridha M, Soebadi DM. ESWL for renal and ureteral stone. Indonesian Journal of Urology. 2014;21:56-62.
7. Turk C, Knoll T, Petrik A, Sarica K, Skolarikas A, Straub M, et al. Guidelines on urolithiasis. European Association of Urology; 2016. p. 1124-851.
8. Alanee S, Ugarte R, Monga M. The effectiveness of shock wave lithotripters: a case matched comparison. J Urol. 2010; 184: 2364-7.
9. Argyropoulos AN, Tolley DA. Optimizing shock wave lithotripsy in the 21st century. European Urology. 2007; 52: 344-54.
10. Bach C, Buchholz N. Shock wave lithotripsy for renal and ureteric stones. European Urology Supplements. 2011; 10: 423-32.
11. Ghimire P, Yogi N, Acharya GB. Outcome of extracorporeal shock wave lithotripsy in western region of Nepal. Nepal Journal of Medicines Sciences. 2012; 1(1): 3-6.
12. Elkoushy MA, Nady M, Hafez AA, Salah E. Predicting the fragility of renal calculi in response to shock wave lithotripsy through their radiographic appearance. African Journal of Urology. 2011; 17(2): 37-42.
13. Lingeman JE, Siegel YI, Steele B, Nyhuis AW, Woods JR. Management of lower pole nephrolithiasis: a critical analysis. J Urol. 1994; 151: 663-7.
14. Abe T, Akakura K, Kawaguchi M, Ueda T, Ichikawa T, Ito H, et al. Outcome of shockwave lithotripsy for upper urinary-tract stones: a large-scale study at single institution. Journal of Endourology. 2005; 19(7): 768-73.
15. Havel D, Saussine C, Fath C, Lang H, Faure F, Jacqmin D. Single stones of the lower pole of the kidney: comparative results of extracorporeal shock wave lithotripsy and percutaneous nephrolithotomy. Eur Urol. 1998; 33: 396-400.
16. Salem S, Mehrsai A, Zartab H, Shahdadi N, Pourmand G. Complications and outcomes following extracorporeal shock wave lithotripsy: a prospective study of 3.241 patients. Urol Res. 2010; 38: 135-42.
17. Musa AA. Use of double-J stents prior to extracorporeal shock wave lithotripsy is not beneficial: results of a prospective randomized study. Int Urol Nephrol. 2008; 40(1): 19-22.
18. Cicerello E, Merlo F, Maccatrozzo L. Management of clinically insignificant residual fragments following shock wave lithotripsy. Advances in Urology; 2012.