PATIENTS' CHARACTERISTICS & FACTORS INFLUENCING SUCCESS RATE OF ESWL IN KARDINAH HOSPITAL TEGAL

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ABSTRACT

Objective: *To evaluate which factors influencing success rate of extracorporeal shock wave lithotripsy (ESWL) in Kardinah Hospital Tegal.* ***Material & methods:*** *This was a retrospective study from secondary database of patients diagnosed with ureter or kidney stone whom underwent ESWL procedure in RSUD Kardinah Tegal from April 2012 to November 2015. Multivariate analysis and Chi-square analysis from SPSS ver. 19 were used to evaluate all the factors related to success rate of ESWL.* ***Results:*** *There were 314 patients included in this study with 59.5% of them were male patients. The average age of patients was 50 ± 5.5 years old. In 256 cases of kidney stones, there were 69 (26.9%) cases with size <10mm, 160 (62.5%) cases with a size of 10-20mm, and with a size >20mm by 27 (10.5%) cases. For ureteral stones, there were 46 (79.3%) cases with size <10mm, 11 (18.9%) cases with a size of 10-20mm, and 1 (1.7%) case with size >20mm. In general there were 238 (75.7%) of patients received no additional ESWL procedure while 61 (19.4%) patients underwent 2nd ESWL procedure, 33 (10.5%) patients underwent 3rd ESWL procedure, and 11 (3.5%) patients underwent more than 4 ESWL procedures. Kidney stones with a size <10mm, ureteral stones with size <10mm got, and location of the stone had p value of p=0.0015, p=0.001, and p=0.031 respectively. Other factors such as gender, age, stone opacity, and the number of shock given did not affect the success of ESWL. Type of lithotripter were not related to SFR in patient with kidney stone but was significantly related in ureter stone with p=0.078 and p=0.04 respectively.* ***Conclusion:*** *Most of patients reached stone free condition after the first ESWL procedure. Factors that influence the success of ESWL were the stone size and stone location. Kidney stone size <10mm and ureter stone <10mm had the highest SFR. Types of lithotripter were not related to SFRs in patients with kidney stone but were significantly related in ureteral stone with Medispec EM1000 electromagnetic and Huikang HK-V electromagnetic had the highest SFRs.*

Keywords: *Extracorporeal shock wave lithotripsy, Kardinah, factors, stone-free-rate.*

ABSTRAK

Tujuan: *Untuk mengevaluasi faktor yang mempengaruhi tingkat keberhasilan Extracorporeal shock wave lithotripsy (ESWL) di RSUD Kardinah Tegal.* ***Bahan & cara:*** *Ini adalah penelitian retrospektif dari bank data sekunder pasien yang didiagnosis dengan batu ginjal atau batu ureter yang menjalani prosedur ESWL di RSUD Kardinah Tegal dalam rentang April 2012 hingga November 2015. Analisis multivariate dan analisis Chi-square dari SPSS ver. 19 digunakan untuk mengevaluasi semua faktor yang berhubungan dengan tingkat keberhasilan ESWL.* ***Hasil:*** *Ada 314 pasien yang dilibatkan dalam penelitian ini dengan 59.5% dari mereka adalah pasien laki-laki. Rerata usia pasien berusia 50 ± 5.5 tahun. Dari 256 kasus batu ginjal, terdapat 69 (26.9%) kasus dengan ukuran <10mm, 160 (62.5%) kasus dengan ukuran 10-20mm, dan dengan ukuran >20mm sebanyak 27 (10.5%) kasus. Untuk batu ureter, ada 46 (79,3%) kasus dengan ukuran <10mm, 11 (18.9%) kasus dengan ukuran 10-20mm, dan 1 (1.7%) kasus dengan ukuran >20mm. Secara umum 238 (75.7%) pasien hanya menjalani prosedur ESWL sebanyak 1 kali dimana 61 (19.4%) pasien menjalani prosedur ESWL ke-2, 33 (10.5%) pasien menjalani prosedur ESWL ke-3, dan 11 (3.5%) pasien menjalani lebih dari 4 prosedur ESWL. Batu ginjal dengan ukuran <10mm, batu ureter dengan ukuran <10mm punya, dan lokasi batu memiliki nilai p=0.0015, p=0.001, dan p=0.031 secara berurutan. Faktor-faktor lain seperti jenis kelamin, usia, opasitas batu, dan jumlah terapi kejut yang diberikan tidak mempengaruhi keberhasilan ESWL. Jenis lithotripter tidak terkait dengan SFR pada pasien dengan batu ginjal tetapi secara signifikan berhubungan dalam batu ureter dengan p=0.078 dan p=0.04 masing-masing.* ***Simpulan:*** *Sebagian besar pasien mencapai kondisi bebas batu setelah prosedur ESWL pertama. Faktor-faktor yang mempengaruhi keberhasilan ESWL adalah ukuran batu dan lokasi batu. Ukuran batu ginjal <10mm dan batu ureter <10mm memiliki angka bebas batu tertinggi. Jenis lithotripter tidak terkait dengan angka bebas batu pada pasien dengan batu ginjal tetapi secara signifikan terkait pada pasien dengan batu ureter dengan Medispec EM1000 elektromagnetik dan Huikang HK-V elektromagnetik memiliki SFRs tertinggi.*

Kata kunci: *Extracorporeal shock wave lithotripsy, Kardinah, faktor, angka bebas batu.*

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INTRODUCTION

Extracorporeal shock wave lithotripsy (ESWL) was firstly introduced by Chaussy in the early 1980 and already became favorable approach to treat ureter and kidney stone due to its invasive characteristic. In general, ESWL have low complication rate and a few absolute contraindications but have high success rate as treatment of ureter and kidney stone.[1,2]

ESWL can be done with the aid of fluoroscopy or ultrasound (US). Besides its risk of radiation, fluoroscopy has excellent function in visualizing calcification and radiopaque stone in kidney and ureter. In another hand, US have excellent function in visualizing radio-lucent stone without any radiation, but cannot assess ureter stone. Combination of fluoroscopy and US can be used to visualize and analyze urinary tract stone in detail with less radiation.[3,4]

Stone free rates (SFR) is free-stone condition after urinary tract stone treatment stated in percentage. In ESWL, SFR can be described as a condition of clinically insignificant fragment or no stone left after ESWP procedure followed by no infection and complain after 3 month post treatment.[5,6]

There are several factors related to success rate of ESWL procedure such as stone size, stone location, anatomy of kidney and ureter, stone composition, patients' body mass index, ESWL performance, and operator skill.[1-3,7] However, like other treatment ESWL have several contraindication such as aorta aneurism and anatomy abnormality of distal stone.[3,4,7]

There are several types of ESWL lithotripter in use today which are electromagnetic, electro-hydraulic and piezoelectric.[8] In electro-magnetic lithotripter, the shock wave is produced by placing a metal plate which is focused by an acoustic lens to produce a shock wave at the desired focus.[8,9] In electrohydraulic lithotripter, the tip of electrode produces acoustic wave which is focused by ellipsoidal reflector in order to produce shock waves.[8,9] In latest generation of piezoelectric lithotripter, it has narrow focus zone in which has precise shock wave that reduces tissue injury.[10-12]

OBJECTIVE

We aimed to evaluate which factors influencing success rate of ESWL in RSUD Kardinah Tegal.

MATERIAL & METHODS

This was retrospective study using secondary data from patients' medical record database in RSUD Kardinah Tegal. All patients diagnosed with ureter or kidney stone that underwent ESWL procedure in between February 2012 to November 2015 were included in this study. Patients were diagnosed of ureter or kidney stone based on ultrasonography, BNO-IVP, or CT-Scan Urografi and were treating using Medispec EM1000 as ESWL lithotripter.

Patients characteristics such as gender, age, stone location, stone side, stone size, number of stone, stone opacity, number of ESWL given, and frequency of shock given in each ESWL were recorded and analyzed. Multivariate analysis and chi-square test from SPSS ver.19 were used to analyze these factors and its influence to success rate of ESWL procedure.

RESULTS

There were 314 patients included in this study with 59.5% of them were male patients. The average age of patients were 50 ± 5.5 years old with the youngest aged of 18 years old and 78 years old for the eldest. However, patients aged between 46 to 55 years old were the common aged group underwent ESWL procedure. Patients' characteristic can be seen in table 1.

In 256 cases of kidney stones, there were 69 (26.9%) cases with size <10mm, 160 (62.5%) cases with a size of 10-20mm, and with a size >20mm by 27 (10.5%) cases. For ureteral stones, there were 46 (79.3%) cases with size <10mm, 11 (18.9%) cases with a size of 10-20mm, and 1 (1.7%) case with size >20mm. In general there were 238 (75.7%) of patients received no additional ESWL procedure while 61 (19.4%) patients underwent 2nd ESWL procedure, 33 (10.5%) patients underwent 3rd ESWL procedure, and 11 (3.5%) patients underwent more than 4 ESWL procedures.

Factors that influencing the success rate of ESWL in RSUD Kardinah were stone size and stone location. Kidney stones with a size <10mm, ureteral stones with size <10mm got, and location of the stone had p value of p=0.0015, p=0.001, and p=0.031 respectively. Other factors such as gender, age, stone opacity, and the number of shock given did

not affect the success of ESWL. Type of lithotripter were not related to SFR in patient with kidney stone but was significantly related in ureter stone with p=0.078 and p=0.04 respectively.

Table 1. Patients' characteristics.

	N=314	%
Gender		
Male	187	59.5
Female	127	41.5
Age Groups		
15-25	7	2.2
26-35	27	8.5
36-45	85	27
46-55	120	38.2
56-65	59	18.7
>65	16	5.1
Mean SD		50.5 ± 5.5 (50)
Stone Location		
Kidney	256	81.5
Ureter	58	18.5
Stone Side		
Right	126	40.1
Left	188	59.9
Stone Amount		
Single	283	90.1
Multiple	31	9.9
Stone Size		
<10mm	98	31.2
10-20mm	188	59.8
>20mm	28	8.9
Stone Opacity		
Opaque	238	75.7
Semi opaque	61	19.4
Non radioopaque	15	4.9
Number of ESWL Given		
1X	209	66.5
2X	61	19.4
3X	33	10.5
>4X	11	3.5
Frequency of Shock		
<2000	4	1.2
2000-3000	104	33.1
>3000	206	65.6

Table 2. SFR according to stone location, stone size, and fragmentation after redo of ESWL.

	Number of Cases	Success ESWL	Redo of ESWL	Fragment Size <4mm	Fragment Size >4mm	SFR (%)
Superior Calyx						
<10mm	13	11	2	2	0	84.6
10-20mm	36	24	12	6	6	66.6
>20mm	6	0	6	0	6	0
Total	55	35	20	8	12	63.6
Medial Calyx						
<10mm	24	19	5	4	1	79.1
10-20mm	45	31	14	5	9	68.8
>20mm	11	0	11	0	11	0
Total	80	50	30	9	21	62.5
Inferior Calyx						
<10mm	14	7	7	4	3	50
10-20mm	26	10	16	3	13	38.4
>20mm	2	0	2	0	2	0
Total	42	17	25	7	18	40.4
Pyelum						
<10mm	18	14	4	2	2	77.7
10-20mm	53	35	18	13	5	66
>20mm	8	0	8	0	8	0
Total	79	49	30	15	15	62
Distal Ureter						
<10mm	5	4	1	1	0	80
10-20mm	2	2	0	0	0	100
>20mm	0	0	0	0	0	0
Total	7	6	2	2	0	85
Proximal Ureter						
<10mm	42	38	4	2	0	90
10-20mm	8	5	3	3	0	62.5
>20mm	1	0	1	0	1	0
Total	51	38	6	5	1	74.5

Table 3. Comparison of lithotripter and stone free rate.

	N	SFR (%)	p
Kidney Stone			0.078
Medispec EM1000 electromagnetic	256	57.1	
Huikang HK -V electromagnetic[13]	220	61.8	
Wolf Piezolith 3000.[11]	114	62.9	
Lithogold LG-380.[14]	45	44	
Ureter Stone			0.043*
Medispec EM1000 electromagnetic	58	79.7	
Huikang HK -V electromagnetic[13]	42	78	
Wolf Piezolith 3000.[11]	25	50	
Lithogold LG-380.[14]	31	29	

Table 4. Factors influencing success rate of ESWL.

	N	%	SFR %	p
Age (years old)				0.431
< 50	179	57.1	66.4	
≥ 50	135	42.9	64.4	
Gender				0.323
Male	187	59.5	67.9	
Female	127	41.5	63.7	
Stone Location in Kidney				0.031*
Superior Calyx	55	21.5	63.6	
Media Calyx	80	31.2	62.5	
Inferior Calyx	42	16.4	40.4	
Pyelum	79	30.9	62	
Stone Location in Ureter				0.653
Distal Ureter	7	24.1	85.7	
Proximal Ureter	51	75.9	86.3	
Kidney Stone Size				0.015*
< 10 mm	69	26.9	73.9	
10 – 20 mm	160	62.5	62.5	
> 20 mm	27	10.6	0	
Ureter Stone Size				0.001*
< 10 mm	47	81.0	93.6	
≥ 10 mm	11	18.9	54.5	
Stone Opacity				0.441
Radio-opaque	238	75.7	65.6	
Non-opaque	76	24.3	68.4	
Shock Frequency				0.482
< 2000	4	1.2	75	
2000-3000	104	33.1	71.1	
> 3000	206	65.6	73.7	

DISCUSSION

In this study, average age of patients underwent ESWL procedure was 50 ± 5.5 years old with more than 50% of them were aged between 40-60 years old. This result was not different with other studies done by Wang Rou et al years 45.5 ± 13.4 old and 47.8 years old respectively.[11,13] From 314 patients underwent ESWL in RSUD Kardinah, most cases were kidney stone (81.5%) followed by ureter stone (19.5%). In study done by Wang Rou et al, most cases were kidney stone (82%) followed by ureter stone (18%). This study also had similar results with study done by Ridha et al with 84% of kidney stone and 16% of ureter stone.[11-13]

In this study, all of patients with ureter stone <20mm underwent ESWL procedure while in kidney stone <20mm it was around 89%. This results were similar with study done by Ridha et al and consistent with guideline published by The America Urological Association Stone Guideline Panel.[4,13] The panel said that ESWL is the first line choice for ureter stone and kidney stone less than 20 mm.[4,10]

In term of stone location, stone less than 20 mm had a good SFR except for stone located in inferior calyx. In inferior calyx, stone size <10mm, 10-20 mm, >20mm had SFRs of 50%, 38.4%, and 0% respectively. These results were similar with a study done by Ridha et al except for inferior calyx stone size <20mm (50% vs 78%).[13] Other studies said that SFRs of inferior calyx were range from 25-85%.[1,15,16] In our study, smaller stone had better SFRs and it was consistent with study done by Elsobky et al. Elsobky et al said that stone less <10mm had fewer residual stone compared with stone >10mm.[17]

SFR in superior calyx and medial calyx were similar for stone size size <10mm (84.6% vs 79.1%), 10-20mm (66.6% vs 68.8%), and >20mm (0% vs

0%). These results were similar with studies done by Ridha et al and Graft et al.[13,18] We also had similar results with a study done by Ridha et al in term of SFR in proximal ureter stone SFR.[13] SFR in proximal ureter were 90% vs 88%, 62.5% vs 73%, and 0% vs 0% for stone size <10mm, 10-20mm, and >20mm respectively.[13] Other study said that SFR or proximal ureter was around 82%.[14]

More than half of patients in RSUD Kardinah had 1 session of ESWL (66.5%). ESWP procedure was limited to 4 sessions with SFR around 57.1%. Other study done using Huikang HK-V electromagnetic had SFR around 61% for 4 session of ESWL procedure.[11] Unlike with mentioned lithotripter, Piezolith 3000 and Lithogold LG-380 were limited to just 2 sessions of ESWL procedure with SFR of 62.9% and 44% respectively.[9,13,14]

In analytical analyses, we found that types of lithotripters were not related to SFR in patients suffered from kidney stone (p=0.078). This result was consistent with study done by Bhojani et al and NG et al. Studies done by both of them said that SFR from electrohydraulic, electromagnetic, and piezoelectric were not different for kidney stone disease.[14,19] Interestingly, types of lithotripter were related to SFR in patient with ureter stone disease (p=0.044). This might be related to operator skill and ESWL performance.

CONCLUSION

Patient underwent ESWL procedure in RSUD Kardinah Tegal were mostly aged 40-60 years old with the largest stone size between 10-20 mm. Most of patients already reached stone free condition after the first ESWL procedure. Factors that influence the success of ESWL procedure in RSUD Kardinah Tegal were the stone size and stone location. Kidney stone size <10mm and ureter stone <10mm had the highest SFR. Types of lithotripter were not related to SFRs in patients with kidney stone but were significantly related in ureteral stone with Medispec EM1000 electromagnetic and Huikang HK-V electromagnetic had the highest SFRs.

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