RELATIONSHIP BETWEEN RENAL STONE LOCATION WITH STONE-FREE RATE AFTER ESWL

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ABSTRACT

Objective: *This study aims to evaluate the relationship between stone location and stone location in kidney stone to the stone-free rate after Extracorporeal Shock Wave Lithotripsy (ESWL) procedure.* ***Material & method:*** *This is a non-experimental research using descriptive analytic method with retrospective study design that takes data from patient medical record diagnosis of urinary tract stones and ESWL action from January 2011 until December 2013 in the Department of Surgery Division of Urology General Hospital H. Adam Malik, Medan.* ***Results:*** *It was found that if the size of the stone only is the only factor that counts in patients who get a urinary tract stones ESWL therapy, it is not found a statistically significant relationship. Stone location plays an important role in the incidence of stone-free patients with urinary tract stones ESWL therapy.* ***Conclusion:*** *ESWL therapeutic efficacy in the treatment of patients with kidney stones is not only determined by the size and location of the stone, but is also determined by the number of stones, stone composition, frequency ESWL is used, and the thickness of the skin of the patient.*

Keywords: *Urinary tract, urinary tract stones, ESWL therapy.*

ABSTRAK

Tujuan: *Penelitian ini bertujuan untuk mengevaluasi hubungan antara lokasi batu dan lokasi batu di batu ginjal pada angka bebas batu setelah dilakukan prosedur Extracorporeal Shock Wave Lithotripsy (ESWL).* ***Bahan & cara:*** *Penelitian ini merupakan penelitian non eksperimental menggunakan metode deskriptif analitik dengan desain penelitian retrospektif yang mengambil data Rekam Medis pasien yang didiagnosis batu saluran kemih dan dilakukan tindakan ESWL dari bulan Januari 2011 sampai Desember 2013, di Departemen Bedah Divisi Urologi RSUP H. Adam Malik Medan.* ***Hasil:*** *Didapatkan hasil bahwa jika ukuran batu hanya merupakan satu-satunya faktor yang diperhitungkan pada pasien batu saluran kemih yang mendapatkan terapi ESWL, maka tidak didapatkan hubungan yang secara statistik signifikan. Lokasi batu memegang peranan penting pada kejadian bebas batu pasien dengan batu saluran kemih yang mendapatkan terapi ESWL.* ***Simpulan:*** *Keberhasilan terapi ESWL pada penanganan pasien dengan batu ginjal tidak hanya ditentukan oleh ukuran dan lokasi batu, tetapi juga ditentukan oleh jumlah batu, komposisi batu, frekuensi ESWL yang digunakan, dan ketebalan kulit pasien.*

Kata kunci: *Saluran kemih, batu saluran kemih, terapi ESWL.*

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INTRODUCTION

Urinary stone by definition is condition where is stone in the urinary tract. The location could be in kidney, ureter, bladder, or urethra. The prevalence of renal stone is between 1-15%, however it is varied between age, gender, race, and geographical location. Extracorporeal Shock Wave Lithotripsy (ESWL) is one of the modalities to fragment the urinary stone using shock wave produced by the machine. There are many factors related to successful rate of ESWL such as stone size, stone location, stone composition, and many others.

OBJECTIVE

This study aims to evaluate the relationship between stone location and stone location in kidney

stone to the stone-free rate after ESWL procedure.

MATERIAL & METHODS

This study was non-experimental descriptive analytic study using retrospective secondary data from database from January 2011 to December 2013. All patients in this study were all patient who performed ESWL procedure in all urinary stone cases. This study was held in Department of Surgery, Division of Urology, RSUP H. Adam Malik, Medan. Patients' medical record were pooled and recorded. The data were recorded in SPSS ver. 18 and the correlation between location of stone and stone size to stone-free rate were analyzed using Chi-square.

RESULTS

There were 318 patients diagnosed with urinary stone who underwent ESWL procedure in RSUP H. Adam Malik from January 2011 to December 2013. There were 178 (56%) male patients and 140 (44%) female patients. Patients' average age was 48 years old with range from 15-77 years old. Others patients' characteristics are described in table 1.

The most common location of urinary stone in patient underwent ESWL were in pyelum (33.6%), inferior calyx (25.8%), medial calyx (17.3%), and followed by superior calyx (6%). The mean stone size was 12 mm with the biggest size was 26 mm and the smallest one was 4 mm. The biggest average size was located in the pyelum with the size of 16 mm and range from 5-26 mm. The stones which were located in the superior calyx, media calyx, and inferior calyx were have similar size, 10 mm, 11 mm, 11 mm, respectively.

Double J Stent (DJ Stent) was placed in 96 (30.2%) patients. Around 281 (88.36%) patient were stone-free after the first ESWL, followed by 26 (8.18%) and 9 (2.83%) patients after second and third ESWL, respectively. However, there were 2 (0.63%) patients need to underwent the fourth ESWL procedure. The mean frequencies of ESWL shock-wave given in each procedure were 4000 times for all location of stone disease (Table 2).

In general, in the first ESWL the stone-free rate was around 75.2% and significantly increased to 94% and 99.4% in the 2nd and 3rd ESWL respectively. There were only 2 patients that needed the 4th ESWL procedure before reaching stone-free condition. In patients with pyelum stone, 60.7% patient reach stone-free condition after the 1st ESWL and increased to 88.8% and 98.1% after the 2nd and 3rd ESWL procedure respectively. There were 19 patients with calyx superior stone and all of them reached stone-free condition after the 1st ESWL. Patients with calyx media stone reached stone-free condition.

Patient with medial calyx stone got 85.5% stone free rate after first ESWL, with improvement of stone-free rate to 96.4% after the second ESWL. Only 2 patients with medial calyx stone underwent third ESWL before becoming stone free. Inferior calyx stone patients got 74.4% stone-free rate on first ESWL, with 95.4% over the second treatment. Only 4 patients underwent third procedure before deemed stone free (Table 3). This study shows that the relationship between stone size and stone-free rates is statistically not significant ($p=0.211$). In sub-analysis calculation regarding the stone location, there are no significant relationship between stone-size and stone location in pyelum, media calyx, and inferior calyx. This study also shows that there was a statistically significant relationship between stone location and stone-free rates ($p<0.001$). Stone-free rate from pyelum stone, media calyx, and inferior calyx were 60.7%, 85.5%, and 74.4%; while superior calyx stone receive 100% stone-free rate after ESWL.

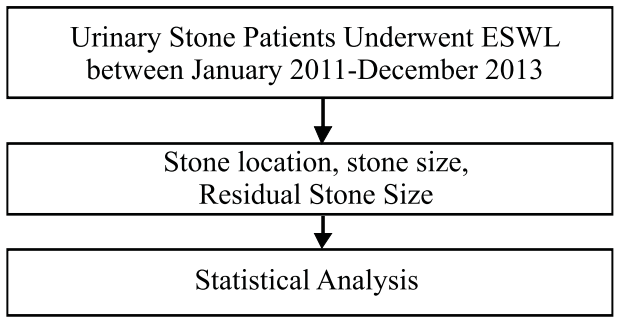

Figure 1. Method Flowchart.

Table 1. ESWL patients' characteristic.

Characteristics	n (%) Median (Minimum - Maximum)
Gender	
Male	178 (56)
Female	140 (44)
Age (years)	48 (15-77)
Stone location	
Pyelum	107 (33.6)
Superior calyx	19 (6)
Medial calyx	55 (17.3)
Inferior calyx	82 (25.8)
Stone size	12 (4-26) 12.96 ± 4.79
Pyelum	16 (5-26) 15.9 ± 5.0
Superior calyx	10 (5-20) 11.2 ± 3.9
Medial calyx	11 (5-22) 12.3 ± 4.8
Inferior calyx	11 (5-22) 12.3 ± 3.9
DJ stent	
Yes	96/318 (30.2)
No	222/318 (69.8)
Number of ESWL	
1	281 (88.36)
2	26 (8.18)
3	9 (2.83)
4	2 (0.63)
Number of shocks given in each procedure	
Pyelum	4000 (3000-4000)/4434 ± 714
Superior calyx	4000 (3000-5000)/4078 ± 534
Medial calyx	4000 (2000-5500)/3927 ± 612
Inferior calyx	4000 (3000-6000)/4219 ± 522
Proximal ureter	4000 (2500-6000)/4296 ± 798
Distal ureter	4500

Table 2. Stone free rate.

	1st ESWL	2nd ESWL	3rd ESWL	4th ESWL
Stone-Free Rate	239 (75.2)	299 (94)	316 (99.4)	318 (100)
Residual Stone	79 (24.8)	19 (6)	2 (0.6)	0
Pyelum Stones				
Stone-Free Rate	65/107 (60.7)	95/107 (88.8)	105/107 (98.1)	107/107 (100)
Residual Stone	42/107 (39.3)	12/107 (11.2)	2/107 (1.9)	0
Calyx Superior Stones				
Stone-Free Rate	19/19 (100)	-	-	-
Residual Stone	0	-	-	-
Calyx Media Stone				
Stone-Free Rate	47/55 (85.5)	53/55 (96.4)	55/55 (100)	-
Residual Stone	8/55 (14.5)	2/55 (3.6)	0	-
Stone Calyx Inferior				
Stone-Free Rate	61/82 (74.4)	78/82 (95.1)	82/82 (100)	-
Residual Stone	21/82 (25.6)	4/82 (4.9)	0	-

Table 3. The relationship between stone size and stone-free rate.

	Stone -Free Rates (n)	Residual Stone (n)	p - value
Stone Size			
<10 mm	65	14	0.211
10-20 mm	160	59	
>20 mm	13	6	
Pyelum Stone			
<10 mm	10	4	0.594
10-20 mm	44	32	
>20 mm	11	6	
Superior Calyx Stone			
<10 mm	3	0	-
10-20 mm	15	0	
>20 mm	0	0	
Medial Calyx Stone			
<10 mm	17	2	0.539
10-20 mm	30	6	
>20 mm	0	0	
Inferior Calyx Stone			
<10 mm	11	6	0.304
>10 mm	50	15	

Table 4. The relationship between stone location and stone-free rate

Stone Location	Stone Free (n)	Residual Stone (n)	Stone -Free Rate (%)	p - value
Pyelum	65	42	60.7	<0.001
Superior Calyx	19	0	100	
Medial Calyx	47	8	85.5	
Inferior Calyx	61	21	74.4	

DISCUSSION

Urinary stone disease is a common disease in urology. In 2014, the incidence rate of urinary stone in Korea was reported around 450 cases in 100.000 population.[1] In China, the incidence rate of urinary stone in 2013 was around 1 case in 25 people.[2] Taiwan has higher incidence rate of urinary stone in which in 2010 around 1.278 cases in 100.000 population.[3] However, unfortunately in Indonesia we don't have exact data about the incidence and prevalence of urinary stone. The incidence of urinary stone is more commonly occurred in male compared to female, 56% vs 48%. The ratio of urinary stone occurrence in male vs female is 1.27 : 1. Our study shows similar results with other study that shows male to female ratio of urinary stone occurrence are around 1.26-1.8.[1,2]

We found patients mean of ages with urinary lithiasis treated with ESWL is 48, vary from 15-77 years old, with most frequent cases between 40-60 years old in male or female.[1,2,4] Majority of stone located on pyelum (33.6%), with the rest are inferior (25.8%), media (17.3%), and superior calyx (6%). Other study also found similar result with majority of pyelum stone (32%), followed by inferior, media, and superior calyx stone (30%, 29%, and 9%).[4] Average stone size is 12.96 mm with SD 4.79 mm. Stone size in this study is not different from other studies that reported average stone size in patients underwent ESWL therapy is 11.6-12.24 mm.[5,6]

Stone free rate in patients underwent first ESWL is 75.2% and may reach up to 99.4% after the third ESWL. In this study the stone free rate after first ESWL is lower than previous study that reported a number of 79.3-88%.[4,6] Stone free rate after third

ESWL is not different with other study that reached 96.3%.6 Every patient with superior calyx stone is stone free after first ESWL. Most of patients with medial and inferior calyx stone are stone free after the second ESWL (96.4% and 95.1% respectively). There were only 2 patients with medial calyx stone and 4 patients with inferior calyx stone that need third ESWL. 98.1% patients with pyelum stone are stone free after third ESWL and 2 patients need to take the fourth ESWL. This is due to the average size of pyelum stone is relatively higher than in other locations. We found that if the size of the stone is the only factor that counts in patients with urinary tract stone who get ESWL therapy, then no association remained statistically significant. Location stone plays an important role in the incidence of stone-free patients with urinary tract stone underwent ESWL therapy. There is statistically significant relationship between the location of stone with stone-free numbers with $p<0.001$.

The weakness in this study is only use the size and location of the stone as a variable determining the stone free rate. The success of ESWL in the treatment of kidney stone are also determined by the amount of stone, stone composition, ESWL frequency.[7] Moreover, the distance between the skin and the stone also affected, which in obese patients who have skin thickness more than non-obese patients has a lower success rate or stone-free rate.[8]

CONCLUSION

There is no statistically significant between the size of the stone with stone-free rate in patients with kidney stone underwent ESWL. Location stone plays an important role in determining the prognosis of stone free which found a statistically significant relationship between the locations of stone with stone-free rate. The success of ESWL therapy in treatment of patients with kidney stone is not only determined by the size and location of stone, but is also determined by the amount of stone, stone composition, ESWL frequency used, and the thickness of the skin of the patient.

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