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Changes in Blood Pressure during Extracorporeal Shock Wave Lithotripsy (ESWL) on Nephrolithiasis Patients in H. Adam Malik Hospital, Medan, Indonesia.

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ABSTRACT

The aim of the study was to determine whether there is a change in blood pressure during Extracorporeal Shock Wave Lythotripsy (ESWL) on nephrolithiasis patients in RS Adam Malik Medan. The blood pressure of the patients was measured 5 times in every 15 minutes in 1 hour when ESWL was conducted. A total of 31 subject of the study, 71% subject were male, and found a relatively small decrease of average initial systolic blood pressure from 143±16,44 to 133,9±19,58 mmHg, as well as diastolic blood pressure that occurs a relatively small decrease of blood pressure from 92,71±10,72 to 90,48±9,92 mmHg. Based on the result it could be concluded that the use ESWL could be considered as therapy for nephrolithiasis with history of hypertension.

Keywords: Extracorporeal Shock Wave Lithotripsy (ESWL), systolic, diastolic, nephrolithiasis.

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INTRODUCTION

Extracorporeal Shock Wave Litotripsy (ESWL) is a method by which the stones in the urinary tract are broken down by the shock wave produced by the machine that carefully focused on the area with the use of ultrasound or x-ray imagine. The waves could through the tissues without causing permanent damage and could break the stone into sand or small pieces. This material will pass out in the urine [1]. Since its introduction in the 1980s, ESWL has become the most popular standard convenient non invasive procedures that used for treatment of renal and proximal ureteric calculi. Nowadays, lithotripters have been reduced in size but there is a decrease in power. Despite a decreased power delivery that often implies multiple session, the second and the third generation of ESWL do not require the use of anesthesia [2]. There are some contraindications for ESWL including uncontrolled uropesis, uncontrolled hypertension, distal obstruction for stone passage, cystine stone and vascular injury [3]. Hypertension is a manisfestation of hemodynamic cardiovascular system balance disorder which is the patophysiology is a multi factor, so it could not be explained with only one single mechanism. Initial reports about new onset hypertension following ESWL were all case analyses without control groups or were only compared to general population, and blood pressure measurements were not standardized. It was reported that nephrolithiasis increases the risk of subsequent hypertension. Therefore it is difficult to illustrate the relationship between ESWL and hypertension from case analysis studies [4]. In another study, Ng [5] reported that there are some controversy about the long term complications of ESWL, including increased incidence of new onset hypertension in the elderly. It is known that there a significant risk on an increase in blood pressure after treatment with ESWL. A large population-based studies show a correlation between hypertension and the formation of stones. Ratio hypertension treated with ESWL in the study was high and the control group compared with the general population. Exclude with patients with a previous history of hypertension, the occurring of incidence of hypertension was significantly higher in patients with ESWL. Renal parenchyme or vascular change associated with ESWL contribute to hypertension in ESWL group [6]. The mechanism of hypertension with ESWL is still controversy, therefore it is important to conduct a study to analyze the relationship of hypertension, the incidence of which occur as well as other complications that could be caused by the treatment with ESWL.

MATERIAL AND METHODS

Population and Samples

Population

The population study were all the nephrolithiasis patients which underwent treatment at the division of urologic surgery in Adam Malik hospital, Medan.

Samples

The samples in this study were the nephrolithiasis patients which treated with ESWL in Adam Malik hospital, Medan, who met the inclusion criteria. To determine the size of samples could be determined by the formula

$$n = [\frac{(z\alpha + z\beta).Sd}{d}]2$$

description :
n = size of samples
zα = type I error constant value (1,96)
zβ = type II error constant value (0,842)
Sd = standard deviation of the mean difference from literature (9,9)
d = minimal difference that is considered significant (5)
based on the formula the number of subject are 31 samples.

Inclusion and Exclusion Criteria

The inclusion criteria were all nephrolithiasis patients who underwent ESWL treatment, fully conscious patients, may follow orders, could communicate well with the doctor or nurse and willing to do

examination after filling informed consent. The exclusion criteria were all nephrolithiasis patients which included into absolute contraindications for ESWL such as pregnancy, obstruction under the location of stones,and urinary tract infections that are not controlled.

Procedures

Before the treatment,the patients are given ketoprofen 100 mg suppository. ESWL machine used in this study was Richard Wolf (Germany) and has been operated for 10 years. Blood pressure measurement was conducted prior to ESWL, then measuring in every 15 minutes for 1 hour during progress of ESWL.

Statistical Analysis

Changes in blood pressure during ESWL will be recorded and then analyzed by Analysis of Variance (ANOVA). If the result obtained by the difference between normal distribution, used repeated ANOVA with *post hoc* Bonferroni . If the distribution difference is not normal, used transformation and Friedman test was conducted with *post hoc* Wilcoxon.

RESULT AND DISCUSSION

Characteristic of Subject

The characteristic of subject described in Table 1 below.

Table 1. Characteristic of subject based on age and sex.

Age group (years old)	Frequency	%
20-30	1	3,2
31-40	6	19,4
41-50	13	41,9
51-65	11	35,5
Sex		
Male	22	71,0
Female	9	29,0
Total	31	100,0

Based on the table it can be determined that majority of the subject were at age group 41-50 years old (41,9), followed by the age group 51-60 years old (35,5%) and the lowest are in the age group 20-30 years old (3,2%).

Changes in Systolic Blood Pressure

The mean value of changes in systolic blood pressure in initial and every 15 minutes are showed in Table 2.

Table 2. Mean value of changes in systolic blood pressure in interval 15 minutes.

Time (minutes)	N	Minimum (mmHg)	Maximum (mmHg)	Mean (mmHg)	SD
Initial	31	100	159	143,00	16,438
15	31	100	173	137,71	16,941
30	31	100	178	136,71	16,989
45	31	99	181	137,32	18,267
60	31	78	165	133,90	19,580

Based on the table above it could be known that there are changes in the average of systolic blood pressure after 15 minutes to 60 minutes after the treatment with ESWL, the reduction of systolic blood pressure occur most common in the first 15 minutes. The changes in mean systolic blood pressure in every 15 minutes interval are shown in Table 3.

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Table 3. Systolic blood pressure changes in interval 15 minutes.

	N	%	Minimun	Maximum	Mean	SD
After 15 minutes						
Constant	**3**	**10**				
Decreased	**19**	**61**	**1**	**29**	**11,42**	**7,089**
Increased	**9**	**29**	**2**	**14**	**5,89**	**4,676**
After 30 minutes						
Constant	**4**	**13**				
Decreased	**17**	**55**	**1**	**12**	**6,18**	**4,319**
Increased	**10**	**32**	**1**	**22**	**7,40**	**6,240**
After 45 minutes						
Constant	**5**	**16**				
Decreased	**12**	**39**	**1**	**14**	**4,75**	**4,309**
Increased	**14**	**45**	**1**	**16**	**5,43**	**4,090**
After 60 minutes						
Constant	**4**	**13**				
Decreased	**15**	**48**	**1**	**80**	**10,00**	**19,996**
Increased	**12**	**39**	**1**	**10**	**3,67**	**2,741**

Based on the statistical t test showed that there significant difference of systolic blood pressure after treatment with ESWL (p<0,05). The result described in Table 4.

Table 4. the mean difference in changes of blood pressure inter temporal after 15 minutes.

Measurement time of systolic blood pressure	Pair differences					t	df	Sig (2-tailed)
	Mean	SD	Std Error Mean	95% confidence interval of the difference				
				Lower	Upper			
Pair 1 15'-30'	**1.000**	**7.776**	**1.397**	**-1.852**	**3.852**	**.716**	**30**	**.480**
Pair 2 30'-45'	**-.613**	**6.037**	**1.084**	**-2,827**	**1.601**	**-.565**	**30**	**.576**
Pair 3 45'-60'	**3.419**	**15.253**	**2.740**	**-2.175**	**9.014**	**1.248**	**30**	**.222**

Changes in Diastolic Blood Pressure

The mean value of change in diastolic blood pressure in initial and every 15 minutes are showed in Table 5.

Table 5. Mean value of changes in diastolic blood pressure in interval 15 minutes.

Diastolic blood pressure	N	Minimum(mmHg)	Maximum (mmHg)	Mean (mmHg)	SD
Initial	**31**	**74**	**113**	**92,71**	**10,715**
15'	**31**	**60**	**108**	**88,97**	**10,245**
30'	**31**	**60**	**103**	**86,81**	**10,193**
45'	**31**	**65**	**105**	**89,71**	**10,587**
60'	**31**	**66**	**104**	**90,48**	**9,916**

Table 5 showed that there is a decline in diastolic blood pressure in the first 15 minutes to 60 minutes, from 92,71±10,71 mmHg to 90,48±9,92mmHg. The changes in mean diastolic blood pressure in every 15 minutes interval are shown in Table 6.

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Table 6. The changes in mean diastolic blood pressure in every 15 minutes interval.

	N	%	Minimum	Maximum	Mean	SD
After 15 minutes						
Constant						
Decreased	**8**	**25,8**				
increased	**19**	**61,3**	**2**	**16**	**7,00**	**4,028**
	4	**16,1**	**1**	**10**	**4,25**	**4,031**
After 30 minutes						
Constant						
Decreased	**5**	**16,1**				
Increased	**19**	**61,3**	**1**	**19**	**5,37**	**4,126**
	7	**22,6**	**1**	**14**	**5,00**	**4,619**
After 45 minutes						
Constant						
Decreased	**5**	**16,1**				
Increased	**7**	**22,6**	**1**	**4**	**2,57**	**1,134**
	19	**61,3**	**1**	**20**	**5,68**	**5,323**
After 60 minutes						
Constant						
Decreased	**6**	**19,4**				
Increased	**7**	**22,6**	**1**	**13**	**5,00**	**4,619**
	18	**58,1**	**1**	**11**	**3,72**	**2,630**

The Table 6 described that the diastolic blood pressure after the first and second15 minutes experienced the greatest reduction in percentage, 61,3%, while in the third and the fourth 15 later minutes later the diastolic blood pressure increased as much as 61,3% and 58,1% respectively. The changes of initial diastolic blood pressure and the next 15 minutes described in Table 7.

Table 7. The changes of blood pressure between initial diastolic blood pressure and next 15 minutes after ESWL treatment.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	**554,129**	**3**	**184,710**	**1,696**	**,172**
Within Groups	**13072,581**	**120**	**108,938**		
Total	**13626,710**	**123**			

From the table above, by ANOVA test it can be seen that there was no significant difference (p>0,05) between the decreases and increases in diastolic blood pressure after 15, 30, 45 and 60 minutes ESWL treatment. The issue regarding hypertension after ESWL still remains controversial. Sato et al [7] reported that just only one prospective study that indicates the occurrence of hypertension. The study dose not provide accurate results on the development of hypertension. Turk et al [8] reported that fluctuations in blood pressure when the patient is given ESWL action is influenced by many factors such as the ability of lithotripter, size, location (ureter, pelvis and calyx), composition (hardness) of the stone, habits of the patient and the implementation of ESWL itself. Sato et al [7] reported that the metabolic aspects, the condition of the stones itself, the damage of renal tissue due to ESWL treatment as well as pain and anxiety are considered responsible for the increase in blood pressure during ESWL treatment. Aghaways et al [9] in their study reported that only 7,9% of patients who treated with ESWL developed hypertension and this relation proved to be insignificantly (p>0,05). Morris et al [10] reported that increasing the provision of the shock waves from 1.000 to 2.000 times may increase the anxiety of patients from 1,4% to 12,8%, so it can be considered as a cause of the increasing of blood pressure. Janetschek et al [11] reported that the stiffness of renal capsule increase with the increasing of age thus providing a high intrarenal pressure and extensive renal parenchyma edem that may affect blood pressure. Lingeman et al [12] suggesting that the decreased or increasing of diastolic blood pressure on ESWL patients may be occurring in parallel : (1) Stone burden in the kidney with its associated obstructive effects may be associated with increased blood pressure which is relieved following

removal of the stone, causing a subsequent decline in blood pressure, (2) exposure of the kidney to shock waves with its associated renal trauma may simultaneously bring a subsequent rise in blood pressure following treatment.

CONCLUSION

The use of ESWL can be considered as one of non invasive treatment for nephrolithiasis patients with a history of hypertension but required a clear informed consent.

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