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ORIGINAL ARTICLE

Success of Extracorporeal Shockwave Lithotripsy (ESWL) in Relation to Triple D Score

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ABSTRACT

Aim: To determine the frequency of success of ESWL in patients with renal stones and to compare the success of ESWL with different Triple D scores in the same group of patients.
Methodology: Descriptive study in the Department of Urology, Sindh Institute of Urology and Transplantation Hospital, Karachi from 29thOctober 2020 to 28th April 2020.
One hundred and fifteen patients with renal stone seen as radio opaque shadow on X rays KUB were included. CT was performed and stone diameters were measured. Quadruple D-score was defied because stone location is combined with TrD-S ranging from 0 (worst) to 3 (best) points. KUB was used for evaluation of stone free status after 4-weeks of ESWL sessions. Patient can be regarded stone free if complete stone was removed.
Results: The mean age was 48.99±10.67 years, the mean size of the stone was 12.99±3.54mm, and the mean triple D score was 1.70±1.00. There were 75(65.22%) males and 40(34.78%) female patients. The success of ESWL was found in 79(68.70%) patients. On comparison of success of ESWL with triple D score, success of ESWL was found in 04(26.7%) having 0 score, in 19(54.3%) having 01 score, in 27(77.1%) having 02 score, and in 29 (96.7%) having 03 score (P<0.001).
Conclusion: The triple D score appears to be a useful predictor of ESWL treatment outcomes. Using the Triple D score may improve the cost-effectiveness of ESWL by limiting its use to patients likely to have favourable outcomes.
Key Words: Extracorporeal shockwave lithotripsy (ESWL), Triple D score, Renal stone

INTRODUCTION

Technological advancements have led to the development of various advanced surgical procedures for renal stone removal, including percutaneous nephrolithotomy (PCNL) and ureteroscopy (URS). Extracorporeal shockwave lithotripsy (ESWL) used to be a first-line treatment for kidney stone removal in the past[1,2]. According to recent studies, ESWL is still the primary procedure for the removal of stones <20mm. Several factors should be taken into consideration for estimating the success rate of stone removal with ESWL, including stone size and location, stone composition[3-6]. skin-to-stone distance, lower pole anatomy of the kidney, attenuation values on computed tomography[7,8,9], shockwave delivery frequency, and obesity/body mass index[10,11].

Although a few parameters are still being used for ESWL outcome prediction, no such model exactly explains the best prediction due to complexity or heterogeneous recommendations[12-15]. Inconsistency and variations in current guidelines lead to confusion among surgeons regarding treatment modalities, especially for stones of size 10–20mm[16,17]. Recently, a simpler nomogram was introduced by Tran et al[14], which relies on three simple parameters such as skin-to-stone distance, stone volume, and stone density for SWL screening patients.

Several studies have reported its practical utility and clinical usefulness[18,19]. A higher area under the curve was reported, which shows successful prediction outcomes for SWL therapy in stone removal. The European Association of Urology guidelines on urolithiasis generally recommend this procedure for kidney stone removal, especially of size ≤10 mm, as a first-line therapy. TrD-S relevance has not been evaluated up until now for 10–20 mm renal stones[14,18,19].

Two hundred thirty-five patients underwent SWL. Of these, 140/235 (59.5%) were stone-free. A triple D score of 0, 1, 2, and 3 correlated with SWL success rates of 21.4%, 41.3%, 78.7%, and 96.1%, respectively[14].

Therefore, the present study was designed to evaluate the success rate of ESWL combined with a triple D-score, and if the success rate of ESWL is found to be high, further studies will be recommended to assess its diagnostic accuracy in predicting the success of ESWL. That will help the clinician counsel the patient and perform the procedure with confidence.

The triple D score is a useful predictor of SWL treatment outcomes, allowing for easy integration of CT imaging parameters into treatment planning and potentially improving SWL cost effectiveness.

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MATERIALS AND METHODS

This descriptive study was conducted at the Department of Urology, SUIT Hospital, Karachi, from October 29th, 2020, to April 28th, 2020 after IRB permission and 115 patients with renal stones were enrolled. All patients aged 30-70 years, either gender, with renal stones seen as a radioactive opaque shadow on X-rays (KUB), untreated before, and having a size greater than 4mm to 20mm, were included. Patients with partial Staghorn calculi, clyceal diverticular stones, horseshoe kidneys, ureteral strictures, and bed-ridden status were excluded.

The history was taken, along with baseline demographics like age, residence, educational status, employment status, family monthly income, history of hypertension, T2 diabetes mellitus, and cerebrovascular accident (confirmed on medical records possessed by the patient). Height was measured by a stadiometer without shoes and a hat at the nearest 0.1cm, and weight was measured on a bathroom scale at the nearest 0.1kg in light clothes without shoes. BMI was calculated by the formula weight in kg divided by height in metres squared. CT was performed, and stone diameters were assessed. The stone volume was also calculated using the standard formula. Skin-to-stone distance was measured through CT at 0°, 45°, and 90°, and stone density was measured in Hounsfild units (HU). The TrD-Score-Scorealculated by adding the number of components and comparing it with their cutoffs. The cut-off value for SV is taken as <150 mm3, <12cm for skin-to-stone distance, and <600 HU for stone density[20].

TrD-score was used in combination with stone location. Triple and quadruple scores were used in a range of 0 for worst and 3 for best in the case of triple, whereas 0 for worst and 4 for best were used for quadruple scores. Three maximum sessions of frequency 60 shocks/min were used in the procedure, and energy level 1 was then increased to energy level 4. Frequency was also slowly increased to 90, depending on the tolerance of patients.

Every session contains 2000–2500 shocks. Stone-free status was assessed with KUB after 4 weeks of the last session. The above information was noted on the proforma. Data was entered and analysed on SPSS version 17.

RESULTS

There were more male patients as compared to females. There were 75(65.22%) males and 40(34.78%) female patients. Hypertension was diagnosed in 47(40.87%) patients, type 2 diabetes mellitus was diagnosed in 36(31.30%) patients, and CVA was diagnosed in 9(7.83%) patients. There were 53(46.09%) from rural areas and 62(53.91%) from urban areas. On the frequency of employment status, 40(37.78%) were employed, 59(51.30%) patients were unemployed, and 16(13.91%) were retired from jobs. On the frequency of educational status, there were 14(12.17%) illiterate patients, 42(36.52%) having primary education, 40(34.78%) having secondary education, and 19(16.52%) having ≥matriculation education. There were 57(49.57%) patients from the lower class, 30(26.09%) from the middle class and 28(24.35%) from the upper middle class. Success of ESWL was found in 79(68.70%) patients, and it was not found in 36(31.30%) patients (Table 1).

The mean age of patients was 48.99±10.67 years, the mean height was 164.21±9.39 cm, the mean weight was 67.32±10.66 kg, the mean body mass index (BMI) was 24.94±3.36kg/m2, the mean size of the stone was 12.99±3.54mm, and the mean triple D score was 1.70±1.00 (Table 2).

Table 1: Demographic information of the patients (n=115)

Variable	No.	%
Gender		
Male	75	65.22
Female	40	34.78
Hypertension		
Yes	47	40.87
No	68	59.13
Type 2 diabetes mellitus		
Yes	36	31.30
No	79	68.70
Cerebrovascular accident		
Yes	9	7.83
No	106	92.17
Residential status		
Rural	53	46.09
Urban	62	53.91
Employment status		
Employed	40	34.78
Unemployed	59	51.30
Retired	16	13.91
Educational status		
Illiterate	14	12.17
Primary	42	36.52
Secondary	40	34.78
≥ Matric	19	16.52
Economic status		
Lower class	57	49.57
Middle class	30	26.09
Upper middle class	28	24.35
Success of ESWL		
Yes	79	68.70
No	36	31.30

Table 2: Descriptive statistics of the patients (n=115)

Variable	Mean±SD
Age (years)	48.99±10.67
Height (cm)	164.21±9.39
Weight (kg)	67.32±10.66
Body mass index (kg/m^2)	24.94±3.36
Size of stone	12.99±3.54
Triple D score	1.70±1.00

On comparison of success of ESWL with triple D score, success of ESWL was found in 04(26.7%) with 0 triple D score, in 19(54.3%) with 01 triple D score, in 27(77.1%) with 02 triple D score, and in 29 (96.7%) with 03 triple D score. The association between the success of ESWL and the triple D score was documented with a p-value of <0.001 (Table 3).

Table 3: Comparison of success of ESWL with triple D score(n=115)

Triple D Score	Success of ESWL		P value
	Yes	No	
0	4 (5.1%)	11 (30.06%)	<0.001
01	19 (24.10%)	16 (44.40%)	
02	27 (34.20%)	8 (22.20%)	
03	29 (36.70%)	1 (2.80%)	

DISCUSSION

Advances in clinical sciences have played a tremendously important role in the health, well-being, and quality of life of patients. In spite of the important role of SWL in renal stone management, various other minimally invasive techniques have usurped SWL in recent years. Although a higher success rate and fewer complications are associated with new technologies, several studies have highlighted the importance of SWL in smaller-size stone removal[20,21,22]. A higher success rate is also associated with SWL; therefore, it makes the decision difficult for both health care professionals and patients to opt for the best treatment option.

To predict the best treatment procedure for renal stone removal, nomograms were developed for evaluating postprocedural outcomes. Numerous benefits are also associated with the use of nomograms, particularly to prevent delays in definitive treatment, lower the economic burden, and minimise treatment-induced kidney damage. Though important parameters were included in these nomograms, they are not widely accepted due to their complex and impractical nature. This problem is resolved with triple-D because it uses only three parameters that are routinely used in CT and thus facilitates the use of a nomogram[23].

There are still no reliable methods to calculate stone burden. It is generally estimated by measuring stone surface area or length; however, it is not proven beneficial because most ureteral and renal stones are irregular in shape with complex geometric properties. Studies prove there is no significant relation between stone length and SWL success rate[24]. Similarly, another study claimed that stone volume is a predictive factor for stone removal after SWL[25]. Before the use of triple D, other nomograms were also made and used for SWL prediction, but they were not based on scoring systems. Other nomograms highlighted the importance of various factors, including stone number, location, size, patients' age, and skin-to-stone distance, for SWL success[26]. Triple-D appeared to be the first scoring system to be used for the adult population for SWL success prediction[27,28].

CONCLUSION

The triple D score appears to be a useful predictor of SWL treatment outcomes. Inclusion of the triple D score in radiology reports will offer a readily accessible means to integrate predictive parameters from CT imaging into treatment planning. Using the triple D score may improve the cost effectiveness of SWL by limiting its use only to patients likely to have favourable outcomes.

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1. Conception and design of or acquisition of data or analysis and interpretation of data.
2. Drafting the manuscript or revising it critically for important intellectual content.
3. Final approval of the version for publication.

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