

Comparative Analysis of Shock Wave Therapy Success Rate in Management of Renal Stones and Patient Anxiety

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ABSTRACT

Objective: The purpose of this study was to evaluate the success rate of shock wave lithotripsy (SWL) and possible effects on the anxiety status of patients.

Methods: Anxiety status of 128 patients was evaluated using State and Trait Anxiety Inventory (STAI) scale. Three groups were created depending on stone condition: Group 1, completely stone-free; Group 2, asymptomatic residual fragments; and Group 3, fragments requiring additional procedures. Anxiety was evaluated comparatively according to analgesic need and emergency department referrals.

Results: Mean score in all 3 groups 1 month after treatment showed significant decrease; however, this decrease was smaller in Group 3 than the other 2 groups. Pairwise evaluation of mean STAI scores revealed significant difference between Group 3 and other groups. Similarly, analgesic need and emergency department referral rate were higher in Group 3.

Conclusion: Residual fragments after SWL procedure may affect the anxiety status of the treated patients due to both symptoms they experience and need for additional procedures. We believe that detailed information should be provided to patients with respect to procedure, possible complications, and potential need for additional treatment.

INTRODUCTION

Urinary system stone disease is a very common problem in developing countries. In Turkey, prevalence has been reported as 14.8%.^[1] Minimally invasive treatment methods have become an important treatment option. Among these methods is extracorporeal shock wave lithotripsy (SWL), which has been widely used since the 1980s. The introduction of SWL revolutionized the treatment of urinary stone disease and was preferred method of treatment for majority of patients with urinary stones between 1980 and 2000. In recent years, with the contribution and impetus of technological developments, endourological methods have gained an important place in the treatment of stone disease; however, SWL is still important. It is often preferred by both physicians and patients as it is less invasive, does not require general anesthesia, is more cost-effective, and has lower rate of serious complications than other methods.

Nonetheless, pain felt during SWL procedure and subsequent urinary symptoms experienced during the course of passing fragments may create distress in these patients.^[2] It is obvious that the stress caused by these discomforts could lead to psychological problems such as worry and depression.^[3] Difficult developments may create anxiety in these patients, negatively affecting their motivation, work performance, and overall quality of life.

There are studies in the literature evaluating anxiety in stone patients treated with SWL. It has been reported that patients may develop anxiety as a result of high-energy shock waves affecting cutaneous pain receptors, pain occurring due to increased intrapelvic pressure and renal capsule tension, and because of the sound the device emits during procedure.^[4-8] Studies have reported correlations between anxiety and type of lithotripter, frequency used, and voltage intensity. In addition, several factors related to the patients themselves and the environment have

been found to be associated with anxiety.^[9] However, studies investigating the relationship between treatment outcome defined as stone-free and patient anxiety are scarce in the literature. Our opinion in this regard is that urinary system symptoms due to obstructions that may develop during passage of fragments after SWL and any additional procedures required could affect patient quality of life and cause anxiety.

In this study, the SWL success rate of achieving stone-free status and possible effects of this parameter on anxiety in patients treated with this method were investigated.

MATERIAL AND METHODS

A total of 128 patients aged over 18 years who were treated with SWL due to kidney stone for the first time between December 2012 and May 2014 were included in this prospectively designed study. Stones were renal pelvis-localized, single, radiopaque stones smaller than 2 cm in size. After receiving approval from the ethics committee of Dr. Lutfi Kirdar Research and Training Hospital, patients were informed about the study in detail, and written, informed consent forms were obtained. First assessment of the patients included detailed medical history and physical examination. Thorough evaluation, with laboratory (renal function tests, complete urine analysis, and urine culture) and radiological (direct urinary system graphy and urinary system ultrasonography) analyses, was conducted for all patients.

Patients with conditions that might be contraindications for SWL procedure, such as acute urinary system infection, urogenital system tumor, previous surgical history of urinary system, neurogenic bladder, urethral stricture, bladder stone, overactive bladder, chronic prostatitis, and benign prostatic hyperplasia, were excluded from the study.

SWL procedure was performed using electromagnetic lithotripter (Dornier Compact Sigma; Dornier MedTech, Munich, Germany). Pain control was achieved in all patients with nonsteroidal anti-inflammatory analgesia (diclofenac sodium, 1 mg/kg, intramuscularly) 45 minutes before the procedure. Maximum 3000 shock waves and 120 kV energy were used in each session. After 3 sessions performed with 1-week intervals, patients with stones that could not be fragmented were excluded from the study. Direct urinary system graphy and urinary system ultrasonography examinations were conducted 1 week and then 1 month after final procedure.

At the end of first month, number of emergency department referrals and need for analgesic agent (diclofenac sodium/mg), as well as the level of general and procedure-related anxiety were evaluated. Anxiety was assessed using the State and Trait Anxiety Inventory (STAI) test.

STAI test was administered to all patients before initiation of treatment, and 1 week and 1 month after procedures were performed. Both trait anxiety (STAI-TA) and state anxiety (STAI-SA) subscales of STAI were used before procedure, while only STAI-SA was administered afterwards. First month evaluation was conducted following any additional procedure required.

Turkish validation of STAI was performed by Öner et al. and the test has been used in clinical practice.^[10] STAI-SA subscale analyzes current state of anxiety and STAI-TA evaluates more enduring anxiety.^[11] STAI form consists of total of 40 questions, with 20 measuring each type of anxiety. Total score of 2 subscales ranges between 20 and 80 points and higher score indicates greater level of anxiety.

At the end of the first month, patients were evaluated and divided into 3 groups: Group 1, patients who were completely stone-free; Group 2, patients with asymptomatic residual fragments <4 mm; and Group 3, patients with fragments >4mm who required additional procedures.

Data obtained in this study were statistically analyzed utilizing Number Cruncher Statistical System (NCSS) 2007 and Power Analysis and Sample Size (PASS) 2008 statistical Software (NCSS, LLC, Kayesville, UT, USA). In addition to descriptive statistics (mean, standard deviation, median, frequency, and percentage), comparison of quantitative data was performed using repeated measure design and one-way analysis of variance for mean values of more than 2 groups. Comparison of qualitative data was conducted with Pearson's chi-square test, and post hoc evaluations were performed using Tukey's honest significant difference test. The results were evaluated with 95% confidence interval and statistical significance level of $p < 0.05$.

RESULTS

Mean age of study patients was as 42.2 ± 6.22 years and mean stone size was 15.8 ± 10.87 mm. Demographic details and mean stone size in the 3 groups are provided in Table 1. At conclusion of first month following SWL procedures, 75 (58.8%) of 128 patients were completely stone-free, while asymptomatic residual fragments <4 mm were observed in 38 (29.7%), and symptomatic residual fragments requiring additional procedures were found in the remaining 15 (11.7%) patients. Double-J (DJ) stent was used in 9 patients for subsequent procedure, and ureterorenoscopic lithotripsy in 6.

Anxiety evaluation revealed mean STAI-SA score of 44.27 ± 11.13 before procedure, 37.87 ± 10.45 one week after procedure, and 22.00 ± 4.08 one month afterwards in Group 1 and mean STAI-TA score of 34.76 ± 10.23 before procedure in the same group. Mean STAI-SA score was 45.32 ± 12.75 , 39.28 ± 10.65 , and 21.74 ± 3.98 at respective intervals in Group 2, while STAI-TA score was 34.76 ± 10.23

Table 1. Characteristics of the patients and stones

Group	Group 1		Group 2			Group 3		p		
	n	%	Mean±SD	n	%	Mean±SD	n		%	Mean±SD
Patients	75	58.6		38	29.7		15	11.7		–
Gender										
Female	30	40		17	45		6	40		^a 1.000
Male	45	60		21	55		9	60		
Mean age (years)			42.4±6.71			43.0±5.41			41.2±6.54	^b 0.743
Mean stone size (mm)			13.9±11.12			14.8±11.08			18.7±10.42	–

^aPearson's chi-square test; ^bOne-way analysis of variance. ^{*}p<0.05; ^{**}p<0.01.

Group 1: Stone-free; Group 2: Asymptomatic residual fragments <4 mm; Group 3: Symptomatic residual fragments requiring additional procedures.

Table 2. Change in STAI score and comparison between groups

Group	Group 1 (n=75)	Group 2 (n=38)	Group 3 (n=15)	p
	Mean±SD	Mean±SD	Mean±SD	
STAI-SA				
Before procedures	44.27±11.13	45.32±12.75	48.52±15.82	^b 0.134
1 week after procedures	37.87±10.45	39.28±10.65	40.37±14.28	^b 0.247
1 month after procedures	22.00±4.08	21.74±3.98	30.00±7.45	^b 0.001 ^{**}
p ^a	^a 0.001 ^{**}	^a 0.001 ^{**}	^a 0.001 ^{**}	
STAI-TA				
Before procedures	34.76±10.23	33.31±11.24	35.17±12.25	^b 0.879

^aRepeated measures test; ^bOne-way analysis of variance. ^{*}p<0.05; ^{**}p<0.01.

Group 1: Stone-free; Group 2: Asymptomatic residual fragments <4 mm; Group 3: Symptomatic residual fragments requiring additional procedures.

STAI-SA: State and Trait Anxiety Inventory-State Anxiety, current state of anxiety; STAI-TA: State and Trait Anxiety Inventory-Trait Anxiety, continuing anxiety.

Table 3. Binary comparison of STAI-SA scores between groups

STAI-SA	Comparison between groups		
	Group 1 & Group 2 (n=75)	Group 1 & Group 3 (n=38)	Group 2 & Group 3 (n=15)
Before procedures	0.658	0.102	0.227
1 week after procedures	0.706	0.181	0.197
1 month after procedures	0.887	0.003 ^{**}	0.002 ^{**}

STAI-SA: State and Trait Anxiety Inventory-State Anxiety, current state of anxiety

Tukey's honest significant difference test ^{*}p<0.05; ^{**}p<0.01.

Group 1: Stone-free; Group 2: Asymptomatic residual fragments <4 mm; Group 3: Symptomatic residual fragments requiring additional procedures.

before procedure in this group. In Group 3, respective mean STAI-SA score was 48.52±15.82, 40.37±14.28, and 30.00±7.45, and STAI-TA score was 35.17±12.25 before procedure. Mean STAI-SA scores evaluated after 1 month indicated statistically significant decrease in all 3 groups (p=0.001); however, this decrease was smaller in Group 3 compared with other groups (p=0.001) (Table 2). STAI-TA

scores evaluated after 1 month were similar in all groups and difference was not statistically significant (p=0.879) (Table 2).

Intra-group comparisons also revealed no significant difference between mean STAI-SA scores before and 1 month after procedures (Table 3), while a difference was observed at first month in STAI-SA scores, which was attributed

Table 4. Comparison of analgesic requirement and emergency department visits

Group	Group 1 (n=75) n (%)	Group 2 (n=38) n (%)	Group 3 (n=15) n (%)	p
Mean number of ED visits				
No	71 (94.6)	27 (81.6)	7 (46.6)	^a p=0.001
Yes	4 (5.4)	7 (18.4)	8 (53.4)	
Mean quantity of analgesic required (mg)	Mean±SD 85.00±0.57	Mean±SD 150.00±1.04	Mean±SD 265.75±3.57	^b p ¹⁻²⁻³ =0.002 ^c p ¹⁻² =0.056 ^c p ¹⁻³ =0.006 ^c p ²⁻³ =0.015

ED: Emergency department. ^aPearson's chi-square test; ^bOne-way analysis of variance; ^cPost hoc test: Tukey's honest significant difference test ^{*}p<0.05, ^{**}p<0.01. Group 1: Stone-free; Group 2: Asymptomatic residual fragments <4 mm; Group 3: Symptomatic residual fragments requiring additional procedures.

to high scores of patients requiring additional procedures compared with the patients in Groups 1 and 2, and this difference was statistically significant ($p=0.003$; $p=0.002$) (Table 3).

Finally, when the groups were compared in terms of use of analgesic agent due to pain developing after procedures, which we believe to be closely associated with anxiety status, need for analgesics was greater in patients in Group 3 than in Groups 1 and 2, and the difference was statistically significant ($b_{p1-2-3}=0.002$; $c_{p1-2}=0.056$; $c_{p1-3}=0.006$; $c_{p2-3}=0.015$). Similarly, number of referrals to emergency department was also greater in Group 3 (53.4%) than in Group 1 (5.4%) and Group 2 (18.4%), and the difference was statistically significant ($p=0.002$) (Table 4).

DISCUSSION

The introduction of SWL to treatment of urinary system stone disease in the 1980s was one of the most important developments in the area of urology. Use has become widespread all over the world; this technique filled an important gap in the treatment of urinary system stone disease.^[12,13]

Numerous studies have shown that SWL is a reliable and effective method of stone fragmentation. However, rate of success achieved varies. Therefore, psychological concerns, such as anxiety and depression, may develop in a substantial portion of patients due to pain, obstruction, emergency department referrals, and the need for additional procedures as result of residual fragments.^[2,3] All of these factors may have significant negative impact on psychological status of the patient and increase anxiety, which may affect work performance and overall quality of life.

In recent years, changes to patient quality of life as result of treatment interventions have become a frequently emphasized and interesting subject in urology practice. In

this respect, the relationship between SWL procedure and quality of life has been investigated in several studies.^[3,14-16] Conclusion drawn from these studies may be summarized as physicians responsible for treatment of stones in the urinary system should not focus only on the rate of stone-free status obtained, and should also take into account possible affect on patients' social and economic status and their quality of life of the treatment administered. More invasive procedures performed following initial procedure in order to increase the rate of stone-free success may negatively affect patients' quality of life and cause increased anxiety.

Anxiety created by endourological procedures is an insufficiently emphasized issue. Studies in the literature on this topic are limited.^[17,18] Brown et al. stated in their study that anxiety symptoms of patients decreased after surgical procedure for kidney stone.^[17]

Published studies in the literature addressing association of treatment success rate of SWL and additional procedures that may be subsequently required and anxiety are scarce. The present study is first in this respect. According to data obtained in our study, in-group score comparison showed significant decrease in all groups, though decrease was smaller in Group 3, which underwent additional procedures after SWL. Evaluation of mean STAI-SA score in pairwise comparison at the first month after procedures showed statistically significant difference between Group 3 and other groups.

Comparison of the groups in terms of the amount of analgesics required revealed that patients in Group 3 needed more analgesics compared to Groups 1 and 2, and patients in Group 3 also presented at emergency department more frequently. Rate of emergency department visits was 53.4% in Group 3, 5.4% in Group 1, and 18.4% in Group 2. Colic pain and urinary system symptoms that may occur in patients treated with SWL, as well as other factors,

such as insomnia, may contribute. However, anxiety scores improved in the first month in patients, with exception of those who underwent additional procedures, suggesting that anxiety was temporary. Higher anxiety score at first month in Group 3, which underwent DJ stent and endoscopic stone treatment, could be associated with the additional procedures performed rather than SWL.

Stone fragments that may occur following SWL treatment may cause anxiety symptoms due to episodes of renal colic with ureteral obstruction, hematuria, fever, and other serious effects.^[3,17,19,20,21] In their study on this topic, Ucar et al. pointed to association between rate of stone-free status and anxiety.^[22]

Other studies performed have reported that urethral obstruction which may require surgical intervention following SWL may cause anxiety.^[23] Several factors may play a role in occurrence of anxiety before surgical procedure. These may include low stress tolerance, fear of anesthesia and surgical intervention, and fear of possible complications and postoperative pain.^[23–25] Postoperatively, factors that may influence anxiety include pain, complaints of the urinary system that disrupt patient comfort, the possibility of additional procedures, and desire of patients to recover quickly.^[25–27] Similar to bronchoscopy, colonoscopy, colposcopy, and other endoscopic procedures, cystoscopic procedure may induce pain and anxiety.^[28–31] In addition, although DJ stenting performed with cystoscopy is mostly safe, its potential complications, development of urinary complaints, and requirement of stent removal may create anxiety.^[26] Supporting the results from these studies, our data also demonstrate that anxiety of patients requiring additional procedures because of the residual fragments following SWL may be greater during postoperative follow-up of 4 to 5 weeks and until the necessary treatment is completed both because of the symptoms brought on by existing stones and the need for another procedure.

This study has some limitations, including gender disassociation, relatively small number of patients, and lack of long-term follow-up. However, as the first study conducted on this topic, it can be said that it will contribute to further studies on this topic as a guide.

SWL procedure is the least invasive method commonly used in the treatment of urinary system stone disease. It should be considered that patients requiring additional procedures following SWL may develop anxiety because of both pain experienced due to residual small fragments and need for emergency referrals, as well as the procedure itself. Therefore, we believe that it would be useful to inform patients in detail before the procedure about method of application, complications that may occur, and additional procedures that may be needed. Further studies on this subject with larger sample size and long-term follow-up will provide helpful data and more reliable results.

Authorship contributions

Concept: C.Ş.; Design: C.Ş.; Data collection &/or processing: C.Ş.; Analysis and/or interpretation: C.Ş.; Literature search: C.Ş.; Writing: C.Ş.; Critical review: K.S.

Conflict of interest

None declared.

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Böbrek Taşlarında Şok Dalga Tedavisi; Elde Edilen Başarı Oranları İle Hasta Anksiyetesinin Karşılaştırmalı Analizi

Amaç: Böbrek taşlarında şok dalga litotripsi (shock wave lithotripsy [SWL]) tedavisi sonrasında elde edilen başarı oranları ile bu parametrenin hasta anksiyetesine üzerine olası etkileri araştırıldı.

Gereç ve Yöntem: Çalışmamıza SWL uygulanan toplam 128 hasta dahil edildi. Hasta anksiyetesini işlemden hemen önce ve işlem sonrası birinci hafta ve birinci ayın sonunda State and Trait Anxiety Inventory (STAI) testi ile belirlendi. Hastalar birinci ayın sonunda taşın yoksunluk durumlarına göre üç gruba ayrıldı; Grup 1: Tamamen taşsız kalanlar; Grup 2: Semptomsuz rezidü taşı olanlar ve Grup 3: Ek girişim gerektiren rezidü taşlı hastalardı. Hastaların anksiyete ölçümlerine ek olarak tüm olgular aneljezik gereksinimi ile acil servise başvuru oranları açısından analiz edildi.

Bulgular: Çalışmamız verilerine göre, grup içi birinci ay STAI skorları karşılaştırmasında tüm gruplarda anlamlı bir düşüş varken, 3. grupta bu düşüş diğer gruplara göre nispeten daha az olduğu görüldü. Gruplar arası ikili karşılaştırmada 3. grup ile diğer iki grup arasında istatistiksel olarak anlamlı fark olduğu gözlemlendi. Benzer olarak 3. grup hastalarda, acil servise başvuru ve analjezik kullanım oranları daha yüksek olduğu görüldü.

Sonuç: Şok dalga tedavisi sonrasında geriye kalan taşlara uygulanan ek tedavilere bağlı olarak hastaların anksiyete durumu etkileyebilmektedir. Bu açıdan hastalara işlemi sonrasında geriye kalabilecek taşların muhtemel ek girişimler konusunda detaylı bilgi verilmeli ve mümkün olduğu ölçüde taşsızlık hedeflenmelidir.

Anahtar Sözcükler: Anksiyete; başarı oranları; böbrek taşı; şok dalga litotripsi.