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Original Article

Does morbid obesity influence the success and complication rates of extracorporeal shockwave lithotripsy for upper ureteral stones?

Morbid obezite üreter üst uç taşlarına uygulanan ESWL'nin başarı ve komplikasyon oranlarını etkiler mi?

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ABSTRACT

Objective: The aim of the current study was to investigate whether obesity influences the outcome of extracorporeal shockwave lithotripsy (ESWL) treatment for upper ureteral stones.

Material and methods: This is a retrospective study of 134 patients who underwent ESWL between June 2011 and May 2014. Patients were divided into 2 groups. Group 1 comprised 94 patients of normal weight, and group 2 comprised 40 morbidly obese patients. Patients in both groups had upper ureteral stones.

Results: The mean age of groups 1 and 2 was 45.6±12.1 and 45.3±15.5 years, respectively (p=0.98). There was no significant difference in demographic variables between the groups. The mean stone size in Groups 1 and 2 was 81.7±25.7 mm^2 and 86.3±22.4 mm^2, respectively (p=0.51), the mean body mass index (BMI) was 27.4±2.9 and 42.9±2.1, respectively (p<0.01), the mean number of ESWL sessions was 2.4±0.6 and 2.4±0.7, respectively (p=0.97), and the mean follow-up time was 7.1±3.4 and 6.6±2.8 weeks, respectively (p=0.67). The overall stone-free rate was 82% in group 1 and 67% in group 2 (p=0.01).

Conclusion: It is well-known that morbidly obese patients have higher rates of anesthesia-related problems due to the comorbidities commonly observed in this population. In the current study, we found that ESWL is a safe and acceptable treatment option for morbidly obese patients with upper ureteral stones.

Key words: Morbid obesity; shockwave lithotripsy; upper ureteral stone.

ÖZET

Amaç: Bu çalışmada obezitenin vücut dışından şok dalga tedavisi (ESWL) sonuçları üzerindeki etkisini araştırmayı amaçladık.

Gereç ve yöntemler: Retrospektif olarak yapılan bu çalışmada Haziran 2011 ve Mayıs 2014 yılları arasında ESWL yapılmış 134 hasta değerlendirildi. ESWL yapılan hastalar iki gruba ayrıldı. İki grupda üreter üst uç taşına sahipdi. Grup 1 94 normal kiloya sahip, grup 2 ise 40 morbid obez hastadan oluşmaktaydı.

Bulgular: Grup 1 ve 2 için ortalama yaşları sırasıyla 45,6±12,1 ve 45,3±15,5'di (p=0,98). Gruplar arasında demografik veriler açısından istatistiksel fark saptanmadı. Taş boyutu ve vücut kitle indeksi (VKİ) grup 1 ve grup 2 için sırasıyla 81,7±25,7 mm^2 ve 86,3±22,4 mm^2 (p=0,51), 27,4±2,9 ve 42,9±2,1 (p<0,01) olarak bulundu. Ortalama hastalara uygulanan ESWL seansı sayısı 2,4±0,6 ve 2,4±0,7 (p=0,97) ve takip süresi 7,1±3,4 ve 6,6±2,8 haftaydı (p=0,67). Tam taşsızlık oranları grup 1 ve 2 için %82 ve %67 olarak bulundu ve istatistiksel olarak anlamlıydı (p=0,01).

Sonuç: Morbid obez hastaların eşlik eden birçok komorbidite sebebiyle anesteziye bağlı komplikasyonlara daha fazla yatkın oldukları bilinmektedir. Bu çalışmada biz ESWL'nin morbid obez hastalar için güvenli ve kabul edilebilir bir seçenek olduğunu bulduk.

Anahtar kelimeler: Üreter üst uç taşı; şok dalga litotripsi; morbid obezite.

Introduction

Urolithiasis is an important health issue, and the lifetime prevalence has been reported to be 10%.[1] Treatment of urolithiasis in obese patients has gained importance in recent years because of increasing rates of obesity.[2] The association between urolithiasis and obesity is well established, and it has been shown that weight gain increases both the likelihood of urolithiasis and the recurrence rate.[3] The ideal treatment for proximal ureteral and renal stones has become controversial as the treatment options have expanded to include therapies such as noninvasive extracorporeal shockwave lithotripsy (ESWL) and improved endoscopic digital technology.

ESWL is the most commonly used method to treat renal and ureteral stones.[4] This method is popular because it is noninvasive and has low complication rates. The success rate of ESWL for the treatment of ureteral stones is approximately 80%-90%.[4,5]

The success rate of ESWL may be influenced by the ureteral location of the stone, stone size, and stone density as well as clinical factors such as abnormal ureteral anatomy, obesity, and degree of hydronephrosis.[6] It is not clear which of these factors influences treatment outcomes the most.[7] Therefore, the goal of the current study was to investigate whether obesity affects the treatment outcomes and complication rates of ESWL for ureteral stones.

Material and methods

Data from 134 patients who underwent ESWL for upper ureteral stones between April 2010 and June 2013 were analyzed retrospectively. This study was approved by the Institutional Review Board of the Dicle University Medical Faculty Ethics Committee, and all patients treated with ESWL provided informed consent before the procedure. Informed consent was also obtained from all other subjects prior to their participation in the study. Abdominal spiral computed tomography (CT) was used to diagnose urolithiasis and to calculate the density of the stones in Hounsfield units (HU). All patients were evaluated for urinary tract infection with urine culture. Patients with a stone size of <4 mm, active urinary tract infection, or blood coagulation disorder were excluded from the study. One hour before ESWL, diclofenac sodium (75 mg), a non-steroidal anti-inflammatory drug, was administered intramuscularly.

Demographic data, including patient age, gender, body mass index (BMI), and history, were collected. Based on the World Health Organization classification system, patients with a BMI of >40 kg/m^2 were classified as morbidly obese. Patients with upper ureteral stones were divided into 2 groups. Group 1 included 94 patients of normal weight (BMI <30), and Group 2 included 40 morbidly obese patients (BMI >40).

ESWL was performed as an outpatient procedure using an electrohydraulic extracorporeal lithotripter (Multimed Classic; Elmed) by a team consisting of an experienced urologist and a technician. The mean number of shock waves delivered, mean number of sessions, mean duration of each session, and any complications that occurred were recorded for both groups. The lithotripter penetration depth was 15-20 cm. For obese patients, we used an abdominal compression strap to facilitate positioning of the stone within the extended shock pathway. After the initial ESWL session, patients with inadequate stone fragmentation were scheduled for another session. Patients were considered stone-free when there was absence of stone fragments on urinary ultrasound examination or plain X-ray. CT was used to detect non-opaque stones. A session was classified as ESWL failure if persistent obstruction of the ureter was observed despite fragmentation of the stone.

Statistical analysis

The Statistical Package for the Social Sciences (SPSS Inc, Chicago IL, USA) software package program was used for all statistical analyses. Mean (± standard deviation) values were calculated, and Kolmogorov-Smirnov tests were conducted to determine the normality of the data. Non-normally distributed data were compared using Mann-Whitney U tests to assess differences between the 2 groups. Categorical values were compared using chi-square tests. A p-value of <0.05 was accepted as the cut-off value for the level of statistical significance.

Results

The mean age of patients in groups 1 and 2 was 45.6±12.1 and 45.3±15.5 years, respectively (p=0.98). No significant demographic differences were detected between the groups. The mean stone size was 81.7±25.7 mm^2 in Group 1 and 86.3±22.4 mm^2 in Group 2. The mean BMI was 27.4±2.9 and 42.9±2.1 in Groups 1 and 2, respectively (p<0.01). The mean number of ESWL sessions was 2.4±0.6 and 2.4±0.7, respectively (p=0.97), the mean number of shock waves was 2635±460 and 2482±385, respectively (p=0.97), and the average energy levels were 23.7±2.92 and 22.8±1.89 kV, respectively (p=0.482). The mean HU level of stone in Groups 1 and 2 were similar (807±32.6 vs. 820±84.2 p=0.08). The mean follow-up time was 7.1±3.4 and 6.6±2.8 weeks in Groups 1 and 2, respectively (p=0.67) (Table 1).

The overall stone-free rate was 82% and 67% in Groups 1 and 2, respectively (p=0.01). The most commonly encountered complication was gross hematuria. Four patients chose to discontinue the treatment because of severe pain during the ESWL procedure. Ureteroscopy was performed in 8 patients in Group 1 and 13 patients in Group 2 after 3 sessions of unsuccessful ESWL (p<0.01). The ESWL success and complication rates are summarized in Table 2.

Discussion

The European Association of Urology guidelines recommend ESWL or ureterorenoscopy (URS) as the first-line treatment for upper ureteral stones.[8] These procedures are preferred because they are less invasive than other approaches, have low complication rates, and are generally well-tolerated by patients. In general, ESWL is preferred by both patients and physicians.[9-11]

The prevalence of urolithiasis is increasing in morbidly obese patients. Urologists are now seeing more patients who are morbidly obese for the treatment of renal stones.[12] Morbid obesity is known to be associated with diabetes mellitus (DM), hypertension, respiratory diseases, and many other serious health

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Table 1. Comparison of patient demographics and operation outcomes between the groups

	Group 1 (n: 94)	Group 2 (n: 40)	p value
Age (years)	45.6±12.1	45.3±15.5	0.98
Sex			
Male	48 (51%)	23 (57%)	
Female	46 (59%)	17 (43%)	
Side			
Right	54 (57%)	22 (55%)	
Left	40 (42%)	18 (45%)	
Stone size (mm^2)	81.7±25.7	86.3±22.4	0.51
Mean HU	807±32.6	820±84.2	0.08
Mean number of shock waves	2635±460	2482±385	0.97
Mean energy level (kV)	23.7±2.92	22.8±1.89	0.482
BMI (kg/m^2)	27.4±2.9	42.9±2.1	<0.01
Number of ESWL	2.4±0.6	2.4±0.7	0.974
Diabetes mellitus	12 (12%)	23 (57%)	<0.01
Hypertension	15 (15%)	31 (77%)	<0.01
Coronary artery disease	12 (12%)	16 (40%)	<0.01
Respiratory disease	4 (4%)	8 (20%)	<0.01

HU: Hounsfield units; ESWL: extracorporeal shockwave lithotripsy; BMI: body mass index

Table 2. Comparison of operation outcomes between the groups

	Group 1 (n: 94)	Group 2 (n: 40)	p value
Success rate	78 (82%)	27 (67%)	0.01
Complication rate			
Gross hematuria	38	15	0.82
Urinary infection	0	0	
Adjunctive procedure to clear the stone after ESWL			
Ureteroscopy	8 (8%)	13 (32%)	<0.01

ESWL: extracorporeal shockwave lithotripsy

problems. These patients tend to be at higher risk for complications related to anesthesia during surgery.[13] Because anesthesia is not necessary for ESWL, this procedure may be particularly advantageous in obese patients.

Several studies have reported that stone size, patient age, stone composition, and BMI can affect ESWL success rates.[7,14] According to recent studies, the overall stone-free rate at 3 months after ESWL is 68% in obese patients and 80%-85% in non-obese patients.[15] The utility of BMI in predicting ESWL success is variable. Pareek et al.[7] suggested that BMI is a significant predictor of success. However, another study suggested that the effect of BMI is probably related to the stone-to-skin distance, which correlates with the shockwave path in the body.[16] The success rate of ESWL for proximal ureteral stones is between 57%–96%.[17] In the current study, patient age, stone size, and stone location were similar between the groups. The success rates in Groups 1 and 2 were 82% and 67%, respectively. Therefore, the success rate in morbidly obese patients was lower. It has been suggested that the lower success rates of ESWL in morbidly obese patients observed in other studies may have been related to increased absorption of the shockwave by thicker tissues in these patients.[18,19] Furthermore, the lower success rates observed in obese patients may have also been related to the increased difficulty in localizing the stone and focusing the ESWL beam.

ESWL is not a surgical procedure and is therefore considered to be a non-invasive approach. Nevertheless, it is important to realize that there are complications associated with ESWL. The most common complication is perirenal, intrarenal, or subcapsular hemorrhage caused by direct tissue damage.[20] Acute pancreatitis is an additional, although rare, complication.[21] Hemorrhage manifested as hematuria in patients in the current study. None of the patients had urinary tract infection or sepsis after treatment in the current study. Three patients suffered from subcapsular hematomas and were treated conservatively. The complication rates were similar in both groups. This finding is particularly important, because patients with DM are more likely to have postsurgical infections.

URS, a minimally invasive treatment that has changed remarkably with improvement in technology, is considered to be an alternative to ESWL for upper ureteral stones. There is an ongoing debate as to whether URS is affected by patient body habitus. Results from a retrospective, single-institution study showed that the stone-free rates among 107 obese and non-obese patients were similar.[22] Another study by Best et al.[23] also showed similar success rates. However, these studies provided only limited information regarding intra- and postsurgical anesthesia-related complication rates in obese patients.

Morbidly obese patients have a higher risk of anesthesia-related complications because of the higher rate of comorbidities observed in this population. Therefore, non-invasive treatment modalities for urinary tract stones in morbidly obese patients may be safer. In the current study, we showed that ESWL is a safe and successful treatment option for morbidly obese patients with upper ureteral stones.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Dicle University Faculty of Medicine.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

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