Dicle Tıp Dergisi /
Dicle Medical Journal

2015; 42 (1): 1-4
doi: 10.5798/diclemedj.0921.2015.01.0520

ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA

The effectiveness of ESWL in the management of lower pole kidney stones

Böbrek alt kaliks taşlarının tedavisinde ESWL'nin etkinliği

Tufan Süelözgen[1], Salih Budak[1], Orçun Celik[1], Mehmet Zeynel Keskin[1], Okan Nabi Yalbuzdağ[1], Selçuk Isoğlu[1], Mustafa Kurtuluş[2], Yusuf Özlem İlbey[1]

ABSTRACT

Objective: The developments in the endourological treatments of urinary system stone diseases led to the discussions about the first choice treatment methods. We have evaluated the results of extracorporeal shock wave treatments being applied in our clinics for the lower pole stones which has the most of the those discussions.

Methods: The records of 271 stone patients who were applied ESWL according to CT results between January 2013 and July 2013 to our clinics were examined. In the controls after the procedure, who could not be evaluated with the non-contrast computerized tomography (CT) and ESWL treatment not completed, were excluded from the study. 52 patients with lower pole stone in total were divided into two according to the success of the ESWL treatment. ESWL success or unsuccessful groups, the size of the stone, density of the stone and the distance between the stone and skin was recorded by examining the abdominal non-contrast computed tomography (CT) of the patient.

Results: Of all, 28 of the patients in the study (54%) were male and 24 of them (46%) were female. The average age was 46±12.3 (21-73) years. Among the 52 patients included in the study after ESWL treatment, the stones of the 24 patients (46.2%) were successfully treated. ESWL treatment was unsuccessful in total 28 patients (53.8%). The average size of the stone was 9.8 mm (6-17 mm), the distance between the stone and the skin was 93 mm in average (50-140). The stone density was measured as 845 HU (353-1600).

Conclusion: The ESWL treatment is still a noninvasive and successful method for the lower pole kidney stones. While the ESWL success is being determined, the imaging method chosen is important, the use of abdominal CT provides accurate evaluation. The higher success rates of minimal invasive surgery methods is promising and might change the treatment methods in the future.

Key words: Kidney stone, lower pole stone, ESWL, success

ÖZET

Amaç: Üriner sistem taş hastalığının endoürolojik tedavisinde ki gelişmeler birincil seçenek tedavi yöntemleriyle ilgili tartışmalara yol açmıştır. Bu çalışmamızda, böbrek alt pol taşı olan hastalara kliniğimizde uygulanan Ekstrakorporeal Şok dalga litotripsi (ESWL) tedavisinin sonuçları incelenmiştir.

Yöntemler: Ocak- Temmuz 2013 tarihleri arasında kontrastsız bilgisayarlı tomografi (BT) sonucuyla teşhis edilip kliniğimizde ESWL uygulanan 271 böbrek taşı hastasının kayıtları retrospektif olarak incelendi. Tedavi öncesi ya da sonrası izlemlerde kontrastsız BT filmleri olmayan ve ESWL tedavisi tamamlanmayan hastalar çalışma dışı bırakılmıştır. 52 hasta, ESWL başarısına göre iki gruba ayrılmıştır. ESWL başarısı, taşın büyüklüğü, taşın yoğunluğu ve taşın cilde olan uzaklığı; kontrastsız BT kayıtlarının incelenmesi ile sağlanmıştır.

Bulgular: Çalışmamız, 28 (%54) erkek ve 24 (%46) bayan hastadan oluşmaktadır. Ortalama yaş 46±12,3 (21-73) idi. ESWL tedavisi alan ve çalışmaya dahil edilen 52 hastanın 24'ü (%46,2) tedaviden fayda görmüştür, 28'i (%53,8) tedaviden fayda görmemiştir. Ortalama taş boyutu 9.8 mm (6-17 mm), ortalama taş-cilt mesafesi 93 mm (50-140) idi, ortalama taş yoğunluğu 845 HU (353-1600) idi.

Tartışma: ESWL tedavisi böbrek alt pol taşlarında hala non-invaziv ve başarılı bir yöntemdir. ESWL başarısı değerlendirilirken seçilen görüntüleme yöntemi önemlidir ve abdominal BT'nin kullanımı doğru değerlendirme sağlar. Minimal invaziv tedavi yöntemlerinin yüksek başarı oranları umut vericidir ve gelecekteki tedavi yöntemlerinin değişimine neden olabilir.

Anahtar kelimeler: Böbrek taşı, alt pol taşı, taş kırma

[1] *Tepecik Training and Research Hospital, Urology Clinic, İzmir, Turkey*
[2] *Tepecik Training and Research Hospital, İzmir, Turkey*

Yazışma Adresi /Correspondence: *Tufan Süelözgen,*
Tepecik Training and Research Hospital, Urology Clinic, Izmir, Turkey Email : tsuelozgen@hotmail.com

Geliş Tarihi / Received: 20.12.2014, Kabul Tarihi / Accepted: 13.03.2015

INTRODUCTION

In the beginning of the eighties, the discovery of extracorporeal shock wave lithotripsy (ESWL) marked a new epoch in the treatment of urinary system stones disease. ESWL, which was developed by a German plane company, Dornier, and whose first clinical trials were conducted by Chaussy et al., has been among the first treatment choices for the kidney stone treatment [1,2]. The place of ESWL in the lower pole stone treatment is being discussed with the developments in endourology and with the increase of the experiences in especially minimal invasive surgery (RIRS, mini PNL, microperc) [3,4]. Besides, only 11% of the patients whose asymptomatic lower pole stones are being followed-up require the treatment [5]. Europe urology guide recommends endourological treatment as the first choice if it is upper 2 cm and ESWL if it is below 1 cm for the treatment of lower pole stones. However, the treatment way to be chosen for the lower pole stones between 1-2 cm is still being discussed [1].

In our study, we have examined the effects of the stone size, stone density and the stone-skin distance on the ESWL success in isolated lower pole stones treatment.

METHODS

The records of 271 stone patients who were applied ESWL according to CT results between January 2013 and July 2013 in our clinics were analyzed retrospectively. Among those, 68 patients (25.1%) who had isolated lower pole stones were evaluated. 5 of those patients (8.5%) were excluded from the study since their ESWL treatment could not be completed. In the controls after the procedure, 11 patients (16.1%), who could not be evaluated with the non-contrast computerized tomography (CT), was excluded from the study. 52 patients with lower pole stones, who were included in the study, were divided into two groups according to the success of ESWL treatment. The stone size, density and stone-skin distances were recorded by analyzing the non-contrast abdominal computerized tomography (CT) in patients included in successful and unsuccessful ESWL groups.

All patients were administered with routine 100 mg Tramadol HCL I.M before the procedure. 3 sessions in total were applied for each patient with the equipment having the brand Elmed 2012, in 60 minutes, 17-20 KV power and 2500 beats per session and if there is no excuse of the patient, one week break was taken between each sessions. Before each session, the final state of the stone was reviewed with direct urinary system graphy (DUSG), DUSG was taken after the last session and the results were recorded by evaluating with the non-contrast abdominal CT approximately after the finishing of third session.

Univariate and multivariate analyses were applied for the statistics. The student's t test and Pearson's chi-square test were used with SPSS version 15.0 program and a p value of <0.05 was considered as significant.

RESULTS

Totally 28 of the patients (54%) included in the study were women and 24 of them (46%) were men. The average age was 46±12.3 (21-73). Among the 52 patients included in the study after ESWL treatment, the stones of the 19 patients (36.5%) were totally broken and made ineffective. In five patients (9.6%) the stone was fragmented into 5 mm small fragments but could not be removed, the clinically insignificant fragments which were asymptomatic were accepted as successful. ESWL treatment was unsuccessful in 28 patients (53.8%) in total. The stone size was 9.8 mm (6-17 mm) in average, the stone-skin distance was 93 mm (50-140mm) in average. The stone density was measured as 845 HU (353-1600) (Table 1).

Table 1. Stone characteristics of the patients

	n	Minimum	Maximum	Average
Stone size (mm)	52	6	17	9.8
Stone-skin distance (mm)	52	50	140	90.7
Stone density (HU)	52	353	1600	845.8

We did not determine any statistically significance in terms of the examined parameters between successful and unsuccessful ESWL groups. There is significant correlation between size of the lower pole stones and the success in univariate analysis. (p:0.03) We determined the stone-skin distance

(p:0.026) and the stone density (p<0,01) as significant in univariate analysis. Only the stone density was shown as significant in the ESWL success in multivariate analysis (p<0.01) (Table 2).

Table 2. Results of the statistical analysis according to the radiological measurements between Successful and Unsuccessful ESWL groups.

	SS ≤ 10mm	SS>10mm	SSD ≤90mm	SSD >90mm	HU≤850	HU>850
Successful, n (%)	17 (48.6)	7 (41.2)	15 (60)	9 (33.3)	19 (64.3)	5 (22.7)
Unsuccessful, n (%)	18 (51.4)	10 (58.8)	10 (40)	18 (66.7)	11 (35.7)	17 (77.3)
p value (univariate)	0.03		0.026		<0.01	
p value (multivariate)	>0.05		>0.05		<0.01	

SS: Stone-Size, SSD: Stone-Skin Distance, HU: Hounsfield Unit

DISCUSSION

Different success rates are being stated in the ESWL treatments of lower pole stones. The success rates ranging from 35% to 70% were reports in various studies (Table 3) [6-8]. In general, besides the stone size, density and stone-skin distance affecting the success of ESWL, the parameters such as the straight infundibulum-pelvic angle, long calyx (above 10 mm), narrow infundibulum (below 5 mm) for the lower pole stones were reported as effective [9,10]. In our study, our success rate in ESWL in lower pole stones was determined as 46% consistent with the literature. We think that making the final control made after ESWL with the direct graphy or the non-contrast abdominal CT might affect the success rates. In the literature, the final controls were revealed with only the direct graphies for the stone free rates [11,12].In our study the residual stones smaller than 5 mm were only determined by the non-contrast abdominal CT. No significant opacity was demonstrated when the direct graphies of those patients were analyzed retrospectively after the sessions. In the literature, the studies in which the controls after ESWL is being done with the non-contrast abdominal CT have similar rates (Deem 33%, Pearle 35%) and they have similar rates with our studies [13,14]. We think that another issue to be discussed should be which imaging technique will be used as the final control at the end of the ESWL sessions.

The success of ESWL treatment in lower pole stone is limited. Demand for a greater success and the rapid developments in endourology made the comparison of minimal invasive surgeries (RIRS, micro pnl) with the ESWL a current issue [7,9].Although there are no studies conducted with a large patients group, RIRS success is approximately two times higher as compared to ESWL [13,15,16]. Tepeler et al. reported the micro pnl as an alternative method in the treatment of the lower pole stones in their studies [17].

Although there is no exact opinion about the quantity of the total shock wave number, there are studies indicating that the less shock waves, especially per session, decrease the renal damage and also that the ESWL treatment applied slowly both decreases the renal damage and increase the stone breaking success [18,19]. However, in the studies conducted on ESWL success in lower pole stones how many stone breaking sessions were applied, the total shock waves per sessions, the power and the frequency were not indicated. Thus, while examining the different success rates for the similar sized stones, a healthier comment might be made by knowing the ESWL application details better.

The discussions for the ideal treatment method for the lower pole stones are still continuing. The disadvantages of the newly defined minimal invasive surgical methods are the anesthesia requirement and surgical complications [3,4,13]. ESWL might still be preferred as the first treatment since it is especially noninvasive, it does not require anesthesia and it has low complication rates. İnci et al. showed that the follow up in the lower pole stones is an important alternative in their study [5]. As a result, the follow up in the treatment of isolated lower pole stone should be evaluated with the ESWL and minimal invasive surgery options.

In conclusion, nowadays, ESWL treatment is still being preferred as a noninvasive and successful method in the treatment of lower pole stones. The preferred imaging method is important while determining the ESWL success and more accurate evaluation might be made with a non-contrast abdominal CT use.

Table 3. ESWL success rates in lower-pole stones in various studies

Studies	Patient number	Stone size	Success rate (%)
Davarcı et al. [8]	33 patients	Unknown	52.4
Turna et al. [11]	40 patients	Below 20 mm	67.5
Danuser et al. [12]	96 patients	Below 20 mm	68
Pearle et al. [13]	26 patients	Below 10 mm	35
Deem et al. [14]	12 patients	Between 10 and 20 mm	33
Süelözgen et al. [Present study]	52 patients	Below 20 mm	46

REFERENCES

1. Türk C (chairman), Knoll T (vice-chairman), Petrik A, Sarica K, Straub M, Seitz C. Guidelines on Urolithiasis. EAU Guidelines. 2012
2. Chaussy CG, Brendel W, Schmidt E. Extracorporeally induced detruction of kidney stones by shock waves. Lancet 1980:2:1265-1268.
3. Ozturk U, Sener N. C, Goktug H. N. G, et al. Comparison of percutaneous nephrolithotomy, shock wave lithotripsy, and retrograde intrarenal surgery for lower pole renal calculi 10-20 mm. Urol Int 2013: 91, 345-349.
4. Knoll T, Buchholz N, Nordahl GW. Extracorporeal shockwave lithotripsy vs. percutaneous nephrolithotomy vs. flexible ureterorenoscopy for lower-pole stones. Arab J Urol 2012:336-340.
5. İnci K, Şahin A, İslamoglu E, et al. Prospective long-term follow up of patients with asymptomatic lower pole caliceal stones. J Urol 2007;177:2189-92.
6. Connors BA, Evan AP, Blomgren PM, et al. Extracorporeal shock wave lithotripsy at 60 shock waves/min reduces renal injury in a porcine model. BJU Int 2009;104:1004-1008.
7. Pishchalnlkov YA, Mcateer JA, WilIams JC, et al. Why Stones Break Better at Slow Shockwave RatesThan at Fast Rates: In Vitro Study with a Research Electrohydraulic Lithotripter. J Endourol 2006:20; 537-541.
8. Davarcı M, Rifaioğlu M, Yalçınkaya F R, İnci M. Üriner sistem taşlarında iki senelik şok dalgası ile taş kırma tedavisi sonuçları. Dicle Tıp Derg 2012;39:377-380.
9. Weld KJ, Montiglio C, Morris MS, et al. Shock wave lithotripsy success according to the patient and computed tomography stone characteristics. Urology 2008:4:91.
10. Kose E, Oğuz F, Beytur A. The effect of the diameter of the lower calyx infundibulum on the success of ESWL. İnönü University Health Sciences Journal 2013:1:43-45.
11. Turna B, Ekren F, Nazlı O, et al. Comparative results of shockwave lithotripsy for renal calculi in upper, middle and lower calices. J Endourol 2007:21:951-956.
12. Danuser H, Müller R, Descoeuders B, et al. Extracorporeal shock wave lithotripsy of lower calyx calculi: how much is treatment outcome influenced by the anatomy of the collecting system? Eur Urol 2007:52:539-546.
13. Pearle MS, Lingeman JE, Leveillee R, et al. Prospective, randomized trial comparing shock wave lithotripsy and ureteroscopy for lower pole caliceal calculi 1 cm or less. J Urol. 2005;173:2005-2009.
14. Deem S, DeFade B, Modak A, et al. Percutaneous nephrolithotomy versus extracorporeal shock wave lithotripsy for moderate sized kidney stones. Urology 2011:78;739-743.
15. Sankhwar SN, Singh BP, Prakash J, Goel A. Extra corporeal shock wave lithotripsy versus retrograde intra renal surgery for 1-2 cm lower calyceal calculi: A prospective case control study. J Urol 2013;189:750-751
16. Salem A, Saad I, Abdelhakim M, et al. Laser Lithotripsy versus ESWL for Lower Calyceal renal stones. J Urol 2013:189;751
17. Tepeler A, Armagan A, Sancaktutar AA, et al. The role of microperc in the treatment of symptomatic lower pole renal calculi. J Endourol 2013;27:13-18.
18. Lingeman JE, Siegel Yİ, Steele B, et al. Management of lower pole nephrolithiazis: A critical analysis. J Urol 1994;151:663-667,
19. Knoll T, Musial A, Trojan L, et al. Measurement of renal anatomy for prediction of lower-pole caliceal stone clearance: reproducibility of different parameters. J Endourol 2003;17:447-451.