

Evaluating the Impact of Age on the Success of SWL Treatment Across Different Age Groups: A Retrospective Cohort Study

Farklı Yaş Gruplarında SWL Tedavisinin Başarısı Üzerine Yaşın Etkisinin Değerlendirilmesi: Retrospektif Bir Kohort Çalışması

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ABSTRACT Objective: This study aims to evaluate the success rates of extracorporeal shock wave lithotripsy (ESWL) across different age groups and determine whether age is a determining factor in treatment success. **Material and Methods:** A retrospective cohort study was conducted on 196 adult patients treated at an ESWL center. Patients were categorized into three age groups: Group 1 (18-30), Group 2 (31-45), and Group 3 (46-60+). Success rates, along with the average number of shock waves and treatment sessions, were analyzed for each group. Statistical analyses were performed using SPSS software, with significance set at $p<0.05$. **Results:** The analysis of 196 patients revealed SWL success rates of 70%, 78.9%, and 85% across the three age groups, with no statistically significant differences ($p=0.155$). Age did not significantly impact success rates ($p=0.240$). The average number of shock waves applied were 5,071, 5,368, and 6,157, while the average number of sessions were 1.5, 1.53, and 1.65, respectively, both showing no significant differences ($p=0.244$ and $p=0.423$, respectively). **Conclusion:** The findings indicate that ESWL success rates do not significantly differ between age groups. Age is not a determining factor in ESWL success and does not affect treatment outcomes. Therefore, age should not be considered a criterion in ESWL treatment.

ÖZET Amaç: Bu çalışmanın amacı, farklı yaş gruplarında ekstracorporeal şok dalgası litotripsi [extracorporeal shock wave lithotripsy (ESWL)] tedavisinin başarı oranlarını değerlendirmek ve yaşın tedavi başarısında belirleyici bir faktör olup olmadığını belirlemektir. **Gereç ve Yöntemler:** Retrospektif kohort çalışması, bir ESWL merkezinde tedavi gören 196 yetişkin hasta üzerinde gerçekleştirildi. Hastalar 3 yaş grubuna ayrıldı: Grup 1 (18-30), Grup 2 (31-45) ve Grup 3 (46-60+). Her grup için başarı oranları ile ortalama şok dalgası ve tedavi seansı sayıları analiz edildi. İstatistiksel analizler SPSS yazılımı kullanılarak yapıldı ve anlamlılık seviyesi $p<0,05$ olarak belirlendi. **Bulgular:** Yüz doksan altı hastanın analizi sonucunda, 3 yaş grubundaki ESWL başarı oranları sırasıyla %70, %78,9 ve %85 olarak bulundu ve gruplar arasında istatistiksel olarak anlamlı bir fark bulunmadı ($p=0,155$). Yaşın başarı oranları üzerindeki etkisi de gruplar arasında anlamlı bir fark göstermedi ($p=0,240$). Uygulanan ortalama şok dalgası sayıları 5.071, 5.368 ve 6.157 iken ortalama seans sayıları sırasıyla 1,5, 1,53 ve 1,65 olup, her iki durumda da istatistiksel olarak anlamlı bir fark gözlenmedi ($p=0,244$ ve $p=0,423$). **Sonuç:** Bulgular, ESWL başarı oranlarının yaş grupları arasında anlamlı bir fark göstermediğini ve yaşın ESWL başarısında belirleyici bir faktör olmadığını göstermektedir. Bu nedenle, yaş ESWL tedavisinde bir kriter olarak dikkate alınmamalıdır.

Keywords: Kidney calculi; age groups; lithotripsy

Anahtar Kelimeler: Böbrek taşları; yaş grupları; litotripsi

Kidney stones are a widespread urological condition, affecting about 10-15% of adults worldwide.¹ The incidence of kidney stones varies depending on geographic location, climate, dietary habits, and genetic factors. The risk of stone formation is particularly higher in hot and dry climates.² Epidemiological

studies have indicated that kidney stones occur more frequently in men, with males being 2 to 3 times more likely to develop stones compared to females.³ Additionally, the risk of stone formation increases with age, peaking between the ages of 30 and 50.²

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The treatment approaches for kidney stones are determined by factors such as the stone's size, location, and composition, along with the overall health of the patient. Available treatment options include medical management, extracorporeal shock wave lithotripsy (ESWL), ureteroscopy, percutaneous nephrolithotomy (PNL), and open surgery.⁴

ESWL is one of the most frequently used non-invasive treatment options for kidney stones, particularly for stones measuring 20 mm or less. The effectiveness of ESWL is affected by various factors, including the size, location, and composition of the stone, the distance between the skin and the stone, as well as the energy of the shock waves.⁵ Reported success rates for ESWL in the literature range from 70% to 90%, depending on these factors.^{6,7} However, factors like the size and location of the stone are regarded as the most crucial in determining the success of the treatment.⁸ For instance, stones found in the lower pole are typically more difficult to break apart and can be harder to pass from the body. In addition, factors such as the skin-to-stone distance, along with the number and energy of the shock waves, play important roles in determining treatment outcomes.⁹ Careful evaluation of these variables is essential when considering ESWL as a treatment option.

This study seeks to examine the impact of age on the success rates of ESWL treatment. Current literature presents conflicting results regarding the influence of age on treatment outcomes. Some studies suggest that age impacts success, while others report no significant relationship.¹⁰ Therefore, the goal of this study is to assess the success rates of ESWL treatment among different age groups and to explore the statistical relationship between age and treatment outcomes.

MATERIAL AND METHODS

This retrospective cohort study included 196 adult patients who underwent treatment for kidney stones at the ESWL unit of our hospital between January 2023 and December 2023. Patients with kidney stones measuring 20 mm or less and a Hounsfield Unit below 1,000, as identified through non-contrast computed tomography (NCCT), were included in the

study. The exclusion criteria involved patients under 18 years of age, stones larger than 20 mm, pregnancy, uncontrolled bleeding disorders, active infections, and those who had received treatments other than ESWL. The study was carried out with the approval of the Sancaktepe Şehit Prof. Dr. İlhan Varank Training and Research Hospital Ethics Committee (date: August 28, 2024, no: 2024/275) and adhered to the principles outlined in the Declaration of Helsinki.

The ESWL procedure was carried out using an electromagnetic lithotripter (Storz Medical SLK Modulith Inline, Switzerland). On the day of treatment, all patients underwent a kidney, ureter, and bladder examination. Thirty minutes prior to the procedure, 75 mg of diclofenac potassium was administered intramuscularly as an analgesic. Each patient received between 3,000 and 4,000 shock waves, depending on the size and location of the stone. The energy and number of shock waves were tailored based on the stone size, skin-to-stone distance, and the patient's response to the treatment.

The success of ESWL treatment was evaluated 3 months after the procedure, based on the presence of complete stone clearance or residual fragments measuring 4 mm or less, as confirmed by follow-up NCCT.

For statistical analysis, the normality of the data distribution was assessed using the Shapiro-Wilk test. The chi-square test and analysis of variance were employed to compare the variables. Data were expressed as mean±standard deviation and percentages (%), with a p-value of <0.05 considered statistically significant. All analyses were performed using SPSS software (version 2.0, IBM Armonk, NY, USA).

RESULTS

Among the 196 patients included in the study, 75.5% were male (n=148) and 24.5% were female (n=48). The patients were categorized into three age groups: Group 1 (18-30 years) comprised 40 patients, with 70% male (n=28) and 30% female (n=12); Group 2 (31-45 years) included 76 patients, with 78.9% male (n=60) and 21.1% female (n=16); and Group 3 (46-60+ years) had 80 patients, with 75% male (n=60) and 25% female (n=20). The mean ages were

TABLE 1: Demographic characteristics, shock wave lithotripsy success rates, shock waves, and sessions numbers of the groups.

		Group 1 (18-30 years) n=40	Group 2 (31-45 years) n=76	Group 3 (46-60+ years) n=80	p-value
Gender (Male/Female)	(Male/Female)	28/12	60/16	60/20	
	%	70/30	78.9/21.1	75/25	
Age ($\bar{X}\pm$ SD)		26.8 \pm 2.5	40.2 \pm 4.1	50.7 \pm 5.3	0.240
Success rate (%)		70	78.9	85	0.155
Shock waves ($\bar{X}\pm$ SD)		5071 \pm 2973	5368 \pm 2393	6157 \pm 3378	0.244
Sessions ($\bar{X}\pm$ SD)		1.50 \pm 0.6	1.53 \pm 0.5	1.65 \pm 0.8	0.423

SD: Standard deviation.

26.8 \pm 2.5 years for Group 1, 40.2 \pm 4.1 years for Group 2, and 50.7 \pm 5.3 years for Group 3. The demographic characteristics of the patients are outlined in Table 1.

SWL treatment success was defined as complete stone clearance or the presence of residual fragments measuring 4 mm or smaller, as observed on NCCT 3 months post-procedure. The success rates were 70% in Group 1, 78.9% in Group 2, and 85% in Group 3. A comparison of these success rates between the groups showed no statistically significant differences ($p=0.155$). Moreover, a chi-square test assessing the effect of age on success rates found no significant differences between the groups ($p=0.240$).

The average shock wave count was 5071 \pm 2973 for Group 1, 5368 \pm 2393 for Group 2, and 6157 \pm 3378 for Group 3. Statistical analysis revealed no significant differences in shock wave counts between the groups ($p=0.244$) (Table 1).

The mean number of sessions required was 1.50 \pm 0.6 for Group 1, 1.53 \pm 0.5 for Group 2, and 1.65 \pm 0.8 for Group 3. The analysis of session numbers in relation to SWL success rates also revealed no statistically significant difference ($p=0.423$) (Table 1).

DISCUSSION

This study evaluated the effectiveness of SWL treatment for kidney stones measuring 20 mm or less, focusing on patient age, the number of shock waves applied, and the number of treatment sessions. Patients were categorized into three age groups, and the success rates of SWL treatment were compared across these groups. The findings showed no statisti-

cally significant differences in SWL success rates among the age groups, indicating that age is not a determining factor in treatment outcomes.

Previous studies in the literature have produced mixed results regarding the influence of age on the success of SWL. Some research suggests that advanced age may negatively impact SWL outcomes, while other studies find no significant correlation between age and treatment success. For example, Madaan and Turney reported that older age may be associated with decreased SWL success. However, the results of our study align with other research, showing that age does not have a significant impact on the success of SWL.

The number of shock waves applied during SWL has been a subject of debate. Some studies suggest that an increased number of shock waves can improve stone fragmentation, but this effect appears to plateau after a certain threshold. In our study, although the number of shock waves applied varied across the age groups, this difference did not have a statistically significant effect on the success of SWL. This finding indicates that increasing the number of shock waves beyond a certain point may not lead to further clinical benefits.

Similarly, the number of SWL sessions has been evaluated in relation to treatment success in various studies. Although additional sessions may appear to enhance treatment outcomes, our study found no statistically significant difference in the number of sessions among the age groups. This suggests that the number of sessions does not play a decisive role in SWL success, and increasing the

number of sessions may not provide additional benefits in certain cases.

Our findings are in line with other studies in the literature, confirming that SWL is an effective treatment for kidney stones measuring 20 mm or less. However, factors like age, the number of shock waves, and the number of sessions do not seem to have a significant impact on the success of the treatment. These findings emphasize the broad applicability of SWL across diverse patient populations and suggest that treatment protocols should be tailored to individual patient characteristics rather than age.¹¹

CONCLUSION

SWL, as a non-invasive treatment option, continues to be an effective and safe method for managing kidney stones measuring 20 mm or smaller. The findings from our study suggest that factors such as age, the number of shock waves applied, and the number of treatment sessions do not have a significant impact on the success of SWL. Therefore, treatment protocols should be tailored to the individual characteristics of the patient rather than relying on age as a

determining factor. Future studies involving larger patient populations are necessary to investigate additional factors that could further improve the effectiveness of SWL treatment.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Erhan Erdoğan; **Design:** Erhan Erdoğan, Nuri Oğuzhan Sağlam; **Control/Supervision:** Kemal Sarıca; **Data Collection and/or Processing:** Erhan Erdoğan; **Analysis and/or Interpretation:** Kemal Sarıca, Erhan Erdoğan; **Literature Review:** Nuri Oğuzhan Sağlam, Erhan Erdoğan; **Writing the Article:** Erhan Erdoğan; **Critical Review:** Kemal Sarıca.

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