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RESEARCH ARTICLE

Does age affect outcomes after fluoroless ureteroscopy? A comparative study of young and elderly patients

Yaş, floroskopi içermeyen üreteroskopi sonuçlarını etkiler mi? Genç ve yaşlı hastaların karşılaştırmalı çalışması

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Abstract

Aim: The purpose of this study was to evaluate the outcomes of fluoroless Retrograde intrarenal surgery (fRIRS) in a younger population with the effectiveness and safety of this technique in treating kidney stones in people over 65.

Methods: Patients who underwent Retrograde Intrarenal Surgery for renal or ureteral calculi between January 2016 and June 2023 were evaluated retrospectively. Patients were divided into 2 groups according to their ages. Group.1 included patients under 65 years of age and Group.2 included patients over 65 years of age. Body mass index, number, size, location and density of the stones were recorded. Demographic characteristics, American Society of Anesthesiologists (ASA) score, anticoagulant use, operative time, fluoroscopy time, stone-free rates and complication rates according to the Clavien-Dindo classification were recorded separately for each group.

Results: When the young and old groups were compared, the primary results were complications and stone-free rate. A total of 1350 patients were included in the study. 1069 were in the younger patient group and 281 in the older patient group. There was no significant difference between the groups in terms of stone-free rate and postoperative complication rate. In terms of length of hospital stay, the older patient group tended to stay in the hospital longer than the younger patient group ($p<0.05$).

Conclusion: fRIRS can be administered as safely and effectively in elderly patients with high comorbidities as in younger patients.

Keywords: Fluoroscopy, radiation exposure, urolithiasis, ureteroscopy.

Özet

Amaç: Bu çalışmanın amacı, 65 yaşın üzerindeki kişilerde böbrek taşlarının tedavisinde bu tekniğin etkinliği ve güvenilirliği ile birlikte, daha genç bir popülasyonda floroskopisiz retrograd intrarenal cerrahinin (fRIRS) sonuçlarını değerlendirmektir.

Yöntemler: Ocak 2016 ile Haziran 2023 tarihleri arasında böbrek veya üreter taşları nedeniyle retrograd intrarenal cerrahi geçiren hastalar retrospektif olarak değerlendirildi. Hastalar yaşlarına göre 2 gruba ayrıldı. Grup 1, 65 yaşın altındaki hastaları, Grup 2 ise 65 yaşın üzerindeki hastaları içermekteydi. Vücut kitle indeksi, taşların sayısı, boyutu, yeri ve yoğunluğu kaydedildi. Demografik özellikler, Amerikan Anesteziyologlar Derneği (ASA) skoru, antikoagülan kullanımı, ameliyat süresi, floroskopi süresi, taşsızlık oranları ve Clavien-Dindo sınıflandırmasına göre komplikasyon oranları her grup için ayrı ayrı kaydedildi.

Bulgular: Genç ve yaşlı gruplar karşılaştırıldığında, birincil sonuçlar komplikasyonlar ve taşsızlık oranıydı. Çalışmaya toplam 1350 hasta dahil edildi. 1069'u genç hasta grubunda, 281'i yaşlı hasta grubunda yer aldı. Taşsızlık oranı ve postoperatif komplikasyon oranı açısından gruplar arasında anlamlı bir fark yoktu. Hastanede kalış süresi açısından, yaşlı hasta grubu genç hasta grubuna göre hastanede daha uzun süre kalma eğilimindeydi ($p<0,05$).

Sonuç: fRIRS, ileri yaşta ki hastalarda da güvenli ve etkili bir şekilde uygulanabilir.

Anahtar Kelimeler: Floroskopi, radyasyon, böbrek taşı, üreteroskopi.

INTRODUCTION

Stone disease is a common disease that can affect all age groups with an incidence of one in every thousand people (1). The incidence and prevalence of urolithiasis have increased globally in recent years, according to numerous studies in the literature, particularly in developed nations (2). The prevalence of kidney stones has been shown to increase with increasing age(2,3). According to reports, between 9.6 and 16% of all stone patients are older than 65, and the lifetime frequency is 14% (4).

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The first-line treatment for kidney stones with a maximal diameter of less than 20 mm is Retrograde Intrarenal Surgery (RIRS), under the guidelines of the European Association of Urology (EAU) (5). Due to the increasing experience in minimally invasive surgical procedures in recent years, some studies have reported that RIRS can be performed without fluoroscopy in selected cases and reported favorable results of this fluoroless RIRS (fRIRS) (6).

Despite being a minimally invasive surgery for kidney stones, flexible ureterorenoscopy (f-URS) is not without its problems. Because of the metabolic changes brought on by aging, stone disease is a serious issue (7). Treatment of stone disease is particularly important because of the increased risk of comorbidities in the elderly population. Despite not being a disease in and of itself, age has a significant role in perioperative complications and adverse outcomes because of the increased comorbidities that occur during surgery (8).

To our knowledge, although there are studies evaluating the safety and feasibility of fluoroless RIRS and conventional RIRS in the current literature, there are no studies investigating the safety of fRIRS in older patients and comparing it with fRIRS in a younger patient population.

Therefore, we aimed to investigate the efficacy and safety of fluoroscopy-free RIRS in the treatment of renal calculi in patients over 65 years of age and to compare the results of this procedure with the results of fRIRS in a younger population.

METHODS

Patients who underwent retrograde intrarenal surgery (RIRS) for renal or ureteral calculi at Karabük Training and Research Hospital between January 2016 and June 2023 were retrospectively evaluated. The procedures were performed under spinal or general anesthesia. Patients were divided into two groups based on age: Group 1 included patients younger than 65 years, and Group 2 included patients aged 65 years or older.

Pediatric age group (<18 years), patients with a history of previous renal or urethral surgery, ureteropelvic or ureterovesical stricture, elevated serum creatinine (>2 mg/dL), anatomical anomalies of the urinary system (horseshoe kidney, pelvic kidney) and non-opaque kidney stones were excluded.

Age of patients, body mass index (BMI), number, size, location and density [Hounsfield unit (HU)] of the stones were recorded. Multicalyceal stone cases were analyzed according to the location of the largest stone or the dominant stone that primarily determined the surgical strategy; for this reason, these cases were not classified as a separate subgroup and were not reported separately in Table 1. Demographic characteristics, American Society of Anesthesiologists (ASA) score, anticoagulant use, operative time (from placement of the cystoscope in the urethra to placement of the double-J stent (DJ) in the ureter), fluoroscopy time and stone-free rates were recorded separately for each group. Postoperative complications were evaluated according to the Clavien–Dindo Complication Classification system and recorded separately for each group. In this classification, Grade I–II complications were considered minor complications requiring pharmacological treatment or simple interventions; Grade III–IV complications were categorized as major for statistical analysis. Grade III complications were defined as those requiring surgical, endoscopic, or radiological intervention, and Grade IV complications were considered life-threatening and required intensive care management.

Urine cultures were obtained from each patient preoperatively, patients with urinary tract infection were given appropriate antibiotic treatment, and patients with no growth in urine culture were operated.

Every treatment was carried out in the conventional lithotomy posture while under either spinal or general anesthesia. All patients received intravenous antibiotic prophylaxis at the beginning of anesthesia according to EAU guidelines. Operations were performed with flexible ureteroscopy. Stones were fragmented with Holmium: YAG laser. The first evaluation of all patients was performed on the first postoperative day. Patients with no complications were discharged on the first day. Patients were called for follow-up on the 14th-28th postoperative days for DJ scan. At 1 month, stones smaller than 4 mm on noncontrast abdominal CT (NCCT) were considered as stone-free. If there were residual stones at follow-up, a second session for retrograde

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intrarenal surgery (RIRS) or ESWL was planned. The study was carried out with the non-interventional ethical committee of Karabük University's 2025/2581 decision and approval. Every patient who was part of the trial signed a voluntary consent form.

Statistical Analysis

The Statistical Package for Social Sciences version 21.0 (SPSS Inc., Chicago, IL, USA) statistical package was used for the entire investigation. To determine if numerical variables followed a normal distribution, the Kolmogorov-Smirnov test was employed. Mean, standard deviation, median, and minimum–maximum values were used to describe numerical variables, while frequency and percentage were used to indicate categorical variables. The Mann-Whitney U test was used to compare two independent medians, and the Student's t test was used to compare two separate means. The Chi-square test (Fisher's exact) was used to examine the association between two independent categorical variables. A 95% confidence level was used for the investigation (a statistically significant difference was defined as $p < 0.05$).

RESULTS

The study included 1350 patients in total, all of whom had successfully used fRIRS. Group 1 consisted of 1069 patients, while Group 2 had 281 patients. Table 1 displays information about the patients' baseline characteristics.

Table 1. Patient and stone characteristics

	Group 1 (<65 years)	Group 2 (>65 years)	p-value
Number of Patients, n (%)	1069	281	
Gender, n (%)			
Male	757 (70.8%)	161 (57.2%)	
Female	312 (29.2%)	120 (42.7%)	
Age (years)	42.04±10.6	67.4±6.6	
BMI, kg/m^2	26.2±4.06	27.7±4.5	<0.005
ASA, n (%)			
I	244 (22.8%)	4 (1.4%)	
II	711 (66.5%)	70 (24.9%)	0.184
III	114 (10.6%)	185 (65.8%)	
IV	-	22 (7.8%)	
Side, n (%)			
Right	562 (52.5%)	118 (41.9%)	0.052
Left	507 (47.4%)	163 (58.0%)	
Stone Location, n (%)			
Ureter	335 (31.3%)	79 (28.1%)	
Middle Calyx	216 (20.2%)	83 (29.5%)	
Upper Calyx	185 (17.3%)	45 (16.01%)	0.052
Pelvis	80 (7.4%)	51 (18.1%)	
Lower Calyx	270 (25.2%)	23 (8.1%)	
Stone Length, mm	12.94±6.3	13.5±6.29	0.089
Stone Density, HU	868.40±453.8	824.81±269.8	0.019
Number of Stones, n (%)	1.39±0.9	1.3±0.76	0.199
Preoperative Stent, n (%)	280 (26.1%)	88 (31.3%)	0.110
Operation time, min.	37.22±17.51	36.8±18.09	0.075
Postoperative DJ stent, n (%)	1060	281	0.082

The mean age of the patients in Group 1 and Group 2 was 42.26 and 67.44 years, respectively. The BMI of Group 1 was significantly higher than that of Group 2. The two groups' American Society of Anesthesiologists (ASA) scores did not differ substantially ($p>0.05$).

Table 2 lists the patients' operational information and the characteristics of the stones. In Group 1, 827 patients underwent spinal anesthesia and 207 underwent general anesthesia, whereas in Group 2, 241 patients underwent spinal anesthesia and 74 underwent general anesthesia. The most common localization of stones was proximal ureter, middle and lower calyx. Preop DJ stent was present in 280 patients in the younger patient group, while this number was 88 in the elderly patient group and both groups were similar in this respect. In terms of length of hospital stay, elderly patients tended to stay in the hospital longer ($p<0.05$).

Postoperatively, 99.2% of the patients in Group 1 had a DJ stent, while 99.3% of the patients in Group 2 had a DJ stent. When the stone-free rates were analyzed by NCCT at the 1st month outpatient clinic controls of the patients, the stone-free rate was 78.7% in the younger patient group and 82.0% in the older patient group. The stone-free rate did not significantly differ among the patient groups. 79.2% of the population was stone-free overall.

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In Table 2, intraoperative or postoperative complications were categorized according to Clavien-Dindo classification. Clavien-Dindo 1-2 complications were observed in 66 patients in Group 1 and 22 in Group 2. Clavien-Dindo 3-4 complications were seen in 10 patients in Group 1 and 1 patient in Group 2. Clavien-Dindo 5 complications were not observed in any patient. When it came to complications, there was no discernible variation between the groups (p>0.05).

Table 2. Postoperative results and complications rate

	Group 1 (<65 years)	Group 2 (>65 years)	p-value
Stone free rate, n (%)	841 (78.7%)	230 (82.0%)	0.030
Residual Stone, n (%)	228 (21.3%)	51 (18.1%)	0.624
Complication rate, n (%)	7.1%	8.1%	0.829
Length of stay, (day)	1.22±1.26	1.5±1.8	0.003
Postoperative Complications, n (%)			
Fever	28 (2.6%)	9 (3.2%)	
Hematuria	25 (2.3%)	10 (3.5%)	
Colic Pain	21 (1.97%)	4 (0.35%)	
Stent migration	2 (0.18%)	-	
Complication Grade, n (%)			
Clavien I-II	66 (6.1%)	22 (7.8%)	0.317
Clavien III-IV	10 (0.94%)	1 (0.35%)	

DISCUSSION

RIRS is the most common treatment modality for renal and proximal ureteral stones smaller than 20 mm. Fluoroscopy enables safe surgical steps such as localization of the stones, determination of the anatomy of the collecting system, and placement of the guidewire and DJ stent.

There are limited published studies investigating the use of low or zero dose fluoroscopy during fURS (9). Studies proving the efficacy of low-dose or zero-dose fluoroscopy in pediatric patients and general population patients are available in the literature (6,10). To our knowledge, there was no study investigating the efficacy of fRIRS in elderly patients. In our study, fRIRS was performed with a success rate of 82.0% in elderly patients and was consistent with the current literature.

In a study by Taguchi et al., the results of RIRS in 3 patient groups <65, 65-84 and ≥85 years of age were compared, and in another study by Emiliani et al., patients <80 and ≥80 years of age who underwent RIRS were compared (11,12). The young and old groups in these studies had comparable SFR and complication rates. Comparably, there was no discernible difference between the groups in our study, and the overall complication rate for fRIRS was 7.3%. In this regard, it was determined that both populations can safely undergo fRIRS.

Berardinelli et al. compared patients aged >65 years and <65 years who underwent RIRS and found that the operation time was similar in both groups (13). In our study, stone size and operation time were similar in both groups and the mean operation time was 35 minutes. In our current study, postoperative DJ stent was used in 99% of the cases and this result was consistent with the existing literature (14).

In a study by Solomon et al. evaluating the safety of RIRS in elderly patients over 80 years of age, the stone free rate (SFR) and complication rates were 73.9% and 25.7%, respectively (15). Tolga-Gulpinar et al. reported SFR rates of 81.1% for patients aged >60 years (16). Our overall stone-free rate and complication rate were reported as 79.2% and 7.3%, respectively. These results were comparable to conventional RIRS for fRIRS. Most of the complications were minor and included post-operative pain or urinary tract infection.

Solomon et al. also concluded that ASA score had no effect on the complications of urine culture (15). In our study, the overall ASA score was ASA-II with a rate of 66.5% in the younger population and ASA-III with a rate of 65.8% in the older population and no significant difference was observed between our groups in terms of ASA score.

Prattley et al. reported low complication rates (Clavien I/II) of 9% and high SFR rates (97%) in the follow-up of patients aged >70 years who underwent RIRS (17). The complications seen in our study were generally Clavien 1-2 complications and were consistent with the literature.

In a study comparing the effects of preoperative ureteral stents on surgical outcomes, it was observed that the surgical features were similar. It was observed that SFR

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rates tended to be higher in the stent group (18). In our study, in which a total of 368 patients had preoperative DJ stents, no difference was observed between the groups in this respect.

Previous studies have shown that there is a relationship between obesity and higher rates of kidney or ureteral stones (19). It is known that the effectiveness of RIRS decreases in obesity and causes lower stone-free rates (20). The older population in our study had a significantly higher BMI. The development of this syndrome is initially attributed to factors like the consequences of chronic diseases and an increasing sedentary lifestyle.

There are some limitations of our study. These include being a single-center and retrospective study, not performing randomization, and not having a comparison group using fluoroscopy. In addition, being one of the rare studies that comparatively evaluated the RIRS technique without fluoroscopy for young and elderly patients makes this study strong.

CONCLUSION

In our study, no significant difference was found between elderly and young patients in terms of outcome and complications after fRIRS, except for the duration of hospital stay. In the elderly group with high comorbidity, fRIRS can be applied safely and effectively with similar stone-free and low complication rates as in young patients.

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Ethic Approval: The study was carried out with the non-interventional ethical committee of Karabük University's 2025/2581 decision and approval.

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