

Comparison of the Effectiveness and Financial Aspects of Emergent Ureterorenoscopy and Elective Ureterorenoscopy in Patients with Symptomatic Ureteral Calculi

Akut ve Elektif Üreteroskopinin Semptomatik Üreter Taşlarında Etkinlik ve Finansal Yönlerinin Değerlendirilmesi

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ABSTRACT Objective: In this study, we aimed to compare the efficacy, complications, and financial aspects of urgent ureteroscopy (URS) with elective URS in patients who applied with the acute flank pain caused by ureteral calculi. **Material and Methods:** The records of 70 adult patients, who applied to the emergency and urology department at Gata Haydarpaşa Research and Training Hospital between June 2012 and May 2014 evaluated prospectively. Patients were divided into two group including the patients with colic pain that had started within 12 hours before admission who also agreed to be operated urgently (Group 1: acute URS) and the patients who requested the necessary intervention only if spontaneous passage cannot be provided (Group 2: elective URS). Kidney, ureter, bladder radiography (KUB), and urinary ultrasonography (USG) were applied to all patients. A total of 16 urgent and 19 elective URSs were performed. **Results:** The average treatment cost of the urgent URS patients was found to be 855.00 TL (143.78 €) per payment, and the average treatment cost of the elective URS patients was found to be 979.00 TL (164.63 €) ($p<0.001$) per patient. These results were statistically significant. **Conclusion:** Urgent URS is a treatment modality that requires minimal additional treatment. Besides, the patients can turn back to their social activities earlier, and it also reduces the psychological side-effects of urolithiasis. Although the superiority of one method over another cannot be concluded with this study, the application of urgent URS costs less compared to elective URS.

Keywords: Ureteral calculi; endoscopy; emergency treatment; elective surgical procedures, treatment outcome

ÖZET Amaç: Bu çalışmada akut böbrek kolik nedeniyle başvuran üreter taşı hastalarda acil üreteroskopinin (URS), elektif URS ile etkinlik, komplikasyon ve finansal yönlerini karşılaştırmayı amaçladık. **Gereç ve Yöntemler:** Haziran 2012-Mayıs 2014 tarihleri arasında Gata Haydarpaşa Eğitim ve Araştırma Hastanesinde acil ve üroloji bölümüne başvuran 70 yetişkin hastanın kayıtları prospektif olarak değerlendirildi. Hastalar iki gruba ayrıldı. Grup 1 (akut URS): kolik ağrısı başvurudan önce 12 saat içinde başlamış ve acil olarak ameliyat olmayı kabul eden hastalar. Grup 2 (elektif URS): Spontan taşlarını düşüremeyip elektif ameliyat olmak hastalar. Tüm hastalara direkt grafi ve üriner ultrasonografi uygulandı. Toplamda 16 acil, 19 elektif URS vakası değerlendirilip karşılaştırıldı. **Bulgular:** Acil URS hastalarının ortalama tedavi maliyeti ödeme başına 855,00 TL (143,78 €), elektif URS hastalarının ortalama tedavi maliyeti 979,00 TL (164,63 €) olarak bulundu ($p<0,001$). Bu sonuçlar istatistiksel olarak anlamlıydı. **Sonuç:** Akut URS ile hastaların ek tedavi ihtiyacı azalmakta ve daha hızlı sosyal aktivitelerine geri dönebilmektedir. Böylelikle taş hastalığının oluşturduğu psikolojik yan etkiler de en düşük seviyeye inmektedir. Her ne kadar akut ve elektif URS etkinlik olarak istatistiksel fark göstermese de akut URS daha düşük maliyet profili ile dikkat çekmektedir.

Anahtar Kelimeler: Üreter taşları; endoskopi; acil tedavi; elektif cerrahi işlemler; tedavi sonucu

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Like any other industry, the health industry aims more effectively, with less cost. The governments all over the world must adjust their health budget very carefully. Thanks to rapid developments in medical technology; the tendency towards minimally invasive surgery, which is more cost-effective than traditional surgeries. As we know, urolithiasis has been the most frequently encountered health problem throughout the history of civilization.^{1,2} Therefore, the cost of the treatment can be a vast amount of money.

Unfortunately, the incidence of the disease has increased with a 4% to 15% rate worldwide recently due to the sedentary lifestyle, changes in our dietary habits. Ureteral stones account for 20% of urolithiasis and about 70% of them distally located.^{3,4}

Ureteral calculi are one of the most important reasons for acute flank pain. Ureteral calculi is detected in 60-95% of the patients, who applied to the emergency room and the urology clinic with acute flank pain.⁵ The primary purpose of the treatment is to ensure that the patient returns to his normal life with the fastest and cost-effective way. Therefore, the most appropriate treatment method of the ureteral calculi depends on the age, comorbidities, renal functions, concomitant infection, and the severity of the symptoms.

In patients, who developed acute colic pain due to ureteral calculi, a new approach formed in the literature. The intervention would be more successful and more cost-effective if the intervention initiated before the development of inflammation and edema.⁶⁻⁸ In this study, we aimed to investigate the role of urgent ureteroscopy (URS) in patients with acute renal colic due to ureteral calculi. We planned a prospective study comparing the efficacy, complications, and financial aspects of urgent URS with elective URS.

MATERIAL AND METHODS

The study was started after the approval of the ethics committee of Cerrahpaşa Faculty of Medicine Dean's Office dated 05 June 2012 and No: B.30.2İST. 0.30.90.00 / 16078. The data of 70 adult (15-80 years old) patients who applied to the emergency and urology department at Gata Haydarpaşa Training and Research Hospital between June 2012 and May 2018 were evaluated prospectively. All procedures performed in the study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Adult patients (15-80 years old) who had calculi in the middle or distal ureter with a size of 5 mm-2 cm and were experiencing acute colic pain included in the study (Table 1). The patients with impaired renal function, severe urinary infection, solitary kidney, ureteral stricture history, and hemorrhagic diathesis were excluded from the study. The diagnosis of the calculi was made primarily with kidney, ureter, bladder radiography (KUB), and ultrasonography (USG). Intravenous pyelography (IVP) and/or computed tomography (CT) were performed in some cases (Table 2). Age, sex, professions, comorbidities, medication, alcohol, and smoking habits were recorded. Serum urea and creatinine levels of all patients were evaluated. The severity of hydronephrosis was assessed with USG weekly.

After the informed consent of the patients had been obtained, they were divided into two groups. The groups included the patients with colic pain that has started within 12 hours before admission and who also agreed to be operated urgently (Group 1: emergent URS approach) and the patients who requested

TABLE 1: Socio-demographic properties of patients according to groups.

	Acute URS (n=16)	Elective URS (n=19)	p*
Sex n (%)	Male: 15 (93.7%) Female: 1 (6.3%)	Male: 17 (89.5%) Female: 2 (10.5%)	1.00*
Age (Median min-max)	31.5 years (21-67)	31 years (22-65)	0.96**
Minor comorbidity n (%)	4 (25%)	1 (5.3%)	0.15*

* Chi square test, URS: Ureterorenoscopy, n: Numbers, Min: Minimum, Max: Maximum.

TABLE 2: Diagnostic tools.

	Acute URS (n=16)	Elective URS (n=19)
KUB/USG n (%)	16 (100%)	19 (100%)
IVP n (%)	1 (6.3%)	8 (42.1%)
CT n (%)	7 (43.8%)	6 (31.6%)

URS: Ureterorenoscopy, n: Numbers, KUB: Kidney, ureter, bladder x-ray, USG: Ultrasonography, IVP: intravenous pyelography, CT: Computerized tomography, Min: Minimum, Max: Maximum.

the necessary intervention only if spontaneous stone passage cannot be achieved (Group 2: elective URS approach). The urgent URS operation performed on the first group within the early 12 hours. For the second group, to facilitate spontaneous passage of the calculi and maintain the analgesia of the patients, MET was given. Weekly control was recommended. Elective URS was planned for the patients who still have stones on day 14. The number of the patients who achieved spontaneous calculi passage, treatments that they received, and the work loss duration were recorded. A single-dose intravenous antibiotic was administered as prophylaxis. URS was performed with Karl-Storz semi-rigid ureteroscope under spinal or general anesthesia. Lithotripsy was performed with pneumatic Swiss Lithoclast Master (EMS). The duration, the level of difficulty, the efficacy, and the complications of the operation recorded alongside with length of hospitalization, and additional treatments were also recorded. Furthermore, all laboratory and radiological tests, additional drug requirements, outpatient clinic applications and the costs of the surgery were calculated. The total costs of both procedures filed according to national health practice notifications.

Statistical analyses was performed by using SPSS for Windows version 15.0 package program. Definitive statistics were demonstrated with the median (the smallest and the highest values) since the number of patients was <25 for constant variables. Chi-square test was used in the comparison of urgent URS and elective URS groups and Mann-Whitney U test was used in the comparison of categorical variables since variables did not conform to a normal distribution. Cases in which the “p” value below 0.05 was evaluated as statistically significant results. G*

Power Version 3.1.7 was used for posthoc power analysis. In the study (acute URS: 16 patients - elective URS: 19 patients; mean cost \pm standard deviation of acute URS: 855.0 \pm 115.0; elective URS mean cost \pm standard deviation: 979.0 \pm 105.0) post hoc statistical power was calculated as 91.1%.

RESULTS

The patients were similar regarding sex and age. Minor comorbidities (diabetes, BPH, depression) presented in 4 patients (25%) in the urgent URS group and minor comorbidity (Parkinson’s disease) seen in 1 patient (5.3%) in the elective URS group. No additional morbidity developed during the operation and follow-up (p=0.15).

Before the process, pyuria presented in 3 patients (18.8%) in the urgent and 4 patients (21.1%) in the elective group. In the urgent group, 1 patient had *Escherichia coli* (100.000 cfu.) in the urine culture. Therefore, 7 days of oral medical treatment was given as guidelines recommended. (p=1.00). Before the process, hematuria presented in 10 patients (62.5%) in the urgent and 9 patients (47.4%) in the elective groups. The average serum creatinine level was 1.1 mg/dl in both groups.

In the urgent group, 1 patient (6.3%) underwent IVP and 7 patients (43.8%) underwent CT scan, in addition to KUB and USG. In the elective group, 8 patients (42.1%) underwent IVP and 6 patients (42.1%) underwent CT scan.

In the urgent group, 4 (25%) of the calculi were located in the middle, and 12 (75%) of them were in the distal ureter. Besides, 12 (75%) of them were located on the right, and 4 (25.0%) of them in the left ureter. In the elective group, 3 of the calculi (15.8%) found in the middle and 16 (84.2%) of them in the distal ureter. Furthermore, 11 (57.9%) of them were in the right, and 8 (42.1%) of them were in the left ureter (p>0.05) (Table 3). The median size of the calculus was 6.5 mm in the urgent group, and 7 mm in the elective group (p=0.55).

While grade I and grade II hydronephrosis were observed in 9 (60.0%) and 6 (40.0%) patients in the urgent group respectively, grade III hydronephrosis was not seen in any of the patients. In the elective

TABLE 3: Comparison of the location of calculi found in the patients among groups.

		Acute URS (n=16)	Elective URS (n=19)	p*
Right ureter	Middle n (%)	4 (33.3%)	0	0.64
	Distal n (%)	8 (66.7%)	4 (100.0%)	
	Total n (%)	12 (100.0%)	4 (100.0%)	
Left ureter	Middle n (%)	2 (18.2%)	1 (12.5%)	1.00
	Distal n (%)	9 (81.8%)	7 (87.5%)	
	Total n (%)	11 (100.0%)	8 (100.0%)	

* Chi square test, URS: Ureterorenoscopy, n: Numbers.

URS group; grade I, II and III hydronephrosis were observed in 5 (26.3%), 11 (57.9%) and 3 (15.8%) patients respectively although the severity of the hydronephrosis was higher in the elective group, no statistically significant difference was seen between the groups (p=0.07).

The median duration of operation was 14.5 minutes in the urgent group and varied between 6 and 40 minutes. In the elective group, length of operation ranged between 5 and 120 minutes and the median duration was 20 minutes (p=0.02) (Table 4).

In the urgent group, ureteral edema was observed in 5 (31.3%) patients, and in 12 (63.2%) patients in the elective group (p=0.06).

Although difficulty to reach the calculi during the operation was experienced in 1 patient (6.3%) in the urgent group, it was experienced in 10 patients (52.6%) in the elective group (p=0.003). The need for additional manipulation (railroad technique, etc.) was required in 5 patients (31.3%) in the urgent group and 8 patients (42.1%) in the elective group (p=0.50). A minor ureteral injury was observed in 1 patient (6.3%) in the urgent group and 5 patients (26.3%) in the elective group (p=0.18). An ureteral stent was needed in 1 patient (6.3%) in the urgent group and in 5 patients (26.3%) in the elective group (p=0.18).

TABLE 4: Comparison of the durations of operations performed on the patients among groups.

	Acute URS (n=16)	Elective URS (n=19)	p*
Duration of the operation (Median min-max)	14.5 min (6-40)	20 min (5-120)	0.02

* Chi square test, URS: Ureterorenoscopy, n: Numbers, Min: Minimum, Max: Maximum.

No calculi were pushed up to the kidney during the operation, and no major complication was observed in both groups. However, a calculus could not be reached in 1 patient in the elective group due to edema. Thus, a Double-J (DJ) stent was placed and a second URS operation was performed 10 days later.

During the follow-ups, 6 patients (37.5%) in the urgent group and 11 patients (57.9%) in the elective group were received medical treatment due to colic pain (p=0.22) immediately after the operations. One patient (6.3%) in the acute group and 7 patients (36.8%) in the elective group required medical treatment due to colic pain (p=0.04) after being discharged.

Fourteen patients (87.5%) in the urgent group stayed at the hospital for 1 day and 2 patients (12.5%) for 2 days. Three patients (15.8%) in the elective group stayed at the hospital for 1 day, 12 patients (63.2%) for 2 days and 4 patients (21.3%) for 3 days (p<0.001).

The average treatment cost of the urgent URS patients was found to be 855.00 TL (143.78 €) per payment, and the average treatment cost of the elective URS patients was found to be 979.00 TL (164.63 €) (p<0.001) per patient (Table 5). These results were statistically significant.

DISCUSSION

Treatment of urolithiasis requires a multidirectional approach. It is a dynamic process that has to be decided together with the patient and the physician according to the patient (age, comorbidity, pain threshold, profession), the stone (structure, number,

TABLE 5: Comparison of the costs of the treatment that have been provided for the patients among the groups.

	Acute URS (n=16)	Elective URS (n=19)	p*
Treatment cost	855.000 TL	979 TL	<0.001
(Median min-max)	(850.000-965.000)	(873.000-1811.000)	

* Chi square test, URS: Ureterorenoscopy.

location, size), and the experience of the physician.⁹ Therefore, perfect treatment is still unclear.

European Association of Urology (EAU) recommends medical expulsive therapy (MET) as the first approach for non-symptomatic calculi, less than 5 mm.¹⁰ However, in patients with acute flank pain, the decision of choice, between extracorporeal shock-wave lithotripsy (ESWL) and URS is not clear. Superiority depends on many factors such as stone-, technique- and surgeon-related factors. The overall better outcome was reported using URS.¹¹ Stone-free rates of 81%, 86% and 94% for proximal, middle and distal ureteric stones, respectively, have been reported after URS procedures.¹²

The concept of emergent definitive stone clearance is attractive and cost-effective. This approach offers a one-stage solution to reduce the patient's suffering and work-loss remarkably. Four published retrospective studies have clearly shown the value of emergent URS stone treatment. They reported that patients relieved from colic pain at an early period, furthermore, no additional treatment is needed, and the cost will be less compared to other treatment modalities.¹³⁻¹⁶ Also, Youn et al. showed that urgent URS is much safer than elective.¹⁷ On the other hand, urgent URS recommended at the expense of discontinuing medical treatment, admission, anesthesia and abandoning the expectant approach for spontaneous stone passage.¹⁸

In the literature, some studies compare ESWL, URS, and flexible URS recently. One of them is T Rombi and et al.'s study. They evaluated the socioeconomic differences of ESWL, URS, and flexible URS. They concluded that, although ESWL is a non-invasive treatment method, it needs much more clinical follow-ups. Therefore, it is more expensive.¹⁹ Another one is Parker et al.'s. They compared flexible URS and ESWL regarding expenses in the prox-

imal ureteral calculi. After a single session of ESWL and URS, 55% and 90.8% of the patients obtained complete removal of the calculi respectively. After ESWL, 9% of the patients required a second intervention. Also, they showed that ESWL was found to be 20.3 percent more expensive. If secondary interventions would be added, the differences increase to 39.9%.²⁰

According to our study, the average treatment cost of the urgent URS was found to be 855.00 TL (143.78 €) per payment, and the average treatment cost of the elective URS was found to be 979.00 TL (164.63 €) (p<0.001) per patient. Workforce loss and medications, which are used for expulsive treatment could not be added to the cost. If these variables could have been added, then the difference would have been more distinctive in favor of urgent URS.

The fact that our work is not up-to-date. It does not reflect the cost difference with the pricing under current conditions. However, the significant difference between the two groups sheds light on our day.

The present study has some limitations, the small number of patients might not have enabled an effective statistical evaluation. Although urgent URS was determined to be more effective and safer than elective URS, it should be considered that some of the calculi may pass spontaneously and unnecessary URS operation may have been performed on these patients.

CONCLUSION

Although spontaneous passage with MET can be achieved and ESWL is known to be an effective treatment, URS is an effective and safe method at an early period, especially in cases with distal and middle ureteral calculi.

Urgent URS is a treatment modality that requires minimal additional treatment. Besides, the patients can turn back to their social activities earlier, and it also reduces the psychological side-effects of urolithiasis. Although the superiority of one method over another cannot be concluded with this study, the application of urgent URS costs less compared to elective URS. Although the treatment and examination fees vary from country to country, we can get an idea in terms of cost via our study. However, this study demonstrated that urologists should be more enthusiastic while deciding on the URS treatment of the ureteral calculi.

In our study, we did not consider the calculi, which passed through the ureter spontaneously. It may be considered a weakness of the study.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki

declaration and its later amendments or comparable ethical standards.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

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: Temuçin Şenkul; **Design:** Cumhur Yeşildal; **Control/Supervision:** Ferhat Ateş; **Data Collection and/or Processing:** Cumhur Yeşildal; **Analysis and/or Interpretation:** Güven Oysul; **Literature Review:** Hasan Soydan; **Writing the Article:** Ahmet Teyfik Albayrak; **Critical Review:** Ahmet Kenan Karademir; **References and Fundings:** Ercan Malkoç; **Materials:** Ömer Yılmaz.

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