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Effects of repeated use of disposable FURS on efficiency, safety and cost analysis

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Abstract

In this study, we aimed to examine cost analysis and evaluate the results of retrograde intrarenal surgery (RIRS) performed with reusable and disposable flexible ureteroscope (FURS) devices in our clinic. In total, we included 96 patients who underwent RIRS surgery for kidney stones with reusable FURS (n = 49) and disposable FURS (n = 47). There were noted preoperative demographic data and stone characteristics of the patients. Also, operation time, fluoroscopy time, hospitalization time, urethral catheter removal time, return to work time, complication rates and cost per procedure were collected and analyzed. There were no significant differences between each groups in terms of demographic characteristics of retrospectively analyzed the data of 96 patients. In addition, the comparison made in terms of operative and postoperative results in both groups was similar. We determined significant difference for mean cost per case compared two groups. There were cost per case $ 293,87 in group 1 and $ 191,48 in group 2. We determined that the repeated use of disposable FURS compared in terms of cost analysis is a safe, effective and low cost method without increasing the infection frequency.

Keywords: Disposable FURS, reusable FURS, cost analysis, repeated use

1. Introduction

Flexible Ureteroscopy (F-URS) is minimal invasive surgical treatment of kidney stone which provides minimal complications and early return to daily life. But it has seem like a disadvantage with its high initial purchase cost. In the recent years, treatment success with the development of disposable F-URSs has been comparable to reusable F-URS results (1, 2, 3).

Some studies have shown that disposable F-URS performs stone free rate (SFR), operative time, and complication rate by high maneuverability and image quality comparable to existing reusable F-URS. The cost of surgery began to raise day by day depend on using high technological materials (4, 5).

We planned to make a comparison between disposable F-URS and reusable F-URS in terms of cost analysis, efficacy and safety in the treatment of kidney stone. In addition, we aimed to investigate the effect of re-use of single-use F-URS with proper cleaning and sterilization after use on treatment costs. To the best of our knowledge, the study presented here is the first attempt to compare reusable F-URS by repeated use of disposable F-URS.

2. Material and Methods

The data of 96 patients who underwent retrograde intrarenal surgery (RIRS) using reusable and disposable F-URS for kidney stones were retrospectively evaluated. Patients between the ages of 19-71 and without comorbidities were included in the study. Exclusion criteria were patients in whom concurrent ureteral stones, kidney anomalies and residual stone after procedure. We formed two groups. Group 1 consisted of 49 patients were operated with reusable F-URS, group 2 consisted of 47 patients were operated with disposable F-URS. The study was approved by the research ethics committee at the institution where the study was conducted.

All operations were performed under general anesthesia and in the dorsal lithotomy position. The ureter was examined endoscopically by entering through the ureteral orifice with a guidewire with a semi-rigid URS (Ultrathin Ureterorenoscope 4.5/6.5 Fr, Richard Wolf GmBH, Knittlingen, Germany) and possible ureteral pathologies were ruled out. There were used 7,95 F superslim reusable F-URS (URF-P7, Olympus, USA) in group 1 and 8.7 F disposable AnQing EU-scope (Anqing medical, China) in group 2. Also, a total of 5 disposable F-URS devices were used to complete the operations of 49 patients in group 2. Stone fragmentation was performed using a 272 micron holmium yag laser probe in the energy range of 1.0–1.5 J and 5-10 Hz by dusting method. A 10.7 F ureteral access sheath (Cook®, Bloomington, IN, USA) was placed in patients with stones of 15 mm and above and in cases where we predicted that the procedure time could be prolonged. The access sheath was successfully attached to all patients we

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planned. Routine antibiotic (cefuroxime) was used for 3 days after discharge for each patient. There were noted preoperative demographic data of the patients and standard preoperative investigation protocol that included stone side, stone diameter and Hounsfield unit (HU). Also, operation time, fluoroscopy time, hospitalization time, urethral catheter removal time, return to work time, complication rates and cost analyzes were collected and analyzed.

2.1. Statistical analysis

Statistical analyses were performed with SPSS version 18. 0 and data were displayed as mean±standard deviation (SD) (range). Wilcoxon Rank Test and independent sample t-test were used for statistical comparisons. A 5% level of significance was used for all statistical testing. A P-value<0.05 was considered significant.

3. Results

There were retrospectively analyzed the data of 96 patients. Mean age of the patients was 45.4±13.1(21-70) years in group 1and 44.6±12.8(19-71) in group 2. There were no significant differences between the two groups in terms of demographic characteristics, age, gender, height, weight, stone characteristics and Hounsfield Unit of the patients (Table 1).

Table 1. Demographic and preoperative parameters of the patients

	Reusable f-URS (n=49) (Group 1)	Disposable f-URS (n=47) (Group 2)
Age(years)	45.4 ±13.1 (21-70)	44.6 ±12.8 (19-71)
Sex (M/F)	26/23	23/24
Height (cm)	165.3±9.2 (152-182)	166.2 ±9.4(151-186)
Weight (kg)	73.7±6.4 (58-96)	74.6±7.8 (54-94)
R/L kidney	27/22	24/23
Stone diameter mm	15.6±4.9 (10-20)	15.4±4.9 (10-20)
Hounsfield unit	884.3±195.7	Hounsfield unit

Our mean operation time were 43±14.3(20-68) minutes in group 1 and 43.5±13.9(20-65) in group 2 respectively. Mean flouroscopy time were 2.9±1.7(0-9) seconds n group 1 and 2.8±1.7(0-8) in group 2. Ureteral access sheath were used in 15 (30%) patients in group 1 and in 16 (34%) patients in group 2. Mean hospitalization period of patients were 16.3±6 (6-24) hours in group 1 and 16.9±6.6(6-24) hours in group 2. Mean return to work time were 71.5±17.9(48-96) hours in group 1 and 72.5±13.6 (48-96) hours in group 2. According the data of the patients, it was observed that there was no statistically significant difference between the two groups in terms of operation time, fluoroscopy time, using ureteral access sheath, hospitalization time and return to work time. (Table 2) The urethral catheter was removed before all of patients were discharged. None of patients were required re-hospitalization. In both groups, urinary tract infection was detected in 3 (6%) patients in the postoperative period and using non-routine antibiotic was required. There were not detected complications such as acute renal injury, subcapsular hematoma, and stent migration any patient in both groups. We determined significant difference for mean cost per case compared two groups. There were cost per case $ 293,87 in group 1 and $ 191,48 in group 2.

Table 2. Comparison of operative, postoperative parameters and cost analysis of RIRS (reusable F-URS and disposable F-URS)

	Reusable f-URS (n=49)	Disposable f-URS (n=47) (Group 2)
Operation time (min)	43±14.3 (20-68)	43.5±13.9 (20-65)
Fluoroscopy time (sec)	2.9±1.7 (0-9)	2.8±1.7 (0-8)
Using ureteral access sheath	15 (30%)	16 (34%)
Hospitalization (h)	16.3±6 (6-24)	16.9±6.6 (6-24)
Return to work (h)	71.5±17.9 (48-96)	72.5±13.6 (48-96)
UTI n (%)	3 (%6)	3 (%6)
Subcapsular hematoma	0	0
Acute renal injury	0	0
Stent migration	0	0
Using non-routine antibiotic	%6 (3)	%6 (3)
Using non-routine analgesic	%12 (6)	%10 (5)
Initial purchase cost	$ 14.400	$ 1.800
Mean cost per case	$ 293,87	$191,48

4. Discussion

F-URS provides lots of advantages to treatment kidney stone. it has been possible to achieve higher success with the advancing technology in kidney stone treatment, and lower complication rates. In addition, operation times have been shortened thanks to the improvement in image quality (6, 7,8). In recent studies, F-URS procedure has begun to be recommended even for kidney stones larger than 2 cm, and higher success rates have been shown (2, 9). However, initial purchase cost, maintenance cost, performance degradation, and poor durability have been limitations of reusable ureteroscopes and led to the development of disposable ureteroscopes (10).

Initial purchase price and costly repairs are limitations on reusable F-URS and these costs show both local and international variations (1,11). In a recent review, purchasing costs were reported to range from $ 13.611 to $ 85.000 for reusable F-URS and $ 800 to $ 3.180 for disposable F-URS, depending on the country and device brand (1). The purchasing costs of the devices we used in our study were $ 14.400 for reusable F-URS and $ 1.800 for disposable F-URS.

The factors determining the durability of the instruments were shown as surgeon experience, repeated instrument passage through the working channel, laser activation in the canal, and increased operation time (12, 13). In a study conducted on the average number of uses until the need for repair, it was shown that a resuable digital ureteroscope was

used 21 times on average, while a resuable fiberoptic ureteroscope was used 6-15 times (14). However, we think that the current numbers are higher due to the increasing experience and the effect of developing devices during the time passed over this study. The study, reusable F-URS using in group 1 which was completed all cases without the need for repair. While a total of 5 disposable F-URS was used in Group 2, 10 cases were made with an average of 1 device. There was no deterioration in the disposable devices. Counter allowing 10 hours of use which set by the manufacturer caused us to change the device. When disposable F-URSs were first released, there was no counter program limiting their hourly use. Later, we think that these counters were added due to financial concerns. It is known that different brands have different durations were known. The disposable F-URS we used had a 10 hours' limit.

The average repair cost per case has been shown to range between $ 355 and $ 511 (15). In another study, the average total cost per case was calculated to be $ 2.799 for reusable F-URS and $ 2.852 for disposable F-URS. Also, the total operating room time was found to be shorter in the disposable F-URS group and it was stated that the time was effective on the cost (16). In our study, no damage was found for the devices used in both groups, and there was no repair cost. Our average total costs per case were calculated $ 293,87 for group 1 and $ 191,48 for group 2. We also found that the total operation times were similar in both groups, so the cost was not affected in this respect in our study.

Legemate, et al. stated in their study that the use of cumulative ureteroscope was not associated with higher microbial contamination and positive urine culture (17). The study, urinary tract infection was detected in 3 (6%) patients in both groups and the patients were treated on an outpatient basis. When considering possible device-related infection, there was no difference between two groups. We think that disposable devices can be reused with appropriate sterilization as indicated by the companies. Considering postoperative complications such as the need for reoperation or re-hospitalization that may affect the cost, this situation was not detected in both groups.

Our study has several limitations. We evaluated our results retrospectively. Other equipment such as laser, working equipment, light sources, video tower and supplies as ureteral access catheter and jj stent were not calculated. But, we primarily aimed to make a comparison between disposable F-URS and reusable F-URS in terms of cost analysis.

In developing countries like ours, surgery cost analysis is an important element, and it is important to reuse instruments with appropriate sterilization without harming patients as much as possible.

In terms of efficiency and safety, reusable F-URS and re-use of disposable F-URS with proper cleaning and sterilization show similar success results. When we compare it in terms of cost analysis, it has been seen that repeated use of disposable F-URS significantly reduces the cost without increasing the frequency of complications.

Conflict of interest

The authors declared no conflict of interest.

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