



Retrograde Intrarenal Surgery

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ABSTRACT

Urinary stone disease is a common health problem in the community. In the last two decades, percutaneous nephrolithotomy (PNL), extracorporeal shock wave lithotripsy (ESWL), and retrograde intrarenal surgery (RIRS) have become popular as minimally invasive methods. The European Association of Urology 2014 urinary stones guideline recommends PNL as the first line of treatment for kidney stones above 20 mm. ESWL remains the first choice for stones of <1 cm within the renal pelvis and upper or middle calices. For kidney stones between 10 to 20 mm, the location and movement of the stone, stone type, calyx anatomy, and patients status contribute to the choice of treatment. RIRS in combination with holmium YAG laser is effective and safe. Initially, RIRS was offered for lower calyceal stones, multiple stones, post-ESWL failure, comorbid illnesses, reduction in the diameter of development of surgical experience ureteroscopy, the development of optics providing better visibility, and the diversification of the equipment. At present, RIRS has become an alternative treatment modality to other minimally invasive therapy. It is thought that advances in technology will lead to more flexible instruments and surgical equipment for RIRS therapy. (*JAREM* 2015; 5: 85-8)

Keywords: Kidney stone, retrograde intrarenal surgery, ureteroscopy

INTRODUCTION

Urinary stone disease is commonly seen all worldwide. Its incidence is reported to be 10% in the United States of America, where the medical record system is thought to be more developed (1). In our country, the frequency of urinary stone disease has been reported to be 14.8% by Akinci et al. (2).

Treatment methods applied for this health problem in the community aim to achieve complete stone-free status with the lowest morbidity rates.

Previously, conventional open surgical techniques were used in urinary stone disease. However, in the last two decades, extracorporeal shock wave lithotripsy (ESWL), percutaneous nephrolithotripsy (PNL), variations of PNL [mini-percutaneous nephrolithotripsy (miniperc) and micro-percutaneous nephrolithotripsy (microperc)], and natural orifice ureteroscopy have been used more frequently. While rigid or semi-rigid ureteroscopes are used for ureteral stone treatment by ureteroscopy, retrograde intrarenal surgery (RIRS) is preferred for surgery on stones in the pyelocalyceal system.

Pérez-Castro Ellendt and Martínez-Piñero (3) performed the first planned ureteroscopy with a rigid ureteroscope in 1980. In the following years, revolutionary developments were seen in this field. The first flexible ureteroscope was used by Bagley et al. (4) in 1983.

Fuchs and Fuchs (5) presented the first large series in 1990, and Grasso and Chalik (6) described the use of a holmium YAG (Ho:YAG) laser in RIRS for the first time in 1998. In recent years, the diameters of flexible ureteroscopes have become smaller, their working channels have expanded, their active movement (deflection) capacities have increased, and their optical qualities have improved (7).

The popularity of RIRS has increased because of it being a minimally invasive method, the use of a natural orifice, its shorter

duration of hospitalization, and it being an effective treatment method for every type of stone when used with a holmium laser. In this study, literature on the use of RIRS in urinary system diseases was reviewed.

Indications, Surgical Technique, and Equipment

Surgical indications for flexible ureteroscopy are urinary stone disease, diagnostic ureteroscopy, treatment of upper urinary tract tumors, and endopyelotomy (8-10).

The equipment that must be kept ready in an operating room for RIRS is as follows:

1. Flexible ureterorenoscope (with a substitute)
2. Monitor system, video camera, and light source
3. Ho:YAG laser and laser probes of different sizes
4. C-armed scope device
5. Radiolucent operating table
6. Auxiliary equipment [hydrophilic and normal guidewires, ureteral catheter, balloon or stage dilator for the ureteral orifice or ureteral lumen, ureteral access sheath (UAS), zero-type nitinol basket catheter, and forceps for removing a stone or for biopsy]
7. Standard cystoscope
8. Contrast agent

The patient is placed in the dorsal lithotomy position. If supine PNL is planned to be performed simultaneously, the patient can also be placed in the Galdakao-modified supine Valdivia position. The procedure is rarely performed under local anesthesia in patients with contraindications for general and/or spinal/epidural anesthesia. Even the minimal movement that occurs during the respiration of the patient can change the surgical position. Therefore, general anesthesia is primarily preferred. To preserve the ureteral orifice and facilitate the process during operation, a



UAS is used over a guidewire placed retrograde into the calyceal system. In cases where ureteral narrowness is suspected, dilation of the ureteral orifice with a balloon or mechanical dilation with a semi-rigid ureteroscope can provide a solution during operation. The use of semi-rigid ureteroscopy also helps the guidewire to be advanced to the pelvicalyceal system under direct view. Owing to developments in instrument technology and reduced instrument diameters, ureteral dilation is less often required (11). A guidewire allows the simultaneous placement of a double J stent if balloon dilation becomes insufficient in the presence of ureteral stenosis. The placement of a passive dilation UAS with a double J stent for two weeks also provides benefits (12). The European Association of Urology (EAU) recommends the insertion of a guidewire for safety (recommendation degree A).

A UAS is advanced without applying force by controlling a c-armed scope device. There are UASs of different sizes (such as 14 Fr diameter and 35–45 cm length). The main benefit of a UAS is that it prevents increases in intrapelvic pressure by providing continuous anterograde fluid drainage from the pelvicalyceal system and that it allows multiple entries for removing stones from the urinary system. In this way, the duration of operation becomes shorter and the flexible ureteroscope is protected (13).

After reaching the calyceal system, the calyx is approached according to the position of the stone. With a Ho:YAG laser, the stone is broken up by using a 200 or 272 nm laser probe in the kidney and a 365 nm laser probe in the ureter. Because collecting stones is not intended apart from in exceptional cases, stones must be cut into small pieces as much as possible. As long as the diameter of the laser probe increases, the deflection capacity of the flexible ureteroscope decreases. Moreover, advancing the laser probe when the ureteroscope is deflected leads to irrecoverable damage to the flexible ureteroscope. Therefore, it is recommended that in particular stones in the lower calyceal system should be carried to the calyx, which can easily be reached with a flexible ureteroscope, with the help of a nitinol basket or forceps and then they should be broken into pieces in the calyx (14). The EAU guideline recommends the use of a nitinol-type basket (12). In some cases after the procedure, such as the presence of residual stone (≥ 3 mm), serious bleeding, ureteral perforation, or pregnancy, a double J stent can be used. There are some studies that report that the insertion of a double J stent in stone-free cases is unnecessary and that the insertion of a double J stent increases morbidity (15, 16). Drainage for 24 hours with a straight ureteral catheter provides the same clinical effect as a double J stent (17). In the EAU guidelines, it is recommended that a double J stent should not be inserted in uncomplicated cases and, if inserted, an alpha blocker should be used for the stent to be well tolerated (Level of evidence: 1a) (12).

DISCUSSION

In the EAU guidelines, PNL is recommended for stones larger than 20 mm placed in all renal calyces and the renal pelvis and ESWL is recommended for stones smaller than 10 mm. On the other hand, for stones of sizes between 10 mm and 20 mm, the

localization, type of stone, calyx anatomy, and patient-related factors are important. RIRS is not recommended for the primary care treatment of urinary stone disease owing to the lack of enough prospective and randomized controlled clinical trials (12).

Although ESWL provides a success rate of 92% with proper patient selection, the success rate can decrease to 56% in some clinical cases such as stones in the lower calyx, radiolucent stones, a number of stones greater than one, the calyceal anatomy, and hard stones (cysteine, calcium oxalate monohydrate, and brushite) (18, 19). Donaldson et al. (20) published a meta-analysis including seven randomized controlled trials (RCTs) that compared ESWL, PNL, and RIRS in lower pole stones. In five RCTs, the efficacy of RIRS and ESWL was compared and complete stone-free status was reported to be achieved at a rate of 89.5% after RIRS and at a rate of 70.5% after ESWL, regardless of stone size. When cases were classified according to stone size, RIRS was found to be superior to ESWL in lower pole stones of sizes between 10 mm and 20 mm, but their success rates were equal for stones smaller than 10 mm. Moreover, although this was not statistically significant, the rates of additional interventions after RIRS treatment were lower.

In an RCT conducted by Pearle et al. (21), it was reported that ESWL provided less need for analgesics, a shorter hospital stay, and better quality of life in lower pole stones smaller than 10 mm. On the other hand, Singh et al. (22) found that the rate of complete stone-free status was 85.7% for RIRS treatment and 54.3% for ESWL treatment in lower pole stones with sizes between 10 mm and 20 mm and they observed that RIRS was markedly superior. There are other studies that report the superiority of RIRS over ESWL in lower pole stones (23–25). In an examination of these studies, it was concluded that RIRS is superior to ESWL with respect to providing complete stone-free status as the size of the stone increases; it gives rise to less need for additional intervention; and morbidity rates are higher than in ESWL, but this is not statistically significant.

In the literature, there are a few meta-analyses that compare RIRS with PNL. In the meta-analysis of De et al. (26), which included 727 PNL and 454 RIRS cases in two randomized and eight non-randomized studies, it was revealed that PNL was markedly superior in terms of complete stone-free status, but the rate of complications such as blood loss was higher. Although the authors did not find any differences between the two treatment methods in terms of operating time or the need for additional intervention, they emphasized that RIRS provided a shorter hospitalization time.

In a retrospective study conducted on 437 patients, whereas the rate of stone-free status was found to be 91.4% in PNL, it was 87% in RIRS. The rate of all complications was reported to be 10.9% in RIRS but 21.1% in PNL. It was also stated that RIRS was more advantageous than PNL in terms of blood transfusion rates, duration of surgery, and duration of hospital stay (27). PNL is effective, in particular in patients with heavy stones, but it is an invasive treatment method (28). The efficacy of RIRS for stones larger than 1.5 cm in the renal pelvis and calyceal system has not yet been proven in prospective and randomized studies.

Although RIRS is a minimally invasive treatment method, it has well-defined complications. In the literature, the rates of these complications were reported to range from 9% to 25% (29, 30). These are generally minor complications and disappear after monitoring. The major complication is ureteral avulsion, which was observed at rates of below 1% after surgical procedures. Avulsion must be corrected by endoscopic, laparoscopic, or open surgery techniques.

CONCLUSION

Retrograde intrarenal surgery is an effective and safe treatment method in patients with kidney stones that are not suitable for ESWL or that are resistant to being broken up by ESWL, multiple small kidney stones, obesity, bone deformity, pregnancy, and hemorrhagic diathesis, and in patients in whom absolute stone-free status must be achieved (such as pilots). It is thought that it will be used more commonly as a result of technical developments in the equipment used in stone surgery (11).

Peer-review: Externally peer-reviewed.

Author contributions: Concept - O.Ö.C.; Design - O.Ö.C.; Supervision - T.A.Ö.; Resources - O.Ö.C., R.K.; Materials - T.A.Ö.; Data Collection and/or Processing - O.Ö.C., T.A.Ö.; Analysis and/or Interpretation - O.Ö.C.; Literature Search - O.Ö.C., T.A.Ö.; Writing Manuscript - O.Ö.C.; Critical Review - T.A.Ö., R.K.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study has received no financial support.

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