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Perspective

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High Durability of Flexible Ureter Scopes: A Single Hospital Experience

Jelena Grusina*

Department of Biotechnology, University of Rome, Aldo Moro, Roma, Italy

***Corresponding author:** Jelena Grusina, Department of Biotechnology, University of Rome, Aldo Moro, Roma, Italy. E-mail: grusinaena@gmail.com

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Description

A surgical method employing a modified technique of using an Olympus digital flexible URF-V ureter scope was developed. We retrospectively studied 546 patients who underwent retrograde intrarenal surgery (RIRS) using this modified approach performed by a single surgeon at our hospital, and investigated the outcome and durability of the ureter scope. The URF-V ureter scope required repair five times in total. During factory maintenance, distal working channel damage was noted twice, and outer bending rubber damage was noted once. The most recent two repairs were required due to laser penetration. Despite the damage and repairs, the deflection system was almost entirely intact after high-frequency use. The durability of FURS determines the efficacy of RIRS for renal stones. Our modified upside-down technique for manipulation of FURS under unequal dual deflection in order to preserve the deflection apparatus, which yielded a greatly prolonged durability. Additionally, the use of mimic drive turning decreased the time needed to train urologists. The fragility and high repair costs of fURS hinder the widespread use in the urological practice. To invent a modified manipulation in RIRS is mandatory for the development of this operation and make the fURS much durable simultaneously. We share our upside down manipulation technique in the reverse type fURS with an unequal dual deflection to preserve the best durability. The associated mimic drive turning decreases the learning curve of young surgeons and makes the RIRS operation easier.

Deflection System

Retrograde intrarenal surgery (RIRS) is a remarkable innovation in the history of renal stone management. With the improvement of ureter scope design and accessory instruments, the indications for this operation have increased, as has procedure safety. However, the high purchase and repair costs of flexible ureter scopes (FURS) have limited the use of RIRS in the clinical setting, suggesting that development of a modified technique or a re-design of the ureter scope is required to extend the life of the scope. In terms of parts that are most vulnerable to incurring damage, these include tip deflection, and damage to the inner lining of the ureter scope and the fiber-optic bundles. Careless deflection of the distal tip of the ureter scope or firing of a laser within the scope may easily damage the working channel, which is the part of the device most commonly damaged. In order to improve the durability of the scope, this common type of damage can be eliminated by retaining the scope in a straight position when the laser fiber is passed through the channel, and ensuring that the laser is not fired inside the scope. Additionally, by using new ureteroscopic accessories in combination, such as a ureteral access sheath [UAS], 200-μm holmium laser fiber, and nitinol devices, damage to the delicate endoscopes can be reduced. Damage may also occur during the handling and sterilization processes, which can be reduced by providing sufficient training to staff. By implementing the aforementioned precautions regarding the working channel, the durability of FURS can be extended to 30 cases. Furthermore, to increase the durability of FURS to the maximum, deflection system maintenance is the most critical component. We devised a novel method of manipulating the ureter scope during surgery, which achieved extended durability of the apparatus and shortened the learning curve for urologists.

Each patient was informed about the benefits and risks of employing the ureter scope, of possible alternative treatments, and of the potential need for a staged procedure to achieve satisfactory stone clearance. The patients were asked to sign an informed consent document prior to the surgery. The inclusion criteria for this study were: age 18–86 years; renal stones ≥0.5 cm in diameter. Pregnant patients were excluded. We reviewed the demographic data, renal stone characteristics and procedure-related outcomes and complications. Routine preoperative and 1-month postoperative work-ups included recording medical history, physical examination, urinalysis, urine culture, and blood tests. Abdominal kidney ultrasound plus kidney, ureter and bladder radiography (KUB) were performed. Intravenous urogram pyelography and non-contrast computed tomography (NCCT) was selectively performed preoperatively. The operative duration was calculated from the time of first insertion of the endoscope (cystoscope or ureter scope) to the completion of stent placement. Peri- and postoperative complications were reported according to the Clavien classification system. The stone successful rate (SSR) was defined as residual fragments up to a maximum of 4 mm in diameter detected on ultrasonography or NCCT at the 1-month follow-up. The stone diameter was defined as the maximum diameter of the biggest stone plus one quarter of the diameter of the second largest stone; the others were neglected in cases of multiple renal stones. The primary end point was the evaluation of the effectiveness of using the ureter scope for the treatment of renal stones, expressed as the SSR. The secondary end point was the assessment of the safety of the procedure, expressed as the complication rate.

Adequate Measures

During our study period, the ureter scope required repair on three separate occasions. The first occurred after 31 cases; the second after a further 84 cases; and the third after another 201 operations had been performed. Fourth and fifth repairs were required after other 126 and 28 cases, and we were able to use the scope for another 76 cases following the last repair. Total 5 repaired in 470 cases and in the first two repairs, the distal working channel required fixing. The third repair required fixing of the outer rubber. The fourth and fifth repairs were needed owing to vertebrae punctures due to laser fiber snapping. However, the deflection system remained almost intact (the maximum ventral and dorsal deflection has deteriorated at 180–160 and 275–250, respectively), even after high-frequency use. The fragility and cost of FURS prevents widespread use in urologic practice. Afane

reported that FURS made by four manufacturers required main repairs after only 15 procedures or 13 h of usage. Shah reported that the average durability of the Olympus URF-V was 14 operations. When handled by expert practitioners, the life of a ureter scope may be extended to 12.5 operations before requiring repair. The three most commonly reported kinds of damage include loss of active tip deflection secondary to extreme ureter scope deflection with or without an instrument, inadvertent firing of the laser in the working channel, and working channel damage resulting from instrument passage.

By taking the aforementioned precautions regarding the working channel, the durability of FURS can be easily extended to 30 cases. Furthermore, to increase the life of FURS to more than 100 operations, deflection system maintenance is the most critical component. It is well-known that the most fragile part of the device is the deflection unit. The deflection mechanism of FURS permits free movement within the renal collecting duct system. This deflection is usually constructed by several wires running down the endoscope from end to end, connected to a manually-operated lever mechanism. The current instrument design trend is to have continuous controlled dual deflection with increased downward and upward deflection up to 275°, referred to as “exaggerated deflection”, in both directions. The purpose of this stressed design is to obtain lower pole access, where the urologist maximally deflects and advances the tip of the endoscope. Traxer performed 50 operations using a new-generation flexible ureter scope, and found that the need for repair occurred less often; after 76 h of use, the maximal ventral and dorsal deflections had deteriorated at 270−208° and 270−133°, respectively. Another study found that the frequency of repair increased with decreasing device diameter and rising ureter scope length, and major types of damage, such as working channel deterioration from laser burn or tool passage, are avoidable if physicians take adequate measures to protect their equipment.