Current Situation of Semirigid Ureteroscopy in the Treatment of Urolithiasis

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INTRODUCTION

The first published description of a ureteroscopy was made in 1980 by Perez-Castro et al. [1] Since then, ureteroscopy (URS) has made a long and fast road to the present time; from a dilated ureter in 1980 to the miniaturized URS and micro-URS of today, from inspection for diagnosing to treatment and from bare hands to medical devices.

This fascinating development of ureteroscopy, it could be summarized in several subjects of interest:

- Technological advances in imaging systems and scopes.
- Stone fragmentation devices and laser approaches
- Anti-retropulsion devices
- Postoperative care

TECHNOLOGICAL ADVANCES IN IMAGING SYSTEMS.

Camera

The camera is the central focus of any endoscopic equipment. The requirements for endoscopic camera systems could be centered on maximum and precise resolution and natural color rendition.

This technology comprise sensors in 1-chip and 3-chip technology, CCD and CMOS sensors. Large sensors can be used in a camera head while uniquely small sensors form the basis of distal “chip-on-the-tip” application.

Light Sources

There are two principal types of light sources: LED and xenon.

LED light sources offer many benefits for users:

1. LED light sources have a very long life time and they virtually never need replacing.
2. The LED lamps are very efficient, i.e. power consumption is low and very little heat is generated in the device.
3. They are virtually inaudible. This feature makes an important contribution to improved working conditions in the operating room.
4. The light color of the LED light sources is very constant and similar to the light generated by xenon lamps, i.e. also suitable for new, digital endoscopic cameras.

Xenon

The high color temperature, similar to daylight (a bluish light) of xenon light is also ideal for new, digital endoscopic cameras, in its two varieties: 100 and 300 watt xenon light.

Fluoroscopy

Probably, the key of the modern C-Arms of fluoroscopy is the latest generation of flat screen detectors. They are more sensitive and faster. Their sensitivity allows a lower dose of radiation for a given picture quality than film, improving differentiation on anatomical structures. They are lighter, far more durable, smaller in volume, more accurate, and have much less image distortion than image intensification detectors and can also be produced in larger sizes. It offers up to 25% larger coverage of the urinary tract than standard image intensifiers, and hence, decreased need for intraoperative movements (larger field of vision).

TECHNOLOGICAL ADVANCES IN URETEROSCOPES

Miniaturization of the ureteroscopes

All suppliers of endoscopic equipment have developed ultrathin ureteroscopes ranging between 6.5 - 4.5 Fr. The main consequence of miniaturizedsemirigid ureterorenoscopes is that the intramural ureter do not require dilation. And the extreme consequence of the miniaturization is Micro-URS, a new approach to the ureter based on the microperc device and attempts to reduce the ureteral damage caused by conventional instrumentation [2]. Probably, the most advanced ureteroscope commercially available nowadays is a semirigid video ureteroscope with a “chip-on-the-tip” technology (EndoEye URS Olympus). The result is a digital quality image in a semirigid scope.

Intracorporeal Lithotripsy Systems and Laser Approaches

Holmium: YAG laser is the gold standard from at least 10 years.
ago because of its effectiveness in the fragmentation of stones of any composition and excellent security profile. It is a solid-state laser operating at a wavelength of 2140 nm, in pulsed mode with a pulse duration of 250 to 350 micro-seconds. The mechanism of laser lithotripsy is an elongated cavitation bubble generating a weak shock wave and through a photothermal mechanism causes vaporization of the stone [3-5]. The laser fibers available in the market are 200, 365, 400, 550, and 1000 microns. Another less expensive method of stone breakage is pneumatic lithotripsy (and its use is limited to semirigid endoscopes due to its rigid probes). Its main features are:

- Independent effect of stone composition
- Simultaneous suction and lithotripsy
- Efficacy and safety
- Risk of stone retropropulsion

A hot topic in the Endourology is how do we break up stones. We must break up piece by piece and basketing or dusting. May be the answer is as stone requires. We could divide these requirements in laser fragmentation in two types:

**Stone location**

- **Kidney** (larger stones) where the speed is important but, at the same time, the kidney is resistant.
- **Ureter**, where caution is important because of its fragility.

**Stone composition**

- **Hard stones**: monohydrate calcium oxalate, uric acid, cistene, are usually broken up in fragments
- **Other stones**: struvite, dihydrate calcium oxalate, could be dusted

**Lasering In the Ureter**

The endourologist must follow a list of rules:

1. Always, or whenever possible, you should use safety wire
2. Lithotripsy should be started at low power: 0,5-1 J/5-10 Hz
3. Basket should be used with caution, because the ureteral stones are always bigger than they appear.

Therefore, dusting, from the periphery to the core of the stone is the ideal situation. But many times, the result is large fragments for basketing or using forceps.

**The Near Future of Holmium Lasers**

The fragmentation rates for long and short pulse durations at identical power settings remain at a comparable level. Longer holmium laser pulse duration reduces stone pushback. Therefore, longer laser pulses may result in better clinical outcome of laser lithotripsy and more convenient handling during clinical use without compromising fragmentation effectiveness [6]. But some times, the oldest is best... And, we shouldn’t ignore the use of the forceps because they are a principal part of our armamentarium.

**Anti-Retropulsion Devices**

Figure 1 classifies the different anti-retropulsion devices.
In conclusion, since its introduction in 1980, ureteroscopy has been used for diagnosing and treating a wide range of urological diseases, but especially urinary lithiasis. The continued development have resulted in miniaturized scopes that combined with refinements in ureteroscopic technique allow to optimize success with reduced morbidity.

**REFERENCES**


**Table 1:** Classify the indications of the ureteroscopy.

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