Endoscopic management of urinary lithiasis through laser energy at the Hospital General “Dr. Manuel Gea González”


Urology Service, Hospital General “Dr. Manuel Gea González”, Mexico City, Mexico

Abstract

Background: Ureteral lithiasis has changed significantly over the last 25 years. The modern era saw the implementation of extracorporeal lithotripsy and percutaneous nephrolithotomy, as well as other endourologic procedures, resulting in the large majority of lithiasis cases being treated with these techniques. The option of laser management of stones has led to perfecting the techniques and obtaining better results.

Aims: The aim of this study was to describe the results in patients with urinary lithiasis managed endoscopically with laser energy at our hospital.

Methods: A descriptive analytic study was conducted on patients diagnosed with pyeloureteral lithiasis that were managed endoscopically and treated with laser energy.

Results: A total of 125 lithotripsies with Holmium laser were performed. The mean age of the patients was 41 years, mean stone size was 1.03 cm, and mean surgery duration was 70 minutes. Complications presented in 4.8% of the total number of patients.

Conclusions: The results of this study showed the high percentage of stone resolution in lithiasis management with laser energy.
Introduction

The management of ureteral stones has changed dramatically in the last 25 years. Up until the 1980s, open ureterolithotomy was the management standard. The modern era of lithiasis management began with the introduction of extracorporeal shock wave lithotripsy (ESWL) and percutaneous nephrolithotomy (PNL). Since then, the development of various endourologic procedures has continued, resulting in virtually all urinary stones being managed with noninvasive or minimally invasive techniques.1,2

While stone management has tended to be less invasive, the residual stone-free result has been less definitive, making it necessary to have postoperative imaging studies for defining the effectiveness of the procedure. Throughout this period, radiologic studies have advanced with the presence of spiral non-contrast computed tomography (CT) as the diagnostic method of choice for lithiasis.3,4

Laser lithotripsy has been established as an effective option. The first laser to be used in the management of urinary lithiasis was the pulsed laser in 1987.4 Afterwards, other types were added, such as the Nd:YAG and Alexandrite lasers. More recently the Holmium laser joined the list of viable options for the management of this pathology.5

From its introduction to the beginning of the 1990s, the Holmium laser has held a prominent position within urologic practice due to its wide variety of indications, from tumor resection and benign prostatic hyperplasia management to lithotripsy in urinary stones. Holmium laser lithotripsy through urethroscopy is a safe and effective method for managing urinary lithiasis, especially for large stones. Ranges of success of over 90% have been reported with complications of up to 10%.6,7

In comparison with other lithotripter apparatuses that fragment stones in irregular fracture planes, the photothermal mechanism of Holmium laser lithotripsy produces symmetrical craters in the surface of the stone; these craters increase in depth and amplitude to the degree that the pulse energy increases and they maintain their symmetrical appearance regardless of the composition of the stone.8

The process of Holmium laser fragmentation is predominantly photothermal, due to long pulse duration that significantly reduces the force of acoustic emission; the vapor bubble produces an open channel so that the laser reaches the stone surface (the Moses effect), the light absorption within the stone causes a rapid increase of temperature that leads to a chemical rupture, resulting in stone decomposition and fragmentation.9

Even though fragmentation with the Holmium laser can take longer than other apparatuses, it produces smaller fragments than other intracorporeal lithotripters. It can also be advantageous for carrying out ureteronephroscopy because the optical energy can be released with flexible, small caliber fiber optics.10,11

The aim of this study was to describe the results of patients with urinary lithiasis endoscopically managed with laser energy at the Hospital General “Dr. Manuel Gea González” within the time frame of January 2011 and August 2013.

Methods

A descriptive, ambispective, observational, and cross-sectional study was conducted. The analysis took into account all the patients with pyeloureteral lithiasis endoscopically managed with laser energy at the Urology Service of the Hospital General “Dr. Manuel Gea González” within the time frame of January 1, 2011 and August 31, 2013 and that had follow-up with CT scan. All patients with incomplete medical records were eliminated from the study.

The variables evaluated were sex, age, stone resolution, stone location, stone size, Hounsfield units (HU), the presence or absence of obstruction, type of procedure (rigid and/or flexible approach), and the presence of complications.

All the procedures were carried out in accordance with the General Health Law in Health Research Material Guidelines, second title, chapter 1, article 17, section I. The study was considered no-risk research, and as such, did not require statements of informed consent. It was accepted by the ethics committee of our institution.
Results
A total of 125 Holmium laser lithotripsies were performed and they were classified according to stone location and size. The procedure was carried out in the operating room using the Deka SMART® 2100 Holmium laser machine that has a wavelength of 2,100 nm, a maximum energy output of 2 J, an exiting diameter of 4 mm, and a frequency of 7, 10, 15, and 20 Hz, with 550, 365, and 200 mm fibers. Access was attained with rigid Storz and flexible Olympus® ureteroscopes with the use of a safety guidewire, and the laser lithotripsy was then performed.

The mean age of the patients was 41 years and there was a predominance of men over women at a ratio of 1.16:1. HU were 1,003 (mean) and stone size was 1.03 cm (mean). Mean surgery duration was 70 minutes and blood loss was 11 mL. Forty-four stones were found in the upper third of the ureter, 23 in the middle third, 40 in the lower third, 4 in the middle calyx, 6 in the lower calyx, and 6 in the pelvis (fig. 1). Total stone resolution was 87.2% and residual lithiasis was 12.8% (fig. 2). Resolution by location was 77% in the upper third, 100% in the middle third, 95% in the lower third, 73% in the calyces, and 50% in the pelvis (fig. 3). Resolution by size was 97.5% in stones < 1 cm, 79.1% in stones of 1 to 1.4 cm, 37.5% in stones of 1.5 to 1.9 cm, 25% in stones of 2 to 2.4 cm, 100% in stones of 2.5 to 2.9 cm, and 40% in stones > 3 cm (fig. 4).

There were complications in 4.8% of the patient total; 3.6% were found in the stone-free group and 1.2% in the residual lithiasis group. Three were immediate complications (ureteral false passage, bacteremia, and pyelonephritis) and 3 were late complications (2 calcified double-J catheters and one renal abscess) (table 1).

The majority of the residual lithiasis cases were able to be resolved with a second pneumatic or laser lithotripsy, with ESWL or open surgery as viable options (table 2).

Discussion
With a complete resolution percentage in the first procedure of 87.2%, we were within the ranges reported at the institutes with expertise in the management of this pathology, worldwide, as well as in the reference literature. Residual lithiasis presentation increased in relation to the increase in stone size, and it had a higher location.

Since the beginning of urinary lithiasis management with laser energy, there have been satisfactory results superior to those of other procedures, making it one of the best options in patients that fit this method’s treatment criteria.
The detected complications were not directly related to stone resolution or residual lithiasis; they were all resolved without sequelae or deterioration of the integral status of the patients.

**Conclusions**

The results of this study show us the high resolution percentage in the management of lithiasis with laser energy. It also makes clear the need to carry out adequate patient selection for this procedure, given that stone size and location directly influence the percentage of disease resolution.

We must have greater experience with this technology in order to achieve a better success rate and to satisfactorily manage more complex stones. As is true with all technology, we must know its limitations and take them into account when making patient-directed decisions.

In addition to being a safe method when employed with the proper precautions, laser lithotripsy enables us to improve the postoperative management of the patient, with less pain and discomfort, a more rapid return to the workplace, and less inconveniences in daily life than other procedures for lithiasis management.

**Conflict of interest**

The authors declare that there is no conflict of interest.
Financial disclosure

No financial disclosure was received in relation to this article.

References