



Looking at surgery in a new light: laser surgery for benign prostate disease

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Introduction

A man who is diagnosed with benign prostatic hypertrophy (BPH) can follow one of the several courses. One option is to do nothing and see what develops. In most cases the enlarged gland eventually pinches the urethra, interfering with urination or causing incontinence. When this happens some men obtain relief from medications, but if symptoms persist surgery may be required.

Many patients are put off by the prospect of undergoing transurethral resection of the prostate (TURP), the standard surgical approach. Like any other invasive procedure, TURP causes serious side effects in a few people. Most medical centers are now promoting laser surgery as a less invasive, less traumatic way to treat BPH in older men. This has piqued the curiosity of patients who are eager for an alternative to standard surgery.

Lasers have evolved over the past decade, with technical refinements that have resulted in procedures that can achieve transurethral-like results in a safe and efficacious manner. The physics and characteristics of the laser light, such as wavelength and power densities, influence efficiency of the treatment and safety profiles of various laser techniques and systems.

Laser physics

The word 'laser' is actually an acronym standing for 'light amplification by stimulated emission of radiation'. Laser light is characterized by being a single wavelength (monochromatic) of collimated coherent light that is emitted from an energized laser material (semiconductor, crystal, gas, or dye). This light carries energy that, when absorbed at a target chromophore, is converted to heat. The level of heat generated can be high enough to vaporize away the targeted material. In surgical applications, the laser energy can produce two types of laser tissue interactions: **coagulation**, the heating of tissue below the boiling/vaporization point but above the temperature threshold for protein denaturation; and **vaporization**, instant removal by heat above the vaporization/boiling point to evaporate away tissue.

The rate of tissue ablation is determined by the rate of laser energy deposition into tissue, which in turn is also driven by the laser light wavelength (λ). In laser prostatectomy, one quickly delivers a sufficient amount of energy per unit volume of tissue to bring cells to vaporization temperature. If cells are brought only to coagulation

temperature with lower power, then only coagulation occurs. The net amount of vaporization and coagulation effects produced by a laser can influence efficiency of tissue removal, persistence of unwanted side effects (e.g., dysuria), and timing of the healing process.

For decades, the gold standard for BPH treatment was the transurethral resection of the prostate. However, complications and side effects of TURP, including fluid absorption, electrolyte imbalance, intraoperative and postoperative bleeding, and inadequate resection, have not made it a first-choice treatment, even among many less effective options. Having led the charge in other clinical applications, laser therapy promised several advantages over standard TURP, including technical simplicity and the absence or minimization of complications, such as intraoperative fluid absorption, bleeding, retrograde ejaculation, impotence, and incontinence. Laser therapy promised a shorter hospital stay and faster recovery. Hemostasis and limiting irrigant absorption—especially hypotonic, hyponatremic solutions—have allowed the treatment of larger prostate glands with laser prostatectomy and the treatment of patients with high surgical risk with less physiologic stress and less morbidity. Not surprisingly, recent estimates demonstrate that an increasing number of practicing urologists are in fact already performing laser prostatectomies on patients with symptomatic BPH, and this number is increasing.

Types of laser prostatectomy

Of the currently commercially available lasers the two that have stood the test of time and have gained in popularity are as follows:

1. The 100 W Holmium laser used to enucleate an enlarged prostate
2. The high energy green light KTP (potassium-titanyl-phosphate) laser used for photoselective vaporization of the prostate gland.

Both have shown to be safe and effective therapeutic alternatives for a wide spectrum of prostate sizes and configurations.

KTP laser ablation

This form of laser ablation uses the KTP laser, which utilizes the beam from a Nd:YAG laser that is then passed through a KTP crystal, halving the wavelength (532 nm), therefore doubling its frequency. At high

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power this causes prostatic vaporization. The 80 W model has been renamed the GreenLight laser and the vaporization procedure employing it is termed as photoselective vaporization of the prostate (PVP). The KTP laser beam at a wavelength of 532 nm is fully transmitted through the aqueous irrigant but is highly absorbed by oxyhemoglobin in the tissue. This allows KTP laser energy to be selectively absorbed by tissue with high oxyhemoglobin content, such as prostatic tissue. This results in vaporization that is focused and more efficient in prostate tissue for vaporization; for this reason, the KTP laser procedure is referred to as photoselective vaporization of the prostate. Because of its hemostatic advantages, it has been used in high-risk patients (e.g., those undergoing anticoagulation with heparin, warfarin, nonsteroidal anti-inflammatory drugs, and aspirin) with excellent safety and efficacy outcomes.

Holmium laser ablation

The Holmium:YAG (Ho:YAG) laser is a solid-state pulsed laser with a wavelength of 2,140 nm and is strongly absorbed by tissue water (comprising over 70% of prostatic tissue). This absorption creates significant vaporization without deep coagulation (depth 0.5mm), allowing dissection under vision to be precise, while maintaining hemostasis and preventing irrigation fluid absorption. These unique properties with regards to tissue incision and hemostasis make it an excellent tool for BPH surgery, as well as being the most versatile energy source for the treatment of stones and other endourological work.

Revolix 70 watt laser system

This is a continuous wave diode laser with a 2.0 μm wavelength that combines the surgical cutting properties of the well known CO₂ laser, the hemostatic effect of the Nd:YAG laser together with the narrow damage zone of the Holmium laser. The laser power is delivered to the surgical site through a flexible fiber ideal for endoscopic and minimally invasive access. Both the less traumatic techniques are of increasing importance where short hospital stays, quick patient recovery and cost reduction matters. The new laser features excellent cutting and excellent hemostasis. Quick surgical performance allows shortening of the theater time.

Laser surgery can be done on an outpatient or overnight basis, requires only spinal anesthesia, and has a shorter, less restricted recovery period. Most patients are able to urinate almost immediately after laser surgery, some may need to use a catheter overnight. Men about to have laser surgery should first have a test for prostate-specific antigen.

Conclusion

Laser prostatectomy has evolved as an advantageous technique for the efficient removal of prostate tissue for the treatment of symptomatic BPH, with an excellent safety profile. Most surgeons agree that lasers will probably play a valuable role in treating BPH in the future.

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Date: 14th-15th July 2007

Venue: Max Super Speciality Hospital, Saket

Course Director: Dr Praveen Khilnani, Head-Pediatric Pulmonology and Critical Care, Max Healthcare.

Advanced Pediatric Mechanical Ventilation Workshop

Date: 29th November 2007

Venue: Max Super Speciality Hospital, Saket, New Delhi

Contact: Dr Praveen Khilnani, Mobile: 9810159466, Email: pkhilnani@vsnl.com

9th IAP National Congress of Pediatric Critical Care (in collaboration with Max Healthcare)

Date: 30th November-1st December 2007

Venue: India Habitat Center, Lodhi Road, New Delhi

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