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OPINION

Is it necessary and feasible to increase the efficiency of 2-μm thulium laser resection of the prostate?

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Two-μm thulium laser has become widely accepted because of the resultant excellent homeostasis and rapid vaporization in prostatectomy. It is necessary for us to increase the surgical efficiency because of increasing numbers of larger-sized, elderly and high-risk BPH patients. We have made efforts to achieve this goal through continued improvement of the 2-μm thulium laser equipment, innovative methods-tangerine technique, reasonable teaching mode and easily grasped learning curve. We prove it necessary and feasible to increase the efficiency of 2-μm thulium laser resection of the prostate.

Transurethral resection of the prostate (TURP) is generally considered the 'gold standard' for the surgical treatment of benign prostatic hyperplasia (BPH),[1] but its use is generally restricted to small- and medium-sized prostates.[2] The complications and morbidities that have been related to this procedure, which include blood loss and disturbances in the fluid balance, have created a need for the development and investigation of newer techniques. Several laser devices working at various wavelengths have been introduced in the last few decades.[3] One of these, the 2-μm thulium laser, is a surgical laser with optional continuous- or pulse-wave modes and a wavelength tunable from 1.75 to 2.22 μm.[4] This laser presents many advantages over the holmium laser, such as an improved spatial beam quality, a more precise tissue incision and the capacity to operate in optional continuous-wave or pulse modes.[5,6] Since 2004, we have used the thulium laser in clinical practice primarily for urogenital endoscopic procedures, and its use has become widely accepted because of the resultant excellent homeostasis and rapid vaporization.

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TURP AND OPEN PROSTATECTOMY TECHNIQUES

Considering the size of China's ageing population, surgical morbidity is expected to consistently increase among urological patients. Thus, we expect to treat more and more complex patients suffering from such serious conditions as cardiovascular and cerebrovascular diseases. These high-risk patients cannot tolerate long operation times or significant blood loss. Many consider TURP to be the gold standard for men with prostates from 30 to 80 ml.[7] However, there are many patients who have larger transrectal ultrasound adenoma volumes. In these cases, open prostatectomy is chosen over endoscopic approaches, despite the fact that open prostatectomy has been associated with notable perioperative morbidity and limited eligibility for high-risk patients.[8] Therefore, it is necessary to improve the safety and effectiveness of those treatment methods that could expand the indications for the surgical treatment of BPH. Technical advances that work to improve safety and reduce operative time while efficiently removing resected BPH tissue will be of clinical benefit to patients.

CONTINUED IMPROVEMENT OF THE 2-μm THULIUM LASER EQUIPMENT

The development of instruments that allow for safe and reliable prostatic dissections through a flexible endoscope is necessary to address these problems. An ideal dissecting instrument should be precise and capable of achieving effective hemostasis. The RevoLix laser (Lisa Laser Products, Katlenburg-Lindau, Germany) is a 2-μm wavelength thulium laser; its effect on the tissue is restricted to less than 2 mm-deep penetrations, measured from the tip of the fiber.[4] At first, the laser was a mobile unit with tunable power of up to 50 W. In an earlier study, although the resected weight of the tissue in the thulium laser resection of the prostate-tangerine technique (TmLRP-TT) group was significantly less than that in the TURP group, there was no significant difference in the estimated resected tissue weight between the two groups, as we discerned that 0.45 g of tissue was vaporized every minute with the TmLRP-TT.[9] Currently, the maximum power of the laser has been improved to 120 W, and theoretically, a mean total of 1.08 g of tissue is vaporized per minute.[10] By combining resection, vaporization and enucleation, the removal rate can be increased to approximately 2–3 g min^{-1} in trained hands. Based on our experience, when the laser fibers are inserted into the prostate tissue, the effects of vaporization are enhanced. Furthermore, if we need to coagulate the vessels, we will maintain a small distance between the fiber tip and the tissue. Thus, a decrease in energy will effectively prevent vaporization and ensure hemostasis.

INNOVATIVE METHODS: TANGERINE TECHNIQUE

There are several research articles that describe the techniques for the 2-μm thulium laser resection of the prostate, including vaporization, resection and enucleation. When we initially used the thulium laser, we attempted several procedures, such as thulium laser incision, thulium laser resection, thulium laser vaporization and thulium laser enucleation. These techniques produced similar results to our early experiences with the holmium laser. However, we believe that the superiority of the present type of laser cannot be reflected by these methods. The 2-μm thulium laser is a new surgical laser with optional continuous- or pulse-wave modes and a wavelength tunable from 1.75 to 2.22 μm. The continuous wave mode, which can provide maximum hemostasis and coagulation, is used for prostate procedures to perform a smooth incision or vaporization.[4]

On the basis of its cut and ablation characteristics, we designed TmLRP-TT, and the preliminary results of its therapeutic efficacy and safety have been reported.[9,10] We completed the incision by making a transverse cut from the level of the verumontanum to the bilateral bladder neck, ensuring that the resection was deep enough to the surgical capsule, and resected the prostate into small pieces with the same technique as one would use to peel a tangerine. As we resected the prostate, the pieces of the prostate were vaporized in small enough samples to be evacuated through the sheath of the resectoscope. Because this technique did not require the use of the mechanical tissue morcellator, the removal rate was greatly increased. At present, this technique is widely used in our prostate therapies, and we believe that in the near future, this procedure will most likely challenge the holmium laser enucleation of the prostate (HoLEP).

TEACHING MODE AND LEARNING CURVE

In a recent review,[8] the authors stated that the occurrence of complications was correlated with the level of the surgeon's experience.[11,12] Thus, we must improve the proficiency and reduce the learning curve of this technique. Our experience has shown that a basic grasp of the technique can be obtained after 30 TURP, 20 HoLEP and only 10 TmLRP-TT training cases. If the surgeon is already familiar with TURP, he can begin performing the procedure on his next patient, under close supervision, after watching a single case. Thus, the learning curve for TmLRP-TT requires the mastery of at least three cases.

During the operation, we always perform an incision along the surgical capsule. As the surgical capsule is always visible throughout the procedure, perforation is nearly impossible. We consider that excellent homeostasis and less capsular perforation with the thulium laser can maintain clear visibility and help the surgeon manipulate the surgical tools. These measures will provide a greater benefit, deepening their comprehension of the operation and permitting rapid progress. First, the surgeon should be familiar with the equipment characteristics; then, the technique is demonstrated through surgical demonstrations and teaching videos. Although initial attempts should begin with smaller cases in trained hands, the prostate size has no statistically significant influence on intraoperative complications.[13]

CONCLUSIONS

The urodynamic results are directly linked to the amount of removed tissue, which is directly associated with intra- and postoperative morbidity.[14] In our opinion, it is very important to improve the removal rate of prostatectomies, as increasing numbers of larger-sized, elderly and high-risk BPH patients will require better healthcare as they age. Advocating improvements in the speed of the procedure is not our sole interest; clinical safety and postoperative efficacy are always our ultimate goals. We must consider the safety of an operation without blindly pursuing speed. Our experience has suggested this seemingly feasible method for improving surgical speed; however, further rigorous, controlled clinical studies should be expanded. As long as we maintain high standards for clinical practice and innovative concepts, these methods may be further improved.

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