

Use of Laser in Urology.



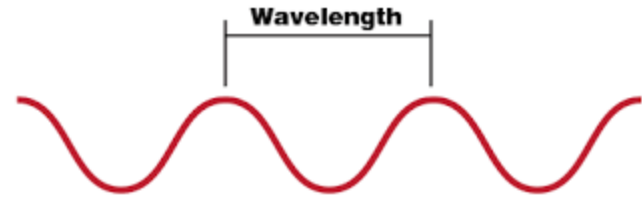
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Introduction.



- Acronym for “light amplification by stimulated emission of radiation”.
- Characterized by : Wavelength (nm), Energy (j), and Power (Watt).

Types:

- Potassium-titanyl-phosphate (KTP), 532 nm.
- Lithium-triborate (LBO), 532 nm.
- Neodymium: yttrium-aluminum-garnet (Nd:YAG), 1064-nm.
- Holmium: yttrium-aluminum-garnet (Ho:YAG), 2140 nm.
- Thulium (Tm: YAG), 2013-nm .
- CO₂ laser.
- Diode laser.

Uses:

- **Prostate.**
- **Urolithiasis.**
- **Urethral and ureteral stenoses.**
- **Bladder and upper urothelial carcinoma.**
- **Penile cancer.**

Prostate

Lasers used in BPH Treatment:

- Ho: YAG laser.
- Green light laser.
- Diode laser.
- Tm: YAG laser.

HoLEP:

HoLEP:

HoLEP:

Morcellation:

- **Video.**

Advantages:

- Excision of large prostates without the need of open procedure.
- Risk of hemorrhage is minimal (decrease in transfusion rate) → Could be done on anticoagulants.
- Use of NSS → no TUR Syndrome.
- Lessens hospital stay (1 day catheterization).
- It appears that re-intervention rate after few years is lower.

Complications:

- **Bladder and ureteral orifices injury.**
- **Incomplete evacuation of the adenoma.**

HoLEP vs TURP: (large RCT's).

	HoLEP	TURP.
Decrease Hb (g/dl)	1.3	1.8
Catheterization time (hours).	27.6	43.4
Hospital stay (hours)	53.3	85.4
Operative time (min).	94.6	73.8
Peak flow rates (at 12 months).	4.9 → 23.1	5.9 → 25.5
Residual volume (ml) at 12 months.	5.3	26.6 (not clinically sig)
AUASS	2.7	3.3

HoLEP vs Open prostatectomy (OP):

	HoLEP	OP
Time to catheter removal (days)	1.5	4.5
Hospital time (days)	2.7	5.4
Blood transfusion		++
Q max.	7.8 → 26.6	8.3 → 24.4
AUASS	22.1 → 2.3	21 → 2.3

Disadvantages:

- **Difficult and exaggerated learning curve → require experience and relevant endoscopic skills.**
- **Increase operative time.**

Recommendations	LE	GR
Holmium laser enucleation and 532-nm laser vaporisation of the prostate are alternatives to transurethral resection of the prostate (TURP) in men with moderate-to-severe LUTS leading to immediate, objective, and subjective improvements comparable with TURP.	1a	A
The long-term functional results of holmium laser enucleation are comparable with TURP or open prostatectomy.	1b	A

Photoselective Prostate vaporization (PVP):

- **Uses Nd:YAG laser, KTP, or LBO.**
- **Called green light laser.**
- **Laser energy is absorbed by haemoglobin, but not by water.**
- **Vaporisation leads to immediate removal of prostatic tissue,**

PVP:

- In 2016 the standard Greenlight procedure was the 180-W-XPS laser.
- The majority of evidence is published with the former 80-W (KTP) or 120-W HPS (LBO) laser systems.

A meta-analysis of the nine available RCTs comparing PVP using the 80-W and 120-W lasers with TURP (2012).

- **No differences were found in Q_{max} and IPSS between 80-W-PVP and TURP.**
- **The 180-W (XPS) laser efficacy is comparable to TURP in terms of IPSS, Q_{max} , PVR volume, prostate volume reduction, PSA decrease and QoL questionnaires, and re-intervention.**

A meta-analysis of the nine available RCTs comparing PVP using the 80-W and 120-W lasers with TURP (2012).

- **The XPS laser prostatectomy is superior to TURP in terms of catheterisation time, length of hospital stay and time to stable health status.**
- **But has a longer operative time.**

Advantages:

- **Combined vaporization and coagulation.**
- **Can be done in patients on anticoagulants.**

Disadvantages:

- **Post-op dysuria and storage symptoms>>>
TURP or OP.**

Practical considerations:

- The 180-W XPS laser should be regarded as the reference for Greenlight laser prostatectomy.
- Studies were done on the former 80 and 120 W.
- Results from the Goliath Study (180-W XPS vs. TURP) are pending.

Recommendations	LE	GR
The short-term and mid-term functional results of 532-nm laser vaporisation of the prostate are comparable with TURP.	1b	A
With regard to intra-operative safety, 532-nm laser vaporisation is superior to TURP.	1b	A
532-nm laser vaporisation should be considered in patients receiving anticoagulant medication or with a high cardiovascular risk.	3	B

Thulium:yttrium-aluminium-garnet laser (Tm:YAG).

- Different applications, ranging from vaporisation (ThuVaP), vaporesection (ThuVaRP), and enucleation (ThuVEP/ThuLEP: similar enucleating techniques) are published.
- ThuLEP and HoLEP were compared in one RCT with eighteen months follow-up with comparable outcomes in both arms.

- **ThuLEP appeared to be equivalent with regard to clinical efficacy and superior with regard to intra-operative haemostasis.**

- The limited number of RCTs and only a few studies with long-term follow-up (up to 48 months) support the efficacy of thulium laser prostatectomy

→ there is a need for ongoing confirmation.

Recommendations	LE	GR
Tm:YAG vaporesction is an alternative to TURP for small- and medium-size prostates.	1b	A
With regard to intra-operative safety and haemostatic properties, diode and thulium lasers appear to be safe.	3	C

Urolithiasis

Urolithiasis.

- The Ho:YAG is one of the newest members of the endoscopic lithotrites.
- It allows segmental resection of all stones regardless of their composition.
- Flexible endoscopes require laser lithotripsy to maintain tip deflection.
- Ho:YAG laser has become the standard.

Advantages:

- **Minimal risk of surrounding thermal injury (in water: beam is absorbed within the 1st few mm) ≠ Nd: YAG.**
- **Minimal fragment migration and retrograde propulsion when low settings are used.**
- **Able to fragment all stones regardless of their composition, size and location (ex: lower calyx).**

Disadvantages:

- Long learning curve.
- Time consuming.
- Easily damaged.

- **Video**

Other uses.

- The introduction of small flexible ureteroscopes and the holmium laser has made ureterorenoscopy a valid treatment option for **transplant calculi**.
- Because of the smaller size of the probes, laser energy is easier to use in smaller instruments and is more useful for **pediatric cases**.

Urethral stenosis

- With the exception of open urethral reconstruction, all are associated with a high rate of recurrence.
- Nd: YAG, KTP, and Ho: YAG lasers have been used.

- They can yield recurrence rates similar to those of cold knife internal urethrotomy (20- 40% success rates). And repeat procedures offer little improvement.
- Recently, hope of using Nd: YAG laser with a crystal tip contact method of vaporization yielded a 93% success rate that durable for a mean over 2 years.

Ureteral stenosis

- **Strictures < 3 cm in length may be treated endoscopically either with percutaneous balloon dilation or antegrade flexible ureteroscopy and holmium laser incision.**
- **In this scenario (laser) the success rate approaches 50%.**

Bladder cancer

EAU 2017

- En-bloc resection using monopolar or bipolar current, Thulium-YAG or Holmium-YAG laser is feasible in **selected exophytic tumors**.
- It provides high quality resected specimens with the presence of detrusor muscle in 96-100% of cases.

- Potassium titanyl-phosphate (KTP) laser vaporisation is associated with a low risk of complications.
- Its oncologic outcomes need to be confirmed in a larger patient population.

Upper urothelial carcinoma:

- **Endoscopic ablation can be considered in patients with clinically low-risk cancer in the following situations:**

- Laser generator and pliers are available for biopsies.
- In case a flexible ureteroscope is available (rather than a rigid ureteroscope).
- The patient is informed of the need for closer, more stringent, surveillance.
- Complete tumor resection can be achieved.

References:

- **EAU guidelines 2017.**
- **Campbell Walsh Urology (11th Edition).**
- **Pubmed.**

THANK YOU !!
