



K. K. HOSPITAL

(AN ISO 9001-2000 CERTIFIED HOSPITAL)

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LASERS IN UROLOGY

INTRODUCTION OF LASER

The development of minimally invasive surgical techniques for the treatment of patients suffering from urinary tract diseases has been greatly dependent on technologic advances in the fields of fiber optics, imaging, and energy sources. These advancements have accelerated the evolution of modern techniques of stone removal, including ureteroscopy (URS), percutaneous nephrolithotomy (PCNL), and extracorporeal shockwave lithotripsy (ESWL) as well as prostatic surgery like TURP & Laser prostatectomy HOLEP/HOLAP).

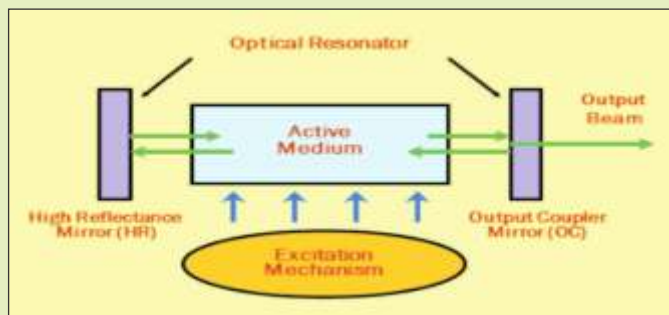
Recent advances in lasers & fiberoptics make them ideally suited to travel through human body easily where no hand or scalpel has gone before. With development of small diameter miniaturized endoscopes, the use of laser technology is on rise.

In urology laser offers many advantages such as better control of surgical margins, haemostasis, safety, speed & less tissue trauma. The efficacy & safety of laser treatment in various urological conditions like stone disease, prostate, tumour & strictures is now well documented.

DEFINITION

LASER is an acronym for Light Amplification by Stimulated Emission of Radiation

LASER COMPONENTS



PHYSICS

Laser energy is produced when an atom is stimulated by an external energy source, which creates a population of electrons in an excited state. These excited or higher-energy electrons can release their excess energy in the form of photons or light energy.

CHARACTERISTICS OF LASER

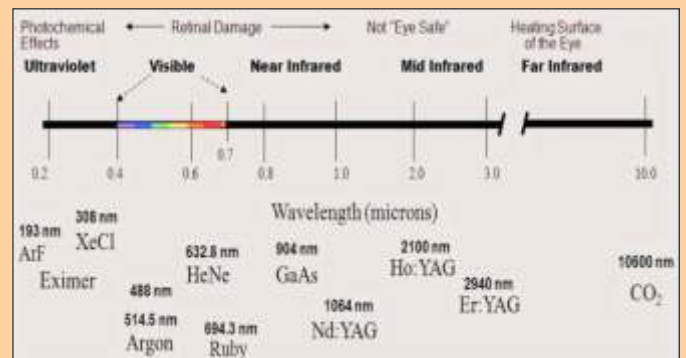
Laser light differs from natural light

- Coherent (all photons are in phase with one another)
- Collimated (photons travel parallel to each other)
- Monochromatic (all photons have same wavelength)

These unique features of laser light allow considerable energy to be transmitted in a highly concentrated manner.

LASER WAVE LENGTHS

Lasers are named after the medium that generates their specific wavelength of light .



TYPES OF LASERS

According to source - Gas, crystal, semiconductor or liquid lasers

According to nature of emission - Continuous or pulse wave

According to wavelength - Visible, Infrared, Ultraviolet, Microwave or X ray region

LASERS IN UROLOGY

Various types of lasers are used in clinical practice

1. CO₂ Laser:
2. Nd: YAG Laser:
3. KTP Laser
4. Ho: YAG Laser &
5. Diode laser

Of all these lasers, Holmium laser is most versatile having maximum clinical applications in Urology

HOLMIUM LASER

The holmium laser crystalline matrix is a YAG crystal doped with chromium, thulium, and holmium. The pulsed solid-state laser operates in the near-infrared portion of the electromagnetic spectrum at 2140 nm. At this wavelength the laser energy is strongly absorbed by water molecules and propagates no farther than 0.5 to 1.0 mm, providing a substantial safety margin during intracorporeal lithotripsy & prostate surgery. At 2140 nm the laser energy is effectively delivered through flexible silica quartz fibers ranging from 200 to 1000 μm . Generally, 200- to 400- μm fibers are used during ureteroscopy & 600 & 800 μm fibers are used for prostate surgery. Holmium laser lithotripsy occurs primarily through a photothermal mechanism resulting in calculus vaporization.

INDICATIONS & USAGES OF HOLMIUM LASER IN UROLOGY

1. **Urolithiasis**
 - **Renal Stone** - PCNL, Miniperc, Ultra mini pcnl, RIRS
 - **Ureteric stone** - URS, Flexible ureteroscopy
 - **Bladder stone**
 - **Urethral stone**
2. **Prostate**
 - Holmium laser enucleation of prostate - **HoLEP**
 - Holmium laser vaporization of prostate / Ablation-HOLAP
 - Holmium laser incision of prostate
3. **Tumours**
 - Bladdertumour resection
 - Ureteric tumour ablation
 - Renal pelvic tumour ablation

4. Strictures

- Urethral stricture laser incision
- Bladder neck incision
- Ureteric strictures

5. Other Applications:

- PUJ obstruction management by endoureterotomy
- Posterior valve fulguration small miniature scopes
- Ureterocele incision endoscopically
- Congenital ureteral polyp excision

HOLMIUM LASER FOR STONE DISEASE

The holmium laser is one of the safest, most effective, and most versatile intracorporeal lithotripters.

The holmium laser permits the safe and atraumatic fragmentation of calculi at any location in urinary tract.

The holmium:YAG laser is recognized to be the gold standard for retroscopic Intracorporeal Lithotripsy.

ADVANTAGES OF THE HOLMIUM LASER IN STONE DISEASE

All types of stone can be fragmented regardless of stone composition.

Laser lithotripsy produces smaller stone fragments compared with other lithotripter systems, reducing the need to basket fragments.

There is a wide margin of safety with less adjacent tissue trauma.

The production of weak shock waves causes less calculus retropulsion compared with other lithotripters

The holmium:YAG laser can transmit its energy through a flexible fiber, which facilitates intracorporeal lithotripsy throughout the entire collecting system.

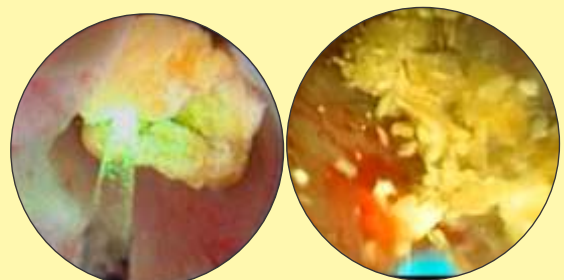
The holmium :YAG laser is safer and more efficient.

Laser lithotripsy has a significantly lower risk of ureteral perforation

Endoscopy with holmium laser lithotripsy is the preferable approach in patients with uncorrectable coagulopathy.

Ureteroscopy, with holmium laser lithotripsy, performed later during pregnancy is safe and free of increased risk to the fetus or mother

Suitable for use in pediatric urolithiasis



HOLMIUM LASER FOR PROSTATE

TURP is recognized as the gold standard for treatment for BPH. However newer modifications have taken place, allowing even an endoscopic "enucleation" to be performed with laser. The laser techniques offers an option other than TURP for treating symptomatic BPH.

There are four types of laser that can be used to treat the prostate.

Nd: YAG

Holmium YAG

KTP Laser

Diode Laser

There are two ways in which lasers can have an effect on the prostate, either by coagulation or by vaporization. In the first of these coagulation is achieved at temperatures of 70° C to 90° C. The second way is by vaporization, which raises the temperature to several hundred degrees Celsius. The factors determining whether coagulation or vaporization occurs are essentially the power density of the laser beam itself, the total energy delivered, and the time for which it is applied.



Prostate before HoLEP



Prostate immediately after HoLEP



Prostate 3 Months after HoLEP

ADVANTAGES OF HOLMIUM LASER FOR PROSTATE

The Holmium laser has been used in both small and large prostates.

HoLEP is superior to TURP in terms of catheterization time, hospital stay, and amount of tissue removed.

The side effects are minimal, with irritative symptoms and dysuria being negligible.

Quality of life improvement is as good as that achieved with TURP.

BLADDER TUMOUR

Laser coagulation allows minimally invasive ablation of tumors up to 2.5 cm in size.

Bleeding is negligible.

There is no risk of obturator reflex.

Small lesions can be treated easily using intravesical anesthesia.

DISADVANTAGE OF LASER

The only major disadvantage of the holmium laser is the initial high cost of the device and the cost of the laser fibers.

ADVANTAGES OF HOLMIUM LASER

- The holmium laser has multiple applications.
- The laser fibers are reusable
- There is no risk of damage to operators cornea
- The holmium laser unit is more compact
- It requires minimal maintenance
- Machine is ready for use 1 minute after it is turned on
- Safe in High Risk Patients



Dr. K.M. Singh

M.S., FICS, FACS, FIMSA, MNAMS

Former

- Professor Surgery
- Founder Professor & Head of Department Urology
- Principal - King George's Medical College, Lucknow
- Founder Vice Chancellor (C.S.M Medical University, Now named King Georges Medical university (Lko)

- Commonwealth Urology-UK
- Member Medical Council of India
- Member Medical Faculty UP
- Master Trainer of N.S.V for U.P & core officer center of excellence for male contraception
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FACILITIES AVAILABLE

- Endoscopic Treatment Of Stone In Kindey, Ureter And bladder
- Endoscopic Treatment Of Prostate (TURF)
- LASER - 50 Watt, German Technology Auriga XL excellent energy source for all Urology applications
- Female Urology
- Paediatric Urology (Endoscopy, LASER)
- Male Infertility
- Kidney Transplant
- Laproscopy
- Video Endoscopy
- RIRS
- Well equipped Operation Theater
- Multipara monitor, defibrillator
- C - arm X - Ray machine
- Lithotripsy (ESWL)
- Central oxygen & monitoring system
- Uroflometry
- Ultra sonography Department
- Pathology Laboratory
- Digital X-Ray Machine
- Lift & Generator facility
- Cashless Insurance facility
- 24 hrs Pharmacy



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CGHS Approved by Quality Council of India

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