

TYPES AND PRINCIPLES OF LASER IN SURGERY

PROF. MAZIN AL-HAWAZ

Definition

Laser is devices that convert light of mixed frequencies into highly amplified visible radiation used in surgical and physiological procedures.

Types

Depend on medium that gives wave length and power.

▣ Properties of laser light

▣ 1-High intensity

▣ 2-monochromatic

▣ 3- parallel beam

▣ 4- Coherent.

▣ (laser invented in early 1960)

Effect of laser on tissue

It depend on

- ▣ Total energy applied.
- ▣ Duration of exposure.
- ▣ Wave length.
- ▣ Size & Type of tissue; pigmented or vascular.

Effects

1. (photothermal) by heating the target tissue .. denaturation of protein and boiling of cell water. Induce haemostasis by
 - ▣ Denaturation of protein by heat and contraction of fibrous tissue will block small veins.
 - ▣ Heat may thrombose blood within the vessels.
- 2.(photomechanical) Local intracellular thermal effect. Sclerosing vessels by selective absorbed wave length with minimal change of surrounding tissues.

- 3-. Photosensetivity effect used in cancer diagnosis and detection of microscopical metastases in the skin and lymph nodes in patient receiving systematic injection of photosensetizing agent as HPD.
- 4- (photoablative) Non thermal effect causing selective destruction of malignant tissue.
- 5-.(photo-chemical) Cytotoxic effect causing destruction of vascular integrity of neoplasm through endothelial damage. And release of vasoactive substance including thromboxane.

Advantages and uses of laser in surgery

1. Precision cut without distorting tissue. Laser incision is less painful and heal quickly.
2. Little surrounding damage.
3. Access to hollow organ and eye (cones).
4. No touch, no contamination.
5. Specific for particular cells.
6. Special anticancer effect by blocking of lymphatic and body supply and killing of cancer cells.

Hazards of laser

1. On eyes of operator, patient and observers (corneal rupture or scarring and impaired vision).
2. Fire of hair, burning of skin.
3. Bleeding (inexperienced user).
4. Infection.
5. Perforation and piercing of organ.
- 6-Complication of general anaesthesia.
7. Incomplete treatment of problem.
8. Dentures, gum disease and tooth decay.

1- Argon laser

- ▣ **Emission of blue green light absorbed by melanin and blood.**
- ▣ **Used to stop bleeding in peptic ulcers.**
- ▣ **Used in dermatology.**

2- Nd-yag laser

- ▣ **Gives deep penetration to tissue.**
- ▣ **Very effective haemostatic ability.**
- ▣ **Used in conjunction with flexible endoscopy.**

3. Carbon dioxide laser

- ▣ Has the ability to evaporizing tissues.
- ▣ Causing a precise incision with less tissue damage because infrared is strongly absorbed by water.

4. Others

- ▣ Low power helium-neon laser using CO_2 .
- ▣ Krypton-ion laser using haemato-prophyrin to produce fluorescence.
- ▣ Liquid dye laser.

Surgical uses of laser

1. Upper GIT bleeding.
2. Mucosal vascular malformation e.g: colonic or caecal angiodysplasia in elderly and hereditary hemorrhage (telangectasia).
3. Early gastric carcinoma without lymph node metastases.
4. Obstructing, bleeding colorectal cancer.
5. Liver resection (photoablation).
6. Laparoscopic adhesolysis and cholecystectomy.
haemorrhoidectomy.

8. Renal system

Lithotripsy.

Stop hematuria.

Ablation transitional cell carcinoma.

Resection of non cancerous prostatic nodules.

9. Vascular;

Argon laser endarterectomy.

Nd-yag angioplasty.

Laser recanalization of prosthetic graft stenosis (stent).

10. Therapeutic surgery:

Control of haemorrhagic haemoptysis.

Palliative and unoperable bronchial carcinoma.

11. Dermatology:

Biopsy and treatment of:

Haemangioma and telangiectasia,
Papilloma.

Viral warts.

Multiple melanoma, and Tattoo

12. Ophthalmology:

Correction of refractory errors. (Lasik-lasek)

Photocoagulation.

Ablation of peripheral retina to protect foveal vision in patient with diabetic neuropathy.

Retinal tear and lattice degeneration.

Cutting non pigmented posterior capsule of the lense
uncomplicated postoperative cataract treatment.

13. Otolaryngology:

Polyp, nodule and larynx.

Incision of laryngeal or tracheal stenosis.

Leukoplakia.

Superficial malignant lesion of the tongue.

14. Neurosurgery:

Removal of cerebral glioma.

Removal of acoustic neuroma.

Removal of intracranial meningioma.

In craniotomy.

15. Gynaecology:

Treatment of carcinoma in situ and cervix.

Vulval lesion.

Fallopian tube surgeries.

Visible deposits of endometriosis seen by laparoscopy.