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Editorial

Recent advances in otolaryngology - head & neck surgery

Otolaryngology emerges from candle to laser illumination. Cochlear implant helps a born deaf child to enjoy the sounds of this nature. Due to laser application a child with recurrent respiratory papillomatosis can enjoy the natural voice without tracheostomy. Endonasal endoscopy with Hopkin's rod telescopy helps otolaryngologists approach to sphenoid sinus, optic nerve, pituitary fossa, clivus, cavernous sinus, anterior and middle cranial fossa without open craniotomy. PET/CT aids in cancer diagnosis and follow up. otolaryngology improved a lot in last two decades.

Stroboscopy: It is based on talbot law. According to it, physical images linger on retina for 0.2 seconds after exposure. Therefore, sequential images produced at interval <0.2 seconds produce the illusion of a continuous image. It involves use of a strobe light which is linked to the frequency of the patient's voice. When the patient utters a tone, the light strobes at a frequency that may be either identical to or close to the frequency of the voice detected. Using this frequency, the recording device can produce a set of rapidly produced still images which gives illusion of continuous motion.[1]

Stroboscopy is used to assess vocal fold vibration patterns, mucosal pliability, underlying layered structure of vocal folds, and undersurface of vocal fold edges.

It is particularly useful when assessing stiffness, scar or sub mucosal injury; detecting small vocal fold lesions; estimating the depth of invasion of a tumor; identifying asymmetric mass or tension; or determining the resumption of voicing activities after phonosurgery.[2]

Laser in otolaryngology - head & neck surgery: Laser means light amplification by stimulated emission of radiation. Lasers used in surgery amplify light and create coherent light beams that range from the infrared to ultraviolet part of spectrum. Lasers work on the theory of stimulated emission given by Albert Einstein in 1917. C. Kumar, N. Patel introduced the CO2 laser in 1962 which was first used in head & neck surgery in 1972 by Jacob & Strong.[3]

Depending on the medium used, lasers can be classified as solid state (Ruby, Nd-YAG, and KTP), semiconductor (Gallium arsenide laser), liquid, gaseous (CO2, Argon) and free electron. The reaction of the laser energy with tissue can be photoablative, photochemical, combined photochemical and photo thermal. Most have a varied combination of these effects. The laser light strikes tissues and scatters till all light is absorbed and reflected. The light absorbed heats up the tissues which produces a series of changes. These changes are of coagulation, denaturation, vaporization, carbonation and incandescence. Cutting by laser is a fine controlled vaporization process where the surrounding tissue is also heated resulting haemostasis by coagulation.[4]

Image guided surgery: This is also known as computer aided surgery, navigational & computer guided surgery. In this MRI, CT or combined image data sets are used to create three dimensional (3D) reconstructions of the

operative volume. These 3D reconstructions can be used to plan, practice or navigate during a surgical procedure.[5]

Preoperative imaging alerts the surgeon to anatomical variations that are inherent or caused due to disease or previous surgery.

Two fundamental processes: registration & tracking are required for intra operative guidance. Registration is the process that relates the patient in the operation theatre to preoperatively taken image data sets. Tracking is the mechanism of following the position of the patient/instrument in the field. There are several tracking methods, the earliest being mechanical arms fitted with potentiometers at every joint. Systems based on magnetic field distribution are also effective and cheap. However, infrared light sensors are most commonly used today. These are active or passive devices. The active one sense infrared light from LEDs attached to the patient or location probe. The passive devices detect infrared light from metallic balls attached to the patient or probe, with the light source located on the sensing device itself.[6]

This surgery has a good scope in areas of the skull base and endoscopic sinus surgery especially in difficult revision cases such as Draf type 2 & 3 procedures and trans sphenoidal, transnasal endoscopic hypophysectomy. In otology, it has helped for locating the facial nerve, identifying lesions of the petrous apex and tumours in the internal acoustic meatus such as meningiomas and vestibular schwannomas.[7]

Photodynamic therapy: Phototherapy is the use of light for therapeutic purposes.

Photochemotherapy is where a drug is administered along with application of light.

Photodynamic therapy is a type of photochemotherapy where in addition to light and the drug, oxygen is administered to complete the process.[8]

The drug is known as a photosensitizer, accumulates within the cell and interacts with light and oxygen to produce 'singlet' oxygen. This singlet O2 damages the tumour cell membrane leading to cell death.

This therapy has been put to use in inverted papilloma, squamous cell carcinomas of the oral cavity, nasopharynx, oesophageal ca and metastatic sq. cell carcinoma in neck.

Skin phototoxicity and limited tissue penetrations are the hindering factors in this treatment.[9]

Contact Endoscopy: First described by Desormeaux who managed to obtain a direct view of the bladder mucosa in 1865. Contact endoscopy is now been used in otolaryngology to asses nasal cavity, nasopharynx, oropharynx and all subsets of larynx. This technique allows the examiner to observe the mucosal vessels and surface epithelium which is already stained by methyline blue. An experienced clinician can diagnose of the pathology and speed up the management procedure. This is complementary to conventional biopsy/ histopathology, not alternative to those.

It is possible to detect the microvascular changes and/or alterations in surface epithelium which are suggestive of subclinical stages of disease. This is so because cells migrate towards the surface and therefore most pathological processes can be seen on examining the surface layers.

For the conditions involving the upper airway, 7215AA and 7215BA, Karl Storz, Tuttlingen, Germany endoscopes are required. The mucosal surface to be examined is gently cleaned with a saline moistened swab or suction. It is then stained with 1% methyline blue impinged on a piece of gelfoam. Tip of the endoscope is then gently placed against the mucosa. Surface epithelium and subsurface microvasculature can be

examined at a magnification of 60x to 150x.This procedure needs to be carried out fast as the staining lasts for about 4-5 minutes before gradual disappearing.[10]

Positron emission tomography: Positron emission tomography (PET) provides a means of identifying the pathology based on altered tissue metabolism. This is a functional imaging technique relies on detection of a radioactive molecule (radiotracer) that decays with emission of positron. The tracer, administered intravenously, taken up by both normal and malignant cells but concentrated more in malignant cells due to their high metabolic activities. Emitted positrons from tracer collide with electrons producing photons in the part of the body which is detected and reassembled into images. Thus we can perform a quantitative scan also.[11]

The majority of studies use 2-(18F) fluro-2-deoxy-D-glucose as tracer substance which reflects glucose metabolism. This is known as FDG-PET and has been used effectively for malignancies including breast, lung, colon, esophageal cancer, brain tumors, malignant melanoma and lymphoma. It helps in detecting occult metastasis nodal disease, distal metastasis, recurrent and residual disease. It practice, FDG-PET is routinely considered 8 weeks or more following RT in head and neck malignancies.[12]

FDG-PET is also helpful in assessment of cochlear implant and it's pattern on stimulation of the central nervous system.

Integrated PET/CT: The advantages of integrated PET/CT include superior localization of lesions and better distinction between physiological uptake and pathology. With PET/CT, CT is acquired followed by PET. This will accurately localize occult primary in oropharynx, in patients with suspected recurrence of thyroid cancer, pulmonary metastasis not identified on FDG.[13]

Implantable hearing devices: These are developed to improve upon stigma, cosmesis, occlusion effect, and feedback, as well as other factors that prevent patients from using traditional hearing aids. However, there are many challenges inherent in designing an implantable hearing device. Although implantable hearing devices are not currently available they do hold promise for patients not adequately served by conventional hearing aids.[14]

Cochlear implants provide sound perception by means of an electrode surgically implanted into the cochlea. Candidates must have bilateral, profound hearing loss and meet strict audiologic criteria.

Auditory brainstem implants (ABIs) were designed to be used in neurofibromatosis type 2 (NF-2) in which tumors involving complexes of both cranial nerve VII and VIII render the patient anacusic. These devices are implanted into the lateral recess of the fourth ventricle adjacent to the cochlear nucleus, usually after the tumor is resected, during the same operation.

Bone-anchored hearing devices (Entific Medical Systems) are a percutaneous implantable device primarily used for conductive hearing loss, or more recently, for single-sided sensorineural hearing loss.

Middle ear implant devices improve fidelity by directly stimulating the ossicles, and they improve comfort and cosmesis allowing the ear canal to remain open. In addition, most implantable middle-ear devices almost completely eliminate feedback, one of the most annoying adverse effects of conventional aids. Piezoelectric Devices, Rion device, Middle ear transducer and Vibrant Soundbridge devices are some of this devices.[15]

Kamrul Hassan Tarafder
Professor, Department of Otolaryngology - Head & Neck Surgery, BSMMU, Dhaka, Bangladesh

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