REVIEW ARTICLE

Oto-Endoscopy – An Advancement in Otology

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Otoendoscopy is being used for various procedures by otologists and has an upper edge of being very useful technology in the modern days. It has revolutionized the field by helping in diagnosis as well as treatment of various conditions of the ear. This knowledge goes a long way in planning the surgical treatment to be employed in tackling a particular condition. It can be performed in the outpatient department with little inconvenience to the patient and with minimal risk. Exploration of the middle ear can now be accomplished using modern technology fibreoptic/rigid telescopes. Endoscopes with small diameters and with wide fields of view provide extraordinary visualization of the middle ear which was previously accessible only by the surgical means (1).

Usually the otoview endoscopes in the size of 1.7 mm with 0^0 - 30^0 view of angle and in size of 2.4 mm with 0, 30 and 70 degree view of angle are used.

Endoscopic photography came with the advent of the Hopkin's optical system, a wide angle endoscope afforded an enlarged field of vision. An endoscopic photograph will make it much easier for the patients to understand a simple explanation for their ear problems. In surgery, photos provide clinical information about lesions and may help the surgeon to decide on the surgical approach and technique. A wide angle lens gives a great depth of field. A lens set at infinity provides a sharp image, starting at 2.5 mm. This is excellent for photography of a mastoid cavity. The focal length used is 140 mm and the choice of the focal length determines the size of the endoscopic image on the film. The photography of the tympanic membrane is at 2 cm approximately (2).

The use of endoscopes for the middle ear was first described by Mer *et. al.* (3) who used fibreoptic system delivered through the existing tympanic membrane perforations in two patients. Eichner (4) popularized rigid endoscopes for improved resolution. Endoscopy of the middle ear has been previously used as an adjunct to microscopic examination in the office (5). Ahmad (6) has described the successful use of 30^0 fibreoptic Hopkin's rod telescope for the post-operative follow-up of the mastoid cavity with gratifying results.

Using a 0-degree endoscope, the intact drum can be examined and the movements of the ear drum evaluated. A fluid level due to middle ear effusion can also be seen much more clearly with otoendoscope than with conventional otoscope. A 30-degree endoscope can sometimes be passed through the perforated ear drum to determine the integrity of the tiny bones in the middle ear and also to diagnose the disease in hidden areas of the middle ear (7). The rigid endoscopes have also been used for endoscopic transcanal myringoplasty. The endoscope is passed through the perforated ear drum to visualize the status of ossicles, eustachian tube orifice and the status of middle ear mucosa. Also the presence of middle ear cholesteatoma and granulations can be visualized (8). The graft take-up rate of myringoplasty using endoscopy is 91.7% and the closing of air bone gap to less than 10 dB in 83.3% cases has been seen (9). Otoendoscopy, also gives better visualization of

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retraction pockets as compared to conventional otoscopy (10). Indirect examination with a mirror or direct examination with the 90^0 needle telescope (middle ear endoscope) may visualize the hidden borders of the retraction pockets (11).

The use of rigid endoscope provides a large field of view which is of excellent revolution and fidility of colour as well as giving good size views (7). Hopkin's rod rigid endoscopes of less than 3 mm diameter may be passed into the middle ear cleft via the drum or mastoid for diagnosing whether the cholesteatoma has recurred behind the drum head or posterior canal wall. One millimetre flexible endoscopes are available which can be passed through the eustachian tube for the same purpose (12). Otoendoscopy (mastoid telescope) is preferred instead of re-opening the post-aural wound at the second stage of a combined approach tympanoplasty. Filmy adhesions in older children and bony overgrowth in young ones, make a poor view in the majority of the cases and furthermore this technique is less practical than it seems (13). Otoendoscopy also enables viewing of different angles of tympanomastoid area and approach to them for better prognosis. A comparative study of post-operative mastoid cavities using Hopkin's telescope, otoscope and microscope has shown better results with telescopic endoscope. Visualization of the sinodural angle and tip cells, sinus tympani, facial recess and ossicles is far superior by rod telescopes. The degree of epithelization and condition of the graft margins can be accurately assessed by the telescope. The sinodural angle and the tip cells are evaluated with 70^0 telescope, sinus tympani, facial recess and eustachian tube are visualized with 30^0 telescope. Rest all structures can be seen with an end on telescope (1).

Rigid otoendoscopy is also useful intra-operatively in detecting completely removed cholesteatomas, and to learn whether "second look" procedures are still needed in children. For this purpose, 30^0, 2.7 mm endoscope is used to evaluate the middle ears. When used intra-operatively, if the residual cholesteatoma is seen, the removal continues until all visualized with the endoscope is removed and if the cholesteatoma is not removed intact, a planned exploratory surgery is performed (14). McKennan (15) has discussed the role of otoendoscopic "second look" mastoidoscopy to rule out residual epitympanic/mastoid cholesteatoma. The postaural route is used with a small 1 cm stab incision made in or just anterior to the 1st stage postauricular incision. The mastoid air pocket is repeatedly checked by passing a 22 gauze needle with a feeling of "give" when the needle passes through the mucosal envelope of the mastoid air pocket. Tiny residual cholesteatoma pearls can be removed endoscopically whereas large cholesteatoma requires postauricular incision as is usually performed in "second look" procedures.

Otoendoscopy offers some of the additional advantages (8) :–

- Visualizes the whole tympanic membrane and the ear canal without having to manipulate the patient's head or the microscope (3).
- Extends the operative field in the transcanal procedures into structures usually hidden under the microscope (anterior tympanic perforation, posterior pocket, facial recess and hypotympanum).
- Visualizes structures from multiple angles as opposed to the microscope's single axis along the ear canal.
- Provides extremely sharp image with high resolution.
- Attains high percentage of dry cavities (1).
- Anatomical variations (tortuous or stenotic ear canal, anterior meatal overhang etc.) that hamper the view of entire tympanic membrane during ear surgery are overcome by otoendoscopy.
- Operative time and post-operative pain as well as morbidity are less.
- No auricular displacement or numbness, a common and annoying temporary side effect of a post-auricular incision (15).

Silverstein (16) discussed the usefulness of laser assisted otoendoscopy at Ear Research Foundation (ERF). Here the otoendoscopy uses the laser to make a bloodless opening in the ear drum. A tiny endoscope can then be inserted through the opening which allows the surgeon to have a thorough look of the little bones of the hearing anatomy in a bloodless field. By this

one can also evaluate certain types of hearing loss, can look through a chronic perforation to determine damage to the hearing bones and ear drum, or whether membranes over the round window need to be removed before medication into the middle ear and inner ear.

In general, various procedures performed under telescopic control include (1) :-

- Removal of granulations by crocodile forceps and suction.
- Removal of epithelial debris.
- Removal of otomycotic flakes.
- Removal of residual cholesteatoma.
- Removal of foreign bodies e.g. cotton ball, thread pieces, maggots etc.
- Removal of aural polyps e.g. small mastoid polyps.
- Lowering of high facial ridge under local anaesthesia.
- Removal of necrosed meatal flaps.
- Promotion of epithelization by application of gention violet to the cavity in case of delayed onset of epithelization (usually 1 month post-operatively).

The two major safety concerns with the otoendoscopes are – one is excessive heat dissipation, evident only when xenon light is used. To prevent this, a regular light source can be used because of the size of the cavity and with this also the illumination can be better. Also the tip of the endoscope needs continuous cleaning with antifog solution, which probably helps in cooling the endoscope. The other safety concern is accidental patient movement with secondary direct trauma by the tip of the endoscope. However, one handed surgical technique, loss of depth perception, limited magnification, need for training and costly instrumentation are some of its pitfalls.

Otoendoscopic procedures need some expertise on the part of the surgeon. Some patients may not allow endoscopy as they are more sensitive. Assurance to the patient and local anaesthesia will help in such type of patients. In case of a discharging ear, the cleaning of the ear with suction or a course of antibiotics is needed prior to procedure in order to have a thorough look of the structures. The procedures can be done both in sitting and lying down position, on an outdoor basis and local or general anesthesia can be used.

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