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Evaluation of endoscopic cartilage myringoplasty with endoscopic temporalis fascia myringoplasty in patients from Bihar region

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Abstract

Myringoplasty is a surgical procedure of closure of tympanic membrane perforation. Myringoplasty surgery involves the use of a graft as a scaffold for the epithelium to grow over the graft and close the perforation. The goal of myrongoplasty surgery is to achieve a dry ear by eradicating middle ear disease and also to improve hearing by the closure of tympanic membrane perforation by grafting. The results of myringoplasty are usually measured in terms of success or failure of graft take-up and hearing improvement. Hence based on above findings the present study was planned for Evaluation of Endoscopic Cartilage Myringoplasty with Endoscopic Temporalis Fascia Myringoplasty in Patients from Bihar Region.

The present study was planned in Department of ENT, Nalanda Medical College and Hospital Patna, Bihar, India. The study was conducted from May 2019 to October 2019. In the present study total 30 patients were enrolled in the present study. Out of that Group I consist of 15 patients were undergone the myringoplasty using temporalis fascia. The remaining 15 patients were compared in Group II in that palisade cartilage was used as a graft material to close the tympanic membrane retraction with perforation.

Various types of grafts and techniques are used to close the perforation of the tympanic membrane. Tympanoplasty by cartilage palisade and temporalis fascia yielded near to equal graft uptake rates. Improvement in hearing is was slightly better with temporalis fascia as graft when compared to cartilage palisade graft. Endoscopic tympanoplasty has following advantage it's sutureless, minimally invasive & reduced operative time. The cartilage tympanoplasty offers an otologist another reliable material in his armamentarium for tympanic membrane reconstruction.

Keywords: myringoplasty, cartilage, temporalis fascia, endoscopic, etc

Introduction

Tympanoplasty is a surgical technique to repair a defect in the tympanic membrane with the placement of a graft, either medial or lateral to the tympanic membrane annulus. The goal of this surgical procedure is not only to close the perforation but also to improve hearing. The success of the operation depends on the ability to eradicate disease from the middle ear (eg, inflamed granulation tissue and cholesteatoma). Various techniques have been developed and refined, and a number of grafting materials are available. Both the lateral and medial grafting techniques are detailed below.

Tympanoplasty is a safe and effective outpatient procedure used to both eradicate disease from the middle ear and restore hearing and middle ear function [1, 2]. A number of surgical approaches and grafting techniques are available for use by the surgeon. Paramount to success are the preoperative assessment, good hemostasis intraoperatively, and thoughtful surgical planning with careful placement of the graft.

Perforations are most problematic when they cause both conductive hearing loss and chronic otorrhea. Although most perforations heal spontaneously, those that persist after dry ear precautions, ototopical drops, or myringoplasty should be considered for repair. Tympanic membrane perforations can arise as sequelae of acute otitis media or chronic otitis media with or without cholesteatoma, as a complication of PE tube insertion, or as a result of barotrauma to the ear. Smaller perforations of the tympanic membrane can result in low-frequency hearing loss, while larger perforations can cause high-frequency and low-frequency hearing loss. Chronic infections and cholesteatoma can also result from perforations of the tympanic membrane [3, 4]. A perforation is a significant risk for the development of otitis when swimming in lakes, rivers, oceans, or pools.

Cholesteatoma is an epidermal inclusion cyst that contains desquamated keratin and accounts for much of the morbidity of otomastoiditis. The in-growth of squamous cells into the middle ear through a perforation can result in an acquired cholesteatoma. Chronic otitis media can occur with or without cholesteatoma, and both varieties can present challenges to the clinician and barriers to the success of a tympanoplasty.

A complete discussion on the etiology and pathophysiology of cholesteatoma is beyond the scope of this article, but multiple theories exist on its etiology. One of the more common theories about how cholesteatomas form involves retraction of the pars flaccida from negative middle ear pressure, resulting in invagination of squamous epithelium into the middle ear and mastoid. Another theory suggests that cholesteatoma arises from ingrowth of epithelium through a perforation of the tympanic membrane.

The 2 other most popular theories involve hyperplasia of the

basal layer of the tympanic membrane and metaplasia of middle ear mucosa. A number of complications of cholesteatoma are related to growth and bony erosion, including hearing loss (via erosion of ossicles and/or cochlea), labyrinthitis or labyrinthine fistula, facial nerve paresis, and intracranial complications.

Although most perforations heal spontaneously, those that persist after dry ear precautions, ototopical drops, or myringoplasty should be considered for repair.

An understanding of the tympanic membrane anatomy is critical to successful repair. Tympanoplasty technique mandates an understanding of the layers. The tympanic membrane typically consists of the following 3 layers: Lateral epithelial layer; Middle fibrous layer & Medial mucosal layer.

The outer epithelial layer is composed of stratified squamous epithelium, which is continuous with the skin of the external auditory canal. This is significant because in-growth of this outer epithelial portion through the perforation can result in an epithelial cyst called an acquired cholesteatoma. Untreated, this cyst then releases destructive enzymes that can enlarge the size of the perforation and ultimately cause ossicular erosion. The lateral grafting technique that is discussed later in this text requires that this entire epithelial layer be stripped from the drum remnant prior to placement of the graft so as to avoid iatrogenic cholesteatoma formation.

The middle fibrous layer is composed of connective tissue consisting of outer radial fibers and inner circular fibers. It provides strength to the drum. A healed perforation is also commonly deficient of this middle fibrous layer. The epithelial and endothelial layers regenerate creating a "dimeric" membrane. This miscalculation can be corrected when carefully examined under binocular microscopy. Because this middle layer is absent in the pars flaccida superiorly, the posterior-superior aspect of the drum can be drawn inward toward the middle ear as a retraction pocket.

The inner layer of the tympanic membrane consists of simple cuboidal and columnar epithelium cells. This layer is identical to the mucosal lining of the rest of the middle ear mucosal tissue and is considered to be critical to ensure healing of tympanic membrane perforations, and the surgeon often abrades or rasps the undersurface of the tympanic membrane remnant to stimulate regrowth.

The peripheral edge of the tympanic membrane is rimmed by a dense fibrous layer called the annulus, which is essentially a thickening of the pars tensa. Successful elevation of the annulus is critical for medial grafting technique. The annulus is deficient superiorly at the "12 o'clock" location. This area is the notch of Rivinus and can guide the surgeon to a natural plane to elevate the annulus.

The ear canal has bone in the medial component (inner one-third). The lateral portion, which extends into the pinna, is composed of cartilage. The bone/cartilaginous interface is located at the medial two-thirds junction. Most incisions that are made to raise a tympanomeatal flap or perform either an endaural or transcanal approaches are made at this location as well. The superiorly placed vascular strip is another critical area within the ear canal. This region is demarcated by the tympanosquamous suture line superiorly and the tympanomastoid junction line inferiorly. Canal incisions are often made along these junctions.

The middle ear is an air-filled space bordered by the bony labyrinth of the inner ear medially, the tympanic membrane laterally, and the cranium superiorly. This space contains the ossicles, nerves (facial nerve, chorda tympani, Jacobsen nerve), small muscles (stapedius and tensor tympani), ligaments, and blood vessels. The petrous portion of the internal carotid artery and the internal jugular vein, which are both in proximity to the middle ear space, can be dehiscent and should be noted on any preoperative imaging. Rarely, middle ear pathology can involve these structures.

In order for successful grafting of the tympanic membrane to improve hearing, an intact ossicular chain must be present. The malleus transmits energy from the tympanic membrane to the incus, which itself is connected to the stapes superstructure resting on the oval window. Diarthrodial joints connect the 3 ossicles and allow the transmission of acoustic energy from the tympanic membrane to the inner ear. The incudostapedial joint is the most fragile and, hence, has the highest likelihood to require repair.

The middle ear communicates with the mastoid air cells via the mastoid antrum. The temporal bone air cells are usually pneumatized by 3 years of age. However, the air cells can remain underdeveloped and sclerotic in patients with persistent eustachian tube dysfunction. A poorly pneumatized or fluid-filled mastoid bone predisposes a patient to require a more extensive tympanomastoidectomy to improve the chances of successful graft placement.

The eustachian tube connects the middle ear with the nasopharynx and allows pressure equilibration in the middle ear. Enlarged adenoids or biofilms within this lymphoid tissue are hypothesized to predispose a patient to persistent middle ear disease. This bony-cartilaginous tube is approximately 45° from the horizontal in adults but only 10° from horizontal in infants. In addition, the infant eustachian tube is about 50% of the adult length.

The inner ear is composed of the cochlea, which is the end-organ for hearing, and the vestibular organs. The vestibular organs include the utricle, saccule, and the 3 semicircular canals and are involved in balance.

The indications and outcomes vary depending on the specific clinical problem. Success rates of tympanic membrane closure vary greatly in the literature (35-98%) but are usually greater than 80% and depend largely on the size and location of the perforation, surgical technique, and overall health of the middle ear. [5, 6, 7]

Complications of the surgery include recurrence of the perforation, tympanic membrane retraction, otorrhea, cholesteatoma development, persistence or worsening of any conductive hearing loss, sensorineural hearing loss (rare), and taste disturbances. Post-auricular incisions are at risk for hematoma, and a mastoid pressure dressing is recommended for the first postoperative night. Outcomes can be optimized by a proper and detailed preoperative assessment and the careful construction of an effective surgical plan.

The graft can fail because of infection, failure to pack the graft securely in place, technical error, failure to clear mastoid and middle ear disease, and because of a concurrent undetected cholesteatoma. Excising all tympanosclerosis at the edge of the perforation so as to allow vascularized perimeters to incorporate the graft is critical.

Myringoplasty is a surgical procedure of closure of tympanic membrane perforation. Myringoplasty surgery involves the use of a graft as a scaffold for the epithelium to grow over the graft and close the perforation. The goal of

myrongoplasty surgery is to achieve a dry ear by eradicating middle ear disease and also to improve hearing by the closure of tympanic membrane perforation by grafting. The results of myringoplasty are usually measured in terms of success or failure of graft take-up and hearing improvement. Hence based on above findings the present study was planned for Evaluation of Endoscopic Cartilage Myringoplasty with Endoscopic Temporalis Fascia Myringoplasty in Patients from Bihar Region.

Methodology

The present study was planned in Department of ENT, Nalanda Medical College and Hospital Patna, Bihar, India. The study was conducted from May 2019 to October 2019.

In the present study total 30 patients were enrolled in the present study. Out of that Group I consist of 15 patients were undergone the myringoplasty using temporalis fascia. The remaining 15 patients were compared in Group II in that palisade cartilage was used as a graft material to close the tympanic membrane retraction with perforation.

The investigations carried out to assess the patients for the study includes examination under microscope, pure tone audiogram, diagnostic nasal endoscopy, Xray paranasal sinuses, chest X-ray, routine blood investigations, ECG. Examination under microscope is done to confirm the diagnosis and the inactive of chronic suppurative otitis media by observing the mucosa of the middle ear and the presence of any discharge or any retraction pocket.

All the patients were informed consents. The aim and the objective of the present study were conveyed to them. Approval of the institutional ethical committee was taken prior to conduct of this study.

Following was the inclusion and exclusion criteria for the present study.

Inclusion criteria: Age >12 years and <50 years, CSOM with central perforation, the ear should be dry for at least 3 weeks, Mild to moderate conductive hearing loss.

Exclusion criteria: Other disease condition which could affect the result of study except the ear disease.

Results & Discussion

Microscopic myringoplasty is one of the most frequently performed traditional procedures. A prominent anterior canal wall, and anterior quadrant or marginal perforations may limit the exposure or surgical manipulations when an operation microscope is used for visualization of the surgical field [8, 11]. In these cases, in order to overcome the disadvantages of using a microscope, more invasive procedures that enlarge surgical field are needed such as canaloplasty or a postauricular approach [11]. Use of endoscopes provides considerable advantages with a wide exposure.

The evolution of the tympanic membrane grafting has been based on biological tissues of mesodermal origin containing collagen matrix. Many autologous grafts such as temporalis fascia, fascia lata, perichondrium, cartilage can be used. Several allografts such as dura mater, pericardium, temporalis fascia, amniotic membrane, skin, cornea were tested in the past. Recently alloplastic graft materials such as absorbable gelatin, sponge and acellular dermal matrix are experimented. Still Temporalis fascia remains the most commonly used graft material.

Repair of tympanic membrane's (TM's) anterior quadrant perforations is harder than the repair of the posterior perforations due to graft's viability, protrusion of the anterior canal wall and medialization of the graft. Graft is usually placed medial to the tympanomeatal flap with an underlay technique for the repair of anterior quadrant perforations.

The modern tympanoplasty techniques were defined in the 1950s with the introduction of operating microscopes [12]. The majority of the cases may require a retroauricular incision and tissue resection in microscopic tympanoplasties. The microscopic tympanoplasty technique is commonly used today most frequently to reconstruct large tympanic membrane perforations located anteriorly. However, a retroauricular scar formation, displacement of the pinna anteriorly, and the development of significant pain in the patients are the disadvantages of the microscopic tympanoplasties [12, 14]. Currently, the minimally invasive techniques have gained popularity. There is an increasing interest in the minimally invasive techniques in otologic and neuro-otologic surgeries. Endoscopic ear surgeries were introduced in the 1990s and they gained popularity in otology. Endoscopically, it is possible to elevate a tympanomeatal flap via the transcanal route, however, it is also possible to perform a tympanoplasty without the elevation of the tympanomeatal flap [15]. The anatomical structures of the middle ear, the anterior and posterior epitympanic spaces, tympanic sinus, and the facial recess can be visualized more clearly by endoscopy [15, 16].

Table 1: Descriptive Statistics

Myringoplasty	Endoscopic Cartilage Myringoplasty	Endoscopic Temporalis Fascia
Age		
20 – 30 years	6	10
31 – 40 years	8	4
40 & above years	1	1
Sex		
Males	6	7
Females	9	8
Pre op (dB)	41.9 – 51.8	43.5 – 53.4
Post of (dB)	25.3 – 35.6	22.4 – 42.7

Table 2: Re perforation

Myringoplasty	Endoscopic Cartilage Myringoplasty	Endoscopic Temporalis Fascia
Re perforation		
Yes	1	2
No	14	13

Since publication of Zollner and Wullstein different graft materials have been promoted in myringoplasty. Temporalis fascia was first used in myringoplasty by Ortegren (1958-59), Heermann (1961). [17-18] It is the most commonly used autogenous graft material. It is most popular for several reasons. Although temporalis fascia has been widely used it can eventually become thin and atrophic. Tragal perichondrial graft avoids amputation of the targus thereby facilitating dissection of the perichondrium from the cartilage as compared to the traditional method. Fat myringoplasty nevertheless is a simple, cost effective, outpatient procedure.

Van Rompey Farr MRB concluded that both conchal and tragal cartilage had similar outcomes regarding auditory properties and a 0.5 mm thickness was considered sufficient to maintain shrinkage resistance and sound conduction

comparable to a normal tympanic membrane [19].

Mohammad *et al*. found that tympanoplasty using temporalis fascia and cartilage showed similar functional outcomes regarding hearing, which varies from our study, temporalis fascia was 100% and cartilage was 85% [20].

A number of techniques have been described for repair of anterior TM perforations. Traditional approach for these perforations include underlay placement of a graft beneath a tympanomeatal flap prepared with skin incisions. Anterior canalplasty is performed as an additional intervention when anterior canal wall is prominent, and anterior annulus cannot be observed. In the technique described herein, the graft can be placed through the perforation by a transcanal underlay approach without any need for skin incisions or preparation of a tympanomeatal flap. A prominent anterior canal wall, and inability to see the anterior edge of the perforation and annulus make myringoplasty difficult when an operation microscope is used. Use of endoscopes provides advantages to surgeon in these circumstances. Microscope magnifies the surgical field on a straight line, however endoscopes magnify the area at a wider angle. Deep corners can be visualized by endoscopes [21].

Therefore, anterior annulus can be easily seen, and the intervention can be performed without any need for an anterior canalplasty. Since magnification is achieved by getting the endoscope closer to the surgical area, manipulation of the endoscope is easier and faster compared to the microscope. Use of endoscopic push-through technique in anterior TM perforations have some advantages over other techniques with smaller skin incisions, less bleeding, a short operation time, ease of application, and no need for postoperative care. In our study, we used endoscopes to take these advantages. However, in anterior quadrant perforations, if the anterior wall is prominent, the problem is absence of suitable standard instruments designed for endoscopic surgery of this region. In this study, we changed the angles of the picks, and used them particularly to gain access to difficult-to-reach areas. Since the endoscope is held with the one hand, and one-hand surgery seems as a disadvantage of endoscopic surgery, however the procedure can easily be performed with one hand as experience is gained and bleeding is controlled well. Great variability exists not only in surgical technique but also in its outcome throughout the world. It is an effective and simple procedure for the closure of tympanic membrane perforations. In patients early timely myringoplasty had good chances of restoring function with the potential for reducing further complications and deterioration [22].

Experimental histopathologic studies have shown that cartilage is stable because of the fibrile structure of the matrix, which is independent of the survival of cellular elements. Reconstruction of the tympanic membrane using the cartilage technique in myringoplasties allowed us to achieve good anatomic and audiologic results that were at least similar, if not better than traditional methods of reconstruction in high-risk cases.

Conclusion

Various types of grafts and techniques are used to close the perforation of the tympanic membrane. Tympanoplasty by cartilage palisade and temporalis fascia yielded near to equal graft uptake rates. Improvement in hearing is was slightly better with temporalis fascia as graft when compared to cartilage palisade graft. Endoscopic tympanoplasty has following advantage it's sutureless, minimally invasive & reduced operative time. The cartilage tympanoplasty offers an otologist another reliable material in his armamentarium for tympanic membrane reconstruction.

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