

## RESEARCH ARTICLE

# Efficacy of Tragal Cartilage Perichondrial Composite Autograft in the Management of Posterosuperior Retraction Pockets

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## ABSTRACT

Chronic middle ear infection is highly prevalent in our country. Retraction pockets elude early detection due to lack of overt symptomatology. The exact etiology of development of retraction pockets is still unknown. But it is certain that faulty middle ear aeration is the primary cause for this clinical entity. This paper is aimed to study the effectiveness of tragal cartilage perichondrial composite autograft in the management of posterosuperior retraction pockets of pars tensa of the tympanic membrane and also to study the predisposing factors responsible for the development of retraction pockets. Eighty-nine ears of 56 patients with retraction of pars tensa were studied. There were 30 males and 26 females; age varies from 6 to 45 with an average of 20 years. Most of the patients in this study had mild or moderate hearing loss. Very few had a severe conductive hearing loss or sensory neural hearing loss. The severity of hearing loss does not bear any relation to the stage of the retraction of the tympanic membrane. Very severe retraction may be associated with mild hearing loss and vice versa.

Similarly, the presence or absence of ossicular necrosis does not make any difference in the degree of hearing loss. Out of this 56 patients, 29 underwent surgical management. Twenty-two out of this 29 patients had ossicular necrosis. Twenty-five patients had no recurrence of retraction after the surgery. Even though four patients developed retraction that was only around the cartilage graft and there were no pocket formations, and the retraction was not directly in contact with the ossicles. There was no graft failure as such; that means graft take up was 100 percent. So the study suggested early surgical intervention with cartilage perichondrial composite grafting is a successful technique for management of posterosuperior retraction pockets of pars tensa to safeguard hearing and to prevent possible cholesteatoma formation later.

**Keyword:** Ear cartilage, Retraction pockets, Tragal cartilage perichondrial composite autograft.

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## INTRODUCTION

Chronic ear infection is highly prevalent in our country today, equally in adults and children. A good number of patients attending the ENT outpatient department of any large general hospital seek treatment for discharging ears. Even though the majority of them fall under the safe category, others are exposed to chances of developing grave complications. It is this group of patients who warrant greater and immediate attention.

Ear discharge is not generally considered a serious disease by the common man. Ignorance about the illness, financial constraints, and callousness towards the health problem discourage them from seeking medical aid. The situation has improved in recent years, with trained, qualified doctors convincing the patient about the gravity of the illness and the need for taking immediate treatment.

But the situation is a little different as far as the retraction pockets of the tympanic membrane are concerned. This entity eludes early detection and warrants constant observation by the ENT specialist to reach a definite conclusive diagnosis. Even doctors neglect the problem due to various reasons. It takes a longer time to develop a complication. Another factor is the nonavailability of an accepted mode of treatment to prevent the complications without jeopardizing hearing.

Retraction pockets of pars tensa are relatively common in patients with previous ear disease, notably otitis media with effusion (MEE), while tubal dysfunction plays an important role in the pathogenesis of such problems. It does not follow that all such cases have an ongoing eustachian tube dysfunction.

The exact etiology of the development of retraction pockets is still unknown. But it is certain that faulty aeration of the middle ear is the primary cause for this problem.

A clinical entity that may lead to the defect in the middle ear aeration includes:

- Any pathology affecting the patency or function of the eustachian tube.

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- Nasopharyngeal pathology.
- Any other condition that may affect the nasal airway.

Since there is no definite treatment available for tubal dysfunction, the medical treatment for retraction pockets is most often ineffective. Surgical management like myringotomy and grommet insertion has been attempted to improve the middle ear aeration but is not yet the final answer for this problem due to frequent recurrences.

The composite graft of cartilage and perichondrium to stiffen the tympanic membrane is the only satisfactory treatment modality available so far.

Tympanic membrane retraction should be treated effectively upon detection. Conservative procedures such as decongestants, Valsalva, and politizerization can be accomplished initially. Swift surgical treatment is the order when conservation measures fail or when the tympanic membrane adheres to middle ear structures. The incudostapedial joint is especially prone to destruction, and the long process of incus can get eroded just in a matter of weeks when tympanic membrane adheres to it.

## AIMS OF THE STUDY

To study the effectiveness of tragal cartilage perichondrial composite autograft in the management of posterosuperior retraction pockets of pars tensa of the tympanic membrane

To study the predisposing factors responsible for the development of retraction pockets.

## MATERIALS AND METHODS

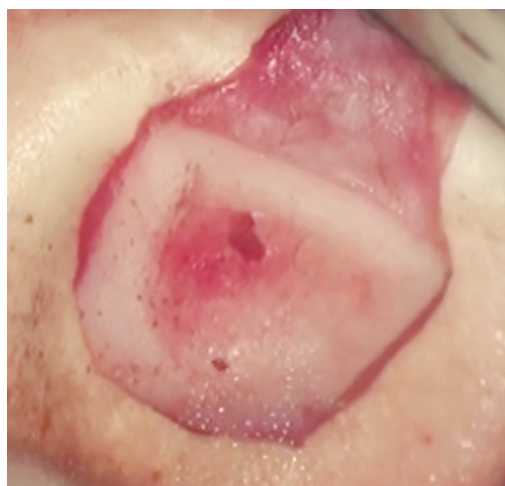
This is a retrospective study conducted in the department of ENT, Government Medical College, Thiruvananthapuram, Kerala, India during 3 years from 01/08/11 to 31/07/2014 wherein all patients with retraction pockets of the posterior segment of pars tensa presented during the period are included in the study. Only patients with retraction of the posterior segment of pars tensa are included in the study. Retractions affecting anterior segment alone, retraction of pars flaccida, patients with obvious cholesteatoma, patients with a history of long-term use of ototoxic ear drops, patients over the age of 60 years are excluded from the study.

Patients were followed up for a period ranging from a minimum of 3 months to 1 year with repeat audiogram done 3 months after the surgery

## Surgical Technique

### *Preparation of the Graft*

Following infiltration of the skin over the tragus with lignocaine 2% with adrenaline (1:200000), an incision is made on the posterior surface of the tragus. The incision just medial to the edge of the tragus reduces the visibility



**Fig. 1:** Tragal cartilage with perichondrium attached on one side

of the scar. The soft tissue is elevated off the tragus, and enough cartilage with perichondrium attached on both sides is harvested. The perichondrium is elevated from one surface of the cartilage using a duckbill elevator leaving the perichondrium attached to the cartilage on the opposite side (Fig. 1). The cartilage is shaped to the appropriate size and shape in such a way that it snugly fit into the bony canal wall and covering the posterosuperior part of tympanic membrane.

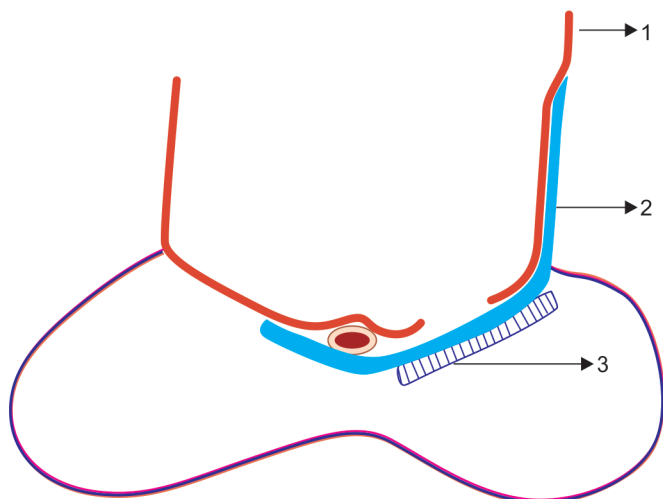
## Procedure

The endaural approach is preferred in most of the cases. The posterior tympanomeatal flap is elevated and retracted part of the tympanic membrane is elevated carefully from the incus, stapes, and promontory. Sufficient posterosuperior bony canal wall is removed to visualize the fundus of the retraction. Ossicular chain is inspected carefully to detect the erosion of any ossicles and mobility of the ossicular chain. The cartilage perichondrial composite autograft is placed as inlay. In cases where the incus is eroded and stapes head is intact, the composite graft is placed in such a way that the cartilage is in contact with the stapes head. Temporalis fascia is used in certain cases as an additional coverage for perforation (Fig. 2).

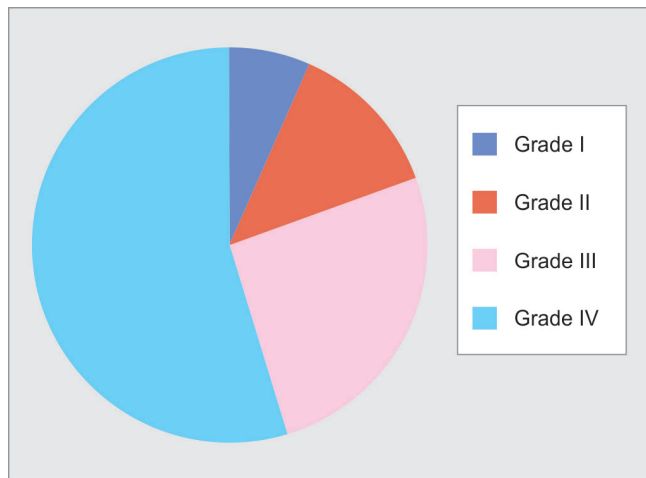
## Relevant Surgical Anatomy

The attic or epitympanum is almost completely separated from the mesotympanum by the ossicles and their mucosal folds except for two small openings namely the isthmus tympani anticus and isthmus tympani posticus.

Whenever the aerodynamics of the middle ear has interfered, the small openings connecting the mesotympanum and epitympanum are occluded by swollen mucosa. This will lead to various aftereffects like negative pressure formation, development of retraction pockets, and formation of cholesteatoma.



**Fig. 2:** Placement of composite graft  
(1) Canal skin; (2) Tragal perichondrium; (3) Tragal cartilage



**Graph 1:** Classification of retractions

**OBSERVATIONS**

Fifty-eight patients with retractions of pars tensa of tympanic membrane who attended the outpatient department of government medical college, Thiruvananthapuram from 1/08/2011 to 31/07/2014 were studied. Thirty patients had bilateral diseases, and 28 had unilateral diseases. The number of males was 30 and females 28. Age varies from 6 years to 45 years with an average of 20 years. Part of tympanic membrane affected and the type retractions are given in Table 1.

Eighty-three ears of 54 patients had retraction pockets in the posterosuperior quadrant. One patient had a central perforation on the opposite ear, and another had a modified radical mastoidectomy cavity in the other ear.

Retractions are grouped according to the classification suggested by Sade in 1980, 89 ears of 56 patients are classified as per Sade (Graph 1).

Hearing loss is classified as mild, moderate and severe. Mild is hearing loss up to 30 db, moderate in between 30 and 45 and severe more than 45 db. Hearing loss detected in this study are given in Table 2.

**Table 1:** Part of tympanic membrane affected and the type retractions

Part of TM affected	No. of Patients	No. of ears	Percentage (%)
Posterosuperior retraction pocket (PSRP)	54	83	91
Other quadrants of TM	4	6	6.5
PSRP with central perforation	6	6	6.5
PSRP with marginal perforation	8	8	8.7
PSRP with cholesteatoma	10	10	11
PSRP with granulations	7	7	7.6
Associated attic pathology	7	9	9.9

**Table 2:** Percentage of hearing loss

Hearing loss	No. of patients	Percentage (%)
Mild	43	48.3
Moderate	39	43.8
Severe	5	5.6
SNHL	2	2.2

Most of the patients in this study had mild or moderate conductive hearing loss. Very few patients presented with severe conductive hearing loss or sensory neural hearing loss. The severity of hearing loss did not bear any relation to the severity of retraction of the TM. Very severe retraction may be associated with mild hearing loss and vice versa.

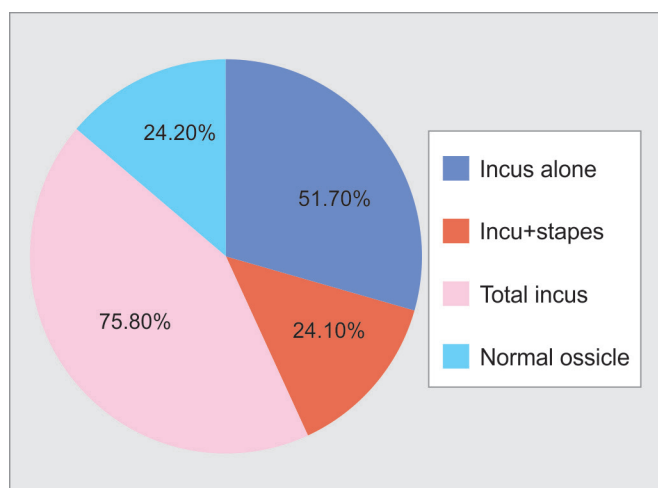
Similarly, presence or absence of ossicular necrosis did not make any difference in the degree of hearing loss. Even in cases with the destruction of incus and stapes the hearing loss most often remained mild. In spite of necrosis of incus in 75.8% and involvement of stapes in 24.1% only 5.6 % of patients had a severe conductive hearing loss. And six patients had a moderate conductive hearing loss with minimal (grade 1) retraction of TM without any involvement of ossicles.

In this study, 29 patients underwent surgical treatment for the retraction pocket of TM. Nature of ossicles in the operated ears is examined, and the findings are given below (Graph 2).

During the follow-up period, one patient showed improvement with nonsurgical treatment. An 18-year-old female with bilateral grade 11 retractions and deviated nasal septum experienced marked improvement in symptoms and the grade 11 retractions were converted into grade 1 retraction on treatment with nasal decongestants and antihistamines for about one month.

In a 6 years old male child with bilateral disease, the condition of one ear worsened rapidly with the development of cholesteatoma within 3 months.





Graph 2: Ossicles affected

Another patient, a 20 years old male, with bilateral grade 11 retraction showed the rapid progression of retraction with the formation of granulations in one ear. During surgery, it is revealed that the long process of incus and stapes suprastructure were eroded.

A few patients had transient improvement in symptoms with nonsurgical treatment, but the retraction of the TM remained same as before. Similarly, certain patients had transient worsening of symptoms, but there were no marked change in the findings of TM.

The only nonsurgical treatment given is nasal decongestants, antihistamines, and antibiotics when necessary.

**CRITERIA FOR SURGICAL TREATMENT**

- Fundus of the retraction not visible in otomicroscopy
- History of discharge
- Moderate or severe conductive hearing loss
- Presence of granulations or suspected cholesteatoma
- Frequent and regular follow-up is not possible

Most of the ears were approached through an endaural incision and the rest postaural. The mastoid antrum and air cells are explored in cases where there were evidence of cholesteatoma or granulations, when the patient gives a history of persistent discharge, and when the fundus of the retraction was not visible even by removing the posterosuperior bony canal wall.

In most of the cases, the antrum was normal. In this series, there were only two cases with the extension of cholesteatoma beyond the aditus into the antrum. In all other cases, the pathology was confined to posterosuperior part of the middle ear, attic or aditus.

During the surgical procedure, inflammatory adhesions were found in between the promontory and TM and in between the promontory and ossicles, interestingly these adhesions were strictly confined to the posterosuperior region and the rest of the middle ear were normal and aerated in most of the cases.

Table 3: Efficacy of TCPA

Graft take up	No. of patients	Percentage (%)
No recurrence	25	86.2
Recurrence	4	13.8

In these 29 surgical procedures, not even a single patient developed perichondritis, a much-feared complication of removal of the tragus, and the scar was well acceptable.

The efficacy of tragal cartilage perichondrial composite autograft (TCPA) is given in Table 3.

Although four patients showed recurrence of retraction of TM, the retraction was minimal and was limited to the margins of the graft; none of them developed a retraction pocket as such to threaten cholesteatoma formation.

As far as the graft take up is concerned, there was no rejection of graft in these series, i.e., the take-up rate is 100%.

The improvement of hearing after surgical treatment with TCPA is grouped into four categories:

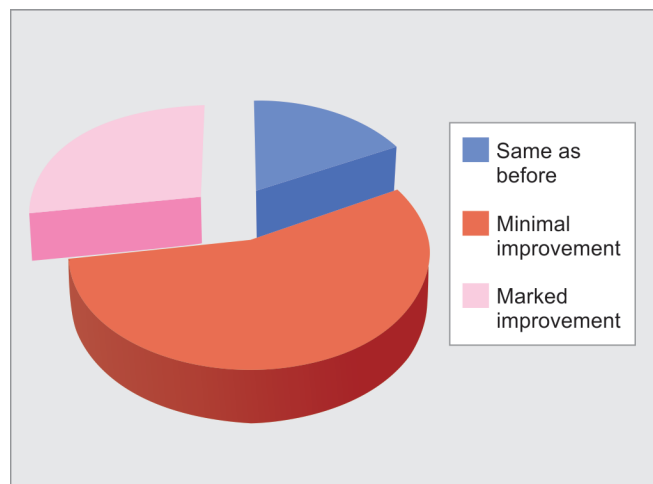
- Hearing worsened after surgery
- Hearing remains the same
- Minimal improvement
- Marked improvement

The results obtained are given in Graph 3.

Fortunately, there were no patients who had to worsen of hearing status after surgery. The commonest ossiculoplastic technique used in this series is type 111 ossiculoplasty. In cases where stapes suprastructure is absent, the result obtained after surgery was rather discouraging.

**DISCUSSION**

Eighty-nine ears of 56 patients with retraction of pars tense of tympanic membrane were studied. Two patients with bilateral disease had a different pathology in the opposite ear. One patient had central perforation, and another had modified radical mastoidectomy cavity in the other ear of the second patient.



Graph 3: Postoperative hearing



In the present study, the common area of the drum affected by retraction was the posterosuperior quadrant (83%). This finding is in accordance with the result reported by Mills,<sup>1</sup> and in contrast to the result published by Sade,<sup>2</sup> who found that retraction of all four quadrants of the drum were the commonest pattern.

In the literature, various speculations have been given for predilection of the posterosuperior quadrant to be affected by retraction of the tympanic membrane. Mills<sup>1</sup> suggested that this part of the tympanic membrane is farther away from the eustachian tube than the anterior part of the tympanic membrane. Alternatively, it may relate to the distribution of forces within a retracted drum. Other reasons suggested are the precarious blood supply of that part of the drum and compartmentalization of the tympanic cavity by mucosal folds.

The presence of inflammatory adhesions found in this series supports the compartmentalization hypothesis. Another interesting finding is about the direction of the retraction of the posterosuperior part of the drum. It is always towards the aditus region and never towards the Eustachian tube.

From these findings, one can presume that the frequent inflammation of the middle ear results in edema of mucosal folds. This edema along with the inflammatory adhesions produces compartmentalization of the middle ear cleft. Due to this, compartmentalization eustachian tube and anterior part of the tympanic cavity are separated from the superior part of the posterior tympanic cavity, aditus, and antrum. So, this posterosuperior portion is no more aerated by the eustachian tube. Air from antrum is gradually absorbed by mucosal lining resulting in negative pressure inside the antrum. This negative pressure inside the antrum is exerted on to the posterior tympanic cavity. The only mobile component in this segment is tympanic membrane hence it bears the brunt of the whole pathophysiological phenomenon and gets retracted. Once a definite thin walled pouch has formed, as stated by Bennet, it becomes a clinical entity on its right.<sup>3</sup>

In most of the cases, during the surgical procedure, inflammatory adhesions were detected in the superior part of the posterior tympanic cavity, but the rest of the middle ear was absolutely normal and well aerated.

From observations like pathology limited to the posterosuperior quadrant, absolute normalcy and aeration of the other regions of the middle ear and direction of retraction towards aditus rather than towards eustachian tube, noted in most of our patients, it is reasonable to infer that a persistent or permanent eustachian tube dysfunction is not the cause of retraction in these patients. Probably a recurrent eustachian tube block and resultant pathophysiological changes occurring in tympanic membrane and middle ear structures may be

the etiological factors playing a major role in the development of retractions in the posterosuperior quadrant of the drum.

Sculerate and Bluestone<sup>4</sup> well supports this explanation. Bennet<sup>3</sup> commented that the retraction pocket at operation appeared to be related to the inflammatory adhesions producing a localized malaeration process, the rest of the middle ear cavity was healthy and aerated. By examining temporal bones Sade et al.<sup>5</sup> also suggested a probable inflammatory cause for the development of retraction pocket. Paperalla<sup>6</sup> also supported the inflammatory theory.

Bennet<sup>3</sup> reported 56.6% of patients with direct evidence of eustachian tube dysfunction. Whereas in our study, only in 19% of patients the probable aetiological factor was persistent eustachian tube dysfunction.

Most of the patients in this study had mild or moderate conductive hearing loss. Only 5.6% of patients had the severe conductive hearing loss, and 2.2% had mixed hearing loss. Mills<sup>1</sup> reported 30% of ears had air bone gap less than 10 dB and in 93% the air-bone gap was less than 30 db. An air-bone gap of more than 40 db was found in 7%. In our study, air-bone gap less than 10db is 49%, and less than 30 dB is 94.3%. Air-bone gaps more than 40db was found in 5.6% only.

Adkins<sup>6</sup> reported 5–10 dB hearing loss where the ossicles were intact and more hearing loss where there were ossicular necrosis. But in our study, no such correlation could be made in between hearing loss and ossicular necrosis. The moderate conductive hearing loss was detected without any ossicular disruption, and the hearing loss was minimal in certain cases with ossicular necrosis. The probable reason for moderate hearing loss without any ossicular involvement may be due to the presence of middle ear effusion or inflammatory adhesions along with the retraction. Adherence of the retracted tympanic membrane to the stapes may be the cause for the better than expected hearing with ossicular necrosis.

The average air-bone gap found in this series is 23 dB. This finding is in accordance with the average air-bone gap of 19db reported by Harner.<sup>7</sup> Due to reasons cited above the severity of hearing loss does not bear any relation to the severity of retraction pocket nor to the presence or absence of ossicular disruption.

Commonest ossicle involved in this study is incus, 75.8%, stapes necrosis in 24.1%. All ossicles were intact in 24.1% of cases. These findings are in accordance with most of the authors with variations in the percentage.

Sade<sup>8</sup> reported 80% incus necrosis in adults and 56% in children. Stapes erosion was found in 40% of adults and 44% in children. Bennet<sup>3</sup> reported incus necrosis in 52% and stapes in 28% of ears.

Harner<sup>7</sup> found necrosis of incus in 58% and stapes in 29%. Mills<sup>1</sup> reported incus disruption in 77% and stapes

in 35%. Linde found only 40% of incus necrosis and 20% of stapes necrosis. Whatever be the reasons for necrosis of ossicles, most of the ears show necrosis of ossicles in this study.

## RESULTS

Since there is no definite treatment available to correct eustachian tube dysfunction till date, the only hope to prevent complications due to retraction pockets is strengthening of the tympanic membrane by some method. Treatment with tragal cartilage perichondrial composite auto graft (TCPA) is probably the best method available to strengthen the retracted drum. This method has two advantages; it prevents recurrence of retraction and protects ossicles thereby preserve hearing.

In this study recurrence of retractions after treatment with TCPA is seen in four patients (13.7 %). Although 4 patients showed recurrence, the retraction was minimal, shallow, self cleaning and was limited to the margins of the graft. This finding is in accordance with the findings reported by Levinson, Adkins and Harner. Levinson<sup>9</sup> reported 12.9 % recurrence in 85 cases, Adkins,<sup>6</sup> 8% and Harner,<sup>7</sup> 10%.

Recurrence rate found in our study is in contrast to the observation made by Mills<sup>1</sup> and Linde.<sup>10</sup> Mills<sup>1</sup> reported 100% recurrence in nine surgical procedures after 2 years of follow-up and Linde<sup>10</sup> reported 100% success rate of 10 cases.

There were no rejection of graft in our study; the take rate is 100%. This is in accordance with most of the studies. There were no failures in the series reported by Linde,<sup>10</sup> Adkins<sup>6</sup> and Harner,<sup>7</sup> Spielman, Mills<sup>11</sup> reported 84% success rate in a series of 51 cases. Couloigner et al.<sup>12</sup> reported recurrence rate of 8% in 56 pediatric patients.

In our study marked improvement of hearing after surgery is obtained in cases where there was necrosis of incus but stapes was intact and the hearing defect was marked before surgery. Inferior results are obtained in cases where stapes suprastructure was absent and only foot plate was present. This finding is in accordance with most of the reported series. Linde<sup>10</sup> reported satisfactory hearing improvement in a study of 10 patients. Roger et al.<sup>13</sup> in a series of 127 cartilage tympanoplasties after a

follow-up of 18 months obtained encouraging functional results.

## CONCLUSION

Fluctuating, rather than ongoing persistent, eustachian tube dysfunction and inflammatory adhesions are the aetiological factor for the development of retraction of pars tensa.

The degree of hearing loss neither bears any relation to the degree of retractions nor the condition of the ossicles.

Surgical treatment with tragal cartilage perichondrial composite auto graft is a very effective method to control the posterosuperior retraction pocket of pars tensa.

Tragal cartilage perichondrial composite auto graft has 100% take rate.

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