

## Role of Adeno-Tonsillectomy in the Management of Mucosal Type of Chronic Otitis Media in Children and Its Influence on the Outcome of Paediatric Type I Cartilage Tympanoplasty

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## Abstract

## Original Research Article

**Aims & Objectives:** To assess whether removal of septic focus (adenoidectomy and/or tonsillectomy) only is sufficient in the management of mucosal type of chronic otitis media in paediatric age group or performing concomitant type I cartilage tympanoplasty gives better long term result in terms of closure of perforation, discharge free ear and hearing improvement. **Materials & Methods:** A prospective randomized clinical study took place at the Dept. of Otorhinolaryngology of a tertiary care hospital, over a period of one year amongst 43 patients, aged between 5 and 12 years, presenting with chronic otitis media with dry central perforation of ear-drum and pure conductive hearing loss with clinical and radiological evidence of chronic tonsillitis and/or adenoid hypertrophy. Patients were randomly divided into two groups. Group 1 (n<sub>1</sub>= 22) underwent type I cartilage tympanoplasty along with adenoidectomy and/or tonsillectomy in the same sitting and Group 2 (n<sub>2</sub>= 21) underwent adeno-tonsillectomy and conservative management of COM. Patients were followed up at 1, 3 and 6 months in post-operative periods. **Results:** 86.4% patients in group 1 (Type I cartilage tympanoplasty with concomitant adeno-tonsillectomy) had anatomic closure of tympanic perforation at 6 months post-operative follow up while that in group 2 (adeno-tonsillectomy alone) was found to be 42.86%. At the end of 6 months post-operative follow up, the mean hearing gain (pre-op A-B gap minus post-op A-B gap) in two groups were found to be 15.91±6.54 dB and 6.56±5.47 dB respectively. **Conclusion:** Removal of septic focus (adeno-tonsillectomy) has a definite role in the management of mucosal type of chronic otitis media in paediatric age group and when it is combined with type I cartilage tympanoplasty, it almost cures the disease.

**Keywords:** tonsillectomy, Otorhinolaryngology, adenoid hypertrophy.

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## INTRODUCTION

In Childhood, otitis media (Acute otitis media, Otitis media with effusion and Chronic otitis media) is most commonly associated with Eustachian tube dysfunction secondary to many conditions [1-5]. Sequel of some hidden septic focus in upper respiratory tract like chronic infections of Waldayer's ring (Tonsillitis, Adenoiditis etc.) is one of them. So in the management of chronic otitis media in paediatric age group, eradication of these septic focuses and addressing the dysfunction of Eustachian tube plays a key role. The role of adenoidectomy (irrespective of its size) in the management of childhood otitis media is well established. Adding tonsillectomy in the management of otitis media may or may not be proved beneficial depending on the risk/cost and benefit ratio in various paediatric age groups. While different authors have

argued in favor of adenoidectomy ± tonsillectomy, in terms of decreasing the chances of re-infection, decreasing the hospitalization, decreasing the number of interventions and curing the disease in acute otitis media and otitis media with effusion [6]; it is expected that a group of patients presenting with chronic otitis media may recover from the disease by only removing the septic focus in the upper respiratory tract. The patients after removal of septic focus, presenting with a dry central perforation can be cured by tympanoplasty and thereby be cured from re-infection of the middle ear cleft.

Tympanoplasty is the gold-standard in the management of chronic otitis media in all age groups. But as children usually suffer from recurrent upper respiratory tract infections, there are possibilities of re-

infection of middle ear and repeated perforations of the ear-drum [7-9]. Hence, success of tympanoplasty in paediatric age group is questioned by many authors and paediatric tympanoplasty has emerged as a long-debated topic [10-13]. If the reservoir of naso or oro-pharyngeal pathogens can be removed by adenoidectomy or tonsillectomy or both, the chance of success of tympanoplasty in children is increased much more [14].

In this study, an attempt is made to find out the role of adeno-tonsillectomy in the management of mucosal type of COM in children and how does it influence the final outcome of paediatric type I cartilage tympanoplasty.

## MATERIALS & METHOD

This study was carried out at the Department of Otorhinolaryngology of a tertiary care hospital after getting proper approval from the ethical committee. 43 patients were selected for this study, who all were between 5 and 12 years of age (both the limits included), attended ENT OPD for chronic otitis media, mucosal disease, presenting with dry central perforation of ear drum and pure conductive deafness with clinical/radiological evidence of chronic tonsillitis/adenoid hypertrophy/ both, over a period of one year. Patients with squamous disease/cholesteatoma, h/o previous tympanoplasty or mastoid surgery, with sensori-neural or mixed hearing loss, with deviated nasal septum, with acute/chronic rhinosinusitis, with congenital anomalies of ear-nose-throat, with per-operative findings of ossicular discontinuity/ fixity and medically unfit patients were excluded from this study. These patients were randomly placed into two groups, viz. Group 1: patients undergoing type I cartilage tympanoplasty with concomitant adeno-tonsillectomy ( $n_1=22$ ) and Group 2: patients undergoing adeno-tonsillectomy and conservative management of COM ( $n_2=21$ ). Anatomical closures of perforation, dryness of the ear, pre- and post-operative air-bone gap (in pure tone audiometry) were the parameters studied in this study.

After proper pre-operative work up and counseling of patients/ parents, written consent was signed regarding the procedures and after getting the

fitness regarding general anaesthesia from the anaesthesiologists, patients were admitted for the surgery. Each patient received one dose of intravenous antibiotic (preferably Amoxicillin+Clavulanic acid) adjusted according to body weight, after proper skin test, one hour before operation.

All the surgical procedures were done under general anaesthesia with endotracheal intubation. Patients in Group 1 underwent adeno-tonsillectomy/ tonsillectomy/ both followed by type I cartilage tympanoplasty in the same sitting and those in Group 2 underwent type I cartilage tympanoplasty alone. Adenoids were curetted by conventional adenoid curette and tonsils were removed by conventional dissection method. Bleeding was controlled and no post-operative complication seen in any of the cases.

Ear was approached through post-aural route (Wilde's incision). Ossicular integrity and mobility, condition of middle ear mucosa and the opening of Eustachian tube were checked in all cases. Autologous tragal cartilage (without perichondrium on both sides) was harvested and sliced to 0.4 mm thickness using cartilage slicer (Kalelkar Surgical, Mumbai, India). The sliced cartilage was then cut in the shape of tympanic membrane and a 'V' shaped notch was made to incorporate the handle and lateral process of malleus. Graft was placed as underlay; shield and sometimes additional small pieces of cartilage were needed as architrave to support the graft or for proper fitting in the bony annulus. Middle ear was filled with antibiotic soaked gelfoam pieces before placing the graft to support the graft from within and after repositioning of the tympano-meatal flap, external canal also filled with antibiotic soaked pieces of gelfoam.

All the patients were followed up at 1, 3 and 6 months post-operative to note the anatomic and functional outcome of the surgery and complication, if any. Pure tone audiometry was done in every case at 3 and 6 months post-operative and hearing gain (Pre-op A-B gap minus Post-op A-B gap) was assessed by comparing it with pre-operative Air-Bone gap.

## RESULTS

**Table-1: Distribution of patients by their age and sex**

Groups	Average Age (in years)		Sex		Total
	Mean±SD	Statistics, df, p	Male	Female	
1. ( $n_1=22$ ) AT+CT	9.09±2.11	0.16, 22, 0.115	14 (63.6%)	8 (36.4%)	22 (100%)
2. ( $n_2=21$ ) AT	8.14±2.03	0.14, 21, 0.200	9 (42.9%)	12 (57.1%)	21 (100%)

[AT+CT=cartilage tympanoplasty with adeno-tonsillectomy, AT=adeno-tonsillectomy with conservative management of COM, df=degree of freedom, p=significance]

The patients were selected between the age of 5 and 12 years, both the limits included and statistical analysis (Kolmogorov-Smirnov test with Lillifors significance correction) showed that the observations

were not normally distributed. Pearson Chi-square test revealed no statistically significant difference in proportion of males and females in two groups.

**Table-2: Pre-operative clinic-radiological evaluation of the patients**

	Finding	Group 1 (n <sub>1</sub> =22)	Group 2 (n <sub>2</sub> =21)	Total
X-RAY MASTOIDS	Sclerotic	22 (100%)	18 (85.7%)	40 (93.0%)
	Diploic	0 (0%)	3 (14.3%)	3 (7.0%)
	Pneumatic	0 (0%)	0 (0%)	0 (0%)
X-RAY SOFT TISSUE NASOPHARYNX	Adenoid Hypertrophied	19 (86.4%)	17 (80.9%)	36 (83.7%)
	Adenoid not hypertrophied	3 (13.6%)	4 (19.1%)	7 (16.3%)
CLINICAL FINDINGS	Tonsils enlarged	12 (54.5%)	15 (71.4%)	27 (62.8%)
	Tonsils not enlarged	10 (45.5%)	6 (28.6%)	16 (37.2%)

So, it is evident from the above table that, 93% patients had sclerotic mastoids suggestive of long standing disease and poor mastoid pneumatisation, 83%

patients had radiological evidence of adenoid hypertrophy and 63% patients had clinical findings of chronic tonsillitis.

**Table-3: Comparison of outcomes of surgery at 1, 3, 6 months follow ups**

GROUPS	FOLLOW UPS						TOTAL
	At 1 Month		At 3 Months		At 6 Months		
	F	NF	F	NF	F	NF	
1. AT+CT	19 (86.4%)	3 (13.6%)	19 (86.4%)	3 (13.6%)	19 (86.4%)	3 (13.6%)	22 (100.0%)
2. AT	9 (42.9%)	12 (57.1%)	9 (42.9%)	12 (57.1%)	9 (42.9%)	12 (57.1%)	21 (100.0%)
TOTAL	28 (65.1%)	15 (34.9%)	28 (65.1%)	15 (34.9%)	28 (65.1%)	15 (34.9%)	43 (100.0%)

[AT+CT=cartilage tympanoplasty with adeno-tonsillectomy, AT= Adeno-tonsillectomy and conservative management of COM; F=Favorable outcomes (Dry ear with Graft taken up/ Well epithelialized graft or Healed perforation); NF=Not favorable/ Unfavorable outcomes (Discharging ear and/or Residual perforation/ Antero-inferior dehiscence or Graft failure)]

Assessment of hearing improvement in study subjects. We recorded the pre-operative A-B gap and post-operative A-B gap at 3 and 6 months follow ups in

each of 43 patients and calculated the hearing gain (Pre-op A-B gap minus Post-op A-B gap) in each case. We took the results at 6 months for comparison.

**Table-4: Hearing gain or improvements (in dB) obtained at 6 months follow up**

GROUPS	MEAN±SD	St. Error of Mean	Minimum, Maximum, Range	Test of Normality (Shapiro-Wilk) Statistic/df/sig
1. AT+CT	15.91±6.54	1.39	3 /35 /32	0.936/22/0.163
2. AT	6.56±5.47	1.19	0/16.3 /16.3	0.900/21/0.035

[AT+CT=Cartilage tympanoplasty with adeno-tonsillectomy, AT=Adeno-tonsillectomy and conservative management of COM; all values in dB]

**Table-5: Complications of Surgery in the Present Study**

COMPLICATIONS GROUPS	Related to Adeno-tonsillectomy	Graft Failure	Residual Perforation/ Antero-inferior Dehiscence	Acute Otitis Media with Discharge	Total
AT+CT (n <sub>1</sub> =22)	0 (0%)	1(4.5%)	1(4.5%)	1(4.5%)	3 (13.6%)
AT (n <sub>2</sub> =21)	0 (0%)	0 (0%)	12 (57.1%)	0 (0%)	12 (57.1%)
TOTAL (N=43)	0 (0%)	1 (2.3%)	13 (30.2%)	1 (2.3%)	15 (34.8%)

[AT+CT=Cartilage tympanoplasty with adeno-tonsillectomy, AT=Adeno-tonsillectomy and conservative management of COM]

## DISCUSSION

Otitis media is predominantly a disease of infancy and early childhood with peak age specific attack rate occurring between 6 and 18 months of age [15]. A functionally and structurally immature Eustachian tube system [1, 2] and an immature immune system [16] are probably the most important factors related to the increased incidence of otitis media in infants and young children. Repeated episodes of acute upper respiratory tract infections (mostly viral, may be bacterial) lead to acute otitis media and otitis media

with effusion; which with or without pre-existing pathophysiology of Eustachian tube [17], result in chronic otitis media in children. Continued E. tube obstruction retards spontaneous closure of the perforation of eardrum. Chronic otitis media in children is multifactorial [9] which includes genetic, infection, immunologic, allergic, environmental and social factors.

Waldeyer's ring plays an important role in the pathophysiology of upper respiratory tract infection and

allergy<sup>16</sup> in paediatric population. Adenoid hypertrophy can cause recurrent acute otitis media (RAOM), otitis media with effusion (OME), Obstructive sleep apnoea syndrome (OSAS) in children [18]. The size of the adenoid causing mechanical obstruction to E. tube, is not the main determinant factor in OME pathogenesis but the degree of bacterial colonization<sup>19</sup> is much more important in COM pathogenesis and a deciding factor whether adenoidectomy should be done in cases of COM or not. Saafan ME *et al.*, [19] from Egypt in 2013 and Szalmas A *et al.*, [18] from Hungary in 2013, have studied extent of surface biofilm of adenoid and evaluated its role in the pathogenesis of COM in children. Badran H *et al.*, [20] from Egypt in 2015 published a paper stating that adenoids can act as bacterial reservoir secondary to bacterial biofilm formation and thereby can induce a chronic infection, which initiate development of complications. The predominant organisms, as they found, are H. influenza, followed by Staph.aureus and Strept.pneumoniae. Gates GA *et al.*, [21] from USA in 1992 had shown adenoidectomy shows significant benefit in the treatment of otitis media, though the benefit may not be enhanced by tonsillectomy. Large tonsils, per se, have not been found to cause an ear infection to keep coming back; but chronic tonsillitis always acts as a reservoir of infection. Park K [22] from South Korea in 2011, described that the middle ear and tonsils are the organs related to the innate immunity, which involves the first line of the mucosal defense system. Homeostatic defense of the middle ear and E. tube is maintained in part by molecules related to the innate immunity. Recent advances have focused on the possibility that chronic otitis media and adeno-tonsillitis may represent a chronic infective state secondary to bacterial biofilms or small colony variants. So, adeno-tonsillectomy is expected to cure the persistence of chronic mucosal based ENT related infections secondary to biofilms.

Though tympanoplasty is considered as gold standard in the management of chronic otitis media; when a child presents with a persistent perforation of ear drum, question arises whether early surgery to be attempted to correct the anatomical defect and thereby improving hearing; or the elective surgery is better to be deferred until the peak incidence of AOM has passed [23, 11]. Jeffrey T *et al.*, [24] in 1999 have shown that otologic surgery in children is less successful and argued for tympanoplasty in older age groups. Nuria Esperanza Boronat Echeverria *et al.*, [14] in 2012 favored paediatric tympanoplasty on the merit that children present greater risk of retraction, SOM, re-perforation with episodes of AOM. They have presented arguments in favor of surgery at an earlier age (<5 yrs); though opinion differs in this regard in various studies like not before 7 years [25], 8 years [26], 10 years [27] and 12 years [28]. On the other hand, long standing or permanent perforation of tympanic membrane can result in long-term irreversible damage to the inner ear in children and early

intervention is always needed from Canada in 2011 [29]. So, tympanoplasty in children not only cures the disease but also lessens the hearing handicap and helps in better school performance.

Though temporalis fascia is a time tested grafting material in tympanoplasty, various authors have used cartilage myringoplasty in different situations like E.tube dysfunction, retraction pockets, subtotal to total perforations, revision tympanoplasty, ear discharging at the time of surgery, myringoplasty in children etc [30-32]. Because of its thickness, rigidity and mechanical stability, cartilage can resist resorption and retraction; it is more resistant to infection and able to withstand adverse states of the graft bed as its vascular demands are less compared to other materials. Since tragal cartilage is yellow fibroelastic cartilage, formed mainly by type II collagen [33], which is also the main type in lamina propria of tympanic membrane and it is easily available at operative field, a thin tragal cartilage graft would be a better option as grafting material. The rigidity of the cartilage that prevents re-perforation however has been questioned to interfere with sound conduction [34]. The cartilage slices < 0.5 mm thick are similar to the tympanic membrane in their acoustic properties [35, 36].

In general, studies support no single conclusion about the usefulness of previous adenoidectomy/tonsillectomy for major ear surgery. While Gianoli *et al.*, [37] and Charlett SD *et al.*, [38] favored adenoidectomy and showed that success rate of tympanoplasty depends on it; Ophir D *et al.*, [39] concluded that adenoidectomy is not related to the success of paediatric myringoplasty. Vartiainen E *et al.*, [40] found that all failure cases of paediatric tympanoplasties occurred in those who underwent previous adeno-tonsillectomy. Many authors consider that a 4 to 6 weeks interval [41] is needed between adeno-tonsillectomy and tympanoplasty to resolve post-operative mucosal oedema that may block E.tube function.

In the present study, type I tympanoplasty and adeno-tonsillectomy were done in the same sitting in one of the study groups in view of the facts that- i) it prevents the child from repeated exposure to general anaesthesia and related hazards, ii) parents counseling is also easier, iii) more easy to follow up in our set up, iv) if adenoidectomy or tonsillectomy or both be done in expert hands and in precise way with modern instruments, it does not cause any E.tube injury or local oedema to hamper E.tube function so as to be the reason behind tympanoplasty failure.

In the present study, we considered chronic tonsillitis or adenoiditis or both as the septic focus in upper respiratory tract to cause chronic otitis media in children, in terms of reservoir of infection or mechanical obstruction to E. tube or both. Adeno-

tonsillectomy in both the groups (1 and 2) resulted in 86.4% and 42.9% favorable outcomes and hearing gain of  $15.91 \pm 6.54$  dB and  $6.56 \pm 5.47$  dB respectively at the end of 6 months follow up. All the patients had a dry ear following surgery except one (2.3%, presented with acute otitis media with discharge) at end of 6 months follow up. The said case was treated conservatively and after a course of antibiotics, the outcome was healed acute otitis media with intact ear drum. So, it can be concluded that, removal of septic focus (adenotonsillectomy) has a definite role in the management of paediatric chronic otitis media, mucosal type.

## CONCLUSION

From this study, we can draw the following conclusions- i) Removal of septic focus (adenoidectomy/ tonsillectomy/ both) plays a vital role in the management of mucosal type of chronic otitis media in children, in terms of anatomic closure of tympanic perforations and hearing gain; ii) Tympanoplasty is still the gold-standard in the management of inactive mucosal type of chronic otitis media in paediatric age group and can be well advocated in the patients of age 5 years and above, iii) Type I cartilage shield tympanoplasty, using sliced (<0.5 mm thickness) tragal cartilage in post-aural route is a good solution to paediatric COM, inactive type and concomitant adeno-tonsillectomy improves the final outcome; iv) Adeno-tonsillectomy and Type I cartilage tympanoplasty can be done in the same sitting without any major complications and post-operative mucosal oedema around E.tube opening is practically nil, if done in hands of experienced surgeon; v) More case series of adeno-tonsillectomy and concomitant type I cartilage tympanoplasty are needed to set up a management protocol in paediatric age group and finally vi) cartilage may be used more liberally in paediatric type I tympanoplasty as grafting material.

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