Pre and Post Operative Status of Contralateral Ear in Unilateral Chronic Otitis Media

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Abstract Chronic otitis media (COM) is one of the oldest disease affecting ears and undoubtedly represents the main area of interest within modern otology. As the main cause of COM is malfunction of Eustachian tube, it is probable that a patient with COM will have a disorder in contralateral ear (CLE) as suggested by the Minneapolis group- called as *Continuum Theory*. This prospective, observational study was conducted in department of ENT at a tertiary care centre of central India from Sep 2012 to May 2015. Study consisted of 537 patients of unilateral COM who fulfilled the eligibility criteria. After careful history and thorough examination of diseased ear and CLE, findings of diseased ear, CLE and 6 months postoperative findings CLE were entered into performa. The data was entered into SPSS software and further analysis was performed. Out of 740 patients of COM operated in our department, 535 (72.9 %) patients had unilateral COM which were included in the study. The mean age was 24.3 (SD $\pm$ 10.63) ranging from 11 to 55 years, of these 51.4 % were females and 48.6 % were males. Out of 535 unilateral COM, 365 (68.2 %) had mucosal while 170 (31.8 %) had squamous type of disease and 30.9 % of total CLE had abnormal findings. The pre and post-operative findings were compared which came out to be statistically significant and there was significant difference in pre and post-op PTA also (0.001). The significant improvement in postoperative status of CLE achieves our objective and also strongly supports the theory of Continuum. The unilateral COM should not be taken as a static phenomenon but as a continuous process in other ear too. We could also shows a significant improvement in the CLE after treatment of

diseased ear, this knowledge can be effectively used in therapeutic planning of diseased ear, counselling of patient regarding other ear and if necessary providing therapeutic intervention in the other ear at the earliest.

Keywords Contralateral ear · Other ear · Continuum theory · CSOM

Introduction

Chronic otitis media (COM) is one of the oldest disease affecting ears and undoubtedly represents the main area of interest within modern otology [1]. COM is chronic inflammation of part or whole of mucoperiosteal lining of middle ear cleft. There are two types of COM, tubotympanic (mucosal type) and attico-antral (squamous type) [2].

There are many predisposing factors of COM to develop. Unhealthy tonsils, adenoids, nasal and sinus disease, deviated nasal septum, allergic rhinitis, low socioeconomic status, size of mastoid air cells, genetic determination etc. and infection of middle ear [2]. Among multiple facets, perhaps the paramount issue COM is its pathogenesis [1]. As the main cause of COM is malfunction of Eustachian tube, it is probable that a patient with COM will have a disorder in contralateral ear (CLE) [3].

Many previous studies on CLE are based on Theory of Continuum; we have also followed the pathogenesis module suggested by the Minneapolis group- called as *Continuum Theory*. According to which “*otitis media (OM) seems to exist through a continuous series of epithelial and subepithelial events and after the initial triggering episode, a serous or purulent otitis media becomes serous-mucoid, then mucoid and in the absence of therapeutic resolution chronicity may ensue*”.

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Chronic otitis media doesn't seem to be an isolated event that occurs in a particular patient. It rather seems to be the product of series of events constitutional of the individuals. The precise and critical evaluation of both ears plays a fundamental role in the prognostic evaluation of the patient, because the ear with established COM can serve as a guide for the probable evaluation in the CLE [4].

Considering that the presence of bilateral otitis media is reported to be high, should not be occurrence of bilateral COM be similarly prevalent? [1]. The study by Rosito on temporal bones also suggested attenuation in CLE (91.8 %) [5]. Based on such reasoning and limited data available in the literature the question comes in mind that if according to theory of continuum disease may spread from one ear to other ear, will there be improvement in CLE after surgical treatment of diseased ear?

Hence, the current research was conducted to study the status of CLE with the specific objectives of:

1. Studying the existence of otoscopic abnormality, mobility, audiological and radiological changes in CLE of patients with COM.
2. Comparing the findings of CLE in patient with squamous and mucosal type of COM.
3. Comparing the pre and post operative changes in status of CLE.

Material and Method

This prospective, observational study was conducted in department of ENT at a tertiary care centre of central India from Sep 2012 to May 2015.

Study consisted of 537 patients of unilateral COM who fulfilled the eligibility criteria. Unilateral COM was defined as chronic inflammation of middle ear cleft in one ear. It was further divided into squamous and mucosal type. The CLE was defined as the asymptomatic ear i.e., without any otorrhoea or perforation.

Inclusion criteria:

1. Unilateral COM.
2. The CLE tympanic membrane should be intact.
3. All age groups were taken in this study.

Exclusion criteria:

1. Previous history of surgery in CLE.
2. History of grommet/VT insertion.

A careful history was taken pertaining to the diseased ear and CLE with particular attention to ear discharge, hearing loss, earache, headache, vertigo, etc. History of nasal obstruction, discharge, allergy and sore throat were taken. A thorough general, systemic and a detailed clinical ENT

examination was done for all patients giving attention to otoscopic findings, otomicroscopy, TFT, nasal examination for DNS, HIT, throat examination for tonsillopharyngitis. The diseased ear was divided into two groups squamous and mucosal.

The findings of CLE were assessed and notes being made of:

1. Normal/abnormal tympanic membrane.
2. Mobility of tympanic membrane.
3. Attic retraction graded by Tos classification.
4. Pars tensa retraction classified according to Sades classification.
5. Other conditions like tympanosclerotic patch, effusion were noted.
6. Pure tone audiometry, tympanometry, Eustachian tube function test, X-ray mastoid bilateral oblique Schuller's view were performed for all patients. X-ray PNS waters view, HRCT temporal bone were done wherever required. Before ear surgery septal correction and tonsillectomy was done wherever indicated.

The final diagnoses with the type of surgery of diseased ear, as well as CLE were entered into performa. All the patients were followed up at 3 and 6 months in relation to anatomy of tympanic membrane (otomicroscopy), physiology (ET function and tympanometry) and pure tone audiometry of CLE and compared with the preoperative findings of CLE. The data was entered into SPSS software and further analysis was performed.

Result

Out of 740 patients of COM operated in our department, 535 (72.9 %) patients had unilateral COM which was included in the study. All the cases were divided in two groups viz. mucosal (tubotympanic) in Group A and squamous (attico-antral) in Group B.

The mean age was 24.3 (SD $\pm$ 10.63) ranging from 11 to 55 years, of these 51.4 % were females and 48.6 % were males. Diseased ear was left in 50.5 % patient and right in 49.5 % patients.

Out of 535 unilateral COM, 365 (68.2 %) had mucosal while 170 (31.8 %) had squamous type of disease. Discharge was the first complaint in 93.5 % patients followed by hearing loss and the mean duration of complaints was 1–5 years.

The otomicroscopy finding of tympanic membrane, mobility and radiology of CLE is depicted in Table 1. The table reveals that out of 365 patients in group A, 145 (39.7 %) tympanic membranes were normal, while in group B only 50 (29.4 %) were normal. The anatomical abnormalities in rest 220 cases were Pars tensa grade I

Table 1 Shows pre-operative otomicroscopy finding of tympanic membrane, mobility and radiology of CLE

	Group A	Group B	χ^2	P value
Otomicroscopy				
Normal	145 (39.7 %)	50 (29.4 %)	64.830	0.001
Grade 1 retraction	105 (28.8 %)	60 (35.3 %)		
Grade 2 retraction	40 (11 %)	15 (8.8 %)		
Grade 3 retraction	25 (6.8 %)	20 (11.8 %)		
Attic retraction	0	20 (11.8 %)		
Tympanosclerotic patch	50 (13.7 %)	5 (2.9 %)		
Mobility				
Normal	255 (69.9 %)	115 (67.6 %)	0.267	0.6
Restricted	110 (30.1 %)	55 (33.3 %)		
Radiology				
Pneumatised	175 (48 %)	30 (17.6 %)	86.211	0.001
Sclerosed	65 (17.8 %)	95 (55.9 %)		
Partially pneumatised	125 (34.2 %)	45 (26.5 %)		

(30.8 %), II (10.3 %), III (8.4 %) retraction (Sade's classification), attic retraction (3.7 %) (only in group B) and tympanosclerotic patch (10.3 %). There was statically significant difference between the findings of group A and B ($\chi^2 = 64.830$; $P = 0.001$).

The tympanic membrane was mobile in 255 (69.9 %) CLE in group A and 115 (67.6 %) in group B, this difference was statically insignificant ($\chi^2 = 0.267$; $P = 0.6$).

The data of X-ray mastoid Schuller's view of CLE depicts that 175 (47.5 %) mastoid were pneumatised in group A while only 30 (17.6 %) were pneumatised in group B this finding was highly significant ($\chi^2 = 86.211$; $P = 0.001$).

Tympanometry was compared with otoscopic findings and mobility of TM of CLE preoperatively, which shows significant relation between two variables ($\chi^2 = 473.1$ and 489.3 respectively; $P = 0.001$). Spearman's rho correlation between pre-op otomicroscopy, mobility and tympanometry was also significant [$r = 0.81$ ($P = 0.001$) and $r = 0.956$ ($P = 0.001$)].

The average PTA of CLE in group A was 22.11 dB (SD ± 8.879) while in group B was 24.24 dB (SD ± 9.715).

When the diseased ear was operated and treatment was given and patient followed for 6 months, at the end of 6 months all parameters (variables) except X-ray mastoid were documented and the results are depicted in Table 2. The preoperative and postoperative abnormal otomicroscopy findings of CLE in group A were 60.27 and 26.03 % and of group B 70.58 and 20.58 % respectively. The table shows improvement in the abnormalities of CLE on microscopy, tympanic membrane became normal in 270

Table 2 Shows post-operative otomicroscopy finding of tympanic membrane, mobility of contralateral ear

	Group A	Group B	χ^2	P value
Otomicroscopy				
Normal	270 (74 %)	135 (79.4 %)	29.687	0.001
Grade 1 retraction	30 (8.2 %)	10 (5.9 %)		
Grade 2 retraction	0	0		
Grade 3 retraction	15 (4.1 %)	15 (8.8 %)		
Attic retraction	0	5 (2.9 %)		
Tympanosclerotic patch	50 (13.7 %)	5 (2.9 %)		
Mobility				
Normal	310 (84.9 %)	155 (91.2 %)	3.99	0.04
Restricted	55 (15 %)	15 (8.8 %)		

(74 %) in group A while 135 (79.4 %) in group B. Rest of the abnormalities are shown in table which remains statistically significant relation between the otomicroscopy and groups of CLE ($\chi^2 = 29.687$; $P = 0.001$).

The mobility of TM on valsalva had also increased postoperatively, as of now 310 (84.9 %) TM was mobile in group A while 155 (91.2 %) TM were mobile in group B which is statistically significant ($\chi^2 = 3.99$; $P = 0.04$). The preoperative and postoperative mobility of tympanic membrane in group A was 30.13 and 15.06 % respectively, though the difference in pre and post-operative finding was grossly appreciable but was just insignificant ($P = 0.06$).

When postoperatively repeat tympanometry of CLE was performed there was statistically significant relation between the tympanometry and otomicroscopy with mobility ($\chi^2 = 264.01$ and 151.54 respectively; $P = 0.001$). Spearman rho correlation was also highly significant ($r = 0.446$; $P = 0.001$ and $r = 0.532$; $P = 0.001$ respectively) (Table 3). The χ^2 test applied to compare the pre and post op tympanometry of group A and B was significant ($\chi^2 = 5.83$; $P = 0.016$).

The mean of average PTA after 6 months follow up was 17.86 (SD ± 6.988) in group A while 20.91 (SD ± 9.038) in group B with significant improvement. For pre and post op avg. PTA paired student t test was applied. The result for both groups was highly significant (group A $t = 17.308$; $P = 0.001$ and group B $t = 16.147$; $P = 0.001$).

Discussion

The aetiology of COM is multifunctional and complex. The prevalence of COM varies in different parts of world, in India it is 7.8 % in school going population (WHO 2004).

The status of CLE is studied in various studies, however those studies have either taken otoscopic findings alone or

Table 3 Pre and post op tympanometry

Tympanometry	Type A	Type C	χ^2		P value
			Anatomy	Physiology	
Pre-op	380 (71 %)	155 (29 %)	473.1	489.35	0.001
Post op	475 (88.8 %)	60 (11.2 %)	264.01	151.54	0.001

included X-ray and PTA findings, but none studied the effect on CLE after treatment or surgery done for diseased ear. In our study we followed the “Theory of Continuum” by Paparella (Minneapolis) that otitis media exists throughout a continuous series of events [6].

According to continuum theory- “*in the absence of arresting mechanisms, the pathology may progress bilaterally in a considerable proportion of cases, although with differing degrees of sensitivity*”. Although clinic studies published by Scheibe et al. as well as other researchers have demonstrated a high prevalence of alteration in CLE [7]. Keeping this in mind the question arises whether this is applicable in COM as well. To prove this we went one step ahead of previous studies by studying 6 months post-operative findings along with pre-operative findings. We have also compared the pre and post operative status of CLE.

In the present study the mean age in our study was 24.3 years which coincides with the study done by Damghani and Barazin [3] and similar studies done in Brazil and Iran had mean age of 26.3, 30 and 32 years respectively [3].

On comparing group A (mucosal) and group B (squamous) the prevalence were 68.2 and 31.8 % respectively, in contrast to the study of Kayhan et al. [8], in which prevalence of both groups were almost same (53.3 and 58.8 %).

In this study, out of 535 CLE 69.1 % were normal (39.7 % group A and 29.4 % in group B), this is similar to results of Kamal-Eldiri et al. (63 %) [2], but in contrast to the study of Vartiainen et al. [9] and Adhikari et al. [4] in which only 37 % and 31.6 % CLE were normal respectively.

The most common presentation of diseased ear was aural discharge in 93.5 % patient, which is in contrast to the study of Kamal-Eldiri et al. [2] and Williams et al. in which 56.5 % patients presented with ear discharge.

Adhikari et al. [4] noted 68.4 % of CLE had some form of abnormality. He found that in group A 62.9 % and group B 71.4 % were abnormal in CLE, whereas in our study abnormal otomicroscopy was 40.3 % in group A and 70.6 % in group B; our results are in contrast in group A whereas similar in group B.

These findings therefore support the continuum theory. In other studies ears with perforation and otorrhoea were also taken as abnormal ear, unlike our study, so difference in prevalence is expected.

Otomicroscopically we found pars tensa retraction more prevalent, followed by attic retraction and TSP in group B as compared to group A which was statistically significant ($P = 0.001$). Similar high incidence in group B was seen by Vartiainen et al. also [9]. Since the attic retraction was present only in group B, it indicates development of Cholesteatoma in both ears sooner or later.

When the mobility of TM of CLE was considered, we found restricted mobility in 30.1 % cases in group A while 33.3 % cases in group B, there was difference but insignificant ($P = 0.04$). Post-operative improvement was seen in mobility, which was 15.15 % in group A and 8.8 % in group B and this difference was statistically significant (0.04).

According to results of tympanometry 29 % of patient had a disorder in CLE which is similar to the study of Damghani and Barazin [3] in which 38 %.

In our study comparison of tympanometry with preoperative CLE otomicroscopy and mobility were done and found to be highly significant ($\chi^2 = 473.15$; $P = 0.001$ and $\chi^2 = 489.35$; $P = 0.001$ respectively), and this shows the correlation of disease with Eustachian tube function. We found only Type A and Type C graphs. In the study done by Damghani and Barazin [3] tympanometry findings were mentioned but significance was not given [3].

As far as the radiology of CLE is concerned, we found pneumatisation in 65.4 % of patients while partial pneumatisation and sclerosed mastoid were seen in 34.6 % patients. Out of 34.6, 52 % were abnormal in group A and 82.4 % in group B which is statistically highly significant in group B ($P = 0.001$). This is in contrast to study of Kayhan et al. [8] who found almost equal percentage of abnormality in both the groups and also with Damghani and Barazin [3] (36 and 31.5 % respectively).

The mean average PTA in CLE group A was 22.11 dB and in group B was 24.24 dB while in the study done by Damghani and Barazin [3] 48 % complained of hearing loss in CLE.

In our study we have compared pre-op and post-op 6 months status of CLE. As depicted in results there was a gross difference in otomicroscopy findings of tympanic membrane and its mobility (Fig. 1). The pre and post-op tympanometry was also compared and came out to be statistically significant (0.016) and there was significant difference in pre and post-op PTA (0.001). As the pre and

Fig. 1 Showing pre-operative and post-operative changes in CLE

post-operative status of CLE were not considered in earlier studies, we are therefore unable to compare these results with earlier findings in this regard.

The significant improvement in postoperative status of CLE achieves our objective and also strongly supports the theory of Continuum.

Conclusion

The high incidences of occurrence of abnormality in CLE indicate that both ears should be regarded as a pair. Disease in one ear, especially, in squamous type needs a close follow up of other ear. The unilateral COM should not be taken as a static phenomenon but as a continuous process in other ear too. We could also shows a significant improvement in the CLE after treatment of diseased ear, this knowledge can be effectively used in therapeutic planning of diseased ear, counselling of patient regarding other ear and if necessary providing therapeutic intervention in the other ear at the earliest.

Compliance with Ethical Standards

Conflict of Interest Dr. Shalini Jadia, Dr. Ashish Mourya, Dr Leena Jain, Dr. Sadat Qureshi declare that have no conflict of interest and no funding was received for the research.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Prior approval from ethical committee of the institute was taken.

Informed consent Informed consent was obtained from all individual participants included in the study.

References

1. da Costa SS et al (2008) The contralateral ear in chronic otitis media. *Arch Otolaryngol Head Neck Surg* 134(3):290–293
2. Kamal-Eldiri AA-E et al (2007) The other ear in unilateral chronic suppurative otitis media. *Saudi J Otorhinolaryngol Head Neck Surg* 9:24–26
3. Damghani MA, Barazin A (2013) Alterations in the contralateral ear in chronic otitis media. *Iran J Otorhinol* 25(2):99–102 (**Serial No.71, spring**)
4. Adhikari P, Khanal S et al (2009) Status of contralateral ear in patients with chronic otitis media. *Internet J Health* 20(2)
5. da Costa RP et al (2007) Contralateral ear in chronic otitis media: a histological media. *Laryngoscope* 117:1809–1814
6. Paparella MM, Schachern PA, Voon TH et al (1990) Otopathologic correlates of the continuum of otitis media. *Ann Otol Rhinol Laryngol* 9:17–22
7. Scheibe B, Smith M, Schimdt L et al (2002) Contralateral ear in chronic otitis media. *Rev Bras Otorhinolaryngol* 68(245–25):9
8. Kayhan FT, Sayin I, Cakabay T et al (2011) Chronic otitis media evaluation of the contralateral ear. *KBB-Forum* 10(4). www.KBB-Forum.net
9. Vartiainen E, Kansanen M, Vartiainen J (1996) The contralateral ear in patients with chronic otitis media. *Am J Otol* 17(2):190–192