

Correlation of Mastoid Pneumatization with Middle Ear Pathology in Unilateral Squamous Type of Chronic Otitis Media

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ABSTRACT

Introduction: Chronic otitis media is chronic inflammation of middle ear cleft followed by permanent abnormality of tympanic membrane. As mastoid a part of temporal bone is in close relation to middle ear; its pneumatization plays an important role in pathogenesis and prognosis of chronic otitis media. **Aims:** To study the pneumatization pattern of mastoid in unilateral chronic otitis media and its relationship with contralateral mastoid, diseased side tympanic membrane and ossicular status. **Methods:** Forty patients of 10-65 year of age diagnosed as unilateral chronic otitis media squamous type were selected. They were otoscopically evaluated for retraction and perforation of tympanic membrane and were subjected to high-resolution computed tomography of temporal bone. High resolution computed tomographies were analyzed for mastoid status of bilateral ear and ossicular involvement. During mastoidectomy ossicular status was noted and correlated with high resolution computed tomography. **Results:** Forty cases were enrolled in the study. Age ranged from 10-65 years. On radiological analysis of temporal bones, 21(52.5%) mastoids were sclerotic, 15(37.5%) mastoid diploic and 4(10%) were pneumatized in the diseased sides. Contralateral side showed pneumatization in 23(57.5%), diploic in 11(27.5%) and sclerotic in 6(15%) Amongst 21 sclerotic mastoid, 11(52.3%) patient had retraction in pars tensa and 9(42.8%) had retraction of pars flaccida. In total 15 diploic mastoids retraction of pars tensa was in 8(53.3%) and pars flaccid retraction in 8(53.3%) All three ossicles were involved in 8(38%), Malleus and incus were eroded in 3(14%), incus were eroded in 7(33.3%), malleus were eroded in 3(14%) and ossicles were intact in 3(14%) of 21 sclerosed mastoids on high resolution computed tomography. In remaining 19 non sclerotic mastoids all 3 ossicles were eroded in 4 (21%), malleus plus incus eroded in 8 (16%), incus were eroded in 5(26.3%) and ossicular chain was intact in 2(10%). **Conclusion:** Mastoid pneumatization pattern not only effect to the pressure of middle ear leading to chronic otitis media but also alter the pathogenesis and outcome of chronic otitis media. Contralateral mastoid pneumatization is not altered in unilateral Chronic otitis media.

Keywords: Chronic otitis media, Pneumatization, Squamous

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INTRODUCTION

Chronic otitis media (COM), is a chronic inflammation of the middle ear that also includes, to a greater or lesser extent, concomitant inflammation of the mastoid air cell system, due to its anatomical proximity to the middle ear.¹ The distinctive presentation is persistent otorrhoea over two to six weeks through a ruptured tympanic membrane.² COM also implies a permanent abnormality of pars tensa or flaccida, most likely a result of earlier acute otitis media, negative middle air pressure or otitis media with effusion. The COM squamous is characterised by only the retraction pocket in the tympanic membrane in inactive types and in active types there is cholesteatoma within the tympanic membrane.³

The pneumatization of the mastoid area is classified as⁴: (1) Cellular mastoid (complete pneumatization); (2) Diploic mastoid (partial pneumatization); (3) Sclerotic mastoid (absent pneumatization). The degree of pneumatization is determined genetically. Impaired pneumatization is a risk factor for otitis media, either acute or chronic. Diamant M estimated that the average size of his patients' cellular systems was 12 square cm.⁵ It has been postulated that the mastoid air cell system works as an air reservoir. By ventilating the middle ear, the mastoid cavity maintains the air pressure in the middle ear cleft. This system's capacity is its volume.⁶ Imaging with a High resolution computed tomography (HRCT) scan permits a full preoperative study of the anatomical variances and bone features of the

middle ear, as well as the ossicular chain and soft tissue. HRCT has its advantage in the evaluation of the temporal bone, especially using thin-section and high-resolution methods, providing a more exact characterization of the pneumatization pattern of the bone and the anatomical extent of middle ear illness.⁷ This study was done to emphasize the importance of HRCT temporal bone in unilateral COM squamous type by correlating mastoid status with ossicular status and with contralateral mastoid.

METHODS

This prospective study was carried out in Nepalgunj Medical College and Teaching Hospital, Kohalpur including forty patients attending ENT OPD from August 2021 to July 2022 after ethical approval from Institutional Review Committee of the institution. All patients diagnosed with unilateral COM squamous were enrolled in the study. A proforma was designed and preoperative investigations were done. Hemogram, pure tone audiometry (PTA) and HRCT of temporal bone with coronal and axial section were performed. Patient ranging 10 to 65 years of age with COM (squamous type) were included in study. Patient with Chronic otitis media mucosal type, granulomatous lesion and malignancies of middle ear were excluded. Informed Consent was obtained from patients regarding nature of disease, surgical procedure and outcome. All the patients underwent mastoidectomy by post aural approach under general anesthesia. Intraoperative ossicular status was assessed.

All radiological findings and intraoperative findings were entered and analyzed in SPSS version 21 and differences calculated using chi square test.

RESULTS

Age and Sex: The most common affected age group in this study were 11 to 20 years and 31 to 40 years followed by 20.5% in age group 41-50 year, 17.5% in 21-30 year group, 5% in less than 10 years and 51-60 years and 2.5% in above 60 year. Majority of the patients were female 23(57.5%) and remaining 17(42.5%) were males. Pneumatization pattern of mastoid: Majority of the patients had sclerotic mastoid, 21(52.5%), diploic was seen in 15(37.5%) and 4(10%) pneumatized in diseased ear in HRCT of temporal bone. Figure 3.

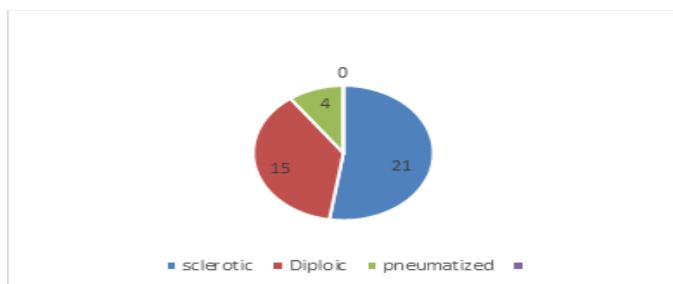


Figure 1: Pneumatization pattern in diseased ear

Pneumatization pattern of contralateral ear: Majority of contralateral normal ear mastoid showed that mastoid was

pneumatized in 23(57.5%), followed by diploic 11(27.5%) and lastly sclerotic in 6(15%) patients. Figure 2.

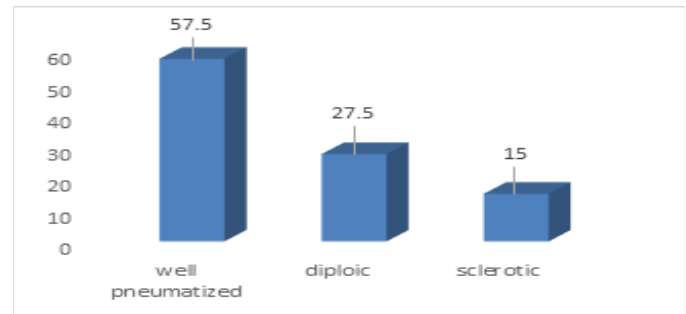


Figure 2: Pneumatization pattern of contralateral ear

Pars tensa with mastoid pneumatization: Out of 21 sclerotic mastoids in HRCT, 11(52.3%) patient had retraction in pars tensa, 6(28.5%) patients had marginal perforation and 4(19%) had normal pars tensa. Fifteen diploic mastoid showed that retraction in 8(53.3%) patients, marginal perforation in 5(33.3%) and normal pars tensa in 2(13.3%) patients. Four well pneumatized mastoid showed retraction in 2(50%) and marginal perforation (50%) as shown in Figure 3. This correlation between pathology of pars tensa and mastoid pneumatization was statistically insignificant (p value>0.05)

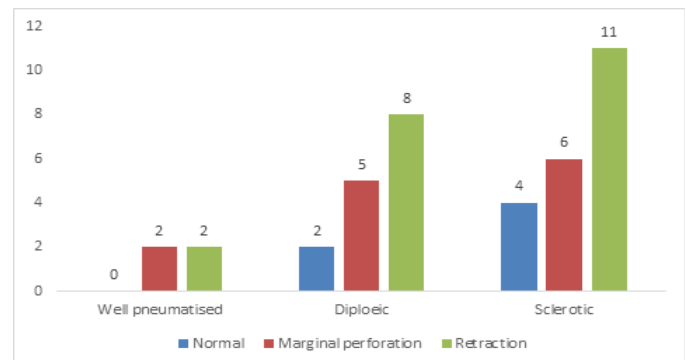


Figure 3: HRCT mastoid status with pars tensa

Pars flaccida retraction with pneumatization: Out of 21 sclerotic mastoids on HRCT, 9(42.8%) had retraction, other 9(42.8%) had perforation and 3(14.2%) had intact pars flaccida. The study of 15 diploic mastoid found retraction in 8(53.3%) patients, perforation in 4(26.6%) patients and intact pars flaccida in 3(20%) patients. On analysis of 4 pneumatized mastoids, 3(75%) had retraction and 1(25%) had perforation. Figure 4

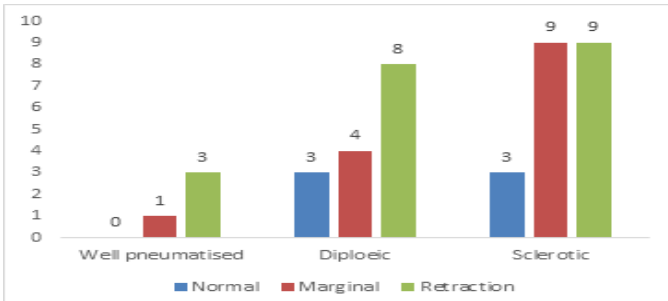


Figure 4: HRCT mastoid status with parsflaccida

Ossicular status with pneumatization: On analyzing HRCT 21 sclerotic mastoids, involvement of all three ossicles was seen in 8(38%) patients, malleus and incus were eroded in 3(14%) patients, incus eroded in 7(33.3%) patients and intact ossicles in 3(14%) patients. Involvement of all 3 ossicles in 4(21%) case, malleus plus incus erosion in 8(42%) patients, incus erosion in 5(26.3 %) patients and intact chain in 2(10%) patient among 19 non sclerotic mastoid.

HRCT ossicular status: It was found that malleus and incus were eroded in 11(27.5%) patients, malleus, incus and stapes involved in 12(30 %) patients, incus eroded in 12(30%) patients and intact ossicular chain seen in 5(12.5%) patients. Figure 5

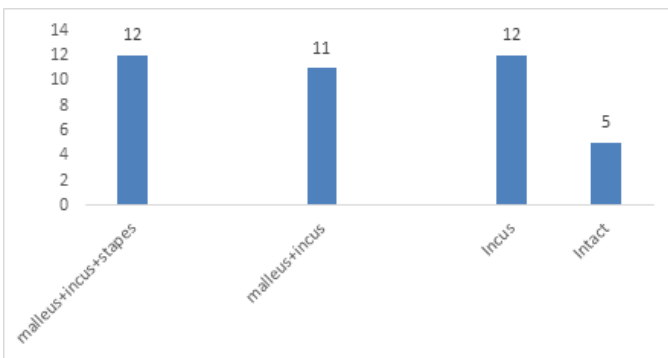


Figure 5: HRCT ossicular status

Intraoperative ossicular status: During mastoid exploration all 3 ossicles were involved in 7(17.5%), malleus and incus eroded in 21(52.5%), incus involved in 8(20%) and intact ossicular chain noted in 4(10%) patients. Figure 6

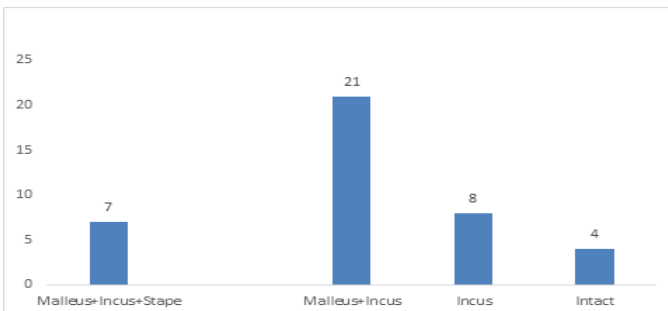


Figure 6: Intraoperative ossicular status

Ossicular status	HRCT	Intraoperative	P value
Intact	5 (12.5%)	4 (10%)	
Incus	12 (30%)	8 (20%)	<0.05
Malleus_+ Incus	11 (27.5%)	21 (52.5%)	
Malleus+Incus+stape	12 (30%)	7 (17.5%)	

Table 1: HRCT Ossicles and Intraoperative ossicular status

It was seen that 12.5% of patients had intact ossicular chain on HRCT and 10% had intact chain intraoperatively. Incus was eroded in 30% cases in HRCT and 20% intraoperatively. On surgical exploration malleus and incus erosion was in 52.5% patients and in 27.5% patient on HRCT. Involvement of all 3 ossicles were 30% on radiological study and 17.5% patients intraoperatively. On correlating overall intraoperative ossicular status with HRCT, it was found to be statically significant. (p value<0.05). Table I

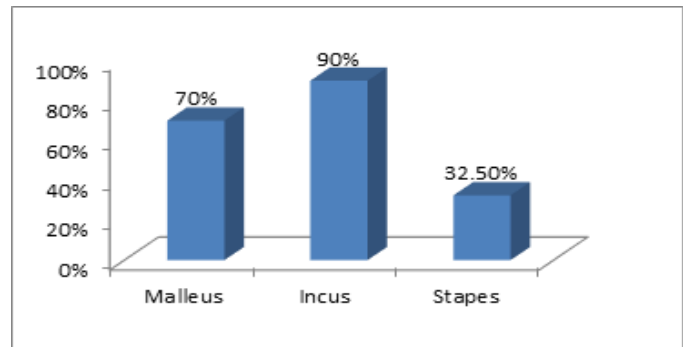


Figure 7: Ossicular status in HRCT

On studying ossicular status in HRCT of forty patient of COM squamous incus (90%) was the most common ossicle to be eroded, malleus (70%) and stapes (32.5%) were least to be involved. Figure 7

DISCUSSION

Our study enrolled wide range of age ranging from 10 year to 65 year. Most common affected age group were children with age ranging from 11 to 20 year (27.5%) followed by patient between age 31 to 40 year (27.5%). Ginni et al⁸ noted that patients of squamous COM are mostly affected in 3rd decade. Memon MA⁹ also observed that chronic suppurative otitis media is a disease of young adults and about 50 % of patients were between the ages of 11-30 years.

Association and correlation of patterns of pneumatization with squamous pathologies in middle cleft was also done. In our radiological study in 40 Temporal bones, mastoids were sclerotic in 21 patient (52.5%), 15(37.5%) were diploic and 4(10 %) were pneumatized. Sade J¹⁰ (82.3%) and Gomaa et al¹¹ found (60.7 %) diploic or sclerotic mastoid associated with COM squamous which is similar to in our study. But Isma et al¹² found that incidence of CSOM was higher in cellular mastoid

(60.3%) which was contradictory to our result.

Regarding status of contralateral mastoid, in the patients with unilateral COM, 23(57%) was pneumatized in this study. This finding is similar to the study done by Maurico et al¹³ which revealed contralateral mastoids pneumatization in 65.3%.

Correlation of retraction of tympanic membrane with mastoid pneumatization, out of 21 sclerotic mastoid cases pars tensa retraction seen in 11(52.3%) and pars flaccida retraction seen in 9(42.8%) cases. In 15 diploic mastoid pars flaccida retraction was found in 8(53.3%)patients and pars tensa retraction in 8(53.3%). This result concludes that poor pneumatization of mastoid may favour the retraction of tympanic membrane.

On correlating between parstensa and pars flaccid retraction with sclerosis of mastoid our result was not stastically significant(p value >0.05). This insignificance may be due to low sample size in our study .

Study done by A Roy et al¹⁴ with 94 patients, showed significant association (p value<0.0001) between retraction and sclerosis. Similar type of study done by Sade¹⁰ regarding pneumatization observed retraction pocket in 49% sclerotic mastoid and in 51% diploic mastoid. Erosion of all three ossicles in HRCT was 13(32.5%) which also matched to intraoperative findings.

The HRCT scan gives an excellent tool for correlation of the middle ear ossicles in our study, and same is also the experience reported by others. Erosion of all three ossicles were more common 8(38%) in sclerotic mastoid where as it was 4(21%) in non sclerotic cases. HRCT analysis on ossicular status showed involvement of incus in (90%), malleus(72%) and stapes in (32.5%). Study done by Shah et al¹⁵ observed ossicular involvement in this pattern (incus 85.7 %, malleus 45.7 %, and stapes 31.4 %). Gomma et al¹¹ also noted that the incus was the most commonly eroded, in 88.2 % of patients, followed by malleus, in 67.9 %.

LIMITATIONS

The major limitation of this study was the sample size. It was found that HRCT temporal bone was expensive and could not be afforded by all the patients. This study would have been more meaningful if the sample size was high.

CONCLUSION

We can conclude from this study that COM squamous is associated with sclerotic mastoid in most of the diseased mastoid but contralateral normal mastoid was pneumatized in majority of the patients. Retraction of pars tensa and pars flaccida was more common in sclerotic mastoid. It suggested that mastoid air cells are responsible for middle ear ventilation. Ossicular status in COM squamous were studied by HRCT and further confirmed intraoperatively. This revealed that HRCT can act as an useful preoperative diagnostic tool as finding of HRCT was well corelated with intra operative ossicular status.

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