

# A Cross Sectional Study of Tubotympanic Chronic Suppurative Otitis Media with Reference to Sinonasal Pathology

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## ABSTRACT

### BACKGROUND

In tubotympanic Chronic Suppurative Otitis Media (CSOM) the persistent inflammation of mucosa leads to irreversible changes in the middle ear and mastoid cavity. The Eustachian tube has several functions that facilitate the communication of the middle ear cavity with the nasopharynx, nasal cavity, nasal mucosa, and indirectly also with the paranasal sinuses and plays an important role in the disorders of middle ear. The Eustachian tube dysfunction and non-ventilation of middle ear cleft leads to vacuuming once the entrapped air gets absorbed by the mucosal capillaries leading to CSOM. A disease of the nose and paranasal sinuses influences causes dysfunction of the Eustachian tube leading to a middle ear infection. We wanted to study the correlation between nasal and paranasal sinus pathologies and their role in the management safe CSOM.

### METHODS

In this observational study, a total of one hundred cases of CSOM in the age group of 20 - 60 years was included in the study as per set criteria over a period of 6 to 7 months. All cases with persistent ear discharge were treated medically before undergoing functional endoscopic sinus surgery and septoplasty simultaneously whenever indicated after routine investigations, diagnostic nasal endoscopy (DNE), computed tomography of paranasal sinuses (CT - PNS) and otoendoscopy. A lesion causing dysfunction of ET in nasopharynx such as anatomical variants like medialised uncinate process, enlarged bulla ethmoidalis, enlarged middle turbinate, accessory ostium and deviated nasal septum (DNS) were searched and noted during DNE, FESS, and in CT - PNS. Postoperatively all cases were followed for 3 months using a nasal endoscope and otoendoscope to assess overall improvement.

### RESULTS

There were 55 males and 45 females, with the male : female ratio of 1.22 : 1. Majority of cases were from the age group of 31 - 50 years (59 %). Among the 100 cases of CSOM, deviated nasal septum (62 %) was the most common sinonasal pathology and the majority of the cases (56 %) had ipsilateral mucopurulent discharge in the middle meatus. Confirmatory finding of DNS was 62 % with CT ( $p < 0.003$ ). There was a significant association between the successful treatment of sinonasal pathology and improvement in the status of CSOM ( $P < 0.003$ ).

### CONCLUSIONS

In this study, DNS is the commonest aetiopathological factor for the development of CSOM apart from medialised uncinate process and hypertrophy of middle turbinate. Documentary evidence of CT scan for confirmation of DNS in the management of active safe CSOM having sinonasal pathology was important.

### KEY WORDS

Otitis Media, Suppurative, Nasal Septum, Eustachian Tube, Paranasal Sinuses

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## BACKGROUND

Chronic Suppurative Otitis Media (CSOM) is the inflammation of the mucosa of middle ear cleft. The middle ear cleft refers to the Eustachian tube (ET), tympanic cavity, and mastoid air cell system 2006.<sup>1</sup> The American Academy of Allergy and Immunology has officially recognized that inflammation in the middle ear is simply an extension of chronic mucosal disease of the nasal and upper airway passages 2008.<sup>2</sup> The nose, paranasal sinuses, and eustachian tube are lined by pseudostratified ciliated columnar epithelium with submucosa goblet cells interspersed in it. The role of eustachian tube patency and its mucociliary transport is important in the outcome of myringoplasties. Patency of the eustachian tube is affected by various pathologies of nose and nasopharynx.

The two major routes of mucociliary transport are identified in the lateral nasal wall. The first route combines secretion from the frontal and maxillary sinuses and anterior ethmoidal complex that drains along the free rear margin of the uncinat process along the medial surface of the inferior turbinate and into the nasopharynx. The second route carries the secretions from the posterior ethmoid and sphenoid sinus to sphenoethmoidal recess from where it is carried to the nasopharynx remaining posterosuperior to eustachian tube orifice. At this point, the secretions pass both anterior and posterior parts of the eustachian tube orifice. Due to its mucociliary clearance, a previously normal eustachian tube can remain resistant to abnormal secretion 2016.<sup>3</sup> Also the virulence and period of offending infection, congestion, and obstruction of the ET orifice lead to slowing down of the mucociliary clearance and resultant changes in the middle ear cleft 2015.<sup>4</sup> Even though mastoid air cells develop after birth during early childhood, a developmental pattern of both paranasal sinuses (PNS) and the mastoid air cell system are identical. The presence of nasal pathologies adversely influence the progressive development of the mastoid air cell system which may be a predisposing factor of consequent otitis media.<sup>5,6</sup> Structural abnormalities in the nose and PNS, deviation of the nasal septum, hypertrophy of turbinates, anatomical variations in the lateral nasal wall and adhesions, etc. lead to the abnormal functioning of the eustachian tube (ET) which may be another predisposing factor of otitis media. In tubotympanic type of CSOM, the disease is limited to the anterior part of the middle ear cleft viz., ET, and anterior-inferior part of the tympanic cavity proper. The persistent discharge through tympanic membrane perforation arising from the middle ear cavity is a typical feature associated with conductive hearing loss which is preventable.

The pathogenesis of otitis media has been related to the presence of prior or concurrent nasal disease 2005.<sup>7</sup> Infection of the nose and paranasal sinuses (PNS) can spread to Eustachian tube (ET) resulting in inflammation and obstruction. Diseases of the nose and PNS can thus influence the middle ear condition. Although most of the literature refers to the sinusitis and upper respiratory tract as causative factors of otitis media, only in few references the actual nasal pathologies are correlated. The study by De Souza C et al state that overall result improves if the nasal and / or paranasal

pathology is diagnosed and managed before treatment in cases of tubotympanic variety of CSOM 1996.<sup>8</sup> The present study was undertaken to correlate the pathologies of nose and PNS in cases being treated for tubotympanic CSOM.

## METHODS

A cross-sectional observational study was undertaken in the Department of ENT, of a tertiary care hospital from July 2018 to December 2019. Ethical clearance from the institutional ethics committee was sought vide letter number KIMSDU / IEC / 05 / 2019 dated 01 / 05 / 2019. As this study was of short duration, it was planned with at least 75 cases. However, keeping the possibilities of drop out during follow up in the study, it was decided to enrol a minimum of 100 cases, and hence the sample size was 100. A Total of one hundred clinically diagnosed cases of chronic suppurative otitis media with sinonasal pathology found at nasal endoscopy and radiological evaluation having age more than 20 and less than 60 years, irrespective of gender and willing to participate in the study were included. Prior informed consent was obtained from all the participants in this study. All cases had a previous history of nasal surgery, sinonasal tumour, traumatic tympanic membrane perforation, congenital craniofacial anomalies, otomycosis, diabetes mellitus, compromised immunity, and atticointral variety of CSOM were excluded from the study.

In all cases after clinical examination, the oto - microscopic examination of ear and assessment of hearing using tuning fork tests were performed. Thereafter, besides CBC, urine, Gram stain and culture sensitivity of ear discharge, pure tone audiometry (PTA), etc., all enrolled cases were subjected to rigid diagnostic nasal endoscopy (DNE), computed tomography (CT) of temporal bones and paranasal sinuses. The procedure of DNE with a 30 - degree rigid Nasal endoscope was done under topical anaesthesia with 4 % lignocaine and adrenaline in 1:10000 concentrations under strict aseptic conditions in every case after due counseling. Topical anaesthesia was achieved by placing three cotton pledges soaked in the above mixture in the nasal cavity for a minimum period of 20 minutes. The endoscope was passed through the nasal cavity using three different passes as below:

1. First pass - The space along the floor of the nasal cavity between the inferior turbinate and septum was accessed endoscopically to visualize the nasopharynx, nasopharyngeal ends of ET, and inferior meatus.
2. Second pass - The space between medial surface of middle turbinate and septum was accessed to examine the spheno ethmoidal recess and roof of the nasal cavity.
3. Third pass - The space between the middle turbinate and lateral wall to examine the middle meatus and osteo meatal complex.

The abnormal nasal and nasopharyngeal secretions if any were noted and sent for microbiological evaluation. Any lesion causing dysfunction of ET in nasopharynx as well as anatomical variants like medialised uncinat process, enlarged bulla ethmoidalis, enlarged middle turbinate, accessory ostium and deviated nasal septum in the nose were searched. In CT - PNS in addition to the above findings of DNE blockage of ostiomeatal complex, mucosal thickening in

maxillary sinus, etc., were also searched. Endoscopic examination of the ear was carried out to note abnormal appearances of tympanic membrane like the type of perforation, quadrants involved, discharge and the condition of middle ear mucosa, etc. All cases treated medically using topical and systemic therapy viz. combination ear drops such as of antibiotic and steroid, also oral antihistamines, decongestants, corticosteroids, and systemic antibiotics for at least 6 weeks.

All cases treated medically using topical and systemic therapy viz. combination ear drops such as of antibiotic and steroid, also oral antihistamines, decongestants, corticosteroids and systemic antibiotics for a period of at least 6 weeks. All cases underwent functional endoscopic sinus surgery (FESS) using the Messerklinger technique 1990.<sup>9</sup> Correction of septal deviation was also undertaken simultaneously whenever it was found pathological.

**Statistical Analysis**

Analysis of data was done using the Statistical Packages for Social Sciences (SPSS), IBM, India version 21.0; SPSS. The descriptive statistics such as frequencies and percentages were used to calculate for study variables and its mean, standard deviation (SD), and range for continuous variables were determined. Simple and multiple bar charts and pie charts were used for the visual representation of the analyzed data. Chi - square the test was used for the association of qualitative data and found to be statistically significant when  $p < 0.05$ .

**RESULTS**

Amongst 100 enrolled cases, there were 55 males and 45 females. Majority of the cases were from the age group of 41 - 50 years (30) and followed by 31 - 40 (29) and the least were from 20 - 30 years. (19) Amongst all cases in the study the mean age was  $32.45 \pm 12.36$  years (Table 1). The diagnostic nasal endoscopy amongst all cases revealed deviated nasal septum in 62, medialized uncinat process in 16, enlarged bulla ethmoidalis in 12 and enlarged middle turbinate in 10 (Table 2).

Similarly, the diagnostic nasal endoscopy revealed presence of discharge at middle meatus which was mucopurulent in 56, purulent in 23 and mucoïd in 21 (Figure 1). Computerized tomography of PNS revealed abnormalities limited to OMC in 52 cases (Grade I findings), incomplete opacification of one or more sinuses (Grade II) in 24, complete opacification of one or more major sinuses (grade III) in 14 and total opacification of all sinuses (Grade IV) in 6. In 4 cases CT PNS was within normal limit (Figure 2).

In this study of CSOM cases having sinonasal pathology, the status of CSOM before and after surgical elimination of sinonasal pathologies was compared. Amongst all 100 cases the most common sinonasal pathology was DNS in 62, out of remaining 38 cases of CSOM 16 had medialised uncinat process, 12 had enlarged bulla ethmoidalis and 10 had

hypertrophy of middle turbinate. These 38 cases of CSOM without DNS underwent FESS.

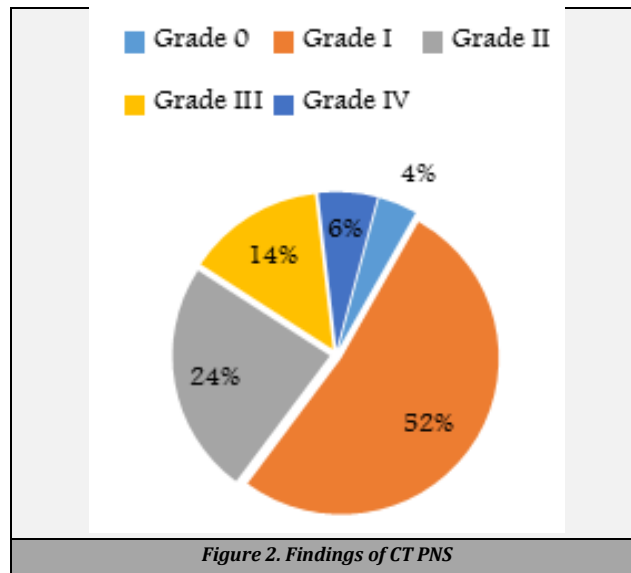
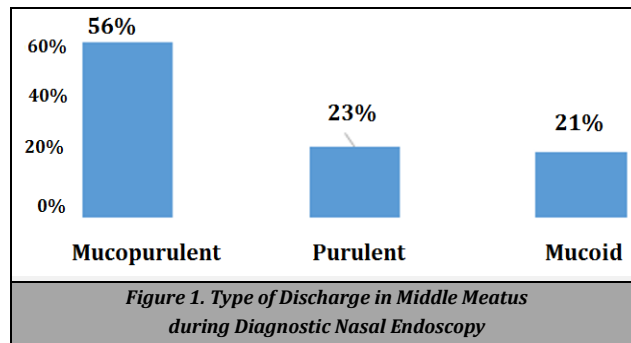
Whereas remaining 62 cases with DNS underwent septoplasty and FESS simultaneously for concomitant sinonasal pathologies of medialised uncinat in 25, enlarged bull ethmoidalis in 22 and hypertrophy of middle turbinate in 15. The association of CSOM with sinonasal pathology and its treatment was found statistically significant ( $p$  - value  $< 0.005$ ). The number of active cases of CSOM with DNS was 62 (100 %) in which 40 (64.5 %) were inactive and 22 (35.4 %) active, similarly 38 cases of CSOM without DNS in which 30 (78.9 %) were inactive and 8 (21 %) active. The status of CSOM improved significantly in 70 cases having sinonasal pathology after surgical treatment (Table 3).

Years of Age	No. of Males	No. of Females	% of Cases	Mean Age
20 - 30	11	8	19	32.45 ± (12.36)
31 - 40	16	13	29	
41 - 50	13	17	30	
51 - 60	15	7	22	
<b>Total</b>	<b>55</b>	<b>45</b>	<b>100</b>	

*Table 1. Distribution of Study Population as Per Sex and Age*

Endoscopic Findings of Sinonasal Pathology	Frequency (Percentage of Cases)
Deviated Nasal Septum	62 (62 %)
Medialised Uncinate Process	16 (16 %)
Enlarged Bulla Ethmoidalis	12 (12 %)
Enlarged Middle Turbinate	10 (10 %)
<b>Total</b>	<b>100 (100 %)</b>

*Table 2. Findings of Diagnostic Nasal Endoscopy*



CSOM with Sinonasal Pathology N = 100	No. of Cases Having Active CSOM		CSOM Status after Treatment of Sinonasal Pathology				Chi - Square Test Results	P - Value
	With DNS	Without DNS	Inactive		Active			
			With NS (%)	Without NS (%)	With NS (%)	Without NS (%)		
Medialised-uncinate Process	25	16	14 (56)	12 (75)	11 (44)	04 (25)	2.54	0.11
Enlarged Bulla Ethmoidalis	22	12	13 (59)	10 (83.3)	09 (40.9)	02 (16.6)	0.25	0.62
Hypertrophy of Middle Turbinate	15	10	13 (86)	8 (80)	02 (13.3)	02 (20)	2.38	0.12
<b>Total</b>	<b>62</b>	<b>38</b>	<b>40 (64.5)</b>	<b>30 (78.9)</b>	<b>22 (35.4)</b>	<b>08 (21)</b>	<b>4.53</b>	<b>0.003*</b>

*Table 3. Status of CSOM before to after Corrective Management of Sinonasal Pathology*

\*Significant if p < 0.005

**DISCUSSION**

A total of 100 cases having safe CSOM, 20 to 60 years of age, was evaluated to find out sinonasal pathologies as a cause for it and the outcome of treatment. The mean age was 32.45 ± 12.36 years. 59 % of cases were from the age group of 31 - 50 years and it was the largest of all. Shrestha et al 2010<sup>10</sup> found the common age group 31 - 40 years. The male to female ratio was 1.22:1. An analogous conclusion has been made by other researchers such as Hossain et al 2006.<sup>11</sup> This could be because males getting more exposed to contamination and contagion while they work outdoor which is common in this region. The commonest associated sinonasal pathology was DNS in 62 %, followed by medialised uncinata process 41 %, enlarged bulla ethmoidalis 34 % and hypertrophy of middle turbinate 25 %. Yeolekar et al 2011<sup>12</sup> in their study of 200 cases of safe CSOM have found 90 % cases having DNS as the commonest associated sinonasal pathology. Fireman et al emphasized that otitis media is a multifactorial disease that was affected by many etiologies including nasal, and paranasal sinus abnormalities.<sup>13</sup> Grote and Kuijpers in their study on the middle ear mucosa using otoendoscopy among the patients with CSOM revealed that 71 % of them had edematous middle ear mucosa and 29 % had polypoidal mucosa which was almost in accordance with this study.<sup>14</sup> At DNE the percentage of cases having mucopurulent discharge at ipsilateral middle meatus was 56 %. The Fujita A et al 1993<sup>15</sup> have also found similar mucopurulent discharge in 62 % cases. Takashi et al demonstrated the inflammatory processes of nasal, and paranasal sinuses resulting in obstruction, inflammation, and resultant dysfunction of the eustachian tube.<sup>16</sup> Majority of investigators have revealed the important role of upper respiratory tract abnormalities as causative factors for eustachian tube obstruction in the aetiopathogenesis of CSOM.<sup>17</sup> In 62 % of cases the CT scan of paranasal sinus confirmed DNS which is per the study by H Gocmen et al 2004<sup>18</sup> having DNS in 52 %. The significant improvement by rendering discharging ear inactive after septoplasty was noted

in 64.5 % cases (p < 0.003). These findings are comparable to studies by Dwight Grady et al 1983<sup>19</sup> and C S Kim et al 1993<sup>20</sup> (p < 0.05). 22 cases having DNS failed to improve the status of CSOM after septoplasty, but after receiving frequent washing of middle ear with 1 % povidone iodine in 1:2 dilutions, suction cleaning and prolonged topical application of culture specific antibiotics as additional measures did render the ear inactive. The 8 refractory cases with causes other than sinonasal pathology, like infective granulation, aural polyp, fibrosis, or the epithelization in the protympanum, cholesteatoma, blockage of aditus add antrum, hypofunction of eustachian tube and primary ciliary dysfunction required cause specific treatment to render the ear inactive.

**CONCLUSIONS**

The mean age was 32.45 ± 12.36 years. Majority of cases (59 %) were from the age group of 31 - 50 years with male to female ratio 1.2 : 1. DNS (62 %) was the most common cause amongst associated sinonasal pathologies of safe CSOM and it was significant (p < 0.003). Hypertrophied middle turbinate (25 %) was the least common cause. CT scan confirmation of DNS was 62 % of cases and was significant. Therefore, CT documentation of DNS in addition to clinical diagnosis can be helpful if the doctor is in a difficult situation after septoplasty especially when the status of CSOM continues to remain active i.e. during litigation after surgical correction of DNS. Otoendoscopy may be essential in refractory cases in treating the cause.

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