

## A Clinical Study on Effect of Functional Endoscopic Sinus Surgery on Tubotympanic Type of Chronic Suppurative Otitis Media

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Received: 25-01-2024 / Revised: 23-02-2024 / Accepted: 26-03-2024

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Conflict of interest: Nil

### Abstract:

**Background:** The chronic inflammation of Mucoperiosteal lining of middle ear cleft is labeled as chronic suppurative otitis media. CSOM is classified as Chronic Mucosal ear disease and Chronic Squamousal ear disease which are again subdivided as Active and Inactive, healed and quiescent. Continuous environmental changes repeated viral and bacterial infections of nose, nasopharynx and Oropharynx results in recurrent assaults on the middle ear mucosa causing permanent pathology. In addition proper functioning of the Eustachian tube is essential to maintain middle ear pressure to achieve optimal hearing capacity. The successes of surgical procedures aim to achieve dry and functioning ears.

**Aim of the Study:** To study the effect of FESS on Tubotympanic type of CSOM.

**Objectives:** To establish the causes of CSOM, to evaluate the nasal causes with endoscopy, to study the efficacy of endoscopic surgery in CSOM and lastly to study the focus of infection in Tubotympanic type.

**Materials:** 50 patients diagnosed with CSOM (Tubotympanic type) were randomly selected for this study. An institution ethics committee approval was obtained before starting the study. An ethics committee approved consent form and proforma were used to collect the data. Patients with Tubotympanic type of CSOM, with ear discharge more than 2 months even after antibiotics with radiological proven chronic sinusitis. Patients of both the genders were included. Patients aged 18 years to 50 years were included. Patients willing to give their consent for inclusion in to the study were considered. Patient willing for follow up during the study were included.

**Results:** 50 patients with CSOM (Tubotympanic type) were included. Demographic profile based on the gender and age and a comparison was made. There were 48% males and 52% females were. There were 10 (20%) patients aged between 18 to 25 years, 09 (18%) patients were aged between 26 and 33 years, 04 (08%) patients were aged between 34 and 41 years and 01 (02%) patient was aged between 42 and 49 years.

**Conclusions:** In the adult population chronic rhinosinusitis is the most important cause of persistent ear discharge causing Chronic CSOM of Tubotympanic disease. Deviated nasal septum, enlarged bulla and prominent middle turbinate are the most common anatomical variants of nose and paranasal sinuses predisposing to chronic rhinosinusitis. Treating chronic rhinosinusitis has a favourable effect on improving the middle ear mucosal status.

**Keywords:** CSOM, FESS, Tubotympanic, sinuses, chronic sinusitis, deviated nasal septum and Tympanic membrane.

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### Introduction

Chronic otitis media is recurrent or persistent infection of the middle ears. When there is a dysfunction of the eustachian tube, air cannot fill the middle ear. This creates a negative pressure, which can lead to fluid build-up in the middle ear, infection of the middle ear, retraction of the eardrum and/or a perforation of the eardrum. Major causes of eustachian tube dysfunction include: immature eustachian tube development in the childhood, common cold, allergic rhinitis, non-

allergic rhinitis, acute or chronic sinusitis, adenoid hypertrophy, and nasopharyngeal tumors. [1] If the function of Eustachian tube does not improve, chronic otitis media will develop in one of these forms: recurrent secretory otitis media or chronic otitis media with a perforation, retraction pocket, or cholesteatoma. [2] 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. [3] Furthermore, it has been demonstrated that the mucosa of middle ear is capable of mounting an allergic immunologic response similar to that seen in rest of the upper respiratory mucosa when confronted by an antigen challenge. [4] Inflammation in the nasopharynx and the pharyngeal portion of the Eustachian tube is considered to be closely related to the tubal constriction, which represents a considerable part of the cause of tubal ventilatory dysfunction. [5]

The lining mucous membrane of the middle ear and eustachian tube is connected with and is the same as membrane of nose, sinuses and throat. Infection of these areas results in mucous membrane swelling which in turn may result in eustachian tubal occlusion. Blue stone [6] in 1989 studied about 40 patients & found "Eustachian tube dysfunction is the main reason for middle ear disease. Disease of the sinuses and upper respiratory tract which cause ET dysfunction;" Adenoids contribute less in comparison to the sinus disease causing eustachian tube blockage. Bluestone, 1971 [6]; Bluestone et al [7]; 1970, and Hanjo et al [8] 1981. In 1869 Politzer [9] first described in his literature and in 1931 it was also noted by Proetz that there is a relationship between patients with rhinosinusitis and chronic otitis media. KOCHS study of 222 patients was the first to include observations of Eosinophilia in Otorrhea "Supporting the contention that the middle ear takes part in allergic reactions similar to those seen in the nose and sinuses". In the article "role of nasal and sinus surgery in otitis medi ET AL [10] emphasize "The effect of changes in the nose and paranasal sinuses are often felt in the middle ear. The conduit that reflects these changes is the Eustachian tube. They further said "Normal function of the nasal and sinus cavities is influenced by the structures in the nasal cavity. Structural problems in the nose and sinuses will adversely affect their normal functions, leading to disease and possibly disrupting the function of the Eustachian tube. [11] Surgery to correct nasal and paranasal sinus will prevent these problems from affecting the eustachian tube". [12]

Nasal and paranasal surgery has dual purposes such as that they restore the normal functioning of the mucosa of the nose and paranasal sinuses, and prevents the recurrent attacks of otitis media and infection of the respiratory tract. [13] As described by Morris PS. Egt al [14] who explained "Nose and paranasal sinuses by their location are the cause of most ear diseases. Diagnosis and treatment of nasal condition is important for successful treatment of the Ear Pathology [15]. Proper evaluation of the nasal and sinus condition in relation to the ear pathology can avoid many unnecessary nasal and ear surgeries. [16] Patience in trying out conservative treatment before

suggesting surgery is a necessary virtue of the surgeon. It is mandatory for every otologist to be able to carry out a good diagnostic nasal endoscopy to detect nasal and paranasal pathology causing persistent otitis media." In an observation made by Morris PS. Et al [17], when persistent discharge develops in ear, then it is extremely important to rule out history of upper respiratory infection, colds and sinusitis. For otologists the primary aim is resolution of ear pathology and successful outcome in cases of surgical intervention. Very often, overlooking the basic pathology in nose or sinuses may result in compromising the results. [18] In a 1996 publication of Operative Techniques in Otolaryngology / Head and Neck Surgery, DeSouza and co-workers (19) stated "The effects of changes in the nose and paranasal sinuses are often felt in the middle ear and that OM is frequently secondary to dysfunction of the ET resulting from such nasal and sinus diseases [20]". They conclude "It is logical to treat nasal and paranasal sinus disease, when it is clinically evident that these processes are a contributing as a cause of OM". Leach AJ, Boswell J and colleagues [21] also proposed that pathologic nasal conditions can cause OM as a result of edema in proximity to the ET and subsequent obstruction of this orifice and by insufflations of contaminated nasal secretions into the middle ear. These investigators support the use of surgical procedures, such as septoplasty, turbinoplasty, creation of nasal antral windows, and endoscopic sinus surgery, to correct anatomic conditions that results in chronic and recurrent nasal and sinus diseases and thereafter in OM. [22]

**Study Design:** A comparative analytical study

**Institute of Study:** Department of ENT, Kakatiya Medical College, Warangal

**Period of Study:** May 2022 to April 2024

**Materials:** 50 patients diagnosed with CSOM (Tubotympanic type) were randomly selected for this study. An institution ethics committee approval was obtained before starting the study. An ethics committee approved consent form and proforma were used to collect the data.

**Inclusion criteria:** Patients with Tubotympanic type of CSOM, with ear discharge more than 2 months even after antibiotics with radiological proven chronic sinusitis. Patients of both the genders were included. Patients aged 18 years to 50 years were included. Patients willing to give their consent for inclusion in to the study were considered. Patient willing for follow up during the study were included.

**Exclusion criteria:** Patients diagnosed with squamosal type of CSOM were excluded. Patients with fungal infection of external ear were excluded. Patients aged above 50 years of age and below 18

years of age were excluded. Pregnant and lactating women were excluded. Debilitated and immunocompromised patients were excluded. Patients not willing to give consent were excluded. Patients not willing for follow up were excluded.

#### Study Population:

The study population consisted of patients with Tubotympanic type of CSOM with chronic rhinosinusitis, who attended the Kakatiya Medical College and MGM Hospital ENT OPD, Warangal during a 24 months period between May 2022 and April 2024.

All the patients with tubotympanic type of CSOM with radiologically proven chronic rhinosinusitis were included in the study. Ear discharge of these patients was sent for culture and sensitivity. The patients were treated with culture directed topical and systemic antibiotics and mucolytic agents and were followed up for a period of 2 months.

The patients selected were subjected to diagnostic nasal endoscopy and computed tomography of paranasal sinuses. Patients with evidence of chronic rhinosinusitis were treated with antibiotics, antihistamines and decongestions for a period of at least 4 weeks. Though they had temporary symptomatic improvement they showed frequent relapse of symptoms. So, they were taken up for endoscopic sinus surgery and were followed up post operatively at 3 weeks, 6 weeks, 3 months & 6 months. The patients were assessed by Oto-endoscopy for decrease in ear discharge, improvement of middle ear mucosal status and size of the perforation.

**Study Area:** Department of ENT, MGM / KMC, Warangal.

**Sample Size:** A minimum of 50 patients with Tubotympanic disease with chronic rhinosinusitis, randomly selected.

**Scope of study:** This study emphasizes the importance of clearing focal infection & ascertains the improvement of Tubotympanic type of CSOM by doing FESS. This approach can have a great impact on treatment modalities of Tubotympanic type of CSOM with chronic rhinosinusitis.

**Statistical Analysis:** Semi structured questionnaire was prepared from Review of Literature which was used to collect details of the patient. Simultaneously after collecting data examination was done and the details were entered in the same. Descriptive statistics like frequencies, proportions, graphs and cross tables were used to display the results. Probability (P) was used to calculate the test for statistical significance. The above statistical procedures have been performed by statistical package namely IBM SPSS Statistics version 20. The P value  $\leq 0.05$  was considered as statistically significant.

#### Results:

Demographic profile: 50 patients with CSOM (Tubotympanic type) were studied for their demographic profile based on the gender and age and a comparison was made. There were 48% males and 52% females were. There were 10 (20%) patients aged between 18 to 25 years, 09 (18%) patients were aged between 26 and 33 years, 04 (08%) patients were aged between 34 and 41 years and 01 (02%) patients were aged between 42 and 49 years. (Table 1).

**Table 1. Age and Sex wise distribution of study subjects:**

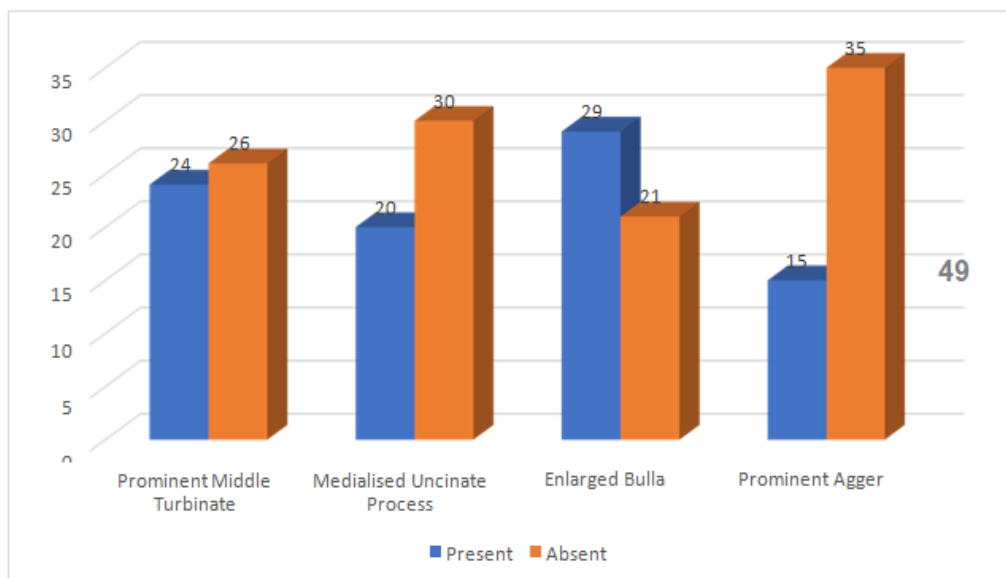
Age group	Male		Female		Total	
	Frequency	%	Frequency	%	Frequency	%
18-25	10	20	05	10	15	30
26-33	09	18	11	22	20	40
34-41	04	08	06	12	10	20
42-49	01	02	04	08	05	10
<b>Total</b>	24	48	26	52	50	100

**Pre and Post-operative findings:** The pre-clinical findings with their incidences were tabulating in the Table 2. Deviated nasal Septum in 32 (64%), prominent middle turbinate in 18 (36%), Medialised Uncinate Process in 30 (60%), Enlarged Bulla in 42%, Prominent Agger in 42%, were observed on CT scan of PNS. The size of the Tympanic membrane Perforation and Middle Ear Mucosal Status were also described in terms of percentages of study subjects in the Table 2.

**Table 2: Pre-clinical and diagnostic manifestation of study subjects:**

Manifestations	Incidence	Frequency n=50	%
Septum	DNS	32	64
	Midline	18	36
Prominent Middle Turbinate	Absent	26	52
	Present	24	48
Medialised Uncinate Process	Absent	30	60
	Present	20	40

<b>Enlarged Bulla</b>	Absent	21	42
	Present	29	58
<b>Prominent Agger</b>	Absent	35	70
	Present	15	30
<b>CTPNS</b>	Grade-I	09	18
	Grade-II	22	44
	Grade-III	11	22
	Grade-IV	08	16
<b>Size of Perforation</b>	Small	12	24
	Medium	16	32
	Large	22	44
<b>Middle Ear Mucosal Status</b>	Congested	50	100



**Chart 2: Pre-clinical and diagnostic manifestation of study subjects**

The pre-operative septal deviation, prominent middle turbinate, Medialised Uncinate Process, Enlarged Bulla and Prominent Agger were corrected with surgeries. The types of surgeries under taken were FESS and FESS with septal deviation correction. FESS was conducted in 18 (36%) of patients. FESS with septal deviation correction was under taken in 32 (64%) patients. (Table 3)

**Table 3: Type of Surgery**

Type of surgery	DNS	Midline	Total	
	No	No	No	%
FESS	0	18	18	36
FESS With septal correction	32	0	32	64
Total	0	18	50	100

After surgery, the crusting was absent in 48 (96%) of the subjects. Prominent turbinate was present in 10 (20%) of the subjects. The discharge was absent among the 14 (28%) of the subjects. Prominent middle turbinate was absent in 40 (80%) of the patients. synechiae were absent in 38 (76%) of subjects. The size of MMA were Patent and not patent 42 (84%) and 08 (16%) of the subjects respectively. (Table 4)

**Table 4: Post-operative Characteristics of study subjects**

Character	Position	Frequency	%
<b>Crust forming</b>	Absent	48	96
	Present	02	04
<b>Prominent Middle Turbinate</b>	Absent	40	80
	Present	10	20
<b>Discharge</b>	Absent	14	28
	Present	36	72
<b>Synechiae</b>	Absent	38	76
	Present	12	24

MMA Size	Not Patent	8	16
	Patent	42	84

$\chi^2$  Value = 9.360, df = 2, P Value = 0.009 (significant). The pre-operative TM perforations were continued as same at 3rd week and 6th week of FESS surgery and the large size perforations were continued as same as on 6th months also. (Table 5)

**Table 5: Pre and post-operative Perforations status (n-50)**

Type of Perforation	Preoperative	3 <sup>rd</sup> week	6 <sup>th</sup> week	3 <sup>rd</sup> month	6 <sup>th</sup> month	
					Same	Reduced
Small	12	12	12	08 (16%)	0	08 (66.6%)
Medium	16	16	16	14 (28%)	0	16 (100%)
Large	22	22	22	22 (44%)	22 (100%)	0
Total	50	50	50	44 (88%)	22 (44%)	24 (48%)

$\chi^2$  Value = 61.11, df = 2 P Value = 0.001 (significant). The pre-operative TM perforations were changed 12 to 08 in small perforations, from 16 to 0 in middle size perforations and no change in case of large perforations at the end of 06 months after FESS surgery. (Table 6)

**Table 6. Comparison of pre and 6th month improvement in size of perforation**

Type of perforation	Number at Pre-operative	At 6 Months					
		Same	%	Reduced	%	Closed	%
Small	12	00	00	08	66.7	04	33.3
Medium	16	00	00	16	100	00	00
Large	22	22	100	00	00	00	00

$\chi^2$  Value = 61.111, df = 4, P Value = 0.000 (Significant). At 3rd month 33.30% of subjects showed improvement by reduction among the small perforations. Similarly, the medium showed 12.5% of reduction. The reduction of small perforation was statistically significant. (p value less than 0.05) At 6 months all the small perforation cases had either reduced (66.70%) or closed (33.3%) and the medium sized perforation cases were improved

(100%) as reduction. The reduction and closure was statistically significant.

#### Pre and Post-operative MEM status and Ear Discharge:

The middle ear mucosa remained congested and Ear Discharge was present at pre-operative, 3rd and 6th week post-operative period in all subjects without any improvement. (Table 7)

**Table 7: Comparison of Pre and 3rd month improvement of MEM status and EarDischarge.**

MEM Status	Number at Pre-operative	At 3 Months	
		No	%
Congestive	50	23	46
Dry	Nil	27	54
Total	50	100	100.0

The 100 percent congestive middle ear mucosa with ear discharge at pre and post-operative periods 3rd and 6th week were reduced to 46% and dry middle ear mucosal status was improved to 54% at 03 months. (Table 8)

**Table 8: Comparison of Pre to 6th month improvement of MEM status and Ear Discharge**

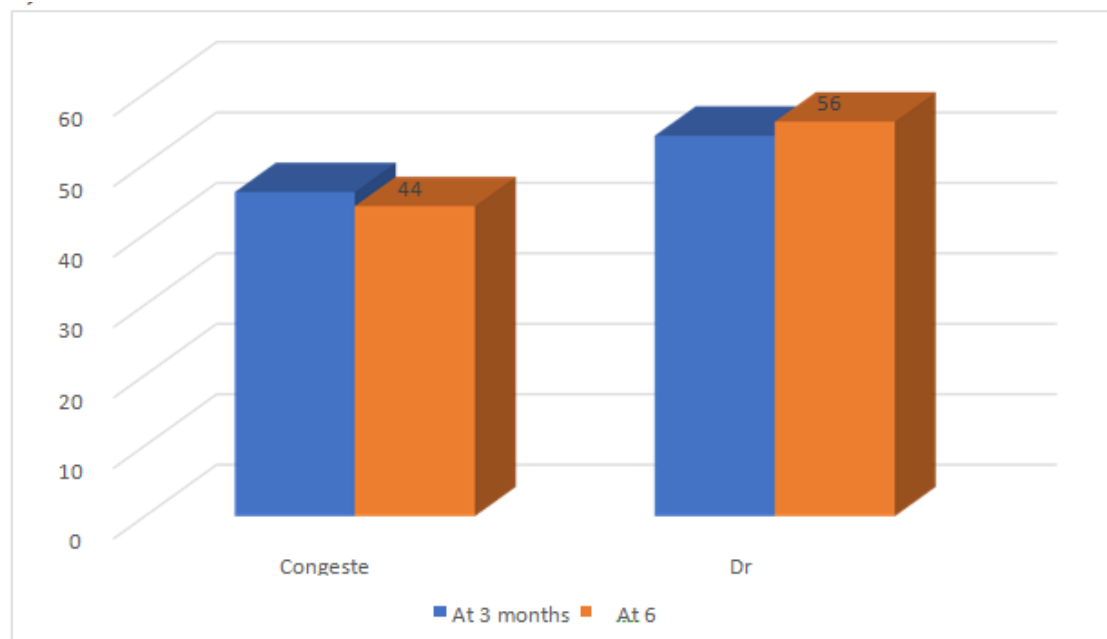
	Number at Pre-operative	At 6 Months	
		No	%
Congestive	50	22	44
Dry	Nil	28	56
Total	50	50	100

The 100 percent congestive middle ear mucosa with Ear Discharge at pre and post-operative periods 3rd and 6th weeks were reduced to 44% and dry middle ear mucosal status was improved to 56% at 6 months. (Table 9)

**Table 9: Comparison of 3rd to 6th month improvement of MEM status and EarDischarge**

MEM Status	At 3rd Months		At 6th Months	
	No	%	No	%
Congestive	22	44	01	02
Dry	00	00	27	54
Total	22	44	28	56

$\chi^2 = 46.118$ , df = 1, P Value = 0.000 (significant).



**Chart 3: Comparison of 3rd to 6th month improvement of MEM status and Ear Discharge**

The improvement of dryness from 54% at 3rd month to 56% at 6th month was statistically significant. (Chart 3).

#### Discussion Points:

1. The pre and post-operative characteristics.
2. Comparison of pre and post-operative characteristics.
3. Comparison of pre and 3rd week to 6th month in respect of Viz. perforation, MEM status and Ear Discharge.

#### Discussion

A total of 50 patients were selected for the purpose of this study. These patients with persistent ear discharge had tubotympanic type of chronic suppurative otitis media even after medical management. In this study we try to emphasize that sinus pathology is a major factor for persistently active tubotympanic disease [23]. Even though other septic foci like chronic tonsillitis, adenoids exist, the percentage is less in comparison to sinus disease [23]. This study of 50 patients over the study period May 2022 to April 2024 included 24 males and 26 females. Maximum number of patients belonged to age group 26 to 33 years. In our study, diagnostic nasal endoscopy was done for all patients. 32 patients (64%) had septal deviation, 58% had enlarged bulla which was the most common anatomical variant, 48% had prominent middle turbinate, 40% had medialized uncinat process and 30% had Prominent Agger. On CT scan paranasal sinuses, Grade I (18%) - minimal disease limited to OMC; Grade II (44%) - moderate/incomplete opacification of one or more sinuses Grade III (22%) - complete opacification of one or more major sinuses; Grade IV (16%) - total opacification of all sinuses. The most common ana-

tomic variant on CT scan was deviated nasal septum in 32 patients. Medialised uncinat with maxillary mucosal thickening was found in 20 patients while enlarged bulla narrowing OMC was seen in 29 patients. Prominent Agger or a type of frontal cell obstructing the frontal recess was found in 15 patients. Prominent middle turbinate was found in 24 patients.

All the patients had anatomic variants and signs strongly suggestive of chronic rhinosinusitis on diagnostic nasal endoscopy and CT scan PNS. Blue stone et al [6] in 1989 studied about 40 patients & found "Eustachian tube dysfunction is the main reason for middle ear disease; "Disease of the sinuses and upper respiratory tract which caused ET dysfunction". Our study correlates with the above study. On Otoendoscopy, 12 patients (24%) were found to have a small central perforation. 22 patients (44%) had a large central perforation while 16 patients [24] had a medium central perforation. Middle ear mucosal status assessed by Otoendoscopy is a reflection of Eustachian tube function [25]. 50 patients had congested middle ear mucosa reflecting poor eustachian tube function. KOCHS study of 222 patients was the first to include observations of eosinophilia in otorrhea "Supporting the contention that the middle ear takes part in allergic reactions similar to those seen in the nose and paranasal sinuses. This is because of the changes in the Eustachian tube. The infection in the nose and paranasal sinuses leads to Eustachian tube dysfunction. This Eustachian tube dysfunction leads to Otitis media [25]". The patients underwent functional endoscopy sinus surgery by Messerklinger technique for the treatment of chronic sinusitis, so as to improve Eustachian tube function.

The preoperative, the septal deviations were corrected by surgery. The prominent middle turbinate, medialized uncinate process, enlarged bulla and prominent agger were also corrected by surgery. In the postoperative period, diagnostic nasal endoscopy was done. There were no crusts in 96% of the patients. The prominent middle turbinate was corrected in 80% of the patients. The discharge was absent among 28% of the patients. The synechiae was absent in 76% of the patients. The MMA sizes were patent for 84% of the patients. Dr. Anand Shah, (BH & MRC, Bombay 2002), emphasized "The situation of nose and paranasal sinuses, being close to ear is the reason for the most ear diseases [26]. So before doing surgery for ear diseases it will be better to evaluate the nose and the paranasal sinuses for good outcome". The comparison of pre & post-operative changes in third and sixth week of post-operative period were same. At 3rd month 33.3% of subjects showed improvement by reduction among the small perforations. Similarly, the medium size perforations showed only 12.5% reduction.

The reduction of small perforation was statistically significant.  $p \leq 0.05$ . At 6 months all the small perforation cases were improved either by reduction (66.7%) or closure (33.3%) and the medium sized perforations were improved (100%) by reduction. The reduction and closure was statistically significant ( $P \leq 0.05$ ). The MEM status remained congestive and Ear Discharge was present without any improvement at 3rd and 6th week post-operative period. The 100 percent congestive MEM with Ear Discharge at pre and post-operative periods 3rd and 6th week was reduced to 46% at 3rd month. The above improvement was statistically significant.  $p \leq 0.05$ . The 100 percent congestive MEM with Ear Discharge at pre and post-operative periods 3rd and 6th week was reduced to 44% at 6th month. The above improvement was statistically significant. Among 50 patients, at the end of six months of regular follow up after FESS, in Otoendoscopy the improvement of middle ear mucosal status was found in 28 patients i.e., Dry MEM without Ear Discharge. Among 50 patients the perforation was closed in 4 patients. The size of perforation has reduced in 24 patients and in 22 patients the size of perforation remained the same.

#### Conclusion:

In the adult population chronic rhinosinusitis is the most important cause of persistent ear discharge causing Chronic CSOM of Tubotympanic disease. Deviated nasal septum, enlarged bulla and prominent middle turbinate are the most common anatomical variants of nose and paranasal sinuses predisposing to chronic rhinosinusitis. Treating chronic rhinosinusitis has a favourable effect on improving the middle ear mucosal status. The treatment of chronic rhinosinusitis by functional

endoscopic sinus surgery in tubotympanic disease patients results in good outcome of tubotympanic disease. Functional endoscopic sinus surgery has emerged as an effective and reliable procedure for chronic rhinosinusitis.

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