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Effect of Surgical Treatment of Sinonasal Pathology on the Outcome of Active Mucosal Chronic Otitis Media

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Abstract

Objectives: *To determine the role of sinonasal pathology in the disease process of active mucosal chronic otitis media and to evaluate the effect of surgical treatment of sinonasal abnormalities on the outcome of active mucosal chronic otitis media*

Materials and Methods: *100 consenting adults aged 20-60 years, with chronic rhinosinusitis and uncomplicated active mucosal chronic otitis media (persisting otorrhoea for 12 or more weeks following culture directed antibiotics) were included. Evaluation including diagnostic nasal endoscopy, otomicroscopy, computerised tomogram of the paranasal sinuses and brain, and culture and sensitivity were conducted. Functional endoscopic sinus surgery, with concomitant correction of nasal abnormalities, was performed and postoperative (otomicroscopy) follow up at 1week, 1, 3, 6months was carried out.*

Results: *Mean age of the patients (58males and 42 females) was 29.6±2.73years.Majority (61%) were in the lower income group. Chronic otitis media was present bilaterally in 62% and unilaterally in 38%, coinciding with laterality of detectable disease in the nose/paranasal sinuses. Cultures isolated 56% Gram negative and 54% Gram positive organisms; Pseudomonas was the commonest pathogen in the ear and Coagulase positive staphylococcus in the nose/paranasal sinuses. Postoperatively, 85% had dry ears at the*

end of 6 months.

Conclusion: *Infection/inflammation of nose/paranasal sinuses is associated with inadequate resolution of active mucosal chronic otitis media. Surgical correction of anatomical abnormality(s) of the nose with functional endoscopic sinus surgery for the treatment of chronic rhinosinusitis reduces inflammation/discharge of the middle ear. Surgical treatment of sinonasal pathology is thus indicated before undertaking ear surgery.*

Keywords: *Otitis Media, Suppurative; Otitis Media/microbiology; Sinusitis/surgery*

INTRODUCTION

Chronic otitis media (COM) implies a permanent abnormality of the pars tensa or flaccida, resulting from earlier acute otitis media, negative middle ear pressure, otitis media with effusion^[1], trauma or extrusion/removal of tympanostomy tube^[2]. COM equates with the classic term chronic suppurative otitis media (CSOM), which is no longer advocated. In active mucosal type, there is chronic inflammation of the middle ear cleft mucosa producing mucopus that discharges^[1] through a pars tensa perforation^[3]. The WHO definition requires only 2 weeks of otorrhoea, but otolaryngologists adopt a longer duration (e.g. more than 3 months) of active disease^[4].

COM is an important cause of preventable hearing loss, particularly in the developing world. Other complications are meningitis, brain abscess, facial nerve palsy, subperiosteal mastoid abscess and even death if not adequately managed^[4].

Despite advances in public health and medical care, COM is still prevalent around the world, being common in developing countries and certain high risk populations in developed nations^[5]. COM is multifactorial in nature with its incidence dependent on race and socioeconomic factors (e.g. poor living conditions, inaccessible medical

care) inadequate antibiotic treatment, frequent upper respiratory tract infections and nasal disease are related to its development^[4].

Global burden of illness from COM involves 65–330 million individuals with draining ears, 60% of whom (39–200 million) suffer from significant hearing impairment. Highest (>4%) prevalence is seen in India. ie. 7.8% and 77% of these suffer from hearing impairment^[4].

Chronic rhinosinusitis (CRS) is characterized by mucosal inflammation affecting both the nasal cavity and paranasal sinuses (PNS), having numerous causes such as allergic/non-allergic rhinitis, nasal polyps, anatomical obstruction (septum/turbinate abnormalities), infection etc^[6]. During the past decade, functional endoscopic sinus surgery (FESS) has been widely used and advocated as the treatment of choice for CRS refractory to medical management^[7].

Of the various etiologies for active mucosal COM such as chronic sinusitis, adenoiditis, tonsillitis etc, in majority of cases, sinusitis acts as a focus of infection in development of COM as these patients with coexisting sinusitis have persistent ear discharge and this interrelationship is supported by clinical experience and literature^[8].

The pathogenesis of otitis media (OM) has been related to the presence of prior or concurrent sinonasal disease^[9]. Pathological findings in the nose/ PNS/ nasopharynx are often said to be responsible for inadequate tubal function^[10], as infection/ inflammation here can involve the Eustachian tube (ET) leading to its obstruction which in turn leads to OM^[11].

When tympanoplasty is to be done in a patient suffering from active mucosal COM, potential interactions between middle ear mucosa, ET function and the nose and nasopharynx are considered, as poor tubal function correlates with a diminished success rate of tympanoplasty^[10]. Thus those patients with COM secondary to nasal and/ or PNS pathology need to have both problems addressed. Those requiring ear surgery should have nasal and/or PNS problem corrected first, if a ear operation is to be successful^[11]. However, there is still no clear consensus on the optimal management strategy for COM^[12].

This study was therefore undertaken with the aims of determining the role of sinonasal pathology in the disease process of active mucosal COM and to evaluate the effect of surgical treatment of sinonasal abnormalities on the outcome of active mucosal COM.

MATERIALS AND METHODS

A prospective observational study was conducted from June 2013 to December 2014. 100 consenting adults of both sexes aged 20-60 years, diagnosed with CRS both clinically and radiographically, with uncomplicated active mucosal COM, with persistent ear discharge for ≥ 12 weeks even following culture directed topical

and systemic antibiotics were included in the study.

Those with history of allergic rhinitis, sinonasal polyposis, functional abnormality of nose/PNS, previous nose/sinus surgery, nasal/paranasal sinus mass, adenoid hypertrophy, COM of active squamous/inactive mucosal/inactive squamous type, adhesive OM, recurrent COM following ear surgery, complicated COM, fungal infection of the external ear, other foci of infection (e.g. tonsillitis), cystic fibrosis, craniofacial anomalies, metabolic disorders, asthma/atopy, immunodeficiency/other systemic illness, attrition to follow up or death from a cause not related to the study parameters in the observation period, were excluded from the study.

Detailed history including socioeconomic status was obtained from all patients. A diagnosis of CRS was made based on a history of symptoms (eg. congestion and/or fullness; nasal obstruction, blockage, discharge and/or purulence; discolored postnasal discharge; hyposmia/anosmia; facial pain and/or pressure) and their duration for ≥ 3 months^[6]. Patients with tympanic perforations which continue to discharge mucoid/mucopurulent material for ≥ 3 months, despite medical treatment, were recognized as COM cases^[4].

General, systemic and ENT examination, including diagnostic nasal endoscopy (DNE) and otomicroscopy were conducted. Swabs for culture and sensitivity were obtained from nasal cavity and ear, based on which antibiotic therapy along with supportive therapy for symptomatic relief was initiated to control the episode of acute infection, if present.

Computerised Tomogram (CT) of PNS, including the brain was obtained for detailed assessment of the nose/PNS and to rule out presence of mastoiditis/complications of COM. PNS disease was classified based on CT findings into 3 grades i.e. Grade I - minimal disease limited to osteomeatal complex, Grade II - moderate incomplete opacification of ≥ 1 sinus(s), Grade III - complete opacification of ≥ 1 major sinus(s), not all and Grade IV - total opacification of all sinuses.

Preoperative workup for general anaesthesia was done. All patients underwent FESS, along with septal correction and submucosal diathermy of hypertrophied inferior turbinate wherever indicated. Postoperative care included empirical antibiotic therapy with antihistamine, decongestant, anti-inflammatory and saline nasal douching.

Patients were followed up postoperatively at the end of 1 week, 1, 3 and 6 months by otomicroscopy for cessation of discharge and improvement in middle ear mucosal status and DNE for assessment of nasal cavities and nasopharynx.

RESULTS

The mean age of the study patients (58 males and 42 females) was 29.6 ± 2.73 years, with a range of 20-60 years. Age distribution of patients was as follows - 48% aged 20-30 years, 23% were 31-40 years, 12% were 41-50 years and 17% were 51-60 years of age.

On analysis of socioeconomic status based on annual per capita income, 61%, 34% and 5% belonged to the lower, middle and higher income groups respectively.

All patients had anatomic variations and features suggestive of chronic sinusitis on DNE and CT-PNS. History and examination revealed bilateral COM in 62% of patients and unilateral COM in 38%, which was identical to the incidence of bilateral and unilateral sinusitis. (Table 1)

Culture of swabs from the middle meatus and external auditory canal showed an overall incidence of Gram negative and Gram positive organisms in 56% and 54% respectively. Common organisms were isolated from both sites in 70% of individuals. (Graph 1). No fungal or mycobacterial agents were isolated. Antimicrobial sensitivity testing revealed highest sensitivity to Ciprofloxacin, Cephalosporins and Gentamycin; 11% were resistant to Amoxicillin.

Postoperatively, otomicroscopy revealed correlation between middle ear mucosal oedema and discharge. (Table 2)

In those in whom ear discharge persisted on follow up, culture and sensitivity was repeated at 1 month and a full course of antibiotics prescribed, followed by cortical mastoidectomy (with definitive establishment of aditus patency) with tympanoplasty if discharge persisted beyond 6 months. In 85% of cases, the middle ear remained dry and these patients were advised to undergo tympanoplasty for the restoration of hearing.

Table 1-Evaluation findings

Abnormality	Percentage of patients
Nose/PNS	DNE/CT
Seen on DNE only	
1) Discharge in middle meatus/around ET (Below ie.anterior sinus group Above ie.posterior sinus group)	100% (81%; 19%)
2) Discharge–Mucopurulent Mucoid Purulent	67% 21% 13%
3) Accessory ostia- Posterior fontanelle Anterior fontanelle	27% 15%
Seen on both DNE and CT	
1) Deviated nasal septum	76%
2) Pneumatised septum	7%
3) Hypertrophied inferior turbinate	32%
4) Enlarged/well pneumatised agger nasi	19%
5) Medialised uncinata	29%
6) Paradoxically bent middle turbinate	21%
7) Concha bullosa	41%
8) Enlarged/well pneumatised bulla	28%
Seen on CT only	
1) Sinus mucosa thickened	100%
2) PNS disease-Grade I Grade II Grade III Grade IV	56% 27% 12% 5%
Ear	Otomicroscopy
1) Discharge– Mucopurulent Mucoid Purulent	69% 20% 11%
2) Central Perforation- Large Subtotal Total	71% 28% 1%
3) Middle ear mucosa- Oedematous wet/inflamed Polypoidal/boggy	65% 35%

Graph 1-Prevalence of organisms isolated on culture

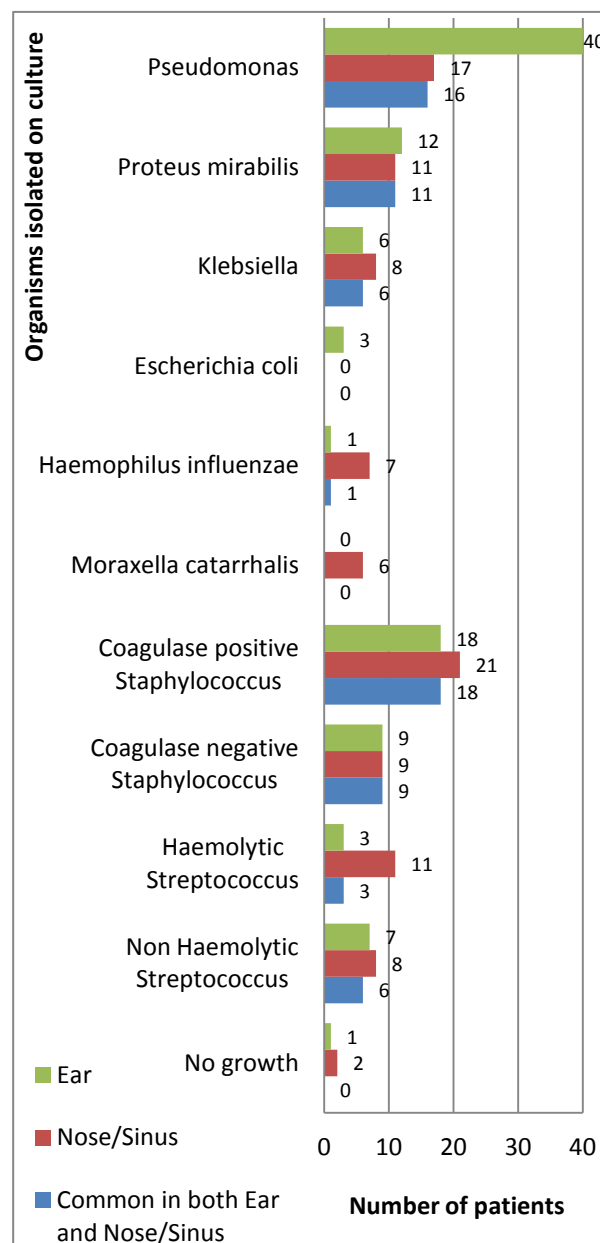


Table 2-Percentage of patients on each follow up with otorrhoea

Postoperative follow up	Percentage of patients with ear discharge/ mucosal oedema
1 week	45
1 month	32
3 months	24
6 months	15

DISCUSSION

In a study on CSOM by Nwabuisi et.al, 57.3% were males and 42.4% were females, which is similar to the sex distribution in our study. This statistically significant difference ($p < 0.001$) correlates with reports in literature which claim a male preponderance attributable to higher exposure of males to infectious conditions during the paediatric stage of growth and a higher level of personal hygiene in females^[5].

In our study, 61% of cases belonged to the lower income group. Studies have found that low socioeconomic class, malnutrition, congestion from high number of individuals in a household constitute significant risk factors for COM^[13].

In our study *Pseudomonas* was the organism most commonly isolated from the ear (40%), followed by Coagulase negative staph. (18%), *Proteus* (12%), Coagulase positive staph. (9%), Non haemolytic strep (7%), *Klebsiella* (6%), *E.coli* (3%), Haemolytic strep. (3%), *H.influenzae* (1%) which concurred with the results in a review by Verhoeff et.al in which microorganisms most frequently isolated in COM were *Ps.aeruginosa* (18-67%), *Staph.aureus* (14-33%), Gram negative organisms, such as *Proteus*, *Klebsiella* and *Escherichia* (4-43%), and *Haemophilus influenzae* (1-11%). They concluded that in COM, the middle-ear environment is thought to be more tolerant to unusual organisms like *Ps.aeruginosa*, *Staph.aureus*; therefore, it is still uncertain whether these bacteria are true pathogens in COM or reflect secondary invaders or contamination from the external auditory canal or reflux from the ET^[12].

Nwabuisi et.al. also concluded that infection with *Pseudomonas*, *Staph*, *Proteus* and *E.coli* are important in the early stages of COM, but after a long time, *Ps.aeruginosa* predominates. Therefore it is important to know the antibiotic susceptibility of causative pathogens in our environment, to ensure appropriate measures for containment and prevention of complications^[5].

In our study, postoperative follow up at 1week showed active ear discharge in 45% of cases, reducing to 24%, 32% and 15% at 1,3 and 6 months respectively. This concurred with the findings in a study by Maier et.al showing deterioration of ET function 1week after nasal surgery, which began to normalise after 6-8weeks, thus concluding that tympanoplasty should not be performed in the same session or in the early postoperative period, but after several months only^[10].

6 months following sinonasal surgery, 85% of our study patients had a dry ear, which concurred with the results of the study by Yeolekar et.al in which 82.5% and 79.31% of patients who underwent surgical treatment for sinusitis and septal deviation respectively, had resolution of ear disease. Failure to improve was possibly explained by presence of granulation, polyp, fibrosis or epithelisation in protympanum, or mastoid infection and aditus blockage, requiring mastoid exploration^[11].

CONCLUSION

Infection/ inflammation of nose/PNS is associated with the persistence of active mucosal COM due to infection harboured in the nose/PNS. Thorough evaluation, followed by FESS for the treatment of

CRS refractory to medical treatment, along with surgical correction of anatomical abnormality(s) of the nose, thereby eradicating the septic focus, brings about a resolution/reduction of inflammation/discharge of the middle ear cleft mucosa and is thus indicated before undertaking reparative/restorative ear surgery to ensure its success. Patients are advised about further management of COM, which entails closure of the perforation by tympanoplasty, with/without mastoidectomy, depending on whether the ear is wet/ dry.

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