

Mucocele of Paranasal Sinuses: Our Experiences at a Tertiary Care Teaching Hospital of Eastern India

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Abstract

Background: Mucoceles of paranasal sinuses are benign expansile mucus-filled cystic lesions due to chronic blockage of the sinus ostia. Due to their expansile growth, may affect nearby vital structures and lead to complications and morbidity. **Objective:** This study aims to evaluate the details of the clinical profile and management of paranasal sinus mucocele. **Materials and Methods:** This is a retrospective descriptive study of 54 patients with paranasal sinuses mucoceles that were managed with surgical interventions. **Results:** The age range of the study participants was between 12 years to 54 years. The mean age of the study patients was 28.61 years. Out of 54 patients, 34 (62.96%) were males and 20 (37.03%) females with a male-to-female ratio of 1.7:1. The frontal sinus (35.18%) was the most common sinus involved with mucocele followed by frontoethmoidal sinus (24.07%), ethmoid sinus, maxillary sinus (14.81%), and sphenoid sinus (9.25%). In this study, the headache was the most common symptom. **Conclusion:** Paranasal sinus mucocele has diverse clinical presentations. Allergic rhinitis, sinusitis, and radiation to the head-and-neck region are important predisposing factors for causing paranasal sinus mucocele. Orbital symptoms are indicators for prompt surgical intervention. Endoscopic sinus surgery is an effective and safe treatment option for paranasal sinus mucocele.

Keywords: Endoscopic sinus surgery, headache, mucocele, paranasal sinus mucocele

INTRODUCTION

Mucocele is a benign, expansile, encapsulated, locally destructive lesion found within cavities, filled with mucus, and lined by epithelium.^[1] Paranasal sinus mucocele is formed due to the accumulation and retention of mucoid secretion inside the sinus, resulting in distension, thinning, and erosion of one or several of its bony walls.^[2] Mucocele occurs when a paranasal sinus ostium or a compartment of a septated sinus becomes blocked thus resulting in the sinus cavity being filled with mucus and becoming airless.^[3] Mucoceles of the paranasal sinuses were first described by Langenbeck in 1820 under the name of hydatids and Rollet coined the word mucocele in 1909.^[4] The etiopathology of the mucoceles remains controversial. The etiopathology may be associated with the inflammatory process in a closed space, related to benign neoplasm, posttraumatic scarring or inflammation, and ostial obstruction resulting in accumulation of mucus secretions.^[5] Any paranasal sinus can develop a mucocele but frontal and ethmoidal sinuses are most often affected followed by maxillary and sphenoid sinus.^[6] Expansions of mucoceles of paranasal sinuses take several years whereas they expand

rapidly when associated with infections resulting in pyoceles.^[7] As the paranasal sinuses are in proximity to the orbit and brain, the pathological process of the paranasal sinus mucoceles will easily affect the orbit and cranium and result in morbidity and mortality.^[7] The diagnosis is usually done with imaging such as computed tomography (CT) scan and magnetic resonance imaging (MRI). CT scan is an important diagnostic tool for showing paranasal sinus mucocele with orbital and intracranial involvement, which is an important part of mucocele. In a CT scan, mucocele is seen as a hypodense, nonenhancing mass that expands, and fills the paranasal sinus cavity. The endoscopic approach for excision of the mucocele and marsupialization is helpful for treatment. The endoscopic approach avoids external

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incision and associated morbidity. However, there are not many studies for clinical profile and appropriate management of paranasal sinus mucocoele. Here, this study aims to evaluate the clinical presentations and management of the paranasal sinus mucocoeles at a tertiary care teaching hospital.

MATERIALS AND METHODS

This is a retrospective descriptive study and the patients with paranasal sinus mucocoele from December 2015 to January 2022 were reviewed. This study was conducted in accordance with the ethical principles that have their origin in the Declaration of Helsinki. It was carried out with patients' verbal and analytical approval before the sample was taken. The study protocol and the subject information and consent form were reviewed and approved by a local ethics committee according to the document number IEC/IMS/SOA/88 on August 16, 2021. We identified 54 patients diagnosed with mucocoeles of the paranasal sinuses and managed with endoscopic approach and open or combined methods with follow up more than 6 months. Patients who had sinonasal tumors or those with medical histories or imaging studies were not available were excluded from this study. Relevant medical history, clinical presentation, diagnosis, and surgical procedures were assessed. The postoperative complication caused by different surgical approaches was recorded, as well as evidence of recurrence detected clinically or by imaging. The duration of surgical time and a hospital stay of the patients were recorded. The microbiological cultures were collected from the mucocoeles of the paranasal sinuses. Preoperative diagnostic nasal endoscopy, CT, and/or MRI were done in participating patients.

Surgical technique

All enrolled patients were operated on under general anesthesia. The endoscopic marsupialization of the paranasal sinuses was done. For maxillary sinus mucocoele, uncinectomy was done followed by wide meatal antrostomy and marsupialization. For ethmoid and sphenoid mucocoeles [Figure 1], complete ethmoidectomy followed by widening of the sphenoid sinus

ostium with excision of anterior and inferior walls. The frontal sinus mucocoele was marsupialized by wide drainage of the sinus with help of endoscopic sinus surgery. The excised mucocoele was sent for histopathological study. The histopathological report was consistent with the diagnosis of mucocoele. Intraoperative and postoperative details of endoscopic surgery for sphenoid mucocoele were recorded as well as the incidence of recurrence documented if any. Secretions from the mucocoeles of the paranasal sinus were sent for microbiological culture. Patients have been checked at weekly follow-up with the cleaning of secretion and sinonasal douching with saline solution until 1 month after surgery. Patients were checked upon at follow-ups every 3 months. Diagnostic nasal endoscopy was performed in all patients during the follow-up period after surgery. Routine postoperative CT or MRI scanning was not done.

Statistical methods

SPSS Statistics for Windows, version 20 was used for all statistical analysis (IBM-SPSS Inc., Chicago, IL, USA).

RESULTS

There were 54 patients enrolled in this study in the age range between 12 years to 54 years. The mean age of the study patients was 28.61 years. Out of 54 patients, 34 were males and 20 females with a male-to-female ratio of 1.7:1. Out of 54 patients, 15 (27.78%) patients were in the age group of 51–60 years, 12 (22.22%) were in 41–50 years, 11 (20.37%) were in 31–40 years, 9 (16.67%) were in 21–30 years, and 7 (12.96%) were in 12–20 years [Table 1]. Out of 54 patients with paranasal sinus mucocoeles, 13 (24.07%) presented with allergic rhinitis, 5 (9.25%) presented with chronic sinusitis, and 3 (5.55%) patients had a history of radiation therapy for head-and-neck cancer [Table 2]. Out of 54 patients, 35 (64.81%) were presenting with headache, 23 (42.59%) were presenting with nasal discharge, 21 (38.89%) presenting with nasal block, 5 (9.25%) presenting with proptosis, 2 (3.70%) presenting with diplopia, and 2 (3.70%) presenting with visual disturbances [Table 2]. The frontal sinus (35.18%) was the most common sinus involved with mucocoele followed by frontoethmoidal sinus [Figure 2] (24.07%), ethmoid sinus (16.67%), maxillary sinus (14.81%), and sphenoid sinus (9.25%) [Table 3]. Out of 54 patients, three presented with double mucocoele inside the isolated paranasal sinus. Two were in one side maxillary sinus and one double mucocoele in the sphenoid sinus. There were three patients who were asymptomatic and routinely detected by routine follow-up CT scan for nasopharyngeal carcinoma. CT scan was done in all cases and MRI was done in 12 cases. No cases showed intracranial extension of the paranasal sinus mucocoeles. All cases underwent surgical intervention. All patients underwent an endoscopic approach for the treatment of the paranasal sinus mucocoeles except for one case of maxillary sinus mucocoele treated with Caldwell-Luc's approach. There were two cases (3.70%) that showed mucopyocoele [Figure 3] found intraoperatively. There



Figure 1: MRI of the head (axial view) showing sphenoid sinus. MRI: Magnetic resonance imaging

were no intra- or postoperative complications in the study cases. All patients improved symptomatically after surgery. Diagnostic nasal endoscopy was used to assess the sinonasal cavity during follow-up at 1 week, 1 month, and 6 months following surgery. Microbiological culture reports of the mucocoeles/mucopyocele of paranasal sinuses did not reveal any bacteriological growth. Out of 54 cases of paranasal sinus mucocoeles, two cases of frontal sinus mucocoeles and one case of maxillary sinus mucocoele revealed recurrence at the follow-up visit of 6 months. Rest cases revealed patent

ostium and clear paranasal sinus cavities in all patients in the follow-up period.

DISCUSSION

Mucocoeles are common expanding lesions of the paranasal sinuses.^[8,9] Mucocoeles of the paranasal sinuses occur most commonly in the frontal sinus followed by ethmoid sinus, maxillary sinus, and sphenoid sinus.^[10] One study showed paranasal sinus mucocoeles predominantly seen in the frontoethmoidal area (64%), followed by maxillary sinus (18.6%), sphenoid sinus (8.4%), and posterior ethmoidal sinus (6.7%).^[11] Another study showed paranasal sinus distribution of mucocoeles as frontoethmoid complex in 33%, maxillary sinus in 11%, ethmoid sinus in 22%, sphenoid sinus in 11%, and middle turbinate in 22%.^[12] In this study, mucocoeles were found in 35.18% of cases of the frontal sinus, 24.07% mucocoeles in frontoethmoid sinuses, 16.67% mucocoeles in ethmoid sinuses, and 14.81% mucocoeles in the maxillary sinus. Mucocoeles are also found in abnormally aerated structures such as concha bullosa (hypertrophied middle turbinate), clinoid process, and pterygoid processes, as well as in abnormally displaced mucosa, often in a posttraumatic patient.^[13,14] In this study, 27.78% of patients were in the age group of 51–60 years, 22.22% were in 41–50 years, 20.37% were in 31–40 years, 16.67% were in 21–30 years, and 12.96% were in 12–20 years. More number of cases of mucocoeles in the elderly age group may be due to the presence of mucosal thickening, infection of dental origin, and impaired ciliary motility of the paranasal sinuses. There are numerous theories for explaining the cause of mucocoeles in the paranasal sinus which include congenital, iatrogenic, infectious, and inflammatory.^[15] The common etiology for paranasal sinus mucocoeles is the history of previous sinus surgery, untreated trauma, and facial bone fractures.^[16] Lund *et al.* suggested the role of inflammation by showing the release of prostaglandin PG2 and pro-inflammatory cytokines (interleukin-1 and

Table 1: Age group of patients with paranasal sinus mucocoeles

Age group (years)	Number of patients (n=54), n (%)
12–20	7 (12.96)
21–30	9 (16.67)
31–40	11 (20.37)
41–50	12 (22.22)
51–60	15 (27.78)

Table 2: Clinical profile and associated diseases of patients with paranasal sinus mucocoeles

	Number of patients (n=54), n (%)
Clinical manifestations	
Headache	35 (64.81)
Nasal discharge	23 (42.59)
Nasal obstruction	21 (38.89)
Proptosis	5 (9.25)
Diplopia	2 (3.70)
Visual disturbances	2 (3.70)
Associated diseases	
Allergic rhinitis	13 (24.07)
Chronic sinusitis	5 (9.25)
History of radiotherapy for head-and-neck cancer	3 (5.55)

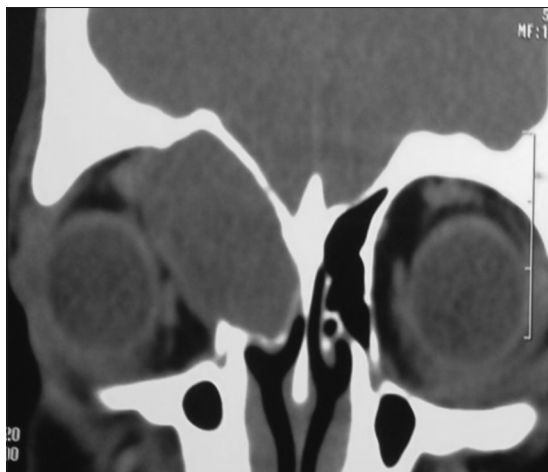


Figure 2: CT scan of the paranasal sinus (coronal view) showing right frontoethmoidal mucocoele. CT: Computed tomography

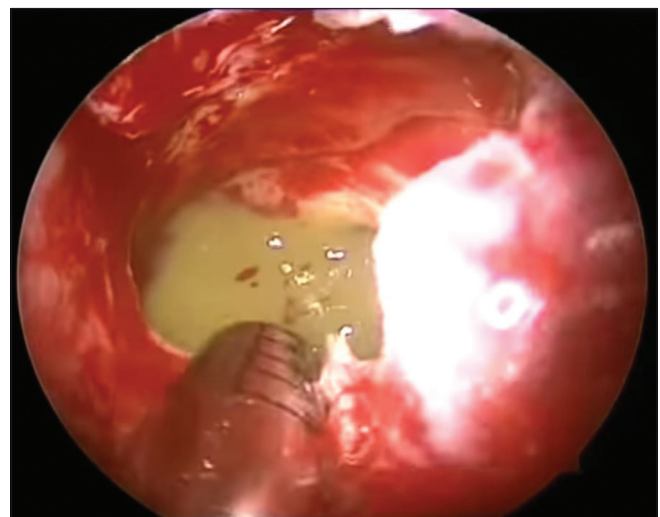


Figure 3: Intraoperative endoscopic picture of the sphenoid showing mucopyocele

Table 3: Management of paranasal sinus mucocoeles

Paranasal sinus mucocoele	Number of patients (n=54), n (%)	Type of surgery performed	Number of recurrences, n (%)
Frontal sinus	19 (35.18)	Endoscopic approach	2 (3.70)
Frontoethmoid	13 (24.07)	Endoscopic approach	0
Ethmoid	9 (16.67)	Endoscopic approach	0
Maxillary	8 (14.81)	Endoscopic approach - 7 Caldwell-Luc approach - 1	1 (1.85)
Sphenoid	5 (9.25)	Endoscopic approach	0

tumor necrosis factor- α) into the wall of the mucocoeles, inducing osteoclastic bone resorption.^[17] Similarly, another report showed that spontaneous mucocoele was prevalent more in the population of patients with sinonasal polyposis (0.6%) than in the general population and the incidence of mucocoele increased to 2.5% in patients with nasal polyposis after surgery.^[18] Patients who operated for sinonasal polyposis form an important risk toward mucocoele formation in the paranasal sinus. Hence, inflammatory and traumatic mechanisms constitute a significant etiology for the development of paranasal sinus mucocoeles. The obstructed paranasal sinuses contain mucoid secretions produced by the mucosal linings. In this study, 24.07% of cases of paranasal sinus mucocoeles were associated with allergic rhinitis, 9.25% of cases were associated with chronic sinusitis, and 5.55% of cases were associated with a history of radiotherapy for head-and-neck cancer. A mucocoele can affect the whole sinus or one air cell or compartment of the paranasal sinus. The majority of mucocoeles are solitary, although multiple mucocoeles have been documented.^[19] It appears that a downstream mucocoele obstructs the upstream paranasal sinuses, leading to the origin of secondary mucocoeles. The large ethmoid sinus mucocoele may cause inflammatory mucosal swelling. The ethmoid sinus mucocoele obstructs the middle meatus, impeding the blockage of the drainage of the maxillary sinus, and resulting in secondary maxillary sinus mucocoele. If there is secondary infection occurs in the mucocoeles of the paranasal sinus, it results in mucopyocoele. In approximately 50% of cases of a paranasal sinus, mucocoele turns into mucopyocoele.^[20] Mucocoeles are expanding lesions that slowly break down the bony walls of the sinus due to the dynamic osteogenic process and bone resorption. Destruction of surrounding bony walls by mucocoeles results in complications such as orbital infection, intracranial lesions, and sometimes hemorrhage into the mucocoele and suddenly may produce severe headaches or retro-orbital pain.^[21] In this study, 3.70% of cases of paranasal sinus mucocoeles showed mucopyocoele.

The diagnosis of paranasal sinus mucocoeles is based on clinical presentations of the patients and radiological tests such as CT scans and MRIs. CT and MRI are considered the gold standard investigations for the diagnosis of mucocoeles of the paranasal sinuses.^[22] CT scans in both axial and coronal planes evaluate the amount of expansion of the mucocoeles and surrounding structures such as orbit, brain, and other tissues.^[23] A CT scan is an excellent diagnostic tool for showing paranasal sinus

mucocoele with orbital and intracranial involvement, which is an important step for the management of the mucocoele. In a CT scan, mucocoele appears as a hypodense, nonenhancing mass that expands and fills the paranasal sinus cavity. Histopathological study shows that mucocoeles are cyst-like structures lined by respiratory epithelium and filled with mucus.

The mainstay of treatment of paranasal sinuses is surgery, which ranges from endoscopic sinus surgery to external approaches such as craniofacial exposure and craniotomy with or without obliteration of the paranasal sinus.^[22] Historically, the recommended surgical treatment is complete excision and removal of the mucocoele lining, although open surgical technique which entails Caldwell-Luc operation, inferior nasointraoral window for maxillary sinus, external ethmoidectomy for ethmoid sinus, and osteoplastic flap to expose the frontal sinus. Since the advent of endoscopic sinus surgery with endoscopic marsupialization gained popularity.^[24] A large middle meatal antrostomy was performed in all cases of maxillary sinus mucocoele after exenterating the anterior ethmoidal cells. The introduction of intraoperative navigation has significantly extended the indications for endoscopic surgery, helping both detection and opening of certain paranasal sinus mucocoeles with difficult anatomical locations.^[25] Currently, the recommended treatment for sphenoid sinus mucocoele is endoscopic transnasal sphenoidotomy and drainage of the mucocoele along with adequate removal of the anterior and inferior wall of the sphenoid sinus for making proper drainage of the sphenoid sinus and avoid recurrence.^[26] In this study, all cases underwent endoscopic excision/marsupialization of the paranasal sinus mucocoele except one case which required a combined Caldwell-Luc approach and endoscopic approach. The objective of the surgical treatment is to clear the lesion, radically excise the paranasal sinus mucosa to prevent a recurrence, and reestablishment a plane of separation between extracranial and intracranial space and at the same time maintain the cosmetic results.

CONCLUSION

Mucocoeles of the paranasal sinuses are uncommon in routine clinical practice. Mucocoeles are usually diverse in their clinical, radiological, and operative presentations. Symptoms of paranasal sinus mucocoeles are usually nonspecific, so diagnosis may be delayed. Clinicians particularly otolaryngologists should take care of the differential diagnosis

and tumor-associated etiology during the management of the paranasal sinus mucocoele. Radiological investigations often help do diagnose early. Currently, the endoscopic approach for mucocoeles of the paranasal sinuses is a safe and effective technique.

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Conflicts of interest

There are no conflicts of interest.

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