Acta Biomed 2025; Vol. 96, N. 6: 17444 DOI: 10.23750/abm.v96i6.17444

Original article

Clinical characteristics and surgical outcomes of paranasal sinus mucoceles at a tertiary referral hospital in Southern Vietnam

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Abstract. *Background and aim:* Paranasal sinus mucoceles are increasingly encountered in clinical practice, often presenting with vague and late-stage symptoms. If left untreated, mucoceles can erode adjacent bony structures and compress critical anatomical areas such as the orbit and skull base, leading to serious complications including visual impairment and intracranial involvement. This study aims to describe the clinical and radiological characteristics, microbiological findings, and surgical treatment approaches for paranasal sinus mucoceles. *Methods:* A descriptive, retrospective study was conducted on 93 adult patients diagnosed and surgically treated for paranasal sinus mucoceles at Cho Ray Hospital, Vietnam, between January 2018 and July 2023. Clinical data, imaging findings, bacterial culture results, and surgical methods were analyzed. *Results:* The mean patient age was 48 years (range: 18–90), with a male-to-female ratio of 1:1.12. The fronto-ethmoidal region was the most frequently affected site (32.3%). A previous history of nasal/sinus surgery was noted in 50.5% of cases. Common symptoms included proptosis (32.3%), blurred vision (25.7%), facial pain (60.2%), and nasal obstruction (33.3%). For maxillary sinus mucoceles, 60% underwent combined endoscopic and Caldwell-Luc procedures. Among fronto-ethmoidal cases, 72.0% were managed with endoscopic surgery alone, while 25.8% required a combined external Jacques approach. The recurrence rate was 15.1%, with an average time to recurrence of 2.52 years. *Conclusions:* Paranasal sinus mucoceles often present with nonspecific and ocular-related symptoms. Endoscopic surgery remains the mainstay of treatment, though combined approaches are warranted in complex or recurrent cases. Long-term follow-up is essential to detect recurrences early. (www.actabiomedica.it)

Key words: endoscopic sinus surgery, mucocele, orbital complications, paranasal sinuses, recurrence, surgical outcomes, Vietnam

Introduction

The mucocele of the paranasal sinuses is a benign cystic lesion, originating from the mucous membrane of the paranasal sinuses, lined with non-proliferative epithelium and typically containing sterile mucoid material within the cystic cavity (1). Mucoceles are usually attributed to chronic inflammatory processes occurring in the sinuses or the association with neoplasms, inflammation, or post-traumatic scarring leading to mucus accumulation due to the obstruction of the sinus drainage pathways (2). Challenges have been

posed in the early diagnosis of paranasal sinus mucoceles since clinical symptoms are poor and non-specific. Patients frequently show no symptoms for a long period and may suddenly present with severe ocular or intracranial manifestations (3). Mucoceles can develop in any sinus, however, they are most commonly found in the frontal and ethmoid sinuses with the risk of compression of the orbital margin relative to their anatomical location. Moreover, surgical intervention remains the definitive treatment. While external surgical approaches were traditionally employed, endonasal endoscopic surgery has become the preferred method due to its minimally invasive nature and its compatibility with the physiological and anatomical characteristics of the sinonasal region (4, 5). A retrospective descriptive study was conducted to investigate the clinical characteristics, radiological findings, microbiological profiles, and surgical outcomes of patients diagnosed with paranasal sinus mucoceles at Cho Ray Hospital, a tertiary referral center in Southern Vietnam, between January 2018 and July 2023.

Materials and Methods

Study subjects

A retrospective descriptive case series was conducted involving 93 patients aged 18 years and older who were diagnosed with paranasal sinus mucoceles. All patients underwent preoperative computed tomography (CT) or magnetic resonance imaging (MRI), which served as the gold standard for confirming the diagnosis, assessing the extent of disease, and guiding surgical planning, and subsequently received surgical treatment at Cho Ray Hospital between January 2018 and July 2023.

Inclusion and exclusion criteria

Patients were included if they provided informed consent to participate in the study, were aged 18 years or older, had a confirmed diagnosis of paranasal sinus mucocele, and underwent surgical intervention at Cho Ray Hospital during the study period. Patients were excluded if histopathological results were unavailable or inconsistent with the diagnosis of paranasal sinus mucocele.

Surgical procedures

All patients with paranasal sinus mucoceles underwent surgery under general anesthesia, with the approach selected according to lesion site and extent. Most cases were treated with endoscopic sinus surgery (ESS) to marsupialize the mucocele and restore sinus drainage. Frontal sinus disease was addressed with Draf IIa, IIb, or III procedures as indicated. Maxillary mucoceles not suitable for ESS or recurrent cases were managed using a Caldwell–Luc approach. In cases with orbital or intracranial extension, combined endoscopic and external osteoplastic flap techniques were performed with multidisciplinary support. Meticulous hemostasis, nasal packing as required, perioperative antibiotics, and postoperative endoscopic surveillance were routinely implemented.

Microbiology (culture and identification)

Intraoperative mucocele fluid was aseptically aspirated before irrigation or antibiotic administration, placed in sterile containers, and transported to the laboratory within 2 hours. Samples were cultured on standard aerobic (blood, chocolate, MacConkey) and anaerobic media and incubated at 35–37 °C under appropriate conditions. Plates were examined at 24 and 48 hours, with anaerobic cultures observed up to 5 days. Bacterial identification was performed using Gram stain, biochemical methods, and/or automated systems (e.g., VITEK® 2 or MALDI-TOF MS). Antimicrobial susceptibility testing followed CLSI M100 guidelines. Methicillin resistance in Staphylococcus aureus was determined using the cefoxitin screen, and ESBL production in Enterobacterales was confirmed by combined-disk synergy or automated methods. Quality control strains (E. coli ATCC 25922, P. aeruginosa ATCC 27853, S. aureus ATCC 25923/29213) were used for validation.

Data collection

Data were collected on potential risk factors associated with mucoceles, including prior sinus surgery or trauma. Clinical symptoms were categorized as ocular symptoms (such as proptosis, blurred vision, ptosis,

and restricted ocular motility) and sinonasal symptoms (including rhinorrhea, nasal obstruction, headache, and facial pain). Physical examination findings included facial deformities such as frontal swelling, medial canthal swelling, and cheek swelling. Radiological data from CT and/or MRI were used to determine the anatomical location and extent of mucocele involvement, including orbital and intracranial extension. Histopathological reports and bacterial culture results of mucocele fluid were also reviewed. The surgical approach was recorded and categorized according to the location of the mucocele.

Statistical analyses

Data were analyzed using IBM SPSS Statistics version 26.0. Continuous variables were expressed as mean ± SD or median (IQR), and categorical variables as frequencies and percentages. Group comparisons used the Chi-square or Fisher's exact test for categorical data and the t-test or Mann–Whitney U test for continuous data. A p-value < 0.05 was considered statistically significant.

Ethics approval

The study protocol was reviewed and approved by the Ethics Committee of the University of Medicine and Pharmacy at Ho Chi Minh City.

Results

Patient demographics and risk factors

A total of 93 patients were diagnosed with paranasal sinus mucoceles during the study period. The cohort demonstrated a slight male predominance, with 51 males (54.8%) and 42 females (45.2%). The mean age at diagnosis was 48.13 ± 14.46 years (range: 18–90 years). The most commonly identified risk factor was a history of previous sinonasal surgery, reported in 47 patients (50.5%). Chronic rhinosinusitis was noted in 27 patients (29.0%), followed by sinonasal trauma in 12 patients (12.9%), nasal polyps in 11 patients (11.8%), and a nasal cavity tumor in 1 patient (1.1%). Notably, no identifiable risk factors were observed in 30 patients (32.3%). It should be noted that multiple risk factors were present in some individuals. Detailed distribution is presented in Table 1.

Mucocele locations

The most frequently involved site was the ethmoid-frontal region, accounting for 30 cases (32.3%). This was followed by isolated involvement of the frontal sinus in 21 cases (22.6%) and the maxillary sinus in 20 cases (21.5%). Less commonly affected regions included the ethmoid sinus (9 cases, 9.7%), sphenoid sinus (8 cases, 8.6%), and combined ethmoid-sphenoid sinuses (5 cases, 5.4%). The distribution of mucocele locations is summarized in Table 2.

Clinical presentations

Patients presented with a diverse range of symptoms involving ocular, sinonasal, and facial regions.

Table 1. Risk Factors Associated with Paranasal Sinus Mucoceles (n = 93)

Risk Factor	Number of Cases	Percentage (%)
Previous sinonasal surgery	47	50.5
Chronic rhinosinusitis	27	29.0
Sinonasal trauma	12	12.9
Nasal polyps	11	11.8
Nasal cavity tumor	1	1.1
No identifiable risk factor	30	32.3

Table 2. Locations of Paranasal Sinus Mucoceles (n = 93)

Location	Number of Cases	Percentage (%)
Ethmoid-frontal sinus	30	32.3
Frontal sinus	21	22.6
Maxillary sinus	20	21.5
Ethmoid sinus	9	9.7
Sphenoid sinus	8	8.6
Ethmoid-sphenoid sinus	5	5.4

The most frequently reported symptom was facial pain, observed in 56 patients (60.2%), followed by nasal obstruction in 31 cases (33.3%) and proptosis in 30 cases (32.3%). Other ocular manifestations included blurred vision (25 cases, 26.9%), ptosis (7 cases, 7.5%), and restricted ocular motility (5 cases, 5.4%). Additional sinonasal complaints comprised headache (24 cases, 25.8%) and nasal discharge (19 cases, 20.4%). Facial deformities were less common, with medial canthal mass reported in 9 patients (9.7%), frontal swelling in 6 patients (6.5%), and cheek swelling in 1 patient (1.1%) (Figure 1). A detailed summary of clinical presentations is provided in Table 3.

Radiological findings and anatomical extension

Radiological evaluation played a critical role in confirming the diagnosis of paranasal sinus mucoceles, identifying bony erosions, and assessing the extent of anatomical involvement. Both computed tomography (CT) and magnetic resonance imaging (MRI) were utilized preoperatively to determine lesion characteristics and to guide surgical planning, especially in cases involving orbital or intracranial structures. Most mucoceles were initially confined to their sinus of origin; however, several cases demonstrated extension beyond the bony confines due to chronic expansion and erosion. Based on anatomical involvement, three primary patterns of extension were identified: orbital, intracranial, and other adjacent sites (Table 4).

Intracranial extension was less commonly noted. Erosion of the posterior wall of the frontal sinus and the superior walls of the ethmoid or sphenoid sinuses was observed in 4.3% of cases each. Figure 2 demonstrates MRI images of a patient with bilateral posterior ethmoid and sphenoid mucoceles, showing characteristic features such as high T2 signal intensity and peripheral enhancement on contrast-enhanced T1 sequences, consistent with chronic inflammatory processes.

Orbital extension was the most frequently observed, present in 60.2% of cases. Among these, erosion of the medial orbital wall was most common (39.8%), followed by involvement of the superior orbital wall (12.9%), inferior orbital wall (4.3%), and the orbital apex (3.2%). Figure 3 illustrates a case of right maxillary sinus mucocele with outward expansion and compression of the right orbit, as visualized on axial and coronal CT scans.

Other expansion sites included the anterior wall of the frontal sinus (9.7%), anterior wall of the maxillary sinus (5.4%), and the inter-sinus septum (3.2%). A detailed summary of the anatomical distribution of mucocele expansion is presented in Table 4.

Table 3. Clinical Presentations of Paranasal Sinus Mucoceles (n = 93)

Symptom Category	Symptom	Number of Cases	Percentage (%)	p
Ocular symptoms	Proptosis	30	32.3	-
	Blurred vision	25	26.9	0,214
	Ptosis	7	7.5	<0,001
	Restricted ocular motility	5	5.4	<0,001
Sinonasal symptoms	Facial pain	56	60.2	-
	Nasal obstruction	31	33.3	<0,001
	Headache	24	25.8	<0,001
	Nasal discharge	19	20.4	<0,001
Facial deformities	Medial canthal mass	9	9.7	-
	Frontal swelling	6	6.5	0,419
	Cheek swelling	1	1.1	0,018*

*Fisher's Exact Test

Table 4. Expansion Directions of Paranasal Sinus Mucoceles (n = 93)

Group	Site of Expansion	Number of Cases	Percentage (%)
Orbital extension	Medial orbital wall	37	39.8
	Superior orbital wall	12	12.9
	Inferior orbital wall	4	4.3
	Orbital apex	3	3.2
Intracranial extension	Posterior frontal sinus wall	4	4.3
	Superior ethmoid/sphenoid wall	4	4.3
Other sites	Anterior frontal sinus wall	9	9.7
	Anterior wall of the maxillary sinus	5	5.4
	Inter-sinus septum	3	3.2

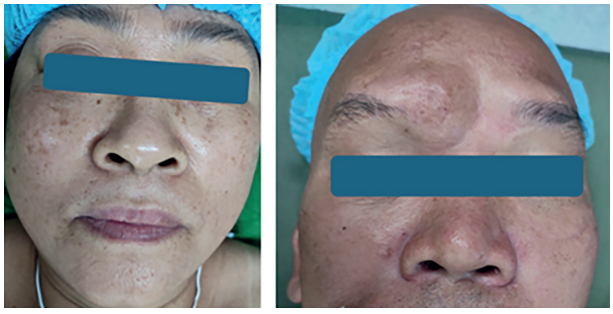

Figure 1. Clinical Presentations of Paranasal Sinus Mucoceles. The image on the left shows a patient diagnosed with a right maxillary sinus mucocele, presenting with pain and visible swelling of the right cheek. The image on the right demonstrates a patient with a right frontal sinus mucocele, manifesting as a prominent swelling in the frontal region.

Microbiological findings, surgical management, and recurrence

Microbiological culture results were available in all cases, with positive bacterial growth observed in 16.1% of patients (15/93). The most commonly isolated organisms were *Methicillin-sensitive Staphylococcus aureus* (MSSA) in 6 cases (6.5%) and *Methicillin-resistant Staphylococcus aureus* (MRSA) in 3 cases (3.2%). Other less frequent pathogens included *Escherichia coli*, *Serratia marcescens*, *Corynebacterium pseudodiphtheriticum*, *Pseudomonas aeruginosa*, *Enterobacter cloacae*, and *Klebsiella pneumoniae*, each detected in one case (1.1%). Surgical treatment was the mainstay of management. The majority of patients (72.0%) underwent isolated endoscopic sinus surgery. This approach was predominantly used for ethmoid-frontal and frontal sinus mucoceles (39.8%), but was also applied in cases involving the ethmoid (9.7%), maxillary (8.6%), and sphenoid or ethmoid-sphenoid regions (14.0%). A combined endoscopic and external approach was employed in 25.9% of cases, particularly for mucoceles located in the maxillary sinus (12.9%) and ethmoid-frontal/frontal regions (14.0%). External surgery alone, specifically via frontal craniotomy, was performed in a single case (1.1%) involving extensive frontal sinus disease. The surgical distribution by approach and site is summarized in Table 5.

A total of 14 patients (15.1%) experienced recurrence. Seven patients (7.5%) had a prior history of mucocele surgery before presenting at the study institution. The remaining 7 patients (7.5%) developed recurrence following surgical treatment during the study period. Among these, 1 case involved bilateral maxillary sinus mucoceles, previously treated with middle and inferior meatal antrostomies on both sides. Five cases of frontal sinus mucoceles recurred, including 3 initially managed with Draf I/IIa, 1 with Draf IIb, and 1 treated using a combined endoscopic and external Jacques approach. One recurrence involved the sphenoid sinus.

Discussion

Causes of paranasal sinus mucoceles

Mucoceles of the paranasal sinuses develop as a result of obstruction of the sinus ostium, which may be secondary to infections, fibrosis, inflammation, trauma,

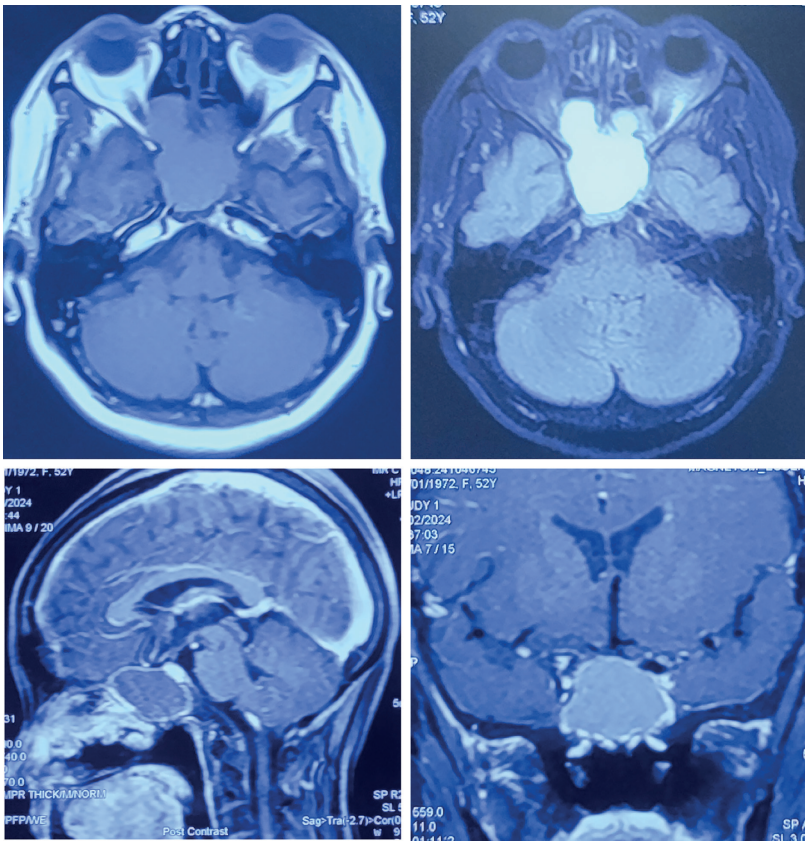

Figure 2. Mucocele of the Bilateral Posterior Ethmoid and Sphenoid Sinuses on MRI. Magnetic resonance imaging (MRI) demonstrates a lesion involving the bilateral posterior ethmoid and sphenoid sinuses. The lesion appears with intermediate signal intensity on T1-weighted images, high signal intensity on T2-weighted images, and shows peripheral rim enhancement on contrast-enhanced T1-weighted sequences. These findings are consistent with a mucocele exhibiting chronic expansion and inflammatory changes.

prior surgery, or neoplasms. Among these, a history of previous sinonasal surgery, either via endoscopic transnasal approach or external techniques, was the most prevalent etiological factor, accounting for 50.5% of cases. This rate is higher compared to findings reported by Scangas et al. (43.6%), and Obeso et al. (35%) (3, 5). Similarly, Benkhatar et al. reported that 20 out of 153 patients were diagnosed with mucoceles following functional endoscopic sinus surgery for nasal polyposis (6). Among 20 patients diagnosed with maxillary sinus mucocele, 9 patients (45%) had a history of prior sinonasal surgery. In the cohort of 47 patients with previous surgical interventions, the latency period from surgery to mucocele diagnosis ranged from 2 months to 30 years, with a mean duration of 7.42 ± 7.35 years. Notably, 4 of these patients had undergone multiple surgical procedures. These findings are comparable to those reported by Devars du Mayne et al., who observed an average interval of 7 years (ranging from 4 months to 20 years) and Benkhatar et al. with the figure of 6.25 years (ranging from 11 months to 16,5 years), but shorter than the interval reported by Obeso et al., which was 15 years (ranging from 1 to 40 years) (5-7). A total of 12 out of 93 cases (12.9%) had a history of nasal or sinus trauma, with the interval from trauma to diagnosis ranging from 1.5 to 44 years (mean: 17.95 years), which is lower than the 25-year average reported by Obeso et al (5). These findings suggest that the onset of mucoceles following trauma tends to occur later compared to those following surgical interventions. Although the latency period

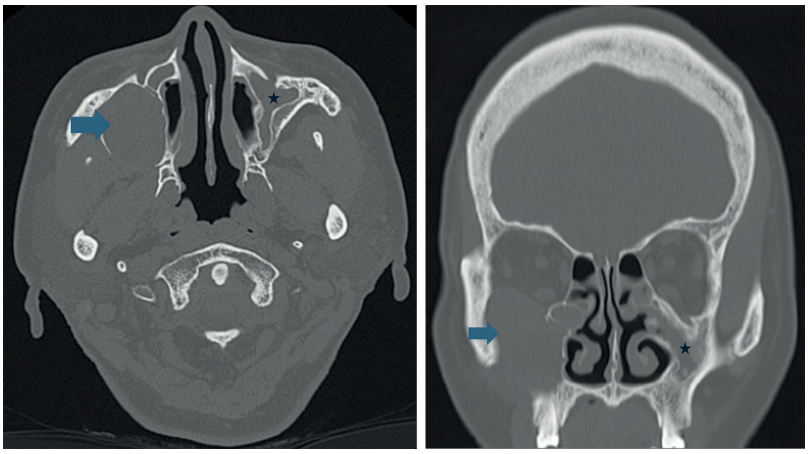

Figure 3. Mucocele of the Right Maxillary Sinus on Axial and Coronal CT Planes. Computed tomography (CT) scans reveal complete opacification of the right maxillary sinus (blue arrows), with evident expansion of the sinus walls and compression of the adjacent right orbital contents, suggestive of mass effect. The contralateral (left) maxillary sinus (asterisks) shows signs of mucosal thickening, inward retraction, and a bony defect in the anterior wall—likely sequelae of a Caldwell-Luc procedure performed two decades prior. The patient presented with right facial swelling and pain.

Table 5. Surgical Methods for Paranasal Sinus Mucoceles (n = 93)

Surgical Method	Site of Mucocele	Number of Cases	Percentage (%)
Isolated endoscopic approach	Maxillary sinus	8	8.6
	Ethmoid sinus	9	9.7
	Ethmoid-sphenoid / Sphenoid sinus	13	14.0
	Ethmoid-frontal and frontal sinus	37	39.8
Endoscopic + external approach	Maxillary sinus	12	12.9
	Ethmoid-frontal and frontal sinus	13	14.0
External approach	Frontal sinus (frontal craniotomy)	1	1.1

varies considerably between individuals, the majority of mucoceles present after a prolonged asymptomatic phase and manifest clinically only once they have progressed significantly.

Anatomical location of the mucocele

Frontal, ethmoidal, and frontoethmoidal sinus mucoceles accounted for the highest proportion in this study, comprising 64.5% of cases. This finding is consistent with prior studies, including those by Swain et al. (75.9%), Yoo-Suk Kim et al. (70.9%), and Varghese et al. (67.9%) (4, 8, 9). In general, previous research on paranasal sinus mucoceles has reported the frontal and frontoethmoidal sinuses as the most commonly affected sites, with prevalence ranging from 70% to 90% (10). Notably, our study observed a relatively higher incidence of maxillary sinus mucoceles (21.5%) compared to earlier reports, such as Yoo-Suk Kim et al. (5.2%) and Swain et al. (14.81%) (4).

Clinical presentations

Proptosis was the most frequently observed ocular symptom, present in 32.3% of cases. Although often the initial complaint leads to clinical evaluation,

proptosis typically represents a late-stage manifestation when the mucocele has eroded one or more orbital walls, such as the medial, inferior, or superior wall, resulting in anterior displacement of the globe. Previous studies have reported higher rates of proptosis, likely due to delayed diagnosis allowing orbital invasion. Blurred vision was also a common symptom, observed in 26.9% of patients, comparable to international literature. A literature review of 457 cases of paranasal sinus mucoceles reported visual impairment in 20.35% of patients (11) . However, 75% of patients were reported with this condition if related to posterior ethmoid sinus involvement (12). Facial pain or pressure was reported in 60.2% of cases, with a 100% prevalence in patients with maxillary sinus mucoceles, consistent with the findings of Plantier et al., who reported facial pain in 60.9% of cases (13). Headache was another frequently reported symptom (25.8%).

Mucocele extension pattern

Bony erosion of the medial orbital wall was observed in 39.8% of paranasal sinus mucoceles. When focusing specifically on ethmoid and frontoethmoid mucoceles, the rate of medial orbital wall destruction increased markedly to 71.8%, consistent with previously reported data (65.6%). This finding correlates with the high prevalence of ocular symptoms in patients with ethmoid and frontoethmoid mucoceles, accounting for approximately 65% (14). This correlates with the high prevalence of ocular symptoms in patients with ethmoid and frontoethmoid mucoceles, accounting for approximately 65%. In the maxillary sinus mucocele group, anterior wall erosion was observed in 25% of cases, comparable to the study by Steven C. Marks et al., which reported facial fistulas in 3 out of 9 patients (33.33%) with maxillary mucoceles (15). Orbital floor erosion caused by maxillary mucoceles was found in 20% of cases in our study, higher than the 7.1% reported by Fatma Caylakli et al., but lower than the 44.1% orbital compression rate reported by Chien-Chia Huang (16, 17).

Bacterial cultures

Positive bacterial cultures from mucoceles were obtained in 15 out of 93 cases (16.1%), predominantly isolating aerobic organisms such as *Staphylococcus aureus* (9.7%), including methicillin-sensitive *S. aureus* (MSSA, 6.5%) and methicillin-resistant *S. aureus* (MRSA, 3.2%), as well as *Corynebacterium pseudodiphtheriticum* and Gram-negative bacilli including *Escherichia coli*, *Serratia marcescens*, and *Pseudomonas aeruginosa*. These findings are comparable to those of Yoo-Suk Kim et al., who reported infection in 15.62% of mucoceles, with β-*hemolytic* α-*Streptococcus* as the most frequently isolated pathogen (33.33%), along with *Staphylococcus aureus* and coagulase-negative *Staphylococcus* species (8). In our study, *Staphylococcus aureus* was the most frequently isolated organism, consistent with findings by Itzhak Brook et al., who also reported the emergence of α-*hemolytic Streptococci*, *Haemophilus* spp., and Gram-negative bacilli (18). However, Busaba NY et al. reported α-*hemolytic Streptococcus* as the predominant pathogen in non-traumatic maxillary mucoceles (19). No anaerobic bacteria were isolated in our series, differing from the study by Itzhak Brook et al., which found anaerobes present in 42% of infected mucoceles (with 19% mixed aerobic/anaerobic and 39% exclusively anaerobic infections) (18). Common anaerobic isolates included *Peptostreptococcus* spp., *Prevotella* spp., *Fusobacterium* spp., and *Propionibacterium acnes*, suggesting a high prevalence of anaerobic involvement. The pathophysiology may be related to poor drainage and increased sinus pressure during the inflammatory phase, which reduces oxygen tension and pH, favouring anaerobic proliferation. The absence of anaerobic isolates in our study may be attributed to the lack of specific anaerobic culture protocols. Additionally, potential contamination by commensal flora, such as *Staphylococcus aureus*, *Corynebacterium* spp., and *Propionibacterium* spp., may contribute to the diversity of cultured organisms.

Surgical methods

All patients with maxillary sinus mucoceles in this study (100%) underwent endoscopic transnasal surgery, either alone or in combination with the Caldwell-Luc procedure. Among them, 30% received combined endoscopic (inferior meatal antrostomy, medial maxillectomy or isolated maxillary antrostomy) and Caldwell-Luc surgery, while

40% were treated solely by endoscopic transnasal approaches, including middle meatal antrostomy and/or inferior meatal antrostomy. Earlier studies reported higher rates of standalone Caldwell-Luc procedures for maxillary mucoceles, such as Steven C. Marks et al. (1997) reporting a rate of 66.7% (15). However, the endoscopic transnasal approach has gained favour in recent years due to its lower complication rates and reduced recurrence, as reflected in the studies by Chien-Chia Huang et al. (17.1%) and Fatma Caylakli et al., who reported no cases treated with Caldwell-Luc (16, 17). In our cohort, 50% of patients undergoing Caldwell-Luc had a history of prior sinonasal surgery, potentially influencing the decision to adopt a combined approach. Additionally, 50% of maxillary mucocele cases were treated using inferior meatal antrostomy, a figure comparable to the 53% reported by Chien-Chia Huang et al (17). In 2019, Motohiko Suzuki et al. demonstrated the efficacy of endoscopic inferior meatal antrostomy with a mucosal flap for secondary maxillary mucoceles post-Caldwell-Luc, showing promise in recurrence prevention (20). Of the 51 cases involving frontal and frontoethmoidal mucoceles, 13 (25.5%) underwent combined transnasal endoscopic surgery and external (Jacques) approach, while one case required a frontal craniotomy. The surgical approach was selected based on lesion location and extent, frontal sinus anatomy, surgeon experience, available instrumentation, and the presence of cutaneous fistulas. Among the 13 cases treated via the combined endoscopic-Jacques approach, 9 exhibited anterior wall erosion of the frontal sinus, 8 presented with frontal or medial canthal swelling, and 6 were recurrent cases (since several cases exhibited bony erosion with extension into more than one adjacent anatomical structure). Two patients underwent Draf III procedures in combination with the Jacques approach, specifically one for recurrence 7 months post-surgery and another following post-traumatic mucocele development. These findings align with those of Rataphol Chris Dhepnorrarat et al., who reported that 3 out of 44 cases required combined endoscopic and external approaches due to recurrence or frontal recess restenosis following prior interventions (21).

Recurrence status

In our study, the overall recurrence rate of paranasal sinus mucoceles was 15.1%. Of these, 7 cases (7.5%) had a prior history of mucocele surgery, while another 7 cases (7.5%) experienced recurrence during postoperative follow-up at our hospital. These included one case of bilateral maxillary mucoceles treated with bilateral middle and inferior meatal antrostomies, five cases of frontal mucoceles (three treated with Draf IIa, one with Draf IIb, and one with a combined endoscopic and external Jacques approach), and one case involving the sphenoid sinus. Reported recurrence rates vary across studies: Sergio Obeso et al. reported 10%, Devars du Mayne et al. 23.5%, George A. Scangas et al. 9%, Plantier DB et al. 15,2% (3, 5, 7, 13). When comparing surgical approaches, our study found a recurrence rate of 9% in the endoscopic group, which was higher than the 4% observed in the combined (endoscopic and external) approach group. This contrasts with prior studies where recurrence rates were typically higher in the combined or external approach group, such as in the studies by Sergio Obeso et al. (17% vs. 5%) and George A. Scangas et al. (25% vs. 8.9%) (3, 5). However, other reports have not demonstrated a statistically significant association between surgical technique and recurrence rate. Notably, combined or external approaches are often reserved for more complex or extensive mucoceles, potentially contributing to higher recurrence in those cohorts. The mean time to recurrence in our study was 2.52 years (approximately 30.23 months), with a range from as early as 2 months to as late as 6 years postoperatively. This duration differs from other reports, such as Devars du Mayne et al. (7 years average), George A. Scangas et al. (3.8 years average, particularly 3.7 years for endoscopic and 4 years for external procedures), and Raghunath D. Shanbag et al. (2.5 years average) (3, 7, 22).

Conclusions

Paranasal sinus mucoceles frequently manifest with ophthalmologic symptoms such as proptosis and blurred vision. Radiological evaluation should be promptly considered in patients presenting with

ocular complaints to exclude underlying sinus pathology. Endoscopic surgery is effective in the majority of cases; however, lesions with extensive anatomical involvement or recurrence may require a combined endoscopic and external approach. Early detection of recurrence remains a clinical challenge. Therefore, long-term, structured follow-up is essential to identify asymptomatic lesions and prevent complications related to delayed diagnosis and compression of adjacent structures.

Ethic Approval: The study was approved by the Ethics Committee of the University of Medicine and Pharmacy at Ho Chi Minh City (Reference No.770; Year: 2023).

Conflict of Interest: All authors declare that they have no financial or commercial relationships—such as consultancies, stock ownership, equity holdings, or patent/licensing agreements—that could be perceived as potential conflicts of interest related to the content of this manuscript.

Authors Contribution: T.A.B.: Drafting the manuscript, Review; L.N.U.C.: Data collection, Literature review; P.H.N.: Data collection, Methodology; H.V.A.: Imaging analysis, Case selection; T.G.H.: Surgical data analysis, Visualization; T.D.H.: Supervision, Review, Editing; N.C.H.T.N.C.T.: Supervision, Conceptualization, Final approval of the manuscript.

Declaration on the Use of AI: None.

Acknowledgments: The authors would like to express their sincere gratitude to the outpatients and clinical collaborators for their participation and support in this study. Special thanks are also extended to Can Tho University of Medicine and Pharmacy and the University of Medicine and Pharmacy at Ho Chi Minh City for their institutional assistance and encouragement throughout the research process.

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Received: 25 July 2025
Accepted: 5 November 2025
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