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Research Article

Incidence of Accessory Maxillary Ostia in Patients of Rhinosinusitis: A Clinical Study

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Abstract

The incidence of an accessory maxillary ostium (AMO) varies depending on the population and the method used to detect it. In general, AMOs are considered to be relatively rare, with an incidence of 1-2% in the general population. However, the incidence may be higher in certain groups, such as patients with chronic sinusitis or polyposis. The degree of association between Rhinosinusitis and presence of accessory maxillary ostium is still a point of debate. It can vary depending on the population being studied and the method of diagnosis. Some studies have found a prevalence of accessory maxillary ostium varies from 2-25%, while others have reported rates as high as 44%. Factors such as genetics, race, and sex may also play a role in the development of an accessory maxillary ostium. It is not clear whether maxillary accessory ostia are congenital or acquired. Some studies claim that they develop following maxillary sinusitis.

Aim and Objective: To determine the incidence of accessory maxillary ostia in patients of rhinosinusitis. To determine the correlation of accessory maxillary ostia and rhinosinusitis.

Methods: A total of 100 consecutive diagnosed patients of Chronic Rhinosinusitis attending E.N.T OPD were enrolled in the study and the correlation between accessory maxillary ostium and rhinosinusitis is assessed.

Results: Most common presenting symptoms were nasal obstruction (83%) while anosmia (9%) was the least common. The other complaints were repeated rhinitis (79%), post nasal drip (75%), nasal discharge (73%), headaches (69%) and facial pain (41). 20% of those patients with chronic rhinosinusitis (CRS) had an accessory maxillary ostium ($p < 0.001$).

Conclusion: To conclude, from our study we can say that patients with chronic rhinosinusitis (Both CRSwNP and CRSsNP) had higher incidence of an accessory maxillary ostium. Presence of accessory maxillary ostium (AMO) requires it's meticulous removal.

Keywords: Chronic Rhinosinusitis; Maxillary Sinus; Accessory Maxillary Sinus Ostia

Abbreviations

CRS: Chronic Rhinosinusitis; ARS: Acute Rhinosinusitis; CRSwNP: Chronic Rhinosinusitis with Nasal Polyposis; CRSsNP: Chronic Rhinosinusitis without Nasal Polyposis; AMO: Accessory Maxillary Ostium

Introduction

Rhinosinusitis is a condition characterized by inflammation and infection of the nasal passages and surrounding sinuses. The chronic nature of the condition can lead to increased illness and

absenteeism from work and school, negatively impacting the patient's overall health, economic well-being, and quality of life. Through the process of evolution, the primary opening for the maxillary sinus, known as the principal maxillary ostium, has shifted to a higher location due to the development of an upright posture in humans [1]. The change in posture as a result of evolution has led to a shift in the location of the principal maxillary ostium to a higher level, where gravity can no longer aid in drainage. This, coupled with disruptions in the mucociliary action of the mucosa lining the maxillary sinus, is a major contributor to blockages in the ostium within the osteomeatal complex [2-4]. The development of maxillary sinusitis can be attributed to the shift in posture from quadrupedal to erect, which caused the drainage of the maxillary sinus to no longer rely on gravity. The obstruction of the ostium at the level of the osteomeatal complex (OMC) is caused by this shift in posture and the disruption of the mucociliary action of the maxillary sinus lining mucosa. It is not entirely clear if maxillary accessory ostia are present at birth or develop later as a result of maxillary sinusitis. Some studies suggest that they are a result of anatomic variations or anomalies near the Primary Maxillary Ostium (PMO), a concept first proposed over a century ago by Zuckerkandl. The process of evolution is gradual and ongoing [3,5,6] The evolution of human posture brought about a shift in the location of the primary maxillary ostium, leading to changes in the way the maxillary sinus drains. The change in location, combined with issues with mucociliary clearance, can cause obstruction at the osteomeatal complex and lead to maxillary sinusitis. The formation of accessory ostia, which are additional openings in the sinus, may be a result of obstruction in the main ostium due to factors such as anatomic variations or pathology. These accessory ostia can mimic the formation of perforations in the ear drum seen in cases of acute suppurative otitis media [2,3,7]. Chronic rhinosinusitis is a group of disorders characterized by inflammation of mucosa of nose and paranasal sinuses for at least 12 consecutive weeks [7-9]. Patients with CRS may have intermittent acute flare ups; in such cases the disorder is called as acute exacerbation of chronic rhinosinusitis.

Chronic rhinosinusitis (CRS) is a complex condition that is caused by a variety of factors. Studies have shown that the most commonly found organisms in CRS are *Staphylococcus* species (55%) and *S. aureus* (20%). Additionally, high prevalence of Enterobacteriaceae, anaerobes, gram-negative bacteria, and fungi have also been found in CRS. One possible mechanism of pathogenesis in CRS is through the release of exotoxins of bacterial superantigens, which can trigger an aggressive inflammatory response. The presence of bacterial biofilms, which are clusters of microbial cells in a self-produced matrix, have also been associated with CRS. Furthermore, CRS may also be caused or exacerbated by allergies, through mechanisms such as inflammation caused by allergies or obstruction of sinus ostia due to nasal inflammation and swelling leading to infection [8,12]. Some studies have shown a high prevalence of Enterobacteriaceae organism, anaerobes, gram negative bacteria and fungi [4,9,13,14].

Host Factor	Environmental	Local
Systemic	Microorganisms – viral, bacterial, fungal	Anatomic
Allergic/immunologic	Trauma	Neoplastic
Genetic/congenital	Noxious chemicals/pollutants/smoke	Acquired mucociliary dysfunction
Mucociliary dysfunction	Iatrogenic	
Endocrine	Medication	
Neuromechanism	Surgery	

Table 1: Factors Associated with CRS [6,10,11].

Acute exacerbation of chronic rhinosinusitis

Acute exacerbation of chronic rhinosinusitis (CRS) is a sudden worsening of symptoms that are typically already present in CRS. These symptoms may include increased nasal discharge, which may become more purulent, increased nasal congestion, and a further loss of smell. Additionally, there may be systemic symptoms such as fatigue, malaise, and even fever. Acute bacterial rhinosinusitis (ABRS) is primarily associated with aerobic organisms, while CRS is associated with a high proportion of gram-negative organisms and anaerobes. Acute exacerbation of CRS is associated with both. With treatment, patients tend to return to their steady state of CRS [6,10,15].

Nasal fontanelle/Accessory ostium/Ostium Maxillare Acessorium

Just posterior to maxillary sinus ostium and inferior to lamina papyracea is the membranous wall called nasal fontanelle

that separates the maxillary sinus from the nasal cavity. They lie immediately anterior (anterior fontanelle) and posterior (posterior fontanelle) to the inferior aspect of the uncinate process. The posterior fontanelle is much larger and more distinct than its anterior counterpart. The dimensions are 1.3 x 5.6 mm Antero posteriorly and 1.1 x 2.5 mm vertically. The shape of the anterior fontanelle is triangular, bounded by the lower border of the uncinate process superiorly, the superior border of the inferior concha inferiorly, and the lacrimal bone anteriorly. The boundaries of the posterior fontanelle are as follows; the posterosuperior border of the uncinate process anteriorly, the perpendicular plate of the palatine bone posteriorly, the orbital floor, the lower horizontal portion of the bulla ethmoidalis and the horizontal portion of the ground lamella of the middle turbinate superiorly, and the superior border of the inferior turbinate inferiorly. There are two methods for distinguishing the anterior and posterior fontanelle. Yamashita., *et al*. divided the anterior and posterior fontanelles using a vertical line passing the conchal process of the uncinate process, and therefore the natural ostium of the maxillary sinus could be located at the anterior fontanelle [1,6,10,16]. However, because Hosemann and Stammberger., *et al*. used the uncinate process itself as a borderline dividing the anterior and posterior fontanelles [1]. By their definition the natural ostium could be located at the most anterior portion of the posterior fontanelle [1,17]. There were three major fontanelle shapes when observed from the medial aspect to the lateral: triangular, pencil-like, and oval. In the triangular type, the posterior height was higher than the anterior height, while the anterior and posterior heights of the pencil-like type were almost the same. The pencil-like type had an anterior end that was similar in shape to the blunt tip of a pencil. However, in the oval type, the mid portion of the fontanelle was the highest, with less anterior and posterior height. The triangular type was the most common (57.3%), followed by the pencil-like type (25%), and the oval type (17.7%). The anteroposterior length of the whole fontanelle was 18.1 ± 3.8 mm (mean ± SD) and the greatest height of the whole fontanelle was 9.2 ± 2.2 mm. These data show that the height of the anterior end was less than the posterior end in most cases. The triangular type is the most common [17,18].

Maxillary sinus ostium (Principal ostium/Natural ostium)

The natural maxillary ostium is located on the medial wall of the maxillary sinus. It is usually found in the posterior half of the ethmoidal infundibulum, or behind the lower third of the uncinate process, intranasally. The posterior edge of the natural maxillary ostium is continuous with the lamina papyracea, making it a reliable landmark for the lateral limit of surgical dissection. It is shaped like an elliptical cleft with a long sagittal axis, but it can also be circular or kidney shaped. The smallest ostium in Lang's report had a diameter of 3 mm, the largest had a diameter of 19 mm, and the width was 5 mm. If an ostium is less than 3 mm in diameter, Simon classifies it as canal type. In 83% of cases, he reported the canal type. The ostium size averages 2.4 mm but can vary from 1 to 17 mm. The ostium is much smaller than that of actual bony defect, as mucosa fills this area and defines the extent of the opening. Most of the time maxillary ostium is hidden behind the uncinate process and therefore cannot be visualized endoscopically [1,2,6,10].

Nasal fontanelle/Accessory ostium/Ostium Maxillare Acessorium

The nasal fontanelle is a thin, membranous wall located just behind the maxillary sinus opening and below the lamina papyracea. It separates the maxillary sinus from the nasal cavity, and it is divided into two sections: the anterior fontanelle and the posterior fontanelle. The posterior fontanelle is larger and more distinct than the anterior fontanelle. The boundaries of the anterior fontanelle are determined by the lower border of the uncinate process, the superior border of the inferior concha, and the lacrimal bone. The boundaries of the posterior fontanelle are the posterosuperior border of the uncinate process, the perpendicular plate of the palatine bone, the orbital floor, the lower horizontal portion of the bulla ethmoidalis, and the horizontal portion of the ground lamella of the middle turbinate. There are different methods for distinguishing the anterior and posterior fontanelles, some authors use a vertical line passing the conchal process of the uncinate process, others use the uncinate process itself as a border. The fontanelle can have different shapes when observed from the medial aspect to the lateral, including triangular, pencil-like, and oval. The triangular shape is the most common, with a higher posterior height than the anterior height. Accessory ostia, additional openings that may form as a result of infection, are often found in the fontanelle and are more common in patients with *rhinosinusitis. Different* techniques have been proposed for determining the location of the anterior and posterior fontanelles. One approach, proposed by Yamashita., *et al*. uses a vertical line

passing through the conchal process of the uncinate process to divide the two sections, with the natural ostium of the maxillary sinus located in the anterior fontanelle. However, another method, as proposed by Hosemann and Stammberger., *et al*. uses the uncinate process as a dividing line, placing the natural ostium in the most anterior part of the posterior fontanelle. These different methods demonstrate the significance of understanding the various techniques and considering the specific context when determining the location of the natural ostium of the maxillary sinus [12]. There were three major fontanelle shapes when observed from the medial aspect to the lateral: triangular, pencil-like, and oval. In the triangular type, the posterior height was higher than the anterior height, while the anterior and posterior heights of the pencil-like type were almost the same. The pencil-like type had an anterior end that was similar in shape to the blunt tip of a pencil. However, in the oval type, the mid portion of the fontanelle was the highest, with less anterior and posterior height. The triangular type was the most common (57.3%), followed by the pencil-like type (25%), and the oval type (17.7%). The anteroposterior length of the whole fontanelle was 18.1 ± 3.8 mm (mean ± SD) and the greatest height of the whole fontanelle was 9.2 ± 2.2 mm. These data show that the height of the anterior end was less than the posterior end in most cases [1,10,17].

When examining the anterior fontanelle in a coronal section, a thick layer of connective tissue is observed between the two epithelial layers of the nasal cavity and the maxillary sinus. However, the posterior fontanelle has a thinner layer of connective tissue when compared to the anterior section. It is in the fontanelle that accessory ostia are commonly found, which are thought to be caused by infections. These accessory ostia indicate previous sinus disease. Although it is difficult to determine the exact prevalence, it is estimated to be around 4-5% in the general adult population and can increase to 25% in patients with rhinosinusitis [10,17-19].

Sr No	Principal maxillary ostium	Accessory maxillary ostium
1	Always present.	Present in about 10-40 percent.
2	Very difficult to see clinically.	Easily seen on endoscopy.
3	Lies deep in the infundibulum	Lies in sagittal plane in fontanelle
4	Usually, oval shaped	Usually round and punched out appearance
5	Always single	Could be multiple.
6	Lies at the level of middle turbinate or upper border of inferior turbinate	Lies anywhere in the middle meatus in anterior or posterior fontanelle.
7	Usually quite small in diameter	Could be large up to half to one centimetre

Table 2: Difference between principal maxillary and accessory maxillary ostium.

Physiology – Mucociliary Clearance Of The Paranasal Sinuses [1]

The flow of mucus in the sinuses is directed towards the ostium, where it leaves the sinus cavity. However, the creation of additional ostia can impede this process and cause ineffective drainage. The movement of mucus in the sinuses was first studied and described by Hilding, whose findings are still considered valid today. Another issue, known as stagnation, can occur when surfaces with cilia come into contact and interfere with the normal flow of mucus, leading to sinusitis. The recovery from sinusitis is accomplished by restoring the normal flow of mucus, referred to as mucociliary clearance [1,10,20].

The mucus in the frontal sinus is cleared by the cilia by moving along the top of the sinus and then towards the openings (ostia) by moving along the side and front walls. Recirculation of the mucus in the frontal sinus can cause sinus infections. In the maxillary sinus, the mucociliary movement starts from the bottom of the sinus and moves upwards along the wall of the sinus towards the ostium.

An inferior antrostomy is a surgical procedure in which antral windows are created to improve drainage from the sinuses. Even after this procedure, the mucus in the frontal and maxillary sinuses will still move upward towards the natural opening, as they are dependent on other structures such as the ethmoid and lateral nasal wall prechambers which control their movement. This movement will persist even with the creation of antral windows.

Figure 1: Mucociliary clearance of Maxillary Sinus.

Figure 2: Endoscopic view Left maxillary accessory ostium.

Materials and Methods

- **Study Title:** Incidence of Accessory Maxillary Ostia in Patients of Rhinosinusitis: A Clinical Study.
- **Type of Study:** Descriptive Longitudinal Study.
- **Duration of study:** 24 months.
- **Study period:** 1st November 2020 to 1st November 2022
- **Sample Size:** 100
- **Study group:** The study subjects comprised patients above 15 years, fulfilling the criteria for diagnosis of CRS. Patients attending ENT Department of Otorhinolaryngology
- **Study Setting:** All patients with chronic rhinosinusitis [CRSsNPs] by diagnostic nasal endoscopy (standard three pass technique) were enrolled in the study from November 2020 at the Department of Otorhinolaryngology. After obtaining a well-informed consent, patients were included and subjected to the following inclusion and exclusion criteria.

Ethical Clearance is obtained from the ethical committee of Dr.B.V.P Rural Medical College Loni

Inclusion Criteria

- Diagnosed patients of Chronic rhinosinusitis in ENT OPD,
- All patients with sinusitis symptoms, infective and allergic etiology, and symptoms lasting for at least 12 weeks
- Endoscopic and radiological evidence of sinusitis.

Exclusion Criteria

- Patients below 15yrs of age.
- Patients with nasal structural abnormalities such as Gross Deviated nasal septum
- History of previous nasal surgery
- Growth in the nasal cavity, benign or malignant, except nasal polyps.
- Pregnant or lactating female patients
- Non-invasive fungal balls**.**

Results and Discussion

Total of 100 patients were examined by nasal endoscopy under local anesthesia, suffering from recurrent rhinological symptoms during the period from July 2020 to July 2022.

The patient's ages ranged from 14-67 years with a mean age of 40.5 years. Maximum incidence of rhinosinusitis was found in fifth decade (30%) followed by fourth decade (26%) and least in second decade (5%). In our present study, there was no statistical significance regarding age.

Sex	Frequency	Percentage
Female	39	39%
Male	61	61%
Total	100	100%

Table 3: Sex Distribution.

In our study, the most common presenting symptoms was nasal obstruction (83%) and least common was hyposmia (9%). The other symptoms included recurrent rhinitis (79%), postnasal drip (75%), nasal discharge (73%), headache (69%), and facial pain (41%). In our present study, there was no statistical significance regarding sex distribution.

Graph 1: Sex Distribution.

In our present study, the most common presenting symptoms were Nasal obstruction (83%), Recurrent rhinitis (79%), POST-NASAL DRIP (75%) and Anterior Nasal Discharge (73%) all the symptoms were noted and tabulated pre-operatively. Hyposmia was the least common presenting symptom with 9%.

SR NO	Symptom	Percentage
1	Nasal obstruction	83%
2	Recurrent rhinitis	79%
3	Post-nasal drip	75%
4	Anterior nasal discharge	73%
5	Headache	69%
6	Facial pain	41%
7	Anosmia/hyposmia	9%

Table 4: Distribution of Nasal Symptoms.

In our present study out of one hundred patients, twenty-four accessory ostia [R:12; L:12] were found in twenty patients (20%). All accessory ostium were round (100%) in shape. Accessory maxillary ostium was found in posterior fontanelle in eighteen patients (18%) and in anterior fontanelle in one patient (1%).

Graph 2: Distribution of Nasal Symptoms (Major).

Accessory maxillary ostium	Right		Left		Total no of patients with AMO
	AF	PF	AF	PF	
Frequency	3	9	2	6	20
Percentage	3%	9%	2%	6%	20%

Table 5: Distribution of Accessory Maxillary Ostium.

Graph 3: Number of Patients with Accessory Maxillary Ostia.

Discussion

It is well known fact that rhinosinusitis is one of the most common reasons an individual seeks medical care. The prevalence and incidence of rhinosinusitis is showing an increasing trend worldwide with about 31 million people suffering from it in USA [21]. Although there is a dearth of such data from India, it can safely be presumed that the same scenario also prevails in India. If an assumption is made that 90% of patients with colds suffer from

sinusitis (bacterial or viral) then it can be estimated that in India there are over 5 billion cases of viral and bacterial rhinosinusitis annually. The incidence of chronic sinusitis in India is 136657953 out of 1,065,070,607 population (12.83%) [21]. Impaired drainage and reduced ventilation of the paranasal sinuses are known to increase the risk of a more long-standing inflammatory process. Since the beginning of the endoscopic era in the field of rhinology, the term 'accessory ostium' has been frequently emphasized. Maxillary accessory ostium the defects in the region of fontanelle is one of the anatomical variations that may play a role in the development of chronic maxillary rhinosinusitis [5,6,18].

In our study we examined 100 patients fulfilling the internationally accepted criteria for diagnosis of rhinosinusitis at Dr.B.V.P.P R.M.C Loni,B.K. Out of hundred patients 61 were male (61%) and 39 were females (39%) aged 14 to 67 years with mean age 40.5 yrs. Though maximum incidence of rhinosinusitis was seen in fifth decade (30%), there is no specific age range predisposing for rhinosinusitis as third and fourth decade had incidence of 22% and 26% respectively. These results go in hand with Reh., *et al*. who stated that older patients had scores similar to younger patients with regards to age range.

Most common symptom was nasal obstruction (83%) while anosmia (9%) was the least common. The other complaints were repeated rhinitis (79%), post nasal drip (75%), nasal discharge (73%), headaches (69%) and facial pain (41). Though Tomassen., *et al*. suggest that a symptom-based definition of chronic rhinosinusitis has a moderate reliability over time, is not influenced by presence of allergic rhinitis and is suitable for epidemiological assessment of geographic variation in prevalence of rhinosinusitis. Accessory maxillary ostia found in 20% of patients. This is to some extent in agreement with Mladina., *et al*. who reported incidence of accessory maxillary ostia in 19.3% of patients of rhinosinusitis with post nasal drip and 0.48% in healthy individuals [22]. He reported that fontanelle defect is not a physiological AO because if it was just an individual anatomical variation, we should be able to find it in many subjects with otherwise healthy maxillary sinuses [22]. He also stated that the defect of the posterior fontanelle indicates chronic maxillary sinusitis, just like a defect of ear drum which indicates chronic otitis media. Jog and McGarry in their study reported accessory maxillary ostia in 8% patients with rhinosinusitis, while 2% in otherwise healthy individuals [23]. Our results agreed with Anon., *et al*. who reported incidence of accessory ostia in 20% to 50% of his patients [24]. The difference may be due to larger study sample size. Stammberger and Kennedy (1995) reported incidence of accessory ostia in 25% to 50% patients of rhinosinusitis and 4.5% in general population. Ahmed Hussein reported incidence of accessory ostia in 32% patients with rhinosinusitis and in 3.45% healthy individuals, also stated there is definite association between isolated maxillary sinusitis and presence of accessory maxillary ostium [25].

Various authors reported the incidence of accessory ostia in cadaver studies ranges between 0 to 43% as follows, Schaeffer [26] (1921)-43%, Myerson [27] (1932)- 30.7%, Van Alyea 62 (1936)-23%, May., *et al*. [28] (1990)-10% (in endoscopic cadaver study), [26], Kumar65 (2001)-30%, Manjula Patil [29] (2012)-26%. All of them found it to be high, but with no data about whether or not investigated subjects suffered from rhinosinusitis. Rates were generally higher in cadaver studies, as moist nasal mucosal tissue can shrink after death because of drying and fixing process, making accessory ostia more obvious. Compared to cadaver studies fewer accessory ostia were found in vivo studies, as these are covered with thin film mucus and are in inaccessible locations [1,30].

Van Aleyea in his study found that, PMO is not approachable in few cases due to variation in the configuration of uncinate process or bulla ethmoidalis. In such cases when AMO is present clinically; it can utilized to cannulate the maxillary sinus by nasal endoscopy [1,10,25,27].

In our study single accessory ostium were found in sixteen patients (80%), while double accessory ostia were found in four patients (20%). Ahmed Hussein reported double accessory ostia in 11.11% of his study population while, Mladina., *et al*. found accessory ostia in 68.3% [22,25]. The difference may be due to large sample size. No study ever reported three or more accessory ostia in unilateral fontanelle.

In our study fifteen patients had accessory ostium in the posterior fontanelle (75%), and five patients had in anterior fontanelle (25%). These results agreed with Jog and Mc Garry study, who stated that the accessory ostia of maxillary sinus, were generally found in the posterior fontanelle and its appearance in

the anterior fontanelle was much less frequent in their experience [23,25]. Mladina., *et al*. not reported a single accessory ostium in anterior fontanelle, as all were in posterior fontanelle. Posterior fontanelle is the most common site for accessory ostium can be explained as posterior fontanelle is bigger in size than anterior fontanelle and the thickness of posterior fontanelle is less than the anterior fontanelle [25]. JH Yoon did histological examination coronal sections of anterior and posterior fontanelle [17,25]. On histological examination of anterior coronal section he found, a thick layer of connective tissue between the two epithelial layers of the nasal cavity and maxillary sinus [17,25]. However in the histological examination of posterior coronal section, a thinner layer of connective tissue is observed compared with the anterior section [17,25]. Suggests that anterior fontanelle is thicker than posterior fontanelle. As discussed earlier in case of maxillary sinus empyema, there is no way out for the overwhelming amount of pus since the natural ostium has already been blocked. The only way out for the pus which is under rising pressure is by perforating the thinnest part of the fontanelle which has less connective tissue in between two mucosal surfaces, that is why the accessory ostia are more common in posterior fontanelle [31]. Genc., *et al*. in his study reported development of accessory maxillary ostium following induced experimental acute sinusitis in 40% of rabbits, which supports that accessory ostium may develop secondary to disease process [25].

Out of twenty patients twelve accessory ostia were right (60%) sided and eight were left (40%) sided. But in literature there is no evidence of common laterality of AMO.

In our study there was no bilateral accessory maxillary ostium. Though Mladina., *et al*. reported 57.5% accessory ostia bilaterally. This difference may be because of larger sample size of his study [10,25]. All accessory ostia were round in shape.

In our study recirculating mucus ring from principal maxillary ostium to accessory maxillary ostium was not seen. But mucus streaks covering the accessory ostia were seen in three patients (15%).

Conclusion

- The accessory ostia are found in 20% of patients suffering from rhinosinusitis.
- Accessory maxillary ostia in posterior fontanelle region are more common than anterior fontanelle.
- Accessory maxillary ostia are usually single and are mostly round in shape.
- Accessory maxillary ostia could serve as maintainers of chronic inflammation and infection of paranasal sinuses especially maxillary sinus; suggests close association between rhinosinusitis and accessory maxillary ostia.
- It appears that the sinus drainage via natural ostium is more essential and mandatory than sinus aeration, because of the higher incidence of maxillary sinusitis in sinuses being better ventilated via accessory ostia.

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