The Association Of Maxillary Accessory Ostia With Chronic Rhinosinusitis What is essential; ventilation or drainage.

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Abstract: Objectives: The study aimed to assess the role of the maxillary sinus accessory or secondary ostia in the pathophysiology of chronic maxillary sinusitis, and to solve the argument between surgeons as regards the close association between isolated maxillary sinusitis and the presence of accessory maxillary ostia and for a healthy sinus; drainage or ventilation is required. **Patients &Methods**: The study included 54 patients of both sexes with chronic or recurrent rhinological symptoms. All patients underwent examination by rigid nasal endoscopy (0&30 degree) for inspection of the inside of the nasal cavity and the lateral nasal wall. Computed tomography of the paranasal sinuses in the direct coronal plane without contrast was done for all patients pre-operatively after adequate medical treatment. Then, the patients had been classified into two groups; group A (with radiological finding of isolated maxillary sinusitis) which include 25 patients, group B (without radiological finding of maxillary sinusitis) either radiologically free or with anatomical variation as deviated septum, concha bullosa and/ or hypertrophied turbinates), which include 29 patients. The patients in each group had been classified into two subgroups according to the presence or absence of accessory ostium (AO); -Subgroups I (A-I and B-I with AO) -Subgroups II (A-II and BII without AO).Twenty six patients (25 patients from group A with isolated maxillary sinusitis and one patient from group B with accessory ostium) underwent middle meatal antrostomies (MMA) under general anesthesia with hypotensive technique. The accessory ostium was connected to the natural ostium, the size of the created opening was around 8-10mm. Surgery was tailored according to the individual pathology as evidenced by the CT scan, the preoperative and operative findings. Post-operative evaluation was done for patients through systematic nasal endoscopy and sinuscopy over 2 years. **Results:** The patient's ages ranged from 13-47 years with a mean age of 26 years. Twenty six patients were males (48.1%) and the other twenty eight were females (51.9%).Twenty six patients underwent MMA (48.1%)**.**A healthy middle meatus (MM) with no evidence of stenosis was noted in all cases operated upon. No adhesion or granulation tissue was present in the MM. There was no crust or discharge in the area. The surgical area had healed completely and lined with normal healthy mucosa. All widened ostia remained patent and healthy. The widened MO was patent in all cases. There was a statistically significant difference between presence and absence of AO in each group in the study, (P<0.05)**.**There was no statistically significant difference between group A and group B as regard the main complaint (P>0.05). There was no statistically significant difference between group (A-I) and group (B-II) as regard the main complaint (P>0.05). The circulating mucous (circular flow) was found in two patients (22.22%) out of 9 patients exhibiting accessory ostium (AO). **Conclusion:** It could be concluded that there is a close association between isolated maxillary sinusitis and the presence of accessory maxillary ostia as the fontanelle defects could serve as maintainers of a chronic inflammation of the maxillary sinus. Also it appears that the sinus drainage via the natural ostium is more essential and mandatory than sinus aeration, in contrary with the condition in the middle ear cleft where the aeration is the most essential because of the higher incidence of chronic maxillary sinusitis (CMS) in the sinuses being better ventilated via AO.
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1. Introduction

Chronic rhinosinusitis (CRS) is a multifactorial disease. Factors contributing can be mucociliary impairment, bacterial infection, allergy, or anatomical variations in the nasal cavity. The ostiomeatal complex, a functional unit of the paranasal sinuses plays a key role in the pathogenesis of rhinosinusitis, **Simmen** [(23)]**.** Chronic rhinosinusitis (CRS) is characterized by mucosal inflammation affecting both the nasal cavity and paranasal sinuses; **Marple *et al.*** [(17)]**.**

Computed tomography (CT) is the gold standard for investigation of inflammatory sinus disease, **Hagtvedt *et al.*** [(7)]**.** Nasal endoscopy has multiple uses in both the medical and surgical management of chronic rhinosinusitis. Nasal endoscopy is the standard for tissue sampling, evaluation of the mucosa and identifying structural alterations, **Kuhn** [(15)].

Maxillary sinusitis is a common condition. Impaired drainage and reduced ventilation of the paranasal sinuses are known to increase the risk of a more long-standing inflammatory process, **Kennedy *et al.* [12].** The ostium must be patent to maintain flow from the sinus into the nasal cavity and maxillary sinusitis is most often due to obstruction of the maxillary sinus ostium (MO), **Messerklinger [18].**
Functional endoscopic sinus surgery (FESS) is a new and exciting treatment for chronic sinusitis. It has become an increasingly popular treatment for chronic inflammatory paranasal sinus diseases. The basic purposes of FESS are to restore the diseased ostio-meatal complex (OMC) and to re-establish ventilation and drainage of the dependent larger sinuses, **Kennedy *et al.* [14].** The goal of FESS is to restore normal mucociliary flow in the sinus. It was proved that normal mucociliary clearance (MCC) is directed towards the natural ostium and surgery that relieves obstruction in this area is supportive of the sinus returning to normal, with restoration of normal mucociliary function, **Stammberger [24]**. The endoscopic middle meatal maxillary antrostomy (MMA) is one of the most commonly performed endoscopic procedures, and had been accepted as a minimally invasive technique for the treatment of chronic and recurrent acute maxillary sinusitis resistant to medical therapy. It restores sinus drainage and ultimately improves sinus mucociliary function. It promotes sinus ventilation and preserves sinus mucosa, **Stammberger [25].** Despite this, we commonly see failed antrostomies requiring revision surgery, **Kennedy and Adappa [13].**

Although anatomic variations of the nasal area are rarely encountered, they are important as they may lead to serious clinical consequences or to difficulties during surgical procedures, **Kantarci *et al.* [11]. S**ince the beginning of the endoscopic era in the field of rhinosinusology, one term has been frequently emphasized: the “accessory ostium” of the maxillary sinus, **Joe *et al.* [8]**. Maxillary accessory ostium is one of the anatomical variations that may play a role in the development of chronic maxillary sinusitis. Although some authors claim that accessory ostia develop following acute maxillary sinusitis, it is not clear whether they are congenital or acquired, **Genc *et al.* [5].** A possible mechanism of formation of accessory ostia is obstruction of the primary ostium by maxillary sinusitis or due to anatomic and pathologic factors in the middle meatus resulting in the rupture of membranous areas known as fontanel, **Kumar *et al.* [16].** The health and normal function of the paranasal sinuses and their lining mucous membranes depends primarily on two important factors: ventilation and drainage. Normal ventilation of the sinuses requires both a patent sinus ostium and a patent pathway (prechamber) connecting the ostium to the nasal cavity, **Stammberger and Hawke [27].** Normal drainage of the sinuses is a complex function of both the production of mucous (mucous secretion) and the ciliary mechanisms that transport the mucous through and out of the sinuses and into the nasal cavity (the mucociliary transportation mechanism). Normal drainage of the mucous from the sinuses depends to a large extent on the amount of mucous produced , its composition, the effectiveness of ciliary beat, mucosal resorption and the condition of ostia, **Stammberger and Hawk [27].** Defects in the fontanelle region of the lateral nasal wall have been described as "accessory" or "secondary" ostia, **Mladina *et al.* [19]**. Recirculation of nasal mucus occurs when secretions that have been transported out of the natural maxillary ostium return to the sinus via a surgically created or accessory ostium. Recirculation increases the risk of persistent sinus infection, **Gutman and Houser [6]**. Recirculation of mucus between adjacent openings into the maxillary antrum is a relatively common cause of persistent sinusitis in either the pre- or postsurgical patient. The condition is easily diagnosed with the nasal endoscope, **Kane [10].**

There is a great controversy among investigators as regard the possible role of the maxillary accessory or secondary ostia in the pathophysiology of chronic rhinosinusitis, and what is essential for the functioning maxillary sinus; sinus ventilation or sinus drainage.

In this study we try to solve for the first time, to our knowledge the argument between surgeons as regards the close association between isolated maxillary sinusitis and the presence of accessory maxillary ostia and for a healthy sinus; drainage or ventilation is required.

2. Patients and methods:

Fifty eight adult patients of both sexes with chronic or recurrent rhinological symptoms were included in this study. Four patients were lost for the evaluation, so they were excluded from this study. This study was done in ENT Department, Benha Faculty of Medicine during the period from February 2010 to January 2012. The following criteria were applied to the patients for performance this work;

Inclusion criteria:

- Adult patients, with nasal obstruction, nasal discharge, headache, diminution or loss of smell despite of appropriate medical therapy.

Exclusion criteria:

- History of allergy or asthma and systemic disease like cystic fibrosis and T.B.
- Acute maxillary sinusitis, sinusitis of dental origin and fungal sinusitis
- Patients with nasal polyposis and previous sinus surgery.

- Patients with radiological finding of pansinusitis.

The selected patients were submitted to the following:

1-Conventional anterior rhinoscopy.

2-CT scan of the paranasal sinuses in the direct coronal plane without contrast were done for all patients pre-operatively after adequate medical treatment.

The patients were classified into two groups:

-**The group A** (with radiological finding of isolated chronic maxillary sinusitis) which include 25 patients, 11 males and 14 females, aged 13 - 47 years (an average 26.92 years).

-**The group B** (without radiological finding of chronic maxillary sinusitis either radiologically free or with anatomical variation as deviated septum, concha bullosa and/ or hypertrophied turbinates) which includes 29 patients, 15 males and 14 females, aged 15 - 41years (an average 25.93 years).

Then, all patients had been submitted to a comprehensive nasal endoscopy using rigid zero and thirty degree 4mm nasal endoscopes.

According to **Anand and Glasgold [(2)],** topical anesthetic and decongestant were used to anesthetize the nasal cavity before nasal endoscopy. About 2 ml of 10% xylocaine is mixed with 2 m1 of 1: 1000 adrenaline and 5 m1 of normal saline. Cotton pledget are dipped in the solution, squeezed dry and used to pack the nasal cavity at different sites; IM, MM and on the septum. Packs are left in place for 5 minutes**.**

According to, **Schlosser and Kennedy [(22)]**, endoscopic examination of the nasal cavity and the lateral nasal wall was done in three steps:-

A) Inspection of the nasal vestibule, inferior meatus and nasopharynx, to get a general survey and orientation within the nose. B) Examination of the sphenoethmoidal recess and the superior meatus. C) Examination of the MM and the lateral nasal wall with its structures (UP, BE, hiatus semilunaris and infundibulum, anterior and posterior fontanelles, and frontal recess).

Examination of the anterior and posterior fontanel was done carefully to identify presence or absence of fontanel defects, presence or absence of circulating mucous and whether the defect is anterior, posterior or both anterior and posterior in relation to the UP.

Endoscopic examination was done on both sides of the nasal cavity, and the patients in each group were classified into two subgroups according to the presence or absence of accessory ostium (AO).

-Group A: AI which include 8 patients with accessory ostium and AII which include 17 patients without accessory ostium.

-Group B: BI which include one patient with accessory ostium and BII which include 28 patients without accessory ostium.

The collected data were recorded after taking consents from the patients and submitted to statistical analysis.

Twenty six patients (all patients from group A with isolated chronic maxillary sinusitis, and one patient from group BI with accessory ostium) underwent middle meatal antrostomy (MMA) under general anesthesia with hypotensive technique. The accessory ostium was connected to the natural ostium, the size of the created opening was around 8-10mm. Surgery was tailored according to the individual pathology as evidenced by the CT scan, the preoperative and operative findings. Nasal packing were applied and removed after 24 hours. Nasal alkaline douches, antibiotics, and decongestants were used for 2 weeks. These twenty six patients submitted for full post-operative evaluation period.

Post-operative evaluation was done for patients initially after 1 week, 1 month, three months and then every six months for two years.

The Post-operative evaluation included:

A- Systematic nasal endoscopy: it was performed using 0 and 30 degree 4mm endoscope to inspect the surgical area (MT, MM and MO).The middle turbinate (MT) was examined for its presence. The middle meatus (MM) was evaluated as regard presence of discharge, edema, adhesion, and crusting. The MO was examined for its patency, shape, size, and flow of mucus. The area was cleaned of crust, discharge and granulation tissue. Any adhesions between the MT and the lateral wall were divided. The created ostium was assessed and cleaned if necessary. Estimation of the size of the ostium was done by the use of maxillary curette which has dimensions of about 3-5 mm.

B-Sinuscopy: it was performed via the canine fossa route. The canine fossa was the preferred route of entry as this provides the best visualization of the MO area. Through the cannula, the ostium was evaluated from inside using the endoscope 30 degree for its, patency and flow of mucus.

3. Results:

Total of (54) patients were examined by nasal endoscopy under local anesthesia, suffering from chronic or recurrent rhinological symptoms during the period from February 2010 to January 2012. The patient's ages ranged from 13-47 years with a mean age of 26 years. Twenty six patients were male (48.1%), and the other twenty eight were female (51.9%).

There was no statistically significant difference between group A in comparison with group B as regard the age of presentation, (P>0.05),Table (1).

Table (1): comparison between group A and group B as regard the age.

	Age		
	A	B	Total
Range (years)	13- 47	15- 41	13- 47
Mean (years)	26.92	25.93	26.39
± SD	9.1	7.4	
t. test	0.4		
p. value	>0.05		

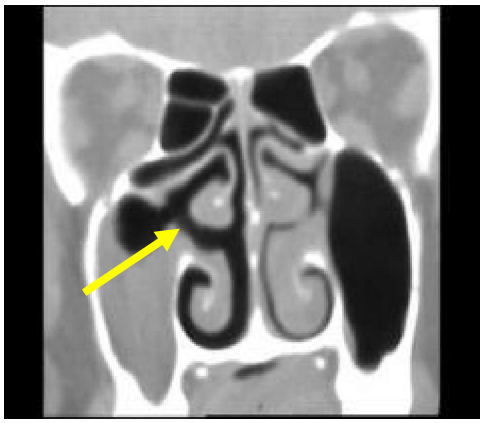

Figure (1); CT scan of paranasal sinuses coronal view with right side complete maxillary sinus opacity associated with accessory ostium (Arrow).

Coronal CT scans of the paranasal sinuses were done for all patients pre-operatively after adequate medical treatment. Isolated opacity of maxillary sinus (MS) was seen in 25 patients out of 54 patients (46.2%), and clear MS were seen in 29 patients (53.7) (Fig.1).

Among these 54 patients, twenty six patients underwent MMA (48.1%); twenty five patients from group (A) and one patient from group (BI). Twenty five patients underwent unilateral MMA while only one patient underwent bilateral MMA.

Follow up was done 9-24 months postoperatively (mean 14.3 months); the twenty six patients were seen for evaluation.

Patients were classified into 2 groups as regard the radiological finding

- Group (A): This included 25 patients (46.2%), with radiological finding of isolated chronic maxillary sinusitis.
- Group (B): This included 29 patients (53.7%), without radiological finding of isolated chronic maxillary sinusitis.

The assessment included:

1-Nasal endoscopy: This revealed that the MT was in place (no lateralization) in all cases operated upon (twenty six cases) (100%). There was no synechia medially or laterally and MT had normal healthy mucosa. Cases with concha bullosa (1 patient); the lateral half of the turbinate had healed completely without any adhesion with the lateral nasal wall. A healthy MM with no evidence of stenosis was noted. No adhesion or granulation tissue was present in the MM. There was no crust or discharge in the surgical area. The surgical area had healed completely and lined with normal healthy mucosa. All widened ostia remained patent and healthy. The widened MO was patent in all cases (26) operated upon (100%) as seen either by zero or thirty degree endoscope. The neo-ostium was circular in shape in 14 cases out of 26 (53.8%), oval in 12 cases (46.2%). As regard patency of the antrostomy opening , it was considered large if it was more than 7 mm in size, wide if it was(4-6 mm) and stenosed if it was less than 3 mm. In our work; the ostia were stenosed but asymptomatic in 4 cases (15.4%), wide in 17 cases (65.4%) and widely patent in 5 cases (19.2%). The natural MO was widened 8-10mm in size and this ended by a patent functioning ostium (no closure) in all patients operated upon. The natural MO was widened to 8-10 mm to prevent post-operative stenosis due to scarring (after complete healing),(Figure 2).

2- *Sinuscopy:* Each sinus cavity was examined using the zero and 30 degree rigid endoscope passing through the inserted cannula. The sinus cavity was empty of secretions in all cases and the lining mucosa was healthy. The MO was patent and healthy in all operated cases.

The main complaint of patients (group A) was "headache" (48%), then "nasal obstruction" **(**32%**)** and "nasal discharge" was found in **(**20%**)**, while in group B, the most common complaint was "nasal obstruction" **(**41.38%**),** then "headache"

(34.48%),then "nasal discharge" (17.24%) and the least common was "hyposmia" which appeared in only two patients of group B (6.9%) . There was no statistically significant difference between group A and group B as regard the main complaint (P>0.05), Table (2).

Table (2); Comparison between group A and group B as regard the distribution of the main complain.

	A		B		Total	
	No.	%	No.	%	No.	%
Headache	**12**	48%	**10**	34.48%	**22**	40.74%
Nasal obstruction	**8**	32%	**12**	41.38%	**20**	37.04%
Nasal discharge	**5**	20%	**5**	17.24%	**10**	18.52%
Hyposmia	**0**	0%	**2**	6.9%	**2**	3.7%
Total	**25**	100%	**29**	100%	**54**	100%
X^2	**2.7**					
***P*-value**	**>0.05**					

Accessory ostium was found in 9 patients out of 54 patients. The accessory ostium (AO) was located in the fontanel region during the endoscopic nasal examination (16.67%), while in 47 patients; Group (A-II,B-II) no AO was found in their fontanel region during endoscopic nasal examination (83.33%).

In group (A-I), the AO was found in 8 patients out of 25 patients suffering from isolated chronic maxillary sinusitis (32%).while group (A-II) refers to the other 17 patients.

In group (B-I), the AO was found in only one patients out of 29 patients (3.45%).while group (B-II) refers to the other 28 patients,

There was a statistically significant difference between presence and absence of AO in each group in the study, (P<0.05), (Figure 3, Table 3).

Figure (2): Left side endonasal endoscopic evaluation after MMA seen by zero endoscope: (yellow arrow).

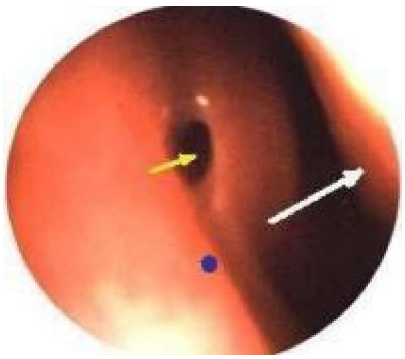

Figure (3): Right side endonasal endoscopic evaluation showing; MT: (white arrow), AO: (yellow arrow) & UP: (blue dot).

Table (3); Comparison between the studied groups regarding presence of AO.

		AO			Z	*P*-value
		With (I)	Without (II)	Total		
A	**N**	**8**	**17**	**25**	**5.02**	**<0.05**
	%	**32%**	**68%**	**100%**		
B	**N**	**1**	**28**	**29**		
	%	**3.45%**	**96.55%**	**100%**		
Total	**N**	**9**	**45**	**54**		
	%	**16.67%**	**83.33%**	**100%**		

The main complaint of group (A-I) patients (with AO), was "headache" (62.50%), then "nasal obstruction" **(**25.00%**)**, and "nasal discharge" **(**12.50%**)**, while in group A-II (without AO) we found that the most common complaint was "headache" **(**52.94%**)**, then "nasal obstruction" **(**33.30%**),** then the least common was "nasal discharge" **(**11.76%**).**There was no statistically significant difference between group (A-I) and group (A-II) as regard the main complaint (*P*>0.05), Table (4). In group (A- I, B-I); only one patient from group (A-I) was found to have double AO in both the anterior and posterior fontanels **(**11.11%**)**. The AO was found to be in the anterior fontanel in another two patients (22.22%) and in the posterior fontanel in six patients (66.67%), (Table 5 &Figure 3).

The circulating mucous (circular flow) was found in two patients **(22.22%)** of those 9 patients exhibiting accessory ostium (AO), (Table 6 & Figure 4).

Table (4); Comparison between group A-I and group A-II as regard the distribution of the main complain.

	A-I		A-II		Total A	
	No.	%	No.	%	No.	%
Headache	**5**	62.50%	**9**	52.94%	**14**	56%
Nasal obstruction	**2**	25%	**6**	33.30%	**8**	32%
Nasal discharge	**1**	12.50	**2**	11.76%	**3**	12%
Total	**8**	100%	**17**	100%	**25**	100%
X^2	**1.3**					
***P*-value**	**>0.05**					

Table (5); The location of the accessory ostium (AO).

	AO	
	No.	%
AF	2	22.22%
PF	6	66.67%
Both	1	11.11%
Total	9	100%

Figure (3): Right side endonasal endoscopic evaluation showing; anterior AO (yellow arrow), posterior AO (white arrow) &UP (blue dot).

Table (6): Relation of the accessory ostium to mucous circulation.

	AO	
	No.	%
NO Circular Flow	7	77.78%
Circular Flow	2	22.22%
Total	9	100%

Figure (4): Right side endonasal endoscopic evaluation, showing: A streak of pus (yellow arrow) coming out of a posterior AO of the right maxillary sinus. & (white arrow) points to MT.

4. Discussion:

Maxillary sinusitis is a common condition. Impaired drainage and reduced ventilation of the paranasal sinuses are known to increase the risk of a more long-standing inflammatory process, **Kennedy *et al.*** [12]. Maxillary accessory ostium is one of the anatomical variations that may play a role in the development of chronic maxillary sinusitis, **Genc** *et al.* [5]. The basic purposes of functional endoscopic sinus surgery (FESS) are to restore the diseased ostio- meatal complex (OMC) and to re-establish ventilation and drainage of the dependent larger sinuses, **Kennedy** *et al.,* [14]**.** FESS restores sinus drainage, ultimately improves sinus mucociliary function, and promotes sinus ventilation and preserves sinus mucosa, **Stammberger** [25].

Since the beginning of the endoscopic era in the field of rhinosinusology, one term has been frequently emphasized: the "accessory ostium" of the maxillary sinus, **Joe et al** [8]. These defects have been categorized as iatrogenic (surgically created) or accessory ostia (presumed to be physiological). However, they have been clinically related to chronic infection of the maxillary sinus by few authors, **Gutman and Houser** [6]**.**

In our study we examined 54 patients presented at ORL clinics of Benha University Hospital, because of chronic rhinological symptoms; nasal obstruction, nasal discharge, facial pain and/or hyposmia. The patients were classified into two groups according to their radiological finding, group A and group B.

Group A**;** which includes 25 patients with radiological findings of isolated maxillary sinusitis, 11 males and 14 females (44% - 56**%** respectively) aged 13 - 47 years (an average 26.92 years).

Group B**;** which includes 29 patients without any radiological finding of maxillary sinusitis either radiologically free or with anatomical variation like; deviated septum, concha bullosa and/ or hypertrophied turbinates, 15 males and 14 females (51.72% - 48.28**%** respectively) aged 15- 41 years (an average 25.93 years). Our results showed that there is no statistically significant difference between the two groups as regard to age and sex (*P*-value **>0.05**). These results go in hand with, **Reh** *et al.,* [21], who stated that older patients had scores that were similar to younger patients with regard to CT findings and there is no specific age range predisposing for chronic sinusitis.

In group **A** we found that the most common complaint was "headache" **(48%)**, then "nasal obstruction" **(32%)** and then "nasal discharge" **(20%)**, while in the group **B**, we found that the most common complaint was "nasal obstruction" **(41.38 %),** then "headache" **(34.48%)**, then "nasal discharge" **(17.24%)** and the least common was "hyposmia" **(6.9%)**.Our results showed that there is no statistically significant difference between the two groups as regard their complaint (*P*-value **>0.05**), and these results were in accordance with, **Bhattacharyya** [4]**,** who stated that the diagnosis of CRS based on symptom criteria is difficult because most symptoms not distinguish between radiographically normal and diseased patients.

In patients of group **A**, AO was found in **(32%)** while in patients of group **B**, AO was found only in **(3.45%)**, these results showed a strongly positive statistically significant difference between the two groups (*P*-value **<0.05**). This is to some extent in agreement with, **Mladina** *et al.,* [19] who reported that there was a statistically significant difference between the groups of patients and controls, as the posterior fontanelle defect was found much more frequently in patients suffering from CMS than in the group of healthy subjects **(19.3%** and **0.48%** respectively). Also, our results go in hand with, **Mladina** *et al.,* [19], who reported that the

fontanelle defect is not a physiological accessory ostium because if it was just an individual anatomical variety, we should be able to find it in many subjects with otherwise healthy maxillary sinuses, and said the defect of the posterior fontanelle indicates chronic maxillary sinusitis (CMS), just like a defect of the eardrum indicates chronic otitis media.

In support of these data, **Jog and McGarry** [9] in their study investigated the association and the prevalence of AO and reported that eight percent **(8%)** of the patients with rhinitis or sinusitis, had AO and only two percent **(2%)** of controls had AO.

In our study the overall prevalence of AO was **(16.67%).** This result agreed with, **Anon** *et al.,* [3] who stated that the accessory ostia into the maxillary sinus had been reported in **25%** to **50%** of his patients, the difference may be due to larger number of patients included in that study. Our results differs from, **Yanagisawa** *et al.,* [28] who stated that accessory ostia of the maxillary sinus, located on the lateral wall of the middle nasal meatus, were present in **30%** of the general population as an anatomical variety. Our results showed a strong relation between the presence and absence of AO and isolated maxillary sinusitis with positive statistically significant difference between patients with AO and patients without AO, (*P*-value **<0.05**).

In our study, single AO were found in **(88.89%)** of patients with AO, while double AO were found in (**11.11%)**, and this result differs from, **Mladina** *et al.,* [19] who found double AO in **(68.03%)** of his study. The difference may be due to larger number of patients included in that study, and go in hand with, **Kumar** *et al.,* [16] who reported double AO in only one patient **(12.5%)** of eight patients with AO among total 30 patients included in their study.

In our study 6 patients had AO in the PF region **(66.67%)**, and only one patient had the defect on both AF and PF (11.11%) while another two had the defect only in the region of AF (22.22%). This result agreed with, **Jog and McGarry** [9], who stated that the AO was generally found in the posterior fontanelle and its appearance in the anterior fontanelle was much less frequent in their experience. The circulating mucous was found in two patient **(22.22%)** of those with AO, these results are in agreement with, **Mladina** *et al.,* [19] who found the circulating mucous in **(9.17%)** of patients with AO. In our study the AO was connected to the natural ostium to avoid the circular flow which goes in hand with, **Albu and Tomescu** [1] who reported that, persistent accessory maxillary ostia were statistically significant predictors of poor surgical outcome. However, our results are contrary with, **Prasanna and Mamatha** [20] who reported that enlarging the accessory ostium or opening the membranous fontanelle may provide only maxillary sinus aeration if the natural ostium is obstructed.

In our study the widened MO was patent in all cases (26) operated upon (100%) as seen either by zero or thirty degree endoscope. The neo-ostium was circular in shape in 14 cases out of 26 (53.8%), oval in 12 cases (46.2%). The natural MO was widened 8-10mm in size and this ended by a patent functioning ostium (no closure) in all patients operated upon. These results agreed with **Stammberger and Posawetz** [26] who mentioned that maintenance of functioning ostium can be expected where the diameter is more than 2.5-3mm.

In conclusion, our study revealed that there is a close association between isolated maxillary sinusitis and the presence of accessory maxillary ostia. The accessory ostia are usually single and frequently found in the posterior fontanelle region. *Fontanelle defects could serve as maintainers of a chronic inflammation of the maxillary sinus.*

In our study, it appears that the sinus drainage via the natural ostium *is more essential and mandatory than sinus aeration, because of the higher incidence of chronic maxillary sinusitis (CMS) in the sinuses being better ventilated via AO,* as our results showed AO in **(32%)** of patients with radiological finding of CMS compared with only **(3.45%)** of patients without radiological finding of CMS.

So we can concluded that in the maxillary sinus, the drainage of the sinus is more essential than sinus ventilation in contrary with the condition in the middle ear cleft where the aeration is the most essential.

References:

1. Albu S, Tomescu E.: (2004): Small and large middle meatus antrostomies in the treatment of chronic maxillary sinusitis. Otolaryngol Head Neck Surg.; 131(4):542-7
2. Anand V.K. and Glasgold M.J.: (2003): Functional endoscopic sinus surgery. In: Operative otorhinolaryngology. Bleach N., Milford C. and Van-Hasselt A. (Edts.). Blackwell Science Ltd., (Section 3), (Chap. 27) Pp.196.
3. Anon J., Rontal M. and Zinreich S.: (1996): Maxillary sinus anatomy. In: Anatomy of the paranasal sinuses. Anon J., Rontal M. and Zinreich S. (Edts.). New York: Thieme; p. 18-21.
4. Bhattacharyya N.: (2006): Clinical and symptom criteria for the accurate diagnosis of chronic rhinosinusitis. Laryngoscope; 116(7 Pt 2 Suppl 110):1-22.
5. Genc S., Ozcan M., Titiz A. and Unal A.: (2008): Development of maxillary accessory

ostium following sinusitis in rabbits. Rhinology; 46(2): 121-4.
6. Gutman M, and Houser S.: (2003): Iatrogenic maxillary sinus recirculation and beyond. Ear Nose Throat J.; 82(1): 61-3.
7. Hagtvedt T., Aalokken T.M. and Notthellen J.: (2003): A new low-dose CT examination compared with standard-dose CT in the diagnosis of acute sinusitis. Eur Radiol; 13: 976-80.
8. Joe J.K., Ho S.Y., and Yanagisawa E.: (2000): Documentation of variations in sinonasal anatomy by intraoperative nasal endoscopy. Laryngoscope; 110: 229-235.
9. Jog M. and McGarry G.W.: (2003): How frequent are accessory sinus ostia? J Laryngol. Otol.; 117:270-272.
10. Kane K.J.: (2007): Recirculation of mucus as a cause of persistent sinusitis. Am J Rhinol.; 11(5): 361-9.
11. Kantarci M., Karasen R.M., Alper F., Onbas O., Okur A. and Karaman A.: (2004): Remarkable anatomic variations in paranasal sinus region and their clinical importance. Eur. J. Radiol.; 50: 296-302.
12. Kennedy D.W., Zinreich S.J. and Rosenbaum A.E.: (1985): Fuctional endoscopic sinus surgery: theory and diagnostic evaluation. Arch Otolaryngol; 111: 576-82.
13. Kennedy DW, Adappa ND; (2011): Endoscopic maxillary antrostomy: not just a simple procedure. Laryngoscope; Oct; 121(10):2142-5.
14. Kennedy, D.W.; Zinreich, S.J.; Shaalan, H.; Kuhn, F.; Naclerio, R. (1987): Endoscopic middle meatal antrostomy. Theory, technique and patency. Laryngoscope 97: [Suppl. 43]: 1-9.
15. Kuhn F.A.: (2004): Role of endoscopy in the management of chronic rhinosinusitis. Ann Otol Rhinol Laryngol Suppl.; 193: 15-8.
16. Kumar H., Choudhry R. and Kakar S.: (2001): Accessory Maxillary Ostia: Topography and Clinical Application. J Anat. Soc. India; 50(1): 3-5.
17. Marple B.F., Stankiewicz J.A., Baroody F.M., Chow J.M., Conley D.B., Corey J.P., Ferguson B.J., Kern R.C., Lusk R.P., Naclerio R.M., Orlandi R.R. and Parker M.J.: (2009): Diagnosis and management of chronic rhinosinusitis in adults. Postgrad Med.; 121(6): 121-39.
18. Messerklinger, W. (1978): Endoscopy of the nose. Urban und Schwarzenberg. Baltimore, Munich. Quoted from Stammberger, H. (1990): Functional endoscopic sinus surgery. The Messerklinger technique. B C Decker. Philadelphia. Schaefer, S.D. (1998): An anatomic approach to endoscopic intranasal ethmoidectomy. Laryngoscope 108: 1628-34.
19. Mladina R., Vuković K, and Poje G.: (2009): The two holes syndrome. Am J Rhinol Allergy; 23(6): 602-4.
20. Prasanna LC, Mamatha H. (2010): The location of maxillary sinus ostium and its clinical application. Indian J Otolaryngol Head Neck Surg. 2010 Oct; 62(4):335-7.
21. Reh D., Mace J., Robinson J. and Smith T.: (2007): Impact of age on presentation of chronic rhinosinusitis and outcomes of endoscopic sinus surgery. Am J Rhinol; 21(2):207-13.
22. Schlosser R.J. and Kennedy D.W.: (2008): Nasal endoscopy. In: Scott-Brown's Otorhinolaryngology, Head and Neck Surgery 7th ed.: Gleeson M., Browning G.G., Burton M.J., Clarke R., Hibbert J., Jones N.S., lund V.J., Luxon L.M. and Wathinson J.C. (Edts), Edward Arnold (publishers) Ltd. Vol. (2): 1344- 1354.
23. Simmen D.B.: (2008): Medical and surgical treatment options in the management of upper airway diseases. Ther Umsch.; 65(3): 175-80.
24. Stammberger H.: (1991): Functional Endoscopic Sinus Surgery. B C Decker Philadelphia.
25. Stammberger, H. (1990): Functional endscopic sinus surgery. Concept, indications and results of the Messerklinger technique. Eur. Arch Otorhinolaryngol. 247: 63-76.
26. Stammberger, H. and Posawetz W. (1990): Functional endoscopic sinus surgery. Concept, indication and results of the Messerklinger technique. Eur. Arch Otorhinolaryngol,247:63-76.
27. Stammberger H. and Hawke M.: (1993): Essentials of Functional Enoscopic Sinus Surgery. Mosby St. Louis.
28. Yanagisawa E., Yanagisava K., Christmas D.A., and Yanagisawa R.: (2004): Endoscopic views of the ostia and ostia-like structures in the lateral nasal wall. Ear Nose Throat J 83:446–448.

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