

Middle Meatal Antrostomy in the Management of Chronic Maxillary Sinusitis

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Abstract: Introduction: sinusitis is a group of disorders characterized by inflammation of the mucosa of the paranasal sinuses. Chronic sinusitis is defined as symptoms lasting longer than 8 weeks, with a global prevalence of around 10.9% with significant impairment in health related quality of life. Imaging advances, increased understanding of the anatomy and the pathophysiology of chronic sinusitis, and image-guided surgery have allowed surgeons to perform more complex procedures with increased safety. FESS emerges as the primary surgical modality for sinus diseases, the most common procedure being middle meatal antrostomy (MMA). Controversy exists over the effectiveness of FESS, judging on subjective and objective parameters. Hence it warrants further research.

AIM: To determine the efficacy of middle meatal antrostomy in the management of chronic maxillary sinusitis in subjective and objective parameters.

Methodology: A hospital based prospective study done in the department of otorhinolaryngology and head neck surgery, VSSIMSAR Burla from October 2015 to September 2017 with a sample size of 60 patients, who meet inclusion and exclusion criteria after clearance from the institutional ethical committee. Pre and post-operative endoscopic and radiological scoring [Lund Mackay], mean area of maxillary ostium as well as symptom and complication charting was done and compared. All data was entered into excel sheets and statistical analysis was done by SPSS version 20 using Pearson chi square test. Data was compared between baseline and 6 months, baseline and 1 year and 6 months and 1 year. Statistical significance was set at $p < 0.05$.

Results: There was significant improvement in the post-operative period in SUBJECTIVE (symptoms) and OBJECTIVE (endoscopic/radiological) parameters.

Conclusion: Our study is conclusive evidence that Middle meatal antrostomy is a safe and effective procedure in patients suffering from chronic maxillary sinusitis with significant improvement in subjective symptomatology as well as objective parameters.

Keywords: middle meatal antrostomy, MMA, maxillary sinusitis.

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I. Background

Sinusitis refers to a group of disorders characterized by inflammation of the mucosa of the paranasal sinuses. Categories based on duration as¹ Acute sinusitis, defined as symptoms of less than 4 weeks' duration, Sub acute sinusitis, defined as symptoms of 4 to 8 weeks' duration and Chronic sinusitis, defined as symptoms lasting longer than 8 weeks Recurrent acute sinusitis, often defined as three or more episodes per year, with each episode lasting less than 2 weeks. Sinusitis is more common in cold and wet climate, atmospheric pollution, smoke, dust overcrowded condition. Increased cases are found in people with poor general health, with recent history of exanthematous fever measles, chickenpox, in nutritional deficiencies, systemic disorders like diabetes, immune deficiency syndromes etc. Impairment of drainage of sinuses by inflammatory oedema of the mucosa is an important contributor to the process. Current thinking supports the concept that chronic rhino sinusitis (CRS) is predominantly a multifactorial inflammatory disease. Confounding factors that may contribute to inflammation are persistent infection (including biofilms and osteitis), allergy and other immunologic disorders, intrinsic factors of the upper airway, super antigens, colonizing fungi that induce and sustain eosinophilic inflammation, metabolic abnormalities. Functionally active L-selectin ligands guiding leukocyte traffic into maxillary sinus mucosa have been suggested preferentially in patients with severe findings of chronic maxillary rhino sinusitis².

Uncommonly sinusitis is component of many systemic syndromes as Wegener granulomatosis, ataxia telangiectasia, cystic fibrosis, immotile cilia syndrome, kartagener syndrome etc. Acute sinusitis may give rise to chronic sinusitis, particularly when there is interference in drainage. Prominent symptoms of acute sinusitis include nasal congestion, purulent rhinorrhea, facial-dental pain, postnasal drainage, headache, and cough. Chronic sinusitis symptoms are similar but might be even more subtle. Clinical signs of both acute and chronic sinusitis include sinus tenderness on palpation, mucosal erythema, purulent nasal secretions, increased pharyngeal secretions, and periorbital edema. There is an overlap in these symptoms with those of perennial rhinitis, and there is a frequent need to perform imaging procedures to confirm the diagnosis. Because of this overlap, some have suggested the use of the term rhinosinusitis. In clinical experience, maxillary sinuses are the most commonly effected, in adults. The maxillary antra are the largest of the paranasal sinuses and are pyramidal-shaped cavities occupying the maxillae. Chronic maxillary sinusitis may or may not involve pathogenic organisms. Maxillary sinusitis may occasionally arises by extension of a peripheral infection through the bony floor of sinus (odontogenic infections). In other cases it is associated with diseases of lower respiratory tract.

The frequency of the disease has sufficient justification for a close study of the disease in view of the serious effects of such chronic type of infection. Roughly ninety percent of adults have had sinusitis at some point in their life³. The global prevalence of chronic rhino sinusitis is around 10.9%⁴ with significant impairment in health related quality of life⁵.

Occasionally it leads to complications like Orbital cellulitis, Orbital abscess, Cavernous sinus thrombosis, Encephalitis etc. which lead the patient to a life threatening conditions. Despite the fact that medical therapy is indicated in all cases of rhino sinusitis and many cases do respond to it, there still exists a number of patients who improve only after surgical management. The majority of surgical procedures in the treatment of sinusitis were originally described in pre-antibiotic era when rapid surgical intervention was often necessary to avert disaster. Today, although the operations remain the same, the indications for their use and the relative frequency with which they are required have altered.

Surgery for sinusitis aims to drain purulent secretions either by way of natural ostium or more usually by the creation of an alternative drainage pathway which may be temporary or permanent. In so doing, complications are avoided and the sinus lining is given opportunity to recover. Antral washout or lavage was a form of conservative surgery done used for draining out the antral secretions through the inferior meatus and for subsequent microbiological study. It has been deemed obsolete in modern times due to its blind nature and limited long term benefits. With the advent of endoscopic nasal procedures focusing on preservation of physiological mucosa, the management of sinusitis has taken a major leap. FESS caters to a wide range of inflammatory sinus conditions. Imaging advances, increased understanding of the anatomy and the pathophysiology of chronic sinusitis, and image-guided surgery have allowed surgeons to perform more complex procedures with increased safety. Endoscopic sinus surgery has undergone radical changes in the last 15 yr. Minimally invasive techniques, combined with advances in instrumentation and computers have reduced postoperative discomfort and improved patient satisfaction⁶. Evidence suggests that adenoidectomy and ESS are the most frequent surgical procedure performed in RS management⁷. FESS emerges as the primary surgical modality for sinus diseases, the most common procedure being middle meatal antrostomy (MMA) for chronic maxillary sinusitis (CMS). Creation of middle meatal antrostomy is also sometimes needed for the following cases: biopsy of an antral mass; resection of a maxillary sinus fungal ball or inverted papilloma; presence of accessory ostia leading to maxillary recirculation; and sometimes to allow for the application of topical medication or outpatient antral lavage in selected cases. Questions over the potential risks of middle meatal scarring, interruption of mucociliary clearance, improper ostial function, development of maxillary recirculation by not including the natural ostia in the middle meatal antrostomy, and the likely need for revision maxillary sinus surgery have raised the issue of whether middle meatal antrostomy is necessary in ESS (Catalano 2006). We decided to conduct a study on Indian patients and judge the effectiveness of FESS on subjective and objective parameters.

II. Aim

To determine the efficacy of middle meatal antrostomy in the management of chronic maxillary sinusitis in subjective and objective parameters

III. Objectives

1. To compare pre and postoperative symptoms in patients 2. To compare pre and postoperative Computed Tomography findings. 3. To compare pre and postoperative endoscopic findings and 4. To assess complications of the procedure and their management.

IV. Methodology

A hospital based prospective study done in the department of otorhinolaryngology and head neck surgery, VSSIMSAR Burla from October 2015 to September 2017 with a sample size of 60 patients after clearance from the institutional ethical committee.

Inclusion criteria was moderate to severe sinus-related symptoms lasting at least 12 weeks despite maximal medical treatment (intranasal corticosteroid and/or antihistamine with or without antibiotics), e.g., at least two major factors (headache, facial pain, nasal obstruction ,nasal discharge, olfactory disturbances etc.) with or without other symptoms(sneezing, post nasal discharge, epistaxis or Sino-nasal polyps etc.) With endoscopic findings (mucosal edema, purulent discharge, nasal polyp) and radiographic evidence (on computed tomography) of maxillary sinus opacity.

Patients with age under 15years or over 60 years, on oral corticosteroid treatment during the two months prior to surgery, with previous nasal surgery for any indication, with history or physical examination suggestive of severe nasal septal deviation (that causes only unilateral nasal obstruction and/or requires septoplasty before performing ESS) and maxillary sinusitis of other origins as dental/ oro-antral fistula etc., aspirin sensitivity, chronic bronchitis, cystic fibrosis, tumor or disease with severe, with impact on general immunity and patients with severe co morbidities(complications of diabetes , asthma, tuberculosis, hypertension , chronic renal or liver disease etc. with recurrent antro-choanal polyps or primary polyps of other sinuses and without consent for surgery were excluded from the study.

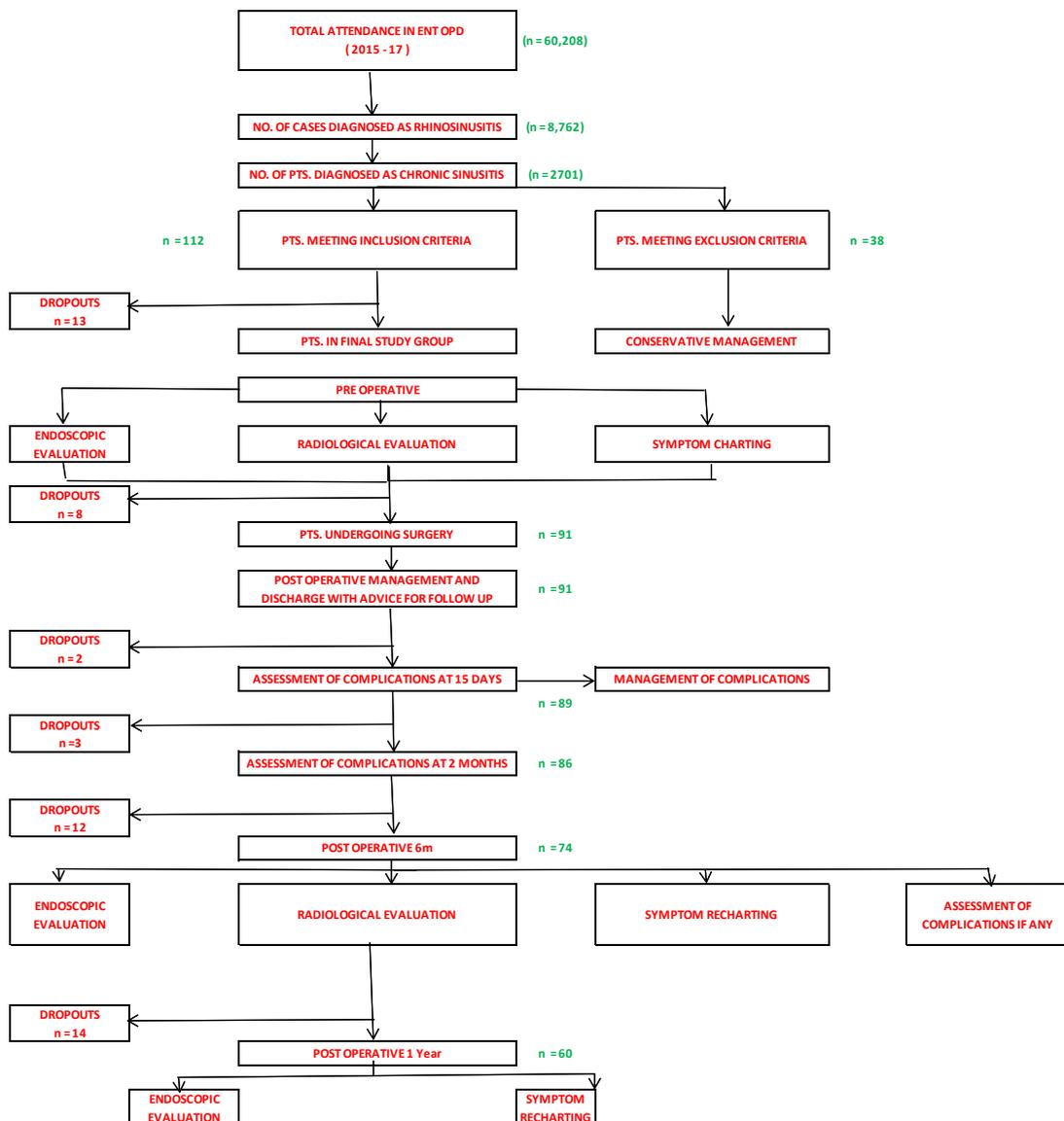


Figure 1: Study Flowchart

Preoperative and postoperative assessment and surgical methods: During the patient's preoperative visit to the department, a complete medical history was taken, and the diagnostic criteria, the execution of proper conservative treatment, and the presence of exclusion criteria were recorded. All patients underwent complete otorhinolaryngological examination with nasal endoscopy under local anesthesia. A clinical otorhinolaryngological examination and nasal endoscopy was repeated on visits 2 weeks, 3 months, 6 months and 1 year postoperatively. Pre and postoperative symptoms were assessed and tabulated. Postoperative computed tomography scans were repeated at 6 months and maxillary sinus grading and scoring [LUND MACKAY] was done. Postoperative nasal endoscopic assessment was done at 6 months and 1 year done and maxillary sinus grading and scoring [LUND MACKAY] was done. Postoperative complications were assessed at 2 weeks and 2 months. Radiographic grading [LUND MACKAY] of other sinuses (ethmoid, frontal and sphenoid) were done preoperatively. All the values were tabulated at baseline and at follow ups. High-resolution CT imaging of the nasal airways and paranasal sinuses was performed. The ostiomeatal complex was reconstructed with a 1 mm slice thickness.

Postoperatively, endoscopy and CT scans provided identical information about the ostiomeatal complex area and maxillary sinus. Two blinded authors calculated the anteroposterior (AP) and the cephalocaudal (CC) dimensions of the ostium on one occasion using variable sized feeding tubes (6FG to 24 FG) (External diameters 2.6 to 7.92 mm). The maxillary sinus ostium was considered to be an ellipse with AP and CC dimensions as the major and minor axis respectively. Thus, the postoperative ostium size was determined to be $0.25\pi APCC$.

Endoscopic sinus surgery was performed under local anesthesia. Cotton applicators soaked in a solution of 4% xylocaine with 5 µg/ml adrenaline were applied for 30–40 minutes before the operation under the middle and lower turbinates and in the roof of the nose cavity to block the sphenopalatine and ethmoidal nerves. At the beginning of the operation, 1 ml of 2% xylocaine with adrenaline (1:200000) was injected submucosally into the medial infundibular wall. Intravenous sedation (midazolam 1–2 mg and/or fentanyl 0.05–0.1 mg) were given at the beginning of surgery and repeated thereafter when needed. The operation was performed using the endoscopic sinus surgery technique, using rigid 4 mm endoscopes (Karl-Storz, Tuttingen, Germany) with deflection angles of 0° and 30° and sometimes 70°. The maxillary sinus ostium was first identified using an ostium seeker. The uncinate process was then identified and medialized, and the lower two-thirds removed using back biting forceps. If mucosa blocked the maxillary sinus ostium on the uncinectomy only side, as little as possible was carefully removed from it without disturbing the bony ostium. Otherwise, the bony ostium was left intact. On the additional middle meatal anrostomy side, the diameter of the ostium was duplicated in the posterior direction with cutting forceps. Of the 8 patients with sino nasal polyps (antro choanal, 7 U/L, 1 B/L), polypectomy was done prior to the procedure and included in study after histopathological confirmation. The posterior ethmoidal cells, sphenoidal sinuses and frontal sinuses were left undisturbed. Hemostasis was achieved with nasal packing (Merocel) under the middle turbinate. The packing was removed on the within 24 – 48 hours by the surgeon. Patients were discharged with post-operative antibiotics, antihistaminic, anti-inflammatory drugs with advice on nasal irrigation with sodium chloride (2.3 gm.) and sodium bicarbonate (700 mg) in 100 ml of warm water. Complications were managed as follows: crusts removed under endoscopic vision with irrigation and manipulation, synechiae released and barrier plating done, all other complications were managed conservatively in all cases.

All data was entered into excel sheets and statistical analysis was done by SPSS version 20 using Pearson chi square test. Data was compared between baseline and 6 months, baseline and 1 year and 6 months and 1 year. Statistical significance was set at $p < 0.05$.

V. Results

Of the 60208 patients attending our OPD chronic rhino sinusitis was diagnosed in 2701. We had no patients less than 10 years and more than 60 years, opting for surgery. Maximum no of patients (~ 65%) were adults between 31 to 50 years of age. Of the subgroups, the highest no. of patients were between 31- 40 years of age. The average age of the series was (34.8 ± 9.24) years. 32 of 60 patients in our study were male and hence there was no significant gender difference.

The patients were equitably distributed in lower and middle socio –economic strata with the upper class patients constituting less than 10% of the study pool. There was no relation found between class and duration or severity of presenting symptoms. Nearly 2/3rd of the patients were from rural areas. Majority of patients practiced Hinduism with Islam being the 2nd predominant religion. The duration of symptoms ranged between 3 months to 4 years. Mean duration was (16.1 ± 11.78) months. Only 2 patients with a longer standing history opted for surgery. There was no co relation between patient age and duration of symptoms at presentation. No correlation could be found between duration and severity of presenting symptoms. Most of the patients were not able to give an exact duration of onset to presentation.

Only 8 patients had concomitant Antrochoanal polyps and maxillary sinusitis. 7/8 cases had uni-lateral polyps (4 on left, 3 on right and 1 case bi lateral).All the polyps were histo-pathologically confirmed.

Nearly 40% cases were unilateral (on radiographs) .7 out of the 25 cases of uni lateral maxillary sinusitis presented with antrochoanal polyps. One case of 35 bilateral cases presented with bilateral antrochoanal polyps. Patient symptoms were not necessarily limited to the side of sinus involvement.

Table 1

RADIOLOGICAL STAGING OF CASES WITH MAXILLARY SINUSITIS			
UNILATERAL CASES			
	No. of cases with score 0	No. of cases with score 1	No. of cases with score 2
LEFT	2	4	4
RIGHT	1	6	8
BILATERAL CASES			
	No. of cases with score 0	No. of cases with score 1	No. of cases with score 2
LEFT	2	12	21
RIGHT	1	10	24

(The radiological grading and scoring system was as follows: SCORE 0- NO OPACITY: SCORE 1– SOME OPACITY/ PARTIAL OPACITY: SCORE 2- COMPLETE OPACITY)

Of the unilateral cases, only 3 patients had no depiction of opacity on radiographs. They were chosen on basis of symptoms and endoscopic grading. Majority of cases had complete opacity (12/25) followed by partial opacity (10/25).Of the bilateral cases (70 maxillary antra), majority(45/70) had complete opacity followed by partial opacity (22/70).Hence less percentage of maxillary antra (4% vs 12%) had absence of opacity which might indicate the bilateral cases being longer standing and more severe. However no such facts could be proven from our study. The right maxillary antra had a higher combined score (80 vs 66) suggesting that right maxillary antra were more frequently and more severely involved than the left. We could not find any striking difference in anatomical variations between the sides, etiology and previous history to render a logic for the above difference.

Table 2

SYMPTOM SCORE PREOPERATIVE		
SYMPTOMS	No. OF PATIENTS	PERCENTAGE
<i>Facial Pain / Pressure</i>	38	63.3
<i>Headache</i>	54	90
<i>Nasal blockage / congestion</i>	36	60
<i>Rhinorrhea</i>	35	58.3
<i>Post nasal discharge</i>	19	31.7
<i>Olfaction disturbance</i>	18	30
<i>Sneezing</i>	23	38.3
<i>Epistaxis</i>	6	10
<i>Nasal mass</i>	3	5

Headache was by far the most common symptom presenting in 54/60 patients. The next common were facial pain, nasal congestion and nasal discharge having almost equal patient share. Only 3/60 patients presented with a nasal mass co relating as 3/8 polyp patients. Almost all patients who had facial pain or pressure had a subjective headache (37/ 54).Post nasal discharge was the next most co related symptoms with the former presenting in 17/ 35 cases of rhinorrhea. All cases presenting with nasal mass had feeling of nasal blockage. More than 50% of patients (36/60) presented with 4 or more symptoms.4/6 cases of epistaxis had history of rhinorrhea.14/18 patients with olfactory disturbances (hyposmia, anosmia, parosmia) did have a history of nasal obstruction making this symptom very subjective as alterations in taste could not be analyzed simultaneously.Sneezing was an associated symptom in almost 40% cases of the present series. Two reasonable explanations are possible. It may be that the patients were allergic prior to their present ailment which probably has predisposed them to chronic sinusitis or that the patients acquired it afterwards being subjected to bacterial allergen as a result of chronic infection in their sinuses.

Table 3

ENDOSCOPIC APPEARANCE SCORE (TOTAL)			
	BASELINE	6 MONTHS	1 YEAR
<i>Polyp Left (0,1,2,3)</i>	9	0	2
<i>Polyp Right (0,1,2,3)</i>	8	0	0
<i>Oedema Left (0,1,2)</i>	68	11	2
<i>Oedema Right(0,1,2)</i>	81	24	5
<i>Secretion Left(0,1,2)</i>	59	13	2
<i>Secretion Right(0,1,2)</i>	62	14	6

Score 0: No Polyps; Score 1: Polyp Only In Middle Meatus; Score 2: Polyps Extending Beyond Middle Meatus; Score 3: Polyps Filling The Nasal Cavity

Mucosal Oedema Score 0: No Edema; Score 1: Mild / Moderate Edema; Score 3: Polypoid Degeneration

Secretion Score 0: No Discharge; Score 1: Hyaline; Score 2: Thick Or Mucopurulent

All patients had review endoscopic scoring at 6 months and 1 year postoperative. The most important role for endoscopy in patients with CRS is in medical management, particularly in cases involving eosinophilic inflammation⁸. Edema on endoscopic observation was the most altered factor followed by secretion.

There was no significant improvement in pre and postoperative assessment of polyps [PEARSON CHI-SQUARE (p-VALUE) =8.241 (**0.221**) (LEFT)] and [PEARSON CHI-SQUARE (p-VALUE) =8.182 (**0.225**) (RIGHT)]

Endoscopic scores for edema showed highly significant improvement postoperatively [PEARSON CHI-SQUARE (p-VALUE) =86.521 (**0.000**)* (LEFT)] and [PEARSON CHI-SQUARE (p-VALUE) = 89.179 (**0.000**)* (RIGHT)]

There was highly significant improvement in secretion scores on post op endoscopic assessment [PEARSON CHI-SQUARE (p-VALUE) = 71.566 (**0.000**)*(LEFT)] and [PEARSON CHI-SQUARE (p-VALUE) =70.285 (**0.000**)*(RIGHT)]

Table 4

SYMPTOM SCORE AT 6MONTHS POST OPERATIVE			AT 1 YEAR POSTOPERATIVE	
SYMPTOMS	No. OF PATIENTS	PERCENTAGE	No. OF PATIENTS	PERCENTAGE
<i>Facial Pain / Pressure</i>	8	13.3	3	5
<i>Headache</i>	28	46.7	26	43.3
<i>Nasal blockage / congestion</i>	7	11.7	3	5
<i>Rhinnorhea</i>	9	15	3	5
<i>Post nasal discharge</i>	3	5	3	5
<i>Olfaction disturbance</i>	12	20	9	15
<i>Sneezing</i>	15	25	14	23.3
<i>Epistaxis</i>	0	0	0	0
<i>Nasal mass</i>	0	0	0	0

There was overall improvement in symptoms at 6 months postoperative. Headache, present in 90% of pre op patients, was **relieved in more than 50%** patients completely. Of the 54 patients preop, only 26 patients had residual headache at 1 year (52% recovered). Persistent patients complained of a lesser degree of headache, more tolerable than before.

Facial pain and pressure was also significantly relieved in **>60% to < 15%** of patients at 6 months, which further decreased to 5% at 1 year. Of the 38 patients preop, only 3 patients had residual facial pain (91% **recovery**). Persistent patients also had headache.

Nasal blockage and rhinorrhea was also relieved in the majority (60%, 58.3% vs 11.7%, 15% vs 5%, 5% respectively). Of the 36 patients preop, there was residual nasal stuffiness in only 3 patients (91.6% **recovery**).

Rhinorrhea present in 35 patients preop persisted in 3 patients at 1 year (91.5% improvement). Post nasal discharge showed a **recovery of 85%** in patients.

Sneezing was the symptom which showed least improvement over 12 months (**<40%**). This could be attributed to allergic etiology in the patients. Patients who complained of epistaxis and nasal mass before

surgery, had no postoperative recurrence of the symptoms, hence showing complete improvement. Olfactory disturbances too **persisted (in 50%)**, although to a lesser subjective degree. All symptoms showed a gradual decrease in severity over 1 year.

TABLE 5

RADIOLOGICAL GRADING OF CHRONIC MAXILLARY SINUSITIS		
	LEFT	RIGHT
PRE OPERATIVE	66	80
POSTOPERATIVE	13	19

Repeat CT scans were done at 6 months in the postoperative period

There was highly significant improvement in radiological scores for maxillary sinus in the postoperative period [PEARSON CHI-SQUARE (p-VALUE) = 37.189 (**0.000**)* (LEFT)] and [PEARSON CHI-SQUARE (p-VALUE) =48.125 (**0.000**)* (RIGHT)]

Table 6

OSTEOMEATAL COMPLEX SCORE		
	PREOP	POSTOP
LEFT	64	26
RIGHT	64	22

Osteomeatal Complex Score; Score 0: No Opacity; Score 2: Opacity

The pre and postoperative ostiomeatal complex score showed highly significant improvement in radiological findings. [PEARSON CHI-SQUARE (p-VALUE) = 12.836 (**0.000**)*(LEFT)] and [PEARSON CHI-SQUARE (p-VALUE) = 15.983 (**0.000**)*(RIGHT)]

Table 7

COMPLICATIONS		
	NUMBER OF PATIENTS	PERCENTAGE
<i>Epistaxis</i>	3	5
<i>Crusts in middle Meatus</i>	35	58.3
<i>Cheek edema</i>	8	13.3
<i>Synechiae</i>	14	23.3
<i>Infraorbital numbness/ Neuralgia</i>	2	3.3
<i>Closure of antrostomy</i>	1	1.7
<i>Discharge from middle Meatus</i>	3	5

Crusts in middle meatus and nasal cavity was the most common post-operative complication. Synechiae were observed in nearly 1/5th of the patients, associated universally with crusts. Epistaxis was seen in a small proportion and so was infraorbital numbness and discharge from the middle meatus. Only one patient reported a post-operative closure of the antrostomy.

VI. Discussion

The results of our study were mainly aimed at the symptomatic benefit and overall gain in comfort of the patients. The demography could be summarized to be favoring adult male Hindus, of lower socio economic class living in rural areas of the geographical region aged between 31 - 50 years. Of the 8 patients presenting with nasal polyps, no patient had recurrence at the end of 1 year although there was polypoidal degeneration of mucosa in 2 patients. Chronic sinusitis and allergic rhinitis seem to play a major role in establishing the ACP.

These inflammatory processes cause mucosal edema and also mucous retention cyst formation^{9,10}. One of the suggested etiological theories for ACP described that inflammatory-related closure of ostiomeatal complex and increase of pressure in maxillary sinus force mucous retention cysts to herniate into the nasal cavity¹¹. The incidence of polyps in our study (in 6 patients) was consistent with previous studies¹².

Majority of cases were bi lateral on presenting radiographs although they did not necessarily corroborate with clinical findings. 7 of 8 polyp cases occurred in unilateral cases which contradicts the findings of¹³, although we both agree that the duration of unilateral sinusitis is usually shorter than that of bilateral sinusitis.

All the patients were staged based on computed tomography findings pre and postoperatively, using the Lund- Mackay scoring system. It is still the most widely used radiological method for assessing the diagnosis and the severity of CRS^{14,15}, although clinical studies have shown that they have little correlation in symptom severity. In the present series positive radiological finding were detected in 89 sinuses (out of 60 cases-120 sinuses). The percentage of positive findings indicative of chronic maxillary sinusitis (i.e. mucosal thickening, fluid level of hazy antrum / opaque antrum) is 74.25%. This is very near the percentage of cases with radiological findings of chronic maxillary sinusitis in Vuorinen et al's, McNeill's, and Jensen.C's series. CT scan scores can help clinicians to predict severity of symptom for nasal obstruction and discharge but not for other symptoms of chronic rhinosinusitis¹⁶. However, there was no association of CT score with the overall disease severity score¹⁶. CT findings did not associate with queried symptoms postoperatively. Poor correlation between symptoms and CT findings has also been detected in other studies^{17,18}. In our study, there was **highly significant statistical improvement in pre and postoperative CT scores at 6 months postop (p< 0.000)**. The ostiomeatal complex is a vital anatomical and surgical area which needed to be evaluated separately. Pre and postoperative CT scores show significant improvement [PEARSON CHI-SQUARE (p-VALUE): **12.836 (0.000)*{L} 15.983 (0.000)*{R}**]

The dominant symptoms in our study were headache, facial pain, nasal congestion and rhinorrhea, corroborating with the observations of many previous studies. There was no correlation of specific symptoms with duration of disease. There was overall significant improvement in symptoms and quality of life of the patients, though not quantified. Reviews of the results of endoscopic sinus surgery have reported excellent subjective results with overall improvements of about 90 % in both short and long term^{19,20}. However studies have demonstrated that symptom improvement does not correlate well to objective endoscopic evidence of disease persistence^{21,22}. Our study differs as there was **statistically significant improvement** in endoscopic parameter scores except polyp after surgery at 6 months and 1 year postop [PEARSON CHI-SQUARE (p-VALUE): **polyp 8.241 (0.221){L} 8.182 (0.225){R} ; oedema 86.521 (0.000)*{L} 89.179 (0.000)*{R}; secretion 71.566 (0.000)*{L} 70.285 (0.000)*{R}**]. But it is imperative to note that endoscopic surveillance postoperatively is continued until a stable cavity is achieved²³.

Crusts in middle meatus was the most common postoperative complication followed by nasal synechiae and cheek edema. The reason could be attributed to the hot and dry climate of the region. Crusts were managed by nasal douching as well as removal under direct vision. Synechiae were released in the earliest postoperative visit with intranasal X ray plating or merocel pack. Other complications as infraorbital numbness, antrostomy closure and persistent discharge from middle meatus were seen in a small proportion of patients (~10%). Similar findings were observed in other studies. The findings include perforation of the septum, retained secretions, small surgical ostium caused by postoperative ostial stenosis, previous Caldwell Luc procedure, recirculation of mucus, hyperplastic nasal disease, synechiae, recurrent disease in previously unaffected sinuses, empty nose syndrome, frontal sinus disease, dental disease, and other, more complicated entities²⁴. The mean area of preop antrum was $(5.58 \pm 2.64) \text{ mm}^2$ vs post op antrum size of $(28.45 \pm 9.16) \text{ mm}^2$. The difference was statistically significant (p=0.0001). Only one patient in our study had partial closure of the antrostomy on postoperative endoscopic evaluation. This befits findings of other long term studies²⁵. No correlation could be accounted for between the patency of antrostomy and presenting symptoms, which again accorded with previous studies²⁶. It has been postulated that a minimum ostial diameter of 3.95 mm is needed in order to guarantee the penetration of a topical treatment to paranasal sinuses²⁷. Our observation firmly adheres to this concept with a widely patent maxillary ostium in >90% of patients in postoperative period. Postoperatively, endoscopy and CT scans provided identical information about the ostiomeatal complex area and maxillary sinus. Owing to the limited sample size and short follow up period, long term observation of patency could not be documented in our study. Endoscopic middle meatal antrostomy is superior to Caldwell-Luc in intraoperative and postoperative parameters and complications²⁸ and results of our study can be inferred for further research.

Radiological grading of other sinus systems was done concurrently and tabulated, although they were not operated postoperatively as the surgery was only limited to the maxillary antrum and puncture of the bulla ethmoidal. Studies have concluded that Functional endoscopic sinus surgery therefore aims at the primary infective foci in the anterior ethmoid and usually cures disease in the larger sinuses without an attack upon the latter sinuses²⁹. Hence our study holds value in evaluation of the maxillary sinus system without extension to

other sinuses. When the focus of chronic sinusitis appears to be situated in the infundibulum/anterior ethmoid region, the functional endoscopic surgery seems preferable; for cases where the inflammatory process was restricted largely to the maxillary sinus a modified inferior meatal antrostomy technique proved to have a higher success rate in few studies³⁰. Our study proves otherwise with certainty given the subjective improvement in patients, also paving way for further research.

Despite the existing controversies on optimal management of rhino sinusitis current knowledge of chronic rhino sinusitis, functional endoscopic sinus surgery is the approach that has shown success in the past when compared to medical management^{31,32}. Given the outcome of our study, Middle meatal antrostomy makes the most sense when surgery is truly required in the management of chronic maxillary sinusitis.

VII. Conclusion

Our study is conclusive evidence that Middle meatal antrostomy is a safe and effective procedure in patients suffering from chronic maxillary sinusitis with significant improvement in subjective symptomatology as well as objective parameters. Patients with recurrent chronic sinusitis after prior surgical intervention pose a particular challenge to the otorhinolaryngologist.

Establishing a correct diagnosis is the first step and requires review of the original pre-surgical symptoms and imaging with endoscopic evaluation; review of the more recent symptoms and images; and reevaluation of environmental, general, and local host factors that may contribute to persistent disease.

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