RESEARCH ARTICLE

TRANSLATIONAL AND CLINICAL RESEARCH

Chronic maxillary sinusitis of dental origin and oroantral fistula: The results of combined surgical approach in an Italian university hospital

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ABSTRACT

Unilateral chronic maxillary sinusitis is a possible complication of odontogenic disease or dental treatment and is mainly due to the development of an oroantral fistula (OAF). The management of chronic maxillary sinusitis of dental origin requires a combined treatment via endoscopic sinus surgery (ESS) and intraoral surgical treatment of the odontogenic source. The aim of this study is to present the results of our university hospital unit in the treatment and follow-up of a case series of 34 patients treated with combined surgical approach for chronic maxillary sinusitis of dental origin due to OAF. All patients were treated with ESS combined with an intraoral approach. No intraoperative or immediate postoperative complications were observed; nasal synechia was found in 3 patients (8.82%). The overall success rate after primary intervention was 94.12%; recurrence was observed in 2 cases (5.88%), both were suffering from diabetes mellitus and were tobacco smokers. Our results confirm that simultaneous surgery with a combination of an intraoral and endoscopic approach can be considered the best strategy for the long-term restoration of a normal sinonasal homeostasis in selected patients with chronic odontogenic sinusitis and OAF, guaranteeing an effective treatment with minimal complications in the short and long term.

KEYWORDS: Chronic maxillary sinusitis of dental origin; oroantral fistula; odontogenic sinusitis; maxillary sinus disease; endoscopic sinus surgery; ostiomeatal complex; Lund- Mackay Grading; Rehrmann flap

INTRODUCTION

Chronic maxillary sinusitis of dental origin (CMSDO) represents a frequent condition that accounts for 10% to 12% cases of maxillary sinusitis (1-3).

Oroantral fistula (OAF), an unnatural communication between the oral cavity and maxillary sinus with epithelialization in the fistula tract, is among the most common causes of CMSDO, accounting for approximately 60% of odontogenic sinusitis cases (4, 5). OAF mainly follows the extraction of upper molar and premolar teeth; other causes include periapical abscess, periodontal disease, placement of dental implants, maxillary cystic lesions or foreign bodies such as endodontic materials and dental fillings (6).

CMSDO must be suspected in patients with unilateral symptoms that do not respond to standard medical therapy, and in those who have a history of dental surgical treatment or dental pain (4, 7-9). High-resolution computed tomography (CT) scans and cone-beam volumetric computed tomography (CBCT) can support in the identification of the dental disease and odontogenic sinusitis (Fig. 1) (10, 11). The management of CMSDO requires sinusitis treatment via endoscopic sinus surgery (ESS) as well as intra-oral surgical treatment of the odontogenic source through a combined approach (12-17).

The aim of this study is to present the results of our university hospital in the treatment and follow up in a case series of 34 patients treated with combined surgical approach for chronic maxillary sinusitis of dental origin due to OAF.

MATERIALS AND METHODS

Between January 2010 and December 2019, 34 patients with chronic maxillary sinusitis and related chronic OAF were treated by ESS and intra-oral OAF closure at the Policlinico Umberto I of Rome. Inclusion criteria were age > 18 years, presence of chronic OAF following tooth extraction and clinical and radiological evidence of ipsilateral chronic maxillary sinusitis.

All patients underwent preoperative otolaryngology and dental clinical evaluation; orthopantomography, axial and coronal contiguous 1 mm CT or CBCT scans of paranasal sinuses and nasal endoscopy were performed to identify the location and extent of the disease.

The following information were collected during the initial visit for each patient: gender and age, comorbidities, and history of smoking.

Surgical intervention

Surgery was performed under general anesthesia by the same surgeons. A local infiltration of the middle turbinate and uncinate process with local anesthetic solution containing epinephrine was performed to minimize bleeding. Medial traction of the middle turbinate and retrograde resection of the posteroinferior part of the uncinated process was performed using a rigid 30° 4 mm endoscope (Karl Storz, Tuttlingen, Germany). The uncinate process cut edges were trimmed with a microdebrider to identify the natural maxillary sinus ostium. The ostium was enlarged in a posteroinferior direction to allow a clear visualization of the natural sinus and its drainage after healing. Foreign bodies were removed through the enlarged maxillary ostium using a 45° and 70° 4 mm endoscope and a curved suction tip. Polyps – if present - were removed, while edematous and hyperemic mucosa was preserved. After ESS, the oral surgery team performed the necessary tooth extractions and removal of pre-existing prostheses or dental implants. Subsequently, the OAF was excised, allowing correct evaluation of size of the bony defect and clear access to the alveolar recess of the maxillary sinus. A buccal advancement flap procedure according to the Rehrmann technique was performed to reach a complete closure of the fistulous defect.

The following information were collected during the first postoperative visit for each patient: surgical technique and intra and postoperative complications, postoperative use of analgesics and antibiotics, duration of hospitalization.

Ethical statement

The study was approved by the local Ethic Committee of our University Department and was performed in accordance with the Helsinki declaration and its amendments. Informed consent was

obtained from all the participants.

Statistical analysis

Descriptive analysis was used to define the main clinical and demographic characteristics of the patients. Data were expressed as means and percentages. Prism Software version 8.3.1 (GraphPad Software LLC) was used to perform statistical analysis.

RESULTS

This study included 34 patients with unilateral OAF situated in the alveolar region. Ten patients were women (29.42%) and 24 were men (70.58%). Patients were aged between 20 to 78 years (mean: 52.63 years).

All patients had a diagnosis of unilateral CMSDO with OAF. In 17 patients (50%), anterior ethmoid sinusitis was also present; 30 patients (88.23%) had an obstruction of the ostiomeatal complex. At the time of surgery, unilateral purulent rhinorrhea was the most common presenting sign in 20 patients (58.82%), followed by unilateral nasal obstruction in 17 patients (50%), postnasal drip in 9 patients (26.47%), hyposmia in 8 patients (23.5%), headache in 7 patients (20.58%), unpleasant smell sensation in 6 patients (17.64%), facial pain in 5 patients (14.7%) and swollen cheek in 5 patients (14.7%) (Table 1).

All patients were classified as Grade II according to the Lund-Mackay Grading and were treated with ESS combined with an intraoral approach (Fig. 2). Post-operative hospitalization was 1 or 2 days (average 1.3 days). Patients were instructed to avoid using straws, smoking and all the activities that could cause pressure changes between the nasal and oral cavities for at least one month. Sutures were removed 7 days after surgery and post-operative follow-up visits were made every six months for one year to exclude signs and symptoms of relapsing forms of maxillary sinusitis and/or recurrence of OAF (Fig 3).

No intraoperative or immediate postoperative complications were observed. Among minor complications, nasal synechia was found in 3 patients (8.82%); recurrence was observed in 2 cases (5.88%), both suffering from diabetes mellitus (DM) and tobacco smokers. The overall success rate

after primary intervention was 94.12%: no recurrent OAF was reported after the second attempt. Intraoperative cultures were performed in 27 cases (79.41%): positivity was found in 13 patients (38.23%) with a predominance of Gram-positive anaerobes. A specific antibiotic therapy guided by antibiograms was performed. A large fungal ball was removed in one case (2.94%), and odontogenic cysts in 6 (17.64%). Thirty patients (88.23%) completed the 12 month follow up; all cases had a complete closure of the OAF, were symptom-free, and a good ventilation in the maxillary sinus was found.

DISCUSSION

The increased use of oral implants in the last three decades has led to an increase in paranasal sinus complications such as penetration/migration of dental implants and/or grafting materials into the maxillary sinus. Recent scientific evidence suggests that the increasing number of dental surgery over the last few years may be associated to a raised incidence of iatrogenic sinusitis (18). The infection is typically polymicrobial, with a large percentage of obligate anaerobes (19). Streptococcus pneumonia, Moraxella catarrhalis and Haemophilus influentiae are the most common pathogens implicated in chronic sinusitis (20-23). The most common symptoms and signs of sinus complications following dental surgery include facial pain, headache, nasal obstruction, swollen cheek, purulent rhinorrhea, post-nasal drip, cacosmia, hyposmia, paresthesia and roncopathy (24-28).

OAF usually occur when the Schneiderian membrane is interrupted by conditions such as the infection of the maxillary posterior teeth, maxillary dental trauma, pathologic lesions of the jaw and teeth, or by iatrogenic effects such as dental procedures (extractions or dental implant complications) and maxillofacial surgery procedures. Several authors showed that surgical procedures of the upper first and second molars teeth is the most frequent etiologic factor for OAF (29-32). In our patients, the second molar tooth was the most involved, and this because the roots of the second molar are in closest proximity to the sinus floor (29).

For an accurate diagnosis of maxillary sinus disease, CT is the gold standard due to the high resolution and capacity to discern bone and soft tissue. CBCT is a relatively new tool that has become increasingly important in diagnosis of sinus disease; it uses approximately 10% of the radiation dose of conventional CT but has a higher resolution compared to conventional thin-slice CT (11). In our patients, we used both methods with a preference for traditional CT because of the higher cost of CBCT.

As already reported by Felisati et al. (33), the surgical management of odontogenic sinusitis, unlike other forms of maxillary sinusitis, requires a combination of intraoral and endoscopic approaches. Indeed, surgical success largely depends on primary closure of the defect and simultaneous recovery of normal sinus function through spontaneous drainage from the natural ostium. To date, buccal and palatal flaps are the most common solutions used for OAF closure (34-36). OAF < 5 mm generally do not need surgery because of spontaneous closure (37), while defect > 5 mm diameter can be surgically closed with buccal flaps. In our study, patients were treated with the buccal advancement flap procedure designed by Rehrmann, which involves the creation of a trapezoid mucoperiosteal flap and its suture over the defect.

The nasal endoscopic approach has several advantages to the previously used Caldwell-Luc technique (38, 39): it is a less invasive procedure and has the possibility of direct endoscopic control and treatment, thus allowing a surgical 'toilette' and enlargement of the maxillary ostium to favor a rapid recovery of maxillary sinus functions that is the key for long term success (40-42). Furthermore, endoscopic approach allows to explore the other paranasal sinuses that may also be involved in the infective process.

In our series, all patients were treated with ESS combined with oral surgery in one-step by the same two surgeons (otolaryngology surgeon and oral specialist) and the incidence of complications was remarkably low (43-45).

Recurrence after combined surgical approach is possible. In our patients, recurrence occurred in two patients, both smokers and with a diagnosis of DM. As known, tobacco use has unfavorable

implications in the postoperative period of oral and sinonasal surgery as it induces the release of catecholamines that favor peripheral vasoconstriction with tissue ischemia and delayed healing. Furthermore, smoking is believed to reduce the immune system response altering the activity of the neutrophils (46). Similarly, patients with DM who undergo ESS and oral surgery have an increased risk for postoperative complications as DM favors greater susceptibility to infections, chronic inflammation and less tissue tropism (47).

The main limitation of our study is represented by the small size of our sample; larger studies are necessary to confirm our results.

CONCLUSION

Our results confirm that simultaneous surgery with a combination of an intra-oral and endoscopic approach can be considered the best strategy for the long-term restoration of a normal sinonasal homeostasis in selected patients with chronic odontogenic sinusitis and OAF, guaranteeing an effective treatment with minimal complications in the short and long term.

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FIGURES AND TABLES
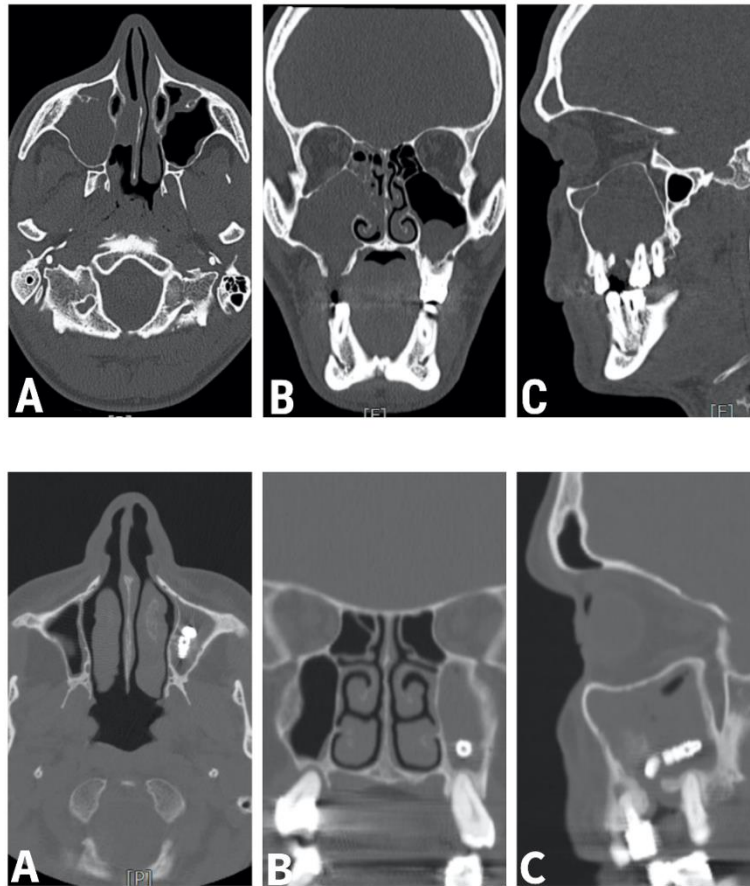
FIGURE 1. Upper panel: Computed tomography scan in the axial (A), coronal (B) and sagittal (C) planes of a patient with right maxillary sinusitis and a large oroantral fistula. Lower panel: Computed tomography scan in the axial (A), coronal (B) and sagittal (C) planes in a patient with a wide floor defect of the left maxillary sinus, associated with implant displacement and complete sinus obliteration.
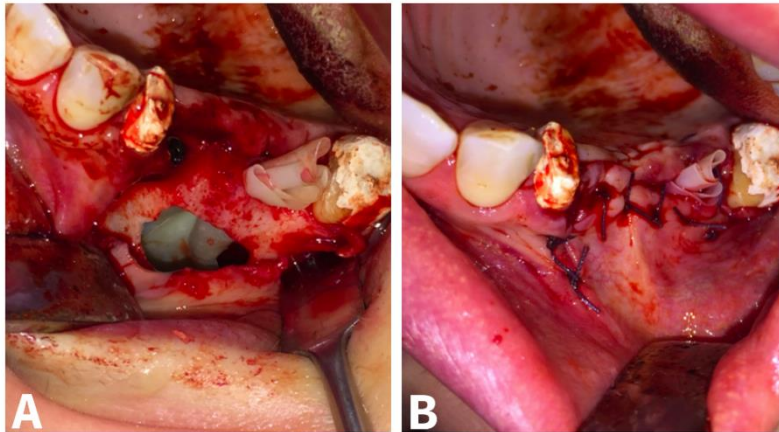
FIGURE 2. A: Intra-oral surgical approach. A large bony defect was found after the extraction of two molars.

B: The Rehrmann flap was closed with a free-tension flap and eversion to avoid wound dehiscence.
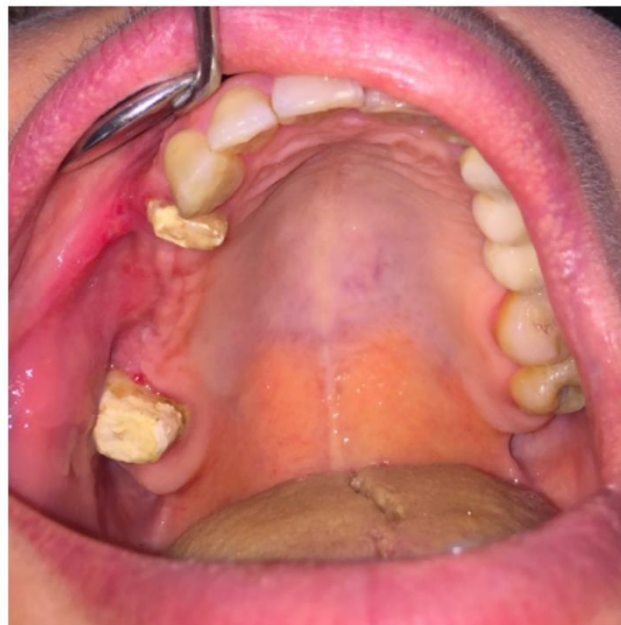
FIGURE 3. Two months after surgery, complete wound healing was observed.

TABLE 1. Demographic and clinical data of patients included in the study

ID	Name	Sex	Age	Preoperative symptoms and signs	Radiological characteristics (the Lund-Mackay Grading)	Risk factors	Surgical treatment	Recurrence
1	RF	M	51	FP + H + NO + PR	GRADE II	None	ESS + Intraoral approach (REHRMANN FLAP)	NO
2	MM	M	57	PR + PD + BS	GRADE II	Smoke	ESS + Intraoral approach (REHRMANN FLAP)	NO
3	RE	M	69	H + P + SC + PR	GRADE II	Diabetes	ESS + Intraoral approach (REHRMANN FLAP)	NO
4	FP	F	61	HY + NO + BS	GRADE II	Smoke	ESS + Intraoral approach (REHRMANN FLAP)	NO
5	RG	M	63	NO + PR + PD	GRADE II	None	ESS + Intraoral approach (REHRMANN FLAP)	NO
6	DB	M	76	PR + PD	GRADE II	Smoke + Diabetes	ESS + Intraoral approach (REHRMANN FLAP)	NO
7	DML	F	49	FP + NO + HY + R	GRADE II	None	ESS + Intraoral approach (REHRMANN FLAP)	NO
8	AD	F	60	PR + H + PD	GRADE II	Smoke + Diabetes	ESS + Intraoral approach (REHRMANN FLAP)	NO
9	IV	M	55	P + SC + PR	GRADE II	Diabetes	ESS + Intraoral approach (REHRMANN FLAP)	NO
10	FD	M	41	NO + PD	GRADE II	Smoke	ESS + Intraoral approach (REHRMANN FLAP)	NO
11	VMS	F	20	BS + PR	GRADE II	None	ESS + Intraoral approach (REHRMANN FLAP)	NO
12	PC	M	41	R + NO + PR	GRADE II	None	ESS + Intraoral approach (REHRMANN FLAP)	NO

13	ZE	F	29	FP + NO	GRADE II	Smoke	ESS + Intraoral approach (REHRMANN FLAP)	NO
14	DPM	M	67	NO + PR + PD	GRADE II	Smoke + Diabetes	ESS + Intraoral approach (REHRMANN FLAP)	NO
15	LAI	F	26	NO + PR	GRADE II	Smoke	ESS + Intraoral approach (REHRMANN FLAP)	NO
16	SF	M	71	PD + H + PR	GRADE II	Diabetes	ESS + Intraoral approach (REHRMANN FLAP)	NO
17	PA	M	38	BS + NO	GRADE II	None	ESS + Intraoral approach (REHRMANN FLAP)	NO
18	DIR	M	36	SC + P	GRADE II	None	ESS + Intraoral approach (REHRMANN FLAP)	NO
19	SC	M	78	PR + NO	GRADE II	Smoke + Diabetes	ESS + Intraoral approach (REHRMANN FLAP)	YES
20	RM	M	51	NO + PR	GRADE II	Smoke	ESS + Intraoral approach (REHRMANN FLAP)	NO
21	SN	F	64	PR + BS	GRADE II	Smoke	ESS + Intraoral approach (REHRMANN FLAP)	NO
22	SS	M	53	NO + H	GRADE II	Smoke	ESS + Intraoral approach (REHRMANN FLAP)	NO
23	RE	F	75	SC + HY	GRADE II	Diabetes	ESS + Intraoral approach (REHRMANN FLAP)	NO
24	DA	M	35	PR + PD + BS	GRADE II	None	ESS + Intraoral approach (REHRMANN FLAP)	NO
25	DPAM	F	73	H + FP + PR	GRADE II	None	ESS + Intraoral approach (REHRMANN FLAP) + Septoplasty	NO
26	MM	M	48	P + NO + HY	GRADE II	Smoke	ESS + Intraoral approach	NO

							(REHRMANN FLAP) + Septoplasty	
27	SF	M	58	NO + PR + BS	GRADE II	Smoke	ESS + Intraoral approach (REHRMANN FLAP)	NO
28	BF	M	34	HY	GRADE II	Smoke	ESS + Intraoral approach (REHRMANN FLAP)	NO
29	BR	F	56	NO + PR + HY	GRADE II	None	ESS + Intraoral approach (REHRMANN FLAP)	NO
30	TA	M	41	FP + P + SC	GRADE II	None	ESS + Intraoral approach (REHRMANN FLAP)	NO
31	ML	M	63	H + PD + HY	GRADE II	None	ESS + Intraoral approach (REHRMANN FLAP)	NO
32	PMG	F	77	R + H + NO	GRADE II	Smoke + Diabetes	ESS + Intraoral approach (REHRMANN FLAP)	YES
33	MG	M	55	NO + PR + HY	GRADE II	None	ESS + Intraoral approach (REHRMANN FLAP)	NO
34	GG	M	26	PR + NO	GRADE II	Smoke	ESS + Intraoral approach (REHRMANN FLAP)	NO

FP = facial pain; H = headache; NO = nasal obstruction; SC = swollen cheek; PR = purulent rhinorrhea; PD = post-nasal drip; BS = bad smell; HY = hyposmia; P = paresthesias; R = roncopathy; ESS = Endoscopic Sinus Surgery.