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RESEARCH PAPER

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# Endoscopic maxillary sinus drainage combined with buccal fat pad flaps for repairing large oroantral fistulas in patients with odontogenic maxillary sinusitis

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## Abstract

**Background:** Oroantral fistula (OAF) is a pathological channel formed between the oral cavity and the maxillary sinus. A large size of OAF (≥5 mm) increases the risk of surgical failure, and an optimal surgical approach should be cautiously selected.

**Objective:** This study aims to characterize the application of nasal endoscopy and buccal fat pad (BFP) flaps to repair large OAFs in patients with odontogenic maxillary sinusitis (OMS).

**Methods:** A total of 32 patients with large OAF combined with OMS after dental extraction who were treated in the Department of Otorhinolaryngology, Nanjing Renpin ENT Hospital from 2018 to 2022, were retrospectively recruited. A thorough preoperative evaluation was performed and all patients were first treated with nasal endoscopy, followed by the repair of OAFs using BFP flaps under general anesthesia. The cure rate and postoperative pain score were used as outcome indicators to evaluate the effectiveness of the procedure.

**Results:** All patients completed a 12-month follow-up. The results showed that OFAs were cured in 25 (32 in total, 78.1%) patients by the second postoperative week. OFAs were healed in all patients at week 8 postoperatively. OMS was healed in 25 (32 in total, 78.1%) patients at the first postoperative week and all patients were healed by the disappearance of symptoms associated with OMS at week 8 postoperatively. At the second postoperative week, complete relief of pain symptoms was obtained in 18 (32 in total, 56.3%) patients (visual analog scale = 0 score), in 25 (32 in total, 78.1%) patients at the fourth postoperative week, and by the eighth postoperative week, all patients had complete resolution of pain symptoms.

**Conclusions:** Secondary maxillary sinusitis is not a contraindication to the treatment of large OAFs. Large OAFs can be effectively closed using BFP flaps combined with endoscopic maxillary sinus drainage.

KEYWORDS
buccal fat pad flaps, nasal endoscopy, odontogenic maxillary sinusitis, oroantral fistulas

### Key points

- **Significant findings of the study**
  In this study, we explored the application of buccal fat pad (BFP) flaps to repair large oroantral fistula (OAFs) in patients with OMS. It was found that endoscopic combined with BFP flaps achieves an acceptable therapeutic outcome in patients with large OAFs and OMS.
- **What this study adds**
  Previous beliefs about secondary sinusitis being a relative contraindication for large OAF repair have been challenged by our findings. This study sheds light on the relationship between OMS and OAF repair and contributes to the understanding of this topic.

## INTRODUCTION

Oroantral fistula (OAF) is a pathological channel formed between the oral cavity and the maxillary sinus, which often develops after tooth extraction. As a major cause of odontogenic maxillary sinusitis (OMS), the OAF leads to the reflux of food and liquid into the maxillary sinus, which can lead to some facial symptoms that seriously affect the daily life.[1] OAF interacts with OMS, adding a huge challenge to clinical management.[2,3] Some believe that an anti-inflammation treatment is a priority for patients with OAF and OMS, followed by the repair of OAF.[4] Besides, a large size of OAF (≥5 mm) increases the risk of surgical failure, and an optimal surgical approach should be cautiously selected.[5] Due to the possibility of failed repair, the previous view was that secondary nasal sinusitis is a relative contraindication to the repair of large OAFs. Based on our previous experience, we believe that an appropriate repair protocol can accomplish the repair of large OAFs. Therefore, the present retrospective study was carried out. In the present study, we retrospectively analyzed patients with large OAFs combined with OMS after dental extraction and managed by the closure of OAFs using buccal fat pad (BFP) flaps and endoscopic sinus surgery for OMS from 2018 to 2022 to explore the potential of BFP flaps in this regard.

## MATERIALS AND METHODS

### Clinical data

We retrospectively recruited a total of 32 patients with perforation of the maxillary sinus and secondary OMS after dental extraction who were treated in the Department of Otorhinolaryngology, Nanjing Renpin ENT Hospital from 2018 to 2022. All of them were initially managed by conservative treatments in local hospitals, all of which failed, and then OAFs developed with clinical symptoms of nasal sinusitis. There were 18 males and 14 females with a mean age of 38 (24–62) years. After admission, patients manifested facial distension and pain on the affected side, ipsilateral maxillary root tenderness, headache, and purulent liquid exudation from the intraoral surgical wound. A fistula formed at the site of extracted tooth, with a minimum diameter of 5 mm (Figure 1). Purulent exudation was observed. Computed tomography (CT) of the sinuses and cone beam volume computed tomography (CBVCT) of the maxillary bone visualized soft-tissue lesions occupying the maxillary

**FIGURE 1** A representative image of a patient with right-sided oroantral fistulas. A fistula formed at the site of extracted tooth, with a minimum diameter of 5 mm.

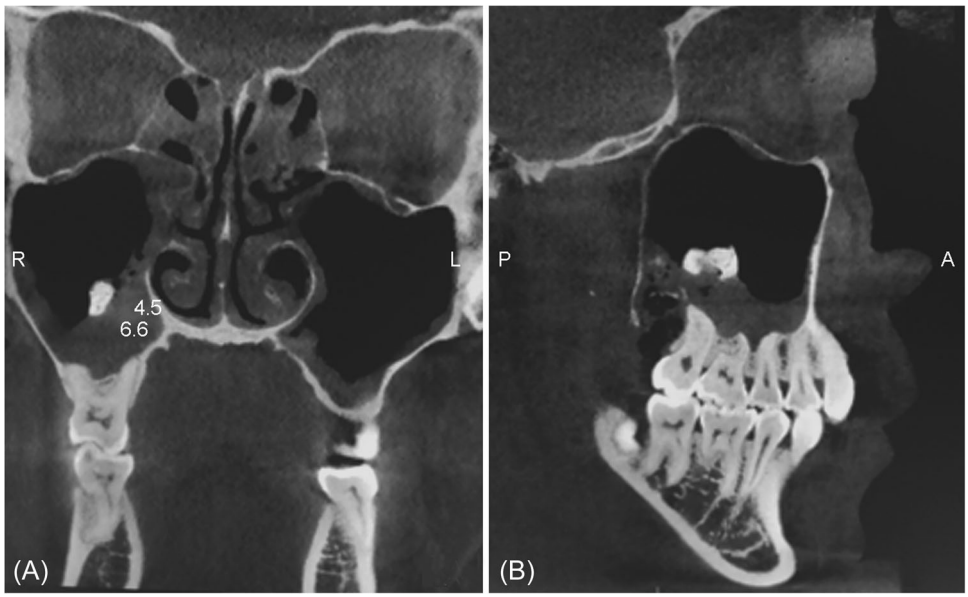


**FIGURE 2** Coronal (A) and sagittal (B) computed tomography scans showed a residual tooth root in the maxillary sinus.

sinus, and residual tooth roots were seen in the maxillary sinus of several patients (Figure 2).

## Preoperative evaluation

A thorough preoperative evaluation was performed, involving medical history, dental examination, nasal endoscopy, spiral CT of the sinuses and CBVCT of the maxillary bone, to determine the nasal and sinus lesions, the location and size of the fistula, and the involvement in the surrounding teeth. None of the patients received any surgical procedures for repairing OAFs before recruitment.

## Surgical procedures

All patients were first treated with nasal endoscopy, followed by the repair of OAFs using BFP flaps under general anesthesia.

Nasal endoscopic surgery: Briefly, the Messerklinger technique was adopted to open the anterior ethmoid and maxillary sinus on the affected side; the foreign bodies and inflammatory secretions were cleared. The middle nasal meatus was enlarged to smooth the drainage of maxillary sinus. Normal mucosa around the sinus ostium was protected to prevent postoperative scar hyperplasia and sinus ostium stenosis. If the drainage of the maxillary sinus was not fluent, or nasal lesions were difficult to be completely removed from the maxillary sinus ostium via middle nasal meatus, an endoscopic inferior meatal antrostomy was preferred for a better intraoperative visualization, and removal of lesions and tooth roots.

OAFs were then repaired using the BFP flaps (Figure 3): A circular incision was made along the edge of the OAF to remove the epithelium of fistula and fistula tract, as well as inflammatory tissues. Cleaning and debridement were necessary, followed by making a buccal incision ipsilateral to the OAF. A blunt dissection was performed posteriorly and medially between the buccinator and masticatory muscles to expose and free the BFP flap. According to the position and size of the fistula, the BFP flap was expanded outward, to a maximum extent, to cover the defect. The fistula was sutured without tension and covered by the adjacent flap. Surgical procedures were gently performed to prevent damage to the envelop of BFP flap, blood vessels, and fat tissues.

## Postoperative management

Nasal packing materials were timely removed after endoscopy, and postoperatively, cefuroxime sodium 1.5 g was routinely administered intravenously twice daily for 3 days, after which it was switched to oral administration for 1 week. Endoscopic redressing and debridement were regularly performed in the outpatient department within 1 month after surgery, aiming to ensure the opening of maxillary sinus ostium and an unobstructed drainage. Sinus irrigation was not routinely performed, which would influence the closure of OAFs due to an excessive pressure in the sinus cavity. All the patients were guided to keep oral hygiene and a healthy postoperative dietary habit.

## Assessment of surgical outcomes

Surgical outcomes of OMS were assessed based on the *Clinical Classification and Staging of Chronic Rhinosinusitis and Nasal Polyps and Evaluation Criteria for the Therapeutic Efficacy of Endoscopic Sinus Surgery (1997, Haikou, China)* as follows[6]: (1) cure: clinical

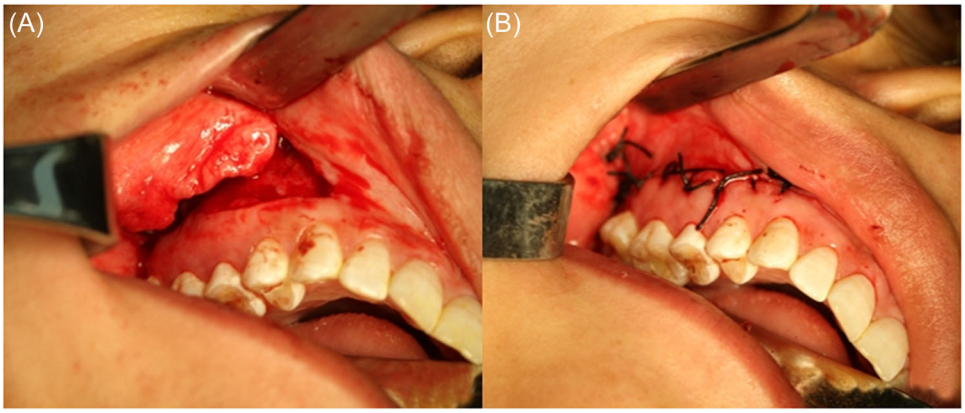


**FIGURE 3** The repair of an oroantral fistula using buccal fat pad flap. (A) A blunt dissection was performed posteriorly and medially between the buccinator and masticatory muscles to expose and free the BFP flap. (B) The oroantral fistula was repaired using the buccal fat pad flap.

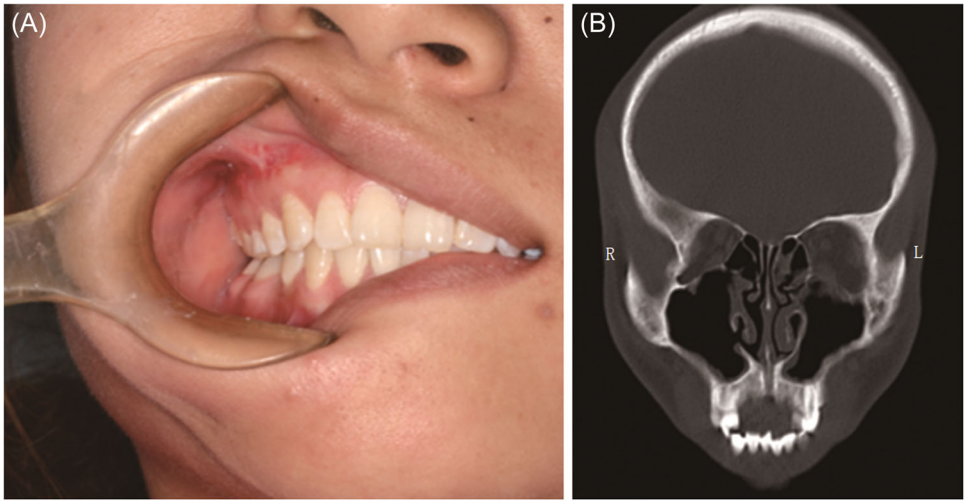


**FIGURE 4** Postoperative of an oroantral fistula (OAF) using buccal fat pad flap. (A) Complete closure of OAF after surgery. (B) Postoperative re-examined computed tomography suggested the relief of inflammation in the maxillary sinus.

symptoms and purulent secretions were absent, and normal opening of the ostium of sinus and mucosal epithelialization were observed by endoscopy; (2) improvement: clinical symptoms were significantly improved, and edema in partial mucosa, hypertrophy, granulation tissues, and a small amount of purulent secretions were observed by endoscopy; (3) invalid: no improvement of clinical symptoms, and adhesion of nasal cavity, stenosis or atresia of the sinus orifice, nasal polyps, and purulent secretions were observed by endoscopy. Surgical outcomes of OFAs were assessed as follows: (1) healed: a complete closure of OFA without purulent secretions (Figure 4A), and absence of inflammation in the maxillary sinus indicated by CT of the sinuses or CBVCT of the maxillary bone (Figure 4B); (2) unhealed: an incomplete closure of OFA with purulent secretions and necrosis of BFP flap.

## RESULTS

### Surgical outcomes

All patients completed a 12-month follow-up. The results showed that OFAs were cured in 25 (32 in total, 78.1%) patients by the second postoperative week. A residual 0.3 mm fistula was found in one patient at 2 weeks postoperatively, which self-closed as an unobscured drainage of the maxillary sinus was performed without inflammation. OFAs were healed in all patients at week 8 postoperatively. OMS was healed in 25 (32 in total, 78.1%) patients at the first postoperative week and all patients were healed by the disappearance of symptoms associated with OMS at week 8 postoperatively (Table 1).

**TABLE 1** Evaluation of postoperative outcome of maxillary sinus fistula with odontogenic maxillary sinusitis ($n = 32$).

| | Outcomes of OMS ($n$) | | Outcomes of OFAs ($n$) | | |
|---|---|---|---|---|---|
| Postoperative time | Healed | Unhealed | Cure | Improved | Ineffective |
| 1 week | 25 | 7 | 0 | 32 | 0 |
| 2 weeks | 25 | 7 | 25 | 7 | 0 |
| 3 weeks | 31 | 1 | 31 | 1 | 0 |
| 4 weeks | 31 | 1 | 31 | 1 | 0 |
| 8 weeks | 32 | 0 | 32 | 0 | 0 |
| 12 weeks | 32 | 0 | 32 | 0 | 0 |
| 6 months | 32 | 0 | 32 | 0 | 0 |
| 12 months | 32 | 0 | 32 | 0 | 0 |

*Note*: Surgical outcomes of OMS were assessed based on the Clinical Classification and Staging of Chronic Rhinosinusitis and Nasal Polyps and Evaluation Criteria for the Therapeutic Efficacy of Endoscopic Sinus Surgery (1997, Haikou, China). Postoperative time was counted from the date of surgery.
Abbreviations: OFAs, large oroantral fistulas; OMS, odontogenic maxillary sinusitis.

**TABLE 2** VAS evaluation of postoperative pain after maxillary sinus fistula with odontogenic maxillary sinusitis ($n = 32$).

| Postoperative time | Outcomes of different VAS score, $n$ (%) | | | |
|---|---|---|---|---|
| | 0 | 1–3 | 4–6 | 7–10 |
| 2 weeks | 18 (56.3) | 5 (15.6) | 2 (6.3) | 7 (21.9) |
| 4 weeks | 25 (78.1) | 6 (18.8) | 0 (0) | 1 (3.1) |
| 8 weeks | 32 (100.0) | 0 (0) | 0 (0) | 0 (0) |

*Note*: VAS pain rating scale (score 0–10): Score 0: no pain; Score 1–3: mild pain, tolerable; Score 4–6: patients had pain and interfered with sleep, still tolerable; Score 7–10: patients had progressively more intense pain, intolerable pain, interfered with appetite, andinterfered with sleep. Postoperative time is counted from the date of surgery.
Abbreviation: VAS, visual analog scale.

## Postoperative pain

The visual analog scale (VAS) scores were graded during the follow-up period. At the second postoperative week, complete relief of pain symptoms was obtained in 18 (32 in total, 56.3%) patients (VAS = 0 score), in 25 (32 in total, 78.1%) patients at the fourth postoperative week, and by the eighth postoperative week, all patients had complete resolution of pain symptoms (Table 2). Most patients experienced mild postoperative pain, and some had surgical wound infections that were relieved by an active symptomatic treatment. During a long-term follow-up period, none of them required a secondary surgical repair.

## Complication

All patients were regularly followed up. Six patients developed an inflammatory response at 1 week postoperatively, manifesting red and swollen surface of repaired BFP flap, obvious tenderness, and secretions coming from the surgical wound, which were cured at 2 weeks by removing nasal packing materials, purulent secretions, and inflammatory tissues. Fungal infections were not reported in any patients. Residuals and cyst formation in the maxillary sinuses were intraoperatively observed in 11 and two patients, which were removed by an endoscopic inferior meatal antrostomy. Clinical symptoms of chronic sinusitis in most patients were cured at 2 weeks postoperatively by removing nasal packing materials, purulent secretions, and inflammatory tissues to ensure a smooth drainage. Inflammatory signs in the maxillary sinus were not detectable on the re-examined CT scans.

# DISCUSSION

The extraction of maxillary teeth, especially maxillary posterior teeth, is a major cause of OAFs.[7,8] An OAF smaller than 2 mm usually self-closes if local inflammation is well controlled, but a large OAF with a minimum diameter of 3 mm combined with maxillary sinus or periodontal inflammation often requires a surgical closure.[9] Several types of flaps, like buccal mucosal flap, BFP flap, and palatal mucoperiosteal island flap, have been applied to the closure of OAFs. Buccal mucosal flaps ensure a simple surgical procedure, stable blood supply, and high survival, but they can only cover small defects and may narrow down the vestibular groove. They are usually used to close lateral or middle alveolar fistulas smaller than 1 cm in orifice diameter.[10,11] The palatal mucoperiosteal island flap can be used to repair large perforations (usually for closure of anteriorly based fistulas), but may cause discomfort in the donor site.[12] The BFP flap, an excellent option for repairing defects in the oral cavity, is mainly composed of fat tissues surrounded by an intact envelop. It has a central body and four extensions: buccal, pterygoid, pterygopalatine, and temporal.[13] The blood supply in the BFP flap comes from the buccal branch of the maxillary artery and the deep temporal artery. The rich blood supply of the BFP flap guarantees a high success rate of reconstruction.[14] The BFP flap is usually used to cover large

defects adjacent to the posterior molar region. Besides, it can be easily prepared and abundant supplies. Nevertheless, it is barely applied to the reconstruction of anterior maxillary defects, due to limitations by anatomic characteristics.[15] Limitation of mouth opening has been previously reported in OAF repair using BFP flaps, because of a large incision in the masseter that generally recovers well after a symptomatic treatment.[16] Hematoma, local necrosis, excessive scarring, infection, or facial nerve injury have also been reported after the reconstruction using BFP flaps.[17] Postoperative complications of defect reconstruction using BFP flaps are usually attributed to the inexperience of surgeons and the complexity of the surgery. Therefore, an excessive stretching of BFP flaps should be avoided, and tension-free suture is recommended to improve blood supply.[18] Based on our clinical experiences, we recommended to narrow down an OAF using an appropriate-size BFP flap, if the fistula is too large or distant from the BFP flap, rather than completely covering it. Subsequently, the fistula can be repaired using surrounding mucosa, thereby preventing an excessive stretching of BFP flap. In the present study, all patients achieved excellent surgical outcomes without postoperative complications like cheek depression and limitation of mouth opening. Therefore, we believe that the decent indications for surgery of FP flap are: fistula formation at oral extraction with a diameter of fistula greater than or equal to 5 mm. Notably, patients with a previous history of local radiotherapy, hypoplasia of the zygomatic bone or parotid gland, and thin soft tissues in the cheek are contraindicated to the use of BFP flap.[19]

Inflammatory factors are of significance in the formation of OAF and its treatment.[20,21] Borgonovo et al.[22] have proposed that reducing inflammation is the prerequisite for the treatment of OAF. Poeschl et al.[23] have reported that eliminating sinus inflammation before the closure of OAF using BFP flap can harvest an acceptable surgical outcome. Our study demonstrated that endoscopic maxillary sinus drainage combined with the use of BFP flap for repairing large OAFs was effective in patients with OAF-induced secondary nasal sinusitis. Therefore, odontogenic sinus disease should be regarded as an indication for endoscopic surgery to relieve clinical symptoms, rather than a relative contraindication to the repair of OAFs.[24]

Notably, postoperative unobstructed sinus drainage is the key to treatment success. In the present study, three of the 32 patients suffered obvious postoperative inflammation, which was cured after removing nasal packing materials, purulent secretions, and inflammatory tissues to ensure a smooth drainage. Nasal packing materials were removed at 3 days postoperatively in the remaining patients; then, the blood scab, pseudomembrane, secretion, and empyema in the nasal cavity and sinuses were immediately cleaned under the nasal endoscope. Patients were asked to regularly change nasal dressing within 1 month after discharge, aiming to prevent postoperative infection and adhesion and keep a smooth drainage. Finally, all patients achieved acceptable surgical outcomes.

Collectively, a thorough drainage of the sinuses and tension-free closure of fistulas are fundamental for the treatment of odontogenic OAFs.[25] An endoscopic surgery is featured by its superb ability to visualize the surgical procedure and postoperative recovery of OAFs. Compared with the conventional Caldwell-Luc operation, an endoscopic maxillary sinus surgery provides a drainage of maxillary sinus through the natural opening of middle nasal meatus and thus enhances the success rate of surgery and reduces the recurrence. However, it was a retrospective study with a relatively small sample size, and our findings should be further validated in large-scale prospective, controlled studies in the future.

## CONCLUSION

Secondary nasal sinusitis is not a relative contraindication to the repair of large OAFs. BFP flaps are an optimal reconstruction material to repair OAFs, due to simple preparation, high survival rate, excellent efficacy, and less complications. Endoscopic maxillary sinus drainage combined with the use of BFP flaps achieves an acceptable therapeutic outcome in patients with large OAFs and OMS.

### AUTHOR CONTRIBUTIONS

*Conceptualization*: Song Li. *Methodology*: Shu-Sen Liu and Chang-Zheng Li. *Validation*: Song Li and Xiang-Hai Hu. *Formal analysis*: Wei-Wei Heng. *Investigation*: Wei-Wei Heng. *Resources*: Wei-Wei Heng and Ping Jiang. *Data curation*: Shu-Sen Liu, Wei-Wei Heng, and Chang-Zheng Li. *Writing—original draft preparation*: Shu-Sen Liu. *Writing—review and editing*: Song Li and Xiang-Hai Hu. *Visualization*: Song Li. *Supervision*: Song Li. *Project administration*: Wei-Wei Heng.

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### CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

### DATA AVAILABILITY STATEMENT

The data and material are available through the corresponding author.

### ETHICS STATEMENT

The Ethics Committee of Nanjing Renpin ENT Hospital approved the study. Informed consent was obtained from all subjects involved in the study.

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