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Palatal island flap with or without hinge flap for closure of oroantral or oronasal fistula: a technical note

Abstract:

Objective: The study aimed to introduce the closure technique using palatal island flap with or without hinge flap for oroantral or oronasal fistula. We explained the surgical methods, assessed the efficacy of these techniques and compared with other closure methods.

Methods: This study included nine patients who were diagnosed with oroantral or oronasal fistula and underwent treatment; closure technique using palatal island flap with hinge flap (double flap closure) or that without hinge flap（single flap closure) between 2000 and 2022. Etiological factors included malignant tumors, benign tumors, cyst, and trauma. Double flap closure was performed in five cases, wherein primary closure was achieved with hinge flap created using surrounding palatal mucosa and secondary closure was achieved with palatal island flap. Single flap closure was performed in four cases.

Results: All nine patients were treated successfully, and follow-up showed no evidence of flap necrosis or major postoperative complications.

Conclusions: The main advantages of this double flap closure technique include effective primary closure with hinge flap, which can prevent perforation into the nasal cavity and/or sinus even if the secondary flap (palatal island flap) becomes loose due to palatal mucosa irritation, and rich blood supply in the palatal island flap from the greater palatine artery. These factors confirm the validity of this technique. Secure closure with single palatal island flap was achieved; however, more secure closure can be achieved by using double flap closure technique. Therefore, it is important to choose single or double flap closure technique depending on the case.

Keywords: oroantral fistula, closure technique, palatal island flap, hinge flap

1. Introduction

Oroantral or oronasal fistula is associated with an increased risk of sinusitis, food spillage into the sinus or nasal cavity, and dysglossia [1, 2]. Oral function can be restored using mucosal flap closures, with the most common methods utilizing buccal, palatal, or buccal fat pad flaps [3]. However, these methods have certain disadvantages including an increased risk of flap necrosis and possible loss of vestibular depth. Therefore, the current study aims to address these limitations by introducing a novel closure technique using palatal island flap with hinge flap.

2. Patients and methods

2.1. Patients

The current study focuses on nine patients (five females and four males, median age: 75 years) who were diagnosed with oroantral or oronasal fistula and underwent treatment at Hokkaido University Hospital and University of Fukui Hospital between 2000 and 2022 (Table1). Of these, five patients exhibited benign tumors, two exhibited malignant tumors, one exhibited cyst, and one presented with palatal trauma. Four patients were treated with one-stage procedure (Table 1: Number. 1 to 4), while the remaining five were treated with two-stage procedure (Table 1: Number. 5 to 9). One-stage procedure is a surgical method that involves removing the tumor and closing the fistula at the same time. We performed closure technique using palatal island flap without hinge flap (single flap closure) in these four cases. Two-stage procedure involves fistula closure, performed after a certain time period (about two years on an average) after tumor removal or trauma. In these five cases, we performed closure technique using palatal island flap with hinge flap (double flap closure). In particular, two-stage procedure was indicated for cases which need intensive follow-up due to a

possibility of recurrence.

2.2. Surgical method

In this study, we explained closure technique using palatal island flap with hinge flap (double flap closure). Closure technique using palatal island flap without hinge flap (single flap closure) is a similar surgical method except for the hinge flap forming step.

We used double flap closure technique for cases like Fig. 1A. First, the size of the fistula was estimated (marked in red in Fig. 1B①) and an incision line that exceeded the length and diameter of the fistula was created on the palatal mucosa (extended incision area shown in yellow in Fig. 1B②③). Thereafter, an incision was made along the predesigned line and a mucoperiosteal flap was elevated toward nasal direction. This step was particularly important as it simplified flap extension (Fig. 1H). After elevating the flaps around the incision area, they were turned orally such that they were facing the periosteum on each side. A hinge flap was then made and sutured to achieve primary closure (Fig. 1C, I).

Secondary closure was carried out by first designing a palatal island flap on the opposite side. At this stage, the width of the flap edge was evaluated (Fig. 1D①) to ensure that it was sufficient to cover the incision area (Fig. 1D②). Thereafter, an additional incision was carefully made at the base of the flap (shown in yellow in Fig. 1E) not to damage the palatine artery in the process. The flap was then rotated toward the primary closure area and sutured and fixed using 4-0 nylon to achieve secondary closure. Thereafter, artificial dermis was transferred to the exposed bone area (Fig. 1F) and fixed with a celluloid mouthguard.

3. Results

All nine patients underwent successful treatment without any postsurgical complications, and the median surgical duration was 2 hours. After surgery, patients ate a normal soft diet. Patients were asked to wear a mouthguard (Fig. 2) all times, except when brushing their teeth,

and were instructed to continue wearing it for about one to two weeks after surgery. The exposed areas of the bone was observed to be epithelialized without any complications three weeks postsurgery (Fig. 3A), and complete healing with flattened palatal mucosa was observed three months postsurgery (Fig. 3B). Furthermore, computed tomography imaging showed presence of 8-mm thick mucosa beneath the nasal cavity, with no observed symptoms of sinusitis (Fig. 3C).

4. Discussion

The most common causes of oroantral fistula, which are abnormal connections between the oral cavity and maxillary sinus [4], include extraction of teeth with root apices that lie close to the sinus (48%), treatment of cystic or neoplastic lesions (18.5%), and trauma (7.5%) [5]. Other plausible causes include necrosis of the flap during surgical procedures close to the sinus and dislodged implants [6].

The buccal flap technique, first introduced by Axhausen in 1930, involves creation of an incision in the buccal mucosa and utilization of a thin layer of buccal muscle to achieve closure [7]. However, this method is often associated with loss of vestibular depth, which can necessitate additional vestibuloplasty [8].

In the palatal flap method, the palatal mucosa is incised and moved toward the fistula to achieve closure [9]. The advantages of this method include adequate blood flow and good tissue quality and thickness, while the disadvantages include flap necrosis caused by excessive rotation and postoperative exposure of the bone surface resulting in surface irregularities and secondary epithelialization [8].

The buccal fat pad flap method involves closure of the fistula using adipose tissue from the buccal fat pad. The main advantage of this technique is the high flap mobility, which can be attributed to the use of adipose tissue. It is also one of the most frequently used methods as

the exposed adipose tissue is quickly epithelialized [10]. The disadvantages of this method are similar to those of the buccal flap and include loss of vestibular depth [8].

The advantages of double flap closure technique include reliable primary closure with a hinge flap (red line in Fig. 1I) that prevents perforation into the nasal cavity and/or sinus, even if the secondary palatal island flap (blue line in Fig. 1J) becomes loose due to irritation to the palatal mucosa. Therefore, this technique can potentially minimize the risk of fistula recurrence. The main disadvantage of this method is that it requires the patient to wear a mouthguard for one to two weeks to allow the exposed bone on the other side of the fistula to be covered with artificial dermis. The design of the flap is also more complicated than that of the other methods, resulting in longer surgical duration.

5. Conclusion

Since the bone surrounding the fistula supports the palatal island flap, single flap closure technique can achieve secure closure; however, more secure closure is possible to achieve by using double flap closure technique without any complications. These closure methods should be selected based on the size and location of the fistula and the patient's general condition.

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Declaration of competing interest

The authors declare that they have no competing financial interests or personal relationships that could have influenced the work reported in this paper.

Ethics approval

This study was approved by the Hokkaido University Hospital Independent Clinical Research Review Committee (Approval No. 022-0021). Informed consent was collected from all participants, and the study was conducted in accordance with the Declaration of Helsinki.

This retrospective study was conducted with the approval of the Hokkaido University Hospital Independent Clinical Research Review (Approval No. No. 022-0021) and waived the requirement for informed consent owing to the retrospective design.

Figure legends

Fig. 1

A: Incision line (dotted line shows the major palatine artery). （**mirror image**）

B: Measuring the fistula size and designing the incision line such that its diameter was wider than that of the fistula.

(①＜②＋③) （**mirror image**）

C: Primary closure (hinge flap). （**mirror image**）

D: Secondary closure (palatal island flap).

The width of the flap edge was evaluated (as shown in ①) to ensure it was sufficient to cover the incision area (shown as ②). （**mirror image**）

E: Incision at the base of the flap to allow smooth extension (shown as yellow lines). （**mirror image**）

F: Rotation of the flap toward the primary closure area, followed by suturing and fixing using 4-0 nylon. （**mirror image**）

G–I: Coronal plane of primary closure.

J: Coronal plane of double flap closure (red line shows primary closure and blue line shows secondary closure).

Fig. 2

Cover with a celluloid mouthguard.

Fig. 3

A: Epithelialization observed 3 weeks postsurgically. （**mirror image**）

B: Complete healing with flattened palatal mucosa observed 3 months postsurgically. （**mirror image**）

C: Computed tomography image of coronal plane three months after surgery.

Table 1

Clinical characteristics of patients treated using the palatal island flap closure technique.

Clinical characteristics of patients treated using the palatal island flap closure technique

Number	Age/Gender	Primary disease	Size of fistula (mm)	Reconstruction
1	75/F	Palate tumor	30 × 30	One-stage
2	67/F	Maxillary gingival tumor	Unknown	One-stage
3	77/F	Palate tumor	10 × 10	One-stage
4	69/M	Palate tumor	Unknown	One-stage
5	76/M	Maxillary cyst	Unknown	Two-stage
6	74/F	Facial fracture	2 × 2	Two-stage
7	75/M	Palate cancer	8 × 7	Two-stage
8	77/F	Palate tumor	12 × 12	Two-stage
9	82/M	Maxillary gingival cancer	26 × 18	Two-stage

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Fig. 1

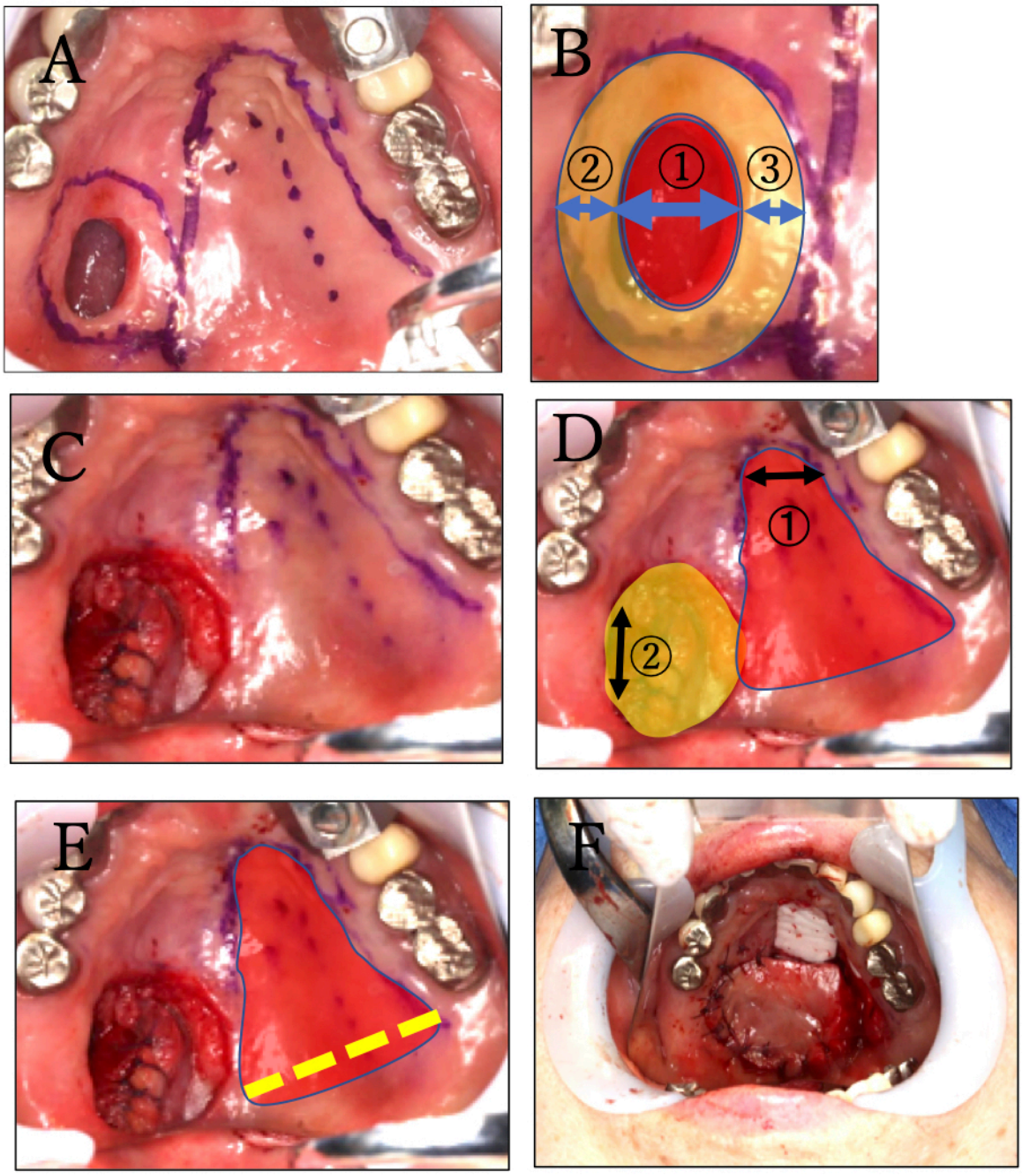

Fig. 1

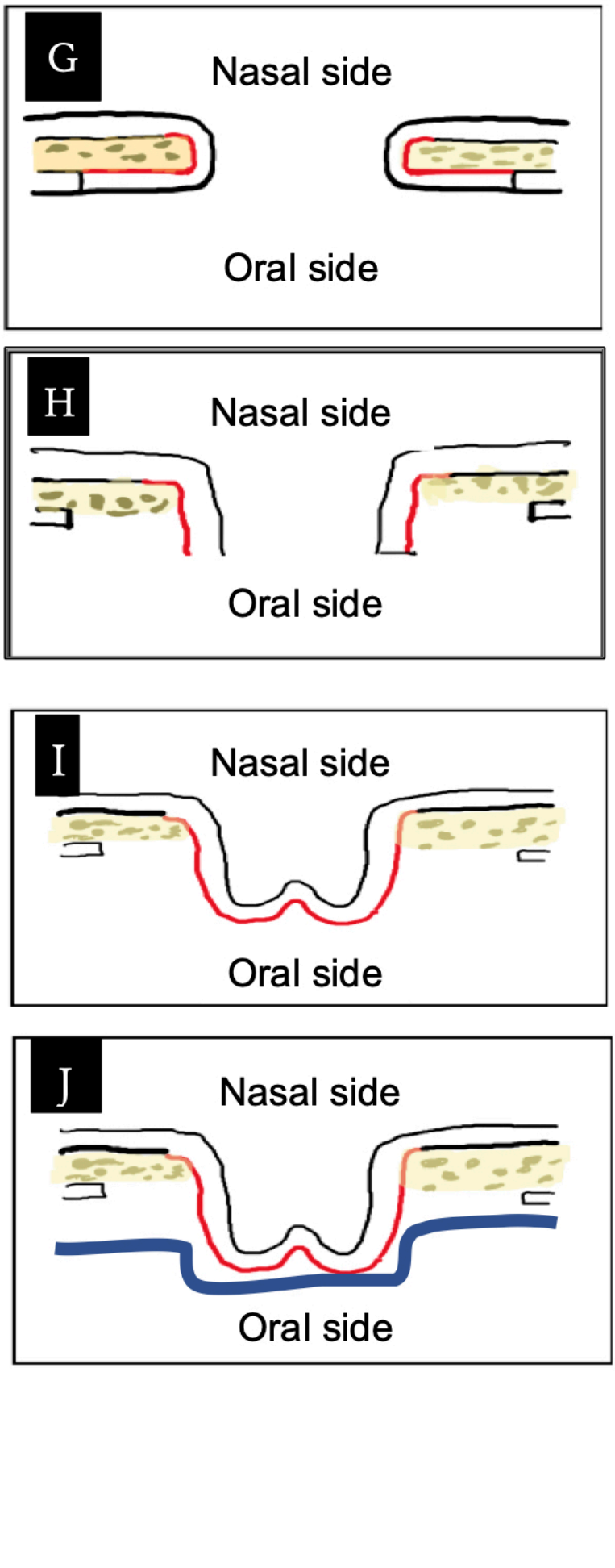
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Fig. 2

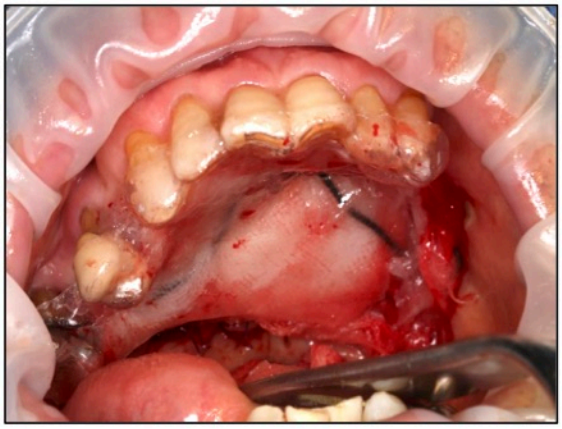
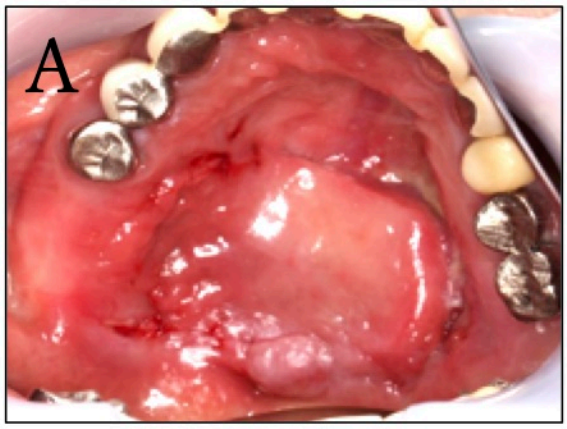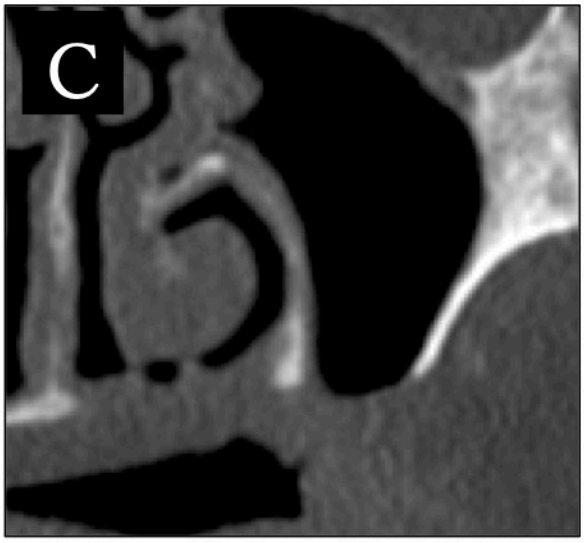
Fig. 3