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Research Article

Facial Artery Musculomucosal Flap for Closure of Fistula After Cleft Palate Surgery

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Abstract

Background: Palatal fistula is the most common complication of palatal repair. Most anterior palatal fistulas need tongue flap for closure, which is a two-stage procedure. In this article, we have used facial artery musculomucosal (FAMM) flap technique, for closure of anterior palatal fistula as a single stage procedure.

Methodology: Twenty-four patients with an oronasal fistula size range between 0.5-2cm² underwent the FAMM flap procedure. Follow-up was up to 2 years, assessing flap viability, recurrent fistulas, and speech changes.

Results: The flap showed promising outcomes, with one case of partial necrosis and no recurrent fistulas. The procedure achieved reduction in the velopharyngeal insufficiency.

Conclusion: FAMM flap offers a reliable one-stage option for oronasal fistula repair, demonstrating minimal complications and improved speech and oral hygiene. Further studies should assess velopharyngeal function in patients undergoing FAMM flap.

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Keywords | : Facial artery musculomucosal flap, oronasal fistula, palate reconstruction, velopharyngeal function, palate surgery.

Introduction

Fistula formation is the most frequent complication after surgery of a cleft palate. The reported incidence of this complication ranges between 8% and 40%[1], particularly in cases of bilateral complete cleft palate. Several factors can contribute to this with most important being the class and extent of cleft, procedure used for repair and the expertise of operating consultant[2,3]. The majority of fistulas occur at the midpoint where hard palate and soft palate meet, but in cases where the cleft is bilateral they occur mostly in the anterior most area close to alveolar arch. Repairing wide clefts or recurrent fistulas can be challenging due to severe scarring and tissue deficiency. Various local flap options have been employed for fistula repair, utilizing local mucoperiosteal flaps. Nasolabial flaps and buccal mucosal flaps, have been historically used.[2] While the tongue flap[3,4] is an effective option for difficult palatal fistulas, it necessitates a two-stage procedure, limiting its acceptance, especially among children.

Addressing the need for a one-step procedure with vascularized mucosal tissue, Pribaz et al. introduced the FAMM flap in 1992.[1] Combining principles from buccal mucosal and nasolabial flaps, the FAMM flap, based on the facial artery, proves reliable and versatile. It has been successfully utilized in various reconstructive scenarios, including oronasal mucosal lip, vermilion, nasal, and palate reconstruction. Notably, it has demonstrated efficacy in anterior cleft fistula repair, making it a valuable choice.[4]

Methodology

Our study analysed the retrospective data of all the patients who were treated with facial artery myomucosal flap for the repair of fistula in anterior palate secondary to previous palate repair procedure. All patients presented with complaints of regurgitation of food or water from nose during eating or drinking along with variable degree of hypernasality during speech. All the surgical outcomes and characteristics of patients were reviewed. The results were labelled as successful if there was no recurrence of oronasal fistula and no subsequent surgeries were required for the fistula.

Operative technique

FAMM flap is based on facial artery and corresponding vein and since it is an axial pattern flap it is designed along the course of the artery and must incorporate the artery in its entire length. Facial artery arises from external carotid artery. After its origin the artery courses upwards over the mandible close to the medial border of masseter muscle, it then travels upwards on the cheek in close proximity to the oral commissure finally coursing towards the lateral wall of nose across the ala dividing into various branches mainly angular artery. Facial vein always courses posterior to the artery[5]. There is a gradual increase in the distance between facial artery and vein as they course much closer to each other at the upper border of mandible with average distance of 4 mm between each other, which becomes almost 15 mm by the time the artery and vein reach at nasal ala. These anatomical observations are very important while planning a surgery as they play a key role when the operating surgeon plans to raise a flap, which is based superiorly. Along with facial artery, the flap also contains deeper fibres of orbicularis oris muscle, some part of buccinators muscle, submucosa and buccal mucosa[6]. Because of the axial nature of the flap it is highly reliable and versatile in its design and can be planned based on either the superior flow or inferior flow with equal reliability. However, when the flap is designed based on superior flow it has the added advantage of a longer arc of rotation than the inferiorly based flap and can reach the far distant areas up to lower orbit, nasal floor and upper lip in addition to alveolar and hard palatal defects[7].

The procedure was conducted with the patient under general anaesthesia, with endotracheal tube placed through mouth. The patient head was place in a position for palatal surgery with neck extension. A handheld Doppler was used to mark the whole course of facial artery from the border of mandible to ala of nose. A Dingman mouth gag was employed to maintain mouth opening.

Before the dissection, a solution of lignocaine and adrenaline was used to infiltrate all the margins of fistula. Dissection was carried out circumferentially making sure that the continuity between fistula margins and alveolar cleft is maintained. Nasal mucosal layer was aimed to be closed primarily by turned down flaps. The flap was usually raised from the side when there was open alveolar cleft in unilateral clefts, on the contrary, it was preferred to be raised from the side of a large fistula or left or right side depending on the handedness of the operator when there is no disparity of size in cases of bilateral clefts.

The flap was designed using reverse planning, creating a paper template covering the defect and indicating the pedicle's length. Flap was infiltrated with a mixture of adrenaline and lignocaine for postoperative analgesia and hydro dissection during flap raising. The flap, up to 30 mm long and 15 mm wide, was designed below the level of parotid duct to prevent inadvertent injury.

Incision was made through buccal mucosa, submucosa, underlying muscle into the buccal fat layer along the outline of the marked flap. After identifying facial artery was divided at the inferior border of flap. As the flap was raised retrograde, the blood supply was maintained through angular artery. A bridge of mucosa was maintained over the pedicle. Sub-periosteal dissection over the maxilla allowed tension free transfer of the flap. After advancing the flap through alveolar cleft, it was sutured into the defect using 5/0 polygalactin suture, and primary closure of donor site was done with 5/0 Polygalactin suture which absorb over four weeks time.

Postoperatively patients were managed with an intravenous cannula for the administration of pain medication and fluids. Subsequently, they were advised to consume soft food. No specific measures were required for the care of the surgical site except for ensuring its protection from harm until it heals. The stitches on the palate advised naturally dissolved in 6 weeks.

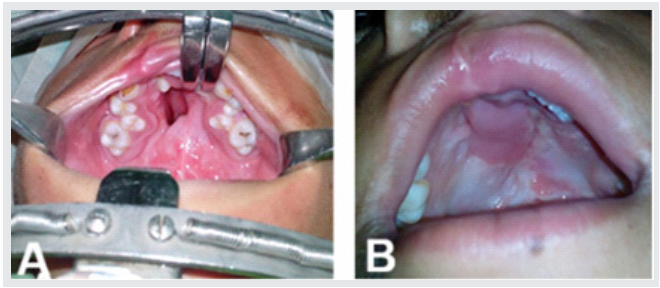

Figure 1. *7-year old child with right sided cleft lip and palate with anterior palatal fistula (A) after Famm Flap*

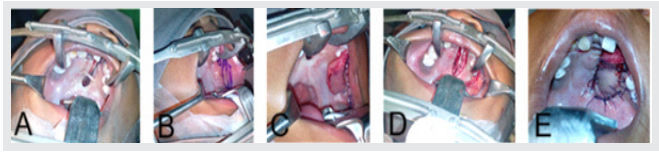

Figure 2. *12-year-old patient underwent surgery for complete unilateral left cleft palate (Veau type III). Pre- and post-surgery appearance of a large (>5mm) Pittsburgh types IV and V hard palate fistula, undergoing two layered closure of fistula in a single stage.(A-E)*

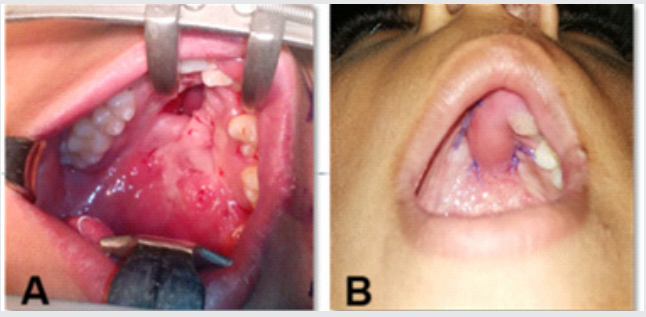

Figure 3: *8-Year-Old Girl with Left Unilateral Cleft and Palate with Anterior Nasoalveolar Fistula(A) Covered With Superior Based Facial Artery Musculomucosal Flap(B)*

Results

Twenty-four patients were included in this series. The average age was 4 years (range, 2 to 9 years). Ten patients had an oronasal fistula in the setting of bilateral cleft lip–cleft palate, two had unilateral cleft lip–cleft palate, one had an isolated cleft palate, and one had a palatal soft-tissue injury. Average oronasal fistula size was 1.5 cm^2 (range, 0.5 to 2 cm^2). Three patients required bilateral facial artery Musculomucosal flaps. The average follow-up was 2 years. There were no complete flap loss or donor-site complications. All patients were free of recurrent oronasal fistula. One patient had necrosis of the distal end (< 1 cm^2) requiring a revision.{Figure 1-4}, [Table 1]

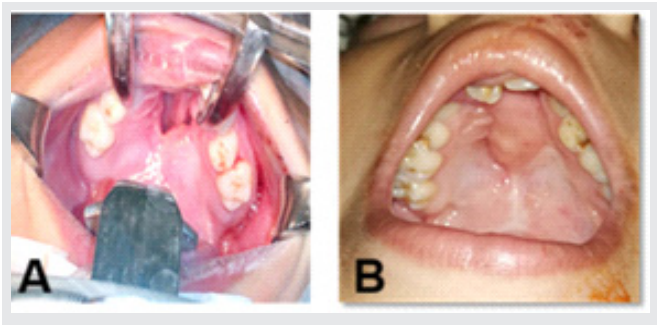

Figure 4: *A 7-year-old patient with a complete bilateral cleft lip and palate (Veau type IV) undergone surgery to address hard palate fistula (>5 mm), causing regurgitation and contributing to hypernasality and halitosis (A). Closure by left sided Facial Artery Musculomucosal (FAMM) flap(B).*

Table 1: *Patients Criteria and FAMM Flap Results*

Patient Criteria	No.	%
Age (2–9 Years; Mean 4 ± 2 Years)		
Gender		
Male	10	41.66
Female	14	58.33
Fistula Site		
Anterior Palate	14	58.33
Junction	10	41.66
Fistula Size		
Small (<0.5 Cm)	9	37.5
Medium (0.5-2 Cm)	15	62.5
Fistula Closure		
Satisfactory	23	95.84
Unsatisfactory	1	4.16
Complication		
Venous Congestion	3	12.5
Dehiscence	1	4.16
Flap Revision	1	4.16
2 Years Follow Up	24	100

Discussion

Different authors have reported many variations of the facial artery musculomucosal (FAMM) flap in the literature. Massarelli et al[6,7]. described an islanded flap involving the dissection of flap island and its

vascular pedicle all the way upto the external carotid artery, requiring the creation of a tunnel in the perimandibular space through floor of the mouth. Similarly Jackson et al[8]. in their respective studies used a different technique to repair oronasal fistula using a buccinator based random pattern buccal myomucosal flap and an incision in the palate would be required for the insetting of flap. In order to maintain the unobstructed motion of palate or without altering its length Matros et al[9]. reported creation of space for FAMM flap across retro molar trigone using medially based mucoperiosteal flap.

The FAMM flap technique, used for oronasal fistula types II-IV [10,11], involves flap insetting in the retro molar trigone and the velum to push back palate, resulting in an 18% average lengthening. Revision intravelar veloplasty further improves levator musculature repair[12,13]. While perceptual speech improved patients, further studies using video Naso-endoscopy and video fluoroscopyis required to assess the impact on velopharyngeal insufficiency.

The FAMM flap proves advantageous for anterior hard palate fistula closure due to its axial pattern, single-stage requirement, and minimal donor site morbidity[14]. Mouth opening reduction is temporary, and patient compliance is crucial for success.[15] Careful patient selection, particularly regarding behavioural issues, is essential. In complex cases which have recurrent fistulas after failed attempts to close them by local tissue or cases where anterior hard palate has wide fistula, the FAMM flap is considered the optimal surgical choice, providing highly vascular tissue closely matching the replaced tissue's characteristics with minimal donor site morbidity[16,17].

Conclusions

FAMM flap emerges as a fitting choice for the reconstruction of small to medium-sized palatal fistulas due to its dependable nature and versatile characteristics. This flap demonstrates minimal complications and guarantees satisfactory functional outcomes following palatal fistula repair, primarily owing to its remarkable similarity to palatal tissue. Positioned as an excellent option, FAMM flap excels in reconstructing fistulas located at the junction of hard and soft palate and also anterior part of hard palate as both of these sites are most prevalent for fistula formation following cleft palate surgery.

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Author's Contribution

Hassan Saeed Khan: Study design, drafting of work, Data Collection and final approval of the version.

Farhan Gohar: Conception and design of the study, critical revision of the article and final approval of the article to be published.

Muhammad Aslam Khan: Conception and design of the study, data collection, analysis and interpretation, Drafting the work Final approval of the version to be published and accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Shiza Naeem: Data collection, Manuscript Revision, analysis and interpretation of data and final approval of the version.

Umar Iqbal: Data collection, Manuscript Revision, analysis and interpretation of data and final approval of the version.

Javeria Khan: Contribution to conception and design of study, Data Interpretation and Analysis and final approval of the version.

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