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Website: https://journals.lww.com/cpcs
DOI: 10.4103/jclpca.jclpca_26_23
Quick Response Code:

# Experience with double transposition flaps and intravelar veloplasty for closure of wide cleft palates

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## ABSTRACT

**Background:** Repairing a wide cleft palate is a challenging task for surgeons. The goals of cleft palate repair such as achieving anatomical closure of the defect, complete velopharyngeal closure, speech development, and to minimize dentoalveolar anomalies are difficult to achieve in wide and massive cleft palates. Several methods have been described for the same. We performed double transposition flaps combined with intravelar veloplasty in our patients. In this article, we share our experience with the same. **Materials and Methods:** We reviewed 9 cases, in which double transposition flaps with intravelar veloplasty were performed. Patient demographics, clinical data, and outcomes were analyzed. Functional status including nasal resonance and palatal mobility were assessed with nasal endoscopy. **Results:** The average age at the time of surgery was 17 months. Four patients had associated diseases. The mean operative time was 55.7 min. The mean follow-up period is 23.7 months. Only posterior palatal closure was done in all the cases and patients were managed temporarily with obturators and are planned for delayed closure later. **Conclusion:** Double transposition flap is a safe, effective, and technically less demanding procedure. It has no wound complications and can avoid the need for osteotomy to correct maxillary retrusion. The main drawback of the procedure is the creation of an anterior palatal fistula that needs closure later.

**Key words:** Double transposition flap, massive cleft palate, palatal fistula, wide cleft palate

## INTRODUCTION

Bardach defined wide cleft as one, in which the distance between both the medial edges of the palate is more than 1.5 cm.[1] Extrawide or massive palatal cleft is defined as a defect larger than the width of both palatal shelves combined or more than 60% of the combined width of palatal shelves [Figure 1].[2] The goals of repairing a cleft palate are to achieve anatomical closure of the defect, competent velopharyngeal closure and speech, minimizing maxillary growth impairments, and dentoalveolar anomalies. Achieving these goals by conventional methods in wide cleft palates can result in wound dehiscence, fistulae, and denuded palate.[3] Hence, several methods of closure of cleft palate have been described. In this series, we performed double transposition flap closure introduced by Bakthavachalam and Ducic.[4] The aim of this study was to assess the efficacy of double transposition flap closure for wide clefts and its postoperative outcomes.

## MATERIALS AND METHODS

Nine cases of wide and extremely wide cleft palate, in which double transposition flap closure was done from 2018 to 2023 were reviewed. Patient demographics, clinical photographs, and clinical outcomes were assessed at the follow-up. Palatal index was calculated based on formula by Rossell-Perry *et al*., once the patient is under anesthesia.[5]

As shown in Figure 2a, the cleft's width (X) and width of both palatal shelves Y1 and Y2 are measured using calipers. All the measurements are taken at the posterior border of hard palate. Palatal index is obtained by

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**Cite this article as:** Kolisetty PV, Ali SS, Sudhy IK. Experience with double transposition flaps and intravelar veloplasty for closure of wide cleft palates. J Cleft Lip Palate Craniofac Anomal 2024;11:16-20.

**Submission:** 23.10.2023 **Revision:** 22.01.2024
**Acceptance:** 08.02.2024 **Web Publication:** 03.04.2024

dividing X with the sum of the width of both palatal shelves (Y1 + Y2). Patients with palatal index of more than 0.4 are considered for posterior palatal repair by double transposition flaps, followed by delayed hard palate closure.

## Operative procedure

All patients were operated under general anesthesia with intraoral endotracheal tube. Loupe magnification (×4.5) was used during surgery. After positioning the patient in neck extension, Dingman mouth gag is placed and 1% lignocaine with 1:1 lac epinephrine was infiltrated into the entire hard and soft palate. Incisions were made along the cleft margin and alveolar margin. These two incisions are joined anteriorly to free the mucoperiosteal flaps [Figure 2a]. Posteriorly, the cleft margin incision is extended up to the uvula and the alveolar margin till Ernst space. Flaps were elevated as in Bardach's two-flap palatoplasty. Flaps are dissected off the bone until greater palatine neurovascular bundle is reached at its foraminal exit [Figure 2b]. Flaps are mobilized toward the midline. In cases of wide cleft palate, when the medial approximation is not possible, the procedure is converted to double transposition flaps and closure done horizontally.

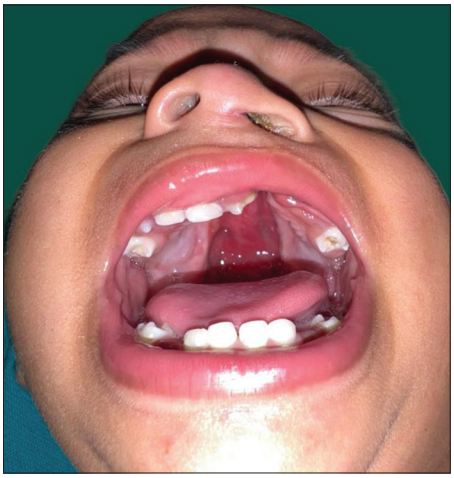

**Figure 1: Preoperative clinical picture of a wide cleft palate**

Nasal mucosa was approximated in the posterior and anterior part of the cleft. Abnormal palatal muscle insertion was detached from the hard palate. Muscle layer was approximated end to end and intravelar veloplasty was done. Both the mucoperiosteal flaps are transposed medially in an oblique fashion and closure was done in three layers with 4-0 Polyglactin sutures in soft palate and two layers in hard palate. We use two small pieces of gelatin sponge (AbGel) to place on the lateral defects as a hemostatic, which later resorbs. With the double transposition flaps, complete closure of the anterior hard palate is not possible. Inadvertently a fistula remains, which will be addressed later [Figures 2c and 3].

Postoperative monitoring of the airway and saturation was done until the patient was completely awake. They were given oral fluids after recovery. A liquid diet was given for 2 weeks, followed by a soft diet.

Patients were followed up at 1-month, 3-month, and 6-month intervals [Figure 4] for any possible complications and to know the functional status. Nasendoscopy was done at 6-month follow-up.

## RESULTS

A total of 9 patients with wide and extra wide cleft palate were operated on. Demographic and clinical characteristics are summarized in Table 1. The average age at the time of surgery was 17 months. Four patients had some associated diseases such as Pierre Robin

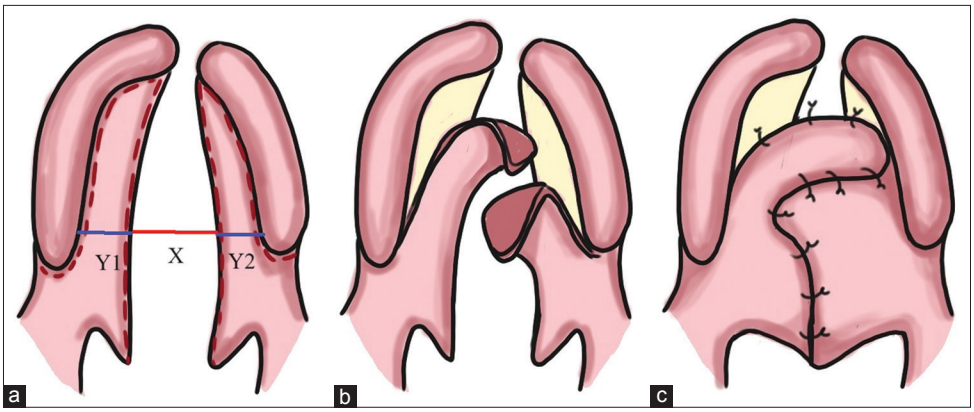


**Figure 2: (a) Diagram showing wide cleft. Incision marked with dotted red line, for the elevation of mucoperiosteal flaps. (b) Flaps elevated and transposed medially. (c) Flap insetting with horizontal closure of hard palate and vertical closure of soft palate. Note that the anterior cleft remains open after the procedure**

**Table 1: Patient demographics, clinical features, and results**

| Patient | Sex | Age (months) | Type of cleft palate | Associated disease | Width of cleft (mm) | Palatal index | Velopharyngeal competence at follow-up |
|---|---|---|---|---|---|---|---|
| 1 | Female | 12 | LAHS | - | 19 | 0.73 | Incompetent |
| 2 | Female | 16 | SH | ASD | 16 | 0.68 | Competent |
| 3 | Male | 13 | SHAL | - | 17 | 0.66 | Competent |
| 4 | Female | 24 | HSH | Dandy-Walker syndrome | 22 | 0.7 | Competent |
| 5 | Female | 19 | hSh | Pierrie Robin sequence | 20 | 0.85 | Incompetent |
| 6 | Female | 22 | SHAL | VSD | 16 | 0.73 | Incompetent |
| 7 | Male | 17 | LAHSHAL | - | 24 | 0.96 | Incompetent |
| 8 | Female | 14 | LAHS | - | 18 | 0.76 | Incompetent |
| 9 | Male | 16 | SHAL | - | 16 | 0.67 | Competent |

LAHS: Lip alveolus hard palate soft palate, SH: Soft palate hard palate, SHAL: Soft palate hard palate alveolus lip, HSH: Hard palate soft palate hard palate, LAHSHAL: Lip alveolus hard palate soft palate hard palate alveolus lip, ASD: Atrial septal defect, VAD: Ventricular septal defect

**Figure 3: Intraoperative picture after insetting of the palatal flaps**

**Figure 4: Follow-up photograph after 1 month. Note the anterior cleft remains unrepaired as a fistula**

syndrome, Dandy–Walker malformation, and congenital heart diseases. The mean operative time was 55.7 min. Complete anterior palatal closure was not possible in all the cases. Three weeks after surgery, all patients showed normal feeding, and there was no evidence of early wound complications in any of our cases. The follow-up period ranged from minimum of 6 months to 46 months with a mean of 23.7 months. During the follow-up, palatal mobility, nasal resonance, and quality of speech showed improvement. However, anterior palatal fistulas are present in all the patients. They are currently being managed with an obturator and are planned for delayed closure later.

## DISCUSSION

Repair of wide cleft palate is a challenging task for surgeons. Standard palatoplasty techniques such as Bardach's two-flap palatoplasty and von Langenbeck repair are used in wide clefts. They result in a high incidence of complications such as oronasal fistula and velopharyngeal incompetence. Several techniques have been described in the literature addressing wide cleft palate.

Bengt Johansson first described an extended pharyngeal flap for closure of extremely wide cleft palate, as reported by Bardach.[1] Bumsted used this principle to attain two-layered closure in a series of 4 patients.[2] Holmström *et al.* performed repair using an elongated pharyngeal flap with a Wardill-Kilner palatoplasty in 11 patients with extensive clefts. All patients had transient dysphagia. Two of them had better speech after surgery.[3]

Free tissue transfers including radial forearm free flap and dorsalis pedis flap are described for acquired palatal clefts and fistulas in adult patients. Although free flaps can provide adequate tissue, they take longer time and are technically challenging. They are not feasible for congenital clefts in infants.[6,7]

Chen and Zhong introduced bilateral musculo-mucosal buccal flaps. They used buccinator muscle for reconstruction. In a series of 26 patients, they achieved satisfactory velopharyngeal closure without any postoperative complications.[8] Mucoperiosteal hinge flap from oral mucosa can be used for nasal layer

reconstruction, combined with pushback palatoplasty for the oral layer. This was introduced by Lee *et al*. but can only be used for small-to-medium-sized palatal defects.[9] Mann and Fisher used a technique of bilateral buccal flaps in combination with Furlow's double-opposing *Z*-plasty. This method increases the length of the palate and reduces tension.[10]

The neurovascular bundle of the greater palatine artery originates from a rigid foramen on the posterior hard palate. Its fixed position is a limiting factor for medial mobilization.[11] To overcome this difficulty, to increase the medial reach of the mucoperiosteal flaps, medial osteotomy of greater palatine foramen has been described.[11] This increases the mobility of palatal flaps and decreases the tension in closure, but it is a traumatic procedure.

Skeletonization of greater palatine artery combined with muscle release increases the reach of the mucoperiosteal flaps. The flaps can be moved medially to close defects of wide palatal clefts. In addition, posterior or backward mobilization lengthens the soft palate.[12]

Double transposition flap was first introduced by Bakthavachalam and Ducic. It is combined with intravelar veloplasty to attain soft palate function.[4] Compared to all the abovementioned techniques, this method of double transposition flaps takes less operative time and is technically simpler. As there is minimal tension at the junction of the hard and soft palate, postoperative dehiscence is unlikely to happen. The resultant scar is *Z*-shaped over the posterior hard palate and linear over the soft palate. This reduces tension in the suture line and avoids the shortening of the soft palate. Using this technique, we could attain 7–10 mm of additional length by posterior mobilization. Pterygoid hamulus was not fractured in any of our cases.

Two-stage closure to improve velopharyngeal competence was introduced by Gillies and Fry in 1921 and further developed by Schweckendiek and Doz, Slaughter.[13-15] In the two-stage repair regime, soft palate repair is done in the first stage, followed by hard palate repair later.[14] This achieves functional veloplasty without disturbing the maxillary fibromucosa during the closure of the hard palate without compromising the length of the soft palate. It also creates the muscular sphincter of the soft palate. Following the closure of the soft palate (and cleft lip if present), the distance between the pterygoid hamuli, maxillary tuberosities, and posterior parts of the alveolar segments reduces. Under the influence of repaired lip, soft palate, and tongue function, the width of the hard palate cleft reduces over 6 months to 1 year. In the case of wide clefts, it might take even longer. Maxillary development and intermaxillary relationship are better with this method but at the expense of speech impairment. Hence, it is now considered obsolete.[16]

In the protocol followed by Rossell-Perry *et al*.,[5] patients with palatal index between 0.2 and 0.4 are managed by two-flap palatoplasty techniques. For patients with palatal index of more than 0.4, they followed delayed hard palate closure as the width of palatal shelves is not enough to close the entire palate without fisula.[5]

In our series, we selectively included patients with wide and extremely wide clefts. Palatal index in all our patients is more than 0.6. Hence, it was impossible to close the cleft only with available narrow palatal shelves. The primary aim was to achieve secondary palatal closure. Hence, the anterior cleft of the hard palate remains as a fistula, for which delayed repair will be planned later [Figure 2c]. This is the drawback of the procedure that we found in our series. This was not mentioned by Bakthavachalam and Ducic in their article.[4] All the patients are being followed up to assess speech development, deglutition, and maxillary growth. As there is tissue deficit and minimal lengthening of the posterior palate, velopharyngeal closure could not be achieved in five of our cases. Limited dissection done in the anterior palate facilitates better growth of maxilla.

## CONCLUSION

For the closure of challenging wide posterior palatal clefts, double transposition flap is effective, safe, and technically less demanding procedure. There is no need for osteotomy and it gives a tension-free suture line to avoid wound dehiscence. It results in a retained cleft of anterior hard palate that needs delayed closure later. This drawback has not been emphasized enough in the literature. However, with extremely wide clefts with limited tissue available, it can be considered an option.

### Financial support and sponsorship
Nil.

### Conflicts of interest
There are no conflicts of interest.

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