

Surgical management of primary palatoplasty - A systematic Review

Type of Manuscript: Review Study

Running Title: Surgical management of primary palatoplasty

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Abstract: Clefts of the secondary palate, either isolated or accompanying, a cleft lip, are characterized by a defect in the palate of varying extent and by abnormal insertion of the levator veli palatini muscles. It is argued that repair of the palate should be carried out in one stage, shortly before or after 1 year of age, and should include intraveloplasty. Surgical corrections of cleft lip and palate primary lip repair such as (surgery for lip correction) and primary palatoplasty (reconstruction of hard and/or soft palate), are recommended in the first year of life. Primary palate surgery can be performed through various surgical techniques, of which the best for the type and the extent of the cleft is chosen, always seeking correction from the anatomic and functional point of view. Surgical failure may occur due to the surgical technique, the surgeon's skill, and/or the extent of the cleft palate. A Cleft palate repair is of concern to plastic surgeons, speech pathologists, otolaryngologists and orthodontists with respect to the timing of the operation, the type of palatoplasty to be considered and the effect of the repair on speech, facial growth and eustachian tube function. The objective of this procedure is to close the palatal defect and create an adequately functioning velopharyngeal mechanism for normal speech production. Surgery of the palate generally occurs between 9-15 months of age. It is done at this time in an effort to provide the child with the best physiological mechanisms for language and speech development. A preoperative work-up with hemoglobin and hematocrit levels must occur within 30 days of surgery. Most children spend 1 or 2 nights in the hospital following surgery. They will return for a follow-up appointment 3-4 weeks after surgery. A visit with the cleft surgeon and other members of the cleft team should occur 3-6 months later. The principal outcome measures are facial, attractiveness, speech, facial growth and psychological wellbeing.

Keywords: Cleft palate, Primary palate surgery, palatoplasty

INTRODUCTION

Cleft lip and palate (CLP) are among the most common congenital malformations.[1] Patients with CLP generally have higher rates of health complications such as speech delays, behavioral disorders, failure to thrive, otitis, hearing loss, and dental anomalies, for which they undergo numerous surgical procedures [2-4]. The functional goals of the cleft palate surgery are to facilitate normal speech and hearing without interfering with the facial growth. [5,6].Although operative treatment has been proven to be beneficial for these patients, there are increasing concerns about higher exposure to general anesthesia and its association with abnormal neurocognitive development. Some ideas regarding surgical treatment of clefts evolved overtime, while others, which were once promising, did not appear to be as successful as previously expected and were finally abandoned. In fact, the efficacy of cleft surgery evolves as well and consequently, older reports about the subject are not fully relevant and up-to-date anymore. Our surgical protocol of treatment of patients suffering from isolated cleft palate is composed of the primary palatoplasty according to one-stage method performed during the second half of the first year of life. Large defects after primary cleft palate repair are not a common complication. In such cases, the extent of functional impairment is great, which has psychological, social, and developmental consequences; therefore, the defect should be repaired.

Von Langenbeck technique

In 1861, Bernard von Langenbeck described a method of uranoplasty (palatoplasty) using mucoperiosteal flaps for the repair of the hard palate region. He maintained the anterior attachment of the mucoperiosteal flap to the alveolar margin to make it a bipedicle flap.[11] Originally only the cleft edges were incised, a lateral incision was made, the flap was elevated from the hard palate, the palatine musculature was divided and finally the sutures were applied. A complication following cleft palate surgery is the development of oronasal fistulas. Despite recent advances aimed at addressing this concern, rates of postoperative fistulas have

remained unchanged and are reported at between 3% and 60%. A study showed the introduction of the anterior triangular flap, and 0 of 180 patients did not develop a postoperative oronasal fistula. This modification of the standard Von Langenbeck uses an anterior triangular flap and confers the advantage of assisting in nasal side closure of the anterior margin of the cleft; in doing so, it reduces the rate of fistula formation.[7]

Bardach Two-flap Palatoplasty

A modification of the von Langenbeck technique in which the incision is made along the cleft margin and the alveolar margin. These are joined anteriorly to free the mucoperiosteal flaps.[13,14] These flaps are based on the greater palatine vessels. The soft palate is repaired in a straight line. The levator palati muscle dissection and reconstruction of the muscle sling is performed as in intravelar veloplasty. This is a technique commonly followed presently. Using this technique, many palatal clefts can be closed without leaving bare bone exposed lateral to the mucoperiosteal flaps in the area of the hard palate. Precise dissection of the muscles of the soft palate from the posterior edge of the bony palate and from the nasal periosteum allows for increased mobility as well as lengthening of the soft palate.

Bardach [16] first devised the two-flap palatoplasty in 1967. In this technique, mucoperiosteal flaps are released from the cleft margins to close relatively narrow clefts. The design of this flap depends entirely on the greater palatine neurovascular pedicle, and it has the advantage of greater versatility for cleft coverage.

The Furlow double-opposing palatoplasty

(FDOP) was first introduced by Leonard Furlow in 1978. It has gained acceptance by many surgeons as the preferred technique for cleft palate repair. Although conceptually and procedurally a challenge, the FDOP has the distinct advantage of lengthening the soft palate and restoring normal velar anatomy and function. Since its introduction, the FDOP has undergone several modifications, much like other named cleft lip and palate techniques. The FDOP is designed for soft palate reconstruction; therefore, a hard palatal procedure is necessary if simultaneous repair is undertaken in the complete cleft case. This topic is discussed more thoroughly elsewhere; however, a brief overview is undertaken here to provide a comprehensive demonstration of how the FDOP is incorporated with hard palate repair. Disadvantages of the FDOP are related to execution of the technique because it involves more geometric configuration in planning and more time spent in creating and transposing the flaps for closure. The Z-flaps have different angles according to the width of the palatal defect and available soft palate tissue. There is a recognized longer learning curve for the FDOP technique, which also may translate into increased operating time initially.

Two-stage palate repair

Two-stage palate repair with delayed hard palate closure is generally advocated because it allows the best possible postoperative maxillary growth in patients with unilateral cleft lip and palate, two-stage palate repair has a smaller adverse effect than one-stage palate repair on the growth of the maxilla. This stage effect is on the anteroposterior development of the maxilla and is attributable to the development being undisturbed before closure of the hard palate (i.e., hard palate repair timing specific).[18] It has been reported that two-stage palatoplasty is excellent in terms of maxillary growth but poor in terms of speech outcomes. We modified the two-stage Zurich approach in two aspects. First, the speech plate is placed immediately after soft palatoplasty using Perko's technique to prevent air leakage through the nose in all cases. The other is that simultaneous closure of the alveolar and hard palate cleft with bone grafting is delayed until age ≥ 8 years to allow maxillary growth. In this paper we report on postoperative velopharyngeal function and role of the speech plate.

Veau-Wardall-Kilner palatoplasty

The disadvantage of using the pushback technique (Veau-Wardall-Kilner palatoplasty) involves increasing the length of the soft palate, thereby lengthening the large raw area of the nasal surface which is left open. The raw area heals by secondary intention and causes shortening of the palate.[19] In this technique V-Y procedure is performed so that the whole mucoperiosteal flap and the soft palate are retroposed and the palate is lengthened.[11] However, it leaves an extensive raw area anteriorly and laterally along the alveolar margin with exposed bare membranous bone. The raw area heals with secondary intention. This causes shortening of the palate and results in velopharyngeal incompetence. The raw area adjacent to the alveolar margin also results in alveolar arch deformity and dental malalignment.

To increase the lengthening of the soft palate George Dorrance advocated horizontal back-cut in the nasal lining at the junction of hard and soft palate.[12] This leaves a large raw area on the nasal surface which is left open. This may contract after healing with secondary intention and may undo the palatal lengthening. Since there is single-layer repair in the region of the back-cut, the incidence of palatal fistula is high.

Intravelar Veloplasty

In 1968 Braithwaite first described the dissection of the Levator Palati from the posterior border of the hard palate, nasal and oral mucosa and posterior repositioning. He also described independent suturing of the muscle with that of the opposite side for the reconstruction of the Levator sling.[22] Palate re-repair with radical IVV (radical secondary IVV) as a method of correcting VPI was introduced by Sommerlad,^{[36],[37]} and he recommended it as the first-line treatment for VPI where primary palate repair had been done with little or no levator dissection and retrodisplacement. A further consecutive series was reported later by Sommerlad *et al.* in which 84% of patients had previously undergone some degree of muscle correction in the primary repair.^[38] The indication for this procedure in patients with confirmed VPI was evidence of anterior insertion of LVP during intraoral examination,

videofluoroscopy, or nasoendoscopy. A pharyngoplasty has been avoided in 88.2% of patients with this procedure. During a 10-year follow-up, the requirement for secondary velopharyngeal surgery reduced from 10.2% to 4.9% to 4.6% by 1992. The rate of fistula repair is reported to have been 15%, considered to be due to attempts to avoid lateral releasing incisions. A retrospective study by Lu *et al.* on the incidence of palatal fistula following IVV by Sommerlad technique showed no increase in fistula rate.^[28] In a study on 175 patients who underwent palatoplasty according to Sommerlad technique by Becker and Hansson,^[29] the fistula rate was found to be low, and they attribute this to liberal use of lateral releasing incisions. The most common site of fistula was at the junction of the hard and soft palate, and no difference in frequency of fistula was seen between different types of clefts in their series.

Furlow Double Opposing Z-Plasty

Furlow adopted a double reverse Z-plasty for the oral and nasal surfaces of the soft palate. The cleft margin forms the central limb. The muscle is incorporated into the posteriorly based triangular flap on the left side for ease of dissection.^[15] The hard palate region is closed by making an incision along the cleft margin, elevating the mucoperiosteum from the medial side and taking advantage of the high arch, the cleft is closed in two layers without making a lateral incision. Furlow described the use of the lateral relaxing incision only when necessary.

Preservation of the mucoperiosteal flaps after palatoplasties guarantees the closure of the cleft and functional outcomes for speech and feeding. Mucoperiosteal flap necrosis is a rare and serious complication after palatoplasty in patients affected by cleft palates. Regarding intraoperative complications, patient presents with excessive bleeding, laceration of the nasal mucosa.

DISCUSSION

Cleft palate surgery has a long history, and it has evolved through modifications made to existing surgical procedures to tackle problems faced by surgeons. The challenge of palatoplasty is no longer just to achieve tension-free closure of the cleft and to prevent palatal fistula, but also to increase palatal length, to improve speech outcomes, and to have a minimal effect on maxillofacial growth [15]

Von Langenbeck's palatoplasty is the most commonly used technique worldwide and involves raising bipediced mucoperiosteal flaps to cover the cleft. Although this procedure is simple, the speech outcomes are poor because of inadequate retroposition [35]. Patients undergoing primary palatoplasty are treated surgically at 6–18 months of age depending on the ease of follow-up. In cases of trans-foramen clefts, primary cheiloplasty is performed in patients older than 3 months and primary palatoplasty can be performed 6 months later using the von Langenbeck technique with or without a vomer flap. Cheiloplasty was not performed together with primary palatoplasty in this population. CP type was classified as narrow, normal, or wide; in narrow clefts, the procedure was performed in one surgical stage, while in normal or wide clefts, it was performed in two stages (soft palate first, hard palate 6 months later).

All patients underwent surgery while under general anesthesia and orotracheal intubation under direct vision. A Dingman mouth gag was positioned after adequate visual inspection. The Veau-Wardill-Kilner technique is a simple V-to-Y incision on the hard palate with closure, thus producing pushback in the palate. It produces excellent results in terms of speech outcomes because it achieves palatal lengthening, but it has the disadvantage of creating larger raw areas anteriorly [1]. Bardach described reconstruction of the cleft utilizing the arch of the palate, which provides the length needed for closure. This technique is essentially a modification of von Langenbeck's technique by extending the lateral alveolar relaxing incisions to the edge of the cleft. However, Bardach's technique is most effective only in narrow clefts

Oronasal fistulas commonly occur between the hard and soft palate and at the anterior portion of the cleft. These fistulas lead to functional problems with nasal emission, hypernasal speech, and food regurgitation through the nose. For clefts of the secondary palate, we developed a modification of the Von Langenbeck technique in which an anterior triangular flap is used to decrease the incidence of postoperative fistulas.

In summary, the FDOP is a sound anatomic and predictable palatoplasty technique for cleft palate repair. Advantages include anatomic reorientation and reconstruction of the tensor levator sling, lengthening of the soft palate without a pushback of the hard palate tissue, low fistula rates, and predictably good speech results. Disadvantages are related to the technical aspects of creating the respective Z-plasties, which may result in longer operating times initially. The major drawbacks of standard procedures of palatoplasty have been inadequate palatal lengthening, velopharyngeal incompetence, impaired maxillary growth with mid-face retrusion and high fistula rates.

The Furlow's double opposing Z-plasty is accepted as one of the better procedures for treating cleft palates.^[40] The major advantages of Furlow's Palatoplasty are excellent lengthening without the use of tissue from the hard palate [44]. The overlap of the levator achieves a better sling i.e., by avoiding a straight line incision, the zigzag incision in a rapidly moving organ like the soft palate gives better functional results [4, 5, 7]. The rate of fistulae formation is less than in other procedures. Furlow palatoplasty was more effective than two-flap palatoplasty in obtaining perfect velopharyngeal closure. A probable explanation may be that Furlow palatoplasty can reposition and overlap the divergent palatal muscle and lengthen the soft palate.

Large raw areas of the hard palate are not left exposed as in VKW procedures, scar formation and maxillary retrusion are minimal. Speech results in all reported series are excellent and hearing loss is an infrequent problem. The drawbacks of this procedure include a demanding and time-consuming surgery. In very wide clefts a back cut or lateral mucoperiosteal relaxing incisions may be necessary and the disadvantage of a zigzag incision is the impossibility of re-opening the soft palate other than by dividing the muscles [6, 7].

Post operative management

1. Postoperative oral fluid is given as soon as the child regains full consciousness
2. NSAIDs such as diclofenac, are given in the form of rectal suppository provides effective analgesia. paracetamol suppository and oral suspension are also given.
3. Arm restraints are used to avoid self-inflicted trauma with uncontrolled hand movement of the child during postoperative period. But many centres have stopped using arm or hand restraint in these children. These centres report that there is no increase in the complication rate in the absence of these splints.

Surgical Complications

Common complications of any palate surgery are as follows:

Immediate complications:

1. Haemorrhage
2. Respiratory obstruction
3. Dehiscence of the repair
4. Oronasal fistula formation
5. Hanging Palate

Late complications

1. Bifid uvula
2. Velopharyngeal Incompetence
3. Abnormal speech
4. Maxillary hypoplasia
5. Dental malpositioning and malalignment
6. Otitis media

CONCLUSION

It is important to evaluate clinical outcomes of primary palatal surgery and to identify factors related to clinical outcomes in order to improve cleft care and achieve the ultimate goal of individuals with cleft palate, that is, to restore a mechanism for normal speech production. To implement a better clinical service approach, it is important to evaluate complications and surgical outcomes. It is also necessary to identify factors that influence surgical outcomes and successful clinical management of individuals with cleft palate. Clinical outcomes of primary cleft palate repair are related to several factors, including cleft type, the extent of innate clefting, surgical repair techniques, expertise of the operating surgeon, preoperative orthopedics, and timing of primary palatal repair. This study examined the effect of only one influential factor on clinical outcomes. Future research should investigate the relationship between several influential factors and clinical outcomes comprehensively.

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 Published online 2011 Jul 21. doi: [10.1016/S0377-1237\(06\)80010-9](https://doi.org/10.1016/S0377-1237(06)80010-9)
 PMCID: PMC4922880
 PMID: [27365686](https://pubmed.ncbi.nlm.nih.gov/27365686/)

Furlow's Palatoplasty for Cleft Palate Repair

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