JURNAL
REKONSTRUKSI DAN ESTETIK

COMPLETE UNILATERAL CLEFT LIP SURGERY USING MODIFIED ROTATION-ADVANCEMENT FLAP TO ENHANCE AESTHETIC APPEARANCE IN RSPAL DR. RAMELAN HOSPITAL: A CASE SERIES

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ARTICLE INFO

Keywords: Cleft lip surgery,childbirth complications, complete unilateral cleft lip,human & health, modified rotation-advancement flap

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***History*:**
Received: August 14, 2024
Revised: October 30, 2024
Accepted: November 5, 2024
Published: December 1, 2024

JRE : Jurnal Rekonstruksi dan Estetik
e-ISSN:2774-6062; p-ISSN: 2301-7937
DOI: 10.20473/jre.v9i2.59067
Open access :

Available at:
https://e-journal.unair.ac.id/JRE/

***How to cite*:** Hadikhosuma JN, Wicaksono B,& Dhiparedja R. COMPLETE UNILATERAL CLEFT LIP SURGERY USING MODIFIED ROTATION-ADVANCEMENT FLAP TO ENHANCE AESTHETIC APPEARANCE IN RSPAL DR. RAMELAN HOSPITAL: A CASE SERIES. Jurnal Rekonstruksi dan Estetik .2024; 9(2):100-110.

ABSTRACT

Introduction: Unilateral cleft lip is a common congenital anomaly affecting the upper lip and nose, impacting both aesthetics and function. Advances in surgical techniques have enhanced cleft lip repair, with the rotation-advancement flap being a notable method. This study examines the outcomes of a modified Millard's rotation-advancement flap technique, developed and refined over 14 years. Case Illustration: Between September 2023 and February 2024, four patients with complete unilateral cleft lip and associated nasal deformity were treated at RSPAL Dr. Ramelan Hospital. Each patient underwent cleft lip repair using the modified rotation-advancement flap technique.

Case Illustration: Four patients presented with complete unilateral cleft lip with nose deformity came to RSPAL Dr. Ramelan Hospital between September 2023 and February 2024, We performed cleft lip surgery using the modified rotation-advancement flap for each patient.

Discussion: Surgical outcomes showed excellent symmetry, proper vermilion border alignment, and minimal scarring. Complications were rare, with no instances of wound dehiscence or infection. The study discusses the aesthetic and functional improvements achieved with this technique, underscoring its effectiveness in treating complete unilateral cleft lip and enhancing patient quality of life.

Conclusion: The Modified Rotation-Advancement Flap technique provides a valuable approach for unilateral cleft lip repair, yielding satisfactory aesthetic and functional results. Further research with long-term follow-up and larger sample sizes is needed to confirm its efficacy and refine the technique.

Highlights:

1. Complete unilateral cleft lip influences not only the aesthetics of the face but also the functionality of the lip, nose, and upper jaw (maxilla).
2. The surgery aims to establish a symmetrical, functional, and visually appealing contour of the lip, vermilion border, and nasal structure.
3. The modified rotation-advancement flap represents a valuable approach for complete unilateral cleft lip repair surgery.

INTRODUCTION

Complete unilateral cleft lip is a complex congenital deformity significantly affecting facial aesthetics and function. [1] It arises when there is an improper fusion of the nasal and upper lip structures during embryonic development. Occasionally, a complete unilateral cleft lip is discovered with the nasal tip depressed, the ala displaced, the nostril floor widened, the columella slanted, and the alar and lower lateral cartilage drooping [2] This defect influences not only the aesthetics of the face but also the functionality of the lip, nose, and upper jaw (maxilla). Surgical repair is essential to address both the aesthetic and functional aspects of the deformity [3]

The surgery aims to establish a symmetrical, functional, and visually appealing contour of the lip, vermilion border, and nasal structure. Repositioning the orbicularis oris muscle along the cleft is crucial for achieving muscle continuity and restoring function. The nasolabial units, consisting of the columella, philtrum, Cupid's bow, and nose (including the nasal alar and tip), should exhibit symmetry. The upper lip should have the correct length, width, and protrusion in comparison to the lower lip, and its detailed structures, such as the contour of the philtral ridge, the placement of the Cupid's bow peak, and the projection of the upper labial tubercle, should look natural. [4]

Over the past few decades, surgical techniques for repairing unilateral cleft lip have significantly improved. The modern approach incorporates tailored planning, careful tissue management, and precise surgical techniques.[3]The modified rotation-advancement flap technique, developed as a modification of the classic Millard technique, is a well-established surgical approach for repairing complete unilateral cleft lips. This technique aims to achieve optimal lip symmetry and minimize scar formation by utilizing precise incisions and tissue rearrangement.[2]

The authors of the current study have employed a modified rotation-advancement flap technique based on 14 years of experience. This article introduces a novel approach to complete unilateral cleft lip repair developed by the senior author to enhance surgical outcomes for patients with this condition. The surgical technique and outcomes of the surgeries, including aesthetic improvements and functional results, are discussed. This case series highlights the effectiveness of the modified rotation-advancement flap in achieving satisfactory results for patients with complete unilateral cleft lips, contributing to their overall well-being and quality of life.

CASE ILLUSTRATION

Four Four patients presented with complete unilateral cleft lip and associated nose deformities at RSPAL Dr. Ramelan Hospital between September 2023 and February 2024. We performed cleft lip surgery using the modified rotation-advancement flap for each patient.

Case 1

A 3-month-old female patient was diagnosed with a complete unilateral cleft lip on her right side, accompanied by a nose deformity involving the drooping of her lower lateral cartilage and alar cartilage.

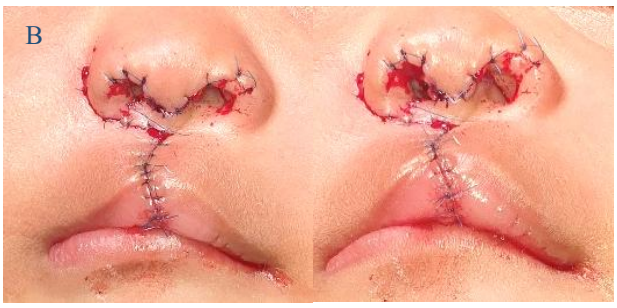


Figure 1. (A) Pre-operative photographs of Case 1. (B) Post-operative photographs. (C) One-week follow-up post-operation shows symmetrical ala nasi, a straight columella, and a natural lip contour.

Case 2

A 3-month-old male patient was diagnosed with a complete unilateral cleft lip on his right side, along with a nose deformity involving the drooping of his lower lateral cartilage and alar cartilage.

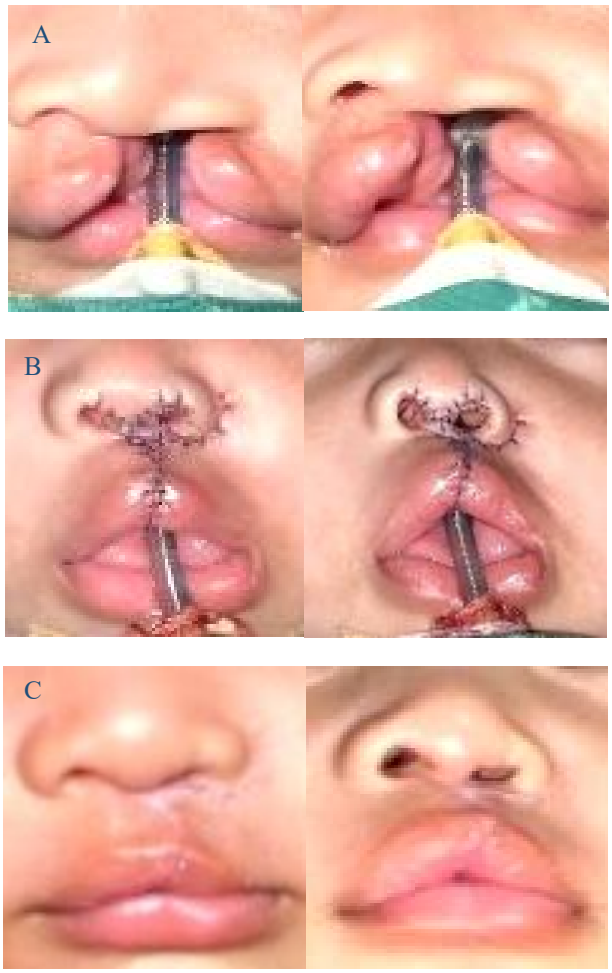


Figure 2. (A) Pre-operative photographs of Case 2. (B) Post-operative photographs. (C) One-week follow-up post-operation shows symmetrical ala nasi, a straight columella, and a natural lip contour.

Case 3

A 3-month-old male patient was diagnosed with a complete unilateral cleft lip on his right side, along with a nose deformity involving the drooping of his lower lateral cartilage and alar cartilage.

Figure 3. (A) Pre-operative photographs of Case 3. (B) Post-operative photographs. (C) Six-month follow-up post-operation shows symmetrical ala nasi, a straight columella, and a natural lip contour.

Case 4

A 3-month-old male patient was diagnosed with a complete unilateral cleft lip on his right side, along with a nose deformity involving the drooping of his lower lateral cartilage and alar cartilage.

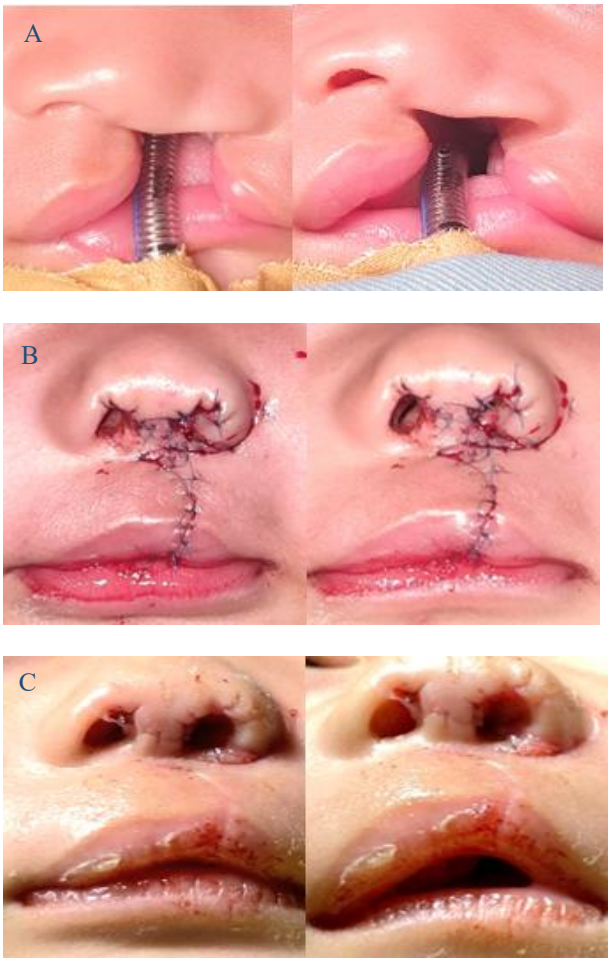
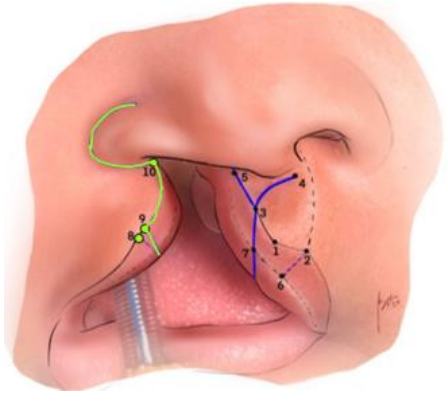


Figure 4. (A) Pre-operative photographs of Case 4. (B) Post-operative photographs. (C) One-week follow-up post-operation shows symmetrical ala nasi, a straight columella, and a natural lip contour.

Case Management

The Design

Cheiloraphy Unilateral describes the strategic placement of incision lines and the mobilization of tissue necessary for the reconstruction of a unilateral cleft lip.



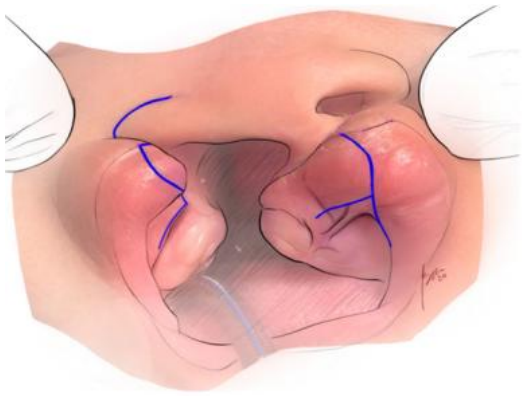


Figure 5. Design Cheiloraphy Unilateral

The design not only seeks to achieve optimal aesthetic symmetry between the affected and unaffected sides of the face but also emphasizes restoring the lip's functional capacity. This includes improving the patient's ability to perform essential functions such as speaking, eating, and smiling. The ultimate goal is to enhance the patient's facial appearance, improve their facial dynamics, and contribute to a more natural and harmonious lip and nasal contour. Through these carefully executed steps, the procedure helps to reduce scarring and ensures the long-term success of the reconstruction.

Medial Segment

To create a detailed outline for the medial segment of the lip and surrounding structures, follow these steps for precise anatomical reference points. First, identify point 1 at the center of Cupid's bow, then mark point 2 at the junction where the cupid bow meets the left philtrum ridge. Next, measure point 3 on the right cupid bow, ensuring it mirrors the left side, maintaining equal distance from point 1 to both points 2 and 3. Determine point 4, which is located 1 mm above the base of the columella, and extend a line to the left philtrum ridge without crossing the imaginary line of the normal left philtrum. Point 5 is located at the junction of the white skin roll and the base of the nose. For point 6 , measure perpendicularly from

point 2 to the dry-wet border of the vermilion to establish the normal width of red lips. Position point 7 at the dry-wet border below point 3, adjusting laterally toward point 6 until its length matches the distance between points 2 and 6. Finally, connect point 3 to point 4 with a curved line that starts straight and then bends towards point 4. Draw a straight line from point 3 to point 5, and another from point 3 to point 7, extending it parallel to the oral mucosa until it reaches the frenulum, while also extending laterally along the gingiva buccal sulcus. This methodical approach ensures accurate anatomical representation for further procedures or assessments.

Lateral Segment

For the lateral segment of the lip reconstruction, precise anatomical reference points must be established. Start by identifying point 8 at the tip of the bulkiest portion of the vermilion. Next, mark point 9 , which is positioned 1 mm medially from point 8; this placement is essential for achieving a smooth, non-angular curvature of the white skin roll when suturing it to the medial segment. Then, determine point 10 at the junction where the white skin roll meets the base of the nose in the lateral segment. From point 10 , draw a line to point 9 that extends to the oral mucosa. Additionally, extend this line from point 10 along the base of the nose until it reaches the alar crease. Finally, ensure the design continues to extend until it meets the oral mucosa. This systematic approach is vital for achieving a harmonious integration of the lateral segment with the overall lip structure.

The Operation

Medial Segment

To begin the surgical procedure, start by making a skin incision according to the design using a blade no. 15 . Next, deepen this incision along the designated lines with a blade no. 11 . Carefully dissect the medial lip mucosa from points 3 to 5 until you reach the sulcus, ensuring to preserve the frenulum. Then, incise the oral mucosa along the gingivobuccal sulcus, extending 10 mm laterally. Following this, dissect the muscle away from the skin and mucosa and release it from the periosteum. The orbicularis muscle should then be split into quarters. Finally, pull the triangular flap laterally until the columella is aligned straight. These steps are essential for the successful reconstruction of the medial segment.

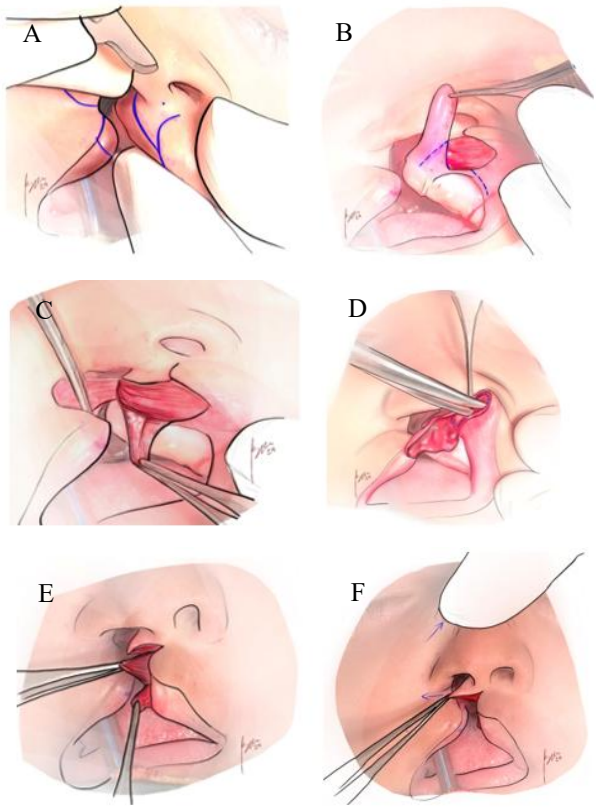


Figure 6. The Incision of The Medial Segment.

Lateral Segment

In the lateral segment of the operation, begin by making subcutaneous deep incisions according to the design using Blade No. 15. Next, deepen these incisions along the designated lines with Blade No. 11. Use Metzenbaum scissors to dissect the

muscle from the skin and mucosa in this segment. Following that, incise the mucosal lining of the nose in an L-shaped design. Incise the mucosa laterally about 10 mm long, starting 5 mm from the gingivobuccal sulcus. Finally, release the soft tissue along the alar crease from the periosteum to complete the lateral segment preparation.

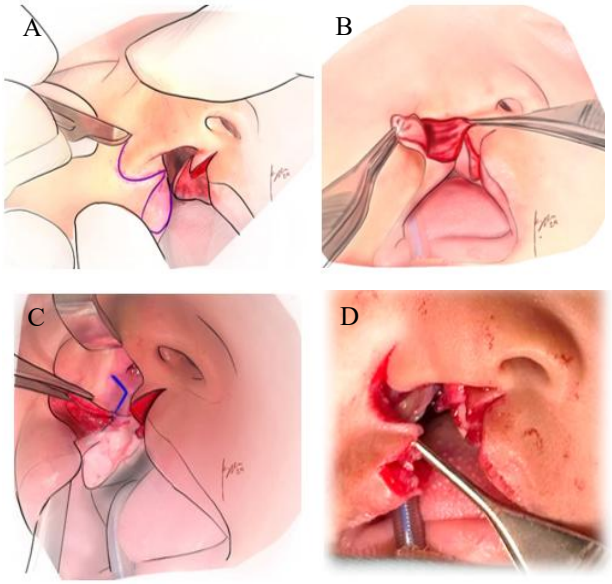


Figure 7. The Incision of The Lateral Segment.

Suturing Lateral Segment and Medial Segment

In the suturing phase for both the lateral and medial segments, begin by using Nylon 7.0 to suture the triangular flap to the alar base, effectively forming the nasal floor. Next, utilize Vicryl 5.0 to suture the muscle at point 10 to the muscle at point 4, filling the gap from the cleft and lifting the nose. Proceed to suture the medial and lateral orbicularis oris muscles together.Lift the alar rim on the cleft side and secure it with sutures. Measure any excess skin in the lateral segment to ensure it fits with the medial segment at points 3-4, then excise the excess. Using Nylon 7.0, suture the medial and lateral lip segments together, starting 0.5 mm above the white skin rolls to accurately align this crucial landmark before continuing with the rest of the skin. Next, employ Vicryl 6.0 to suture the oral mucosa, beginning from the innermost intraoral area and working upward to the border of the wet-dry vermilion, ensuring uniform bulkiness of both medial and lateral lips . Finally, reattach the frenulum and use Nylon 7.0 for suturing the dry vermilion area.

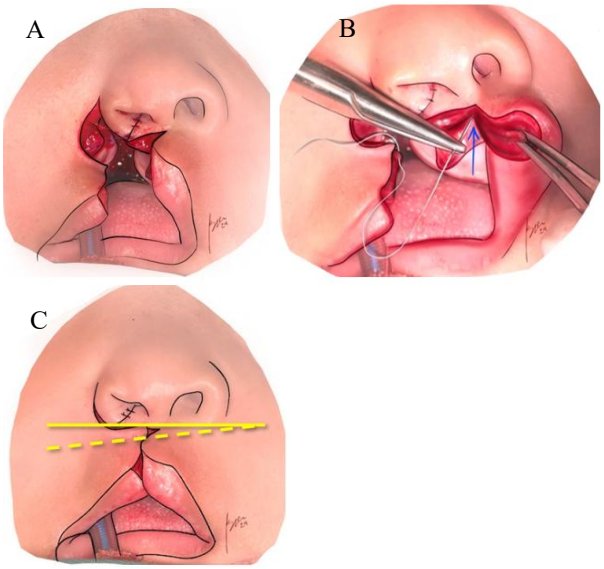


Figure 8. Suturing the triangular flap to the alar and the muscle of flap point 10 with point 4.

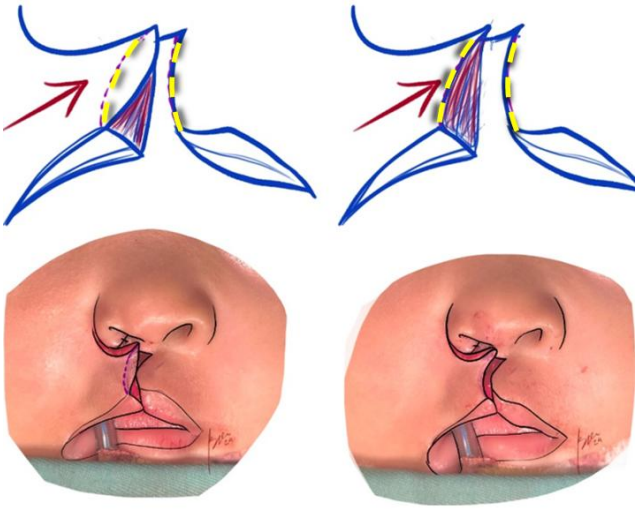


Figure 9. Measure the excess skin at the lateral segment to fit with the medial segment.

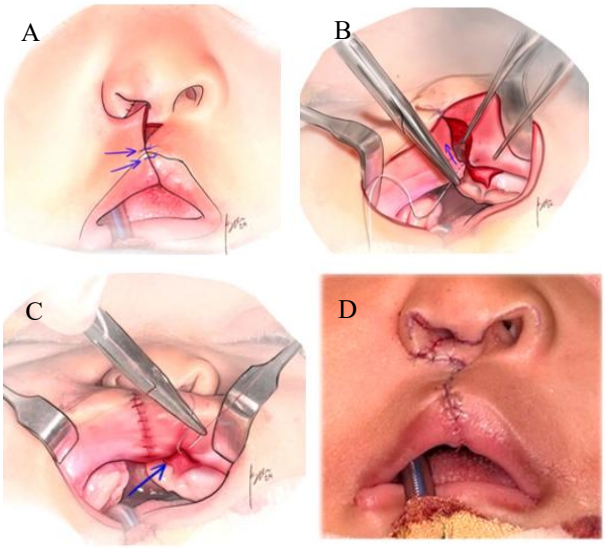


Figure 10. Suturing the Lips of The Medial Segment and Lateral Segment.

Nose Correction

Nose deformities are corrected by making an incision at the columella and along the alar rim using blade No. 11, followed by dissecting the subcutaneous tissue until both nasal cartilages are exposed. The deformed lateral crus cartilage is identified and anchored to the normal lateral crus using nylon 6.0 sutures to ensure symmetry. Stitches are then fixed to the roof of the nose with nylon 6.0 to create a defined rim, and the procedure is completed by suturing the skin with nylon 7.0.

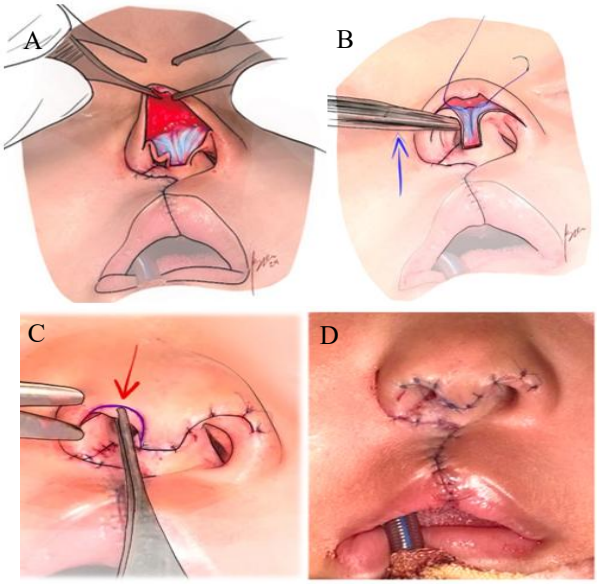


Figure 11. Nose Correction.

DISCUSSION

Cleft lip deformity is one of the most frequent congenital malformations. It results from the failure of the frontonasal and maxillary processes to fuse during development. Disruptions in the embryological formation of the upper lip can lead to a cleft lip, which may be either unilateral or bilateral. Additionally, depending on their severity, cleft lip deformities can be classified as complete or incomplete. A complete cleft involves a full vertical split of the upper lip and is often associated with an alveolar defect, as the alveolus is a component of the main palate. In contrast, an incomplete cleft affects only a portion of the upper lip's height, leaving a connected segment between the separated areas.[5,6]

Unilateral cleft lip deformity is primarily characterized by a reduction in vertical lip height due to the thinning of lip tissues near the cleft margin, resulting in several anatomical abnormalities. On the cleft side, the lower lateral cartilage typically exhibits a long, more caudally positioned lateral crus and a shorter medial crus. The columella is usually situated on the non-cleft side, while the nasal tip and nasal septum deviate towards the non-cleft side. Additionally, the alar base on the cleft side is often shifted laterally, downward, and backward. These nasal deformities are mainly attributed to the abnormal insertion of the orbicularis oris muscle and the absence of the anterior nasal floor[5,7,8].

The surgical correction of complete unilateral cleft lip poses unique challenges due to the complex anatomical and functional considerations involved. Efforts to maintain anatomical boundaries and relocate incision lines to less noticeable areas led to the development of the rotation advancement flap repair technique, notably advanced by Millard. The essential actions of Millard's surgical technique involve rotation and advancement. This technique elevates the Z-plasty just below the nasal

sill while also rotating the central lip element to its natural anatomical position.[8–10]

The effectiveness of the rotation flap in restoring vertical lip height relies on the back-incision technique. This involves making an incision across the midline of the columellar labial junction, extending back towards the noncleft side philtral column without violating it. The length of thisback-incision is determined incrementally during surgery, guided by the surgeon's experience to achieve the necessary downward rotation. The defect created by the back-incision is filled by advancing the leading edge of the flap from the lateral lip, thereby correcting the deficiency in vertical lip height. Simultaneously, mobilizing the advancement flap into the rotation flap's defect corrects alar flare and reconstructs the nasal sill on the cleft side. Subsequently, a superiorly based triangular C-flap can be rotated either medially to lengthen the columella or laterally into the nose to assist in nasal floor closure, provided there is sufficient columellar length. [8]

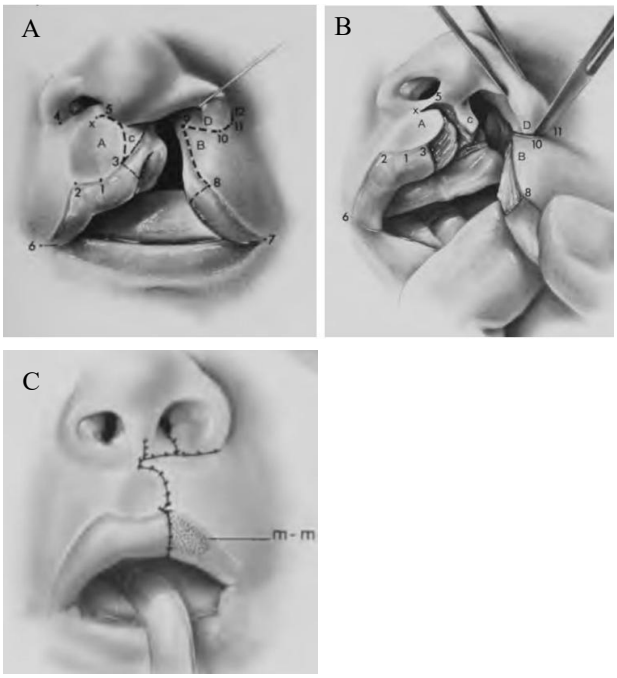


Figure 12. The original MillardRotation-Advancement Flap Technique.[11]

The rotation advancement technique offers several advantages, including maximal preservation of tissue, versatility in addressing various cleft lip configurations, and a scar that is discreetly placed along the new philtral column. However, there are also notable disadvantages. These include the risk of nostril stenosis, challenges in closing wide clefts effectively, and increased complexity for less experienced surgeons. The technique demands skilled intraoperative judgment for adjusting flap modifications as the procedure unfolds.[12,13]

The Millard rotation-advancement flap has been successful in addressing these deformities, but modifications to these techniques may be necessary to enhance aesthetic outcomes further and minimize postoperative complications. [5,14]

The Modified Rotation-Advancement Flap technique has been refined by our senior author, highlighting several key updates for improved outcomes. First, a semicircular incision is made along the nasal-cheek crease to address the nasal deformity. To enhance the natural curvature of the cupid’s bow, an additional 1 mm is added medially from point 8 to point 9 when suturing to the medial segment. Flap point 3 (C-Flap) is established to serve as the nasal base rather than being positioned at the nasolabial area. The orbicularis oris muscle is split to create a denser vermillion, filling the void left by the cleft on the nasal base. For lip suturing, the process begins with the innermost intraoral mucosa and progresses outward to maintain symmetrical vermillion width. The triangular flap incision must align with the normal philtrum ridge, and the width of the dry-wet vermillion must match between the lateral and medial segments to avoid notching; the incision on the dry vermillion of the medial segment should be slightly slanted while maintaining this width. Lastly, it is essential to ensure that the muscle in the lateral segment is entirely separated

from the overlying skin and mucosa for optimal healing.

A semicircular incision is typically made along the nasal cheek crease to release the deformed nose, allowing it to be repositioned to achieve the desired nasal contour. This incision is particularly useful for correcting wide gaps. Subsequently, the flap at point 3 (C- flap) is utilized to pull the columella into a contralateral position, creating a perpendicular columella. This flap is then sutured to the nasal ala, forming the nasal base. In contrast, Millard's technique uses the C flap advancement to fill the gap created by the rotation of the medial lip element at the base of the columella. This method also helps to lengthen the shortened columella on the cleft side.[12]

The orbicularis muscle on the lateral segment is separated into two parts; the upper one is used to fill and lift the nasal base. The lower part is then sutured to the orbicularis muscle in the medial segment. The addition of 1 mm medial to point 8 is important for forming a natural, non-angled Cupid's bow when sutured to the medial segment. Sometimes, sewing the lips from the outside causes them to be pulled inward, making them appear thin and lacking in volume. Therefore, stitching should be done from the inside to the outside, and attention should be paid to the symmetry of lip thickness between the medial and lateral segments during stitching. At this stage, the cleft lip should be properly corrected, marked by the formation of parallel ala nasi, a perpendicular columella, a parallel white skin roll, and symmetrical shape and thickness of the lips. However, generally, the nostrils are still not corrected, especially in wide gaps. Nose correction with rhinoplasty can be performed at this stage to ensure that a round and symmetrical nostril is ultimately achieved.

The modified rotation-advancement flap described in this case series represents a refinement of the traditional approach, incorporating flap design, tissue handling, and wound closure adjustments to achieve more natural and symmetrical lip contours. This technique can also be applied to wide cleft lips.[14]

A significant advantage of the modified technique is its ability to enhance the vermilion contour and achieve better lip symmetry, which are crucial aspects of aesthetic lip reconstruction. Through precise alignment and tension adjustments of the rotation-advancement flap, surgeons can create a smooth and natural transition between the cleft and non-cleft sides of the lip, resulting in a harmonious and aesthetically pleasing lip appearance. This aspect is particularly important in pediatric patients, where achieving satisfactory aesthetic outcomes can have a significant impact on psychosocial development and quality of life.[15]

This case series describes four cases of complete unilateral cleft lip surgeries performed using the Modified Rotation-Advancement Flap technique. The surgical outcomes showcased excellent symmetry, precise alignment of the vermilion border, and minimal scarring. Complication rates were low, with no instances of wound dehiscence or infection reported. These findings underscore the effectiveness of the Modified Rotation-Advancement Flap in reducing postoperative complications and promoting optimal healing outcomes.

The uniqueness of this technique lies in its tailored approach to enhancing aesthetic results while addressing functional challenges, marking a significant advancement in cleft lip repair. However, limitations may include the potential for complications in less experienced hands and the need for precise execution to avoid asymmetry. Overall, the impact of the modifications to the Rotation-Advancement Flap is profound, enhancing not only patient outcomes in terms of appearance and function but also contributing to the body of knowledge in cleft lip surgical techniques, paving the way for further innovations in the field.

CONCLUSION

The Modified Rotation-Advancement Flap represents a valuable approach for the repair of complete unilateral cleft lip, providing satisfactory outcomes in both aesthetics and function. Its meticulous surgical principles and emphasis on lip symmetry make it a preferred choice for many surgeons worldwide. Further research, long-term follow-up studies, and larger sample sizes are required to validate its effectiveness and refine surgical techniques.

ACKNOWLEDGMENTS

We would like to thank Dr. Burhan Husein for drawing the illustrative pictures. We also extend our gratitude to the staff and interns of the Plastic Reconstructive and Aesthetic Surgery Division, Department of Surgery, RSPAL Dr. Ramelan Hospital, Surabaya, Indonesia. Additionally, we would like to express our heartfelt thanks to all the patients who provided their consent to publish their cases.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

FUNDING DISCLOSURE

No funding was received for this study.

AUTHOR CONTRIBUTION

The authors' contributions are as follows: Conceptualization: JN. Data Collection: JN, RD, BW. Drafting the article: JN, RD, BW. Critical revision of the article and proofreading: All authors have reviewed and approved the final version of the manuscript for publication.

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