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A CASE REPORT: EARLOBE RECONSTRUCTION ON CONGENITAL AURICULAR LOBE DEFECT USING Z-PLASTY

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ABSTRACT

Introduction: Earlobe defects, often due to embryonal growth failure or injury, can affect aesthetics and social interactions despite not impacting hearing. Earlobe defect can be formed either from birth as congenital defect or secondary manifestation of other causes such as tumor and external factor such as earring usage or trauma. This study aimed to address these issues by performing auricular lobuloplasty using a Z-plasty flap technique. The procedure, crucial for protecting the auditory canal and facilitating eyeglass use, was successful in achieving the desired aesthetic outcome. Data on microtia prevalence, particularly in Indonesia, highlights the need for such reconstructive surgeries.

Case Illustration: A 9-year-old boy underwent auricular lobuloplasty to correct a cleft earlobe deformity, which caused social discomfort. The surgery, performed under general anesthesia, utilized a Z-plasty technique to lengthen and reorient the scar. Postoperative care included wound dressing changes and oral pain medication. After two weeks, satisfactory results were observed with no reported complications.

Discussion: The study on congenital ear deformities focuses on Z-plasty for earlobe reconstruction, detailing classifications, surgical techniques, and case results. The surgery was successful with minimal scarring and no keloid formation. Using Weerda's classification, the technique showed minimal scarring and no keloid formation. The approach, emphasizing proper skin envelope and alignment with Langer lines, offers effective aesthetic restoration, making it a valuable reference for future earlobe reconstruction cases.

Conclusion: Utilizing Z-plasty for earlobe defect reconstruction aids in improving the earlobe's appearance with minimal to no complications.

Highlights:

1. Congenital ear defects typically result from growth failures during the fifth to ninth weeks of gestation or from mechanical stress during this period.
2. Auricular lobuloplasty using the Z-plasty flap technique effectively addresses earlobe defects, resulting in optimal aesthetic outcomes with no keloid formation, minimal scarring, and no complications.

INTRODUCTION

Several previous studies on the management of earlobe defects highlight various approaches, focusing on outcomes, successes, and shortcomings of each approach. While earlobe defects may not affect hearing, they can cause discomfort and aesthetic dissatisfaction. Moreover, it's important to recognize that the social consequences of these defects can extend beyond mere aesthetic concerns. These defects can lead to social repercussions, such as verbal threats from peers and teachers, which often disrupt a patient's social interactions and overall quality of life. Therefore, a deeper understanding of the psychological and social impacts of earlobe defects is crucial in planning appropriate treatment. Auricular lobuloplasty correction is not just about improving

aesthetic aspects, but also has a significant impact on patient's quality of life. By understanding and addressing the social consequences of earlobe defects, this research contributes to a more holistic understanding of the benefits of this surgical approach.

Preserving the earlobe's shape is crucial for protecting the auditory canal from foreign bodies and for eyeglass usage.[1] Defects can result from injury, skin cancer, earring use, or embryonal growth failure. The ear forms from the 50th day of embryonic development, and a failure in the fusion between the first and sixth hillocks, tragus, and lobule can result in cleft earlobe malformation.[2] Auricular defects, collectively termed microtia, are often associated with anomalies such as acoustic meatus atresia, preauricular skin tags, hemifacial microsomia, facial nerve paralysis, and congenital heart disease.[3] The prevalence of microtia varies from 0.83 to 17.4 per 10,000 births worldwide, with higher occurrences in Hispanics, Asians, Native Americans, and Andeans.[4] According to the American Society for Aesthetic Plastic Surgery, 21,802 people underwent ear reconstruction for cosmetic purposes in 2022. [5] In Indonesia, Dr. Hasan Sadikin General Hospital reported 71 microtia cases from 2017-2022[6], and Dr. Soetomo General Academic Hospital reported 86 cases from 2016-2019[7].

The size of the auricle is influenced by posture and age, with growth typically reaching 85% of its final length by age six and 90% by age nine. The increase in length occurs gradually, mainly due to soft tissue loosening in the lobule rather than genuine growth. Final width is affected by body size and age, with approximately 95% of its eventual size reached by age six. However, the outward extension of the outer ear remains relatively consistent throughout life. On average, the ear protrudes 20.4 mm, with typical measurements falling between 12 and 28 mm.[8] Surgical removal of tumors and trauma are the primary causes of acquired outer ear deformities. [9]

In this study, performing auricular lobuloplasty using a Z-plasty flap to address these defects. The aim is to evaluate the effectiveness of this technique in achieving the desired aesthetic and functional outcomes. The desired result was achieved, highlighting the potential benefits of this surgical approach.

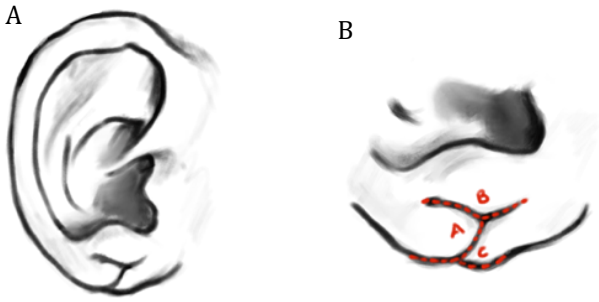
CASE ILLUSTRATION

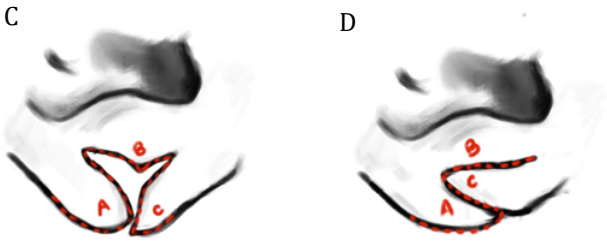
A 9-year-old boy presented with a right auricular deformity present since birth, with no associated defects. The patient has normal hearing and no discomfort complaints. He faces social consequences including verbal threats from peers and teachers, affecting his social interactions. Clinical examination revealed a complete cleft on the lower third of the right ear, specifically the lobule, without redness or pain. Laboratory tests showed no bleeding disorders or other contraindications. The patient underwent auricular lobuloplasty under general anesthesia, preceded by premedication with cefixime and paracetamol. He was followed up two weeks post-surgery for wound care and to monitor for complications.

Figure 1. Preoperative of 9-Year-Old Patient's Cleft Earlobe

The surgery was conducted under general anesthesia due to the challenges posed by the young patient's tendency to be less cooperative and have a lower pain threshold. The procedure involved outlining an incision line using the Z-plasty technique to adjust and elongate the scar (Figure 2B). This technique entails creating two diagonal arms at the scar's ends. These arms are typically of equal length with 60-degree angles from the central scar, forming a 90-degree rotation and extending the scar's length by 75%.[10]

Pehacaine, a solution containing 1% lidocaine HCL and epinephrine along with 8.4% sodium bicarbonate, was administered at the surgical site. In this instance, a ratio of 1 ml of sodium bicarbonate to 10 ml of Pehacaine was used to buffer the solution. Pehacaine was selected for its ability to minimize bleeding. The skin was then incised along the pre-marked lines (Figure 2C), followed by the elevation of flaps in a subdermal plane. Wide undermining of the surrounding area was performed to facilitate flap transposition, while care was taken to preserve the subdermal plexus. Hemostasis was achieved, avoiding aggressive electrocautery to prevent flap necrosis. The flaps were transposed, with subcutaneous pockets being fixated using 6/0 Vicryl sutures. Closure of the anterior and posterior surfaces of both edges was done using 6/0 Vicryl subcutaneous sutures and 6/0 nylon skin sutures (Figure 2D).





Source: Courtesy of own

Figure 2. (A) Illustration of the earlobe pre-surgery, (B) Placement of the Z-plasty marker, (C) Surgical incision following the designated line, and (D) Securing and closing the flap

Figure 3. Post-operative appearance following suturing

Before the surgery, the patient experienced social discomfort due to the earlobe defect, such as verbal threats from peers and teachers, which disrupted his ability to interact socially. However, after undergoing auricular lobuloplasty using the Z-Plasty technique, the clinical results showed significant improvement. The patient was evaluated two weeks post-surgery. The scars and pinna notching were at an acceptable level. No complaints or complications were reported. Postoperatively, the patient experienced significant improvement in his physical appearance, as well as reduced social anxiety and discomfort. The patient was advised to refrain from rubbing or exposing the wound area to water. Dressings were replaced weekly, and oral paracetamol was administered if there were any signs of fever or pain. The stitches were removed after a period of two weeks. Long-term evaluation will be needed to monitor the sustainability of the surgical outcomes and their impact on the patient's quality of life over a longer period.

Figure 4. (A) Outcome two weeks post-surgery, (B) pre-suture removal, and (C) post-suture removal

DISCUSSION

Classification

Congenital ear deformities result from either insufficient growth of fetal ear cartilage during weeks five to nine of gestation or abnormal mechanical forces during development that disrupt normal growth. The auricle develops from the first and second brachial arches, which later give rise to structures such as the earlobe, facial nerve, middle ear, inner ear, mandible, maxilla, and hyoid bone.[11]

Bartel-Friedrich[12] referenced different classifications of ear defects, covering

external, middle, and inner ear issues, as well as other anomalies like ear cysts. Specifically, for external ear deformities, Weerda's classification system was employed, which integrates earlier classifications and provides surgical guidance based on the severity of the defect.

Table 1. Microtia classifications by Weerda[11,13]

Classification	Description
Dysplasia grade I (Slight malformation)	Recognizable normal pinna structures. Little to no use of additional skin or cartilage for reconstruction required.
Dysplasia grade II (Moderate malformation)	Some structures of normal pinna are recognizable. The use of some additional skin and cartilage are required to partially reconstruct the pinna.
Dysplasia grade III (Severe malformation)	Anotia or normal structures of the pinna are completely undetectable. Total reconstruction requires additional skin and large amounts of cartilage.

Microtia is classified into three degrees. First-degree microtia encompasses features such as macrotia (enlarged ears), protruding, and cryptotia (hidden ears), absence of the upper helix, clefts, and minor deformities. Second-degree microtia involves cup ear deformity and miniature ears, while third-degree microtia is characterized by the absence of recognizable auricular structures.

The 9-year-old child in this case exhibits first-degree abnormalities, with a cleft identified in the left ear lobule. The patient experiences social repercussions due to verbal threats from peers and teachers, affecting social interactions. Treatment approaches vary by region of the auricular defect. Smaller defects in the upper third of the auricle may heal naturally or benefit from wedge excision to facilitate primary closure. However, larger defects may necessitate flap procedures, such as chondrocutaneous advancement flaps or pedicled flaps sourced from preauricular or postauricular skin.[14]

In cases of middle third defects, wedge excisions are commonly employed for smaller defects. However, this method may result in decreased vertical height of the ear and potential mismatched fusion when the edges are brought together. For larger defects, wide local excisions and local flap techniques can be used. If necessary, skin and cartilage can be sourced from adjacent structures. Lower third defects typically do not involve cartilage, making local flap procedures preferable, especially in patients over 8 years old with a chest diameter exceeding 53 cm.[15] It is advisable to wait until the patient is sufficiently mature for surgery. In cases of traumatic or extensive loss, consider utilizing manufactured auricular prostheses for reconstruction.[16] For defects involving the helix and lobule, postauricular tubed flaps are a safe and dependable choice, although they may require multiple stages to complete.[17]

Extensive reconstruction of the outer ear may not always be necessary for patients undergoing ablation procedures, particularly if the conchal bowl remains intact and the upper part of the ear is preserved. This approach is particularly pertinent for older patients or those with advanced-stage malignancies, where cancer recurrence is a significant concern.[18] However, this technique may offer benefits for older patients in need of reconstruction, utilizing excess skin for flaps derived from natural sagging following the removal of skin malignancies.[19]

Technique

Maintaining the ear's original size and shape as closely as possible is crucial, often using the contralateral ear as a reference.[20] Replicating the delicate and intricate architecture of the helix is challenging,

requiring careful measurements.[21] Successful auricular reconstruction necessitates a good skin envelope and three-dimensional structure, with the skin envelope needing the appropriate size and thickness.[15]

When making an incision, it is essential to consider the direction in which the skin stretches most effectively for optimal defect closure. Langer lines, which map the natural parallel alignment of collagen fibers in the dermis and are generally perpendicular to the underlying muscle fibers, should be taken into account. Aligning incisions along these lines typically results in less noticeable scars.[22]

Achieving an even shape, texture, and color with local flap skin grafting is challenging. Using a mastoid or neck skin flap can result in a thick, unsightly appearance due to scar contracture and may leave a scar at the donor site.[23]

Z-plasty is a technique used to lengthen and reorient scars, enhancing their aesthetic appearance and function. To reduce standing skin deformity at the pivot point, broad undermining across the surrounding tissue is necessary when transposing the Z-plasty flap. This helps to distribute tension and compression forces, promoting closure without tension. Preventing closure under tension is crucial, as tension negatively impacts the perfusion of the flap tip and wound edges. [24]

This paper presents the results of Z-plasty reconstruction on the lower auricular lobe of a 9-year-old Indonesian boy, who has a higher risk of keloid formation due to his darker skin pigment. Observations showed that this technique resulted in minimal scarring and did not lead to keloid formation.

The use of creep and stress relaxation, where skin stretches under internal or external force, allows for the closure of defects with local flaps by recruiting distant tissue for reconstruction. Rotating the Z-plasty flap based solely on geometry may result in a slight loss of flap length, but this is generally compensated for by creep and stress relaxation. [25]

Z-plasty is often indicated for various purposes, primarily to release tension and improve the range of motion at the pivot point. In some cases, it is also used for scar camouflage and reorienting defects.[24] We employ this technique to minimize surgical scarring and preserve tissue volume by removing as little tissue as possible.

Table 2. Three earlobe reconstruction goals according to Grabb [26]

Section	Goal
Front View	The edge of the helix should be visible, not far hidden behind the folds of the antihelix.
Rear View	When viewed from behind, the edge of the helix should be straight, not curved like a "C" or "hockey stick". If the edges of the helix are straight, the degeneracy is harmonic; The upper, middle and lower thirds of the ear are arranged in proportion to each other. For example, if the middle third is too far back compared to the top and bottom thirds, the edges of the helix form a "C" shape when viewed from the back, a condition known as warping calls. Also, if the earlobes are not pulled back far enough, the back view looks like a hockey stick on the contour of the helix edge.
Lateral View	Contours should be soft and natural, not sharp and "man-made".

Utilizing the Z-plasty technique, we successfully managed tissue rearrangement, restoring both the function

and appearance of the earlobe. This case can serve as a helpful reference for future earlobe reconstruction efforts. We found that the Z-plasty technique is highly effective for earlobe reconstruction. However, it may not be applicable to all earlobe defect cases, as many factors need to be considered, such as the location of the injury, risk of keloid formation, sex, and age.

The analysis of psychosocial aspects in ear reconstruction becomes crucial due to its significant impact on the psychological well-being and quality of life of patient. Ear deformities can trigger social stigma, causing patient to feel isolated or marginalized, disrupting their self-confidence and social interactions. Emotional disturbances such as stress, anxiety, or depression are also commonly experienced by patient due to low self-esteem or negative perceptions of their physical appearance. Social support from family, friends, and medical professionals is key in helping patient overcome these psychosocial challenges. The process of ear reconstruction can also affect patient' self-acceptance of their physical appearance, where positive self-acceptance can help reduce social stigma and improve quality of life. Therefore, the role of psychologists or counselors in the care team is crucial in providing the emotional and psychological support needed for patient during the ear reconstruction process. After ear reconstruction surgery, patient experience increased self-confidence, feel relieved that physical issues have been addressed, and are satisfied with his new appearance.

This study provides a comprehensive classification system for ear deformities, offering a structured framework for understanding and categorizing various auricular anomalies. Additionally, it discusses a wide range of reconstruction techniques, providing valuable insights into the surgical management of these deformities. By encompassing both classification and surgical approaches, the study equips medical practitioners with a holistic understanding of auricular reconstruction, enhancing patient care and surgical outcomes.

One of the notable novelties of this study lies in its application of reconstruction techniques to a specific case involving a 9-year-old Indonesian boy with a predisposition to keloid formation. By adapting surgical techniques to individual patient characteristics and risk factors, the study demonstrates a personalized approach to auricular reconstruction, potentially improving outcomes and reducing postoperative complications. This emphasis on tailored surgical interventions underscores the importance of considering patient-specific factors in reconstructive surgery, marking a significant contribution to the field of ear reconstruction. However, the study is limited by its constrained generalizability due to its reliance on a single specific case. Long-term evaluation of ear reconstruction outcomes is also crucial for a more comprehensive assessment of the success of the reconstruction techniques employed.

CONCLUSION

The Z-plasty technique proves effective in rectifying the appearance of the earlobe. While earlobe defects may not impair hearing function or cause physical discomfort, they often lead to significant aesthetic dissatisfaction and social repercussions, especially in children. Through the utilization of Z-plasty, a proven surgical approach, the appearance of the earlobe can be enhanced to achieve a more uniform shape, texture, and color, resulting in satisfactory reconstruction outcomes with minimal or no significant complications. Thus, Z-plasty emerges as a compelling and efficient choice for addressing earlobe deformities, restoring patient confidence, and enhancing overall quality of life.

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CONFLICT OF INTEREST

The authors declare that have no conflict of interest.

FUNDING DISCLOSURE

The authors declare no additional sources of funding, and no financial interests.

AUTHOR CONTRIBUTION

NFA was analysis and interpretation of the data, drafting of the article, collection and assembly of data. IDS was conception and design, critical revision of the article, final approval of the article, provision of study patient, collection and assembly of data.

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