Functional Restoration of the Superior Auriculocephalic Sulcus in Cryptotia: A Case Report Validating the Twin Compression Theory via an Extended Sub-Galeal Advancement Flap

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A B S T R A C T

Background: Cryptotia, characterized by the invagination of the superior helix beneath the temporal skin, presents significant functional challenges regarding the retention of eyewear and protective masks. While prevalent in East Asian populations, data from the Indonesian archipelago is scarce. This study aims to document the functional and aesthetic outcomes of a modified surgical technique in a monozygotic twin, addressing the twin compression etiological hypothesis. **Case presentation:** A 7-year-old male monozygotic twin presented with Type I Cryptotia of the right ear, with a superior helix-to-mastoid distance of 0 mm. The co-twin exhibited normal auricular morphology. The patient underwent a partial otoplasty combined with a modified posterior auricular advancement flap. The specific modification involved extended sub-galeal undermining to recruit maximum tissue elasticity. Cartilage reshaping was performed using non-absorbable horizontal mattress sutures. Postoperative evaluation at 3 months revealed a superior helix-mastoid distance increase to 12 mm and an auriculocephalic angle restoration to 30 degrees. Patient-Reported Outcome Measures via a validated Visual Analog Scale showed an improvement from 2 to 9 out of 10. No immediate recurrence or hypertrophic scarring was observed. **Conclusion:** The extended sub-galeal advancement flap offers a promising solution for sulcus restoration, prioritizing vascularity and tissue recruitment over skin grafting. This case supports the intrauterine mechanical compression theory as a viable etiology for sporadic cryptotia. Short-term results are robust, though long-term surveillance is required to monitor cartilage memory.

1. Introduction

The human auricle is a complex topographic structure where form and function are intimately intertwined.[1] Among the spectrum of congenital auricular anomalies, Cryptotia presents a distinct and clinically challenging entity. Colloquially known as pocket ear or buried ear, cryptotia is a rare congenital malformation affecting the upper third of the auricle.[2] Unlike microtia, which is characterized by a deficiency of tissue, or prominent ear, which involves a failure of antihelical folding, cryptotia is defined by a unique anatomical paradox: the cartilaginous framework is generally present but is obscured. The defining feature of this anomaly is the invagination of the superior helical rim beneath the temporal skin, resulting in the complete effacement and obliteration of the superior auriculocephalic sulcus. This condition is not merely a dermatological shortage; it often involves complex underlying structural deficits. Anatomically, the deformity is frequently accompanied by a specific deformation of the cartilaginous framework itself.[3] Upon surgical exploration or physical manipulation, the buried cartilage often appears deformed, compressed, or folded due to extrinsic tethering. Historically, this pathology has been attributed to intrinsic muscular abnormalities, specifically

involving the transverse and oblique auricular muscles. Theories suggest that during embryological development, an anomaly in the insertion of the superior auricular muscle prevents the separation of the helix from the cranial skin, effectively tethering the ear to the mastoid and temporal region. This disruption likely occurs during the critical window of the 9th to 13th weeks of gestation, a period when the auricle normally projects away from the head.[4]

The epidemiology of cryptotia exhibits a marked and well-documented racial predilection, highlighting potential genetic or environmental susceptibilities specific to certain populations. It is a relatively common occurrence in East Asian populations, with literature consistently citing a high prevalence in Japan, where incidence rates approach 1 in 400 to 1 in 500 births.[5] In sharp contrast, the condition remains a rarity in Caucasian demographics, often leading to misdiagnosis or delayed recognition in Western clinical settings. Furthermore, demographic analysis reveals distinct patterns in presentation. There is a noted gender disparity, with males affected more frequently than females. Laterality also appears non-random, with the right ear being more commonly involved than the left. However, despite the robust datasets available from East Asia, specifically Japan and Korea, there is a conspicuous paucity of data regarding the prevalence and management of cryptotia in the Indonesian archipelago. Indonesia, with its vast population and ethnic diversity, remains underrepresented in the craniofacial literature. A comprehensive search of regional medical databases reveals a virtual non-existence of documented management strategies or prevalence data for this specific anomaly within this demographic. This represents a significant gap in the Southeast Asian craniofacial literature, obscuring the true burden of disease in the region and potentially delaying the adoption of standardized management protocols.

While congenital ear deformities are often categorized as cosmetic concerns, the functional sequelae of cryptotia are increasingly relevant in the modern clinical landscape.[6] The superior auriculocephalic sulcus is not merely an aesthetic landmark; it serves as a critical anatomical shelf for the retention of external devices. The absence of a defined superior sulcus renders the retention of spectacles and eyewear physically impossible, a deficit that can severely hamper a child's educational development and daily activities. Similarly, for the aging population or those with hearing impairments, the inability to secure behind-the-ear hearing aids presents a significant barrier to auditory rehabilitation.

Moreover, the global clinical landscape has shifted dramatically in recent years, placing new emphasis on respiratory hygiene. The widespread necessity for protective face masks has highlighted the profound difficulty these patients face in securing ear-loop masks. This inability adds a layer of psychosocial stress to the physical deformity, as patients may feel unprotected or socially awkward in environments requiring face coverings. Furthermore, the lack of a superior helical overhang predisposes the external auditory canal to water intrusion during bathing or swimming, thereby increasing the risk of recurrent otitis externa. Consequently, the correction of cryptotia is no longer viewed solely as a plastic surgical procedure for aesthetics but as a functional restorative necessity. Early surgical intervention is advocated not only to correct the form but to mitigate these functional impairments and the associated psychosocial distress that often arises during school-age years.[7]

The etiology of cryptotia is complex and likely multifactorial, bridging the gap between genetic programming and intrauterine mechanics.[8] On the molecular front, genetic underpinnings have been identified, particularly in syndromic presentations. Recent genetic studies have implicated mutations in GNAI3, PLCB4, and EDN1 genes. These mutations are often associated with Auriculocondylar Syndrome, a condition affecting the pharyngeal arches, which govern ear and jaw development. In familial cases, these genetic markers suggest a hereditary disruption in the embryological dysgenesis of the auricular

muscles.

However, the genetic theory does not account for all presentations, particularly sporadic cases occurring in individuals without a family history or syndromic features. In these instances, mechanical theories gain prominence. Sporadic cases, particularly those occurring in multiple gestations, suggest a mechanical basis for the deformity. The twin compression theory posits that intrauterine crowding exerts aberrant pressure on the developing fetus. During the critical gestational weeks when the ear is meant to separate from the scalp, mechanical pressure from a uterine wall or a co-twin may exert a medial force on the developing superior helix. This extrinsic pressure prevents the elevation of the helix and may force the superior auricular muscle to insert abnormally into the cartilage rather than the skin, creating the tethering effect observed clinically. This theory is particularly compelling in cases of monozygotic twins where only one twin is affected, or where the twins exhibit discordant phenotypes despite identical genetic material, suggesting that the intrauterine position—rather than the genome—is the primary determinant of the anomaly.

The surgical correction of cryptotia presents a unique challenge to the reconstructive surgeon: the absolute shortage of skin in the retro-auricular sulcus. Unlike prominent ear correction, where skin excision is often performed, cryptotia requires the recruitment or addition of tissue. Historically, management strategies have been broadly categorized into non-surgical and surgical interventions. Non-surgical molding can be effective, but its utility is largely limited to the neonatal period when maternal estrogens keep the cartilage malleable. For older children, surgery is the definitive treatment.[9]

Surgical techniques vary widely, including skin grafts, Z-Plasties, V-Y Plasties, and various local flaps. Skin grafts, while capable of covering large defects, are notoriously prone to secondary contracture, which can obliterate the reconstructed sulcus over time. Furthermore, grafts often result in poor color matching with the surrounding auricular skin. To circumvent these issues, local flaps such as the Z-plasty or V-Y advancement flap have been employed. These techniques utilize adjacent tissue, ensuring a better color match and bringing their own blood supply, which makes them more resistant to contracture. However, the choice of flap must be meticulously planned to release the abnormal cartilaginous adhesions while simultaneously recruiting sufficient local tissue to line the new sulcus without tension. The advancement flap technique, in particular, has emerged as a robust solution, capable of prioritizing the restoration of the auriculocephalic sulcus through local tissue recruitment.[10]

Against this background of epidemiological scarcity in Southeast Asia and the etiological debate regarding mechanical compression, this study presents a significant contribution to the literature. This manuscript aims to document a rare case of Type I Cryptotia in an Indonesian pediatric patient associated with twin gestation. By presenting a case involving a monozygotic twin, this report seeks to substantiate the twin compression mechanical hypothesis as a distinct etiological pathway separate from purely genetic causes. Furthermore, this study aims to validate the efficacy of a specific surgical modification—the partial otoplasty combined with a posterior auricular advancement flap utilizing extensive sub-galeal undermining. We propose that this technique offers superior functional and aesthetic outcomes by addressing the absolute skin shortage and cartilage deformity in a single stage, eliminating the need for skin grafting and minimizing donor site morbidity. Through quantitative anthropometric analysis, this report provides objective evidence of sulcus restoration, contributing vital data to the unaddressed gap in the Indonesian medical literature.

2. Case Presentation

Written informed consent was obtained from the patient's parents for the publication of this case report and any accompanying clinical images. The study protocol adhered to the ethical principles outlined in the Declaration of Helsinki and was conducted in

accordance with the institutional guidelines of the Department of Otorhinolaryngology, Faculty of Medicine, Universitas Andalas, Indonesia.

A 7-year-old male presented with a congenital right ear deformity (Figure 1). The patient was the first-born (Twin A) of a monozygotic twin pair, delivered via Caesarean section at 38 weeks gestation. The pregnancy history was marked by documented oligohydramnios in the third trimester. Maternal abdominal distension was significant consistent with twin gestation. The combination of twin crowding and reduced amniotic fluid volume strongly supports the Twin Compression hypothesis, suggesting mechanical constraint of the fetal head against the uterine wall. Crucially, the younger twin (Twin B) underwent a detailed otologic examination and revealed Grade 0 (Normal) auricular morphology bilaterally. The discordance in monozygotic twins argues against a purely Mendelian genetic etiology and reinforces the mechanical compression theory. No history of consanguinity or craniofacial malformations was present in the pedigree.

Physical examination confirmed Type I Cryptotia (Hirose Classification). The upper helix was buried, and digital manipulation could externalize the cartilage, which immediately retracted upon release due to significant skin shortage and cartilage memory. Otoscopic examination revealed a patent external auditory canal and an intact tympanic membrane. Specifically, the superior helix-to-mastoid distance on the affected right side was measured at 0.0 mm, indicating total invagination of the helical rim beneath the temporal skin, in sharp contrast to the physiologic 12.0 mm observed on the contralateral side. Consequently, the superior auriculocephalic angle was markedly suppressed to less than 10 degrees, compared to the normal 30-degree projection on the left. Beyond the sulcal effacement, morphometric analysis revealed a global constriction of the cartilaginous framework. The affected ear demonstrated a reduced vertical length of 52.0 mm and a width of 28.0 mm, representing a deficit of 2.5 mm and 3.0 mm, respectively, compared to the healthy ear. This dimensional asymmetry suggests that the deformity involves not only an absolute deficiency of retro-auricular skin but also a concomitant deformation of the scapha and antihelix due to chronic extrinsic tethering (Table 1a and 1b).

Figure 1. Preoperative assessment of the right ear.

TABLE 1A. GENERAL CLINICAL ASSESSMENT
Vital Signs & Systemic Examination on Admission (Twin A)

PARAMETER	PATIENT FINDINGS	REFERENCE / STATUS
I. VITAL SIGNS (BASELINE)		
Blood Pressure	**105/65** mmHg	Normotensive
Heart Rate	**88** bpm	Regular Rhythm
Respiratory Rate	**20** breaths/min	Eupneic
Body Temperature	**36.6** °C	Afebrile
Oxygen Saturation (SpO2)	**99%** on Room Air	Normal
II. GENERAL & SYSTEMIC EXAMINATION		
General Appearance	Active, Well-nourished, No Distress	STABLE
Consciousness (GCS)	E4 V5 M6 (15/15)	Compos Mentis
Cardiovascular	S1/S2 regular, no murmurs	Normal
Respiratory	Vesicular sounds, clear bilaterally	Clear
Head & Neck	No lymphadenopathy, Trachea midline	Normal

TABLE 1B. DIAGNOSTIC ASSESSMENT
Laboratory Panel & Local Auricular Anthropometry

PARAMETER	PATIENT FINDINGS	REFERENCE / STATUS
III. LABORATORY ASSESSMENT (PRE-OP)		
A. Hematology		
Hemoglobin (Hb)	13.2 g/dL	Ref: 11.5 - 15.5
Leukocytes (WBC)	7,500 /µL	Ref: 5,000 - 13,000
Platelets	285,000 /µL	Ref: 150,000 - 450,000
B. Coagulation Profile		
Prothrombin Time (PT)	11.5 sec	Ref: 11 - 13.5
APTT	32.0 sec	Ref: 25 - 40
IV. LOCAL STATUS (AURICULAR ANTHROPOMETRY)		
Right Sup. Helix-Mastoid Dist.	0.0 mm	PATHOLOGICAL
Left Sup. Helix-Mastoid Dist.	12.0 mm	NORMAL CONTROL
Ear Length (Right vs Left)	52.0 mm vs 54.5 mm	Δ -2.5 mm
Ear Width (Right vs Left)	28.0 mm vs 31.0 mm	Δ -3.0 mm
Cartilage Palpation	Retracted upon release	High Elastic Memory
Retro-auricular Skin	Tethered / Deficient	Tissue Deficiency

The patient underwent definitive reconstructive surgery in July 2025, under general anesthesia. The patient was positioned supine with the head rotated to the contralateral side to maximize exposure of the affected right temporal and mastoid regions. Prior to incision, the surgical field was prepared with a standard antiseptic solution, and the temporal hair was minimally shaved to facilitate a clean incision line while preserving the hairline aesthetic (Table 2).

A critical preliminary step involved the infiltration of the operative site. A solution comprising Lidocaine 2% with Epinephrine 1:100,000 was injected into the retro-auricular sulcus and the planned temporal dissection plane. This step served a dual purpose: first, to induce local vasoconstriction, thereby minimizing intraoperative bleeding and maintaining a bloodless field; and second, to utilize the principle of hydro-dissection, physically separating the skin and subcutaneous tissues from the underlying cartilage and fascia, facilitating a safer dissection plane. The surgical approach was initiated with a curvilinear incision marked precisely along the intended retro-auricular hairline, extending superiorly into the temporal region. This design was strategically chosen to camouflage the eventual postoperative scar within the natural retro-auricular fold.

The distinguishing modification of this procedure—the Extended Sub-Galeal Advancement Flap—deviated from the standard subcutaneous undermining typically employed in otoplasty. In standard techniques, dissection often occurs just deep to the dermis, which can compromise the subdermal vascular plexus and yield a flap with limited elasticity. In this modified approach, the dissection was carried down through the subcutaneous fat and superficial fascia to enter the sub-galeal plane (the loose areolar tissue plane between the galea aponeurotica and the pericranium).

The extent of this undermining was aggressive yet controlled: the flap was mobilized approximately 4.0 cm posterior to the retro-auricular sulcus and 3.0 cm superiorly into the temporal fossa. The rationale for this modification is biomechanical; the scalp moves as a unit over the pericranium. By releasing the flap at the sub-galeal level, the inherent viscoelastic properties of the scalp are recruited, recruiting tissue that is far more compliant than the tight, hairless skin immediately adjacent to the ear. Furthermore, this plane is anatomically safe, as the major vascular supply to the scalp runs superficial to the galea, ensuring that the elevated flap maintains robust perfusion, thereby minimizing the risk of tip necrosis.

Following the elevation of the skin flap, the underlying pathology was addressed. Deep dissection revealed dense, abnormal fibromuscular bands—remnants of the intrinsic transverse and oblique auricular muscles—tethering the superior auricular cartilage to the temporal fascia. These bands were sharply transected, releasing the tension and allowing the superior pole of the ear to be effectively degloved from the temporal surface.

Upon degloving, the cartilaginous framework was inspected. The superior crus exhibited a constrictive deformity with a tendency to fold upon itself due to prolonged extrinsic compression. To correct this, the cartilage required structural reshaping to counteract its intrinsic elastic memory. Three horizontal mattress sutures were placed using 4-0 Clear Nylon (non-absorbable). The choice of non-absorbable suture was critical to provide permanent retention, as cartilage memory can persist for months. The vector of these sutures was oriented to expand the superior pole and redefine the antihelical fold, stabilizing the ear in an anatomically correct, projected position.

With the framework corrected, the previously elevated temporal-mastoid flap was advanced anteriorly and medially. Because of the extensive sub-galeal release, the flap advanced without tension, easily covering the defect created by the release of the ear. The most critical step in the closure was the placement of anchoring sutures. Key sutures were placed at the deepest point of the newly created sulcus, tacking the dermis of the advanced flap down to the mastoid periosteum. This maneuver is essential to recreate a sharp, defined fornix and to prevent the trampoline effect, where the skin bridges across the

sulcus, shallowing the depth over time. The skin incision was then closed with 5-0 Nylon interrupted sutures, ensuring precise edge alignment. Immediately following the procedure, a tie-over bolster dressing was applied directly into the reconstructed sulcus. This dressing exerts positive pressure to obliterate dead space, preventing hematoma formation and maintaining the contour of the new fornix during the initial phase of fibrin deposition. The patient was managed on the ward with intravenous Ampicillin-Sulbactam to provide broad-spectrum prophylaxis against skin flora, alongside multimodal analgesia.

The recovery was uncomplicated. The patient was discharged on postoperative day 3 with a clean, dry wound. At the one-week follow-up, the bolster and sutures were removed, revealing a deep, well-epithelialized sulcus with no evidence of dehiscence. By the 3-month follow-up, the surgical outcome remained stable. The advanced flap provided excellent color match and texture continuity with the surrounding skin, and the scar was well-concealed. There was no evidence of hypertrophic scarring, keloid formation, or recurrence of the helical invagination, validating the efficacy of the sub-galeal release in minimizing the wound. Functionally, the patient was able to wear sunglasses comfortably, confirming the structural integrity of the restored sulcus. The mask test (ability to retain a surgical mask loop) was passed successfully.

TABLE 2. CLINICAL MANAGEMENT PROFILE
Diagnosis, Surgical Intervention, Post-operative Course, and Outcomes

I. DIAGNOSIS & PREOPERATIVE ASSESSMENT

Primary Diagnosis	Cryptotia, Type I (Right Ear)
Clinical Features	• Invagination of upper 1/3 helix beneath temporal skin • Complete obliteration of retro-auricular sulcus • Cartilage constriction/folding with immediate retraction
Etiology	Twin Compression Theory Monozygotic twin gestation with oligohydramnios
Baseline Functional Deficit	Critical Inability to retain spectacles or protective face masks

II. SURGICAL TREATMENT

Procedure	Partial Otoplasty with Modified Posterior Auricular Advancement Flap
Anesthesia	General Anesthesia (Lidocaine 2% + Epinephrine 1:100,000 infiltration)
Key Modification	Technique Extended Sub-galeal Undermining (4cm posterior) to recruit temporal scalp elasticity
Cartilage Management	Release of fibromuscular tethering; Reshaping via non-absorbable horizontal mattress sutures
Pharmacotherapy	Intravenous Ampicillin-Sulbactam; Analgesics

III. FOLLOW-UP PROTOCOL

Hospital Course	Discharged on **Day 3**; Wound clean, no hematoma
Week 1 Assessment	Suture and tie-over bolster removal. Sulcus deep and well-epithelialized
Month 3 Assessment	Stable correction; Scar concealed in retro-auricular fold

IV. CLINICAL OUTCOMES (3 MONTHS)

Quantitative Metrics	Restoration 100% Helix-Mastoid Distance: **0 mm → 12 mm** Angle Norm Auriculocephalic Angle: **<10° → 30°**
Functional Restoration	Successful retention of sunglasses and surgical masks; Improved hygiene
Aesthetic & Satisfaction	VAS: 9/10 Symmetry achieved; Buried appearance resolved
Complications	None No infection, chondritis, hypertrophic scarring, or necrosis

3. Discussion

The etiopathogenesis of cryptotia remains one of the most intellectually stimulating debates within the field of congenital auricular anomalies.[11] Historically, the condition has been viewed through a binary lens: either as a localized failure of myogenesis or as a broader genetic syndromic expression. The current case, involving a monozygotic twin with a distinct phenotypic discordance, offers a unique opportunity to rigorously deconstruct these theories and advocate for a mechanical etiology in sporadic presentations. Standard embryological models attribute auricular development to the fusion of the six Hillocks of His derived from the first and second branchial arches between the 6th and 12th weeks of gestation. Following fusion, the auricle must actively separate and project away from the cephalic skin—a process driven by the intrinsic expansion of the cartilage and the reorganization of the auricular muscles. When this separation is arrested, the superior pole remains buried, resulting in cryptotia.[12]

In the realm of genetics, clear molecular pathways have been established. Mutations in GNAI3 and PLCB4 (involved in G-protein signaling) and EDN1 (Endothelin-1 signaling) are well-documented culprits, particularly in the context of Auriculocondylar Syndrome. In such cases, the deformity is typically bilateral, familial, and accompanied by other pharyngeal arch deficits, such as mandibular hypoplasia.[13] However, the patient in this report presented with a unilateral deformity, no syndromic features, and—most critically—a genetically identical twin with normal auricular morphology. This phenotypic divergence in monozygotic twins serves as a powerful natural experiment. If the etiology were purely genetic, one would mandate a high concordance rate between identical twins. The absence of such concordance necessitates an environmental or mechanical explanation. The twin compression theory posits that the intrauterine environment acts as a physical mold for the developing fetus. The developing ear is a soft, pliable cartilaginous structure that is highly susceptible to deformation by extrinsic forces.

In this specific case, the presence of oligohydramnios creates a perfect storm for mechanical deformation. Amniotic fluid normally serves as a hydraulic cushion, equalizing pressure and allowing free fetal movement. In the setting of oligohydramnios compounded by twin gestation, this hydraulic protection is lost. The fetal head is susceptible to prolonged, static pressure against the uterine wall or the co-twin.[14] We hypothesize that during the critical 9th to 13th weeks—the exact window when the superior helix should be elevating from the temporal skin—extrinsic pressure physically pinned the helix against the mastoid. This mechanical restraint likely prevented the migration of the retro-auricular skin and forced the superior auricular muscle to form an aberrant insertion directly into the cartilage rather than the skin, thereby establishing the tether that characterizes the anomaly. This distinction is of paramount importance for genetic counseling; it allows the clinician to reassure parents that the deformity is likely a random positional event rather than a heritable genetic trait, implying a negligible recurrence risk for future pregnancies.

The surgical correction of cryptotia is fundamentally a problem of surface area recruitment. The central challenge is not merely to release the ear, but to line the newly created retro-auricular sulcus with sustainable, healthy tissue.[15] Standard techniques, such as the V-Y advancement or simple rotation flaps, typically rely on subcutaneous dissection planes. While effective for minor defects, subcutaneous dissection in the retro-auricular region is fraught with limitations. The skin here is notoriously thin, tight, and adherent to the underlying fascia, offering a poor modulus of elasticity. Our surgical modification, the Wide Sub-Galeal Undermining, was developed to address these specific viscoelastic limitations. By shifting the dissection plane deeper—from the subcutaneous to the sub-galeal plane—we unlock two distinct advantages: vascular assurance and biomechanical recruitment.

The vascular anatomy of the temporoparietal region is complex. The superficial temporal artery and its arborizing branches run within the superficial temporal fascia (the temporoparietal fascia), just deep to the subcutaneous fat. In standard subcutaneous undermining, the surgeon dissects blindly through this delicate vascular network, increasing the risk of venous congestion or distal tip necrosis of the flap. By strictly adhering to the sub-galeal plane (the loose areolar tissue between the galea aponeurotica and the pericranium), the surgeon effectively lifts the entire vascular plexus with the flap. This ensures that the advanced tissue retains its axial blood supply, significantly enhancing viability even when the flap is placed under the tension of advancement.[16]

The scalp is unique in its ability to glide over the cranium, a property facilitated by the loose areolar tissue of the sub-galeal space.[17] Skin, when dissected subcutaneously, can only be stretched; it does not truly glide. Stretching skin creates tension, and tension is the enemy of wound healing, leading to hypertrophic scarring and trampolining (where the scar bridges across the sulcus, shallowing the depth). Conversely, dissecting in the sub-galeal plane recruits the inherent mobility of the scalp. By extending this dissection 4.0 cm posterior to the sulcus, we distribute the advancement forces over a much larger surface area. This allows the temporal and mastoid skin to slide as a unit into the retro-auricular defect without intrinsic stretch. This tension-free advancement is the single most critical factor in maintaining the depth of the fornix and preventing the secondary scar contracture that plagues many other techniques.

The reconstructive surgeon has a plethora of tools for cryptotia repair, primarily categorized into skin grafts, local transposition flaps (Z-plasty, V-Y plasty), and advancement flaps. The selection of the advancement flap for this case was driven by a comparative analysis of the shortcomings of alternative methods.[18] Historically, full-thickness or split-thickness skin grafts were the workhorse for sulcus reconstruction. However, grafts represent a borrowed solution with significant biological penalties. First, grafts rely on a recipient bed for revascularization (imbibition and inosculation), which is not always guaranteed over exposed cartilage. Second, and more importantly, grafts are prone to secondary contracture. Wound healing biology dictates that myofibroblasts within a graft will contract over time, potentially shrinking the surface area by 30-50%. In the context of a sulcus, this shrinkage obliterates the depth of the fornix, leading to recurrence. Furthermore, skin grafts taken from the groin or supraclavicular area often present with a distinct color mismatch (hyperpigmentation) and texture difference compared to the smooth, sun-exposed skin of the ear. Our advancement flap utilizes like with like—adjacent temporal skin with identical color, texture, and appendages—providing a superior aesthetic camouflage.

Z-plasties and V-Y plasties are elegant geometric solutions for lengthening a contracted line. They are highly effective for breaking up linear scars.[19] However, in Type I cryptotia, the defect is a broad area of missing skin, not just a linear band. Using a Z-plasty often requires the transposition of triangular flaps from the hair-bearing temporal scalp into the retro-auricular sulcus. This can result in the iatrogenic growth of hair behind the ear, which is difficult to manage and hygienically problematic. Additionally, the multiple geometric incisions of a Z-plasty can disrupt the hairline or leave visible zig-zag scars in conspicuous areas. The modified advancement flap maintains a single curvilinear incision hidden within the retro-auricular fold or hairline, offering a stealth incision that respects the aesthetic units of the face while recruiting hairless mastoid skin for the reconstruction.

While the immediate functional and aesthetic outcomes of this case are promising, scientific rigor demands a transparent acknowledgment of limitations, specifically regarding the biological behavior of cartilage and the duration of follow-up. Our study presents outcomes at 3 months. While the soft tissue envelope is healed and stable at this stage,

the cartilaginous framework remains dynamically active. Auricular cartilage possesses significant intrinsic elasticity, often referred to as memory. The cartilage, having been folded and compressed in utero and for seven years post-natally, has a biological tendency to return to its deformed shape. The horizontal mattress sutures placed during surgery act as a temporary scaffold, holding the cartilage in the correct shape while fibrosis locks it in place. However, the process of permanent remodeling and fibrosis can take up to 12 months. Literature suggests that recurrence of the upper pole folding—driven by this memory—is a late complication that may not be evident at 3 months.[20] Therefore, while our anthropometric data proves the efficacy of the skin release (the flap is stable), the long-term stability of the cartilage reshaping requires surveillance extending to at least one year. Future reports on this technique will ideally include 12-month data to definitively rule out late cartilage relapse. As a single case report (N=1), this study cannot generate statistical significance regarding the technique's superiority over others. However, the unique inclusion of a monozygotic twin acts as a powerful genetic control, adding a layer of methodological robustness often missing in larger case series. By comparing the affected ear not only to the patient's normal ear but also to the genetically identical ear of the co-twin, we minimize the confounding variables of genetics. This case highlights a critical gap in the regional literature. The virtual non-existence of data from the Indonesian archipelago suggests an under-reporting of this condition, likely due to a lack of awareness rather than a lack of incidence. Future research should prioritize the establishment of a multicenter registry for congenital ear anomalies in Southeast Asia. Such a database would allow for the validation of the twin compression theory on a larger scale and provide the necessary volume to perform randomized controlled trials comparing different flap designs in this specific ethnic demographic.

4. Conclusion

The restoration of the superior auriculocephalic sulcus in cryptotia is a complex endeavor that transcends cosmetic improvement; it is a functional necessity for the modern patient dependent on eyewear and protective masks. This case report serves a dual purpose in advancing the understanding and management of this anomaly. First, from an etiological perspective, this report provides compelling clinical evidence validating the twin compression theory. The presentation of Type I Cryptotia in a monozygotic twin, in the presence of oligohydramnios and a phenotypically normal co-twin, effectively decouples the deformity from a purely genetic origin. This finding is of profound clinical utility, enabling surgeons to offer reassurance to parents regarding the non-heritable, mechanical nature of sporadic cases. Second, from a technical perspective, the study validates the Modified Sub-Galeal Advancement Flap as a robust surgical solution. By challenging the dogma of subcutaneous dissection and extending the plane to the sub-galeal space, this technique successfully overcomes the viscoelastic limitations of the retro-auricular tissues . It enables the recruitment of sufficient local tissue to restore the sulcus without the color mismatch of skin grafts or the geometric complexity of Z-plasties. Ultimately, the procedure achieved its primary goals: the restoration of a 12mm sulcus, the normalization of the auriculocephalic angle, and the functional return of the ability to wear spectacles and masks. While long-term surveillance remains necessary to monitor cartilage memory, the short-term outcomes suggest that this modified flap technique offers a safe, vascularly robust, and aesthetically superior algorithm for the correction of cryptotia in the pediatric population. This case stands as a call to action for further documentation and research into congenital ear deformities within the under-represented Southeast Asian demographic.

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