

USE OF A MODIFIED Z-PLASTY FOR CRYPTOTIA CORRECTION

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ABSTRACT

Cryptotia, also known as hidden ear, is a congenital upper ear malformation and is the fourth most common ear anomaly, with the highest incidence primarily in East Asian population: 1 in 400 births in Japan.^[1] This auricular deformity involves an embedded upper pole underneath the skin of the temporal region and loss of the auriculotemporal sulcus. The cryptotic portion has a tendency to restore its original position after retraction or pulling of the upper pole of the ear.^[2] and it is associated with abnormal muscle and soft tissue attachments of the deformed auricular cartilage to the galeal and temporal fascia. Although there are various surgical techniques described in the literature, they are not without flaws.

INTRODUCTION

Here we propose a modified Z-plasty technique with favorable outcomes achieved in addition to reduced reported relapse or reinvagination cases. This technique was applied for all grades of cryptotia with advantages including simplicity of design, single stage with no additional grafts or skin flaps required, resulting in a deepening of the auriculotemporal sulcus whilst preserving the auriculocephalic sulcus.

PATIENTS AND METHODS

This retrospective study included a total of 15 consecutive cryptotia patients (with 23 ears) who underwent cryptotia correction at Great Ormond Street Hospital (London) using the described technique. No patients were excluded from this study. Patients' demographic data was recorded. Preoperative and postoperative photographs were taken. Follow-up data included reporting the postoperative complications. The study was conducted according to the Declaration of Helsinki principles and was approved by the local Research Ethics Committees.

Surgical technique

The operation is performed as a general anesthesia day case procedure. Local anesthetic (5 ml of 0.25% Chirocaine and 1% xylocaine with 1/200,000 adrenaline)

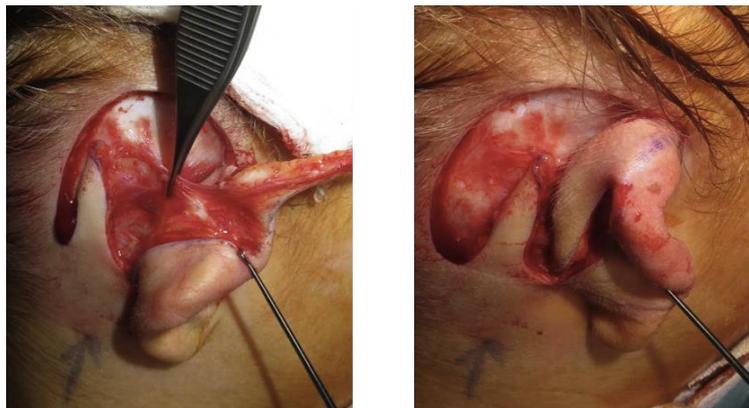
is infiltrated in the post-auricular surface of the ear and non-hair bearing skin of the mastoid in order to improve post-operative pain relief, reduce bleeding and facilitate the dissection.

Modified Z-plasty design

The modified Z-plasty design is asymmetrical due to the differing limb lengths and angles (fig 1). It consists of cranial and caudal skin flaps. Gentle posterior traction is applied to the upper part of the auricle away from the scalp, which reveals the hidden cartilage and identifies the curvature of upper helix which is marked. This marking is the base of the cranial flap and it extends from the ideal position of the anterior extent of the new sulcus back to where the helix becomes evident in the relaxed cryptotia. The upper limb of the z-plasty is drawn from that anterior point of the cranial flap base along the junction of scalp hair line with the non-hair bearing mastoid skin. This flap is completed by marking the central Z-plasty limb from the inferior point of the hair line limb to the posterior point of the cranial flap base. The base of the caudal flap lies between the apex of the cranial flap and the post auricular sulcus. The lower limb of the z-plasty follows the post auricular sulcus to meet the central limb at the posterior point of the hidden helical marking and cranial flap base. The skin flaps are elevated with the galea to improve flap vascularity.



Figure 1: (A-B) Preoperative design of the flaps.



1 (C) The Forceps pointing at the abnormal insertion off the auricularis superioris muscle to the eminence of the scapha, 1 (D) Transposition of flaps.



1 (E-F) immediate post operative view.

Release of aberrant Muscle and Soft tissue attachments

Dissection proceeds exposing the posterior surface of the upper half of the auricle. This is the key to success of the procedure as the combination of an abnormal course of the auricularis superioris muscle in addition to shortening of the intrinsic transverse muscle cause the tension that pulls the auricular framework anteriorly under the temporal skin leading to the buried cartilage and the deforming forces to the auricular framework. The auricularis superioris muscle is normally inserted onto the eminence of the triangular fossa. However, in cryptotia, this muscle is abnormally inserted into the cartilage of the scapha inducing deformity of the upper portion of the ear.^[2-4] In addition, the fibrous connections

and the intrinsic transverse muscle causing the contracture of the antihelix should be divided allowing cartilage to unfurl. It is critical that all muscles and soft tissue attachments of the upper portion of the auricular cartilage are divided to reduce relapse and reduce the degree of auricular cartilage deformity.

Wound closure, Dressing and Postoperative care

The cranial and caudal flaps are transposed but due to the difference of the z-plasty limb lengths, especially for the longer upper limb, that a degree of cheating is required to assist closure. The measurement of the central limb is marked along the upper limb and the caudal point of the central limb is advanced superiorly towards this point to reduce the discrepancy. Subdermal 4/0 Monocryl

interrupted stitches and 5/0 Vicryl Rapide are used. Dressing should be light, using a small piece of paraffin impregnated gauze, cotton wool roll and head bandage. Dressing are kept for one week. Scar massage and the application of silicone gel is encouraged after 3 weeks. We recommend no contact sports and a soft head band should be worn at night for 3 months.

RESULTS

All cases were corrected using this modified Z-plasty and release technique. The mean age at surgery was 6 years, with a range from one to 14 years. Of the 15 patients, 8 (53%) were males and 7 (47%) were females. Cryptotia was bilateral in 8 patients and unilateral in 7

patients (4 on the right side and 3 on the left side), giving a total of 23 ears repaired. Figure 2 and 3 show some preoperative and postoperative photographs. Follow-up was two years. (1 case out of 23 ears - 4.3% had wound dehiscence. This was managed by regular wound dressings until healing by secondary intention. One bilateral patient had unilateral relapse with loss of auriculotemporal sulcus. However, the patient's preference was not to have revision surgery and we used a custom-made splint to overcome the relapse. Hypertrophic scarring occurred in 2 patients. This resolved after encouraging patients to do scar massage and application of silicone gel products (twice daily, 5 minutes per application) for 3 to 6 months.



Figure 2: (A) Preoperative unilateral cryptotia-frontal view, (B) Preoperative right ear lateral view, (C) Preoperative right ear AP view.



(D) Postoperative unilateral cryptotia, (E) Postoperative right ear lateral view, (F) Postoperative right ear AP view.



Figure 3: (A) Preoperative bilateral cryptotia-frontal view, (B) Preoperative right ear lateral view, (C) Preoperative left ear lateral view.



(D) Postoperative bilateral cryptotia, (E) Postoperative right ear lateral view, (F) Postoperative left ear lateral view.

DISCUSSION

Cryptotia is a congenital ear anomaly. The superior portion of the auricle is pulled anteriorly and deeply underneath the overlying temporal skin due to abnormal muscle and soft tissue attachments which also cause deformity of the cartilage framework shape. This deformity has aesthetic consequences because it is not cosmetically acceptable and can lead to psychological impact on the child. It also may have functional problems due to the challenges in wearing glasses or accommodating hearing aids due to the absence of the auriculocephalic sulcus.^[2-4]

Tanemura,^[5] Tachibana,^[6] and Fukuda^[7] were amongst the first to investigate cryptotia. They postulated that cryptotia is one of the most common head and neck anomalies in Japanese population, with a male to female ratio of 2:1 and a unilateral predilection.^[8] The etiology remains undetermined. However, there are a number of theories: Werden, in 1870, proposed that cryptotia is caused by the abnormal insertion of the superior auricular muscle into the upper helix rather than the triangular eminence, whereas Hirose suggested that the abnormality is due to an aberrant intrinsic muscle of the ear. Meanwhile, Sercer believed it was a cartilaginous deformity with abnormal fibrous adhesive bands that contribute to faulty auricular cartilage framework.^[9-10] Hirose contributed to the classification of cryptotia due to the intrinsic auricular muscle action leading to the shape of the auricle, in particular the antihelix. He correlated the degree of antihelix deformity to the state of the intrinsic auricular muscles resulting in two types of cryptotia. In the more common type I, "transverse muscle type" cryptotia, the antihelix body and superior crus are compressed together, with an abnormal antihelical bend and a broad transverse muscle, resulting in a buried upper portion underneath the skin. In type II, "Oblique muscle type" cryptotia, the antihelix and inferior crus are contracted and acutely bent over, in addition to a defective oblique muscle attachment to the inferior crus.^[10] Non-surgical correction and management of cryptotia has been described using splintage when instigated in early neonates before the age of 6 months, due to the circulating maternal estrogen maintaining the cartilages pliability.^[11-13] Lack of

compliance with splintage, in addition to more recalcitrant, more severe cases, renders surgical treatment to become the mainstay of management of cryptotia. A multitude of surgical techniques for correction of various degrees of cryptotia have been described including the use of skin grafts, rotational flaps,^[10] V-Y advancement^[14] and Z-plasty transposition flaps.^[2] Other surgical techniques included a modified Z-plasty by Onizuka,^[15] a modified trefoil flap by Adams et al in 2011,^[16] superior auricular myocutaneous flap by Sakamoto et al in 2010^[17] and in 2009 both; modified square flap by Xu et al,^[11] and the switched double banner flap suggested by Kajikawa.^[18]

The correction of cryptotia using this modified Z-plasty places the upper limb along the hair line, thus avoiding scars in the hair bearing scalp. In addition, the lower limb is placed along the auriculocephalic sulcus, thus avoiding scars on the posterior auricular surface as well as preserving the auriculotemporal sulcus, while also providing good access to the posterior surface of the upper auricular cartilage. The transposition of the Zplasty flaps, combined with division of the deeper abnormal muscular and soft tissue attachments, leads to the creation of this robust post auricular sulcus with only one case requiring revision. The design of the modified Z-plasty means that the scars are placed behind the ear along natural cosmetic boundaries of the hair line, along the auriculo-cephalic sulcus and are therefore hidden behind the posterior surface of the ear. Whereas some other z-plasty designs either place hair-baring scalp skin in non-anatomical positions, requiring later corrective laser depilation or result in unsightly and visible scarring anterior to the ear^[19], our technique offers a simple and reliable method, with aesthetically pleasing scars, without abnormal positioning of hair baring skin in the zone of post-auricular non-hair baring skin (Fig. 2 and 3). Complete release of abnormal muscular insertions and fibrous adhesions reduces the chances of relapse and allows for corrective procedures to be performed to reduce the degree of auricular cartilage deformity on a case by case basis.^[20,21] In our group of patients, we have not felt the need for using cartilage grafts or Medpor as described by some authors, as the patients and their families have felt that there has been a satisfactory

improvement in the auricular cartilage form.^[22,23] We agree with other authors that there are challenges and limitations in all techniques to achieve symmetry in cases of unilateral and bilateral cryptotia. Patient selection, counseling, attention to details and meticulous technique, as with all auricular reconstructive procedures, are keys to delivering favorable results.

CONCLUSION

This modified Z-plasty and release technique has a simple design and is a reproducible procedure that delivers a deep post-auricular sulcus. It also provides direct exposure of the posterior surface of the upper auricular cartilage, allowing division of abnormal attachments of both extrinsic and intrinsic muscles of the auricle and correction of cartilaginous deformities. All the scars are behind the ear and almost hidden in the shadow of the ear. The post auricular hair line is preserved and kept undisrupted, preventing scarring alopecia. This technique is simple, robust and can give pleasing long-term results.

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