

Surgical treatment of unilateral lambdoid craniosynostosis with revolution spiral osteotomy: a case report

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Introduction/Background: Lambdoid craniosynostosis (LC) is the premature fusion of the unilateral or bilateral lambdoid suture. It is a rare condition associated with neurodevelopmental implications across different ages. Therefore, early diagnosis and treatment are crucial for a positive outcome.

Case Presentation: Here, we report the case of an 11-month-old male patient diagnosed with LC, presenting facial shift and altered ear positioning consistent with the condition. For the case, we employed the revolution spiral technique, a less invasive corrective method that minimizes bone loss and reduces postoperative morbidity. The patient showed no complications during surgery and was then evaluated 3 months after surgery, showing correction of the cranial deformity and no procedure-related complications.

Conclusions: We propose the revolution spiral technique as an effective alternative for the surgical management of LC, with minimal associated risks.

Keywords: lambdoid synostosis, craniosynostosis, osteotomy

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INTRODUCTION

Lambdoid craniosynostosis (LC) is the premature fusion of a single or bilateral lambdoid suture that leads to skull deformity and subsequent physiological and social problems. Unilateral LC is the rarest form of craniosynostosis with a reported incidence of 1 in 40,000 births [1]. In the reality of the increase of posterior cranial deformities after the supine position guidelines to prevent the sudden infant death syndrome the recognition of a real LC led to a diagnosis uncertainty and late recognition when surgical treatment is planned [2].

LC is primarily managed through surgical correction to restore normal cranial morphology, allowing appropriate cranial expansion for brain development. Multiple surgical techniques can be employed depending on the specific cranial deformity and surgeon preference. Endoscopic strip suturectomy, barrel staving osteotomies, distraction osteogenesis or spring-assisted correction are examples of surgical strategies [3]. We present here a case to highlight key aspects of the management of right-sided lambdoid craniosynostosis using the revolution spiral osteotomy technique and the cosmetic results.

CASE REPORT

An 11-month-old male patient was evaluated for an asymmetry of the posterior cranial vault, with shallowing of the right occipital bone. Bossing of the left parietal bone, right mastoid bossing, and inferior posterior displacement of the right ear were observed (Figure 1). In addition, the face appeared tilted toward the left. These findings changed the perception from a positional plagiocephaly to the possibility of a true lambdoid craniosynostosis. A computed tomography (CT scan) showed an obliterated right lambdoid suture, with clear thinning of the posterior calvaria at the right occipital bone (copper beaten skull) (Fig. 1). A posterior cranial vault correction was proposed.

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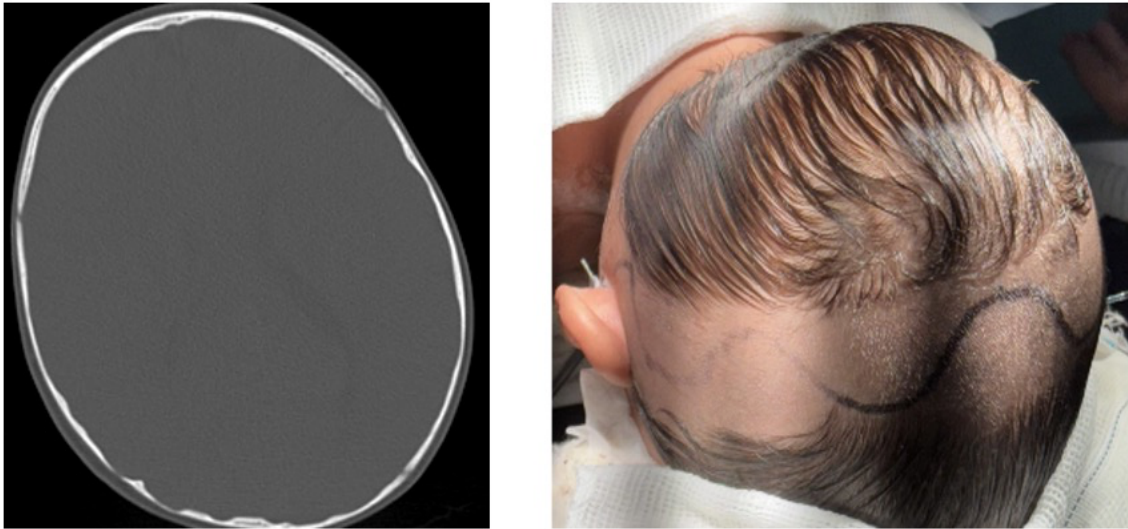


Figure 1. Deformity of the right occipital bone before surgical approach. Left, density reduction of the occipital bone evidenced by CT scan. Right, posterior right side skull depression prior to surgical management

After general anesthesia, monitoring, and central vein line placement, the patient was positioned in the ventral position. A curved incision was designed from both ears toward the vertex. After subgaleal dissection and exposure of both occipital bones, a revolution spiral osteotomy was drawn with the central line close to the midline (Figure 2). With careful dissection, the osteotomies were performed using piezosurgery, with immediate control of the sagittal sinus and emissary veins to avoid blood loss.

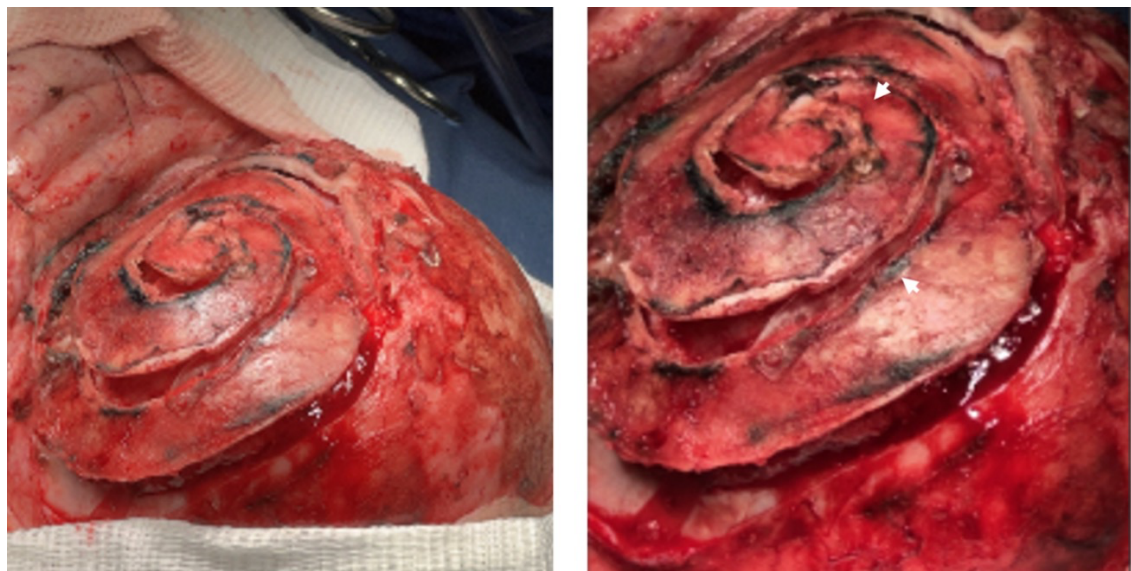


Figure 2. Spiral osteotomy drawn in the right occipital bone. Left, final intraoperative view showing expansion of occipital bone using absorbable plaques. Right, magnification with arrows indicating the position of plaques

At the end of the bone work, a construct with absorbable plates was made to create advancement with stability. The drawing of the remodeling was guided by placing the plates in the most depressed area of the occipital deformity. The total blood transfusion was approximately 75 ml. After two days, the subcutaneous drain was removed, and the patient was discharged. Occipital advancement was noticeable

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at the time of surgical closure (Figure 3). A CT scan performed at three months showed a good correction with aesthetic remodeling of the skull.



Figure 3. Immediate postoperative result of right-occipital bone remodeling. Left, pre-operative view of the right occipital bone. Right, immediate post-operative view showing expansion of skull and correction of appearance

DISCUSSION

Unilateral lambdoid craniosynostosis (ULC) is a rare clinical condition and challenging deformity if there is a late diagnosis. The differentiation from positional plagiocephaly is extremely important given that the treatment of ULC is surgical and the positional deformity non-surgical. The ear positioning in ULC is traditionally posterior and low but some authors have demonstrated cases of ULC with anterior ear displacement, like cases of positional plagiocephaly. A CT scan clearly shows a premature closure of lambdoid suture and a high frequency of ipsilateral mastoid “bulging” [3].

The main reason for ULS surgery depends on the spectrum of presentation of the disease. Vinchon et al described different presentations associated with an isolated ULC form or combined with other synostosis or syndromes [1]. The decision to operate or not a ULC depends on morphological impact of the deformity and evidence of intracranial hypertension. Possible venous sinus compression is another factor that takes account when considering posterior cranial vault expansion in ULC [1].

The choice of the surgical technique to correct the deformity is an important step still unsolved in the literature. There are many options showing that no technique is superior to the other. The age of the diagnosis is an important question since compensatory contralateral growth and additional deformities change surgical planning and demand a more aggressive procedure. Over the years, recognition of the complexity of this problem has led to raising a huge number of techniques.

Persing et al advocate a bilateral parieto-occipital approach with remodeling using multiple barrel stave osteotomies [4]. A greenstick fracture is made at the flattening area to increase the bone projection. Even with more aggressive and bilateral techniques it is difficult to adjust cranio-caudal shifts. J-F. Wilbrant et al published an unilateral technique with a straight-line incision with a squared "meander-shaped" craniotomy along the pathological suture [5]. The results in a photogrammetric analysis of the two cases showed an improvement without a final completely normal volume of the posterior skull.

Jimenez et al advocate minimally invasive suturectomy accompanied by orthotic therapy reporting short periods of hospitalization and transfusion needs. Most of these are used in patients at an early age

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to take advantage of progressive skull and brain growth. The advantage of early correction extends to avoid secondary and cranial base deformities including ear positioning and mastoid bulging [6].

The correction of an excessive flattened or even concave surface is difficult in patients with more severe lambdoid craniosynostosis which typically presents to the neurosurgeon in older ages. Multiple strips craniectomies following by reshaping and repositioning have been widely used. Jimenez et al described previously the “sunrise” technique with bilateral advancement and argues that the bilateral nature of the problem with the frontal bossing and occipital contralateral bossing demanding a more aggressive approach [7].

One of the advantages of multiple revolution spiral technique is the considerable flexibility of the osteotomies which facilitates the reshaping in flattened areas [8]. The amount of bone loss is minimal just restricted to the drill bit used for drawing the osteotomies. In our case, the use of piezosurgery was an advantage to create narrow and unnoticed bone spaces at post operative follow-up. The position of the center of spiral telescoping can be adjusted to create different amount of curvature needed to the patient.

The use of absorbable plates at each level of the spiral osteotomies was cited by Caycedo et al previously [9]. The plates help to maintain bone distraction and expansion even after the replacement of scalp flap and whenever there are compressions of the child’s head, e.g. at sleep. Performing the osteotomies requires a certain level of expertise mainly when close to the sagittal sinus. It is a good option for older patients and can be performed for children aged 4 years or less [9].

In our case, we have slightly altered the technique described by Caycedo et al. We didn’t fix the absorbable plates in a 180° position from base to apex, mainly due to the lack of large plates at our facility. The way we decided to place the plates creates an organized piled up osteotomy that resulted in an immediate correction of the most flattened area of the occipital bone (Figure 3).

Disadvantages of this technique are the need of absorbable plates for ensuring the remodeling and the risks of blood loss in osteotomies close to the midline. The use of piezosurgery can help to minimize this loss, but in association with the absorbable plates, makes the surgical procedure more expensive mainly to public health systems.

CONCLUSION

While numerous surgical techniques exist for treating LC, this case highlights the effectiveness of the revolution spiral technique, particularly in its ability to reshape severely flattened areas and provide a stable correction with minimal bone removal. The use of absorbable plates further supports the long-term maintenance of the corrected skull shape. Although the procedure requires specialized equipment and carries a higher cost, our findings suggest it is a valuable and effective option for the management of LC, offering excellent cosmetic results with low associated risk.

DISCLOSURES

ETHICAL APPROVAL

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the local Ethics Committee.

CONSENT TO PARTICIPATE

The patient gave consent to use his information and images for publication.

CONFLICT OF INTEREST

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper

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CONTRIBUTIONS

Angelo Silva Neto: Conceptualization, Data curation, Methodology, Writing – original draft, Writing – review & editing

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Lauren Beatriz Gomes Fortes: Supervision, Validation, Writing – review & editing

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