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OUR EXPERIENCE IN EAR RECONSTRUCTION USING THE ANTIA BUCH PRINCIPLES

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Abstract:	Objective: Presenting our experience with chondrocutaenous flap reconstruction of the ear to obtain more aesthetic results with fewer complications. Background: Satisfactory reconstruction of the ear following a resection of the helix, scapha and anti-helix remains an ongoing problem in plastic surgery. Many techniques had been developed to approach this issue and to minimise the complications raised from resection of tumours as well. However, no studies have yet mentioned specific details of aesthetic outcomes. Methodology: The study is retrospective in design, with accurate description of the ear reconstruction technique and outcomes in series of cases that were performed by the same surgeon on all patients. Twenty patients were included in this study. The collected data included demographics, any post-operative complications, and post-operative measurements of both reconstructed and normal ears. Results: In all cases, all tumours were completely excised with no known post-operative complications such as flap loss, wound infection, dehiscence or haematoma were reported. The mean residual defect was 21.8 mm ranging from 14 mm to maximum of 30 mm in size. The differences in height, width and projection carried the means of 6.8, 4.3 and 3.8 mm respectively. Conclusion: The modified Antia-Buch technique allows preservation of anatomical landmarks and contour of the ear and therefore maintaining normal overall three-dimensional appearance of the reconstructed ear. Reconstruction of 10 mm defects can be confidently performed using this technique with no loss in size. However, due to the potential lobule distortion, we recommend applying this technique to defects only up to 25 mm.

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Background: Satisfactory reconstruction of the ear following a resection of structures such as the helix, scapha and anti-helix remains an ongoing problem in plastic surgery. Many techniques had been developed to approach this issue and to minimise the complications raised from resection of tumours as well. However, no studies have yet mentioned specific details of aesthetic outcomes.

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Conclusion: The modified Antia-Buch technique allows preservation of anatomical landmarks and contour of the ear and therefore maintaining normal overall three-dimensional appearance of the reconstructed ear. Reconstruction of 10 mm defects can be confidently performed using this technique with no loss in size. However, due to the potential lobule distortion, we recommend applying this technique to defects only up to 25 mm.

Introduction:

Satisfactory reconstruction of the ear following a resection of structures such as the helix, scapha and anti-helix remains matter of active discussion in plastic surgery.
Nearly 6% of all skin cancers are found in the ear. The external ear carcinomas are mostly located on the helical rim, anti-helix and the post-auricular region [1]. Therefore, appropriate resection has to be made to achieve the margin free outcome.

Many techniques had been formulated to attempt appropriate and complete tumour resection while minimising complications. Some of these include wedge resection and primary closure, advancement flaps, composite grafts, fascial grafts and tube flaps. When selecting a technique, the surgeon must consider the size, location of the defect and the goals of reconstruction [2]. In 1967, the Antia-Buch technique was first described in order to restore the three-dimensional shape of the ear with the fewest complications and best outcomes [3]. Due to the safety, ease of method and the promising results, the technique steadily gained popularity. Nevertheless, complications followed in some patients, especially those required wider excision for tumours, therefore a modified Antia-Buch technique was developed to overcome these complications [4,5].

In outlining the benefits and risks of this technique, it is first important to understand the key anatomy of the ear. The skin of the helix and anti-helix surfaces of the ear is different to the lobule. This skin is attached to the perichondrium without any subcutaneous tissue. It contrasts the skin that covers the lobule which has more subcutaneous tissue to it. The structural framework is then entirely reliant on the elastic cartilage of the ear which is both flexible and resilient at the same time. The cartilaginous framework of the helical rim is therefore critical for the structural support and maintenance of ear contour. Other parts, such as the concha and triangular fossa, can be excised without significant deformity [2].

The blood supply in the external ear allows the design of very creative local flaps. The posterior auricular artery and the superficial temporal artery represent the main sources of vascularization, with a supplementary influx from the occipital artery in 10% of the cases. Of clinical significance, is the presence of two arterial networks one overlying the triangular fossa and scapha and the other the concha. Perforators coming from the posterior auricular artery at five different levels (helical root, triangular fossa, cymba, cavum and lobule) allow the design and advancement of composite flaps when reconstructing defects [6].

All technical efforts need to be made in a quest for a result to preserve the important anatomical landmarks and matching the contralateral side as closely as possible.

We present our experience with ear reconstruction using Chondrocutaneous flaps and a modified Antia-Buch technique seeking to obtain a more realistic result, with better cosmesis and with fewer complications

Material and methods:

The study is retrospective in design, we collected data of patients in a single specialist practice whom underwent reconstructions using the Modified Antia-Buch with Chondrocutaneous flap technique following a partial loss of the helix and / or antihelix. The reconstructions occurred between 2004 and 2015, the number of patients underwent the modified Antia-Buch flap ear reconstruction were 20 in total, they comprised 16 males, 4 females. They had an average age of 67 years.

All the patients had oncological operative indications. They underwent excisions and reconstructions with the use of the same type of flap, which was performed by the same surgeon. They eventually followed-up at the same practice. Patients' consents were obtained for the study. No ethics approval was required given the retrospective nature of the study.

Defects following the resection were monitored by the plastics team: these defects were distributed in the upper and middle third of the encroaching helix and antihelix.

A key element of the study was the comparative biometrics of original and then reconstructed ear. The surgeon had made measurements both pre-and post-intervention. Key measurements included the height (from the very tip of the helical rim to the very tip of the lobule), the width (from the root of the helix to the furthest point on the helical rim) and the projection (from mastoid to helical tubercle on the side of the normal ear or, alternatively, to the newly created helical tubercle on the operated ear). Measurements were performed on the operated ear as well as normal ear post-operatively, at an average of one year with a range of 6-18 months. Simple data and statistical analysis was performed using SPSS (Statistical Package for Social Sciences) Software version 15.

Technique:

Given the nature of excised lesions, being mostly carcinomatous in nature, meticulous and full excision is required to prevent recurrence of lesions but at the same to allow good recovery with least amount of aesthetic and functional loss. Local advancement flaps in the ear have indeed better aesthetic outcome than end to end repair, as the latter usually cause buckling of the ear especially if the defect is larger than 20mm [4].

Our technique is found suitable for defects of the helix and antihelix. It uses the residual framework and cover to reconstruct a well-shaped ear. The peculiarities of the blood supply to the ear forms one of the basis of our technique. Chondrocutaneous flaps are designed adjacent to the defect, based on a large posterior skin pedicle. To that intent, an incision on the surface of the ear after performing pre-operative marking of the lesion and the planned resection and injection of 2%

lignocaine with 1:80000 adrenaline anaesthetic solution. This incision only involves the anterior skin and the cartilage. The posterior skin is thus kept intact, which would also provide an intact source of blood supply for the new flaps. The dissection continues between the skin and the cartilage in the direction of the external auditory meatus. The dissection planes are easy to identify but haemostasis needs to be meticulous to avoid post-operative haematomas. The upper pole of the helical rim is mobilized on a post auricular skin flap. The flaps are advanced into the defect in a V to Y advancement fashion and secured. They should move freely and the helical sutures should not be under tension. The advancement of the mobilised helical flaps would likely create a varying degree of buckling at the apex of the resection. This is dealt with by cartilage and skin resection, as per Burrow triangles principle at the anti-helical and even conchal level if required. Finally, closure of wound is done in two layers using absorbable suturing material, Jelonet gauze along with moderate pressure dressing is applied to the operated ear. The dressings usually replaced 5-7s post-operatively then on two weeks mark when full healing is usually achieved. These steps and outcomes can be correlated with photographs shown in Figure (1) and (2).

Discussion:

Different techniques have been described for reconstruction of helical defects. Progressively more sophisticated methods for using the local tissues in ear reconstruction have been devised [7]. Many have been proposed with the presence of risk of residual structural defects such as cupping or notching of the ear, especially with larger defects [5].

The flap surgeries by Antia and Buch and even the newer modified Antia-Buch, indeed, from literature and from our experience, is a relatively simple and fast technique [8]. They are made to cover the acquired post-excision defects in the helix and anti-helix. They allow safe transfer of ear tissue with a known rich and definite presence of vascular supply therefore, reducing the risk of tissue necrosis [9]. In addition, the ease of alignment which comes from proper and abundant dissection in the right planes prevents any residual architectural defects and preserves the structure of the ear [6,8,9,10].

External ear carcinomatous lesions mostly occur on highest sun exposure location, being the helical rim, anti-helix and the back of the ear [1], the excision is usually large to obtain margin free resection, and if the classic Antia-Buch technique is to be used, loss of vertical height and distortion of the lobe contour can usually occur [11]. However, the “like for like” principle of reconstruction in our layered structure makes the Chondrocutaneous flaps a prime candidate.

The classic Antia-Buch flap is a good choice for defects less than 2 cm [12]. The modified chondrocutaneous advancement flap, on the other hand, allows reconstructing helical defects of more than 2 cm diameter including cartilage. This flap, when ideally performed, does not diminish vertical height of the ear, unlike the classic approach in such sized defects which could end with distortion of reconstructed ear. This flap allows retaining the principal form of the ear with the only consequence being the narrowing of the horizontal diameter of the ear for about half a centimetre without distortion of the ear lobe.

Because the mobilisation of this flap is excellent, there is no traction on the helix and, in consequence, no notching. We used our technique in various defects of the helix and antihelix. The copious cartilage resection allowed precise alignment, avoiding buckling and sharp edges on the external surface of the ear. The large dissection permits ample tissue advancement and consequently minimal reduction in size. Upon movement of the flaps during the reconstruction, there is a constant reduction in the lobule size and lobule skin redundancy. Looking at the ears

simultaneously, the anatomical landmarks are always preserved, together with the three-dimensional shape.

We found that two problems pertaining to the aesthetics of the ear can arise. A flattened, short upper pole can occur if the flaps do not advance freely. Alternatively, an off-ended helix generates an "operated look" in the ear. Scrupulous alignment of the helical rim is quintessential in producing a natural look.

Results:

There were no complications at the immediate postoperative patient follow-up; all tumours were completely excised, with no flap loss, wound dehiscence, or haematoma.

Measurements of the native ear reveal that the average height, width, and projection were 82.15 mm, 40.69 mm and 25.69 mm respectively. Following reconstruction, post-operative average height, width and projection were 79.76, 38.38 and 25.46 mm respectively.

In interpreting the measurements, one should focus on the spatial differences between the native ear and the operated one. The residual defect after resection averaged 21.8mm (max 30mm, min 14mm), the height difference averaged 7.3mm (max 13mm, min 0mm), width difference 3.5mm (max 8mm, min 0mm), projection difference 3.9mm (max 9mm, min 0mm). This can be explored in greater depth in *Table 1.*

Conclusion:

Just as in any other part of the body, the flap advancement depends on the flap length. Since most of our defects pertain to the upper and mid third of the ear, the flap length is similar, hence the observation that our flaps advance by about 5mm each.,

With a reliable flap advancement of 5mm on each side, the above technique allows the reconstruction of 10mm defects without loss in size. Due to the potential lobule distortion, we recommend applying this technique to defects up to 25mm.

Differences in height and width are hard to notice since ears are seldom visualised simultaneously, making the normal appearance of the ear (anatomical landmarks and contour) the hallmark of an aesthetically acceptable result.

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Tables:

Ear Measurement	Mean (mm)	SD* (mm)	Minimum (mm)	Maximum (mm)
Native Height	82.15	6.42	70	93
Native Width	40.69	2.98	36	49
Native Projection	25.69	4.25	20	32
Defect size	21.84	5.12	14	30
Post-operative Height	79.76	5.47	70	88
Post-operative Width	38.38	4.69	30	44
Post-operative Projection	25.46	7.45	18	39
Height Difference	6.48	4.27	0	13
Width Difference	4.30	3.32	0	10
Projection Difference	3.82	2.81	0	9

Table (1)

* SD (Standard Deviation)

Figures:

Permission is provided to publish the following photographs.

Figure (1)

Figure (1) represent the step by step approach to resection of a left ear lesion and reconstruction of the ear according to our modified Antia-Buch approach as described in the discussion.

(Figure 2)

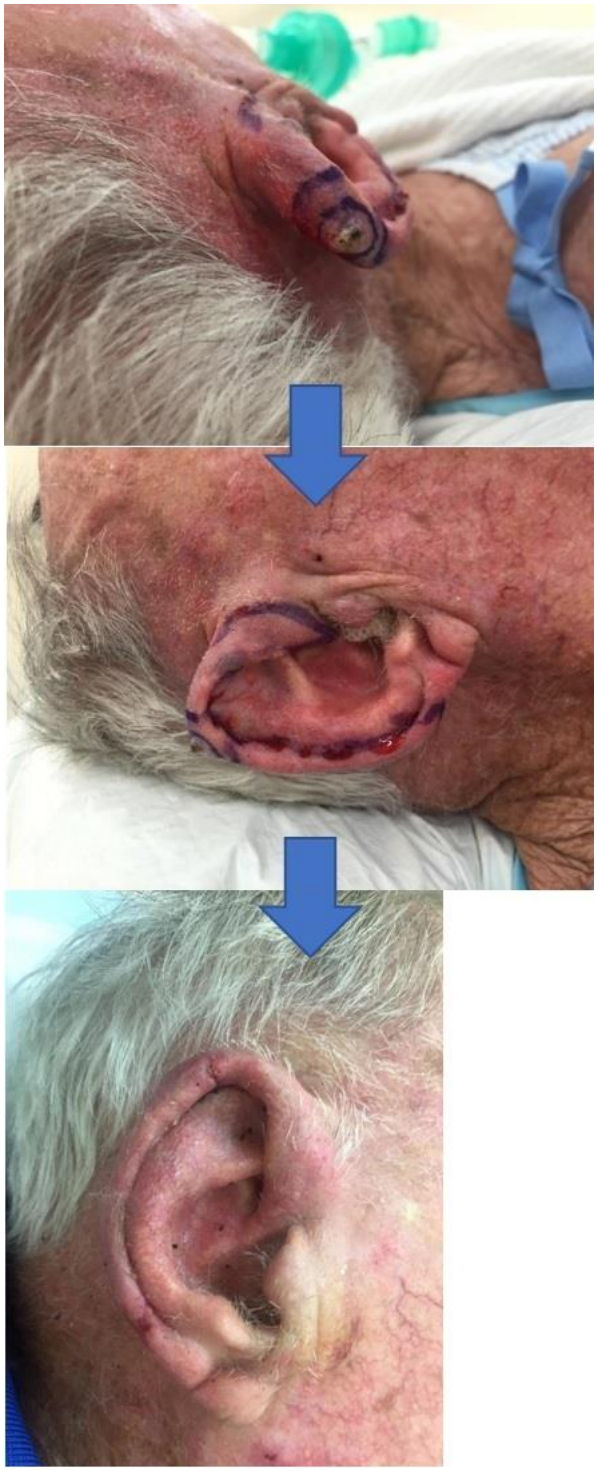

Figure (2) represent a photo of another pre and post treatment of right superior helical ear malignant tumour.