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Cartilage excision for antihelix creation in prominent ear correction: A prospective study

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ORIGINAL ARTICLE

Cartilage Excision for Antihelix Creation in Prominent Ear Correction: A Prospective Study

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Abstract

Background: **More than 100 different methods, including excisions, incisions, scoring, and suturing techniques, have been used for the treatment of prominent ears, indicating the lack of a single widely accepted strategy that has been adopted by the majority of surgeons.**

Aim: **This study aims to evaluate the cartilage excision procedure to create the antihelix in prominent ear correction.**

Patients and methods: **This prospective study utilized 20 cases with prominent ear deformity. The study was conducted in the University Hospitals, Faculty of Medicine, Al-Azhar University. Ethical approval was obtained from the same institution. Every patient wrote an informed written consent.**

Results: **We found that the procedure revealed a statistically significant decline in all six Auricular anthropometric measurements used in the study. CS angle, AC angle, upper AC, middle AC, lower AC distance, and Conchal depth on follow-up of the studied population. Even without conchal reduction and setback in most cases our studied patients developed minimal postoperative complications. Paresthesia was developed in 5% of patients, it resolved after 3 months spontaneously followed by hematoma and sharp antihelix in 5% of patients, the hematoma was evacuated bedside and compression dressing, sharpness of antihelix was early postoperative and improved after 2 months very well then Pressure ulcer in 5% of patients healed by secondary intention. Lack of symmetry was reported in 10% of cases which was mild. None of our included patients develop local infection and other complication. Patient satisfaction scores ranged between 19 and 30 with a mean value of 25.19 ± 4.06. Most of our patient's satisfaction was excellent and good.**

Conclusion: **The cartilage excision procedure was effective in the creation of the antihelix in prominent ear correction. The procedure was followed by minimal postoperative complications, good aesthetic outcomes, and high patient satisfaction.**

Keywords: Antihelix, Cartilage excision, Prominent ear

1. Introduction

Common congenital abnormalities include prominent or protruding ears. Genetic syndromes, environmental factors during pregnancy, and gene mutations are just a few of the many contributing factors to the cause. Prominauris' detrimental psychosocial effects are frequently what spur people to seek surgical treatment.[1]

One of the following anatomical variations may be the cause of the resulting ear defect: an underdefined antihelical fold, anterior rotation of the concha (an increased conchomastoid angle), deep concha, increased conchoscaphal angle, excessive anterior lobule projection, and conchal hypertrophy or a combination of these deformities.[2]

Due to the lack of an 'excellent' technique that reduces complications and recurrences, numerous surgical corrective approaches for prominent ears have been developed over the past few decades. Numerous different surgical methods, including endoscopic methods, have been developed by surgeons and are documented.[3]

Although each of these methods has unique patient-specific indications, they can all be grouped into one of three categories: suture-based, cartilage-cutting, and cartilage-sparing techniques.[4]

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Cartilage excision is not a new technique it is used mainly for a conchal reduction but we utilized it for the creation of an antihelix. So this clinical study tried to investigate the hypothesis that is cartilage excision reliable for creating the antihelix in prominent ears and could that procedure minimize cosmetic deformity and improves incidence of recurrence or not.

This study aims to evaluate the cartilage excision procedure to create the antihelix in prominent ear correction.

2. Patient and methods

This prospective study utilized 20 cases with prominent ear deformity. The study was conducted in the university hospitals, Faculty of Medicine, Al-Azhar University, from July 2022 to August 2023. Ethical approval was obtained from the same institution. Informed written consent was obtained from every patient.

2.1. The inclusion criteria

Prominent ear deformity, age from 5 to 50 years, male and female cases, bilateral or unilateral cases.

2.2. The exclusion criteria

Revision and recurrent cases associated with other congenital auricular deformities, and previous auricular injuries.

2.3. Data collection

Detailed medical history was taken from the patient or the parents regarding: demographics, the chief complaint, surgical history, especially any previous session of otoplasty or history of auricular trauma. Careful examination was done to look for any swelling or post traumatic cartilage deformity. Laboratory investigations including routine lab. Complete Blood Count, coagulation profile, liver function, kidney function, and viral markers were done for every patient preoperatively. Problem analysis was performed for each case to determine anthropometric measurements and cartilage pliability. Six anthropometric measurements were recorded preoperatively with the patient's head in the Frankfort horizontal plane. Photographic documentation of all steps is an essential item throughout the whole work.

2.4. Operative technique

2.4.1. Anesthesia

Local anesthesia: in co-operative adult patients. General anesthesia: in uncooperative and pediatric patients.

2.4.2. Position

Patient is supine, head is supported in a doughnut head ring, and table is tilted up. We turned the head to make the ear -we want to operate on-uppermost.

2.4.3. Marking

Proper draping and sterilization procedures were done perfectly for the operating room. Anti-helix, Anterior and posterior crus.

In order to identify the new antihelix, the ear is held up against the head and traced out with a marking pen (Fig. 1a).

2.5. Posterior skin excision

The assistant surgeon held the ear forward so we can mark a skin ellipse on the posterior surface of the ear to detect the skin to be resected (Fig. 1b).

2.6. Local infiltration

For the retro auricular area, a solution of 1% lidocaine, 1 : 100,000 adrenaline, and sodium

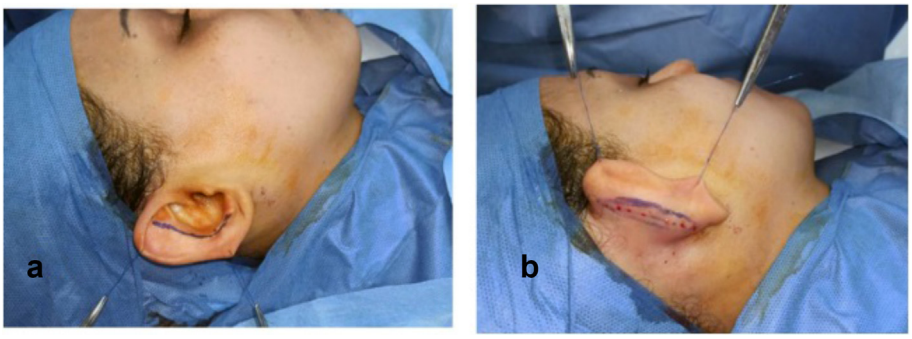

Fig. 1. (a): Intraoperative marking of the new antihelix. (b): Marking the skin ellipse that will be removed from the retro auricular skin.

bicarbonate 8.4% in concentration 1:1 : 0.1, respectively was infiltrated into a supra perichondral plane using a 30-gauge needle-making hydro dissection and vasoconstriction effect. Postauricular sulcus and the mastoid region also infiltrated.

2.7. Posterior skin excision

To continue skin undermining on the back of the auricle, the previously marked ellipse of postauricular skin is excised, stopping 1 cm short of the helical rim. To make the cartilage as clear as possible for the remainder of the procedure, any soft tissue attached to the back of the auricle is dissected out (Fig. 2).

2.8. Marking a mirroring anti helical mark on posterior surface of cartilage

Fig. 3.

Fig. 2. Supra-perichondria dissection till the helical rim.

Fig. 3. Marking of excised elliptical cartilage.

2.9. Strip cartilage excision to create desired antihelix

The new antihelical fold is excised using a scalpel and dissector (Fig. 4). The excising ellipse is about 2–4 mm wide with preservation of the anterior perichondrium.

2.10. Sutures to secure the defined new antihelix

To keep the new antihelical fold in place, three or four horizontal mattress sutures made of 3/0 nonabsorbable proline are used. The anterior skin is not stitched through; only the entire thickness of the cartilage is stitched through. It uses a bite size of 4–6 mm, which is large enough to prevent cutting through the cartilage but not so large that it buckles (Fig. 5). Care is taken to bury the knots in small subcutaneous pockets so that they do not protrude from the suture line.

Complementary procedures are done if required as: Concha reduction, Concha setback by conchomastoid sutures, ear lobule correction.

2.11. Skin closure and dressing

The postauricular incision is stitched shut in a single layer using continuous 4/0 proline sutures to complete the procedure. A similar correction is made to another ear. The previously mentioned operative procedures are applied to all patients. The ear dressing is applied. The chonca, the scapha, and the retro auricular sulcus are filled with paraffin gauzes (Fig. 6).

2.11.1. Postoperative

Follow-up at 1 week, 3 weeks, 6 weeks, 3, and 6 months, first dressing at 1 week, Skin suture removal at 2–3 weeks, Garments keeping auricle in place for 6 weeks.

Close monitoring was done for the first 24 h to detect any hematoma formation. On the second day the patient is discharged with strict recommendation to avoid any traction to the ear. Over the first two weeks, 4 follow-up visits were scheduled for detection of any early complication and removal of stitches followed by monthly follow-up visits. Postoperative measurements were recorded at least after 1 month, 3 months and 6 months to compare with preoperative measurements.

A questionnaire is filled by the patient if older than 10 years or by the parents in patients younger than 10 years to assess the patient/parent satisfaction. Excellent. (27–30) Good. (21–26) Average. (20–15) Poor. (10–14) Very poor. (0–10).

Fig. 4. Cartilage excision 2–4 mm width.

Fig. 5. Mustardé suture are taken to form the new antihelix.

The evaluation ofpatients were based on three aspects: aesthetic outcome which determined by: symmetry, anthropometric measurements measured preoperative 1 and 3 months postoperative. Patient satisfaction using a questionnaire form. Occurrence of early and late complications. Recurrence, redo, and revision procedures.

3. Results

Our study included 20 cases (43 ears); their age ranged between 8 and 34 years with mean value of 20.35 ± 8.24 years. Among our included patients 60% were male and 40% were females. Regarding the side 65% were bilateral, 35% were unilateral (Table 1).

We found that procedure revealed statistically significant decline of all six Auricular anthropometric measurements used in the study. CS angle, AC angle, upper AC, middle AC, lower AC distance, Conchal depth on follow-up of the studied population. Even without conchal reduction and setback in most cases.

Among our studied patients, 10% developed postoperative complications which is minimal with

Fig. 6. (a and b)The new auricle shape. (c) A formal mastoid type head bandage (cotton filled dressing wrapped with a crepe bandage) was applied for 7 days. (d) Postoperative ear dressing and formal head bandage.

Table 1. Demographics of the patients who were the subject of the study.

The following tables and figures present the results of this study	$N = 20$
Age (Y)	
Range	8–34
Mean ± SD	20.35 ± 8.24
	N (%)
Sex	
Male	12 (60%)
Female	8 (40%)
Side	
Unilateral	7 (35%)
Bilateral	13 (65%)

regard of sample size. Paresthesia was developed in 5% of patients, it resolved after 3 months spontaneously followed by hematoma and sharp antihelix in 5% of patients, hematoma evacuated bedside and compression dressing, sharpness of antihelix was early postoperative and improved after 2 months very well then Pressure ulcer in 5% of patients healed by secondary intention. Lack of symmetry was reported in 10% of cases which was mild not noted by the patient but the surgeon. None of our included patients develop local infection, hypertrophic scar, suture extrusion, recurrence, redo, and revision procedures.

Patient satisfaction scores ranged between 19 and 30 with mean value of 25.19 ± 4.06. Most of our patient's satisfaction was excellent and good.

Our study revealed a statistically significant decline of upper, middle and lower auriculocephalic (AC) distance on follow-up of the studied population (Table 2).

The current study revealed a statistically significant decline of AC angle and conchoscaphal (CS) angle on follow-up of the studied population (Table 3).

The current study revealed statistically significant decline of Conchal depth on follow up of the studied population (Table 4).

4. Discussion

Ely first proposed the idea of breaking the ear's cartilaginous framework in 1881. He performed a cartilaginous incision at the location of the future antihelix and then closed the wound with skin. The creation of a more accurate antihelix has since undergone numerous tests and modifications. To the cartilaginous incision made by Ely earlier, Luckett added horizontal mattress sutures in 1910. Both techniques, though, have resulted in skin necrosis and a very sharp antihelix. Two parallel cartilaginous incisions were made by Converse and Wood in 1964, followed by the creation of a cartilage island that was tubed to create an antihelix. In 1987, Pitanguy et al. separated a straightforward ellipse of island cartilage that was pushed anteriorly, then the cut edges were stitched together behind it to form an antihelix. To create an antihelical fold, Cho et al. in 2003 made two parallel cartilaginous incisions without separating them first. The disadvantages of all prior studies include producing a sharp

Table 2. Follow-up of AC distance of the studied population.

	Mean	SD	Minimum	Maximum	One way ANOVA	
					F	*P*-value
Upper AC distance					1.27.121	<0.0001*
Pre-op	25.35	4.65	16	32		
FU 1 week	10.05	2.76	9	12		
FU 3 week	10.35	1.74	10	12		
FU 6 week	10.65	1.04	10	12		
FU 3 month	10.8	1.23	10	12		
FU 6 month	11.35	1.23	10	12		
Middle AC distance						
Pre-op	30.7	4.14	23	38	737.716	<0.0001*
FU 1 week	15.06	1.32	14	17		
FU 3 week	15.3	1.43	14	18		
FU 6 week	16.01	1.22	15	18		
FU 3 month	16.2	1.30	16	18		
FU 6 month	17.05	1.28	16	18		
Lower AC distance						
Pre-op	36.35	4.65	32	41	139.578	<0.0001*
FU 1 week	20.15	1.76	19	22		
FU 3 week	20.55	1.74	20	22		
FU 6 week	20.75	1.04	20	22		
FU 3 month	21.1	1.23	20	22		
FU 6 month	21.45	1.23	20	22		

Table 3. Follow-up of AC and CS angle of the studied population.

	Mean	SD	Minimum	Maximum	One way ANOVA	
					F	*P*-value
AC angle						
Pre-op	40.75	4.24	37	49	248.518	<0.0001*
FU 1 week	20.85	1.42	19	21		
FU 3 week	21.65	1.11	20	22		
FU 6 week	22.05	1.99	20	22		
FU 3 month	22.50	1.28	20	22		
FU 6 month	23.15	1.28	20	22		
CS angle						
Pre-op	110.75	14.95	100	130	60.843	<0.0001*
FU 1 week	80.05	3.07	76	89		
FU 3 week	82.75	2.36	80	89		
FU 6 week	84.95	1.89	80	89		
FU 3 month	85.2	1.20	80	89		
FU 6 month	88	1.52	82	89		

Table 4. Follow up of Conchal depth of the studied population.

Conchal depth	Mean	SD	Minimum	Maximum	One way ANOVA	
					F	*P*-value
Pre-op	16.01	2.64	11	19	17.313	0.0001*
FU 1 week	12	1.16	10	15		
FU 3 week	12.05	1.61	10	15		
FU 6 week	12.07	1.62	10	15		
FU 3 month	12.2	1.39	11	15		
FU 6 month	12.5	1.36	11	15		

antihelical fold, posting high recurrence rates due to the use of non-permanent sutures, and/or failing to perform anterior scoring.[5]

Our current study included 20 patients (43 ears); their age ranged between 8 and 34 years with mean value of 20.35 ± 8.24 years. Among our included patients 60% were male and 40% were females. Regarding the side 65% were bilateral, 35% were unilateral.

Regarding the pre and post anthropometric measurements, our results showed that there was a statistically significant decline of upper, middle, and lower AC distance, conchal depth on follow-up of the studied population. Even without conchal reduction and setback in most of cases. Excision helping in conchal reduction not only creation of antihelix and we can increase width of excised cartilage, so we did not need additional cartilage excision in most of cases with conchal hypertrophy or increased depth. Also, there was a statistically significant decline of AC angle as well as CS angle on follow-up of the studied population. All of the results are within normal aesthetic measurements.

Our findings agree with Mayer et al. who aimed to study modified island technique for prominent ears demonstrated that good aesthetic symmetric as he can get a narrow CS angle and can add excision of 1–2 mm cartilage strip from scapha in asymmetric scaphal size. We excision the island about 2–4 mm that more effective in narrowing of CS angle and we can excess more cartilage in cases of asymmetric scapha and conchal hypertrophy this gives aesthetic symmetry and gives some choncal reduction and setback.[6]

Four patients had Mayer complications that were found. One of them experienced a postoperative hematoma on the left side, necessitating evacuation into the operating room and eventual recovery without complications. Another patient experienced internal suture extrusion, while a third patient's retro auricular sulcus developed hypertrophic scarring that responded well to local steroid injections every 2 weeks. There was no wound dehiscence, but one partial relapse was found during follow-up. As for us one auricle developed hematoma but was evacuated bedside with compression dressing and resolved well. No partial or complete relapse and hyper trophic scar.[6]

As well as Ahmed and colleagues reported that except two ears in two (2.2%) patients, the early postoperative course for helix-free otoplasty for the correction of prominent ears was uneventful. Their auricular hematomas required aspiration under aseptic conditions, and pressure bandages were used to treat them. Infections, skin necrosis, or bleeding complications were not reported.[7]

Two of the patients (2/31) with late complications were recorded (6.4%). Due to excessive anterior scoring, the first case developed irregularities of one antihelix with sharp edges. It underwent a second operation through a posterior approach, where the contour was adjusted and the sharp edges were rasped, trimmed, and stitched permanently. In the other case, one ear's superior crus became ill-defined. A posterior skin ellipse was removed, a small cartilage incision was made, the posterior cartilage was wrapped, there was little anterior scoring, and a permanent suture fixation was made between the scape and triangular fossa. As there was no external meatus narrowing, there were no other late complications such as recurrences, loss of sensation, sensitivity to sound, telephone ear deformity, suture extrusions, keloids, or hypertrophic scars. However, we have 1 case of sharp anti helix with no irregularity it improved very well within 3 months as we preserve anterior perichondrium without lifting any sharpness or need revision.

Our study is conflict with Kompatscher and colleagues who aimed to compare the Cartilage-cutting technique (Converse) versus the Cartilage-sparing (Francesconi). Their study reported that all of the patients in the Francesconi group had a concoscaphal angle of 90° or less, however, eight (57%) patients in the converse group had a concoscaphal angle of 90° or more ($P = 0.041$).[8]

As we got very good objective and subjective results of narrow CS angle in all patients less than 90.

Regarding postoperative complications in the studied population, we found that among our studied patients 10% developed postoperative complications which is a minimal as regard of sample size (Table 5). Paresthesia was developed in 5% of patients, it resolved after 3 months followed by hematoma and sharp antihelix in 5% of patients, hematoma was evacuated bedside and compression dressing, sharpness of antihelix was early postoperative and improved after 2 months very well then Pressure ulcer in 5% of patients healed by secondary intention. Lack of symmetry was reported in 10% of cases which was mild not noted by patient but surgeon. None of our included patients develop local infection, hypertrophic scar, suture extrusion, recurrence, redo, and revision procedures.

Table 5. Postoperative complications of the studied population.

	N = 20 *N* (%)
Hematoma	1 (5%)
Pressure ulcer	1 (5%)
Redo and revision procedures	0
Recurrence	0
Local infection	0
Hypertrophic scar	0
Parathesia	1 (5%)
Suture extrusion	0
Lack of symmetry	2 (10%)
Sharp antihelix	1 (5%)

NB, some patients developed more than 1 complication.

Also, Hendrickx et al. who aimed to study the 'WiFi' otoplasty, which involved 200 bilateral otoplasties and combined concentric posterior micro chondrectomies and sutures for the treatment of prominent ears, revealed that 400 ears were treated in total. There were no significant issues, and there were no hospital readmissions for hematomas or infections. A localized recurrence of the upper pole deformity necessitated minor revisions in 10 (5%) patients resulting in replacement of the superior most suture (scapho-temporal suture). Three (1.5%) patients experienced total recurrence two unilaterally and one bilaterally. More than 3 months after surgery, the sutures caused problems in seven (3.5%) patients, including palpable Ethibond conchamastoid sutures in four (2%) patients and visibly bridging superior nylon stitches in three (1.5%) patients. The problematic suture was removed in all 7 instances, and no subsequent recurrence occurred.[9]

Furthermore, Rubino and colleagues who sought to evaluate the upper helical cartilage's anterior scoring as a refinement in aesthetic otoplasty reported that there were no postoperative complications other than physiologic mild ecchymosis. Hemostasis, an infection, or hypertrophic scars have never been reported in a patient. Due to light bleeding, one patient required a dressing change one day after surgery. At the 1-year follow-up evaluation, there were no cartilage irregularities, residual ear prominence, or upper third prominence. No patient has expressed concern about obvious suture material.[10]

A study by Szychta et al. who sought to compare cartilage scoring and cartilage sparing techniques in unilateral Otoplasty reported that the mean age at operation was 12 years, ranging from 5 to 40 years old. In contrast to the mean follow-up of 1710 days (4 years and 8 months) from the operation to the end of the study period, the mean follow-up from the operation to clinic discharge was 93 days. In these procedures, there were 20 in group A (anterior cartilage scoring), five in group B (posterior suturing alone), and 15 in group C (posterior suturing with adjunct fascial flap). The three groups' rates of early complications varied significantly ($P = 0.018$). The incidence of early complications was much higher in group A (35% of patients (7/20) reported one), group B (60%, 3/5), and group C (0%, 0/15). Only a few operations, though, were in group B. On the other hand, there was no discernible difference between

the groups in the frequency of late complications ($P = 0.795$). In the study population, revision surgery was performed in just 1 case in group A and 1 case in group C.[11]

Finally, the findings of our study revealed that patient satisfaction scores ranged between 19 and 30 with a mean value of 25.19 ± 4.06. Most of our patient's satisfaction was excellent and good (Table 6).

Our study is consistent with Ahmed and colleagues who stated that 96.8% of their clients and/or their legal representatives were pleased with the outcomes. Only one (3.2%) patient expressed dissatisfaction with the outcome; this patient had antihelix irregularities, which required repeating the procedure before he was satisfied.[7]

A full-thickness cartilage strip, an incomplete cutting technique, was used by Elmelegy to assess the outcomes of correcting various degrees of the prominent ear. According to his study, 63 patients underwent surgery; of these, 46 were men and 17, the patients' ages ranged from 4 to 23, and their mean age was 9.7 years. Clinical outcomes showed that 37 (58.7%) patients had excellent results, 18 (28.6%) patients had good results, 8 (12.7%) patients had fair results, and none had poor results. In terms of patient satisfaction, 32 (51.8%) patients had excellent results, 22 (34.9%) patients had good results, nine (14.3%) patients had fair results, and none had poor results.[12]

Table 6. The patient satisfaction of the studied population.

	$N = 20$
Total score	
Range	19–30
Mean ± SD	25.19 ± 4.06
Ear shape is better	
Range	3–5
Mean ± SD	4.08 ± 0.78
Satisfied by ear shape	
Range	3–5
Mean ± SD	3.99 ± 0.88
Fulfill your expectation	
Range	3–5
Mean ± SD	4.03 ± 0.69
Advice others by surgery	
Range	4–5
Mean ± SD	4.45 ± 0.50
Annoyed of ear shape	
Range	3–5
Mean ± SD	4.28 ± 0.83
Need another operation	
Range	3–5
Mean ± SD	4.37 ± 0.69
Patient satisfaction%	
60–79%	6 (30%)
80–90%	5 (25%)
91–100%	9 (45%)

4.1. Conclusion

Cartilage excision procedure was effective in creation of the antihelix in prominent ear correction. The procedure was followed by minimal postoperative complications, good aesthetic outcomes and high patient satisfaction.

Conflicts of interest

There are no conflicts of interest.

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