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# Titanium Mesh for Correction of Stahl's Ear Deformity

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## Abstract

*Background:* Stahl's bar is a rare auricular malformation that can bring social stigma to the patient. Stahl's deformity is congenital anomaly, characterized by an accessory third crus in the ear cartilage, giving rise to an irregular helical rim and paradoxically bent scaphoid fossa along its two axes [1].

Correction of such ear deformity can be a challenging task for the surgeons. There are no standard techniques for correcting this deformity [2]. Several different techniques are described in literature which yield unpredictable results. The conventional techniques of correcting this deformity include either excision of the cartilage, repositioning of the cartilage, or scoring techniques, also correction using internal sutures [3]. We studied a new technique for correction of this deformity using titanium mesh. The technical details of the surgery are described along with a review of literature on correcting similar anomalies.

*Aim of Study:* Our aim is to evaluate and discuss the efficacy and safety of using titanium mesh to correct Stahl's ear deformity.

*Subjects and Methods:* A prospective randomized study conducted from June 2017 to March 2019. In all, 7 patients having the Stahl's bar deformity, two bilateral and five unilateral (9 ears) included. All patients have been presented and managed at the Department of Otolaryngology, Hearing and Speech Institute. Patients have been managed surgically to correct the deformity. Surgery was by implanting a piece of titanium mesh which has been shaped and tailored to reverse the paradoxically bent scaphoid fossa. The titanium mesh with its new curve was put inside a small sub-perichondrial pocket along the long axis of the deformed bar. Regular follow-up visits were done every month for at least 6 months.

*Results:* The operative time ranged from, 45 to 70 minutes with a mean of 62 minutes. Surgery was easy straight forward, Blood loss was minimal. As regards the final outcome, the affected auricles regained its normal appearance with fine scaphoid fossa and helical rim intraoperatively. The ears that were operated were of normal size and shape. All patients and their families were satisfied with the final result. There were no complications.

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*Summary:* Correction of Stahl's bar deformity can be accomplished easily and safely by implanting a pre shaped titanium mesh forcing the abnormally curved cartilage to regain its normal curvature.

***Key Words:*** *Stahl's bar – Titanium mesh auriculoplasty.*

## Introduction

**IN** the 19th century, Stahl described and classified different auricular malformations into three types: "helix transversus spleniformis", "crus antihelics trifurcata" and "crus superium turgidum". Currently, the term Stahl's ear refers to the second type a rare auricular deformity characterized by hypoplasia of the antihelix crus, with enlarged base and a third crus of the antihelix extending from the antihelix to the helix crus, this abnormal 'third crus' traverses the upper pole of the scapha and may deform the posterolateral wall of the external auditory cana [l4].

This anomaly has aesthetic and social consequences, but it does not affect hearing. It is more common among eastern people and rarely seen in white people, however, its real incidence has not been established [5,6] so far. The deformity is most commonly unilateral, and it can be bilateral in 20% of cases. In general, other anomalies are also present, such as narrowing of the helix, hypoplasia or absence of the superior crus of antihelix and enlargement of the triangular fossa [7].

Stahl's ear would be the consequence of dysgenesis of the intrinsic auricular muscle during the third month of embryogenesis [8]. Embryonic muscular dysgenesis leads to hypoplasia of the superior crus of antihelix, and development of a third crus of the antihelix. The third crus that connects the antihelix to the posterolateral wall of the helix is responsible for causing the defect on the curvature of the auditory canal [9]. The course of the intrinsic auricular muscles have not been confirmed by

surgeons during the operation. So, in a study done by Yotsuyanagi et al., to provides insight into the etiology of Stahl's ear and provides guidance for a new surgical treatment [9].

The solution for the deformity is reconstructive surgery, however, because of the diversity of clinical presentations, no standard technique exist for all cases. But there is no consensus regarding the technique to be used [10,11].

A "turnover and rotation" procedure. In this procedure, the deformed cartilage itself is used in its original contour to form a new scaphoid fossa, thus simplifying the corrective procedure and establishing a reliable operative method in which reversion to the original state is thought to be highly unlikely [12]. A wedge excision is made of the anterior skin and cartilage of the abnormal, third crus prominence. The abnormal, flat part of the helix is excised. A conchal cartilage graft is used to support the area after closure of the defect, including advancement of the helical edges [5,13].

Cartilage scoring and a folding cartilage flap has been used. The entire layer of the cartilage was cut through and the anterior skin covering the cartilage was dissected to the external border of the desired superior crus and antehelix to form a fan-shape flap. After scoring of the posterior surface of the cartilage, the cartilage flap was folded and sutured to the cartilage below to build the superior crus [14].

In other study, a case report of an 18-year-old white man with Stahl's ears deformity. A retroauricular access was performed in the concha-Antihelix transition with detachment to anterior portion, enabling degloving of the ear and exposure of the third crus. A resection of the third crus was performed with primary approximation of the defect. To reconstruct the superior crus of the antihelix, prior cartilage weakening was done with metal scraping and Mustarde 4-0 polyglactin suture. To reconstruct a uniform curvature of the helix, a subsequent cartilage weakening was carried out with a scalpel blade no. 15 and x-suture for eversion with 4-0 polyglactin. Closing of the posterior incision was performed using a Greek bar suture with 4-0 polyglactin. Ear dressings were made with sterile bandages and maintained for 48 hours. The same procedure was performed in both ears. The result after the surgery showed little changes in size of the ear is observed associated with absence of third crus, and presence of helix and superior crus [15].

## Subjects and Methods

*Ethics:* We have obtained a written informed consent from each patient accepting to participate in the study according to and approved by the Institutional Ethical Committee.

*Subjects:* 7 patients having the Stahl's bar deformity, two bilateral and five unilateral (9 ears). All patients were males with age range of (15-37) and a mean of 22,5 years old.

*Exclusion criteria:* Patients with other deformities beside the Stahl' deformity were excluded from the study. Also patients with recurrence or failed surgical correction were excluded.

*Methods:* A prospective randomized study conducted from June 2017 to March 2019. In all patients having the Stahl's bar deformity. All patients have been presented and managed at the Department of Otolaryngology, Hearing and Speech Institute. Patients have been managed surgically to correct the deformity. Surgery was by implanting a piece of titanium mesh which has been shaped and tailored to reverse the paradoxically bent scaphoid fossa. The titanium mesh with its new curve was put inside a small sub-perichondrial pocket along the long axis of the deformed bar. Regular follow-up visits were done every month for at least 6 months.

*Operative technique:* Under general anesthesia, after proper sterilization and draping Fig. (1), local infiltration using saline adrenaline with a concentration of 1/200000 was done at the helical rim and the dorsal aspect of the auricle along the axis of the third abnormal crus Fig. (2). Within ten minutes of the infiltration hemostasis, we fashioned a piece of titanium mesh with dimensions of, 5 * 1.5cms and we bend it making a fine curve which match the normal scaphoid fossa concavity. By a scalpel no. 11, incision being done at the helical rim opposite the abnormal bar or crus measuring about 1.5-2cms. By sharp and blunt dissection using fine scissors and dissectors we perform a tight sub perichondrial pocket running along the long axis of the abnormal crus or bar Fig. (3). Now we proceed to insert the pre fashioned tailored titanium inside the pocket Fig. (4). Meanwhile, we notice the abnormal crus being acquiring its new curvature till its disappearance inside the scaphoid fossa concavity Fig. (5). Closure of the wound by interrupted silk or vicryl sutures Fig. (6). Additionally, we have done 2-3 quilting sutures from the ventral to the dorsal aspect of the auricle passing through the titanium mesh fenestra using 2-3 zero vicryl sutures. Light sterile dressing was done.

Postoperative prophylactic broad spectrum antibiotic and analgesic for one week. Removal of the skin sutures after one week and the quilting sutures after two to three weeks. Regular follow-up monthly visits for six months.

## Results

The operative time ranged from 45 to 70 minutes with a mean of 62 minutes. Blood loss was minimal. As regards the final outcome, the affected auricles regained its normal appearance with fine scaphoid fossa and helical rim Fig. (7). The ears that were operated were of normal size and shape. All patients and their families were satisfied with the final result. No postoperative complications like hematoma formation or perichondritis. Postoperative pain was mild with rapid healing. Long term follow-up showed stable results of normal shape and recurrence of the deformity.

Fig. (1): Stahl' bar ( Before correction).

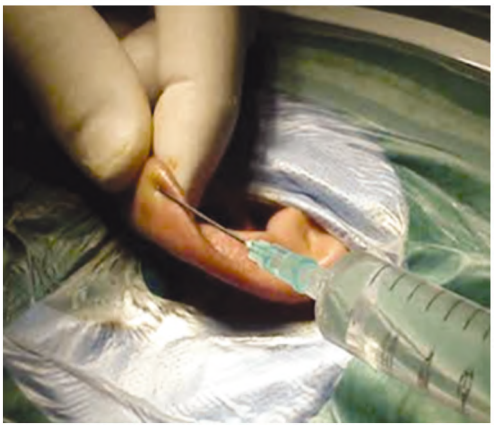

Fig. (2): Local Infiltration.

Fig. (3): Sharp dissection by scissor making a sub-perichondrial pocket.

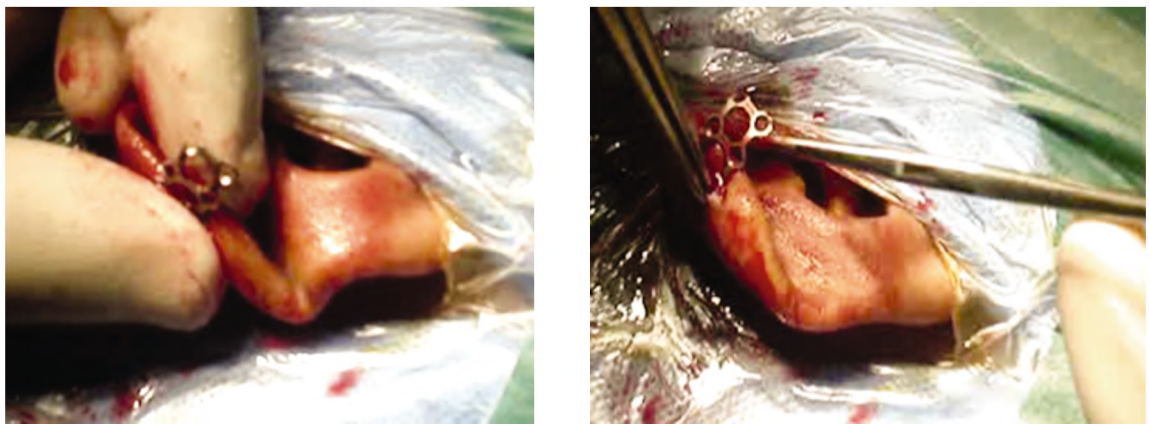

Fig. (4): Insertion of the shaped Titanium mesh in the pre fashioned pocket.

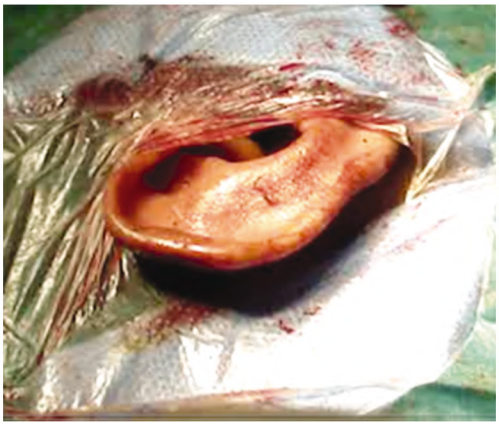

Fig. (5): The primary appearance after titanium mesh insertion.

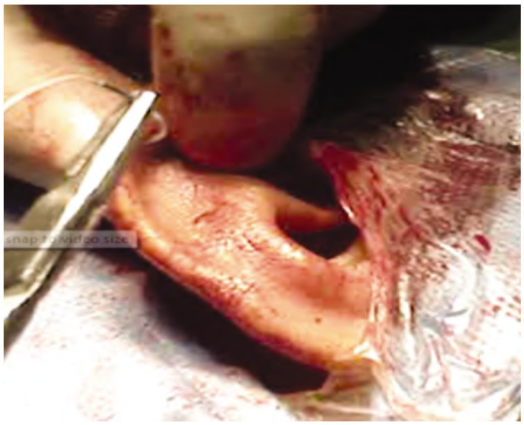

Fig. (6): Closure of the wound by interrupted vicryl sutures.

Fig. (7): Case 2, Before and after insertion of titanium mesh.

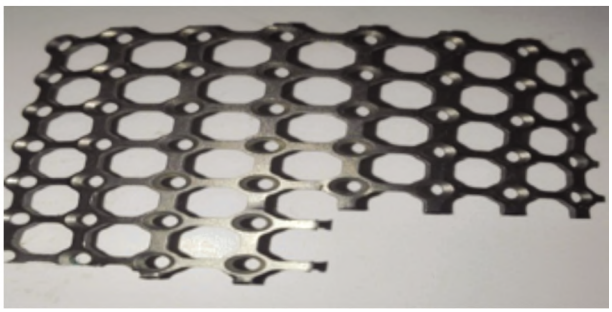

Fig. (8): Titanium Mesh.

## Discussion

Congenital auricular deformities are defined as malformations (microtia, cryptotia). Deformities are characterized as a normal chondrocutaneous component, but with an abnormal architecture categorized as constricted, prominent, and Stahl deformity, as described in this study **[16]**.

A number of techniques for surgical reconstruction of Stahl's ear have been described. These techniques range from simple procedures as zetaplasty, which is a realignment of the third crus, the wedge resection of cartilage, the local grafting after its reversion **[17,18]** to more complex procedures such as temporal periosteal flap for auricular support described by Nakayama et al., **[18]**.

There are reports of non-operative treatment using splints, which are used to shape the auricle, however more satisfactory results are seen if this treatment is performed in the neonatal period **[19,20]**. However, there are different degrees of clinical presentation of the syndrome, therefore it is difficult to achieve consistent results using a standard surgical technique **[21,22]**.

Currently, the modified Chongchet technique are the most commonly used for the treatment of this anomaly **[23]**. There is a trend to use Mustarde sutures in mild deformities associated with cartilage weakening maneuvers. Severe cases require the use of previous technique associated with excision of cartilage and skin **[24-26]**.

In this study we have practiced a new method to correct this deformity. By using titanium mesh utilizing its biophysical properties being stiff, inert and can be shaped without recoil. Titanium alloy Fig. (8) is an inert material used in implantable medical device products and stents in orthopedics, maxillo-facial bone fractures. Titanium is utilized in the form of plates screws and meshes.

Fashioning a strip of titanium mesh measuring. 5 by 1.5cms and bowing it longitudinally to lie on the dorsal aspect of the abnormal bar sub perichondrially forcing it to reverse its curvature. Surgery was safe, easy and minimally invasive avoiding cartilage excision or exteriorization which may compromise its nutrition leading to unpredictable outcome. Postoperatively, the auricle regained its normal contour and scaphoid concavity. No post-

operative complications like hematoma formation or perichondritis. Postoperative pain was mild with rapid healing. Long term follow-up showed stable results of normal shape and no recurrence of the deformity.

*Conclusion:*

Stahl's bar is a rare auricular malformation that can bring social stigma to the patient. Stahl' ear is one such anomaly, characterized by an accessory third crus in the ear cartilage, giving rise to an irregular helical rim.

Correction of partial ear deformities can be a challenging task for the surgeon. There are no standard techniques for correcting many of these deformities, and several different techniques are described in literature. The conventional techniques of correcting this deformity include either excision of the cartilage, repositioning of the cartilage, or scoring techniques. We recently used a novel method utilizing a titanium mesh with very good results. The technical details of the surgery are described along with a review of literature on correcting similar anomalies.

To correct Stahl's ear and acquire a natural-looking appearance, a technique of implanting a fashioned titanium mesh was studied and evaluated.

*Recommendation:*

We recommend using the pre shaped and fashioned titanium mesh in correction of Stahl's bar deformity as a simple, safe and accurate method of management with no complications.

## References


1- FISCHL R.A.: The third crus of the anthelix and another minor anomaly of the external ear. Plast Reconstr Surg., 58 (2):192-5. PMID: 940872 DOI: http: //dx. doi.org /10. 1097/00006534-197608000-00009, 1976.

2- FERRARO G.A., PERROTTA A., ROSSANO F. and D'ANDREA F.: Stahl syndrome in clinical practice. Aesthetic. Plast. Surg., 30 (3): 348-9. DOI: http: //dx. doi. org/10.1007/s00266-005-0139-4, 2006.

3- NAKAJIMA T., YOSHIMURA Y. and KAMI T.: Surgical and conservative repair of Stahl's ear. Aesthetic. Plast. Surg., 8 (2):101-7. DOI: http://dx. doi. org/10 . 1007/ BF01575252, 1984.

4- PORTER C.J. and TAN S.T.: Congenital auricular anomalies: Topographic anatomy, embryology, classification, and treatment strategies. Plast. Reconstr. Surg., 115 (6): 1701-12. PMID: 15861078 DOI: http: //dx. doi. org/10.1097/01 . PRS.0000161454.08384.0A, 2005.

5- ONO I., et al.: An operation for Stahl's ear. Br. J. Plast. Surg., 1996.

6- AKI F.E., et al.: Correction of Stahl's Ear. Aesthetic. Plast. Surg. Sep-Oct., 2000.

7- PARK C., et al.: An update on auricular reconstruction: Three major auricular malformations of microtia, prominent ear and cryptotia. Curr. Opin. Otolaryngol. Head. Neck. Surg., 2010.

8- YOTSUYANAGI T., NIHEI Y., SHINMYO Y. and SAWADA Y.: Stahl's ear caused by an abnormal intrinsic auricular muscle. Plast. Reconstr. Surg., 103 (1): 171-4. PMID: 9915179 DOI: http://dx.doi.org/10.1097/00006534-199901000-00027, 1999.

9- GLEIZAL A. and BACHELET J.T.: Aetiology, pathogenesis, and specific management of Stahl's ear: Role of the transverse muscle insertion. Br. J. Oral Maxillofac. Surg., 51(8):e230-3. DOI: http://dx.doi. org/10.1016/j.bjoms . 2013.01.018, 2013.

10- CHONGCHET V.: A method of antihelix reconstruction. Br. J. Plast. Surg.,16:268-72. PMID: 14042756 DOI: http: //dx.doi.org/10.1016/S0007-1226 (63): 80120-4, 1963.

11- KHAN MUHAMMAD ADIL ABBAS M.R.C.S., JOSE RAJIVE M. M.S., F.R.C.S (Glasg), ALI SYED NADIR F.R.C.S (Glasg). and YAP LOK HUEi F.R.C.S (Edin).: Correction of Stahl Ear Deformity Using a Suture Technique. Journal of Craniofacial Surgery: September - Volume 21- Issue 5- p 1619-1621 doi: 10. 1097/SCS. 0b013e3181ef2f0c, 2010.

12- SUGINO H., et al.: Surgical correction of Stahl's ear using the cartilage turnover and rotation method. Plast. Reconstr. Surg., 1989.

13- FURUKAWA M., et al.: A simple operative procedure for the treatment of Stahl's ear.

14- AL-QATTAN M.M., et al.: An alternative approach for correction of Stahl's ear. Ann. Plast. Surg., 2004.

15- WEINFELD A.B. J.: Stahl's ear correction: Synergistic use of cartilage abrading, strategic Mustarde suture placement, and anterior anticonvexity suture. Craniofac Surg., 2012.

16- KAPLAN H.M. and HUDSON D.A.: A novel surgical method of repair for Stahl's ear: A case report and review of current treatment modalities. Plast. Reconstr. Surg., 103 (2): 566-9. PMID: 9950546 DOI:http://dx.doi.org /10.1097/00006534-199902000-00031, 1999.

17-LIU L., [1] PAN B., LIN L., YU X., YANG Q., ZHAO Y., ZHUANG H. and JIANG H.: A new method to correct Stahl's ear. J. Plast. Reconstr. Aesthet. Surg. Jan., 64 (1): 48-52. doi: .1016/j.bjps.2010.03.056. Epub 2010 May 13, 2011

18- EL KOLLALI R.: Posterior Z-plasty and J-Y antihelixplasty for correction of Stahl's ear deformity. J. Plast. Reconstr. Aesthet. Surg., 2009.

19- LINDFORD A.J., HETTIARATCHY S. and SCHONAUER F.: Postpartum splinting of ear deformities. BMJ. 334 (7589): 366-8, 2007 PMID: 17303887 DOI: http://dx. doi.org/10.1136/bmj.39063.501377. BE. Br. J. Plast. Surg., 1985.

20- NAKAYAMA Y. and SOEDA S.: Surgical treatment of Stahl's ear using the periosteal string. Plast Reconstr Surg. 77 (2): 222-6. PMID: 3945685 DOI: http: //dx. doi. org/10 . 1097/00006534-198602000-00008, 1986.

21- YAMADA A., et al.: Evaluation of Stahl's ear, third crus of antihelix. Ann. Plast. Surg., 1980.

22- BI Y., et al.: Surgical correction of constricted ear combined with Stahl's ear. Plast. Reconstr. Aesthet. Surg., 2015.

23- LIU L., et al.: A new method to correct Stahl's ear. J. Plast. Reconstr. Aesthet. Surg., 2011.

24- PARK C., et al.: Antihelical shaping of prominent ears using conchal cartilage-grafting adhesion. Laryngoscope, 2012.

25- SERVICE G.J., et al.: Current concepts in repair of aural atresia. Curr. Opin. Otolaryngol. Head. Neck. Surg., 2010.

26- JOÃO MAXIMILIANO[1], ANTÔNIO CARLOS PINTO OLIVEIRA[1,2], LEONARDO MILANESI POSSAMAI[1], JOÃO BOMBARDELLI[2] and MARCUS VINICIUS MARTINS COLLARES[1,4]: Management of Stahl's ear: A case report Relato de Caso - Ano 2017 - Volume 32 - Número [1].

# استخدام شبكة التيتانيوم فى اصلاح تشوه ستال بالأذن

تشوه ستال بالأذن هو التشوه النادر الذى يمكن أن يجلب الوصمة الأجتماعية للمريض. تشوه ستال هو التغير الخلقى الذى يتميز بوجود ضلع ثالث للأنتى هلكس فى غضروف الأذن، مما يؤدى إلى حافة حلزونية غير منتظمة.

تصحيح هذا التشوه بالأذن يمكن أن يكون مهمة صعبه للجراحين. لا توجد تقنيات قياسية لتصحيح هذا. وتوصف عده تقنيات مختلفة فى الأبحاث التى تسفر عن نتائج لا يمكن التنبؤ بها. وتشمل التقنيات التقليدية لتصحيح هذا التشوه اما استئصال الغضروف، وأعاده تموضع الغضروف، أو تقنيات التهديف، وأيضا تصحيح باستخدام غرز داخلية. فى بحثنا درسنا تقنية جديدة لتصحيح هذا التشوه باستخدام شبكة التيتانيوم. يتم وصف التفاصيل الفنية للجراحة إلى جانب مراجعة الأبحاث حول تصحيح التشوات المماثلة.

دراستنا قد أجريت من يونيو 2017 إلى 2019. على7 مرضى مصابين بتشوه ستال بالأذن، اثنان ثنائية وخمسة من جانب واحد (9 أذن) وقد تم عرض جميع المرضى فى معهد السمع والكلام. وقد تم علاج المرضى جراحيا لتصحيح التشوه. وكانت الجراحة عن طريق غرس قطعة من شبكة التيتانيوم التى تم تشكيلها ومصممة لعكس وتصحيح انحنائات غضروف الأذن. وضعت شبكة التيتانيوم مع منحنى جديد داخل جيب صغير تحت الغضروف على طول محور طويل من الشريط المشوه. وقد أجريت زيارات متابعة منتظمة كل شهر لمدة 6 أشهر على الأقل. تراوحت مدة الجراحة من 45 إلى 70 دقيقة بمتوسط 62 دقيقة. كانت عملية جراحية سهلة مباشرة. وكان فقدان الدم الحد الأدنى. وفيما يتعلق بالنتيجة النهائية. استعادت الأذن المتضررة مظهرها الطبيعى من حيث الانحناء والتقعر والحافة الحلزونية. لم توجد صعوبات فى الجراحة. ولم تحدث مضاعفات جراحية أو بعد الجراحة.