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Reconstruction of traumatic upper eyelid avulsion with modified Cutler-Beard procedure using autogenous auricular cartilage: a case report

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Abstract

Background: Reconstruction of full-thickness upper eyelid defects for optimal cosmetic and functional outcomes is challenging. The modified Cutler-Beard procedure has been advocated for the repair of large upper eyelid defects.
Case presentation: A 45-year-old man presented with left upper eyelid avulsion and tissue loss. More than half of the length of the left upper eyelid had a full-thickness defect extending from the middle up to the lateral canthus with lid margin, tissue loss, and intact globe. The fellow eye and all other bilateral ophthalmic examinations were normal. Computed tomography imaging revealed no foreign body in the orbit or orbital wall fracture. The patient underwent reconstructive surgery using modified Cutler-Beard flap with auricular graft in the left eyelid in 2 stages.
Conclusion: The modified Cutler-Beard technique with auricular graft is an effective procedure to repair full-thickness upper eyelid defects, which fully restored eyelid anatomy, function, and cosmesis in our patient.

Keywords: auricular graft, modified Cutler- Beard procedure, reconstructive eyelid surgery, upper eyelid defect

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Prosedur Culter-Beard yang dilakukan ke atas kelopak mata yang mengalami trauma dengan menggunakan rawan aurikular: laporan kes

Abstrak

Latarbelakang: Rawatan untuk luka besar kelopak mata sehingga mencapai fungsi dan kosmesis sepenuhnya adalah merupakan satu cabaran yang besar. Prosedur Cutler-Beard amat digalakkan sebagai rawatan untuk kecederaan kelopak mata seperti ini.
Pembentangan kes: Seorang lelaki berusia 45 tahun datang mendapatkan rawatan di Jabatan kecemasan hospital untuk kecederaan di bahagian kelopak mata kiri. Sebanyak lebih dari separuh kelopak mata di atas terkoyak dan terdapat kehilangan sebahagian tisu mata. Keadaan bola mata masih sempurna. Tiada kecederaan pada mata kanan. Imbasan CT menunjukkan tiada benda asing di dalam orbit atau kepatahan tulang di keliling orbit. Pesakit menjalani rawatan pembedahan kelopak mata menggunakan teknik Cutler-Beard flap yang diubahsuai dengan melibatkan graf dari kelopak telinga.
Kesimpulan: Kaedah rawatan Cutler-Beard yang diubahsuai dengan menggunakan graf kelopak telinga amat berkesan dalam rawatan untuk luka besar di kelopak mata. Hasil pembedahan tersebut berupaya mengembalikan struktur dan fungsi asal kelopak mata bersama dengan memberi hasil kosmesis yang baik.

Kata kunci: cantuman aurikular, luka besar kelopak mata atas, pembedahan kelopak mata rekonstruktif, prosedur Cutler-Beard diubahsuai

Introduction

Ocular injuries may result from a variety of causes ranging from minor to major ocular damage. A study reviewing ocular injuries in Malaysia conducted in 2017 showed that these types of injuries often occur in the workplace (38.5%), during a quarrel (5%), traffic accidents (20.5%), or while participating in sports (29%). These injuries can be caused by sharp (72.5%) or blunt objects (27.5%).[1] The study also reported that domestic injuries were predominant in those aged below 12 years (75.2%), while assault-related injuries were seen mostly among young men between the ages of 20 and 30 years (7.7%).[1] Eyelid defects can be classified into full-thickness, margin-involving, or anterior lamellar. Full-thickness defects can be further classified into small (< 25–50%), medium (> 50–75%) and large (> 75%), which may involve the upper or lower lid.

Reconstruction of full-thickness upper eyelid defects seeks to restore the eyelid's normal anatomy, functionality, and cosmesis. Cutler and Beard introduced their method to repair large upper eyelid defects in 1955, describing an advancement flap from the lower eyelid that includes the skin, orbicularis oculi muscle, and conjunctiva.[2] Originally, the flap excludes the inferior tarsal plate, as it is inadequate to recreate the upper eyelid tarsal while maintaining the upper and lower eyelid functionality postoperatively. Over the years, complications from the procedure, such as ectropion and lid shrinkage, led oculoplastic surgeons to carry out trials with different grafts to provide stability to the upper eyelid flap.[2] Several different materials have been used as tarsal substitutes. Here, we show that the auricular cartilage provides many advantages compared to other materials.

Case presentation

A 45-year-old man who was allegedly assaulted with a wine bottle presented to Emergency Department with left upper eyelid avulsion with tissue loss. On examination, bilateral visual acuity was 6/6, relative afferent pupillary defect was negative, bilateral extraocular muscle movements were full, anterior segment and fundus examination were normal, and the fellow eye was normal. More than 50% of the length of the left upper eyelid had a full-thickness defect extending from the middle up to the lateral canthus with lid margin, tissue loss, and intact globe (Fig. 1). The lower eyelid was not involved. Computed tomography imaging revealed no foreign body in the orbit nor orbital wall fracture.

The patient underwent reconstructive surgery of the left eyelid using a modified Cutler-Beard flap with auricular graft within 24 hours of trauma. A full-thickness cutaneo-myoconjunctival horizontal incision was made in the lower eyelid, 4 mm parallel to the inferior lid margin and just below the inferior portion of the tarsal plate. Two vertical full-thickness incisions in the medial and lateral sides of the horizontal incision were then made, corresponding to the width and height of the upperlid defect, respectively. The gap of the upper lid defect was filled by the vertical advancement bridge flap from the lower eyelid. The full-thickness flap was divided into anterior and posterior lamellae, where the posterior lamella was sutured to the conjunctiva of the upper eyelid using 6/0 vicryl. A vertical incision was made at the back of the left pinna (ipsilateral side of the traumatic eyelid) and a rectangular partial thickness auricular cartilage was harvested corresponding to the upper eyelid tarsal defect (Fig. 2). The harvested auricular cartilage was anchored to the levator palpebrae superioris superiorly, tarsal plate medially, and lateral canthal tendon laterally using 6/0 vicryl to form the new tarsal plate. The anterior lamellar flap was sutured to the anterior lamella of the upper eyelid using 6/0 nylon, sandwiching the autogenous auricular cartilage. The second stage of the procedure to separate the upper and lower eyelid was performed 4 weeks

Fig. 1. Upper lid laceration wound prior to surgery with eyes *(a)* closed and *(b)* open.

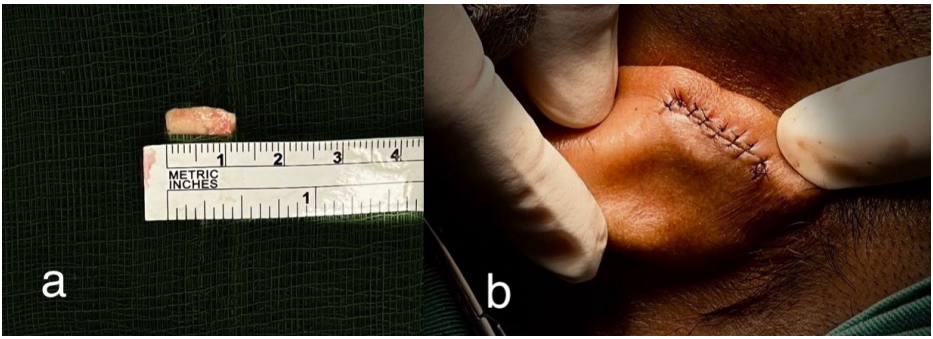

Fig. 2. (a) Harvested autogenous ear cartilage. *(b)* Posterior pinna of the left ear.

Fig. 3. At 2 months postoperative with eyes *(a)* closed and *(b)* open.

later. At 2 months postoperatively, the patient had a fully functional left eyelid without any lagophthalmos and the wound was fully healed (Fig. 3).

Discussion

The upper eyelid is one of the most challenging areas to reconstruct due to its highly specialized anatomy and function. Isolated anterior lamellar defects have the advantage of a vascularised bed and are therefore manageable using reconstruction techniques such as flaps, grafts, and healing by secondary intention. The reconstruction of full-thickness eyelid defects is best approached using an algorithm of techniques based on defect size. This requires careful assessment of

the defect, including horizontal measurement under gentle tension and eversion of the eyelid to assess residual tarsus. The management algorithm for upper eyelid defects has been described by Espinoza *et al.*[3] Each case should be carefully assessed, including the health, expectations, and needs of the individual patient. However, suitability will depend on the creativity of the reconstructive surgeon.

The modified Cutler-Beard technique, which involves a 2-stage eyelid sharing technique, was the preferred choice in our case as more than 50% of the upper eyelid was avulsed with tissue loss. In this technique, the anterior and posterior lamellar flap from the lower eyelid recreates the anterior and posterior lamellae of the upper eyelid defect with autogenous auricular cartilage substituting the tarsal plate. The initial Cutler Beard procedure, which does not include grafts, resulted in complications related to lid instability due to lid retractor disruption. A variety of grafts and tissues have been used to substitute the tarsus to stabilise the eyelid flap. The 2 main groups are autologous grafts and allografts. Autologous grafts include auricular cartilage, nasal septal cartilage, buccal mucosa, and hard palate mucosa. Allografts include archillis cadaver tendon and donor sclera. Technoclogical advancement in bioengineered materials have also manufactured tarsal substitutes such as tarSys™ and acellular dermal matrix.

Autologous grafts are usually the main option since they are easily available and do not require infective screening compared to donor grafts. In our case, auricular cartilage was harvested from the same side of the affected eye as to allow easy recalling. Suga *et al.* compared auricular cartilage to nasal septum cartilage, finding the results aesthetically and functionally satisfactory in both groups.[4] However, in the nasal septum group, 1 patient suffered from nasal septum perforation and another patient suffered from nasal bleeding postoperatively. There were no donor site complications in the auricular cartilage group.[4] These findings indicate that chondromucosal grafts from the nasal septum and auricular cartilage grafts are adequate graft choices for the inner layer of the lower eyelid. Regarding the donor site, however, auricular cartilage grafts have the advantage of lower complication rates.[5] To date, no comparison studies have ben conducted for grafts created from buccal and hard palate mucosa.[5]

Allografts have also been used as substitutes. They are attractive because they are “ready-made” for surgery, decreasing operative time. There is no donor site, precluding harvest morbidity associated with autologous materials. Potential downsides include cost, availability, and the theoretical risk of disease transmission. Most importantly, they have variable resorption rates, thus decreasing effectiveness and predictability. According to Holloman *et al.*, the main advantage of using Achilles tendon grafts is its unlimited quantity, which provides sufficient length for reconstructing large areas.[6] Achilles tendon is more pliable and mobile than cartilage, yet it remains stable over time.[6] In 1980, Wesley and McCord found that transplanted donor sclera was well tolerated by all of his 26 patients.[7] There were no reports of infection, migration, or rejection. No absorption or shrinkage

of the transplanted sclera was apparent with follow-ups ranging from 8 months to 9 years[7]. However, there were reports of shrinkage of donor sclera in cases where the sclera was not covered with conjunctiva.[7]

The main limitation in the use of bioengineered tarsal substitutes is the cost. Reports recount 2 instances in which a foreign body giant cell reaction to TarSys necessitated graft removal.[8] Acellular dermal matrix (ADM) is also gaining increased attention based on a recent article published in 2021, which described the use of allogeneic ADM without a mucous layer to prolong the original tarsal plate and thus strengthen support in patients with lower eyelid retraction [9] ADM is an acellular collagen matrix obtained from the skin, porcine dermis, and bovine ligament of fresh human corpses and is composed of basement membrane and dermal layer.[9] The antigenic components in normal skin are removed using different methods to achieve immunologic inertia. It also provides adequate support to maintain eyelid appearance as a scaffold. ADM can induce orderly and well-integrated growth of fibroblasts and capillaries with adjacent tissues. Unfortunately, this material is currently unavailable in Malaysia.

Conclusion

The modified Cutler-Beard technique paired with auricular graft is an effective procedure to repair full-thickness upper eyelid defects and fully restore eyelid anatomy, function, and cosmesis. Auricular cartilage is most advantageous as a tarsal substitute, not only providing stability and adequate structure, but also reduced risk of infection and cost-effectiveness. In terms of effectiveness as well as lower failure rates and cost, the modified Cutler-Beard procedure with auricular cartilage graft is advantageous in both wealthy countries and those with limited resources.

Declarations

Informed consent for publication
The patient has provided written informed consent for the publication of the clinical data and images contained in this report.

Competing interests
None to declare.

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