Polypropylene Darning: A New Alternative for Reconstruction of Orbital Floor after Total Maxillectomy

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Received: 6 January 2015 / Accepted: 18 March 2015 / Published online: 23 April 2015
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Abstract Removal of orbital floor is an integral part of total (radical) maxillectomy (type IIIa), which if not managed properly, may lead to some eye related distressing complications like diplopia, eyelid malposition, epiphora, dacryocystitis, enophthalmos and ectoprion. Among all, diplopia is the most distressing complication which hampers daily activity. Various options for orbital floor reconstruction are available like titanium sheet, polypropylene mesh, non-vascularized or vascularized bone graft, pedicled flaps, micro-vascular free flaps, prosthesis placement, and split skin graft followed by obturator placement. Till date no-body has tried stabilization of eye ball by ‘darning’ the orbital floor using non-absorbable suture. ‘Polypropylene suture darning’ is an easy to learn, novel method with equally good results. Five patients with potentially resectable tumors underwent total maxillectomy. I used polypropylene 3–0 round body suture and ‘darning’ was done at orbital floor, incorporating periosteum (if remaining) and peri-orbital fat into the sutures. Muscle flaps were done to provide bulk and palatal reconstruction. Assessment of patients was done post-operatively at day-5 i.e., before discharge and at 1 month after surgery, and also in further follow up visits. The results were very good in terms of clear vision & eye movements (directly related to ‘darning’), and the aesthetic look of patients and bilateral symmetry were satisfactory (not related to darning). Darning of orbital floor by polypropylene after total maxillectomy is an easy to learn and cost-effective method of reconstruction with good results.

Keywords Orbital floor darning · Total maxillectomy · Orbital floor reconstruction · Stabilization of eye ball

Introduction

Removal of orbital floor is an integral part of total (radical) maxillectomy (type IIIa) [1]. Such cases if not managed properly, may lead to some eye related distressing complications like diplopia, eyelid malposition, epiphora, dacryocystitis, enophthalmos, global ptosis and ectoprion [2]. Out of all these diplopia is the most distressing complication which hampers daily activity. Diplopia occurs due to loss of support to eye ball and extra ocular muscles causing loss of coherence with the opposite eye.

Various options for orbital floor reconstruction are available like titanium mesh [3], polypropylene mesh, non-vascularised [4] or vascularised bone graft [5], pedicle flaps, micro-vascular free flaps [5, 6], muscular slings [7], prosthesis placement, and split skin graft followed by obturator placement. Each method has got its own advantages and disadvantages related to cosmetic or functional outcome, technical expertise and complications related to adjuvant radiotherapy. Split skin grafts and muscular slings don’t provide sufficient support to eye ball resulting into complications. By providing a solid floor and rim, these complications can be prevented with satisfactory function and asthetically acceptable results [2].

Till date no-body has tried stabilization of eye ball by ‘darning’ the orbital floor using non-absorbable suture. ‘Polypropylene darning’ is an easy to learn, cheaper method with equally good results. We found no hindrance in vision and movement of eye ball after the surgery. This work in

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future can prove to be a landmark in Indian surgery where cost-effectiveness matters a lot.

Material and Method

Five patients, three males & two females, of age group between 18 years and 72 years, with potentially resectable tumors underwent total maxillectomy. We used polypropylene (prolene) 3–0 round body sutures and ‘darning’ was done at orbital floor, incorporating periosteum at floor of orbit (whenever it is saved), peri-orbital fat & connective tissue and extra-ocular muscles (usually origin of inferior oblique medially, if visible) into the sutures. Temporalis muscle flap was done in four cases to provide bulk and palatal reconstruction. Gel-foam was also put into cavity for overlying skin contouring.

Assessment of patients was done post-operatively at day – 2, before discharge and also in further follow up visits. Photographs and videos were taken.

Important points of note during orbital floor darning –

1. A mesh like framework should be created at the orbital floor to prevent the sagging of eye ball downwards.
2. The sutures should be just tight enough to hold the soft tissues, not too tight or too loose.
3. The sutures should incorporate the extra-ocular muscles (origin of inferior oblique if visible) in their natural position and also the peri-osteum if it is remaining there.
4. Sutures should be taken superficially (not too deep) to avoid globe perforation and to also to avoid extra ocular muscles (especially inferior rectus). All the recti are originating from the round sling situated posteriorly around optic foramen and they all are covered well with the fat. So usually they are not encountered as we don’t go so posteriorly.
5. The suture material should be monofilament, non-absorbable and thin enough to penetrate the tissues without much injury.
6. The darning should be done in such a way that most of the suture remains embedded into the peri-orbital tissue. The knots and visible suture should preferably be covered with the healthy soft tissue (flap) to prevent post-operative infection.

Results

The results were very good in terms of clarity of vision & eye movements which were directly related to ‘darning’, indicating that the support to eye ball and platform for extra-ocular muscles were adequate. The aesthetic look of patients and bilateral symmetry were satisfactory but this feature was not directly related to darning, as it depends upon the type of flap used and amount of tissue transferred. Moreover it did not cause any procedure related postoperative complication. I found no hindrance in vision and movements of eye ball after the surgery. The functioning of eye ball remained same even after adjuvant radio-therapy whenever it was given. The follow-up ranges from 4 months to more than 3 years, with the average follow-up being around 18 months. There were no complications related to orbital function or suture material used.

Discussion

Santamaria & Cordeiro [1] classified maxillectomy into 4 types: type I, limited maxillectomy; type II, subtotal maxillectomy; type IIIa, totalmaxillectomy with preservation of the orbital contents; type IIIb, total maxillectomy with orbital exenteration ($n=18$); and type IV, orbitomaxillectomy. A maxillectomy defect creates a communication from oral cavity to nasal cavity that may extend to the orbit. The maxillectomy defect creates a significant rehabilitative issue as functional deglutition and speech problems with a significant soft tissue deficit ensue, with added ophthalmic problems whenever orbital floor is removed.

In the past, surgical reconstruction of a palatal defect was contraindicated, as it did not allow close observation of the tumor site at follow-up physical examinations. The use of a palatal obturator has been used for accessibility to evaluate the maxillectomy defect, the most common site of recurrence. The split skin graft was not sufficient to support eye ball so patients used to have many eye related problems. Now it is considered that ‘Free tissue transfer’ offers the most effective and reliable form of reconstruction for these complex maxillectomy defects [5]. The various options are osteocutaneous flaps, rectus abdominis or radial forearm free flap in combination with immediate bone grafting

and anterolateral thigh flap [6]. The choice of flap depends on the defect, amount of bulk needed and surgeon's preference. But this microvascular procedure is time consuming and technically demanding. It also increases morbidity rate and financial burden to the patient.

Use of pre-operatively bent titanium mesh also gives a good result, but needs proper soft tissue coverage. There are chances of mesh exposure after adjuvant radiotherapy [3]. The rate of post-operative complications is almost same as compared to the vascularised bone or cartilage grafts [8].

Benefits of orbital floor darning technique –

1. Less chances of post-operative infection as no prosthesis is used and most of the suture remain embedded in the soft tissue.
2. Excellent functional results.
3. Easy to learn technique.
4. Bony points are not always required for fixation.
5. Specific instrumentation not required.
6. Can be easily combined with other soft tissue flap reconstructions.

Conclusions

Darning of orbital floor by a non-absorbable monofilament suture (polypropylene) after total maxillectomy is an easy to learn and cost-effective method of reconstruction with good results.

Wrong Method of Orbital Floor Darning
(This Patient had diplopia after Surgery)

CASE - 1 : Ganglioneuroma of Maxilla

CASE - 2 : Right Maxillary Sarcoma

CASE - 3 : Carcinoma Upper Alveolus

CASE - 4 : Carcinoma Upper Alveolus

CASE - 5 : Sarcoma Left Maxilla

Acknowledgments I acknowledge the support of head of the departments of general surgery and anesthesia. I also acknowledge the support of nursing staff and technical staff who were involved in the process surgery, postoperative care, data collection and other works. I also acknowledge all the patients who gave us consent and supported us for this study. I acknowledge the immense help received from the scholars whose articles are cited and included in references of this manuscript. I am also grateful to authors/editors/publishers of all those articles and journals from where the literature for this article has been reviewed and discussed. There were no special support sources/ or grants used. There were no conflicts of interest.

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