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Management of Midface Fracture with Orbital Exenteration- A Case Report

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Abstract:
Serious injuries of the orbital contents are uncommon in closed maxillofacial trauma, as the anatomical configuration of the orbit offers important protective mechanisms against external trauma. Retrobulbar haemorrhage (RBH) potentially a threatening condition often associated with midface fracture and may cause vision loss if not treated early. This case is conducted on the incidence, treatment outcomes, and clinical features of RBH in patients after midface fracture. This paper deals with a case report of a 38 year old male patient of malunited midface fracture with blindness of right eye due to RBH and treated with fixation of fracture with orbital exenteration (OE) of right eye.

Keywords: *Lateral canthotomy, Orbital exenteration, Retrobulbar Haemorrhage, Traumatic optic neuropathy*

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I. Introduction

Modified orbital exenteration is a surgical technique that consists of removal of the entire intraocular contents, while preserving eyelids.[1] Clinically significant retrobulbar haemorrhage (RBH) is a rare but potentially blinding consequence of craniofacial trauma. Estimates of its incidence vary, but it is commonly recognised that 0.3% of patients with fractures of the zygomaticomaxillary complex (ZMC) develop it severely enough to require intervention. Any large increase in retrobulbar volume therefore results in an orbital compartment syndrome (OCS). Three pressure-related mechanisms of vision loss have been suggested: occlusion of the central retinal artery, direct compression of the optic nerve, and compression of the orbital vasculature. When intraocular and intraorbital pressures exceed arterial perfusion pressure, the retina and optic nerve become ischaemic, and permanent damage may result if this unfavourable gradient is not rapidly reversed. Observational studies and animal models have suggested that permanent ischaemic changes begin within 60 minutes of visual dysfunction, while appreciable loss of acuity can occur within 1.5 - 2 hours.[2]

II. Case Report

A 38 years male patient reported with a chief complaint of facial asymmetry, difficulty in chewing, limited mouth opening, malocclusion, problem in vision for the last past 28 days. He had a history of road traffic accident (RTA). On clinical examination, (Fig 1A, 1B) there were facial asymmetry with depressed malar prominence on the right side with scar marks, complete vision loss of right eye, left side presence of enophthalmos, absence of consensual light reflex, presence of ptosis. CT images showed, (Fig 1C,1D,1E,1F) lefort 2b fracture, right Zygomaticoorbital(ZMO) fracture(knight and north type IV) fracture in right zygomatic arch(M shaped), disruption of optic nerve and haemorrhage in intraconal space in right orbit.

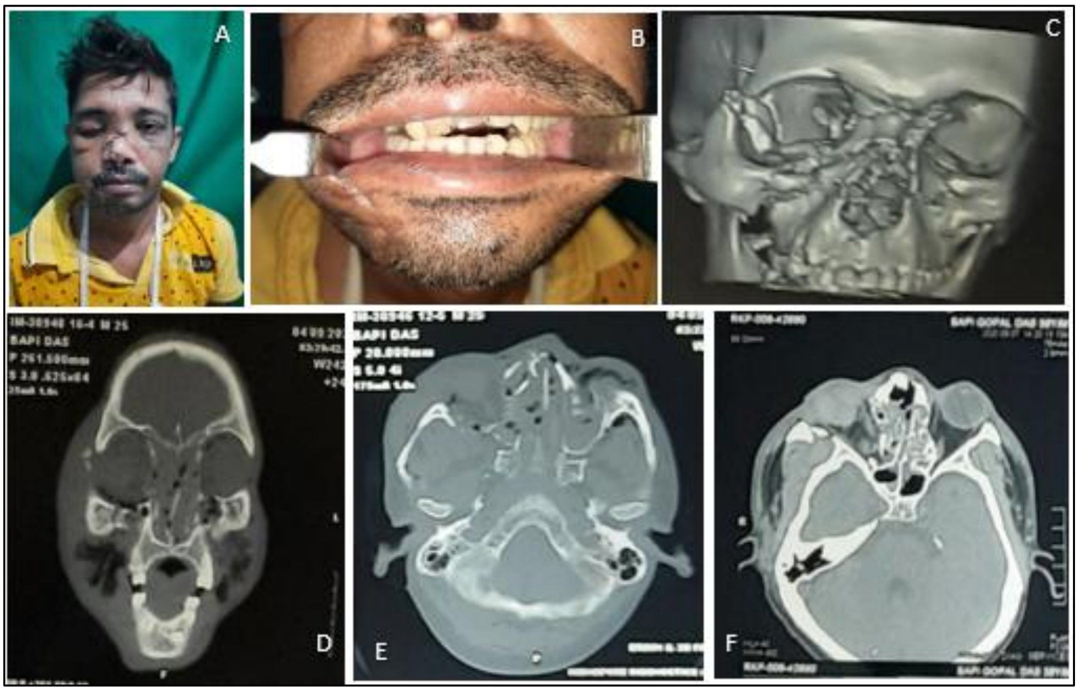


Fig 1-Preoperative clinical and radiographic image- A. Frontal profile, B. Occlusion, C.3D CT scan, D. Coronal view ct showing right zmo and lefort 2b fracture, E. Axial view CT showing zygomatic arch fracture in right side, F. Axial view CT showing hemorrhage in right orbital intraconal space

Due to presence of lefort 2b fracture and trismus- blind intubation or submental could not be performed, hence tracheostomy was performed. In surgical planning opening of all the fracture sites were planned followed by reduction of ZMO fracture followed by one point fixation of frontozygomatic suture for right side ZMO fixation followed by disimpaction of lefort 2b fracture followed by IMF and lefort fracture fixation and followed by modified orbital exenteration of right eye. As orbital exenteration was planned so fixing the infraorbital rim in right side ZMO fracture was omitted. Autologous grafting of communited nasoorbitoethmoidal (NOE) fracture was planned for a later surgery as it could increase the surgical time and per-operative complication of the patient. Coronal incision was given (Fig 2A). Incision was made through skin, subcutaneous tissue & galea, revealing the subgaleal plane of loose areolar connective tissue overlying the pericranium. With the raising of the anterior and posterior wound margins bleeding vessels were cauterized and haemostatic clips were sequentially applied. The plane of dissection strictly followed the superficial temporalis fascia downwards and forwards. The superficial layer of temporalis fascia was incised at the root of the arch, just in front of the ear, continuous anteriorly & superiorly at a 45 degree angle with the zygomatic arch. Subperiosteal elevation was done which exposed the lateral surfaces of zygomatic arch, body & lateral orbital rim on right side. Infraorbital rim was exposed via infraorbital skin crease incision on left side. Incision was made through skin and orbicularis musculature. Muscle was elevated laterally from the orbital septum and a small slit was opened. Through this opening, the orbicularis muscle was undermined in the preseptal space, the muscle layer was separated from laterally to medially along the course of the muscle fibers leaving the orbital septum intact. dissection proceeded inferiorly in a preseptal suborbicular plane to reach infraorbital bony margin. Left side zygomaticomaxillary buttress was opened by vestibular approach. Reduction of ZMO fracture done with Rowes zygomatic elevator. After that fracture segment mobilized with rowes elevator and intermaxillary fixation (IMF) done with 4 IMF screws. After exposure of the right side fracture segments in the lateral orbital rim and zygomatic arch miniplates were placed (Fig 2B). A 'Y' shaped miniplate placed on NOE fracture. After exposure in left side zygomaticomaxillary buttress and infraorbital rim is fixed with miniplates (Fig 2C, 2D). Sutures were given in layers.

In a second surgical procedure modified OE (Fig 2E, 2F) done while keeping the eyelids. Two traction sutures placed in the lower eyelid. Approach was done by incision through orbital septum superiorly and inferiorly. The dissection is carried out to periosteum of orbital rim. The periosteum is elevated from the margins of the orbit and into the orbit with a periosteal elevator. The lateral canthal tendon is incised with the unipolar cautery. The zygomatico-temporal and zygomatico-facial vessels are cauterized as they are encountered using unipolar cautery. The dissection is then continued across the floor of the orbit. The dissection then continues from the superolateral orbit to the superomedial orbit. The supraorbital and supratrochlear vessels are cauterized using bipolar cautery and transected. As the dissection approaches the medial canthas, the angular vessels are cauterized using bipolar cautery. The anterior limb of the medial canthal tendon is incised with the unipolar cautery and reflected off the underlying bone with a periosteal elevator. The lacrimal sac is rotated posteriorly and laterally and the posterior limb of the medial canthal tendon is incised with the sharp end of the periosteal elevator. The periorbita is raised from the medial orbital wall with the periosteal elevator taking great care not to fracture the lamina papyracea. The anterior and posterior ethmoidal vessels are identified as they pass through the periosteum to their respective foramina and are cauterized. Superomedially, the trochlea is elevated along with the periosteum. Once the dissection has approached the apex of the orbit, the periosteum is incised with the unipolar cautery medially and laterally. Unipolar cautery is applied to the stump of tissue at the orbital apex. Superior ophthalmic vein, inferior ophthalmic vein, ophthalmic artery, optic nerve, lacrimal nerve, trochlear nerve, abducens nerve, nasocilliary nerve dissected from orbital apex. Surgicel placed over the orbital apex. Orbital cavity filled with abdominal fat graft (Fig 3A). Eyelid closure done with 3-0 mersilk. A custom made acrylic prosthetic eye was placed in anophthalmic socket after 8 weeks.

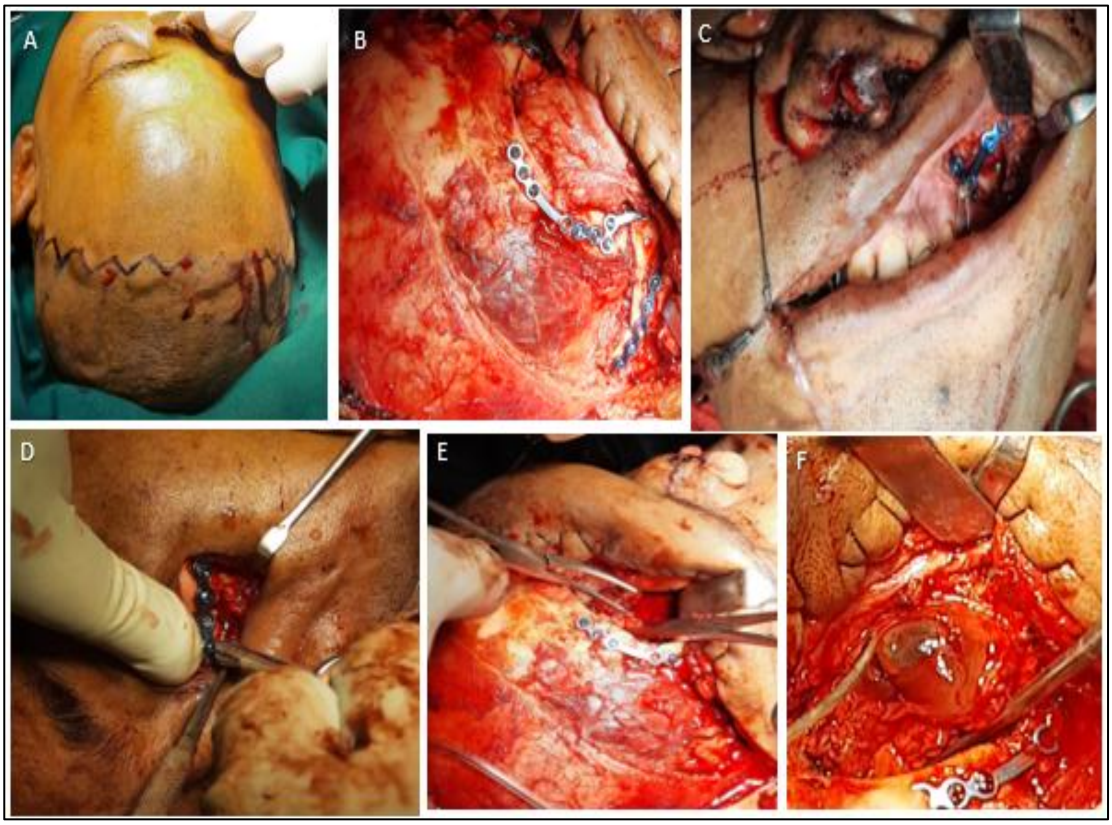


Fig 2-A. Incision; B, C, D.ORIF in respective areas; E,F. Modified orbital exenteration

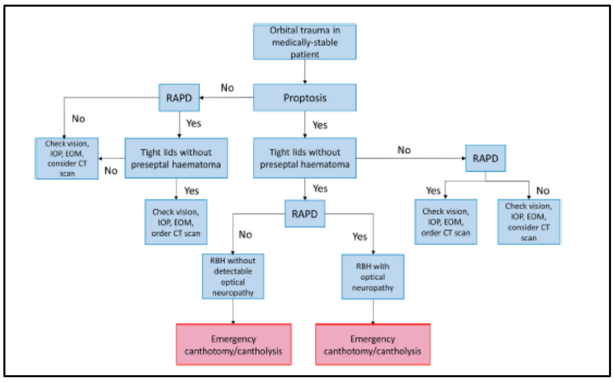
Fig 3-A. After placing fat graft; B. 7 Days post op ; C. 14 days post op D. Post op radiograph

III. Discussion

Midface injuries are often associated with high kinetic energy transfer to multiple subunits of the facial skeleton; they are complex in nature and can present surgeons with serious acute issues requiring emergency management. These are mainly because of the proximity of the airway and the rich vasculature of the skull base and midface region. Furthermore, concomitant injuries to the head and brain, C-spine and orbital region can complicate the management of these patients, requiring a systematic multidisciplinary and often customized approach.[3] The zygoma has 4 suture lines, and in zygomatic tripod or tetrapod fractures, fracture fragments are separated from the adjacent bones or located near these suture lines. To re-establish facial symmetry in tripod fractures, correct reduction is needed. Several authors had proposed fixation protocol according to suture lines.[4] Markowitz and Manson(1989) showed that the frontozygomatical area is not a good reference point for fracture reduction and that a second or perhaps even a third area of evaluation can be beneficial.[5] Ellis(1996) advised the zygomaticomaxillary approach as the first choice, followed by the infraorbital rim and lateral orbital rim.[6] Habal (2010) demonstrated good reduction by their sequential surgical approach using the zygomaticomaxillary buttress as first approach, followed by the infraorbital rim and frontozygomatical area in the third place.[7] Rohner et al[8] (2002) advocate placing a plate on the sphenozygomatic(SZ) suture in addition to two other points after their cadaveric biomechanical studies revealed improved structural strength compared with that of four-point fixation. He also suggested to fix SZ suture for greater stability. Ellis et al.[6], Farber et al.[9], Surala et al[10]., Ellstrom et al.[11], Evans et al[12] proposed about 4 point fixation in cases of comminuted ZMC fracture in ZM buttress, infraorbital rim, frontozygomatic (FZ) suture and zygomatic arch. Also the same authors proposed about 3 point fixation for medially or laterally rotated ZMC fracture in frontozygomatic suture, infraorbital rim, ZM buttress or Zygomatic arch and 2 point fixation for unrotated body ZMC fracture in FZ and infraorbital rim or FZ and ZM buttress. One point fixation for stable ZMC fracture proposed by Hwang et al[13] in FZ suture; Kim et al[14] in ZM buttress; Ellis et al[15] in ZM buttress.

OCS is a potentially vision threatening condition and may cause Traumatic optic neuropathy (TON). TON refers to any insult to the optic nerve secondary to trauma. The controversies surrounding the optimal management of TON have been the subject of recent Cochrane systematic reviews. Despite these persisting uncertainties, the main treatment options in current use for TON are as follows: (1) systemic steroids of varying doses, duration, and mode of administration; (2) surgical decompression of the optic canal; (3) a combination of steroids and surgery; and (4) observation alone (i.e., conservative management). Steroids have been used both on its own and in combination with surgical optic nerve decompression either pre-, intra-, or postoperatively. Based on the initial daily dose of methylprednisolone used, steroid regimens can be classified as: (1) low dose

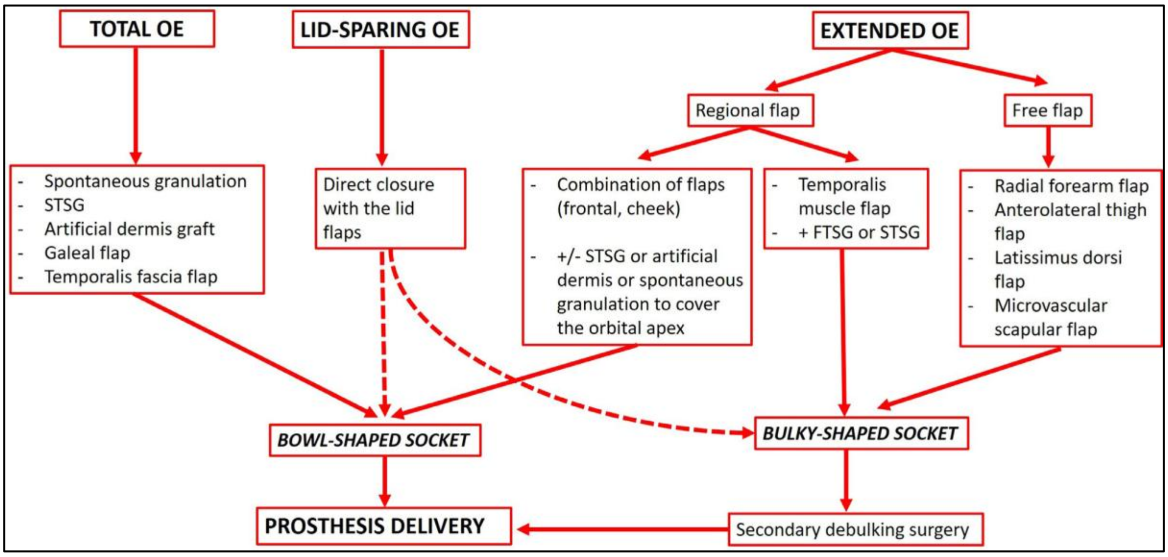
(< 100 mg), (2) moderate dose (100-499 mg), (3) high dose (500-1999 mg), (4) very high dose (2000e5399 mg), or (5) megadose (> 5400 mg). The most commonly used steroid protocol in TON is a course of intravenous methylprednisolone in the very high-dose to megadose range.[16] Popat et al. claim medical treatment is as important as surgical treatment as it has been shown to produce a satisfactory outcome when used as a sole treatment. Mannitol 1-2 g/Kg of 20% solution intravenously over 30–50 min; acetazolamide 500 mg bolus followed by 125–250 mg intravenously four times a day 250 mg intravenously four times a day is another common dosing approach; and methylprednisolone 1 g intravenously as a single dose is the most frequently reported regimen and some have reported good results with medical treatment alone.[17] On diagnosis, treatment should be executed immediately. Treatment has historically included medical and surgical management, but urgent surgical decompression of the orbit is the most accepted approach. The gold standard treatment is lateral canthotomy and inferior cantholysis when no previous surgical wound exists to explore.[18] Several authors support extension of this procedure to include superior cantholysis and, if needed, inferolateral anterior orbitotomy if pressure does not decrease to a safe level. Others advocate decompression by removal of orbital bone, but this is invasive, time consuming, and requires an operating room. Lateral canthotomy and cantholysis, which reduced orbital pressure by an average of 56 mm Hg (52% reduction). Normal intraorbital pressure is 3–6 mm Hg. Normal intraocular pressure is 10–20 mm Hg. Blunt trauma to the face or globe can cause bleeding in the retrobulbar space, which quickly causes an increase in retrobulbar pressure due to the lack of distensibility of the surrounding structures. Retinal ischemia results, and vision loss can be permanent after as little as 60–100 min of ischemia. Arterial blood flow has been demonstrated to cease at tissue pressures significantly lower than diastolic blood pressure. When the vasa nervorum are affected by increased intraorbital pressure, optic nerve ischemia will result. When the central retinal artery is affected by increased intraocular pressure, retinal ischemia will result. The orbit lacks lymphatic drainage, so the only drainage is via the compressible ophthalmic veins. As little as 7 mL of fluid experimentally injected into the orbit can produce persistent retinal changes.[19]
Popat et al suggested that RBH can be predicted by the presence of three or more of the following characteristics: pain, proptosis, chemosis, diplopia, subconjunctival haemorrhage, raised IOP, tense globe, reduced vision, ophthalmoplegia, or loss of the pupillary light reflex.[17] In our case the patient came to us after 28 days from RBH, so any of the above treatment was not possible.
Erickson et al[2] proposed an algorithm for managing acute retrobulbar trauma management.



FLOW CHART 1: Evidence-based algorithm for identification and acute management of retrobulbar haemorrhage after orbital trauma[2] (RAPD = relative afferent pupillary defect in the traumatised eye; IOP = intraocular pressure; EOM = extraocular movements; CT = computed tomography; RBH = retrobulbar haemorrhage).

OE is considered to be a mutilating surgical procedure reserved for relentlessly progressive neoplastic disorders or extensive facial trauma with unfavourable eye involvement.[20] According to Cameron et al.[21] there are 3 types of (OE) - Subtotal, Total and Extended. Meyer and Zaoli's classification dating from 1971 which classifies four types of OE for tumours in relation to the extent of destruction involved in the surgery: – Type I: palpebral skin and conjunctiva are spared; – Type II: only the palpebral skin is spared and the eye - ball and its appendages are removed with the conjunctiva ; – Type III: both eyelids are removed with orbital con tents; – Type IV: the eyeball, eyelids and appendages of the eye are removed with the involved bone structures.[22]

According to Martel et al[23] they have algorithm for reconstructing the orbital socket based on the type of surgery performed.



FLOW CHART 2: Proposal of a surgical algorithm for reconstructing the orbital socket based on the type of surgery performed and the need for a bowl shaped orbital cavity.[23]

According to Kesting et al [20] they have classified OE with their reconstruction.

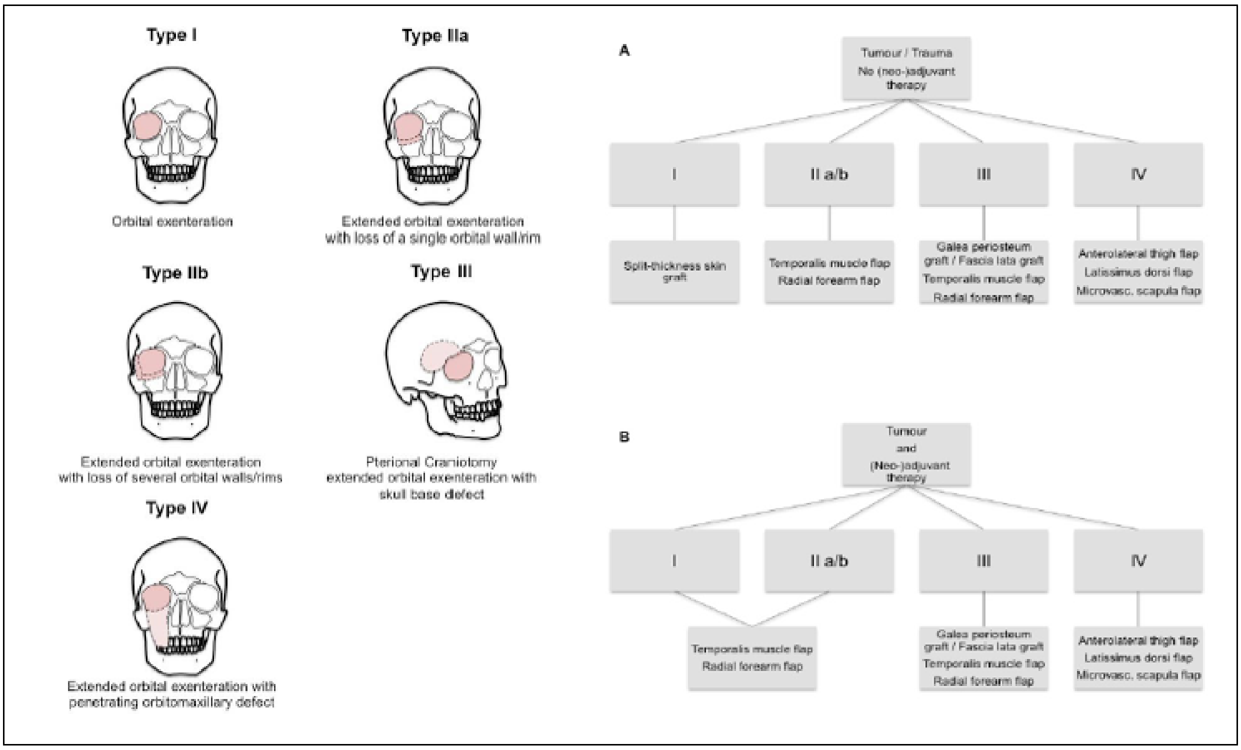


Fig 4: Classification of orbital exenteration defects & Reconstruction guideline for orbital exenteration[20]

Kazimierz Kobus[24] in his study 3 orbital trauma patient went for OE due RTA and electric burn and got reconstructed with retroauricular island flap. Nicoli et al[25] in his study 3 trauma patients underwent OE and got reconstructed by gracilis free flap. Baum SH[26] et al in his study showed 2 facial trauma patient went for OE.

IV. Conclusion

Facial and orbital trauma can precipitate vision-threatening injuries. It is imperative that these are investigated and management initiated promptly after life-saving treatments to minimize loss of vision. RBH is a surgical emergency and rapid lateral canthotomy and inferior cantholysis remain the first line treatment. There is some evidence that the use of steroids in TON may be associated with significant morbidity but this remains unproven. There is a relatively high rate of spontaneous visual recovery among patients managed conservatively. In the case of the ruptured globe primary surgical exploration and repair should be attempted; however, with an unsalvageable eye there is no consensus in the literature as to whether OE is the best treatment.

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