



Zygomatic Complex Fractures and its Management

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Abstract

Zygomatic complex fracture is the second most common fracture of facial region just behind isolated nasal fractures. The prominent convex shape of the zygoma makes it prone to trauma. The incidence of zygomatic complex in males is four times that in females. Most cases occur in young people in their second and third decades of life. The purpose of this article is to discuss the fractures in relation to zygoma and complications associated with same.

Keywords: Zygoma; Fractures; Trauma

Introduction

Zygomatic complex is the term used for the structure formed by the zygomatic bone and parts of anatomically related neighboring bones. It consists of zygomatic bone and parts of maxilla, frontal, temporal and sphenoid bone. It forms the infrastructure of anterolateral part of the face and prominence of the cheek. Along with anatomical and aesthetic, zygomatic complex also shows functional importance as it transmits the occlusal stress to the base of skull along its vertical and horizontal struts. Fracture of this region varies in severity from a simple crack to major disruption. Fracture may involve only zygomatic arch or may have varying degree of involvement of soft tissues and bones of the complex. The zygomatic complex is more important as it serves as a bony wall, separating orbital constituents from maxillary sinus and temporal fossa [1]. Incidence of fractures of the face including zygomatic complex have been noted as early as 3000 B.C. Attempts to treat such fractures have been also recorded as far back as 2500 - 3000 B.C. The Smith Papyrus is perhaps the first document in which treatment modalities of several types of zygomatic fractures are described and suggested [2]. Zygomatic complex fracture is the second most common fracture of facial region just behind isolated nasal fractures. The prominent convex shape of the zygoma makes it prone to trauma. The incidence of zygomatic complex in males is four times that in females. Most cases occur in young people in their second and third decades of life. Among the four articulating surfaces of the zygoma, the zygomatico-maxillary suture line is relatively stronger than the fronto-zygomatic, the zygomatico-temporal or zygomatico-sphenoidal suture line. So the zygomatico-maxillary suture line frequently remains intact even after multiple fractures of the complex [3]. Isolated fractures of the zygomatic arch are less common and

are only about 10% of zygomatic arch fractures. Rests are combined and secondary to a fractured zygoma [4].

Clinical Features

Clinical features of any fracture are mostly related to the surgical anatomy of the relevant part. Not all the clinical features appear in each and every case, but most of these are commonly present. In majority of the cases of zygomatic complex fractures, the fractured part displaces inward. This results in the flattening of the cheek. But, this may be masked under the swelling of the overlying soft tissues soon after injury. Flattening becomes obvious when swelling dissipates. Periorbital oedema and ecchymosis develops within few hours of injury and may interfere with the examination of eyes. In such cases, complete examination of eyes is performed after partial resolution of the swelling. Ecchymosis in the maxillary buccal sulcus is also an important sign. It may occur even with a small disruption of anterior or lateral maxilla and should be sought in patients with suspected zygomatic complex fracture. Subconjunctival haemorrhage is also one of the common features of the zygomatic complex fracture. The extent of haemorrhage depends on the severity of the fracture. Usually, subconjunctival haemorrhage has no posterior limit and remains bright red owing to the ability of oxygen to diffuse through the conjunctiva to the collection of blood. Lid ecchymosis occurs due to hemorrhage anterior to the orbital septum. Ecchymosis of the eyelid alone shows soft tissue injury. Proptosis of the eye may occur after zygomatic complex fracture. The basic reason behind it is retrobulbar hemorrhage. In some cases of zygomatic complex fracture, there may be epistaxis of the same side. This is due to disruption of 'Schneiderian membrane' of the maxillary sinus, which drains

into the nose via middle meatus. Alteration in the ocular level due to zygomatic complex fracture is a result of fracture of the lateral wall of the orbit. Damage to the 'Lockwood's suspensory ligament', which supports the globe of the eye from lacrimal bone region to Whitnall's tubercle region leads to this alteration. It is called hooding of eye. If fracture line remains below Whitnall's tubercle, there is no alteration in the ocular level. Zygomatic complex fracture having trauma to extra-ocular muscles leads to the limitation of ocular movements. This causes double vision or diplopia. In their case studies, Mansfield (1948), Barclay (1958), and Tempest (1960) found diplopia in 13.1%, 8.4% and 7.2% cases respectively [5]. The degree of diplopia can be recorded by means of a Hess-chart, which points out the particular damaged extra-ocular muscle. It may be monocular or binocular. Enophthalmos is inward displacement of eyeball due to increase in the orbital volume, which is a result of the fracture of orbital walls. Other causes include loss or decrease of orbital contents, loss of ligament support, post-traumatic fibrosis, scar or fat atrophy. Any injury to the lacrimal apparatus involving either puncta or passages during zygomatic complex fracture can lead to continuous overflow of tears. This condition is known as epiphora. Tenderness and bony deformity on palpation may be found at the infra-orbital margin, the fronto-zygomatic suture, over the antero-lateral antral wall, the zygomatic buttress, the zygomatic bone and arch may also show tenderness and deformity. Intra-orally, buccal vestibular palpation may also give the similar features. Tenderness on palpation is present in approximately 70% cases. Zygomatic complex fracture resulting in depression of the zygomatic bone or arch may lead to restricted opening of the mouth, deviation of mandible in opposite side during opening and restricted lateral movement in the fractured side. This is due to touching of coronoid process of mandible with displaced zygomatic bone or arch during movement of the mandible. Rounding of angle of the mouth may occur after zygomatic complex fracture either due to partial detachment of zygomaticus major muscle or severe displacement of the zygoma.

Historical Background

History of incidence and the management of the zygomatic complex fracture is very old. Many of the methods of management were in fact established long ago [6]. In 1751, Duverney described temporalis muscle pull in medially displaced fractures and intra-oral and external manipulation of bone fragments. In 1825, Ferrier tried to reduce the zygomatic bone fracture through an incision above the zygomatic arch. In 1847, Dupuytren discovered the relationship of the temporal fascia and the muscle as a pathway to the zygomatic bone and arch in case of compound fracture. In 1884, Stroymer gave percutaneous traction hook technique for medically displaced arch, interfering with coronoid process of the mandible. This method is still in use. In 1896, Treves advocated antral perforation through canine fossa and outward reduction of fractured and medially displaced antral wall. In 1896, Weir advocated the instrument number 24 French sound for malar elevation and antral pack through the antral approach. In 1901, Cheyne and Burghard described intra-oral digital reduction technique. But if this technique fails, open reduction may be necessary. In 1906, Lothrop supported antral approach and antral pack with long and narrow strips of iodoform gauze and sterile gauze. In 1927, Gillies proposed his approach to elevate the zygomatic arch through temporal incision, within the hairline. This cosmetic approach increased the acceptance of the method. In 1931, Shea introduced intra nasal anrostomy technique for malar elevation. But antral pack is not possible through this blind approach. In 1952, Anthony gave water balloon antral pack method through intra-nasal anrostomy approach. Interosseous wire fixation became the method of choice to receive stability of the reduced fragments in mild 20th century, with specific fixation technique independently described by Adams, Fryer and Dingman and Natvig. After Late 1980s, uses of miniplates became popular. These advancements provided a more rigid and stable fixation of the zygomatic plates and screws are being used. The use of miniplates was actually developed by Spiesel, *et al* in 1971.

Complications associated with zygomatic complex fractures

Zygomatic complex fractures frequently lead to some complications. Many of these may arise just after fracture and can be corrected by the proper treatment. But some complications may persist even after treatment or may arise during or after management procedures. These complications are like diplopia, enophthalmos, retrobulbar haemorrhage and blindness, trismus, zygomatico coronoid fibrous ankylosis, infraorbital; nerve dysfunction, latent papilledema, lower eyelid malposition, infection, malunion and facial asymmetry, complications associated with plates and screws and iatrogenic complications. Diplopia characterized by blurred and double vision, is a common complication following zygomatic complex fracture. This may be temporary or permanent. This may be monocular (involving single eye) or binocular (involving both eyes. According to Koornneef, this complication is caused by the injury to extra-ocular muscles or their motor nerve supply, oedema or hemorrhage in or around muscles [2]. Incidence of diplopia after zygomatic complex fracture ranges from 7 - 20% [5,7]. In separate reviews of cases by Mansfield (1948), Barclay (1960) and Tempest (1960), the incidences of diplopia were found 13.1%, 8.4% and 7.2% respectively [6]. Enophthalmos or inward sinking of the eye is one of the troublesome complications of the zygomatic complex fracture. This may itself be a cause of diplopia. According to this study of Zingg, *et al.* (1992), the incidence of enophthalmos in zygomatic complex fracture is about 3 - 4% [2]. Enophthalmos is characterized by reduced anterior projection of the globe as

viewed from above and accentuation of the upper eyelid (hooding). The condition can be corrected by surgery in early stages. If delayed, fibrosis causes difficulty in correction. Retrobulbar hemorrhage and blindness are rare complications of the zygomatic complex fracture. According to a study, performed at Canniesburn hospital, Glasgow, between January 1973 and July 1979, 1405 zygomatic complex fractures were seen. But the incidence of postoperative retrobulbar hemorrhage and visual loss was approximately 0.3%. Blindness due to retrobulbar hemorrhage following the reduction of zygomatic complex fracture has been reported by Gordon and Macrae (1950), Penn and Epstein (1953), Magoon (1963), Rowe and Killey (1968) and Varley, *et al.* (1968) [8-10]. In zygomatic complex fractures involving arch, approximately 45% cases shows various degrees of trismus. This is due to impingement of zygomatic arch upon the coronoid process of the mandible. This requires accurate reduction of the displaced arch and proper fixation. If any new bone formation below the arch is responsible for the restriction of the movements of the mandible, coronoidectomy may be necessary [2]. Zygomatico coronoid fibrosis ankylosis is rare complication of zygomatic complex fractures resulting due to prolonged immobility or hematoma. The incidence is about 1.3% [11]. The development of this fibrosis is slow and gradual. These cases require intra-oral coronoidectomy. In few cases partial myotomy of the masseter muscle may be the treatment of choice. Postoperative physiotherapy is very important for the improvement of the condition. Zygomatic complex fractures frequently leads to infra-orbital nerve dysfunction. As the fracture in the vicinity of infra-orbital foramen and canal are very common, the incidence of this complication is also very high and can range from 24 - 50% [12]. The dysfunction of this sensory nerve can be characterized by dysesthesia of the skin of the nose, cheek, lower eyelid, upper lip, gingiva and anterior teeth of the affected side. According to many studies, open reduction and miniplate fixation give better recovery of sensory function than open reduction with intraosseous wiring or open reduction with intra-antral support or closed reduction without fixation [12,13]. Fractures of the zygomatic complex usually involve the orbit. Direct injury to the bone or optic nerve gives symptoms immediately. But the latent papilloedema or optic disc edema is that complication which appears after many days or even weeks after the injury. It is a sign of increased intracranial pressure [14]. Obstruction of the normal fluid flow from the eye leads to swelling of the optic nerve head. Capillary permeability increases. These are also considered one of the causes of papilledema. Fully developed or on reaching in chronic stage, papilledema may cause visual field losses or even blindness. Infection after the treatment of the zygomatic complex fracture is an infrequent complication. In cases of rigid internal fixation, the chances of infection greatly reduce in comparison to intraosseous wiring. The incidence of postoperative infections is 0.8%. Though sinusitis is the most common among this but preseptal cellulitis and dacryocystitis may be found in few cases. According to Zingg (1991), 7%

cases show postoperative transient maxillary sinus opacification, but only 1.6% cases show symptoms [15].

Conclusions

Zygomatic complex fractures are the second most common fracture after nasal bone fracture. Zygoma has prominent position on lateral aspect of face and gives facial contour. Fractures pertaining to the zygoma lead to disturbances in the cosmetic as well as restrictions in the mouth opening. Proper management of such fractures prevents the untoward complications.

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