International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 4s, 2025
https://www.theaspd.com/ijes.php

Management Of Zygoma Fracture With Open Reduction And Internal Fixation

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Abstract
Introduction: Zygomatic fractures affect both functional and cosmetic features of the face. The complexity of zygomatic bone anatomical structure makes the management of zygomatic fractures very specific. A good understanding of clinical evaluation and management options for zygomatic fractures will improve outcomes and reduce the risk of complications. Objective: To evaluate the management of open reduction internal fixation (ORIF) in cases of zygomatic fractures. Case report: A 20-year-old man suffered a zygomatic fracture due to a traffic accident. The patient experienced asymmetric face and eye movement disorders after the incident, accompanied by displacement and fracture segments. Management with ORIF was performed on the patient. No complications were found in the patient up to one year after surgery. Methods: A literature search was conducted in PubMed with the keywords "zygomaticomaxillary complex" AND "fracture" AND "management". Results: Seven case reports relevant to the topic and available in full text were obtained from a total of 66 search literatures. Conclusion: Management of zygoma fractures with ORIF is performed in patients with functional and cosmetic disorders, such as asymmetric face, abnormal orbital cavity volume, visual impairment, and impaired chewing function. Other treatments for zygoma fractures include conservative therapy and closed reduction. Conservative therapy is performed in zygoma fractures without functional or cosmetic disorders, such as fractures without displacement or without fracture segments, and in patients with contraindications to surgery. Closed reduction is performed in simple zygoma bone fractures, with minimal displacement, without functional disorders, and stable patient conditions.

Keywords : *zygoma, fracture, management, conservative, reduction.*

Introduction

The complexity of anatomical structure of zygoma causes the management of zygoma fractures to be precise and different for each patient. Zygoma is an essential structure that forms the face and protects the cranial base during trauma. This bone articulates with four surrounding bones (also called tetrapods), frontal, sphenoid, maxillary, and temporal bone. Zygoma and its articulation are called the zygoma-maxillary complex/zygomaticomaxillary complex (ZMC). Fractures of the zygoma and its articulation significantly impacts the functional and cosmetic aspects of the face.[1,2]

Zygoma fractures occur at least 25% of all maxillofacial fractures.[3] Zygoma fractures are almost always caused by high-impact trauma, due to accidents or abuse. The most common cause of zygoma fractures is traffic accidents (57.1%). Zygoma fractures occur more often at more than 1 point (63.2%). The majority of patients with zygoma fractures require open reduction (83.7%), with fixation generally performed at 2 points (42.4%).[2] Postoperative complications are also significant to evaluate because at least 20-40% of patients experience facial asymmetry due to inadequate reduction, and 5% of postoperative patients require reoperation.[4]

Management of zygoma fractures can be conservative, closed reduction, or open reduction and internal fixation (ORIF). The difference in management in cases of zygoma fractures is based on the results of clinical evaluation and supporting examinations performed. Conservative therapy and closed reduction can be performed on patients with zygoma fractures with minimal displacement and fairly good clinical outcomes. Open reduction is more often performed because the majority of patients with zygoma fractures not only experience cosmetic

disorders but also functional disorders from the orbit to the masticator.[2,5]
Based on the above explanation, zygoma fracture cases require understanding the comprehensive management and good clinical evaluation of each patient. This will help improve patient outcomes and reduce the risk of complications. The purpose of this paper is to report a case of zygoma fracture.

Case Report
A 20-year-old male referral from Bojonegoro Hospital came to the Emergency Room (ER) of Dr. Soetomo Regional General Hospital Surabaya on November 22, 2022, at 22.30 WIB with the main complaint of swelling in the right temple for one week before admission. Complaints were accompanied by pain in the right side of the face and pain in the right eye when looking to the right side. The patient did not complain of headaches or vomiting, and there were no complaints of problems opening or closing the mouth. The patient had a traffic accident using a motorbike one week before coming to the ER, falling off the motorbike after hitting a truck. The right forehead and right arm hit the sidewalk. The patient was unconscious for two days after the accident. The patient had undergone degloving surgery and was hospitalized for five days after the accident before coming to the ER. The patient has no history of hypertension or diabetes; the patient works as an employee of a travel agency.
The patient's physical examination found a general sufficient condition, competent consciousness, height of 173 cm, and weight of 65 kg, with vital signs within normal limits. Head examination found an asymmetrical face, lacerations in the right frontal region measuring 6x1 cm and 3x1 cm, and the left temporal region measuring 5x1 cm (Figure 1), and crepitation in the right zygoma region. Examination of the local status of the ears, nose, and throat found results within normal limits. Examination of the cervical spine, thorax, abdomen, and pelvis was within normal limits. Examination of the limbs found swelling and deformity in the right antebrachii region, accompanied by tenderness and limited movement (range of movement) due to pain. Lacerations were also found in the right pedis region measuring 6x1 cm.

Figure 1. Clinical photo of the patient upon arrival at the ER.

A computed tomography (CT) scan of the head at Bojonegoro Hospital one week before found fracture lines in the zygomatic process of the frontal bone, the frontal process of the zygomatic bone, and the zygomatic process of the right maxillary bone, there were fracture lines in the lateral wall, anterolateral orbital floor, and anteroposterior rima oculi right (Figure 2). A plain X-ray of the antebrachii and right humerus at Bojonegoro Hospital, one week before admission, found a fracture line in the right radius bone. A plain X-ray of the thorax at Bojonegoro Hospital, one week before, showed no abnormalities in the heart and lungs.

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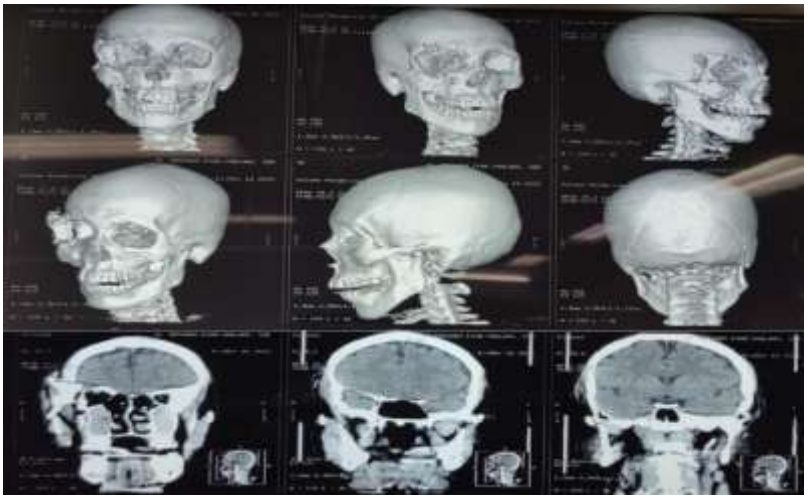

Figure 2. Computed tomography (CT) scan of the head one week before admission.

The patient was treated together with colleagues ophthalmologist, neurosurgeon, and orthopaedic surgeon with a diagnosis of complete closed fracture of the right zygoma-maxilla, lateral wall fracture, anterolateral orbital floor, and right ocular anteroposterior rima, right ocular subconjunctival hemorrhage, mild brain injury, anterior skull base fracture, right frontal region aperture vulnus, closed fracture of the proximal 1/3 of the right radius, and disruption of the distal radius-ulnar junction (DRUJ) right. The patient was planned to undergo open reduction internal fixation (ORIF) surgery of the zygoma-maxilla complex, exploration of the dura mater and frontal sinus (by neurosurgeon), orbital floor fracture repair (by ophthalmologist), and ORIF of the radius (by orthopaedic surgeon) two weeks after admitted in the operating room of the integrated central surgery building Dr. Soetomo Hospital, Surabaya.

The operation was initiated by exploring the dura mater and opening the incision wound from the degloving operation in the right frontal region. No leakage or lesion was found in the dura mater (Figure 3a). The operation was continued with ORIF of the zygoma-maxilla complex, through the incision that had been made in the right frontal region previously. The zygoma was repositioned and fixed to the frontal region using plates and screws (Figure 3b). Zygoma fixation was also performed to the maxilla, starting with an incision in the lateral orbit, followed by plate and screw installation (Figure 3c). The operation was continued with orbital floor fracture repair, starting with an incision in the inferior palpebral, with plate and screw installation (Figure 3d). The operation was ended by ORIF right radius with plate and screw installation. Post-surgery the patient was hospitalized for three days before finally being allowed to be discharged.

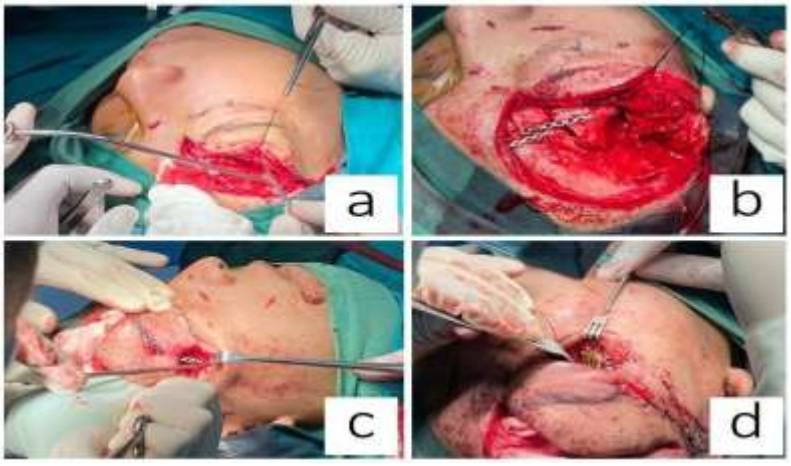

Figure 3. During the operation, (a) dura mater exploration, (b) ORIF of the zygoma to the frontalis, (c) ORIF of the zygoma to the maxilla, (d) repair of the orbital floor.

The patient then went for a check-up at the ENT Outpatient Dr. Soetomo Surabaya General Academic Hospital one week after surgery, it was found that the deformity in the right temple had decreased, there was no double vision, there was no pain in the surgical wound, the stitches were dry and good (Figure 4). Surgical wound care and partial removal of stitches were performed. The patient was checked at the Orthopaedic and Traumatology Outpatients of Dr. Soetomo Hospital, Surabaya, two weeks after surgery, and found minimal swelling, deformity, tenderness, and limited range of movement (ROM) due to pain in the right antebrachial region. The patient was given 500 mg of mefenamic acid tablets every 8 hours and calcium tablets every 12 hours orally. The patient was also checked at the Ophthalmology Outpatient of Dr. Soetomo Hospital, Surabaya, and found complaints of eye obstruction, no pain, improved vision, and conjunctival chemosis. The patient was given 4 mg methylprednisolone tablets every 8 hours orally, one drop of levofloxacin eye drops every 4 hours, and chloramphenicol eye ointment applied every 8 hours to the right eye.

Figure 4. First control, one week after surgery.

The second patient was checked at the ENT Outpatient by Dr. Soetomo General Academic Hospital, Surabaya, two weeks after surgery. The patient was found to have dry and good suture scars, with no pain. Surgical wound care and removal of all stitches were performed. The patient was also checked at the Ophthalmology Outpatient, Dr. Soetomo General Academic Hospital, Surabaya, three weeks after surgery, and found pseudoptosis, no complaints of double vision, no pain, no conjunctival chemosis. Wound care and removal of all stitches were performed. The patient was given methylprednisolone tablets 4 mg every 24 hours orally, levofloxacin eye drops one drop every 6 hours in the right eye, and chloramphenicol eye ointment applied every 8 hours in the right eye. The next patient was checked one month after surgery; no complaints were found in the patient, the surgical wound was good, and pseudoptosis improved. A follow-up one year after surgery found no complaints from the patient, and the surgical wound was good.

Figure 5. Follow up one years after surgery.

Clinical Questions

What is the proper management for zygomatic fractures?

Methods

A literature search was conducted in November 2023 in PubMed with the keywords "zygomaticomaxillary complex" AND "fracture" AND "management".

Result

A total of 7 case reports relevant to the topic and available in full text were obtained from a total of 66 literature search results. Management of zygoma fractures varies for each individual, according to the patient's condition. In general, management of zygoma fractures is divided into conservative and surgical. The surgery performed can be in the form of closed or open reduction, with 2-3 points of fixation (Table 1).[6-12]

Table 1. Analysis of problem, intervention, control, outcomes, dan time frame/PICOT.

	Problem	Intervention	Control	Outcomes	Time frame
Arun *et al.*, 2023.[6]	Zygomatic fracture with/without fracture fragments and deformity	Conservative therapy	-	Zygomatic fracture without fracture fragments and deformity, with pretty good results	6 months after surgery
Widodo *et al.*, 2021.[7]	Zygoma-maxilla fracture with fragments and displacement	ORIF with 3 fixation points	ORIF with 2 fixation points	*Postoperative clinical outcomes and stability of fracture fragments in 3-point fixation were better.*	3 months after surgery
Payak *et al.*, 2023.[8]	Zygomatic-maxillary fracture	ORIF with 2 fixation points	ORIF with 3 fixation points	2-point fixation has fewer facial and nerve complications.	6 months after surgery
Gawande *et al.*, 2021.[9]	Zygomatic-maxillary fracture	ORIF with 2 fixation points	ORIF with 3 points of fixation	Fewer facial and nerve complications are seen with 2-point fixation.	6 months after surgery
Lee *et al.*, 2022.[10]	Zygomatic-maxillary fracture	ORIF with 2 fixation points	ORIF With 1 fixation point	Fixation at 2 points results in better bone alignment and bone continuity.	3 months after surgery
Nasr *et al.*, 2017.[11]	Fraktur zigoma-maksila dengan *displacement*	ORIF with 2 fixation points	ORIF With 3 fixation points	2-point fixation is as adequate as 3-point fixation, but at a lower cost.	3 months after surgery
Mittal *et al.*, 2019.[12]	Zygomatic-maxillary fracture	ORIF with 2 fixation points	-	Complications arising from the lower 2-point fixation	3 months after surgery

Discussions

A 20-year-old man experienced a zygomatic fracture due to a traffic accident while riding a motorcycle. The patient's zygomatic fracture occurred at more than 1 point, namely the zygomatic process of the frontal bone, the frontal process of the zygomatic bone, and the zygomatic process of the right maxillary bone. Zygomatic fracture is a discontinuity of the zygoma caused by direct or indirect trauma.[1] Epidemiologically, zygomatic fractures account for 25% of all maxillofacial fracture cases. Zygomatic fractures are most often caused by a traffic accident (57.1%), especially in males aged 12-25 years. [2,3,13] Zygomatic fractures generally occur at more than 1 point

(63.2%). [2]

The patient in this case experienced impaired eye movement, accompanied by an asymmetric face and fracture lines on the lateral wall, anterolateral orbital floor, and anteroposterior rima oculi dextra of the patient, but without occlusion disorders. This condition is in accordance with the literature stating that zygoma fractures can have functional and cosmetic effects on the facial area. This is because the zygoma is an essential structure in the facial aesthetic system, so that fractures can cause cosmetic facial disorders.[1,14] Functional disorders due to zygoma fractures can manifest as impaired eye movement or occlusion disorders. Impaired eye movement occurs due to the impact caused by zygoma fractures on the volume of the orbital cavity, which is due to the direct relationship with the lateral wall and orbital floor. Occlusion disorders in zygoma fractures occur due to depression of the zygoma arch, which interferes with the insertion area of the temporalis muscle.[4]

Open reduction internal fixation was performed in this case due to indications of functional eyeball movement disorders and cosmetic disorders of the face. Displacement with fracture segments was also found in this case. Previous studies on managing zygoma fractures stated that most (83.7%) cases required surgical intervention in the form of ORIF.[2,4] Management of zygoma fractures with ORIF is performed in patients with functional and cosmetic disorders, such as asymmetric face, abnormal orbital cavity volume, visual impairment, and impaired chewing function. Surgery for zygoma trauma is repositioning the bone at the fracture line to achieve an accurate and normal anatomical position, and internal fixation is performed along the fracture line with plates and screws in the area around the fracture. [1] Management of zygoma fractures should be performed 7-10 days after the incident; if accompanied by orbital floor repair, it should be less than two weeks, because the rest will be more difficult due to fibrosis and scarring. [5]

Other treatments for zygomatic fractures include conservative therapy or closed reduction. Conservative therapy is performed on zygomatic fractures without functional or cosmetic disorders, namely fractures without displacement or without fracture segments, and in patients with contraindications to surgery.[15] This therapy shows a better prognosis in the healing process, mainly due to the reduced pain caused.[6] Closed reduction is performed in simple zygomatic fractures, such as fractures in the zygomatic arch, with minimal displacement, and stable patient conditions.[3] Fractures with minimal displacement generally have intact periosteal attachments, making them easier to closed reduction without subsequent fixation.[16] Zygomatic-maxillary and zygomatic arch fractures with minimal displacement also show fairly good results with closed reduction.[17] There is no significant difference in surgical outcomes and postoperative complications between closed reduction and ORIF in zygomatic arch fractures with minimal displacement. [18] Supraorbital rim consists of frontal bone, while frontal bone articulates with zygoma forming lateral rim (fronto-zygomatic suture), infraorbital rim shaped by zygoma and maxilla (zygomaticomaxillary suture), medial is a complex join of lamina papyracea, ethmoid, lacrimal bone, maxilla, and processus frontal of nasal bone. [19]

Open reduction with internal fixation of the zygoma in this case was performed through an incision that had been made, followed by repositioning the zygoma and fixation to the frontalis using plates and screws. Reduction and fixation also need to consider the aspect of minimal dissection, avoiding unnecessary incisions, as part of soft tissue management for better outcomes.[4] Zygoma fixation was also performed to the maxilla starting with an incision in the lateral orbit followed by plate and screw installation. This is based on previous studies, which stated that most patients with zygoma fractures who underwent ORIF required at least 2 fixation points (42.4%).[2] Previous studies also indicated that zygoma fixation at 3 points reduced the potential for instability of the fracture segment and orbital dystopia 3 months after surgery. [20] Accurate reduction and stable fixation of the zygoma are needed to prevent functional sequelae due to changes in the volume of the orbital cavity. [14] The use of plates and screws aims for stable fixation after returning to the previous anatomical position.[21] The operation is continued with repair of the orbital floor fracture, with an incision in the inferior palpebral, with the installation of plates and screws.

Postoperatively, the patient's eye movements had returned to normal. No complications were found in the patient up to 1 year after surgery. Postoperative care begins when the patient undergoes postoperative hospitalization and lasts until the patient is checked one month later. Postoperative hospitalization is needed to evaluate direct postoperative complications, such as bleeding and infection.[4] Previous studies have stated that complications in postoperative bone fragment mobility, facial asymmetry, malocclusion (temporomandibular joint dysfunction), and infraorbital sensory nerve disorders (permanent paresthesia) are rare.[2,4,22] Another study

also stated that postoperative facial asymmetry occurs in 3-4% of patients.[14] Complications in zygomatic fractures also depend on the fracture type, because a study stated that comminuted fractures have poor outcomes and a higher potential for reoperation.[23] Another study stated that at least 5% of patients require reoperation due to inadequate fracture reduction.[24] Although open reduction with internal fixation is generally performed, there are several cases of fractures that are not classifiable due to limited imaging examinations.[25] Other complications include epistaxis, trismus, ptosis, enophthalmos, and diplopia.[19,26]

Conclusions

The case report discusses a 20-year-old man with a zygomatic fracture who underwent open internal reduction. Postoperatively, the patient's eye movements had returned to normal, and his face was symmetrical. No complications were found in the patient up to one year after surgery. Management of zygomatic fractures with open reduction or ORIF is performed on patients with functional and cosmetic disorders, such as asymmetric face, abnormal orbital cavity volume, visual impairment, and impaired chewing function. Other treatments include conservative therapy and closed reduction. Conservative therapy is performed on zygomatic fractures without functional or cosmetic disorders, namely fractures without displacement or without fracture segments, and in patients with contraindications to surgery. Closed reduction is performed on cases of simple zygomatic fractures, with minimal displacement, without functional disorders, and stable patient conditions.

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