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Retrospective Evaluation of Various Surgical Approaches For Open Reduction And Internal Fixation of Fractures Involving Zygomati-Comaxillary Complex (ZMC) - A hospital based study.

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Abstract

Introduction: The zygoma is presented with four projections creating a quadrangular shape. It articulates with four bones: the frontal, temporal, maxilla, and sphenoid. When the zygoma is separated from its four articulations it is called a zygomatic complex fracture. Zygoma fractures are classified according to **Larsen & Thomsen** classification. In zygomaticomaxillary complex

(ZMC) fracture various incisions are useful. We reviewed various approaches for the treatment of ZMC fractures and discussed about incisions and fixation methods.

Methods: A 3 years retrospective study was conducted on 46 patients with ZMC fractures. We analyzed the most common type of fracture, etiology of fracture, clinical symptoms, approaches used and management of the same.

Results: In this study etiology of trauma was RTA in 44 & fall in 2 cases. Out of 46,4 patients had preoperative paresthesia but there was no postoperative paresthesia. Out of 46, 6 patients had preoperative diplopia & only 1 patient had it postoperatively. Intraoral vestibular approach was most commonly used (95.65%) .In 42 cases open reduction & internal fixation was needed, out of 42 one point fixation was done in 12 case, two-point fixation done in 19 cases & three-point fixation was done in 11 cases.

Conclusion: Most of our patients required ORIF as they were in Group B Among those cases, two-point fixation was indicated in maximum patients. Intra oral vestibular approach was maximum used as all cases required fixation at buttress. We recommend that most cases of require twopoint fixation with buttress and infra orbital fixation through vestibular approach. This approach restores both stability and esthetics of the patient with less complications.

Keywords: various surgical approaches, Larsen & thomsen classification, point of fixation, paresthesia, Diplopia.

Introduction

The zygoma is presented with four projections creating a quadrangular shape. It articulates with four bones: the frontal, temporal, maxilla, and sphenoid. When the zygoma is separated from its four articulations it is called a zygomatic complex fracture. Zygomatic arch may be fractured independently or as part of a zygomatic complex fracture. It connects the temporal process of the zygoma and the zygomatic process of the temporal bone. The infraorbital nerve (IO) passes through the orbital floor and exits at the infraorbital foramen.[1] It provides sensation to the anterior cheek, lateral nose, upper lip, and maxillary anterior teeth. Muscles of facial expression originating from the zygoma include the zygomaticus major and labii

superioris. They are innervated by cranial nerve VII.[2] The zygomaticomaxillary complex (ZMC) is a major buttress of the midfacial skeleton. The ZMC is important to structural, function=nal, and aesthetic appearances of the facial skeleton. A ZMC fracture is also known as a tripod, tetrapod, or quadripod fracture, trimalar fracture or malar fracture.[3] An intact zygoma (or zygomatic bone) and its surrounding bony anatomy are essential for maintaining facial contour, such as cheek prominence, as well as orbital integrity. Anatomically, the zygoma is attached to the frontal bone (via the frontozygomatic suture), the maxilla (via the zygomaticomaxillary suture), the squamous part of the temporal bone (via the zygomaticotemporal suture) and the sphenoid bone (via the zygomaticosphenoid suture). Fractures that involve the zygoma often occur at these four suture sites, leading to a "tetrapod" fracture pattern, known as a "zygomatic complex fracture" (ZMC). Furthermore, the zygoma is connected to the maxilla and sphenoid bone as part of the inferior orbital floor, and forms the lateral orbital margin with the frontal bone. Thus, fractures of the zygomatic complex inevitability lead to a certain degree of orbital defect.[4] Other fracture patterns, include isolated zygomatic arch fractures, or ZMC fractures with associated pan-facial fractures, such as Le Fort II and III fracture patterns. Indication for fixation of zygomatic fractures includes aesthetic defects (e.g., cheekbone flattening or a dimple) or functional defects (e.g., restrictive mouth opening, malocclusion or ophthalmic issues such as diplopia, restricted eye movements, enopthalmus and hypoglobus).[5] Diagnosis of fractures involving zygomaticomaxillary complex region are by clinical and radiographic examination. The management of this fracture is based on the displacement of the fracture; non displaced fracture can be managed conservatively. The degree of displacement can be easily

checked by 3DCT radiograph. The surgical approach is devised based on the findings from the physical examination and imaging studies.[6] Various surgical approaches and treatment strategies have been proposed to obtain successful treatment outcome, including the Gilles temporal approach, coronal, eyebrow, upper eyelid, transconjunctival, subciliary, subtarsal, lower eyelid, intraoral vestibular approaches & approaches from existing scar. The surgical approach for adequate reduction of zygomatic complex fractures must provide maximum necessary exposure of the fractured segments, minimize the potential for injury to facial structures, and ensure a good functional and cosmetic result.[7] The Gilles temporal approach has been a commonly used surgical technique for the reduction of zygomatic complex fractures. However, this surgical approach is associated with a scar in the hairline, fracture of temporal bone and risk of facial nerve palsy.[8] Moreover, further exposure of the zygomaticofrontal junction or the inferior orbital rim is required for placement of mini-plates fixation in case of an unstable zygomatic complex fracture. Surgical reduction of zygomatic fractures by an intraoral surgical approach was first described in 1909 by Keen, and several studies have subsequently documented the treatment outcome after open reduction of zygomatic complex fractures by an intraoral surgical approach.[9] In our department we have been using keen's intraoral approach, Gillies approach & lateral brow approach for reduction of zygomatic arch. Routine surgical approach we used for fixation of miniplates were extraoral approaches like Gilles temporal approach, coronal, eyebrow, upper eyelid, transconjunctival, subciliary, subtarsal, lower eyelid, existing scar & intraoral vestibular approaches.

Material & methodology

Study design: a retrospective study

Place of study- Department of Oral & Maxillofacial

Surgery, KMSDCH

Source of data- Archives of data from department of oral & maxillofacial surgery,K.M. shah Dental College & Hospital.

The data to be analyzed will be in scanned format collected from the scanned data base which is present in the department.

Related approvals- From department of oral & maxillofacial surgery & HRRP and ethical committee **Sample Description-**We would like to retrospectively analyze cases which were treated for fixation of zmc fracture who Came to KMSDCH, DGH, casualty with satisfying inclusion & exclusion criteria from January 2017 to May 2020.

Selection criteria

Inclusion criteria

- The Participants above 14 years will be included for study.
- Both the genders of participants will be included.
- Participants with immunocompromised disease, associated with any medical condition but who were physically fit for surgery under general anesthesia.

Exclusion criteria

• Participants whose complete data will not available for the study.

Material & Methodology

- The data for the retrospective study of ZMC fractures would be collected from department of Oral and Maxillofacial Surgery, KMSDCH and Dhiraj hospital.
- Patient's data will be evaluated for clinical findings like type of fracture, diplopia, paresthesia & other associated clinical sign & symptoms.
- Imaging modalities available like PNS, jug handle view & ct scan will be reviewed for the type of zmc fracture & post operatively to assess the reduction &

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fixation of fracture.

- The type of fracture, the treatment done & the surgical approach used will be evaluated to assess the post-operative outcome of the surgery.
- The postoperative results will be evaluated from the data up to one month from the date of surgery.

Statistical analysis: Microsoft office 2007 was used for the statistical analysis. Descriptive statistics like mean and percentages were used for the analysis.

Result

The present study was carried out to evaluate to retrospectively evaluate various surgical approaches for open reduction and internal fixation of fractures involving zygomatico-maxillary complex. The results are based on analysis in 46 patients evaluating neurosensory changes in relation to infraorbital nerve preoperatively & postoperatively, relation of fracture line to infraorbital foramen, preoperative & postoperative diplopia, cases which required one point, two point & three-point fixation for zmc fracture, surgical approaches used for accessibility to fixation of zygomatic buttress fracture, frontozygomatic suture fracture, infraorbital rim fracture.







Graph 2: shows preoperative paraesthesia present only 4 cases but no patient had post- operative paraesthesia.



Graph 3: shows preoperative subconjunctival hemorrhage present in 38 cases & it was absent in 7 cases.



Graph 4: shows alteration of globe level in 16 cases preoperatively.



Graph 5: shows out of 46 cases preoperatively step deformity palpable at infraorbital rim in 42 cases.



Graph 6: shows out of 46 cases preoperative flattening of malar prominence palpable in 41 cases



Graph 7: shows out of 46 cases flattening over zygomatic arch was palpable in 24 cases.



Graph 8: shows preoperative diplopia present in 6 cases but postoperatively diplopia present in only 1 case.



Graph 9: shows in 9 cases fracture line was medial to infraorbital foramen, in 9 cases it was lateral to infraorbital foramen & in 20 cases it was through infraorbital foramen



Graph 10: shows out of 46 cases 1 case fall under Group A,41 cases fall under Group B & 3 cases fall under Group C according to Larsen & Thomsen classification.



Graph 11: shows out of 35 cases which was operated for open reduction & internal fixation one- point fixation was done in 12 cases, two-point fixation was done in 19 cases & three-point fixation was done in 11 cases.



Graph 12: shows intraoral vestibula approach (95.65%) was 1st choice for treatment of zmc fracture followed by pre-existing laceration (23.91%).

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Graph 13: shows one-point fixation was done at ZMB in 10 cases & at infraorbital rim at 2 cases, two-point fixation was done at ZMB in 18 cases, at infraorbital in 13 cases, at FZ in 8 cases & at zygomatic arch in1 case & three-point fixation was done in all 11 cases at ZMB, infraorbital rim & FZ.

Discussion

Zygoma because of its prominent location is the most commony fractured bone in the midace. Road traffic accident was the most common cause of the zygomatic bone fracture in our study; out of 46 patients RTA was cause of fracture in 44 patients(95.65%) & remaining 2 (4.35%) had history of self-fall. Similar high percentage of road traffic accidents were reported by Chowdhury and Menon 86.20%, Fasola et al 81.6%, Ozemene 81%. However, Kovacs et al 46.2%, Zingg et al 29% reported interpersonal violence as the leading cause of zygomatic fracture. Interestingly Sulliven STO et al reported Sports injury as 27.5%. Gomes PP et al reported accidental self fall as 21.83% as a most common cause of zygomatic fracture.[11] In Our study we found that male predilection toward ZMC fracture. The reasons could be greater social and economic involvement of young adult males. The age group most commonly involved in this study was from 3rd decade followed by 2nd and 4th, the lowest incidence was found in 5th decade. Studies reported by Chowdhury et al, Motamedi MH, Ozemene et al, AL Ahmad HE et al 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.[12] Nerve injury following fracture may present with various pathophysiology involving traction, pressure, ischemia, inflammation and physical damage of the infra-orbital nerve resulting in sensory neuropathy and motor functions in the area of innervation of infra-orbital nerve both as presenting symptom and as a postoperative complication.[13] Out of 46 patients 4 patients had preoperative paraesthesia but no patients had paraesthesia post operatively. The results of the study are in agreement with other recorded incidence of infra-orbital nerve injury following ZMC fractures ranging from 18-83% in a study from Israel and 58 to 94% from India.[16] Subconjuctival hemorrhage is a frequent finding in zygomatic fractures. It may accompany even a hairline crack through the orbital rim if the periosteum has been torn. Its absence dose not exclude an orbital rim fracture because if no disruption of the periosteum has occurred, bleeding can accumulate in a subperiosteal location and may not be visible under the conjunctiva. In our study subconjunctival hemorrhage was present in 82.61% cases. The result of previous studies shows subconjunctival hemorrhage is present in 50% -70 %

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and Fasola et al showed that zygomatic bone fracture

are common in 3rd decade.[10] Zygomatic complex

fractures frequently lead to some complications. Many

cases of ZMC injuries.[14] 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. Incidence of diplopia after zygomatic complex fracture ranges from 7 - 20%. In our study 46 patients,6 patients have pre-operative diplopia & only one patient had it postoperatively. 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.[24] 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.[12]in our study out of 46 patients 16 patients had alteration of globe level. Hypo Globus occurred in most of cases. Fractures running through the orbital rim often result in a gap, or step deformity, if displacement has occurred. This finding is frequently noted at the infraorbital and lateral orbital rims when zygomatic fractures are present.in our study it was present in 91.30% cases pre-operatively. Flattening of cheek appear to be the striking feature of zygomatic injury. It is reported in 70 % to 86% of cases by Larsen and Thomson, Ellis et al Balle et al.[15] It is more prominent in those cases in which distraction of the FZ suture and medial rotation or combination have occurred. Our study shows similar result for flattening

of cheek, which was 89.13%, more or less similar with the results of previous study of Larsen and Thomson, Ellis et al Balle et al.[21] A characteristic indentation or loss of the normal convex curvature in the temporal area accompanies fractures of the zygomatic arch. Visual and digital comparison with the opposite side is extremely helpful for detection of depressions of the zygomatic arch in our study we found it was present preoperatively in 52.17% cases. We used the simplified Larsen & Thomsen classification of ZMC fracture to make appropriate treatment plan preoperatively. According to Larsen & Thomsen ZMC fracture are classified into following groups:[1]

Group A: Stable fracture requires no treatment.

Group B: Unstable fracture requires reduction & fixation.

Group C: Stable fracture which require reduction but no fixation.

In our study out of 46 patients, there was only 1 patient in group A,41 patients were in group B & 3 patients were group C. Out of the 46 patients ;3 patients were diagnosed with isolated zygomatic arch fractures; all were treated with indirect reduction using Gillies lift or Keen's approach. This was similar to a study in which 26 isolated zygomatic arch fractures were all managed with indirect reduction. Out of 46 patients 42 patients with ZMC fracture were treated with ORIF. This is in keeping with a study of 532 ZMC fractures in which all were treated with ORIF. However, in a retrospective study of 210 cases of ZMC fractures, 84% (n = 177) patients had ORIF, whilst 16% (n = 33) had closed reduction. A survey answered by over 1600 ENT, OMFS and plastic surgeons that showed 81% would choose ORIF for ZMC fractures.[16] Champy et al in his study reported satisfactory results with a single point fixation of the zygomatic complex fracture at the

FZ region. Ji Heui kim et al46 concluded that one-point fixation at the ZMB through a gingivobuccal sulcus incision was effective for isolated fracture of zygoma without comminution of lateral orbital rim. Hwang suggested that one-point fixation of tripod fractures through a lateral brow incision can apply to cases with minimal or moderate displacement of the infraorbital rim.[17]Paik-kwoon Lee et al stated that two point miniplate fixation at the infraorbital rim and frontozygomatic region provide significant amount of stability, provided the comminution of zygoma is not severe. Davidson et al stated that the two-point fixation using miniplate alone conferred a degree of stability comparable to most methods of three-point fixation regardless of the site in which the miniplates were applied.[10] In our study 89.13% cases were treated by open reduction and internal fixation using miniplates. One-point fixation was done in 34.29% of cases in which fixation at ZMB was done in 10 cases followed by 2 cases at IOR margin was stabilized and fixed. Two-point fixation was done in 54.29% cases cases in which fixation at ZMB was done in 18 cases followed by 13 cases at IOR margin,8 cases at FZ region & in 1 case at zygomatic arch. Three-point fixation was carried out in 11 patients accounting for 31.43%. In our study for ORIF we used lateral brow incision (13%) for the reduction and fixation at FZ suture, subcilliary (6.50%) for infra orbital rim, transconjunctival (2.17%) approach for fixation at infraorbital rim and FZ Suture, intraoral maxillary vestibular (95.65%) approach was used for reduction and fixation of ZMB region and infraorbital rim. In 23.91% cases fractured site was reached through existing laceration. Though transcutaneous and transconjunctival incisions provide direct access to the fracture at infra orbital rim, they are associated with various complications like hypertrophic

scar formation, scleral show, mild lid edema, keratoconjunctivitis, epiphora, ectropion, lagophthalmos, and nasolacrimal injury. In majority of our cases we had done ORIF at zygomatic buttress followed by Infra orbital rim through intra oral vestibular incision. In cases where ORIF was required at both buttress and infraorbital rim, we had modified the vestibular incision in order to gain better access to the infra orbital rim. This technique reduced the operating time, avoided second surgical site, better esthetics and reduced rate of secondary infection.

Conclusion

In this study most of our patients required ORIF at two points as they were in Group B. The modified Intra oral vestibular approach was maximum used as all cases required fixation at buttress and infraorbital rim. In most cases which require two point fixation, where orbital floor exploration is not necessary, fixation of buttress and infra orbital rim through modified infra orbital incision gives better access, reduces the surgical time and morbidity, avoids second surgical site, better fracture stability and improved esthetics.

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Reference

- Forouzanfar T, Salentijn E, Peng G, van den Bergh B. A 10-year analysis of the "Amsterdam" protocol in the treatment of zygomatic complex fractures. Journal of Cranio-Maxillofacial Surgery. 2013 Oct 1;41(7):616-22.
- 2. Datta R, Harit K, Grewal Y. Management of isolated

zygomaticomaxillary complex fractures with an individualized approach: a retrospective study. Plast Aesthet Res. 2014 Jul 1;1(2).

- Olate S, Lima Jr SM, Sawazaki R, Moreira RW, de Moraes M. Surgical approaches and fixation patterns in zygomatic complex fractures. Journal of Craniofacial Surgery. 2010 Jul 1;21(4):1213-7.
- Ungari C, Filiaci F, Riccardi E, Rinna C, Iannetti G. Etiology and incidence of zygomatic fracture: a retrospective study related to a series of 642 patients. Eur Rev Med Pharmacol Sci. 2012 Oct 1;16(11):1559-62.
- Haider AK, Hameed H. Evaluation of ocular injuries associated with mid-facial trauma. Pakistan Oral & Dental Journal. 2018 May 23;38(1):38-41.
- El-Anwar MW, Sweed AH. Infraorbital foramen localization in orbitozygomatic fractures: a CT study with intraoperative finding. European Archives of Oto-Rhino-Laryngology. 2018 Mar 1;275(3):809-13.
- Ji SY, Kim SS, Kim MH, Yang WS. Surgical methods of zygomaticomaxillary complex fracture. Archives of Craniofacial Surgery. 2016 Dec;17(4):206.
- Yamsani B, Gaddipati R, Vura N, Ramisetti S, Yamsani R. Zygomaticomaxillary complex fractures: a review of 101 cases. Journal of maxillofacial and oral surgery. 2016 Dec 1;15(4):417-24.
- Dakir A, Muthumani T, Prabu NP, Mohan R, Maity A. One point fixation of zygomatic tripod fractures in the zygomatic buttress through Keen's intraoral approach: A review of 30 cases. Journal of pharmacy & bioallied sciences. 2015 Apr;7(Suppl 1):S238.
- Ashwin DP, Rajkumar GC. A study on assessing the etiology and different treatment modalities of zygomaticomaxillary complex fracture. International Journal of Contemporary Medical Research. 2017;4(6):1423-30.

- Qayyum Z, Khan AU, Khitab U. Characteristics and etiology of zygomatic complex fractures. Pak Oral Dent J. 2006;27(1):93-6.
- Gupta M, Das D, Soodan K, Singh C. Dental injuries in patients associated with fracture of facial bones. Oral and maxillofacial surgery. 2019 Mar 6;23(1):63-9.
- Noor M, Ishaq Y, Anwar MA. Frequency of infraorbital nerve injury after a Zygomaticomaxillary complex fracture and its functional recovery after open reduction and internal fixation. International Surgery Journal. 2017 Jan 25;4(2):685-9.
- Larsen OD, Thomsen M. Zygomatic fractures: I. A simplified classification for practical use. Scandinavian journal of plastic and reconstructive surgery. 1978 Jan 1;12(1):55-8.
- 15. Bradley D, Leung B, Saxena S, Dungarwalla M, Chapireau D, Fan K. Surgical management of zygomatic complex fractures in a major trauma centre. Plastic and Aesthetic Research. 2019 May 24;6.
- 16. Zingg M, Laedrach K, Chen J, Chowdhury K, Vuillemin T, Sutter F, Raveh J. Classification and treatment of zygomatic fractures: a review of 1,025 cases. Journal of oral and maxillofacial surgery. 1992 Aug 1;50(8):778-90.
- Hwang K, Kim DH. Analysis of zygomatic fractures. Journal of Craniofacial Surgery. 2011 Jul 1;22(4):1416-21.
- Ogata H, Sakamoto Y, Kishi K. A new classification of zygomatic fracture featuring zygomaticofrontal suture: injury mechanism and a guide to treatment. Plastic Surgery Int J. 2013 Mar.
- Naveena R. Evaluation of treatment modalities and its complications in the management of zygomatic complex fractures.2013(Doctoral dissertation, Sri

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Ramakrishna Dental College & Hospital, Coimbatore).

- 20. Bush BF, Philbert RF, Zola MB. A vertical incision for intraoral approach to a zygomaticomaxillary fracture. The British journal of oral & maxillofacial surgery. 2014 Sep;52(7):e41.
- 21. Yoo JY, Lee JW, Paek SJ, Park WJ, Choi EJ, Kwon KH, Choi MG. Advantages of intraoral and transconjunctival approaches for posterior displacement of a fractured zygomaticomaxillary complex. Maxillofacial plastic and reconstructive surgery. 2016 Dec 1;38(1):36.
- 22. Starch-Jensen T, Linnebjerg LB, Jensen JD. Treatment of zygomatic complex fractures with surgical or nonsurgical intervention: A retrospective study. The open dentistry journal. 2018;12:377.
- Ishaq Y, Noor M, Anwar MA. Comparison of infraorbital nerve recovery after open and closed reduction of zygomaticomaxillary complex fractures. Int J Otorhinolaryngol Head Neck Surg. 2018 May;4:613-7.
- Padmanavam A, Mishra S. Patient perspective in the management of zygomatic fractures. Annals of Maxillofacial Surgery. 2018 Jul;8(2):239.
- 25. Hammuda A. Intraoral Approach for Reduction and Fixation of Infraorbital Rim Fracture. Egyptian Journal of Oral and Maxillofacial Surgery. 2018 Oct 1;9(4):179-84.