LONG-TERM OUTCOME IN PATIENTS TREATED FOR MAXILLOFACIAL FRACTURES

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ABSTRACT

Background: Previous study reported that facial fracture sequelae can affect patient's quality of life. The treatment of maxillofacial fracture ranges from conservative treatment to surgery. The aim of our study is to assess the outcome in patients treated for maxillofacial fractures, both surgically or conservatively.
Method: This study was a retrospective study conducted in 2019-2021. Data including general characteristics, fracture pattern and treatment information were collected from medical records.
Sequelae was classified into four categories, such as sensibility disturbance, vision disturbance, cosmetic disturbance and mouth opening disturbance. Patients were assessed for long-term sequelae in follow-up records for 12 months post-trauma. Sequelae will be compared to assess the effectiveness of therapy.
Results: Our study involved 138 subjects. The most fracture pattern found was isolated maxilla (26.09%) and Le Fort II (22.46%). Mandible (65.94%) was the most found bone fracture, followed by maxilla (61.59%) and orbital (53.62%). After 12 months, numbness, sense of pricking, pain, blindness, scar and loss of check contour was significantly reduced in the surgery group ($p<0.05$). Hyperesthesia, involuntary movement and trismus also significantly improved in the surgery group ($p<0.01$).
Conclusion: Surgery gives significantly better outcome than conservative therapy. Thorough examination is essential in determining the choice of therapy to prevent sequelae. Even in surgery group, long term follow up should be carried out since sequelae can be induced by structural manipulation during intervention.

Keywords: Maxillofacial fracture, outcome, surgery, conservative therapy, sequelae

INTRODUCTION

The first focus in a patient with trauma should be to address any life-threatening situation and general condition stabilization. Facial trauma is often associated with high-energy mechanisms such as violence and traffic accident that may results in multiple injury.[1] However, the examination of maxillofacial fracture can be troublesome due to heavy facial swelling, inability of clinician to perform a thorough physical examination due to uncooperative patients that leads to undetected facial trauma.[2] Neglected facial fracture may causes long term complication depends on the extent and localization of initial injury. Even after appropriate treatment, sequelae can also be seen due to the treatment itself.[1]

The prevalence of maxillofacial fracture varies depending on age, gender, etiology, lifestyle and cultural difference. However, most maxillofacial fracture was seen in younger (63.1%) male (82.2%) due to traffic accident (83.1%).[4] This should raise our awareness since the National Committee of Transportation Safety in Indonesia reported that in the last 10 years, traffic accident has caused 698 death and 1171 injured.[5]

The treatment of maxillofacial fracture ranges from conservative treatment to surgery with a similar goal that is to restore the function and cosmetic aspect as soon as possible while minimizing cost and discomfort of the patient.[3] Petersen et al. reported that facial fracture sequelae can affect patient's quality of life especially within 90 days post-trauma. In most cases, long-term complications involve both functional and cosmetic aspects. Their study reported that 80% of facial fracture patients complained of minimal one sequelae within the first 3 months, mostly sensory deficit, and decrease to 58% in the next 3 months.[6] Hence, a long-term holistic approach, all physically, mentally, and socially of sequelae is recommended since some sequelae may improve spontaneously, while some other may require several intervention to maintain or improve patient's quality of life (QoL).[6]

Somoye et al. reported that the QoL of subjects with maxillofacial fracture is significantly lower before treatment ($p=0.001$). The QOL progressively improved after 6 weeks and 12 weeks after therapy. This study also stated that after 6 weeks, the QoL of patients underwent Open Reduction Internal Fixation (ORIF) was significantly higher than in the closed reduction group. However, this difference diminished in the 12th week.[7] Multidisciplinary follow up is inevitable even though grandiose to achieve due to high rates of loss to follow up that may leads to lack of long-term reported outcome.[6] The aim of our study is to assess the long-term outcome in patients treated for maxillofacial fractures, both surgically or conservatively.

METHOD

This study was a retrospective study conducted in one referral hospital in West Java, Indonesia during 2019-2021. The study was participated by patients with maxillofacial fractures that were confirmed by CT scan during study period. Patients with incomplete data were excluded.

Data including general characteristics, fracture pattern and treatment information were collected from medical records. Fracture patterns were classified based on CT scan into upper face, midface, lower face and panfacial fracture. Treatment was classified into conservative and surgical, both closed and open reduction. Surgery was conducted based on the general condition of the patient, severity/ displacement of fragments, functional or cosmetic disorder and patient's autonomy. Displaced fracture was described as discontinuity in the bone more than 3 mm.

Sequelae was classified into four categories, such as sensibility disturbance, vision disturbance, cosmetic disturbance and mouth opening disturbance. Patients were assessed for long-term sequelae in follow-up records for 12 months post-trauma.

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Statistical analysis was conducted using SPSS statistics. Descriptive analysis was performed in general characteristics, fracture pattern and surgical information. Data will be presented as frequency (n) and percentage. Numeric data will also be presented as mean, standard deviation (SD) and range. Kolmogorov-Smirnov test was used to assess data normality (n>50). Mann-Whitney U test was carried out to compare the sequelae found in conservative and surgical groups. The statistical significance threshold was $p < 0.05$. This study was approved by the Health Research Ethics Committee, Faculty of Medicine Padjadjaran University, Dr. Hasan Sadikin Hospital, with approval number of ….

RESULTS

Our study involved 138 subjects. Subject's general and clinical characteristics are shown in Table 1. Most participants were male (68.84%) aged 26-45 years old (42.03%) with an average of 41.84 years old. Most maxillofacial fracture occurs due to traffic accidents (84.78%), mostly in two wheeled vehicles (50.72%) without helmet (31.88%) as seen in Table 1.

Table 1 General Characteristics of Subjects

General Characteristics	N=138	%
Age (years old)		
0-11	8	5.80
12-25	28	20.29
26-45	58	42.03
>45	44	31.88
Mean ± SD	41.84 ± 22.3	
Range	1-85	
Gender		
Male	95	68.84
Female	43	31.16
Etiology		
Traffic accident	117	84.78
Four or more wheeled vehicles	29	21.01
Two wheeled vehicles	70	50.72
Helmet +	26	18.84
Helmet -	44	31.88
Pedestrian	18	13.04
Occupational accident	5	3.62
Sport accident	2	1.45
Violence	4	2.90
Fall	10	7.25

The most fracture pattern found was isolated maxilla (26.09%) and Le Fort II (22.46%) as seen in Table 2. Several participants had multiple fractures involving the upper, middle or lower facial bones. Only 3.62% reported with panfacial fracture. Majority of participants had non-displaced bone fragments (42.03%) and were treated with conservative treatment (59.42%). In our study, mandible (65.94%) was the most found bone fracture, followed by maxilla (61.59%) and orbital (53.62%).

Table 2 Fracture Pattern of Subjects

Fracture Characteristics	N=138	%
Site of Maxillofacial Fracture		
Upper face		
Frontalis	6	4.35
Midface		
Le Fort I	4	2.90
Le Fort II	31	22.46
Le Fort III	13	9.42
Blowout fracture	2	1.45
Zygomaticomaxillary Complex	9	6.52
Naso Orbito Ethmoidalis	5	3.62
Rima Orbita Inferior	18	13.04

Isolated Maxilla	36	26.09
Isolated Zygoma	16	11.59
Nasal	19	13.77
Palatum	4	2.90
Lower face		
Mandibular	86	62.32
Panfacial		
Panfacial	5	3.62
Severity of Fracture		
Not displaced	58	42.03
Displaced	36	26.09
Multifragment	44	31.88
Treatment		
Conservative	82	59.42
Surgery	56	40.58

The most subjects with surgery treatment underwent surgery within 7 days post trauma (46.43%) with open reduction (69.64%) and subciliary approach (66.07%) as seen in Table 3.

Table 3 Surgery Information of Subjects

Surgery Information	**N=56**	**%**
Time of Surgery		
Surgery within 7 days	26	46.43
Surgery 8–14 days	13	23.21
Surgery > 15 days	17	30.36
Reduction		
Closed reduction	17	30.36
Open reduction	39	69.64
Surgical approach		
Subciliary incision	27	48.21
Transconjunctival incision	2	3.57
Frontozygomatic suture incision	18	32.14
Intraoral incision	8	14.29
Through existing wound	6	10.71
Gillies incision	19	33.93
Bicoronal flap	3	5.36

Patients were followed up for 12 months and were asked about the remaining symptoms. The symptoms reported sequelae can be seen in Table 4. Numbenss (28.99%), diplopia (40.58%), scar (45.655) and trismus (32.61%) was the most common sequelae reported in this study.

Sensibility, vision, cosmetic and mouth opening disturbance was reported by the majority of the conservative group. Numbness, sense of pricking, pain, blindness, scar and loss of check contour was significantly reduced in the surgery group ($p<0.05$). Hyperesthesia, involuntary movement and trismus also significantly improved in the surgery group ($p<0.01$).

Table 4. Symptom Reported Sequelae in Conservative and Surgery Group

Symptom Reported	**Total**		**Conservative**		**Surgery**		**RR**
	N=138	**%**	**N=82**	**%**	**N=56**	**%**	
Sensibility Disturbance							
None	80	57.97	37	45.12	43	76.79	
Numbness	40	28.99	26	31.71	14	25.00	0.46*

Sense of pricking	23	16.67	15	18.29	8	14.29	0.46*
Hyperesthesia	10	7.25	8	9.76	2	3.57	0.22**
Pain	17	12.32	14	17.07	3	5.36	0.18*
Vision Disturbance							
None	97	70.29	52	63.41	45	80.36	
Blurred vision	44	31.88	28	34.15	16	28.57	0.66
Diplopia	56	40.58	36	43.90	20	35.71	0.64
Increased tear flow	19	13.77	12	14.63	7	12.50	0.67
Sensitivity to light	13	9.42	7	8.54	6	10.71	0.99
Blindness	12	8.70	8	9.76	4	7.14	0.58*
Cosmetic Disturbance							
None	78	56.52	43	52.44	35	62.50	
Scar	63	45.65	38	46.34	25	44.64	0.81*
Enophthalmos	23	16.67	13	15.85	10	17.86	0.95
Ectropion	13	9.42	7	8.54	6	10.71	1.05
Involuntary movement	5	3.62	4	4.88	1	1.79	0.31**
Loss of zygomatic prominence/ cheek contour	29	21.01	21	25.61	8	14.29	0.47*
Not specified	5	3.62	4	4.88	1	1.79	0.31**
Mouth Opening/ Bite Disturbance							
None	93	67.39	46	56.10	47	83.93	
Trismus	45	32.61	36	43.90	9	16.07	0.24**

Analysis was carried out using Mann-Whitney U test
**P-value <0.05*
**P-value <0.01*

DISCUSSION

The most participants with maxillofacial fracture were 26-45 years old with an average of 41.84 years old. These findings were supported by Ariobimo et al. which reported that the 26-45 years old group (48.52%) had the highest proportion of maxillofacial fracture, especially due to traffic accidents. This age group in considered as a productive age that spend more time traveling than other age group.[8] The National Committee of Transportation Safety also reported that most traffic accident happened at 12.00-18.00 as the busiest time in traffic because employees come home from work.[5]

In our study, traffic accident is the most common etiology of maxillofacial fracture, especially in non-helmet users in two wheeled vehicles. This finding is supported by the National Committee of Transportation Safety in Indonesia which stated that West Java had the highest rate of traffic accidents. This phenomenon may be influenced by the geographical difference. West Java has more hilly and mountainous areas with ups, downs and bends roads which increase the risk of accidents compared to other provinces in Indonesia.[5] The high incidence of motorcycles in this study may be related to the socioeconomic level of Indonesia. Singh et al. reported that a low or middle-income countries have higher prevalence of motorcycle as a cheaper mode of transport and the ability to move faster in congested lane.[9]

Roselló et al. reported that the most common facial bone fracture is mandible (41.6-75.2%), maxilla and orbit (39.8% each). This finding is similar with our study which found that mandible (65.94%), maxilla (61.59%) and orbital (53.62%) is the most common facial bone fracture.[2] Singh et al. reported that not using helmet was significantly associated with facial fracture cases, especially mandibular fracture (RR 4.75; CI 95% 1.99-11.35) as also seen in our subjects. Even in the helmet-users group, the type (standardized/ non-standardized helmet) and the method of helmet used (fastened/ loosely fastened) may influenced the incidence of maxillofacial fracture.[9] Another study by Fakhrurrazi also reported that mandibular fracture was more commonly found in traffic accident due to a direct it on the chin which may results in bilateral condyles fracture. While a hit on the angle of parasymphysis may results in contralateral condyles or angulus fracture.[10]

In our study, most participants were given conservative therapy due to non-displaced or minimally displaced fracture, refused treatment or asymptomatic fracture. Most surgery was carried on within 7 days since mandibular fracture should be treated as soon as possible.[11] However, subciliary incision was the most surgical approach done due to the high proportion of orbital rim fracture (53.62%) in our study.

Bone fragments can compress, stretch and even cut the adjacent nerve, causing sensory disturbance based on the nerve concerned. In our study, most patients complained of numbness and a sense of pricking around the chin and lower lip. This complaint can be caused by injury of mandibular adjacent nerve such as inferior alveolar nerve.[12] In our study, sensibility disturbance (numbness, sense of pricking and pain; $p<0.05$, hyperesthesia; $p<0.01$) was significantly lower in the surgical group compared to conservative group. Reduction, both open and closed, aims to realign and reposition the bone fragments to ensure immobilization that optimize bone healing. This intervention results in the realignment on inferior alveolar nerve back to the mandibular canal hence reducing sensibility disturbance.[13]

Diplopia and blurred vision are the most common vision disturbance in our study. A study in India reported that vision disturbance in maxillofacial trauma can be classified into extraocular lesion (ptosis, enophthalmos, exophthalmos and diplopia), intraocular lesion (optic nerve compression, retrobulbar hemorrhage and retinal detachment) and blindness. Diplopia was reported in 5-37% of patients. In trauma cases, a monocular diplopia can be caused by edema, hematoma, muscle

entrapment, nerve injury or even displacement of attachment of suspensory ligament of globe.[14]

Monocular blindness or diminished vision resulting from eye trauma is a relatively infrequent occurrence in cases of maxillofacial trauma, with an estimated prevalence ranging from 0.32% to 9%. In our research, we observed a significant reduction in the incidence of blindness among patients who underwent surgical intervention ($p<0.05$), which aligns with the findings of a study conducted by Rajkumar et al. This aforementioned study highlighted that maxillofacial trauma increases the vulnerability to eye injuries, particularly those affecting the optic nerve or optic canal. It is worth noting, however, that damage to the optic nerve is relatively uncommon due to the presence of a robust bony ring that acts as a protective barrier for the nerve as it enters the orbital region. Vision disturbance is highly associated with midfacial fracture such as Le Fort II-III, zygomaticomaxillary complex and naso-orbito-ethmoid fracture. Even after surgery, blindness can still occur. Hence, vision assessment should be carried out before and after surgical repair.[14]

The mostly seen cosmetic disturbance is scar and loss of check prominence in our study. Both are significantly reduced in surgery group compared to conservative group ($p<0.05$). Cosmetic disturbance is associated with negative feelings. Nayak et al. reported that scar is present in 61.2% patients with maxillofacial fracture. The presence of facial scar is significantly associated with Post-Traumatic Stress Disorder (PTSD) development.[15]

Zygoma is a crucial component in maintaining cheek architecture. Zygoma fracture is reported as the second most common maxillofacial fracture. This fracture is also associated with ocular and mandibular functional disruption such as mouth opening as the bone fragments may impinged on the coronoid process. In our study, zygoma fracture was found in 21.74% patients.[16]

Involuntary movement is reported after trauma or even oromaxillofacial procedures. Facial muscle twitches in a spontaneous muscle contraction, usually unilateral, of a small muscle group that is innervated by seventh cranial muscle.[17] Peripheral nervous system conducts an ability to regenerate after traumatic injury. After injury took place, the nerve fibers distal to the injury undergo Wallerian degeneration. Schwann cells then proliferate and elongate to guide the regenerating axons. Surgery group has significantly lower muscle twitch rate than the conservative group ($p<0.01$).

Maxillofacial fracture involving mandible, zygoma and zygomatic arch may cause temporomandibular movement disruption, causing trismus.[18] In trauma cases, trismus can be caused by several mechanisms. Trismus can be observed due to inflammatory process of masticatory muscle (masseter, temporalis, lateral pterygoid, and medial pterygoid), displaced meniscus anteromedially to the condyle in temporomandibular joint, depressed or rotated zygomatic arch or complex.[19,20] After surgery, trismus can be caused by injury to medial pterygoid muscle during nerve block. Trismus can also be caused bleeding and fibrosis formation.[18]

This study has several limitations. We present the patient reported sequelae of maxillofacial trauma. However, further study should be conducted to assess the impact of fracture sequelae as in QoL assessment. The sequelae noted in this study were subjective feelings of our subjects.

CONCLUSION

Surgery gives significantly better outcome than conservative therapy. Thorough examination is essential in determining the choice of therapy to prevent sequelae. Even in surgery group, long term follow up should be carried out since sequelae can be induced by structural manipulation during intervention.

REFERENCE

1. Verbruggen K. Long-term Complications after facial trauma: literature review. B-ENT. 2016;(2):47–58.
2. Roselló EG. Facial fractures : classification and highlights for a useful report. Insights Imaging. Insights into Imaging; 2020;11(49):1–15.
3. Abouchadi A. Pan-Facial Fractures: A Retrospective Study and Review of Literature. Open J Stomatol. 2018;8(4):110–9.
4. Abosadegh MM. Epidemiology of Maxillofacial Fractures at a Teaching Hospital in Malaysia: A Retrospective Study. Biomed Res Int. Hindawi; 2019;2019.
5. Saputra AD. Studi Tingkat Kecelakaan Lalu Lintas Jalan di Indonesia Berdasarkan Data KNKT (Komite Nasional Keselamatan Transportasi) Dari Tahun 2007-2016. Injury. 2017;43(1):179–90.
6. Petersen LØ. Sequelae of Major Trauma Patients with Maxillofacial Fractures. Ann Otol Rhinol Laryngol. 2021;130(5):475–82.
7. Somoye MS. A comparative study of quality of life of patients with maxillofacial fracture and healthy controls at two tertiary healthcare institutions. J Korean Assoc Oral Maxillofac Surg. 2021;47(5):351–9.
8. Ariobimo BN. Profile of Maxillofacial Fracture Patients at General Hospital in Surabaya. Biomol Heal Sci J. 2021;4(1):1.
9. Singh RK. Helmet shielding effect in mandibular fractures during road traffic accident. Natl J Maxillofac Surg. 2021;12(1):56–61.
10. Fakhrurrazi. Relationship between trauma mechanism and etiology on mandibular fracture patterns. Dent J (Majalah Kedokt Gigi). 2010;43(1):1.
11. Dergin G. Evaluation and Management of Mandibular Fracture. Trauma Dent. 2018;0–16.
12. Sulistyani LD. Evaluation of Neuro-Sensory Disturbances of the Inferior Alveolar Nerve After Orif Procedure in Mandibular Fracture: a Systematic Review. J Stomatol. 2022;75(2):130–7.
13. Tay ABG. Inferior Alveolar Nerve Injury in Trauma-Induced Mandible Fractures. J Oral Maxillofac Surg. Elsevier Ltd; 2015;73(7):1328–40.
14. Rajkumar GC. Ocular Injuries Associated with Midface Fractures: A 5 Year Survey. J Maxillofac Oral Surg. Springer India; 2015;14(4):925–9.
15. Nayak SS. Effect of oral and maxillofacial injuries on the development of post-traumatic stress disorder: A cross-sectional study. Pesqui Bras Odontopediatria Clin Integr. 2021;21:1–8.
16. Thiagarajan B. Fracture zygoma and its management our experience. Otolaryngol Online J. 2013;13:1–5.
17. Grosjean L. Facial twitches in patients after maxillofacial surgery: A case series. Oral Maxillofac Surg Cases. 2017;3(3):76–9.
18. Khwairakpam M. Trismus: An overview and management. Drug Invent Today. 2019;(9):1882–6.
19. Kassam K. Fractured zygomatic arch: A traumatic cause for trismus. BMJ Case Rep. 2014;2013–4.
20. Borba AM. The effect of facial fractures on mouth opening range: a case series. Rsbo. 2018;1(3):142.