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Predictors of Intracranial Lesions in Le Fort II and III Maxillofacial Trauma Fractures in Prof. Dr. Igng Ngoerah Hospital

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ABSTRACT

Identifying intracranial lesions in patients with maxillofacial injuries is crucial to improving survival. The purpose of this study was to compile a predictive index of the occurrence of intracranial lesions based on age, location of trauma, and cause of injury in maxillofacial trauma patients. An analytical observational study with a retrospective cohort design. Bivariable analysis and Multivariate analysis using SPSS IBM 26. The value of $p<0.005$ is significant. There were 81 subjects with maxillofacial trauma with intracranial lesions. Most of the samples were 25 years old (71.6%). Meanwhile, based on the location of the fracture, most of the subjects suffered from Le Fort I, Le Fort II, or a combination of both (70.4%). Only 12.3% of subjects had Le Fort III fractures (with or without Le Fort I or II fractures), and only 17. 3% had concurrent Le Fort II and III fractures. As for 80.2% of the subjects suffered injuries caused by traffic accidents. Intracranial lesions were found in 59.3% of subjects with predominant EDH (21%). Age 25 years increased the risk of intracranial lesions with adjusted OR 19.77 (95% CI 3.77–103.67). Le Fort II & III fractures adjusted OR of 52.68 (95%CI 2.50–112.188). Traffic accident an adjusted OR of 16.75 (95%CI 2.83–99.29). There was a significant and independent relationship between age 25 years, location of Le Fort II & III fractures, and traffic accidents as a cause of injury with intracranial lesions in patients with maxillofacial fractures.

Keywords: maxillofacial trauma; intracranial lesion; predictor

INTRODUCTION

Maxillofacial trauma includes injury to the soft tissues and bones that comprise the maxillofacial structure. These bones have the nasoorbitoethmoid bone, zygomaticomaxillary bone, nasal bone, maxillary bone, and mandibular bone.[1] Patients with maxillofacial trauma often develop acute intracranial lesions because of the proximity of the maxillofacial anatomy to the skull. The maxillofacial area involves several essential functions: sight, smell, breathing, speech, and eating. These functions are very influential in injury and impact on quality of life the bad one.[2]

Cranial fractures are more likely to occur in the thin temporal and parietal bones, the sphenoidal sinus, the foramen magnum, the petrous temporal ridge, and the inner portions of the sphenoidal wings at the cranial base.[3] When the skull is impacted over a large area, deformity (change in shape) of the skull can occur with inward and outward bending. Linear cranial fractures in the temporal bone can sever the middle meningeal artery, which runs in a groove in the temporal bone, resulting in an intracranial lesion.[4]

Maxillofacial trauma has acute intracranial lesions of around 20% in Diangelis' study (2014), and in Yavad's study, only around 16.4%.[2,5]Patients with maxillofacial trauma accompanied by acute intracranial lesions have a poor prognosis if appropriate treatment is delayed. Some of these patients may end up with functional disabilities and even death.[3,5] Age, location of the maxillofacial fracture, initial Glasgow Coma Scale (GCS) score, and cause of injury is said to provide opportunities for acute intracranial lesions.[6]

Identification of intracranial lesions is crucial in the management of head trauma. Early detection of intracranial trauma can determine the treatment given and affect patient survival.[7](Detection of intracranial lesions is best done using a CT scan. However, this equipment is only sometimes available, especially in remote areas. Therefore, the authors are interested in identifying these factors because only a few studies have been conducted. It is essential for doctors who work in regions with no CT-scan facility. Hence, it overviews factors influencing acute intracranial lesions in Le Fort II and III maxillofacial trauma patients.

METHODS

An analytical observational study with a retrospective cohort design. The study was conducted at Prof. Dr. IGNG Ngoerah Hospital Bali from August to September 2021. The research data were taken from medical records with samples of maxillofacial trauma patients (mandibular fracture, maxillary fracture, and zygoma fracture) aged 17 years due to blunt objects from January - December 2020. Samples were excluded if the variables were incomplete, there was a history of comorbidities (brain tumor, meningitis, stroke, vascular disease in the brain), and damaged, lost, torn, or wet medical records. The data were age, location of the maxillofacial fracture, cause of injury, and intracranial lesions. Bivariable analysis was used to describe predictor factors or categories of predictor factors based on case-control groups calculated Crude odds ratio (OR). Multivariate analysis using logistic regression with the measure of association used is the adjusted odds ratio. The value of $p<0.005$ is significant.

RESULTS

This research was conducted at the Triage of Surgery and Medical Record Installation at Prof. Dr. IGNG Ngoerah Denpasar Hospital. Eighty-one study subjects experienced maxillofacial trauma with intracranial lesions and met the study inclusion criteria. The characteristics of the research subjects are presented in Table 1.

TABLE 1: Characteristics of research subjects.

Variable	
Gender, n (%)	
Man	70 (86.4)
Woman	11 (13,6)
Age, n (%)	
<25year	23 (28.4)
≥25 years	58 (71.6)
Location of fracture, n (%)	
Le Fort Ior II	57 (70.4)
Le Fort III	10 (12,3)
Le Forts II & III	14 (17,3)
Cause of injury, n (%)	
Not traffic accident	16 (19,8)
Traffic accident	65 (80.2)

Data on the proportion of intracranial lesions and the degree of injury severity are presented in Table 2.

TABLE 2: Description of the proportion of intracranial lesions and the severity of the injury.

Variable	
Intracranial lesion, n (%)	
No	33 (40.7)
Yes	48 (59.3)
EDH, n (%)	
No	64 (79.0)
Yes	17 (21.0)
SDH, n (%)	
No	72 (88.9)
Yes	9 (11,1)
SAH, n (%)	
No	73 (90.1)
Yes	8 (9,9)
ICH, n (%)	
No	72 (88.9)
Yes	9 (11,1)
Others, n (%)	
No	61 (75.3)
Yes	20 (24.7)

The results of the chi-square analysis test for age, fracture location, and cause of the fracture are in Table 3.

TABLE 3: Age factor, fracture location, and causes of injury as a predictor of acute intracranial lesion in maxillofacial trauma patients.

Characteristics	Intracranial Lesion		P	OR	95% CI
	Negative	Positive			
Age Group					
<25 years	18 (54.5)	5 (10,4)	< 0.001*	10,320	3.26 – 32.66
≥ 25 years	15 (45.5)	43 (89.6)			
Fracture Location					
Le Fort I and/or II	28 (84.8)	29 (60.4)	0.017*	1	
Le Fort III	4 (12,1)	6 (12.5)		1.45	0.37 – 5.69
Le Forts II & III	1 (3,0)	13 (27.1)		12.55	1.54 – 102.42
Fracture Causes					
Non-Traffic Accident	14 (42.4)	2(4,2)	< 0.001	16.95	3.51 – 81.87
Traffic Accident	19 (57.6)	46 (95.8)			

The results of multivariate data analysis on the effect of age, fracture location, and causes of injury with intracranial lesions using the logistic regression test are shown in Table 4.

TABLE 4 : Test results for the relationship between the cause of the injury and intracranial lesions.

Variable	OR	95% CI	p. s
Age, n (%)			
<25year			
≥25 years	19.77	3.77 – 103.67	< 0.001*
Location of fracture, n (%)			
Le Fort Ior II			
Le Fort III	1.87	0.28 – 12.27	0.517
Le Forts II & III	52,68	2.50 – 112.188	0.011*
Cause of injury, n (%)			
Non-Traffic Accident			
Traffic Accident	16.75	2.83 – 99.29	0.002*

*Statistically significant relationship

DISCUSSION

In this study, accidents were the most significant cause of maxillofacial trauma, covering 65 out of 81 research subjects. Considering that many motorized vehicles are in Indonesia, accompanied by a lack of awareness of wearing helmets according to standards and using safety belts for car drivers.[8]These results are similar to a study conducted at H. Adam Malik General Hospital, where it was found that the most common etiology was an accident (93.33%), followed by a fall (6.67%).[9]Kumar et al. also reported that accidents (86.4%) were the most common etiology, followed by falls (8.9%), violence (1.8%), and others.[10]

The incidence of maxillofacial trauma by sex in this study was male compared to females, 70: 11, where males experienced more maxillofacial trauma than females. This is to several studies conducted by Zandi and Seyed, which reported that the ratio of men to women was 7.8: 1.[11] Pappachan and Alexander also said that sex preference was seen in more men (90%) than women (10%), with a ratio of 9: 1.[12] Roccia (2019) stated that men tend to be more involved in driving cars, riding motorbikes, and violence, so they have more potential to cause maxillofacial trauma.[13]

The age distribution of the subjects in this study showed that more were aged more than or equal to 25 years (71.6%). This is comparable to research conducted in Turkey by Arslan (2014), where it was found that the average age was between the second and fourth decades. This is because, at that age, they are prone to outdoor activities, especially on the highway, so they are at risk of having a traffic accident.[6]

EDH was the most common specific intracranial lesion in this study, found in 21% of subjects. Different results in the incidence of intracranial lesions were obtained in a study by Arslan (2014), where subarachnoid hemorrhage was said to be the most common brain injury that occurred together with maxillofacial trauma (44.8%), followed by contusion (22.4%), epidural hematoma (20.9%), pneumocephalus (19.4%), subdural hematoma (16.4%) and diffuse axonal injury (6%).[6]This is different because the place and time of the research are different.

Based on the results of the chi-square analysis in this study, a p-value of 0.001 was obtained (P Value <0.05) with an OR value of 10.320 (95% CI 3.26 – 32.66). So it can be concluded that age can be used as a predictor of intracranial lesions because it differs statistically significantly.

Similar results were found in multivariate analysis with an adjusted OR of 19.77 (95% CI 3.77 – 103.67), indicating an independent relationship between age and intracranial lesions.

This aligns with findings from other studies, which state that young people have a greater risk of developing intracranial lesions. In a study conducted by Salottolo et al., it was found that in 6170 patients with injuries studied, it was found that worsening occurred in the younger age group compared to the older group.[14] Head trauma is more common in people under the age of 35.[15]The incidence of head injuries mainly occurs in the productive age group between 15-44 years.[16] Zamzami et al. (2013) found the highest prevalence of age between 18-45 years (59.9%), and the age of 21-40 years (39.6%) was the highest prevalence in Ilyas's study (2010).[17,18]

Likewise, according to American research, the incidence of head injuries due to trauma decreases in adulthood, where motor vehicle accidents and violence, previously the main injury etiologies, are replaced by falls at the age of> 45.[19]Similar results were found in the Capizin study, in which head injury was said to be the most common among 15 to 24-year-olds.[20]

Chi-square analysis between categories of fracture location and intracranial lesions in this study obtained a p-value of 0.001 (P Value <0.05) for the Le Fort II & III fracture category compared to the Le Fort I and/or II fracture category only. So, the location of the fracture can be used as a predictor of intracranial lesions because it differs statistically significantly.

These results agree with previous findings that found an association between fracture location and intracranial lesions. Le Fort II fractures were found to be associated with intracranial lesions. In addition, the number of maxillofacial fractures also dramatically influences the occurrence of acute intracranial lesions. The greater the number of fractures, the greater the risk of acute intracranial lesions.[11]This explains why the combination of Le Fort II and III fractures was associated with an increased risk of intracranial lesions in this study.

In 2013 in Indonesia, the prevalence of head trauma was 8.2%, with the most common causes of injury falling at 40.9%, motorcycle accidents at 40.6%, injuries from sharp and blunt objects at 7.3%, other land transportation at 7 .1%, and fell at 2.5%.[8]Likewise, this study found that out of a total of 81 samples, the majority, namely 65 people, had accidents.

Furthermore, chi-square analysis and logistic regression in this study found an association between traffic accidents as a cause of injury and intracranial lesions. In the chi-squared analysis, a p-value <0.05 was found, which indicated a relationship. A significant and independent association was found in logistic regression between injuries caused by traffic accidents and intracranial lesions with adjusted OR 16.75 (95% CI 2.83 – 99.29).

The pathomechanism of intracranial lesions in maxillofacial fractures is that the bone functions as a safety cushion that protects the brain from injury and protects motorists when traffic accidents occur. However, the effects of the impact are still transmitted to the brain structures. Although the maxillofacial bone absorbs the forces of impact trauma, multiple fracture sites and mechanisms of severe injury can exacerbate intracranial lesions. Traffic accidents were also found to be the most common cause of maxillofacial trauma, and the most common head injury was motorcycle accidents (43.7%), followed by car accidents (29.8%), violence (16.9%), falls from heights (8,3%), others (0,3%).[11]

With this research, it is hoped that the successful management of maxillofacial trauma with head injuries will improve and significantly reduce patient morbidity and mortality. However, the principle of early administration of trauma, especially maxillofacial trauma, should not be forgotten. Airway management and control of the cervical spine remain the main mandatory. An essential, safe, and clear airway is ensured at the first step. In maxillofacial trauma or other conditions associated with complex airway maintenance, where upper airway obstruction may occur suddenly due to aspiration of broken teeth, blood clots, or fracture fragments, emergency cricothyroidotomy may be performed on a temporary airway. Reckless and unstable manipulation of the spine in an attempt to maintain the airway increases the risk of spinal cord injury. Therefore equal priority should be given to cervical spine stabilization with in-line traction and efforts to keep the airway.[10]

This study has several limitations; the limited sample size accompanied by the sample distribution between categories in the variables studied causes wide confidence intervals. The analysis results above show that the sample distribution tends to be unequal in one type, such as a ratio of 70:11 for sex characteristics and 65:16 for injury-causing factors. The small number of n in one or more of the cells in the cross-tabulation analysis and logistic regression, which is then performed, causes the confidence range to tend to be broad. In addition, this study only addresses some factors associated with intracranial lesions.

CONCLUSION

Based on the results and discussion above, some conclusions can be drawn as follows:

1. There is a significant and independent relationship between older age, especially≥25 years old, with intracranial lesions in patients with maxillofacial fractures.
2. There is a significant and independent relationship between the location of Le Fort II & III fractures that occur together with intracranial lesions in patients with maxillofacial fractures.
3. There is a significant and independent relationship between traffic accidents as a cause of injury and intracranial lesions in patients with maxillofacial fractures.

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DECLARATIONS

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