

Correlation between the Severity Level of Maxillofacial Trauma with Prealbumin Level in Patient Treated with Open Reduction Internal Fixation Followed by Intermaxillary Fixation

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Abstract: ***Introduction:** Nutritional status is a factor that must be critically evaluated in candidates for oral surgery patients, who will be carried out open reduction internal fixation (ORIF) followed by intermaxillary fixation (IMF) because it will disrupt the patient's normal diet. Prealbumin (PAB) is a biomarker that is sensitive to malnutrition. The purpose of this study was to analyze differences in prealbumin levels before and after ORIF and IMF and the relationship between prealbumin levels and MFISS scores in maxillofacial trauma patients. **Methods:** Analytical observational study with a cross-sectional approach was carried out in patients with maxillofacial trauma that will be treated with ORIF and IMF at HasanSadikin Hospital, Bandung, Indonesia on periode October 2017- March 2018. The assessment of MFISS scores performed one day before the operation and the retrieval of the blood sample examination material taken a day before the operation and postoperatively at day 2 and 14. The data collected then analyzed by using Wilcoxon test to determine prealbumin levels before surgery and postoperative, while Chi Square test used to fill MFISS scores with pre and postoperative prealbumin levels. **Results:** From 16 maxillofacial trauma patients, 3 patients with minor category, 4 patients with moderate category, 3 patients with serious category, and 6 patients with severe category. Analysis of the correlation between preoperative prealbumin levels and postoperative days 2 and 14 with p-values of 0.033 and 0.191, respectively. Correlation analysis between MFISS score and preoperative prealbumin level, on day 2 and day 14 after operation with p-value 0.145; 0.017; and 0.325, respectively. **Conclusion:** There was a significant difference between prealbumin levels of preoperative and postoperative day 2. Furthermore, there was a significant correlation between the severity of maxillofacial trauma based on MFISS scores with prealbumin levels postoperatively on day 2.*

Keywords: IMF, Maxillofacial Trauma, MFISS, ORIF, Prealbumin

1. Introduction

Maxillofacial injury is a trauma with a high incidence. In maxillofacial trauma, the maxilla and mandible are generally involved. One treatment option is open reduction internal fixation (ORIF) which is then followed by the use of intermaxillary fixation. Intermaxillary fixation serves as the basis for maxillofacial reconstruction, providing a stable basis for restoring facial shape and function.¹⁻³ The incidence of maxillofacial fractures varies greatly between different countries. The main causes throughout the world are traffic accidents, attacks, falls and sports injuries⁴

Nutritional status is one of factor that must be critically evaluated on candidate patients for oral and maxillofacial surgery, because this evaluation complete surgeons with an indication of the patient's response to stress from surgery, because in the intraoperative period the patient will lose large amounts of fluid, blood, and nutrition, then in the postoperative period, patients can also show edema, pain, and paresthesia which makes difficult to eat. Intermaxillary fixation interferes patient's normal diet. Many studies have shown the role of nutrition in the body's healing process.^{1,5,6}

Prealbumin serum (PAB) is often used to help assess the adequacy of nutritional support that is preferred over other serum proteins such as albumin and transferrin, due to a shorter biological half-life of 2-3 days.^{6,7,8}

Chen Chen et al conducted a study in 2014, comparing 4 systems that measured the severity of maxillofacial trauma that was often used, namely: New Injury Severity Score (NISS), Facial Injury Severity Scale (FISS), Maxillofacial Injury Severity Score (MFISS), and Mandibular Injury Severity Score (MISS). In this study it was found that MFISS is a system of assessing severity that is more suitable for maxillofacial assessment.⁹

2. Methods

Research procedure was approved by Health Research Ethics Committee Universitas Padjadjaran Fakultas Kedokteran, Bandung, Indonesia number 990/UN6.C.10/PN/2017. Patient will get information about the research procedure and give the approval by signing informed consent.

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This research was cross sectional research with analytical observational data from patient with maxillofacial trauma treated with ORIF and IMF at HasanSadikin Bandung Hospital from October 2017 to March 2018. The inclusion criteria were patients aged 14-60 years who would be treated with ORIF, then followed by intermaxillary fixation, and does not have a history of malnutrition, thyroid disease, kidney disorders, lung disease, and diseases with damage to the hepatocellular or cardiovascular system.

Research data was obtained from medical record of the patient included information about data identification from each patient who are eligible, pathology diagnose from panoramic rontgen, skull AP lateral, *Computed Tomography (CT) scan*, and laboratorium examination for prealbumin level. The assessment of the MFISS score was done the day before the operation and blood sampling was carried out the day before the operation, 2nd and 14th day postoperatively. The data collected were then analyzed by Wilcoxon test for differences in preoperative and postoperative prealbumin levels while Chi Square test for the association of MFISS scores with pre and postoperative prealbumin levels.

3. Results

Patient characteristic in this research was included gender and age. Characteristic data was:

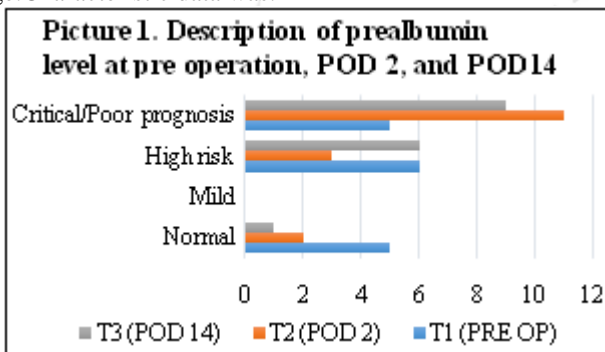


Table 1: Patient characteristics

| Patient characteristics | f (n) | Percentage (%) |
|-------------------------|-------|----------------|
| Gender | | |
| Male | 13 | 81.3 |
| Female | 3 | 18.3 |
| Age | | |
| ≤20 years old | 7 | 43.8 |
| 21-30 years old | 4 | 25.0 |
| 31-40 years old | 3 | 18.8 |
| 41-50 years old | 2 | 12.5 |

Most of patient was male (81.3%) dan female only (18.3%). Most of patient range age was ≤ 20 years old with percentage was 43.8%, while the rest was between age 21-50 years old.

Maxillofacial trauma was calculated based on MFISS to evaluate the severity of maxillofacial trauma. According to this research, from 16 patients, 37% was in severe category, 25% in moderate category, then minor and serious category were 19%, respectively.

Data recorded about nutritional status of patients was measured by taking the patient's blood serum to check the patient's prealbumin level. Prealbumin can be categorized as normal, mild, high risk, and critical or poor prognosis.

According to Figure 1 it can be seen that before treatment, from 16 patients, 6 patients (31.3%) were in high risk categories, 5 patients (31.3%) were in critical or poor prognosis, and 5 patients (31.3%) others were normal, two days after the internal reduction fixation, the prealbumin level dropped in the critical category with the number of patients increasing, as many as 11 patients (68.8%), and 14 days after internal fixation with intermaxillary fixation, 9 patients (56.3%) still in the high risk category of prealbumin level. Comparison of prealbumin levels at pre and post ORIF with intermaxillary fixation is shown in table 2. Shows a significant difference between prealbumin levels before and two days after ORIF treatment with p-value (p 0.033) while prealbumin levels of maxillofacial trauma patients before and 14 days after ORIF treatment with intermaxillary fixation did not have a significant difference (p 0.191).

Table 2: Comparison of prealbumin levels at pre and post ORIF with intermaxillary fixation

| Prealbumin Level | Wilcoxon Test* | | |
|------------------|----------------|-------|---------|
| | Mean | SD | p-value |
| T0-T1 | 7,47 | 15,07 | 0,033* |
| T0-T2 | 8,40 | 15,26 | 0,191 |

Note: The test uses the Wilcoxon test

*Meaningful if the value of p <0.05

The relationship between the severity of maxillofacial trauma based on MFISS scores and prealbumin levels in patients can be seen in table 3. The table shows that there is a significant relationship between the severity of maxillofacial trauma based on MFISS scores and prealbumin levels after 2nd day ORIF surgery (p 0.017) with the association degree of relations in the strong category (0.702) while the relationship between MFISS scores and pre-albumin levels preoperative and after 14th day ORIF surgery does not have a significant relationship, respectively (p 0.145) and (p 0.325).

Table 3: Relationship between the severity of maxillofacial trauma based on MFISS scores and prealbumin levels in patients with ORIF accompanied by intermaxillary fixation

| MFISS Scores | Prealbumin Levels | | | | | | | | | | | |
|--------------------|-------------------|-----------|----------|------|--------|-----------|----------|------|--------|-----------|----------|------|
| | Preoperative | | | | POD 2 | | | | POD 14 | | | |
| | N | High Risk | Critical | f(n) | N | High Risk | Critical | f(n) | N | High Risk | Critical | f(n) |
| Minor | 0 | 3 | 0 | 3 | 1 | 2 | 0 | 3 | 0 | 1 | 2 | 3 |
| Moderate | 2 | 1 | 1 | 4 | 4 | 0 | 0 | 4 | 2 | 0 | 2 | 4 |
| Serious | 1 | 0 | 2 | 3 | 3 | 0 | 0 | 3 | 2 | 0 | 1 | 3 |
| Severe | 2 | 1 | 3 | 6 | 3 | 0 | 3 | 6 | 4 | 0 | 2 | 6 |
| Prob. Chi Square | 0.145 | | | | 0.017* | | | | 0.325 | | | |
| Association degree | 0.611 | | | | 0.702 | | | | 0.55 | | | |

Note: The test uses the Chi-Square relationship test

* Meaningful if the value of $p < 0.05$

3. Discussion

The maxillofacial region is the most open and more vulnerable to trauma. The main causes for maxillofacial fractures as reported throughout the world are interpersonal violence, traffic accidents, falls, and sports injuries. Traffic accidents contribute significantly to mortality and morbidity throughout the world and especially in developing countries.^{10,11}

Significant differences were found in the levels of prealbumin pre and 2nd day post ORIF. In accordance with research by Lulian DT, et al.¹² and Wang F, et al.¹³ in patients with different types of surgery showed a significant difference between pre and postoperative prealbumin levels (thoracic surgery). As previously discussed, the metabolism of protein is significantly impaired after trauma, such as surgery, sepsis and burns. Some literature showed that catabolism in injury triggers an increase in vascular permeability. The most important thing about protein loss in postoperative due to fluid sequestration in the third space due to inflammatory after surgery and trauma which caused by tissue swelling and protein leakage into the interstitial space. Capillary leak is known as an important phenomenon in sepsis and trauma (surgery). The transcapillary exchange clearly depends on the underlying trauma and does not increase after minor surgery. Hemodelusi is also one of the causes of postoperative decline in prealbumin and albumin levels. Thus the duration and blood loss can be a reliable parameter for the decrease in postoperative prealbumin levels.

There was no significant difference in prealbumin levels on pre and POD 14th were still in the critical category because even the phase of inflammatory had ended the patient were still in the state of lack of nutrition and dehydration due to the use of intermaxillary fixation which limited the patient's diet. It is difficult to compare with other studies because there is no reference showed prealbumin levels with intermaxillary fixation measures.

A significant relationship between the severity of maxillofacial trauma based on MFISS scores and prealbumin levels after 2nd day post ORIF. Large of trauma such as surgery, often followed by tissue and systemic inflammatory reactions, transfer of fluid to the interstitial space and intravascular, then the response to trauma is followed by a decrease in albumin and prealbumin levels. In addition, the

decrease in prealbumin levels is due to its nature as a negative reactant in the acute phase, whose levels will decrease with stress. In the early phase of the stress response, catabolic processes predominate and there is net loss of nitrogen while available amino acids are diverted towards positive acute phase reactant synthesis such as C-reactive protein, complement protein, and fibrinogen. Prealbumin levels usually reach the nadir within 3 to 5 days after the onset of acute injury, coinciding with the peak urinary nitrogen excretion. Prealbumin levels were also found to decrease with the length of stay. This study is similar to a study conducted by Hubner et al. (2015) which examined albumin levels which also act as negative acute phase proteins as markers of surgical stress, finding that rapid postoperative albumin reduction illustrates the severity of surgical trauma and is associated with surgical side effects.

The MFISS score itself illustrates the severity of trauma so that it can be concluded that the higher the severity of the trauma will affect the surgical procedure to be performed, both in the level of difficulty of the operation and the duration of the operation. Prealbumin itself is closely associated with reliable replacement parameters from the degree of operating difficulties (duration and blood loss).

5. Conclusion

Patients with maxillofacial trauma and treated with ORIF, the prealbumin levels would be decreased after surgery due to surgical stress that causes systemic and tissue inflammatory reactions, accompanied by large amounts of fluid entering the interstitial and intravascular spaces. The severity of maxillofacial trauma will affect the decrease in prealbumin levels of patients after internal open reduction fixation, the higher the severity of maxillofacial trauma, the prealbumin levels will also decrease postoperatively.

4. Acknowledgement

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5. Conflict of Interest

The authors report no conflict of interest

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