Original Research Article

Relationship between the injury severity score and GAP score with IL-6 cytokine in fracture patients with multiple trauma

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ABSTRACT

Background: ISS, GAP scores and the cytokines IL-6 reflects the severity of an injury. Recently levels of the cytokine IL-6 are the best biomarker that reflects the severity of the trauma. There has been no research on the relationship between ISS and GAP scores with IL-6 cytokine level in fracture patients with multiple traumas. This study is a cross-sectional observational study.

Methods: All fracture patients treated at Sanglah Emergency Unit started in January 2016 that met the inclusion criteria became sample. At sample, we calculate ISS and GAP scores and took blood samples for examination of IL-6 cytokine level. Bivariate analysis performed by Chi-square to determine the relationship between ISS and GAP score with IL-6 cytokine level.

Results: Samples were 60 patients from January to April 2016. In this study, the correlation between the ISS and IL-6 cytokines was 0.05 (p=0.705), whereas the correlation between GAP scores and IL-6 cytokines was -0.399 (p=0.002).

Conclusions: In this study there was positive correlation that weak and not significant between the ISS and IL-6 cytokines and there was a negative correlation that had moderate strength and significant between GAP scores and IL-6 cytokines.

Keywords: ISS, GAP score, IL-6 cytokine, Multiple trauma

INTRODUCTION

Multiple trauma was defined as an injury to at least two organ systems with a degree of severity that is quite high which is accompanied by systemic reactions which would then lead to a dysfunction or failure of the organ (multiple organ dysfunction syndrome / MODS) that is far from injury site and organ systems that are vital but not experiencing injury from direct trauma. In fracture patient with multiple trauma requires special management that we called damage control orthopaedi which aims to provide initial management of fractures without increasing physiological stress on the patient, and then when the patient is stabilized, the definitive treatment can be taken.[1]

Injury Severity Score (ISS) more than 16 used to define multiple traumas. ISS as a trauma scoring system has limitations, for example the number of injuries that was counts can only be three, which one came from three regions of the body which has the worst injury, so it will cause underscoring when the patients have more than one significant injury in one region of the body. ISS only take into account the anatomical data and ignore the physiological.[2] Yutaka Kondo et al in 2011 created a new trauma scoring system called GAP score (GCS, Age, and Arterial Pressure). Yutaka Kondo et al stated that GAP score may reflect the severity of the trauma and predict mortality in trauma patients better than other trauma scoring system.[3]

In addition to trauma scoring system, there are other parameters that are used to reflect the severity of the trauma and predict mortality in patients with multiple traumas, one that is widely studied is cytokine. In the study by Michael Frink et al in 2009 on the correlation between levels of the cytokine TNF-α, IL-1β, IL-6, IL-8 and IL-10 with the occurrence of mortality, they found a correlation between elevated levels of the cytokine IL-6, IL-8, and IL-10 with the occurrence of mortality in patients with multiple trauma and found that IL-6 has the highest accuracy to predict mortality in patients with multiple trauma.[4]

Injury Severity Score, GAP scores and IL-6 cytokines reflects the severity of an injury. Recently IL-6 cytokines is the best biomarker which can reflect the severity of the trauma. There has been no study on the relationship between ISS and GAP scores with IL-6 cytokines in fracture patients with multiple traumas.

METHODS

The study was conducted from January 2016 until April 2016 at the Sanglah General Hospital Denpasar Bali. The aim of this study is to determine the relationship between the ISS and GAP score with IL-6 cytokines in fracture patients with multiple traumas.

This study is a cross sectional observational designs with the sample are fracture patients with multiple traumas in Sanglah General Hospital with consecutive sampling method. Sixty multiple trauma patients were included. At sample, we calculate ISS and GAP scores and took blood samples for examination of IL-6 cytokine level. The analysis begins with a descriptive analysis to determine the characteristics of the subjects then bivariate analysis was performed using Chi-square to determine the relationship between ISS and GAP score with IL-6 cytokines.

RESULTS

Sample of 60 people from Sanglah Hospital from January 2016 until April 2016 who met the inclusion criteria and no exclusion criteria were taken for the study.

Table 1: Sample characteristics.

	Total (n=60)
Sex	
Male	68.3%
Female	31.7%
Age	35.5±15.6
Mechanism of accident	
Traffic accident	71.7% (43)
Other than traffic accident	28.3% (17)

The sample consisted of 41 male (68.3%) and 19 women (31.7%) with a mean age of 35.5 years (SD=15.6). The

mechanism of injury of the sample are traffic accident for 43 people (71.7%) and not traffic accident for 17 people (28.3%). Characteristics of this research can be seen in Table 1. In this study, the mean ISS was 19.6 (SD = 2.9) and GAP score was 19.9 (SD = 2.4). Levels of the cytokine IL-6 has a mean of 172.1 pg / mL (SD = 159.6). ISS, GAP score, and the cytokines IL-6 can be seen in Table 2.

Table 2: ISS, GAP score and IL-6.

	Total (n=60)
ISS	19.6±2.9
GAP score	19.9±2.4
IL-6 cytokine level	172.1±159.6

(Mean ± SD)

In this study, the correlation between the ISS and IL-6 cytokines was 0.05 (p=0.705), whereas the correlation between GAP scores and IL-6 cytokines was -0.399 (p=0.002). Correlation between the ISS and GAP score with IL-6 cytokines can be seen in Table 3.

Table 3: Correlation between ISS and GAP score with IL-6 cytokines.

	ISS	GAP score
Pearson correlation	0.05	-0.399
Sig (2 tailed)	0.705	0.002

DISCUSSION

Gebhard F et al describes the changes in cytokine levels of IL-6 post-trauma. In the study it was found that there is a correlation between levels of cytokines IL-6 in the first 6 hours post-trauma with the degree of trauma. Patients with the most severe injuries had the highest levels of IL-6 cytokines. That study concluded that the levels of the cytokine IL-6 may be used to evaluate the impact of trauma on the body of the patient.[5] Stensballe et al in 2009 found that the first day patients' level of the cytokine IL-6 more than 300 pg / mL correlated with 30-day mortality following trauma.[6]

In this study it was found there is a weak positive correlation and not significant between the ISS and IL-6 cytokines (Pearson correlation of 0.05 and p=0.705). Multiple trauma is defined when ISS more than 16. ISS as a trauma scoring system has limitations, the number of injuries that counts only three, only counts the three regions of the body that has the worst injury, underscoring can be happen when the patients have more than one significant injury in one region of the body. ISS only consider one injury per region of the body and unable to evaluate multiple injuries that occurred in the region of the same body so that the degree of severity of a trauma often incorrectly estimated. Additionally, ISS only take anatomical data into account and did not account the physiological data.[2] There are several scoring systems for trauma and it can be broadly classified into

three types based on the components that are used, that are anatomical score, physiological score, and combinations score. For anatomical score, there are several scoring systems, that are abbreviated injury score (AIS), injury severity score (ISS), and new injury severity score (NISS).

To score the physiological, revised trauma score (RTS) is a score that is most frequently used. RTS consists of three components, namely the Glasgow Coma Scale (GCS), systolic blood pressure (SBP), and respiratory rate (RR). The calculation of RTS is complicated that caused the limitations of the use of a score on the ground. The advantages of RTS are emphasizing the impact of significant head injury against the outcome of trauma patients. The disadvantage of RTS is the inability to accurately assess trauma patients that were intubated or on mechanical ventilation, as well as trauma patients who are under the influence of drugs and alcohol[2].

Weaknesses in RTS can be overcome by using GAP score. GAP score has three components, GCS, age and systolic blood pressure. GCS component is a component that has the highest proportion in the GAP score (highest score of 15 points), followed by a systolic blood pressure (the highest score of 6 points) and age (highest score of 3 points). High value of GAP score (max 24) reflect good prognosis whereas high value of ISS (max 75) reflect poor prognosis. Lichtveld RA et al found that head injuries and bleeding are the two most important factors that lead to death within 24 hours. GAP scores do not consider the respiratory rate as a component of the score and replaced by components of the patient's age. Lichtveld RA et al also found higher mortality in older patients. The decline of physiological function, reduced physiologic reserve, and the presence of comorbid conditions are factors that contribute to the higher mortality in older patients. Besides that, GAP scores are also more practical use in the field compared to RTS.[7,8]

In this study it was found that there was a negative correlation with moderate strength and significance between GAP scores and the IL-6 cytokines (Pearson correlation -0.399 and p = 0.002). Yutaka Kondo et al stated that GAP score may reflect the severity of the trauma and predict mortality in trauma patients better than other trauma scoring system. GAP scores has a score range between 3-24, a high value indicates a good prognosis.[3] GAP score has a negative correlation with the levels of the cytokine IL-6. Based on research data above, the low degree of trauma will show low levels of cytokines IL-6 and the high GAP score, and also have good prognosis. Levels of the cytokine IL-6 as a marker to predict the degree of trauma has a weakness, that are invasive, the results could not be known immediately and also expensive. GAP score has the advantage compared to the levels of the cytokine IL-6, that are not invasive, the score can be calculated immediately, and does not require an additional fee.

CONCLUSION

In this study there was positive correlation that weak and not significant between the ISS and IL-6 cytokines and there was a negative correlation that had moderate strength and significant between GAP scores and IL-6 cytokines.

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