

ELEVATION OF SERUM C-REACTIVE PROTEIN AS A PREDICTOR FOR SYSTEMIC INFLAMMATORY RESPONSE SYNDROME IN CERVICAL SPINAL CORD INJURY PATIENTS

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Objectives: Spinal cord injury has been an important medical issue with high incidence, complications, and mortality rate. For the past 2 decades, there have been a number of researches about the role of inflammatory mediators in trauma patients. However, up to now, there were limited references about the role of CRP as a predictor of SIRS in cervical spinal cord injury. **Methods:** This was an analytical prospective cohort study of 28 patients to determine the role of increase CRP serum as a predictor for SIRS in cervical spinal cord injury in Sanglah General Hospital, Bali-Indonesia. The data were descriptively analyzed by applying univariate and multivariate analysis to determine the role of increase CRP serum with SIRS in cervical spinal cord injury. Results were considered significant if $p < 0.05$. **Results:** From 28 samples collected, 18 samples (64.28%) were male, 12 samples were in >50 years old age group (42,86%), and the most frequent spinal cord injury scale was ASIA A (12 samples, 42,86%). Both univariate and multivariate analysis showed that increased serum CRP and ASIA Score were significant predictors of SIRS in cervical spinal cord injury patients. **Conclusion:** Increase in serum CRP value can be used as a reliable predictor for SIRS in cervical spinal cord injury patients.

Keywords: *C-Reactive Protein, Systemic Inflammatory Response Syndrome, Cervical Spinal Cord Injury.*

INTRODUCTION

Spinal cord injury was associated with 80% of multiple trauma.¹ Based on our experience in Sanglah General Hospital Bali-Indonesia, the majority of spinal cord injury patients was associated with prolonged hospital stay and multitude of complications, namely SIRS which will usually end with sepsis. Inflammatory response was found in trauma patients, though the exact mechanism is yet to be determined. Increase in circulatory cytokines, chemokines, and acute phase proteins have been detected in traumatic spinal cord injury (SCI) patients and C-reactive protein (CRP) were found as a potential marker for SIRS in traumatic SCI.² Serum CRP value was elevated in chronic spinal cord injury patients (7.3 ± 3.5 mg/dL, $p=0.05$) after the third day of admission.³

The purpose of this study was to determine the role of serum CRP level increase as a predictor for SIRS in traumatic SCI patients.

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METHOD

This was an analytical prospective cohort study of 28 traumatic SCI patients to determine the role of increase CRP serum as a risk factor for SIRS from January 2013 until April 2013. Samples were recruited consecutively for traumatic SCI patients who came to Emergency Department Sanglah General Hospital Bali-Indonesia and were given inform consent prior to data collection. Institutional review board/ethics committee approval was obtained from Local Medical Center and this study adhered to the tenets of the Declaration of Helsinki.

The diagnosis of traumatic SCI was based on clinical and radiological examination after the primary survey. Patients with multiple trauma, chronic inflammatory disorder, and under immune suppressive therapy were excluded. Serum CRP level was determined during admission and during the third day. During the third day, the samples were evaluated clinically for SIRS.

Data was described descriptively and Shapiro Wilk normality test was performed. The correlation between serum CRP level and SIRS was analyzed using Chi Square test and the mean difference of

increase CRP serum was analyzed using paired t-test. The samples were analyzed multivariately to determine the role of serum CRP increase as a predictor for SIRS.

RESULTS

From the 28 samples, there were 18 males (64.28%) and 10 females (37.72%). During admission, we observed that 16 samples (57.14%) had increase CRP serum and 12 samples (42.86%) did not. While on the third day, 14 samples (50.00%) had serum CRP level increase (Table 1).

Table 1

Sample Characteristic.		
Variables	n	%
Sex		
• Male	18	64.28%
• Female	10	35.72%
Age Group		
• 0-30 years	7	25.00%
• 31-50 years	9	32.14%
• >50 years	12	42.86%
ASIA Score		
• A	12	42.86%
• B	2	7.14%
• C	0	0.00%
• D	3	10.71%
• E	11	39.29%
Smoking		
• Yes	10	35.71%
• No	18	64.29%
CRP		
• Increased	16	57.14%
• Not Increased	12	42.86%

The correlation between variables and serum CRP level is shown in Table 2. Age group and ASIA Score were significantly correlated with serum CRP level increase (p=0.028 and p=0.002 respectively). From the multivariate analysis, ASIA Score was associated with serum CRP level increase (p=0.016, Exp(B)=0.034).

Table 2

ASIA Score and increase level of Serum CRP

Variables	Increase CRP Serum		Total	P-Value
	Yes	No		
ASIA Score				
ASIA A	8	4	12	0.002
ASIA B	2	0	2	
ASIA C	0	0	0	
ASIA D	0	3	3	
ASIA E	2	9	11	

Bivariate analysis of research variables with SIRS (Table 3) showed that serum CRP level increase (p=0.0001) and ASIA Score (p=0.002) were significantly correlated with the occurrence of SIRS in traumatic spinal cord injury patients.

Table 3

Correlation between Serum CRP, ASIA Score and SIRS

Variables	SIRS		Total	p
	SIRS (+)	SIRS (-)		
CRP				
Increase	14	2	16	0.001
Not Increased	0	12	12	
	14	14	28	
ASIA Score				
ASIA A	10	2	12	0.02
ASIA B	2	0	2	
ASIA C	0	0	0	
ASIA D	0	3	3	
ASIA E	2	9	11	
	14	14	28	

DISCUSSION

This prospective cohort study of 28 SCI patients determine that the role of increase CRP level as a predictor for SIRS. Among 28 samples, 16 samples (57.14%) had an increase of CRP serum level, 14 of them had SIRS (p=0.001). Multivariate analysis of research variables showed that serum CRP level increase and ASIA score were correlated significantly with SIRS in SCI patients. Loerakker et al (2012) found similar results from their samples, they found that serum CRP level started to increase during the first until third day of admission in SCI patients. They only used SCI patients with ASIA score A and B, which was concurrent with our results which showed that ASIA A-B group was significantly correlated with serum CRP level increase on the third day (p=0.02).⁴ We found no correlation between age, sex, and smoking with either serum CRP level increase and SIRS. Similar results was also found by Morse et al (2008), they concluded that serum CRP level increase >3mg/L was a risk factor for complications in SCI patients.⁵

The correlation between ASIA Score and SIRS in this study was most probably due to the more severe comorbidities in SCI patients with severe ASIA Score (ASIA A and ASIA B). These comorbid factors were responsible for the progressive inflammation process which will lead to SIRS⁶. The clinical implications of muscle paralysis in SCI patients was observed by Yamamotova et al in 2010. Serum profile of blood sugar, protein, lipid, and CRP will change immediately after SCI.⁷ A number of pathways which will lead to secondary damage on SCI have been identified. The role of neurological dysfunction and muscle paralysis in SCI have been studied by some researchers.⁸⁻¹⁰ Their findings

were in accordance with Ohnishi et al (2012), which stated that disuse muscle atrophy will lead to caudal motor neuron degeneration in SCI patients. From the biomolecular point of view, Fry et al (2012) stated that the proteolysis process in SCI patients was in fact was an autophagic process. Overexpression of autophagic protein Beclin-1 in denervated mouse models was correlated with muscle atrophy¹². They also found that SIRT1 protein overexpression will induce autophagic process through muscle cells starvation, in which SIRT1 will induce FoxO3a deacetylation and lead to muscle autophagy after atrophy.¹²

CONCLUSION

Serum CRP level increase was a predictor for SIRS in cervical SCI patients. Where an increase >14.22 mg/L of serum CRP level will lead to SIRS. ASIA Score was also correlated with SIRS in cervical SCI patients.

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