

Original Research Article

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## Systemic Inflammatory Response Syndrome Associated Alterations in Platelet Indices in Dogs

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### ABSTRACT

Systemic Inflammatory Syndrome (SIRS) has been recognized as a life threatening condition in both human and small animal patients admitted in critical care units. Septic and non-septic etiologies were documented in the cases with SIRS. Thrombocytopenia and disseminated intravascular coagulopathy (DIC) were consistently observed in many cases with SIRS. Hence, this study was carried out to evaluate the pattern of platelet indices in dogs with Systemic Inflammatory Response Syndrome (SIRS) in comparison with healthy controls. This study evaluated the platelet indices in blood samples obtained from 30 dogs admitted in Critical Care Unit of Madras Veterinary College with SIRS and the results were compared with 10 healthy dogs. Based on physical and hematological examination the dogs with SIRS were classified as SIRS signs with thrombocytopenia (n=15) and SIRS signs without thrombocytopenia (n=15). Blood samples were collected by cephalic venipuncture and analysis was performed using the auto hematology analyzer. The parameters assessed were viz., Mean Platelet Volume (MPV), Platelet Distribution Width (PDW) and Plateletcrit (PCT). The factorial ANOVA model was used for statistical analysis. The results revealed significant variations in platelet indices viz., MPV, PDW and PCT between the healthy dogs and the dogs with SIRS.

#### Keywords

Platelet Indices,  
Thrombocytopenia,  
SIRS, DIC, Dogs.

#### Article Info

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### Introduction

Systemic inflammatory response syndrome (SIRS) is a wide spread host response to an infectious as well as non-infectious insults and it is a clinical state rather than a disease entity. If SIRS left untreated, it can lead to multiple

organ failure and death (de Laforcade, 2015). Platelet activation during systemic inflammatory conditions contributes to the development of macro- or micro-thrombi, which can result in significant morbidity and mortality in hospitalized patients (Kidd and Mackman, 2013).

Platelet (PLT) indices are a group of parameters that are used to measure the total amount of PLTs, PLTs morphology and proliferation kinetics (Zhang *et al.*, 2014). Most important parameters among them are plateletcrit (PCT), mean platelet volume (MPV) and platelet distribution width (PDW) (Wiwanitkit, 2004). The average platelet size is described by the MPV and the variability in platelet size by the PDW (Bommer *et al.*, 2008). PCT determines the percentage of the blood volume that consists of platelets (Giacomini *et al.*, 2001).

### **Materials and Methods**

The study was carried out on the dogs admitted in the Critical Care Unit of Madras Veterinary College Teaching Hospital, Chennai. The dogs were screened for the characteristic signs of SIRS. The dogs presented with two or more of the SIRS criteria (Table 1) as described by Otto (2007) were included in this study.

Hence, the dogs presented with hypothermia, hyperthermia, tachycardia, tachypnea, leukocytosis, leukopenia, thrombocytopenia, progressive multi organ dysfunction syndrome, persistent hypotension were assessed through clinical examination. Blood samples were collected from apparently healthy dogs (n=10) brought for immunization and dogs with SIRS (n=30) by cephalic venipuncture into EDTA anticoagulant tubes and transported to the laboratory immediately.

Mean Platelet Volume (MPV), Platelet Distribution Width (PDW) and Plateletcrit (PCT) analysis were performed using the BC-2800 Vet Auto Hematology Analyzer (Mindray Medical Instrumentation).

Selected cases were subjected for further diagnostic tests *viz.*, abdominal ultrasonography, radiography of thorax and

abdomen, fine needle aspiration cytology of lumps, examination of peripheral blood smears stained with Giemsa stain for blood parasites, microscopic agglutination test for leptospirosis for diagnosing the existing etiology of SIRS. Based on physical examination and hematological analysis, the dogs were classified into three groups *viz.*,

Group 1: SIRS signs with thrombocytopenia (n = 15)

Group 2: SIRS signs without thrombocytopenia (n = 15) and

Group 3: Apparently healthy control (n=10)

Statistical analysis was performed using SPSS 12 statistical package. Data were analyzed by using one way ANOVA and the critical difference was estimated by Duncan's test. Receiver's operating curve (ROC) analysis was performed using Medcalc-version 18.5. The sensitivity, specificity and J index were calculated (Table 4).

### **Results and Discussion**

Underlying disease identified in thirty SIRS patients are given in table 2. In the present study number of male animals (n=19) reported were higher than females (n=11).

There was a variety of breeds represented within the study, with the most common being Spitz (8), Non Descripts (5), Labrador Retriever (5), German Shepherd (4), Golden Retriever(3), Doberman (3), Great Dane (1) and Boxer (1). The age represented in this study were ranged from 2 months to 14 years. The results of statistical analysis are given in table 3. In this study we found that platelet count and PCT were decreased whereas MPV and PDW were increased in response to SIRS associated coagulopathy.

**Table.1** Criteria for SIRS in dogs

<b>Temperature</b>	<37.2°C or >39.4°C
<b>Heart Rate (beats/min)</b>	>150/minute
<b>Respiratory Rate (breaths/min)</b>	>40/minute
<b>WBC count (cells/cmm)</b>	<5000 or >19000 >5% bands

**Table.2** Etiological diagnosis of SIRS patients

Clinical Diagnosis	Number of cases	Diagnostic methods
<b>Ehrlichiosis</b>	7	Peripheral blood smear stained with Giemsa stain
<b>Skin/Soft tissue infections</b>	5	Deep pyoderma and septic wound during clinical examination
<b>Haemorrhagic Enteritis</b>	4	Clinical examination and history of haemorrhagic diarrhoea
<b>Snake bite</b>	4	History and clinical examination, presence of fang marks / edema and necrosis of local tissue
<b>Pyometra</b>	3	Abdominal ultrasound
<b>Leptospirosis</b>	2	Microscopic Agglutination Test
<b>Mammary Tumour</b>	1	Fine Needle Aspiration Cytology
<b>Prostatic abscess</b>	1	Abdominal ultrasound
<b>Trypanosomiasis</b>	1	Peripheral blood smear stained with Giemsa stain and Woo's method
<b>Ancylostomiasis</b>	1	Fecal examination
<b>Bebesiosis</b>	1	Peripheral blood smear stained with Giemsa stain

**Table.3** Values of Platelet Indices (Mean± SE) in apparently healthy dogs and dogs with SIRS

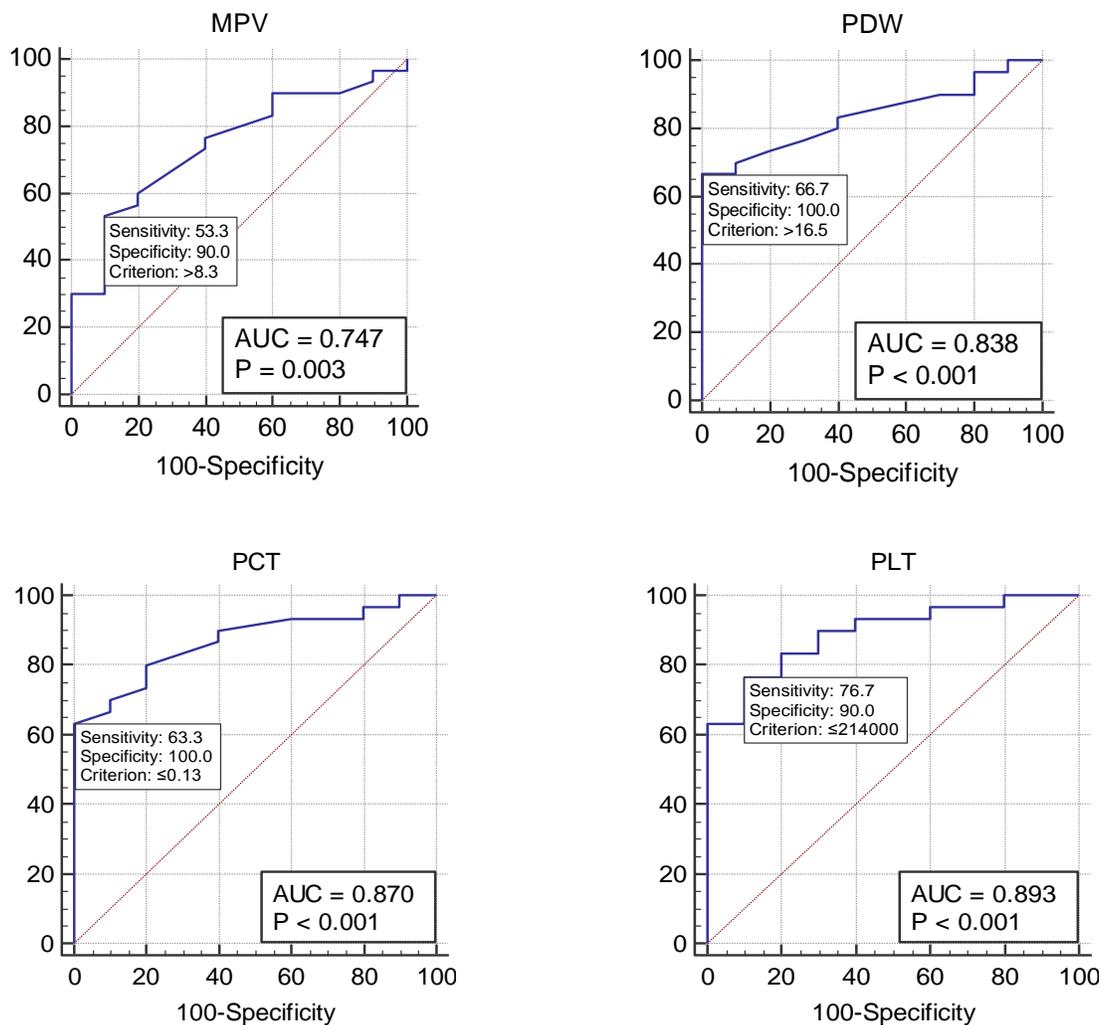
	Group 1	Group 2	Group 3	F value	Significance
PLT count (lakhs/cmm)	49,133±7482 <sup>a</sup>	2,35,000±21,137 <sup>b</sup>	3,72,000±51,358 <sup>c</sup>	35.38**	p<0.000
MPV( fL)	8.89±0.24 <sup>b</sup>	8.08±0.23 <sup>a</sup>	7.66±0.21 <sup>a</sup>	6.703**	p<0.003
PDW(%)	17.19±0.20 <sup>c</sup>	16.48±0.24 <sup>b</sup>	15.8±0.21 <sup>a</sup>	8.826**	p<0.001
PCT(%)	0.05±0.07 <sup>a</sup>	0.20±0.03 <sup>b</sup>	0.29±0.04 <sup>c</sup>	18.74**	p<0.000

<sup>a,b,c</sup>The mean values bearing different superscripts vary significantly

**Table.4** ROC curve analysis (95% Confidence Interval)

	AUC	Z Stat	p	Y Index J	Sensitivity (%)	Specificity (%)
<b>Platelet Count (lakhs/cmm)</b>	0.893	7.621	<0.0001	0.6667	76.67	90.00
<b>MPV (fl)</b>	0.747	2.931	0.003	0.4333	53.33	90.00
<b>PDW (%)</b>	0.838	5.499	<0.0001	0.6667	66.67	100.00
<b>PCT</b>	0.870	6.590	<0.0001	0.6333	63.33	100.00

**Fig.1** Receiver's operating curve analysis for MPV, PDW, PCT and Platelet counts



In the present study PLT count, PDW and PCT showed a marked significant difference in between the control and the two groups of SIRS with thrombocytopenia and SIRS without thrombocytopenia whereas MPV

showed marked significance in SIRS with thrombocytopenic group when compared to SIRS without thrombocytopenia and healthy controls.

Receiver's operating curve analysis (Fig. 1) revealed that the platelet count was found more sensitive (76.7 %) than MPV, PDW and PCT. Whereas, PDW and PCT were found highly specific (100%) in the dogs with SIRS. Thus, the determination of MPV, PDW, PCT in addition to Platelet counts is highly valuable to predict the outcome in canine patients with SIRS.

Inflammatory processes may trigger activation of coagulation by an impaired function of natural anticoagulants (Levi and van der Poll, 2008). Feistritzer and Wiedermann (2007) stated that the activation of hemostasis may finally result in overt disseminated intravascular coagulation (DIC). Reports also indicated that DIC has been associated with increased platelet destruction (Acikgoz *et al.*, 2012). Yilmaz *et al.*, (2008) reported that changes in platelet count and its association with platelet indices may reflect alterations in platelet production and reactivity. Smith *et al.*, (2014) stated that monitoring of platelet activation status in hospitalized patients will be useful for early detection of patients at risk of thromboembolism might allow initiation of thromboprophylaxis and monitoring of the response of platelets to the treatment of underlying disease conditions

The result of the present study suggested that platelet indices are significant parameters in the diagnosis of SIRS associated coagulation disorders. Patients have high risk of death when they are presented with reduced PLT count & PCT or increased MPV & PDW as compared to patients with normal platelet indices.

## References

Acikgoz, S., D. Akduman, Z.M. Eskici, M. Can, G. Mungan, B. Guven, F. Comert and V. Sumbuloglu.2012. Thrombocyte and erythrocyte indices

in sepsis and disseminated intravascular coagulation. *J Med Biochem.* 31:60-64.

Bommer, N.X., D.J. Shaw, E.M. Milne and A.E. Ridyard, 2008. Platelet distribution width and mean platelet volume in the interpretation of thrombocytopenia in dogs. *J Small AnimPract*49:518–524.

deLaforcade, A., 2015. Systemic Inflammatory Response Syndrome, In Silverstein, D.C and K. Hopper, In textbook of Small Animal Critical Care Medicine, 2<sup>nd</sup> Edition. Saunders Elsevier, St Louis, pp: 30-34.

Feistritzer, C and C.J. Wiedermann, 2007. Effects of anticoagulant strategies on activation of inflammation and coagulation.*ExpetOpinBiolTher.* 7:855–870.

Giacomini, A., P. Legovini, G. Gessoni, F. Antico, S. Valverde, M.M. Salvadego and F. Manoni, 2001. Platelet count and parameters determined by the Bayer ADVIATM 120 in reference subjects and patients. *Clin Lab Haematol.*, 23(3): 181-186.

Kidd, L and N. Mackman., 2013. Prothrombotic mechanisms and anticoagulant therapy in dogs with immune-mediated hemolytic anemia. *J Vet Emerg Crit Care* 2013; 23(1): 3–13.

Levi, M and T.van der Poll, 2008. The role of natural anticoagulants in the pathogenesis and management of systemic activation of coagulation and inflammation in critically ill patients. *Semin Thromb Hemost.* 34:459–468.

Otto, 2007. Sepsis in veterinary patients: what do we know and where can we go? *J Vet Emerg Crit Care.* 17(4):329-332.

Smith, J.R., K.F. Smith and B.M. Brainard, 2014. Platelet parameters from an automated hematology analyzer in dogs with inflammatory clinical

- diseases. *Vet J.* 201(3):406-411.
- Wiwanitkit, V., 2004. Plateletcrit, mean platelet volume, platelet distribution width: its expected values and correlation with parallel red blood cell parameters. *ClinAppl Thrombosis/Hemostasis.* 10(2):175–178.
- Yilmaz, Z., O. Eralp and Y. Ozarda, 2008. Evaluation of platelet count and its association with plateletcrit, mean platelet volume, and platelet size distribution width in a canine model of endotoxemia. *Vet ClinPathol.* 37(2): 159–163.
- Zhang, Z., Xu, X., Ni, H. and Deng, H., 2014. Platelet indices are novel predictors of hospital mortality in intensive care unit patients. *J Crit Care,* 29(5): 885.e1-6.

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