

# Are Platelet Indices Useful in the Clinico Pathological Evaluation of Thrombocytopenic Dogs with Ehrlichiosis and Babesiosis?



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## Abstract

Thrombocytopenia is a common clinical syndrome seen in emergency veterinary patients and is the most common acquired hemostatic defect of dogs. Around 180 dogs brought to the Madras Veterinary College Teaching Hospital with clinical signs of thrombocytopenia and related spontaneous bleeding tendencies were evaluated for and usefulness of Platelet Indices useful in Ehrlichiosis, Babesiosis and Leptospirosis. The platelet indices were measured and the platelet morphology, status of activation, size and shape of the platelets was documented. The Platelet histogram of the platelet counts were plotted against the Mean Platelet Volume (MPV), Platelet Distribution Width (PDW) and Plateletcrit (PCT) and the platelet parameters of the thrombocytopenia group were compared with the control. The platelet indices did not have any diagnostic role in any of the thrombocytopenic disease in dogs with Ehrlichiosis and Leptospirosis. Where as an increased MPV was detected in Babesiosis affected dogs which can be adapted as a screening methodology to identify Babesiosis. Like the erythrocytic indices, the platelet indices seem important and need to be focused to detect platelet abnormalities in dogs affected with thrombocytopenia.

**Keywords:** Canine thrombocytopenia; Platelet indices; Hemostasis; Hemo protozoans

**Abbreviations:** MPV: Mean Platelet Volume; PDW: Platelet Distribution Width; PCT: Plateletcrit; IMTP: Immune-Mediated Thrombocytopenia; TCP: Thrombocytopenia

## Introduction

Platelets are the first line of defense in preventing blood loss due to micro and macro vascular injury. Abnormal platelet function and counts can result in bleeding typically characterized by mucocutaneous hemorrhage [1]. Thrombocytopenia is a common clinical syndrome seen in emergency veterinary patients and is the most common acquired hemostatic defect of dogs and cats. There are many causes of thrombocytopenia, including accelerated removal, decreased production, increased consumption and increased sequestration in the spleen and sample dilution [2].

The evaluation of thrombocytopenia plays a pivotal role in the prognosis of bleeding diatheses in dogs. However, the pathophysiology of thrombocytopenia, whether it is due to destruction or reduced production of platelets in dogs remain unclear. The Platelet indices i.e., Mean Platelet Volume (MPV), Plateletcrit (PCT) and Platelet Distribution Width (PDW) contribute more towards the platelet study.

## Review

Bommer et al. [3] demonstrated the relationship between MPV, PDW and platelet counts in a population of clinically healthy and systemically ill thrombocytopenic dogs and confirmed that both MPV and PDW were functions of platelet count, and changes in platelet volume indices should be interpreted in relation to platelet number.

According to Zvorc et al. [4] the common disorders in Babesia affected dogs were thrombocytopenia with decreased PCT and increased MPV (suggested activation of platelets).

Kaito et al. (2005) [5] and Boomer et al. (2008) [3] opined that the quantification of platelets in peripheral blood was a well-recognized tool in veterinary diagnostics and recently, new indices related to platelet counts have been provided by haematologic analysers, namely plateletcrit (PCT) and mean platelet volume (MPV), where platelet volume represents a marker of platelet function and activation.

Elevated MPV values have been associated with an adequate/increased number of megakaryocytes on bone marrow cytology in human beings and dogs [6].

Moritz et al. (2003) [7] stated that despite the potential useful application of PDW and MPV in dogs, they were not currently used in daily clinical practice and attributed this to limited information in the veterinary literature.

Northern and Tvedten (1992) recorded the mean platelet volume (MPV) in 68 dogs with thrombocytopenia attributable to various causes. Platelet size was high or low in some dogs and the most clinically useful observation was that low MPV (microthrombocytosis) was a specific indicator of immune-mediated thrombocytopenia (IMTP) in these thrombocytopenic dogs.

Dircks et al. (2009) [8] reported that platelet counts, results of bone marrow analysis, and MPV might be helpful in dogs for the differentiation between primary IMTP and thrombocytopenia resulting from other diseases.

## Materials and Methods

Dogs brought to the Madras Veterinary College Teaching Hospital with clinical signs of thrombocytopenia viz. petechiae, ecchymosis, purpura, epistaxis, gingival bleeding, hyphaema, melena, haemetemesis, haematuria, haemoglobinuria or other spontaneous bleeding tendencies from the mucosal surfaces were screened for routine hematology and platelet counts. The clinicopathological findings and therapeutic trials for the mild, moderate and severe thrombocytopenic dogs were evaluated and the usefulness of Platelet Component transfusion was assessed. The platelet indices were measured and the platelet morphology, status of activation, size and shape of the platelets was documented. The Platelet histogram of the platelet counts were plotted against the MPV, PDW and PCT and the platelet parameters of the thrombocytopenia group were compared with the control group as per Bommer et al. (2008) [3] and the results were assessed and tabulated.

## Design of Study

A methodical diagnostic approach to dogs with bleeding disorders was carried out with a comprehensive history and physical examination, followed by laboratory tests to differentiate a coagulation defect or a platelet or vascular disorder. About 180 dogs with thrombocytopenia (TCP) of platelet counts less than 100,000 cells/cm were taken for the study.

## Study Group

### Apparently healthy group

Thirty apparently normal dogs belonging to various police dog squad units formed the control group and were subjected to a detailed clinical and haematological examination.

## Disease group

A population of 180 dogs suffering from TCP dogs with mild, moderate and severe bleeding tendencies was taken for study.

The thrombocytopenic dogs were grouped into-

- Group I - Ehrlichiosis induced thrombocytopenia (60 dogs)
- Group II- Babesiosis induced thrombocytopenia (60 dogs)
- Group III -Leptospirosis induced thrombocytopenia (60 dogs)

Each TCP group was divided into sub groups of -

- Mild thrombocytopenia (50,000 to 100,000 cells/cmm)
- Moderate thrombocytopenia (25,000 to 50,000 cells/cmm)
- Severe thrombocytopenia (less than 25,000 cells/cmm)

The dogs were subjected to methodical history, physical examination, hematological and clinical evaluation of thrombocytopenia.

Peripheral smear examination was done to visualize platelet size, gross morphology and granularity and for the confirmation of the automated platelet count. An estimate of the platelet count was done by routine light microscopy of a Wright's-stained peripheral smear. The count was done in 1000 x oil immersion by multiplying the number of platelets per field by 15,000, or more accurately, by multiplying the sum of the number of platelets counted in 8-10 fields less than 1000 x oil magnification by 2000. Every blood smear was carefully evaluated for the presence of platelet clumps that may falsely lower the platelet count. The manual counts were correlated with the auto analyzer counts.

The platelet indices were carried out with the BC-2800 Vet Auto Hematology Analyzer (Mindray Medical Instrumentation). The morphology, status of activation, size and shape of the platelets was documented. The Platelet histogram of the platelet counts were plotted against the MPV, PDW and PCT respectively. The platelet parameters of the thrombocytopenia group were compared with the control group as per Bommer et al. (2008) [3] and the results were assessed and tabulated.

## Results

### Platelet Indices in Ehrlichiosis induced mild, moderate and severe thrombocytopenic dogs

The mean platelet counts and their platelet indices including the Mean Platelet Volume, Platelet Distribution Width and the Plateletcrit in Ehrlichiosis induced thrombocytopenia were analyzed and tabulated (Table 1). The platelet histogram was represented accordingly (Figure 1).

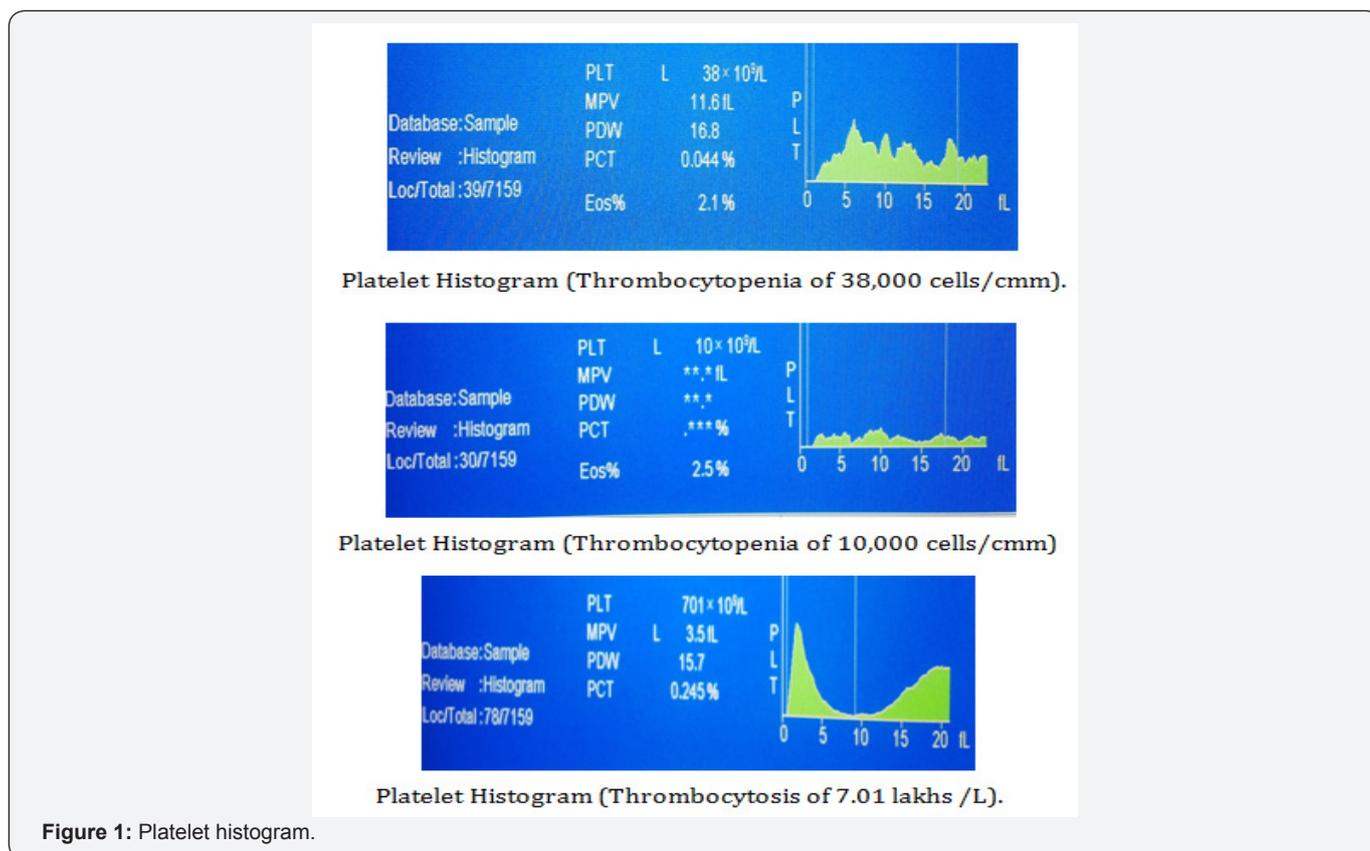


Figure 1: Platelet histogram.

Table 1: Platelet Indices (Mean±Se) In Ehrlichiosis (N=60).

	Control	Group 1	Group 2	Group 3	F value
Platelet Counts	448888.88±17640.26 <sup>c</sup>	76700.00±4536.39 <sup>b</sup>	42000.00±930.94 <sup>a</sup>	17500.00±2171.78 <sup>a</sup>	455.74**
MPV	8.35±0.19 <sup>c</sup>	8.02±0.32 <sup>c b</sup>	7.50±0.16 <sup>b</sup>	7.06±0.93 <sup>a</sup>	3.92*
PDW	16.07±0.16 <sup>a</sup>	16.66±0.27 <sup>a</sup>	16.53±0.24 <sup>a</sup>	15.81±0.49 <sup>a</sup>	1.71NS
PCT	0.286±0.06 <sup>a</sup>	0.062±0.005 <sup>b</sup>	0.029±0.003 <sup>a</sup>	0.033±0.019 <sup>a</sup>	26.80**

a,b,c The mean values bearing different superscripts vary significantly.

\*P<0.05, \*\*P<0.01, NS-Non significant

Group 1: Ehrlichiosis induced mild thrombocytopenia

Group 2: Ehrlichiosis induced moderate thrombocytopenia

Group 3: Ehrlichiosis induced severe thrombocytopenia

MPV: Mean Platelet Volume; PDW: Platelet Distribution Width; PCT: Plateletcrit

In the present study, the PCT showed a marked significant difference in between the control and the three groups of mild, moderate and severe TCP whereas the MPV and the PDW did not show any significant difference among the three groups.

### Platelet Indices in Babesiosis induced mild, moderate and severe thrombocytopenic dogs

The platelet indices including the MPV, PDW and PCT in Babesiosis induced mild, moderate and severe thrombocytopenia were analyzed and tabulated (Table 2). The platelet histogram was documented.

**Table 2:** Platelet Indices (Mean±Se) in Babesiosis (N=60).

	Control	Group 1	Group 2	Group 3	F value
Platelet Counts	448888.88±17640.26d	79650.00±4428.47c	41350.00±1135.41b	14260.00±1663.94 <sup>a</sup>	547.04**
MPV	8.35±0.19 c	8.81±0.39 b c	7.96±0.34 <sup>a</sup> b	10.44±0.32 <sup>a</sup>	7.25**
PDW	16.07±0.16 <sup>a</sup>	17.03±0.27 <sup>a</sup>	16.48±0.77 <sup>a</sup>	15.89±0.29 <sup>a</sup>	2.06NS
PCT	0.286±0.003 <sup>a</sup>	0.0521±0.005b	0.0398±0.003 <sup>a</sup>	0.0301±0.002 <sup>a</sup>	6.39**

a,b,c The mean values bearing different superscripts vary significantly.

\*P<0.05, \*\*P<0.01, NS-Non significant

Group 1: Babesiosis induced mild thrombocytopenia

Group 2: Babesiosis induced moderate thrombocytopenia

Group 3: Babesiosis induced severe thrombocytopenia

MPV: Mean Platelet Volume; PDW: Platelet Distribution Width; PCT: Plateletcrit

In the present study, in between the control and the three groups of TCP, the PCT showed a marked significant difference whereas the PDW did not show any significant difference between the 3 groups. However, the MPV showed increased levels in the severe TCP of Babesiosis.

### Platelet Indices in Leptospirosis induced mild, moderate and severe thrombocytopenic dogs

**Table 3:** Platelet Indices (Mean±SE) in leptospirosis.

	Control	Group 1	Group 2	Group 3	F value
Platelet Counts	448888.88±7640.26 <sup>d</sup>	75150.00±5125.12c	41860.00±1403.42b	13890.00±2139.70 <sup>a</sup>	531.75**
MPV	8.35±0.19 <sup>c</sup>	8.02±0.32 <sup>b c</sup>	7.41±0.15 <sup>a b</sup>	6.73±0.261 <sup>a</sup>	8.378**
PDW	16.07±0.16 <sup>ab</sup>	16.66±0.27 <sup>b</sup>	16.53±0.24b	15.35±0.41 <sup>a</sup>	4.092*
PCT	0.286±0.003 <sup>a</sup>	0.0496±0.007 <sup>a</sup>	0.0378±0.004 <sup>a</sup>	0.067±0.033 <sup>a</sup>	1.062 <sup>NS</sup>

a,b,c The mean values bearing different superscripts vary significantly.

\*P<0.05, \*\*P<0.01, NS-Non significant

Group 1: Leptospirosis induced mild thrombocytopenia

Group 2: Leptospirosis induced moderate thrombocytopenia

Group 3: Leptospirosis induced severe thrombocytopenia

MPV: Mean Platelet Volume; PDW: Platelet Distribution Width; PCT- Plateletcrit

The platelet indices including the MPV, PDW and PCT in Leptospirosis induced mild, moderate and severe thrombocytopenia were analyzed and tabulated (Table 3).

In this study, the PCT showed a marked significant difference in between the control and the three groups of mild moderate and severe TCP whereas the MPV and the PDW did not show any significant difference between the three groups.

### Discussion

Pantanowitz, (2000) opined that the quantitative changes in platelet counts may result from decreased platelet production, hypersplenism and non-immune as well as immune-mediated destruction or consumption of platelets.

In the present study mild, moderate and severe TCP associated with Ehrlichiosis, Babesiosis and Leptospirosis were

recorded which could attribute to any of the causes listed above. Woody and Hoskins (1991) [9] and Breitschwerdt (2000) [10] recorded the lower platelet counts in TCP induced by Ehrlichiosis and Babesiosis.

Ralph and Brainard, (2012) [11] observed less of platelets in dogs suffering from Leptospirosis. The observations made in the present study correlated with the findings of the above workers. Platelet indices such as Platelet Distribution Width (PDW), Plateletcrit (PCT) and Mean Platelet Volume (MPV) could provide clinical information about the underlying conditions of thrombocytopenia [3].

PCT is an indicator of platelet mass in the body, whereas MPV represents a marker of platelet function and activation. PDW is the measure of the relative size of platelets and has been used to discriminate between immune mediated thrombocytopenia and thrombocytopenia in aplastic anemia in human beings and less understood in veterinary literature [5].

In the present study, the platelet indices viz. PDW, and PCT did not show significant difference between the control group and the thrombocytopenic groups and in between the thrombocytopenic groups.

Whereas, the MPV showed increased levels in the severe TCP of Babesiosis and these results were in correlation with the observation of Zvorc et al. (2010) [4] who claimed that thrombocytopenia was with decreased PCT and increased MPV in canine Babesiosis.

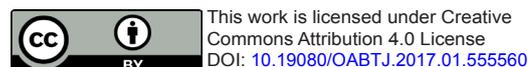
## Conclusion

The platelet indices (MPV, PDW, and PCT) did not have any diagnostic role in any of the thrombocytopenic disease in dogs with Ehrlichiosis and Leptospirosis. Whereas an increased MPV was detected in Babesiosis affected dogs which can be adapted as a screening methodology to identify Babesiosis.

Like the erythrocytic indices, the platelet indices need to be focused to detect platelet abnormalities in dogs affected with thrombocytopenia.

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