A Study of Platelet Count and Platelet Indices in Neonatal Sepsis

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Abstract

Introduction: Neonatal sepsis has always been a significant health problem worldwide, especially in developing countries. Since it is a treatable condition, it has to be diagnosed at the earliest to initiate treatment and to avoid abuse of antibiotics. *Objectives:* To study the various changes associated with platelets in neonatal sepsis, and to check the diagnostic value of these markers in the early diagnosis of sepsis in neonates. Study and Design: This is a cross-sectional analytical study. *Methods:* This is a study on the evaluation of platelet count and platelet indices viz, Platelet Distribution Width (PDW) and Mean Platelet Volume (MPV) in neonatal sepsis on blood obtained from neonates with a clinical suspicion of sepsis. A total of 100 cases were included for the study. The platelet count and platelet indices were obtained using automated haematology analyser. Leishman stained smears were studied for platelet count and morphology and correlated with blood culture results. *Results:* PDW showed sensitivity and specificity of 82% and 73 % respectively. MPV showed sensitivity and specificity of 76% and 40 % respectively. Thrombocytopenia showed sensitivity and specificity of 64% and 82 % respectively. *Conclusion:* Platelet Distribution Width was the most sensitive marker (82%). Thrombocytopenia was the most specific marker (82%). Owing to the diagnostic confusion that usually surrounds Neonatal Sepsis due to the myriad of clinical features it presents, platelet studies could be used as easily accessible and inexpensive tools for the early detection and treatment of this condition.

Keywords: Platelet Indices; Thrombocytopenia; Neonatal Sepsis.

Introduction

Systemic infection in the newborn is one of the commonest cause of neonatal mortality, amounting to almost twenty per thousand live births [1]. Neonatal septicemia is characterized by clinical signs and symptoms accompanied by bacteremia in the 1st month of life [2]. A lot of factors including unhygienic conditions, illiteracy, poverty in developing countries and inadequate maternal and child health services increase the risk for a high rate of bacterial infections in neonatal period. Clinical diagnosis of neonatal septicemia remains a difficult task as it mimics various other diseases [1]. The newborn especially the premature are prone to serious infections because most of the time the signs of these infections may be absent or subtle and hard to detect. Thus, fatal septicemia may occur with little warning [3].Hence, timely diagnosis of sepsis in neonates is important to prevent rapid progression [4].

Almost all organs and systemsincluding the haemostasisare adversely affected in sepsis [5]. In the pathophysiology of sepsis clotting cascades do not function. Many pro- and anti-inflammatory cytokines are released from mononuclear and endothelial cells. Endothelial dysfunction is also noted. At later stages there is plasminogen stimulation and antithrombin-III activation fibrinolytic system along with simultaneous thrombus formation [6]. In the end, Disseminated Intravascular Coagulation results with increased platelet destruction [7,8]. There is also peripheral non-immune destruction of platelets, hemophagocytichistiocytosis and marrow suppression, all playing different roles in thrombocytopenia and changes in platelet

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morphology in septic patients [9].

Approximately 40% of patients with severe sepsis have platelet counts less than 80,000/Davangere, Karnataka 577005µL[9]. Decreased platelet counts parallel the severity of infection. MPV is highin destructive thrombocytopenia and low in hypoproliferative thrombocytopenia [10]. As the demand for platelet increases, young platelets are released into circulation which are larger in size. This causes rise in MPV. Since there is a dual population of both young and new platelets in circulation, the PDW also increases [11,12].

Even though blood culture is the gold standard for diagnosis of neonatal sepsis, it is a time consuming procedure, leading to delayed initiation of treatment. Hence, easily accessible, inexpensive, and widely usedlaboratory tests like platelet studies that show the severity of sepsis are important. MPV and PDW are widely and routinely used in clinical practice worldwide. Low platelet count, increased MPV and PDW have been found in sepsis [5].

However, the role of these parameters in severe sepsis needs to be investigated further.The current study was undertaken toevaluate the changes in platelet count and platelet indices; MPV and Platelet Distribution Width in clinically diagnosed cases of neonatal sepsis and to determine their effectiveness as an early auxiliary diagnostic tool for neonatal sepsis.

Materials and Methods

This is a cross sectional analytical study on platelet count and platelet indices of neonates with a presumptive clinical diagnosis of septicemia. The study was undertaken in the haematology laboratory over a period of three months.

Blood from 100 neonates with a clinical suspicion of sepsis, irrespective ofcause, age (early and late neonates), onset and symptoms were included in the study. Blood was collected in tripotassium EDTA vacutainers. Platelet count and platelet indices were obtained using HORIBA ABX PENTRA XL automated haematology analyzer.

Two peripheral smears were prepared and stained with Leishman's stain for confirmation of platelet count obtained by the haematology analyzer. Blood culture reports were obtained from the Department of Microbiology.

Platelet parameterswere analyzed using EPI INFOVERSION 6.0. Blood culture was taken as the gold standard for the diagnosis of septicemia. Sensitivity (Sn), Specificity(Sp), Positive Predictive Value(PPV), Negative Predictive Value (NPV), Positive Likelihood Ratio (PLR) and Negative Likelihood Ratio (NLR)of each parameter taken into account to determine their value in the diagnosis of neonatal sepsis.

The following values were considered to be deranged: PDW: > 18 %, MPV: >8 fl, Total Platelet Count < 150000 /µl [13,114,15].

Results

Out of the 100 cases taken for study, 39 were culture positive and 61 were culture negative.

The parameters taken for analysis were Total Platelet Count, Platelet Distribution Width (PDW) and Mean Platelet Volume (MPV).

Thrombocytopenia was found in 36 cases, out of which culture positive cases were 25 (69.4%). The sensitivity and specificity was 64% and 82% respectively.Increased PDW was found in 46 cases, out of which culture positive cases were 32 (69.5%). The sensitivity and specificity was 82% and 73% respectively. Increased MPV was found in 65 cases, out of which culture positive cases were 30 (46.1%). The sensitivity and specificity was 76% and 40% respectively. The diagnostic values of the three parameters are tabulated below. (Table 1)

The Mean Platelet Count in Culture Positive and Negative cases was 136000/µL and 279000/µL respectively. The mean PDW in Culture Positive and Negative cases was 24.1% and 15.2% respectively. The mean MPV in Culture Positive and Negative cases was 12.4fl and 8.6 fl respectively.

Table 1: Diagnostic Value of Various Parameters in Neonatal Sepsis

Parameters	Sensitivity %	Specificity %	PPV	NPV	PLR	NLR
Thrombocytopenia	64	82	70	75	3.5	0.41
Increased PDW	82	73	72	80	3.03	0.25
Increased MPV	76	40	44	75	1.26	0.6

Discussion

Sepsis Neonatorum has always been and continues to be a serious health hazard. Owing to the subtlety and varied nature of its clinical signs and symptoms, it is important for us to devise methods for early diagnosis and treatment. The time lag between onset of disease process and the receipt of blood culture report could prove to be costly.

This study revealed that PDW had a high sensitivity (82%) and specificity (73%) as compared to MPV which showed sensitivity of 76% and specificity of 40%. Thrombocytopenia on the other hand had a low sensitivity of 64% but a high specificity of 82%.

Overall Mean PDW and MPV were markedly raised and Platelet count was markedly reducedin culture positive cases as compared to culture negative cases.This was in concordance with previous studies [15,16,17].This means that increased PDW and MPV values were indicative of culture positive sepsis and hence warranted early treatment. Conversely, normal or raised values of platelet count was helpful in ruling out culture positive sepsis, thereby reducing antibiotic abuse.

Since MPV is affected by aging of platelets and varies according to the balance between production and destruction, the degree of systemic inflammation and changes in MPV appear to be correlated.A prospective study by Aydin et al concluded that septic newborns have greater MPV than those without sepsis [18]. Furthermore, according to literature there is a strong inverse correlationbetween platelet count and MPV even in healthy individuals [19]. Thusvariations in platelet count should be considered when evaluating MPV. The present study also showed high MPV and a low platelet count in neonates with sepsis.

It has been demonstrated that coagulation and platelet activation/hyper aggregation can occur in an early phase of sepsis[5]. In order to obtain a larger surface, platelets change their discoid shape to a spherical shape during activation. At the same time, pseudopodia formation occurs. Platelets with increased number and size of pseudopodia may affect the PDW [20]. Also newly recruited platelets are larger in size. Platelet volume is also related to platelet function and activation. Generally, platelet production increases as platelet count decreases. An increased number of young platelets is also functionally more active than older platelets [21].This is probably the reason for an increased PDW and MPV along with thrombocytopenia.

Conclusion

Platelet counts and platelet indices were found to be helpful in predicting the presence of underlying culture positive sepsis and can be used as auxiliary tests for the early detection of neonatal sepsis, which is useful for starting early treatment whenever necessary.

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