

## A Hospital Based Study to Correlate the Degree of Thrombocytopenia and Platelet Indices with Neonatal Sepsis

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### Abstract

**Aim:** To correlate degree of thrombocytopenia and platelet indices with neonatal sepsis in our NICU set up.

**Material & Methods:** This study was conducted in the Department of Pathology, Government Medical College, Bettiah, Bihar, India, we studied total 100 cases over a span of 8 months.

**Results:** 40 out of 150 neonates (26%) were classified as sepsis proven, as they have positive blood culture, 63 (42%) had probable infection and 47 (31%) were non-infected Gram negative organisms were more commonly isolated in neonatal sepsis cases. Pseudomonas aeruginosa was isolated in 16 cases out of 40 proven sepsis which was most common organism found in our NICU set up.

**Conclusion:** Variation in the degree of thrombocytopenia and platelet indices was seen in neonatal sepsis. Severe degree of thrombocytopenia associated with proven sepsis. PDW was significantly increased in newborns with sepsis. Gram negative organisms were common cause of neonatal sepsis.

**Keywords:** C Reactive Protein (CRP), Mean Platelet Volume (MPV), Platelet Distribution Width (PDW)

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### Introduction

Neonatal sepsis is a clinical syndrome characterized by signs and symptoms of infection in neonatal period of life. It covers various systemic infections of newborn such as septicaemia, meningitis, pneumonia, arthritis, osteomyelitis and urinary tract infections. It is estimated that 20% of neonates develop sepsis and approximately 1% deaths are related to sepsis [1].

Though blood culture is gold standard for diagnosis but it is not always positive even in presence of clinical features of sepsis in a neonate. A high index of suspicion and its confirmation are necessary for early diagnosis of sepsis. Various tests are traditionally applied. [2] The negative predictive value of various sepsis screen parameters is too low to confidently rule out sepsis. There is no ideal test or combination of tests which are bench

markers of an excellent test. [3-5] Due to these drawbacks we need to find parameters which can increase the sensitivity and specificity of sepsis diagnosis in an inexpensive and easy manner. Platelet indices (platelet counts, platelet distribution width-(PDW), mean platelet volume- (MPV)) are one such set of parameters which can be helpful for the diagnosis and hence early treatment of neonatal sepsis. Advantages of platelet indices are that the sample for these can be drawn at the same time as that for other investigations and require no special sampling techniques and are easily available. Few studies have documented significant changes in platelet indices in neonatal sepsis as well as older children and adults. [6-8]

Sepsis should not be regarded as a homogenous entity, as it neglects the pathogenic and clinical differences between the various causative micro-organisms and clinical syndromes and presentations of neonatal sepsis. In this study we therefore choose to present the characteristics of sepsis-related thrombocytopenia separately for Gram positive and Gram negative bacteria. Previous studies have found either no convincing difference between the occurrence and course of thrombocytopenia in sepsis caused by either Gram positive or Gram negative bacteria [9], or have reported a higher incidence of thrombocytopenia in Gram negative sepsis [10-13].

Thus, we aim to correlate degree of thrombocytopenia and platelet indices with neonatal sepsis in our NICU set up.

### **Material & Methods:**

This study was conducted in the Department of Pathology, Government Medical College, Bettiah, Bihar, India. we studied total 100 cases over a span of 8 months.

### **Inclusion Criteria**

- All neonates (<28 days) presenting with symptoms and signs of sepsis like poor feeding, lethargy, tachypnea, hypothermia, convulsion, etc. were included in the study.

### **Exclusion Criteria**

All newborns with neonatal hyperbilirubinemia due to causes other than sepsis like physiological jaundice, Rh, ABO incompatibility, TTN, MAS without clinical or laboratory suspicion of sepsis were excluded from the study.

Neonates were enrolled in the study if there were predisposing factors (i.e., maternal fever, significant PV leaking, maternal UTI, etc) or if there was clinical suspicion of sepsis. Written and informed consent was taken from parents/guardian of neonate. Ethical committee approval was taken from institute for study. The blood samples were sent to the pathology laboratory collected by peripheral venipuncture using aseptic precautions in EDTA bulb, from which values of Haemoglobin, total leukocyte count, platelet count, haematocrit, RBC count, Plateletcrit, PDW (Platelet Distribution Width), Mean platelet Volume (MPV) were derived. In plain bulb sample was taken for C - reactive protein (CRP) which was processed using C-reactive protein kit. The routine haematological investigations performed on multichannel automated cell counter with standard calibration.

Special investigation: Blood culture and sensitivity - 1-3ml venous sample was taken in blood culture bottle under all aseptic precautions. The culture and sensitivity report was done by Bactec method. All the above tests were done in pathology and microbiology laboratory.

The study group was categorised in three groups:

1. Proven Sepsis (Septicaemia) - It is characterised by positive blood culture with clinical and/or laboratory evidence of sepsis.

2. Probable Sepsis- Blood culture negative but having clinical criteria for sepsis as per IMCI /WHO criteria. i.e., Neurologic-convulsions, drowsy/unconscious, decreased activity, bulging fontanel.
  - a. Respiratory - Respiratory rate >60 breaths/min, grunting, severe chest in drawing, central cyanosis.
  - b. Cardiac- poor perfusion, rapid and weak pulse.
  - c. Gastrointestinal - jaundice, poor feeding, abdominal distension
  - d. Dermatologic- skin pustules, periumbilical erythema or purulence.
  - e. Musculoskeletal - edema or erythema overlying bones or joints.
  - f. Other- Temperature > 37.7°C or < 35.5 C.
3. No Sepsis – Babies without clinical or laboratory evidence of sepsis.

### Grading of Thrombocytopenia

Thrombocytopenia is graded to different severity for the risk assessment and management as following

- Severe degree of thrombocytopenia- <50,000 /  $\mu$ L.
- Moderate degree of thrombocytopenia- 50,000 -1,00,000 /  $\mu$ L.
- Mild degree of thrombocytopenia- 1,00,000-1,50,000 /  $\mu$ L.

### Platelet Indices

Platelet indices are:

- Mean Platelet Volume (MPV).
- Platelet Distribution Width (PDW).
- Plateletcrit (MPV $\times$ platelet count).

The values of MPV and PDW were studied in relation to sepsis in all three categories. The findings of investigations were entered in proforma. The data were analysed using standard statistical software.

### Results:

40 out of 150 neonates (26%) were classified as sepsis proven, as they have positive blood culture, 63 (42%) had probable infection and 47 (31%) were non-infected (Table 1).

**Table 1: Infection status ( based on blood culture)**

Infection status	Number of neonates n%
Sepsis proven	29
Probable sepsis	38
No sepsis	33

Out of 100 cases CRP value is negative i.e., below 6 mg/ liter in 52 cases and positive in 48 cases. Out of positive 48 cases 21% cases are sepsis proven and 18% are of probable sepsis (Table 2).

**Table 2: CRP and sepsis**

CRP levels	Clinical diagnosis			Total
	Sepsis proven	Probable sepsis	No sepsis	
< 6 mg/ltr	8	21	23	52
> 6 mg/ltr	21	18	9	48
Total	29	39	32	100

Gram negative organisms were more commonly isolated in neonatal sepsis cases. Pseudomonas aeruginosa was isolated in 16 cases out of 40 proven sepsis which was most common organism found in our NICU set up. Other was Klebsiella, E coli. In gram positive organisms, staph

aureus was most commonly found. The most common fungal organism isolated was Candida albicans. The other less commonly isolated organism was acinetobacter, enterobacter etc [Table 3] and 4].

**Table 3: Isolated blood culture**

Organism isolated	Number of neonates
Pseudomonas	11
Staph. aureus	6
Candida	5
Klebsiella	3
Acinetobacter sp.	2
Escherichia coli	1
Enterobacter	1
<b>Total</b>	<b>29</b>

**Table 4: Isolated blood culture**

Organisms	Frequency
Gram negative	22
Gram positive	5
Fungal	2
Total	29

20 out of 29 sepsis proven cases showed severe thrombocytopenia whereas 10 out of 38 probable sepsis cases showed severe thrombocytopenia (Table 5).

**Table 5: Degree of thrombocytopenia and sepsis**

Status of sepsis	Thrombocytopenia			Total
	Mild (1.5L - 1,00,000)	Moderate (50,000-1,00,000)	Severe (<50,000)	
Sepsis proven	6	3	20	29
Probable sepsis	20	8	10	38
No sepsis	24	3	6	33
Total	50	14	36	100

Here 30 cases out of 80 cases of sepsis had increased MPV. (Table 6).

**Table 6: Relation of sepsis with mean platelet volume**

Status of sepsis	MPV category			Total
	Increased	Normal / Decreased	Not Detected	
Present	30	31	19	80
Absent	8	7	5	20
Total	38	38	24	100

**Discussion:**

The exact pathogenesis of neonatal thrombocytopenia in maternal hypertension is unknown, but it is thought that maternal hypertension leads to fetal hypoxia, which has a depressant effect on fetal megakaryocytopoiesis and platelet production [14]. Intravascular thrombosis

is highly associated with the use of vascular catheters. Catheters may cause increased platelet consumption by (1) causing mechanical damage to the vascular wall and alteration of the blood flow, but may also (2) consist of potentially thrombogenic material or may (3) be a medium to infuse damaging agents to the vascular walls [15].

Platelet indices (platelet counts, platelet distribution width-PDW, mean platelet volume-

MPV) are laboratory parameters which can be added to battery of traditional tests for more reliable rapid diagnosis. These indices are widely available and are inexpensive laboratory investigations. Platelet count is an important haematological parameter in neonatal sepsis. Several studies have been done in analysing platelet indices like MPV and PDW besides platelet count in neonatal sepsis. Few studies have documented significant changes in platelet indices in neonatal sepsis as well as older children and adults. [16-19]

*Pseudomonas aeruginosa* was the most common organism followed by *Staphylococcus aureus*. Gram negative organisms (67.5%) were relatively higher than gram positive organisms (17.5%) and fungal organism (15%) in studies conducted by Krishna et al [20] and Kumhar et al [21].

E Guclu et al., [19] found PDW as a significant parameter in neonates with sepsis. Ferhatcatal et al., found that there is significant differences between control and sepsis group in terms of platelet count, PDW/MPV ( $p < 0.005$ ) [22,23].

### Conclusion:

Variation in the degree of thrombocytopenia and platelet indices was seen in neonatal sepsis. Severe degree of thrombocytopenia associated with proven sepsis. PDW was significantly increased in newborns with sepsis. Gram negative organisms were common cause of neonatal sepsis.

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