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Mean platelet volume and serum uric acid in neonatal sepsis: A case-control study

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HIGHLIGHTS

- Mean platelet volume (MPV) reveals the presence of inflammatory burden and disease activity in many diseases. Serum uric acid (SUA) is one of the most important antioxidants in human biological fluids.
- Serum uric acid cutoff point was 3.7 mg/dl, sensitivity was 13%, specificity was 19%, positive predictive value was 19%, negative predictive value was 13% and diagnostic accuracy was 15%.
- This study revealed that MPV showed a statistically significant positive correlation with WBCs and CRP, and a statistically significant negative correlation with gestational age, birth weight and platelet count.
- Cutoff point of MPV was 10.2 fl, sensitivity was 71%, specificity was 63%, positive predictive value was 74%, negative predictive value was 59% and diagnostic accuracy was 68% SUA showed a statistically significant positive correlation with gestational age and birth weight, and significant negative correlation with CRP.

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ABSTRACT

Background: Mean platelet volume (MPV) is a measure of platelet volume. It reveals the presence of inflammatory burden and disease activity in many diseases. Serum uric acid (SUA) is one of the most important antioxidants in human biological fluids and is responsible for neutralizing > 50% of the free radicals in the human blood. For this reason, it was thought that the antioxidant effects of SUA could increase the life expectancy and/or reduce the incidence of malignancy.
Objectives: To determine the role of mean platelet volume (MPV) and serum uric acid (SUA) level in the diagnosis of neonatal sepsis (NS).
Methods: This case-control study was done on 80 newborns divided into 3 groups: group A (n = 22): clinical NS, group B (n = 18): Proven NS and Group C (n = 40): apparently healthy control. All patients in the study were subjected to adequate assessment of history, full clinical examination, complete blood count including MPV, C - reactive protein (CRP), blood culture in CRP positive cases, and SUA level at the time of diagnosis of sepsis.
Results: Septic neonates showed statistically higher values of MPV and statistically lower levels of SUA than the control group. The diagnostic cut-off values of MPV and SUA for NS were 10.2 fL, and 3.70 mg/dL, respectively.
Conclusions: MPV could be assessed in the early diagnosis of neonatal sepsis while SUA level has lower sensitivity in neonatal sepsis.

1. Introduction

Sepsis is recognised as one of the most severe pathologies in newborns and young infants [1] and is responsible for almost one and a half million deaths each year worldwide [2]. Up to 10% of

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infants have infections in the first month of life, the matter which results in 30–50% of total neonatal deaths in developing Countries [2]. And it is considered the single most important cause of death [3] accounting for up to 50% of neonatal mortality [4]. For many years, a search has been ongoing to find predictors for neonatal sepsis that identify effectively patients who are at risk of infection [5]. Mean platelet volume (MPV) is a measurement of the average size of platelets found in the blood [6]. The increase in MPV could express either the development of a more invasive infection or the presence of an infection unresponsive to the antibiotic therapy [7]. Serum uric acid (SUA) has important antioxidant properties in vitro, by scavenging free radicals and chelating iron, the latter preventing iron-catalyzed oxidation. There is a strong correlation between the concentration of SUA in biologic fluids and demonstrable antioxidant activity. Indeed, SUA contributes as much as 60% of free-radical scavenging in human serum [8]. Free radicals have been implicated in the pathogenesis of neonatal septicemia [9].

2. Aim

This study aimed to determine the role of mean platelet volume (MPV) and Serum uric acid (SUA) level in the diagnosis of neonatal sepsis.

3. Subject and methods

3.1. Subjects

After approval of the Local Institutional Ethical Committee of Benha University, and obtaining written consents from all parents of patients to participate in this study, this case-control study was carried out on full-term and preterm neonates attending neonatal intensive care unit of Benha University Hospitals, during the period from September 2015 to April 2016. The neonates were classified into three groups: group A (n = 22): diagnosed with clinical neonatal sepsis (NS), 11 males and 11 females their age mean ± SD (5.41 ± 2.68) years, group B (n = 18): diagnosed with Proven NS, 8 males and 10 females their age mean ± SD (4.89 ± 2.24) days and Group C (n = 40): apparently healthy control, 19 males and 21 females their age mean ± SD (5.05 ± 3.4) days. Exclusion criteria: Dysmorphic features suggestive of chromosomal abnormalities, perinatal asphyxia and neonates under a course of antibiotics prior to appropriate blood sampling.

3.2. Methods

All neonates were subjected to the following:

(1) **Complete history taking from parents**: including obstetric history (death of a previous sibling, previous admission to neonatal intensive care unit, etc.),
   Prenatal history: diabetes mellitus, maternal fever >38 °C, maternal antibiotics, maternal urinary tract infection (UTI).
   Natal history: premature rupture of membrane (PROM), maternal fever, prolonged second stage of labour, etc.,
   Postnatal History: low Apgar score at 1 and 5 min, aggressive resuscitation, respiratory distress, cyanosis, fever, jaundice.
   Current history: includes most common symptoms of sepsis in the neonates.

(2) **Thorough clinical examination** including assessment of gestational age, birth weight measurement, detection of clinical signs of sepsis such as: temperature instability (<37 or >38.5 °C), respiratory dysfunction (apnea, intercostal retraction, increased oxygen requirement, signs of respiratory distress), circulatory dysfunction (poor peripheral circulation, hypotension, tachycardia, shock, prolonged capillary refill), GIT dysfunction (abdominal distension, bloody stool, feeding intolerance, hepatomegaly, jaundice), neurological dysfunction (irritability, hypotonia, lethargy), hypoglycemia, hyperglycemia, petechiae, bleeding (with thrombocytopenia), or DIC.

(3) **Laboratory investigations** at the time of diagnosis of sepsis including complete blood cell count with differential leukocytic count & MPV, CRP Quantitative assay, blood culture and serum uric acid measurement.

Table 1
Comparison between studied groups regarding their demographic data.

Demographic Data	Group A (N = 22)	Group B (N = 18)	Group C (N = 40)	Test	P value
	NO. %	NO. %	NO. %		
Age/day (mean ± SD)	5.41 ± 2.68	4.89 ± 2.24	5.05 ± 3.4	F = 0.165	0.848
Gender (NO. %)					
Male	11 (50%)	8 (44.4%)	19 (47.5%)		0.941
Female	11 (50%)	10 (55.6%)	21 (52.5%)	$\chi 2 = 0.123$	

SD = Standard deviation.

3.2.1. Sampling

Four millilitres of venous blood samples were collected aseptically by venipuncture from all participants, and distributed as follows:

a 2 mL whole blood was put in EDTA vacutainer (violet cap) and mixed up & down gently which was used to measure CBC & MPV.
b 2 plain wasserman tubes without anticoagulant. The plain test tubes were left till coagulation. After coagulation, samples were centrifuged (at 1500 rpm for 15 min). The separated serum was used for the assay of CRP and uric acid.

3.2.2. Laboratory investigations

1 CBC was done for all samples using **Sysmex KX-21N** for red blood cell (RBC) count, haemoglobin level, hematocrit value, WBC count (total and differential), platelet count and MPV.

Table 2
Clinical criteria indicating sepsis in the studied neonates (N = 40).

Criteria for sepsis	No.	%
Poor suckling	35	87.5
Lethargy	31	77.5
Poor Moro	31	77.5
RD	33	82.5
Jaundice	36	45.0
Abdominal distension	10	0.25
Seizures	7	17.5
Apnea	5	12.5
Vomiting	28	70
Bleeding	19	47.5
HSM	7	17.5
Hyperthermia	3	7.5
Hypothermia	8	20
Diarrhea	2	5
Sclerema	3	7.5
Purpura	2	5
Umbilical sepsis	5	12.5
Skin infections	2	5

RD: respiratory distress.