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PERFUSION INDEX AS A MARKER OF NEONATAL SEPSIS - A PROSPECTIVE OBSERVATIONAL STUDY

Paediatric Medicine

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ABSTRACT

Background: Sepsis in newborns plays a significant role in the mortality of newborns. Serological markers offer poor qualities for diagnostic tests, while blood cultures, the gold standard for the diagnosis of sepsis, take 48–72 hours. A real-time, non-invasive, point-of-care (PO) marker called the perfusion index (PI) can identify microcirculatory abnormalities even before other clinical signs of sepsis become evident. **Aim:** To assess the perfusion index's (PI) diagnostic efficacy in diagnosing neonatal sepsis **Materials and Methods:** Perfusion index was continuously monitored in all enrolled neonates with risk of sepsis. Clinical sepsis was defined when PERFUSION INDEX was below 0.8. When the value of perfusion index was persistently below 0.8 in neonates for more than 45minutes, minimum of 1 ml of blood was withdrawn and sent for blood culture. Sensitivity, Specificity, PPV,NPV,Likelihood ratios were studied. **Results:** Among 95 neonates, 81 neonates of suspected sepsis were noted of which 51 were culture positive and 30 were sepsis screen positive. Using a cut off 0.8 in neonates, PERFUSION INDEX yielded a Sensitivity of 89.47%, Specificity of 21.05%, PPV of 62.96%, NPV of 57.14%, Positive likelihood ratio of 0.7 and Negative likelihood ratio of 0.5 respectively **Conclusion:** This study shows that Perfusion index might serve as an early, non-invasive marker of Neonatal sepsis.

KEYWORDS

Perfusion index, Neonatal Sepsis, Non invasive marker, Point of care (POC).

INTRODUCTION

Systemic infection is the most frequent underlying cause of neonatal death, It accounts for about one-third of neonatal deaths worldwide. The gold standard for identifying neonatal bacteraemia is still blood culture. Despite the high prevalence of sepsis, only 31.8% of cases have sepsis that has been confirmed by culture. Low levels of bacteraemia, limited amounts of blood inoculated and laboratory variables are to blame for the high prevalence of false negative. Neonatal sepsis can be detected using a range of biochemical markers. C-reactive protein (CRP) is the most frequently used . It is one of five indicators that make up the sepsis screening test, along with the Total leukocyte count, absolute neutrophil count (ANC), immature to total neutrophil ratio, and micro erythrocyte sedimentation rate (ESR). It has been demonstrated that the presence of two aberrant values in a sepsis screen has sensitivity range of 93-100%, specificity of 83%, and a negative predictive value range of 100%. However, intraventricular haemorrhage, meconium aspiration syndrome, respiratory distress syndrome, and transitory tachypnea are other conditions associated with elevated CRP . There is a need for a non-invasive and early marker of sepsis because of the significant mortality and morbidity linked to sepsis.. The endothelial cels of the microvasculature were harmed by sepsis which impair signalling and reduce the perfusion in the peripheries. The failure of this regulation leads to heterogeneity in blood, leading some capillaries to be under-perfused while others are over-perfused, which is the essential requirement for appropriate tissue oxygenation and subsequently organ function. Peripheral PI, a noninvasive indicator of peripheral perfusion, is obtained from the photoelectric plethysmography signal of pulse oximetry. It displays real-time variations in peripheral blood flow and is likely to be impacted by variations in arterial circulation. With PI, the degree of a newborn's disease can be easily, non invasively, and unattendedly monitored. PI has been proven to be a marker for severe sickness in newborns, the need for vasopressors. the detection of prenatal inflammation, and congenital heart defects.

In a newborn with antenatal risk factors for infection who is asymptomatic, Pl has been examined as an early predictor of sepsis.In this study, we sought to evaluate the diagnostic efficacy of Pl in identifying newborns hospitalised

What is Already known ?

PI can detect high illness severity , subclinical chorioamniotits ,shock and congenital heart disease in neonates

What This Study Adds ?

PI can serve as a non invasive and early marker for detection of sepsis in neonates before clinical signs become apparent

AIMS AND OBJECTIVES

To assess the perfusion index's (PI) diagnostic efficacy in diagnosing neonatal sepsis

MATERIALS AND METHODS

A prospective observational study was conducted from 1st April 2022 to 30th September 2022 in the Neonatal Intensive Care Unit (NICU) of Narayana Medical College and Hospital , Nellore , AP after obtaining clearance from the institutional Ethics committee. Sample size was 91 obtained by convenience sampling method.subjects were recruited

Inclusion criteria

1. Inborn neonates admitted from Day 1 of life
2. Neonates with Risk of sepsis (PROM) chorioamniotis, Maternal fever , multiple per vaginal examinations , (Foul smelling liquor)

Exclusion criteria

1. Parents not willing to participate in them study .
2. Neonates with congenital anomalies.
3. Retropositive mothers.
4. Already on antibiotics.
5. Admitted in NICU for less than 72 hrs.

Parents of subjects who meet the requirements for eligibility were recruited to participate in the study and provided with information about it.

After obtaining written informed consent from a parent, the baby was enrolled. Full history, antenatal, perinatal was recorded in the predesigned performa

Measurement

Perfusion index is monitored continuously using a pulse oximeter (or) multi parameter monitor and was recorded every half an hour .When the value of perfusion index is persisted below 0.8 for more than 45min the time was noted

Laboratory measurements

In laboratory parameters, CRP of >5mg/dl, TLC of <5000/mm3 or abnormal neutrophil count will be considered to be sepsis screen positive .A minimum of 1 ml of blood will withdrawn for culture from a fresh Venipuncture site, under all aseptic precautions prior to starting antibiotics. Sending of sepsis screen and blood culture samples will be

decided clinically. Vitals in the form of HR, RR Temperature will be monitored on hourly basis. All the babies will continuously monitored for perfusion index and 02 saturation through an attached monitor .The babies whose blood culture is positive will be considered to have sepsis, while those with negative blood will be considered as no sepsis.

Statistical analysis

Data was entered into pre-designed performa spreadsheet, analysed using proper statistical techniques . Sensitivity, Specificity, PPV, NPV of each was determined.

RESULTS

Among the neonates delivered in this study period, 206 babies met the eligibility criteria. Of them, 111 babies were excluded. Out of excluded babies, Fourty five neonates were admitted in NICU for less than 72 hours, thirty neonates born to mothers who don't have risk factors and thirty six neonates were already on antibiotics (Figure 1).Finally 95 neonates were enrolled in the study. 51 neonates were sepsis positive and 30 neonates were sepsis negative None of the subjects were lost to follow up and data of all 95 subjects were collected and analysed Out of 95 neonates , clinical sepsis was present in 81 (85.2%), using a cut off value of PI <0.8 . All neonates whose perfusion index is < 0.8 were monitored continuously an attached monitor . Among 81 neonates , 51 neonates showed blood culture positive for various organisms and considered as sepsis .Among the clinical parameters, new or more frequent apnea was most frequently noted that is in 10 events. This was followed by prolonged capillary filling time in 31(33.3%) events, heart rate variability in 26 (28%) events, temperature instability in 21 (22.6%) events, unexplained metabolic acidosis in 5(5.4) .Other signs of blood stream infection were seen in 65 (70%) of events. Sepsis screen positivity, as defined by CRP of > 5 mg/d1, TLC of less than 5000/mm or ANC abnormal as per Manroe and Mouzinho charts was seen in 30 neonates and considered as no sepsis. PERFUSION INDEX yielded a sensitive 89.47% , Specificity of 21.05% , PPV of 62.96%, NPV of 57.14%,, Positive likelihood ratio of 0.7 and Negative likelihood ratio of 0.5 respectively.

Table I. Demographic and other parameters

Gestational age in weeks mean (SD)	37.4
Birth weight in kg mean (SD)	2.7
Male gender	60
Female	35
Hours of life at NICU admission	9
HR during admission to NICU	142
Temperature during admission to NICU	36.3
RR during admission to NICU	46
Perfusion index during admission to NICU	1.1

Table 2: Profile of perfusion index and sepsis

	SEPSIS	NO SEPSIS
Low perfusion index (<0.8)	51	19
Normal perfusion index	6	5
Total	57	24

Table 3:Sensitivity, specificity, PPV, NPV of perfusion index in detecting Neonatal sepsis

	VALUE
Sensitivity	89.47%
Specificity	21.05%
Positive predictive value	62.96%
Negative predictive value	57.14%
Positive likelihood ratio	0.7
Negative likelihood ratio	0.5

DISCUSSION

In this prospective observational stud conducted in NICU ,a total of 81 neonates of suspected sepsis were noted. In 85% events of sepsis, PI was found to fall below cut off prior to sepsis. As compared to laboratory markers ,fall in PI helped in detecting sepsis early by a margin of 4.5 hours. PI is a comparative evaluation of the pulse intensity at a particular monitoring location.

Initially, a pulse oximeter's index was used to describe it (Masimo signal extraction pulse oximetry) PI is the ratio of an AC/DC signal, which can be either pulsating or nonpulsating. The relationship between the two signals, which are both produced from the quantity of infrared light absorbed, indicates the amplitude of the plethysmographic. Alterations in perfusion will modify the ratio and are reflected in real time in the pulse oximeter. PI is definitely affected by perfusion Which can alter in a quick period of time merely by bending or moving an extremity, even when utilising monitors with SET, for this reason continuous monitoring of Pl and then averaging the PI value is done. In order to assess newborn sepsis ,PI serves as a good non invasive tool.

Limitations

The limitation of using Pl as a marker of neonatal sepsis is that it can be affected by multiple factors including shock, heart disease, or perinatal inflammation

CONCLUSION

Hence assessment of non invasive bedside point of care , assessment of perfusion index would be used as an early marker to predict neonatal sepsis .

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