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Review

Transcranial Doppler evaluation of cerebral hemodynamic alteration in preterms with early onset neonatal sepsis



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Received 9 February 2017; received in revised form 18 April 2017; accepted 19 June 2017
Available online 30 July 2017

KEYWORDS

Transcranial Doppler;
Cerebral hemodynamics;
Preterm;
Early-onset neonatal sepsis

Abstract Objective: To evaluate the cerebral blood flow and the cerebral hemodynamic alteration by Doppler ultrasound in preterms with early onset-neonatal sepsis.

Method: Total forty two preterms divided into two groups whether with clinical and laboratory diagnosis of early onset neonatal sepsis (EONS) or not. Both groups assessed with Doppler Ultrasound of the anterior (ACA) and middle (MCA) cerebral arteries, with the peak systolic velocity (PSV), end diastolic velocity (EDV), resistivity index (RI) and pulsatility index (PI) calculation and recording.

Results: Statistically significant lower RI ($p: .0001$), lower PI ($p: .0001$) in both the ACA and MCA in the group with neonatal sepsis, in comparison with the group with no clinical evidence of neonatal sepsis.

Conclusion: Study results showed vasodilatation and reduced resistance in the cerebral arteries in preterms with early onset neonatal sepsis.

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<http://dx.doi.org/10.1016/j.artres.2017.06.004>

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Introduction

Worldwide annual 1 million neonatal deaths is attributed to neonatal sepsis alone.¹

Neonatal sepsis is defined classically as a clinical syndrome characterized by systemic signs of infection frequently accompanied by bacteremia.²

Two types of neonatal sepsis have been observed: early-onset disease, when features of sepsis appear during the first 72 h of birth; and late-onset disease, where the disease manifests beyond 72 h. Early-onset neonatal sepsis is acquired in utero resulting in chorioamnionitis.³

Hospital-born babies in developing countries are at increased risk of neonatal infections because of poor intrapartum and postnatal infection-control practices. The reported rates of neonatal infections in developing countries were 3–20 times higher than those reported for hospital-born babies in industrial countries.⁴

Cerebral blood flow (CBF), as measured by Doppler Ultrasound, has been studied mainly to help determine whether alterations have occurred in the neonatal cerebral circulation that could result in brain damage and adverse developmental outcomes. Establishment of the predictive validity of the cerebral blood flow measured by Doppler ultrasound is essential to ensure their usefulness in the early assessment and interpretation of hemodynamic changes.⁵

Studying the cerebral blood flow in neonatal sepsis is of concern because, the brain of the newborn is highly susceptible to blood flow fluctuations. Moderately elevated CBF can increase the risk of cerebral hemorrhage whereas moderate hypoperfusion can expose the brain to ischemic damage.⁶

Previous studies on EONS were performed giving results of significantly lower resistance, vasodilatation, and higher blood flow were noted in all the cerebral arteries of the sepsis group.⁷

In our study we aimed to evaluate the cerebral hemodynamic of the preterms with early onset neonatal sepsis using Doppler ultrasound.

Methods

Patient population

Forty-two patients from the Neonatal intensive care unit (NICU) were enrolled in this cross-sectional study. They

were eligible if they had a gestational age less than 37 weeks.

An informed oral consent was obtained from all patients' parents – the guardians – before involving them in the study as no interventional process was done and there was no perceived risk. The steps of the study, the aims and the procedure were discussed with the parents of the study group. Confidentiality of all data was ensured. All the human studies have been approved by the ethics committee of the university Hospital and have therefore been performed in accordance with the ethical standards laid down in the Helsinki Declaration of 1975 and its late amendment.

Inclusion criteria

We included neonates with presence of foul smelling liquor or two of the following risk factors as those are high-risk factors – preterm is already a risk factor – which have been associated with an increased risk of early onset sepsis

- Foul smelling and/or meconium stained liquor
- Prolonged rupture of membranes >24 h.
- More than 3 vaginal examinations during labor
- Prolonged and difficult delivery with instrumentation

Two laboratory criteria (WBC <5000 or >20,000 × 10⁹ cells/L; I/T ratio > 0.2; platelet count < 100,000 × 10⁹/L.⁸

And who showed clinical symptoms & signs of the following:

- Respiratory compromise: tachypnea, increased apnea and increased desaturations.
- Metabolic changes: hypothermia, hyperthermia, feeding intolerance, glucose instability, metabolic acidosis.
- Neurological changes: lethargy, hypotonia, decreased activity.

Exclusion criteria

Perinatal asphyxia, Congenital infections, Respiratory distress syndrome, Meconium aspiration syndrome, Congenital heart disease, Hemolytic anemia, Metabolic

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