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Assessment of cerebral edema in birth asphyxia by using transcranial color doppler

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Abstract
In this study 50 neonates having gestational age of more than 37 to less than 42 completed weeks with perinatal asphyxia delivered or referred to Nalanda medical college and hospital, patna were enrolled. Measurement of cerebral blood flow velocity was done by the use of colour doppler ultrasound. Cranial Ultrasound was done in neonates with birth asphyxia in first 24 hours of life and repeat scan on 3rd postnatal day.
The study had proved that color Doppler USG would be of practical importance in evaluating the cerebral blood flow velocity in neonate with HIE. A skilful detection of decrease in cerebral blood flow of neonate in postnatal first 12 hrs& medication & treatment being based on such detection would contribute to a good prognosis.

Keywords: colour doppler, perinatal asphyxia, HIE, etc.

Introduction
Asphyxia means lack of oxygen. Birth asphyxia happens when a baby's brain and other organs do not get enough oxygen before, during or right after birth. This can happen without anyone knowing. Without oxygen, cells cannot work properly. Waste products (acids) build up in the cells and cause temporary or permanent damage.
Perinatal asphyxia, neonatal asphyxia or birth asphyxia is the medical condition resulting from deprivation of oxygen to a new born infant that lasts long enough during the birth process to cause physical harm, usually to the brain. Hypoxic damage can occur to most of the infant's organs (heart, lungs, liver, gut, kidneys), but brain damage is of most concern and perhaps the least likely to quickly or completely heal. In more pronounced cases, an infant will survive, but with damage to the brain manifested as either mental, such as developmental delay or intellectual disability, or physical, such as spasticity.
It results most commonly from a drop in maternal blood pressure or some other substantial interference with blood flow to the infant's brain during delivery. This can occur due to inadequate circulation or perfusion, impaired respiratory effort, or inadequate ventilation. Perinatal asphyxia happens in 2 to 10 per 1000 newborns that are born at term, and more for those that are born prematurely [1]. WHO estimates that 4 million neonatal deaths occur yearly due to birth asphyxia, representing 38% of deaths of children under 5 years of age [2]. Perinatal asphyxia can be the cause of hypoxic ischemic encephalopathy or Intraventricular hemorrhage, especially in preterm births. An infant suffering severe perinatal asphyxia usually has poor color (cyanosis), perfusion, responsiveness, muscle tone, and respiratory effort, as reflected in a low 5 minute Apgar score. Extreme degrees of asphyxia can cause cardiac arrest and death. If resuscitation is successful, the infant is usually transferred to a neonatal intensive care unit.
There has long been a scientific debate over whether newborn infants with asphyxia should be resuscitated with 100% oxygen or normal air [3]. It has been demonstrated that high concentrations of oxygen lead to generation of oxygen free radicals, which have a role in reperfusion injury after asphyxia [4]. Research by Ola DidrikSaugstad and others led to new international guidelines on newborn resuscitation in 2010, recommending the use of normal air instead of 100% oxygen [5, 6].
There is considerable controversy over the diagnosis of birth asphyxia due to medicolegal reasons [7, 8]. Because of its lack of precision, the term is eschewed in modern obstetrics [9].

Risk Factors
- Elderly or young mothers
- Prolonged rupture of membranes
- Meconium-stained fluid
- Multiple births
- Lack of antenatal care
- Low birth weight infants
- Malpresentation
- Augmentation of labour with oxytocin
- Antepartum hemorrhage
- Severe eclampsia and pre-eclampsia
- Antepartum and intrapartumanemia

Cause
- Inadequate oxygenation of maternal blood due to hypoventilation during anesthesia, heart diseases, pneumonia, respiratory failure
- Low maternal blood pressure due to hypotension e.g. compression of vena cava and aorta, excess anaesthesia
- Inadequate relaxation of uterus due to excess oxytocin
- Premature separation of placenta
- Placental insufficiency
- Knotting of umbilical cord around the neck of infant

- During the post asphyxial period a consistent observation has been a marked increase in cerebral blood flow which continues for several hours and may or may not decline towards baseline. This reperfusion phase is responsible for secondary brain injury. In infants with HIE, high cerebral blood flow measured at 12 and 24 hours is associated with a poor neurological outcome [3].
- Doppler sonography is a non invasive method and can help in early assessment of neonatal cerebral hemodynamics and shows consistent changes in cerebral blood flow velocities in infants with intrapartum asphyxia.

Methodology

In this study 50 neonates having gestational age of more than 37 to less than 42 completed weeks with perinatal asphyxia delivered or referred to Nalanda medical college and hospital, patna were enrolled. Measurement of cerebral blood flow velocity was done by the use of colour doppler ultrasound. Cranial Ultrasound was done in neonates with birth asphyxia in first 24 hours of life and repeat scan on 3rd postnatal day.

Inclusion Criteria

- APGAR score of 4 or less at one minute or 6 or less at five minutes
- Respiratory depression, hypotonia, or bradycardia
- Signs of fetal distress
- A need for resuscitation for more than 1 minute afrer birth

Exclusion Criteria

- Babies having jaundice
- Congenital anomalies

Results & Discussion

The data from the enrolled patients were collected and presented as below.

The table 1 indicates the distribution of the patients as per the grades of the HIE.

Table 1: Grades of the patients

Grade	Males	Female
HIE-1	5	1
HIE-2	30	11
HIE-3	3	0
Total	38	12

Table 2: Mean RI value in Middle Cerebral artery according to grading of birth asphyxia

	Number of cases	1st day	3rd day
HIE-1	6	0.69±0.02	0.52±0.061
HIE-2	41	0.55±0.03	0.50±0.08
HIE-3	3	0.22±0.01	0.28±0.02

This table show that means RI value in Middle cerebral artery decrease with severity of birth asphyxia, it is lowest in HIE-3, and in grade -2.

Table 3: Correlation of resistive index with grading of birth asphyxia

Grade	Total	Abnormal			Normal		
		No.	1st day	3rd day	No.	1st day	3rd day
HIE-1	6	0	0	0	6	0.61	0.54
HIE-2	41	41	0.55	0.58	0	0	0
HIE-3	3	3	0.22	0.54	0	0	0

Resistive index was low in grade II and grade III HIE on day 1 and day 3 and was normal in HIE grade I.

When asphyxia is followed by hypoxic ischemic injury to brain, a syndrome has been described known as 'Hypoxic ischemic encephalopathy'. Early assessment of the degree of resulting hypoxic– ischaemic encephalopathy (HIE) can provide prognostic information for both clinical management and the potential use of cerebroprotective strategies. However, clinical assessment is often difficult because the neurological state of the infant may be altered by pharmacological interventions such as sedation, muscle relaxation, or anticonvulsant treatment. Moreover, clinical signs of HIE may not develop until at least 12 hours after birth.

The haemodynamics in term infants with acute encephalopathy are deranged during the first 24 hours after presumed perinatal asphyxia. These consist of an increase in cerebral blood flow velocity (CBV) and a significant reduction in cerebral blood flow velocity resistance (CBVR). CBVR tended to return to normal values after the first 24 hours of age. CBV and CBF were frequently increased in the first 24 hours after birth were associated with a greater severity of acute encephalopathic signs and adverse outcome [10].

Attempts have been made to diagnose ischemic encephalopathy by use of CT, MRI and ultrasonography. Various authors in different study have emphasized that Doppler sonography is a practical, non-invasive and accurate method of diagnosing a wide spectrum of intra-cranial conditions due to HIE in neonate. Sonography is now established as a primary method for recognizing neonatal cerebral ischemia.

Having found normal RI values with Doppler method, the clinician can confidently reassure parents that their baby has a little risk of death. Prognostication of long term outcomes is one of the main objectives in Doppler sonography of the brain of full term neonate who experienced perinatal asphyxia. In this study maximum number of cases occurred in male.

Our study analyzed the relationship of cerebral blood circulation parameters (PSV, EDV & RI) registered in the anterior & middle cerebral arteries evaluated at 12-24 hr of life and its relation to long term neurological outcome.

Doppler studies done in intracranial vessels in asphyxiated infants found an increase in diastolic flow and lowering of the RI to be the usual initial response detectable in initial 4 days of birth asphyxia [11].

Conclusion

The study had proved thatcolor Doppler USG would be of

practical importance in evaluating the cerebral blood flow velocity in neonate with HIE. A skillful detection of decrease in cerebral blood flow of neonate in postnatal first 12 hrs& medication & treatment being based on such detection would contribute to a good prognosis.

References

1. Brain damage from perinatal asphyxia: correlation of MR findings with gestational age - Barkovich and Truwit - American Journal of Neuroradiology". www.ajnr.org. 2008; 11(6):1087.
2. Aslam Hafiz Muhammad, Saleem Shafaq, Afzal Rafia, Iqbal Umair, Saleem Sehrish Muhammad, Shaikh Muhammad WaqasAbid. Risk factors of birth asphyxia. Italian Journal of Pediatrics. 40. doi:10.1186/s13052-014-0094-2. ISSN 1824-7288. PMC 4300075 Freely accessible. PMID 25526846, 2014.
3. Davis PG, Tan A, O'Donnell CPF, Schulze A. Resuscitation of new born infants with 100% oxygen or air: a systematic review and meta-analysis". The Lancet. 2004; 364:1329-1333.Doi:10.1016/S0140-6736(04)17189-4. PMID 15474135.
4. Kutzsche S, Ilves P, Kirkeby OJ, Saugstad OD. Hydrogen peroxide production in leukocytes during cerebral hypoxia and reoxygenation with 100% or 21% oxygen in new born piglets. Pediatric Research. 2001; 49:834-842. Doi:10.1203/00006450-200106000-00020. PMID 11385146.
5. ILCOR Neonatal Resuscitation Guidelines, 2010.
6. Norwegian paediatrician honoured by University of Athens, Norway.gr
7. Blumenthal I. Cerebral palsy-medicolegal aspects. Journal of the Royal Society of Medicine. PMC 1282294 Freely accessible. PMID 11733588, 2001; 94(12):624-7.
8. Dhar KK, Ray SN, Dhall GI. Significance of nuchal cord. Journal of the Indian Medical Association. 1995; 93(12):451-3.PMID:8773129.
9. ACOG. Committee Opinion, Number 326, December 2005: Inappropriate Use of the Terms Fetal Distress and Birth Asphyxia. 2010.
10. Judith H Meek, Clare E Elwell, David C McCormick, A David Edwards, Janice P Townsend, Ann L Stewart, John S Way; abnormal cerebral hemodynamics in perinatally asphyxiated infants and their outcome. Arch Dis Child Fetal Neonatal Ed. 1999; 81(2):F110-F115.
11. Van Bel F, van de Bor M, Stijnen T, Baan J, Ruys JH. Cerebral blood flow velocity pattern in healthy and asphyxiated newborns: a controlled study. Eur J Pediatr. 1987; 146(5):461-7.