Original Research Article

Involvement of multiple organ system in perinatal asphyxia

Dilip Kumar Mandal[1*], Ravi Prakash Anand[2], Uday Shankar Prasad[3]

[1]Associate Professor, [2]Assistant Professor, [3]Professor, Department of Paediatrics, M.G.M. Medical College and L.S.K. Hospital, Kishanganj, Bihar, INDIA.
Email: drdilip86@gmail.com

Abstract

Background: Organ dysfunction other than the central nervous system is common after perinatal asphyxia, and organ-specific studies have looked into the pathophysiology and clinical symptoms of hypoxic-ischemic insults to the heart, lungs, kidneys, and intestine, a5 However, there have been few studies that have looked at multisystem involvement in seriously asphyxiated people. To determine the extent and severity of multisystem dysfunction following perinatal asphyxia, as well as to investigate the association between perinatal asphyxia clinical and biochemical markers and multiorgan involvement. **Methods:** A total of 50 term newborn babies with perinatal asphyxia is prospectively observed. Study conducted in the department of paediatrics in M.G.M. Medical college Kishanganj, Bihar. A comprehensive neurological, vascular, lung, cardiac, and gastrointestinal examination was carried out. Each organ's involvement was categorized as mild, moderate, or severe. Duration of the study period was March 2017 to January 2018. **Results:** Total 50 asphyxiated babies were included in the study. In this study, out of 50 neonates, 24 were male and 26 female. About 56% of our patients were delivered by vaginal delivery, whereas 44% of them were delivered by cesarean section, Central nervous system involvement occurred in 35 (70%) of the infants. According to the hypoxic-ischemic encephalopathy staging, 21 (60%) infants had stage 1, 9 (25.7%) had stage 2, and 5 (14.3%) had stage 3. **Conclusion:** In babies who follow all standards for asphyxia, the Apgar score at 5 minutes is potentially the single perinatal criterion that better distinguishes infants at risk of organ dysfunction. Since new treatments for extreme CNS damage are being investigated, it is important to investigate the involvement of other organs.

[*]**Address for Correspondence:**
Dr Dilip Kumar Mandal, Associate Professor, Department of Paediatrics, M.G.M. Medical College and L.S.K. Hospital, Kishanganj, Bihar.
Email: drdilip86@gmail.com
Received Date: 06/10/2020 Revised Date: 10/11/2020 Accepted Date: 14/12/2020
DOI: https://doi.org/10.26611/10141813

Access this article online

Quick Response Code:

Website: www.medpulse.in

Accessed Date: 10 April 2021

INTRODUCTION

Perinatal asphyxia is still a major cause of neonatal death, morbidity, and long-term consequences, especially in developed countries. Since hypoxic-ischemic encephalopathy causes death or morbidity with sequelae in a significant percentage of instances, the emphasis of perinatal asphyxia is primarily on the brain. Some organ systems are often affected by hypoxic-ischemic insult, but they are often overlooked.[1] Despite the fact that the fetal and neonatal myocardium seems to be immune to hypoxia,[2] cardiac failure was the most common symptom of myocardial instability after perinatal asphyxia.[3] As a result, while less serious manifestations of cardiac injury can be common, the occurrence of severe heart failure is minimal.[4] In 29 percent of the children suspected of having cardiac involvement, a murmur indicative of atrioventricular value insufficiency, electrocardiographic anomalies typical of myocardial ischemia, or both were observed.[5] Cardiogenic shock and hypotension, functional tricuspid incompetence due to acute cardiac dilation, arrhythmia, and myocardial ischemia are also known symptoms that can be detected by an electrocardiogram. However, the true occurrence of moderate myocardial ischemia could be exaggerated if pathological tests are not conducted, since the incidence of histologically confirmed myocardial ischemic injury following perinatal asphyxia seems to be higher than should be expected on clinical grounds.[6]

How to cite this article: Dilip Kumar Mandal, Ravi Prakash Anand, Uday Shankar Prasad. Involvement of multiple organ system in perinatal asphyxia. *MedPulse International Journal of Pediatrics.* April 2021; 18(1): 10-12. http://medpulse.in/Pediatrics/index.php

METHODS

A total of 50 term newborn babies with perinatal asphyxia is prospectively observed. Study conducted in the department of paediatrics in M.G.M. Medical college Kishanganj, Bihar. A comprehensive neurological, vascular, lung, cardiac, and gastrointestinal examination was carried out. Each organ's involvement was categorized as mild, moderate, or severe. Duration of the study period was March 2017 to January 2018. Neonates born before 37 weeks of gestation, or born outside or with congenital anomalies or with early-onset sepsis were excluded from study. A detailed history was taken and examination performed at the time of admission to NICU. Up to 14 days after birth, the neonatal clinical course was followed. The information gathered in this manner was reported. The aim of taking a natal history was to determine the mode of delivery and any indications for intervention, if any. There were complications before labor. The mother's last menstrual cycle was used to determine gestational age in completed weeks, and was then checked where possible by a routine early antenatal ultrasonography (USG) review. When the last menstrual cycle (LMP) was unavailable and an antenatal ultrasound was not performed, the gestational age was determined using the Modified Ballard Scoring method.[7]

All biochemical samples were taken on admission. Special investigation like echocardiography (ECHO) was done at Department of Radiology at M.G.M. Medical College and L.S.K. Hospital Kishanganj, Bihar. Daily follow-up of the patient was done, and overall progress was monitored till the discharge from NICU or death of the baby.

Cardiac evaluation:

In the first 72 hours of life, all asphyxiated neonates had their 12-lead serial ECGs registered to search for transient myocardial ischemia. Mild injuries were diagnosed in infants with ECG changes of grade 1 or 2, while serious injuries were diagnosed in infants with changes of grade 3 or 4. Jedeikin *et al.* specified the grading standards, which were followed. [8]

RESULTS

Total 50 asphyxiated babies were included in the study. In this study, out of 50 neonates, 24 were male and 26 female. About 56% of our patients were delivered by vaginal delivery, whereas 44% of them were delivered by cesarean section,

Central nervous system involvement occurred in 35 (70%) of the infants. According to the hypoxic-ischemic encephalopathy staging, 21 (60%) infants had stage 1, 9 (25.7%) had stage 2, and 5 (14.3%) had stage 3. Clinical seizures were present in 7 (10%) infants. Central apnea requiring ventilatory support occurred in 2 infants; 1 of them also had pulmonary hemorrhage or meconium aspiration syndrome. Sonographic evaluation revealed homogeneous or heterogeneous diffusely increased echogenicity of the brain parenchyma with obliteration of the ventricles in 6 infants.

The 2 infants who died had HIE stage 3. Moderate or severe renal involvement was found in 22 (44%) infants. Oliguria was present in 14 (28%) neonates during the first 24 hours of life and persisted in 2 (4%) for the first 48 hours. Proteinuria was noted in 15 (30%) infants. Oliguria and proteinuria were associated in 9 infants (p 0.4 for more than 4 hours, the mean duration being 45 hours. 9 (18%) infants required mechanical ventilation for pulmonary disease. 2 required mechanical ventilation for more than 72 hours;

Table 1

	Group- A(n=23)		Group- B(n=27)	
	Total	Severe	Total	Severe
Renal	09	02	10	03
Pulmonary	02	00	03	01
Heart	00	00	01	00
CNS	11	03	12	05
Gastrointestinal	01	00	01	01

In group A (infants with involvement confined to just one organ) and group B (infants with involvement confined to several organs), the frequency of complete and extreme involvement with each organ was calculated (infants with two or more organs involved).

DISCUSSION

These results indicate that pefinatal asphyxia, defined by the presence of at least three traditional criteria, is frequently followed by dysfunction of one or more organs during the neonatal period. Involvement of at least one organ was found in 46% of the infants and 54% were involved dysfunction of one or more organs during the neonatal period Our study differs from those previously reported[9] in two main ways: the criteria for inclusion of the infants in the study and the basis for defining dysfunction for each organ. Previous prospective reports included only asphyxiated infants who required admission to the neonatal intensive care unit. In contrast, our study included all the infants who met biochemical and clinical criteria for perinatal asphyxia; thus a broad spectrum of clinical effects, from none to severe, was found in our population (only 30% required admission to the neonatal intensive care unit). Second, in previous prospective studies, the definition of dysfunction for each organ evaluated either was not clearly provided or was based on very different criteria for each organ in the same study (i.e., mild biochemical involvement without clinical repercussion was defined as involvement in some organs, but severe failure was the criterion in others). Therefore the relative frequency of organ involvement was probably skewed toward those organs evaluated with the most sensitive definition of dysfunction. Although finding a balanced

definition of involvement for different organs is difficult, our distinction between normal, moderate, and severe involvement for each organ was an attempt to enhance comparability among the organs evaluated.

According to the presence of primary signs of acute neonatal encephalopathy, the CNS was the organ most frequently involved in this study. However, most infants had only transient neurologic abnormalities[10] of the 23 infants with moderate CNS involvement. In contrast, the 2 neonates who had severe HIE (stage 3) had brain damage documented by imaging techniques. As previously reported,[11] meconinm aspiration syndrome, pulmonary hemorrhage, and pulmonary hypertension were the most frequent pulmonary abnormalities. The specific mechanisms causing respiratory failure in asphyxiated neonates are difficult to isolate, and multiple factors probably are mutually reinforcing in each infant: fetal hypoxemia, ischemia, meconium aspiration, left ventricular dysfunction, coagulation defects, oxygen administration, and the use of mechanical ventilation[12] probably play interrelated roles in the clinical course of these infants. We found no relationship between umbilical cord arterial pH, meconium-stained amniotic fluid, umbilical cord abnormalities, presentation or type of delivery, and the frequency or severity of organ involvement. Although acidosis has been considered the best evidence of perinatal asphyxia·[13] the pH of umbilical cord arterial blood was not related to the frequency or severity of organ involvement. Other studies have not found any relationship between acidosis and either neonatal encephalopathy[14] The Apgar score was the only perinatal factor related to the number of organs affected and to the severity of organ involvement. Moreover, the Apgar score at 5 minutes best defined the subgroup of infants at risk of organ dysfunction. Other studies also have found a relationship between the Apgar score and short-term morbidity after perinatal asphyxia,[15] The results of this study further delineate the clinical picture of multiple organ involvement in the asphyxiated term newborn infant and indicate the need for global management of these infants. The Apgar score at 5 minutes in infants who meet other criteria of asphyxia is probably the single perinatal marker that best identifies infants at risk of organ dysfunction. It is important to study the involvement of other organs because new therapies for severe CNS damage are under investigation.

CONCLUSION

In babies who follow all standards for asphyxia, the Apgar score at 5 minutes is potentially the single perinatal criterion that better distinguishes infants at risk of organ dysfunction. Since new treatments for extreme CNS damage are being investigated, it is important to investigate the involvement of other organs. Future clinical trials of hypoxic-ischemic encephalopathy therapies must closely assess any adverse side effects on other tissues, as well as improvements in drug pharmacokinetics as a result of organ failure, which may not be clinically apparent until several hours after the procedure has been initiated.

REFERENCES

1. Neil M, Ben S. Birth asphyxia. In: Forfar and Arneil's Textbook of Paediatrics. 6th ed. New York, USA: Churchill Livingstone; 2003. p. 197-201.
2. Fisher DJ. Increased regional myocardial blood flows and oxygen deliveries during hypoxemia in lambs. Pediatr Res 1984;18:602-6.
3. Rowe RD, Izukawa T, Mulholland HC, Bloom KR, Cook DH, Swyer PR, *et al.* Nonstructural heart disease in the newborn. Observations during one year in a perinatal service. Arch Dis Child 1978;53:726-30.
4. Perlman JM, Tack ED, Martin T, Shackelford G, Amon E. Acute systemic organ injury in term infants after asphyxia. Am J Dis Child 1989;143:617-20.
5. Dijxhoorn MJ, Visser GH, Fidler VJ, Touwen BC, Huisjes HJ. Apgar score, meconium and acidaemia at birth in relation to neonatal neurological morbidity in term infants. Br J Obstet Gynaecol 1986;93:217-22.
6. Donnelly WH, Bucciarelli RL, Nelson RM. Ischemic papillary muscle necrosis in stressed newborn infants. J Pediatr 1980;96:295-300.
7. Mohan PV, Pai PM. Renal insult in asphyxia neonatorum. Indian Pediatr 2000;37:1102-6.
8. Jedeikin R, Primhak A, Shennan AT, Swyer PR, Rowe RD. Serial electrocardiographic changes in healthy and stressed neonates. Arch Dis Child 1983;58:605-11.
9. Sexon WR, Sexon SB, Rawson JE, Brann AW. The multisystern involvement of the asphyxiated newborn [Abstract]. Pediatr Res 1976;10:432.
10. Garcfa-Alix A, Cabafias F, Pellicer A, Hernanz A, Stiris TA, Quero J. Neuron-specific enolase and myelin basic protein: relationship of cerebrospinal fluid concentrations to the neurologic condition of asphyxiated full-term infants. Pediatrics 1994;93:234-40.
11. Shankaran S, Woldt E, Koepke T, Bedard MP, Nandyal R. Acute neonatal morbidity and long-term central nervous system sequelae of perinatal asphyxia in term infants. Early Hum Dev 1991;25:135-48.
12. Tyler DC, Murphy J, Cheney FW. Mechanical and chemical damage to lung tissue caused by meconium aspiration. Pediatrics 1978;62:454-9.
13. Low JA. The role of the blood gas and acid-base assessment in the diagnosis of intraparturn fetal asphyxia. Am J Obstet Gynecol 1988;159:1235,40.
14. Low JA. The role of the blood gas and acid-base assessment in the diagnosis of intraparturn fetal asphyxia. Am J Obstet Gynecol 1988;159:1235,40.
15. Perlman JM, Risser R. Severe fetal acidemia: neonatal neurologic features and short-term outcome. Pediatr Neurol 1993; 9:277-82.

Source of Support: None Declared
Conflict of Interest: None Declared