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Original Article

Clinico- Biochemical Profile of Neonates with Birth Asphyxia in Eastern Nepal

Shah GS[1], Agrawal J[2], Mishra OP[3], Chalise S[4]

[1]Dr. Gauri Shankar Shah, MBBS, MD, Professor and Head of Department, [2]Dr. Jyoti Agrawal, MBBS, MD, Senior Resident, [3]Dr. Om Prakash Mishra, MBBS, MD, Professor (visiting), [4]Dr. Shiva Chalise, MBBS, MD, Senior Resident. All from the Department of Paediatrics, BP Koirala Institute of Health Sciences (BPKIHS), Dharan, Nepal.

Address for correspondence: Dr. Gauri S Shah, E-mail: gaurishankarshah@live.com

Abstract

Introduction: Perinatal asphyxia is a common problem with the incidence varying from 0.5 – 2% of live births. It is an important cause of neonatal mortality and is a frequent cause for admission to neonatal intensive care units (NICU). The aims of this study were to find out the clinical and biochemical alterations in different stages of HIE. **Materials and Methods:** This was a prospective hospital based observational study performed during the period of February, 2010 to January, 2011. **Results:** Sixty inborn neonates satisfying the criteria for birth asphyxia requiring admission to pediatric wards and neonatal intensive care unit were studied. There were 13(21.7%) cases of mild hypoxemic ischemic encephalopathy (HIE), 27 (45%) moderate and 20 (33.3%) severe HIE. Seizures 41(68.3%), respiratory distress 32(53.3%) and shock 29(48.3%) were predominant manifestations observed. Meconium aspiration syndrome was found in 13.3% of neonates. Hypoglycemia 11(18.3%), hypocalcaemia 7(11.7%), hyponetremia 14 (23.3%) and hyperbilirubinemia 9(15%) were associated biochemical abnormalities. Twenty cases (33.3%) had acute renal failure and they belonged to moderate and severe stages of HIE. Seizures (P< 0.001), respiratory distress (P=0.015), shock (P<0.001) and serum creatinine (P=0.004) were found to be significant among different HIE stages. **Conclusion:** Neonates having birth asphyxia had HIE, seizures, respiratory distress, shock, hypoglycemia hypocalcaemia, hyponetremia, hyperbilirubinemia and acute renal failure mostly in moderate and severe stages

Key words: Birth asphyxia, Acute renal failure, Seizures

Introduction

Perinatal asphyxia is a common problem with the incidence varying from 0.5 – 2% of live births[1-4]. It is an important cause of neonatal mortality and is a frequent cause for admission to neonatal intensive care units (NICU). According to World Health Organization (WHO), approximately 4 million babies die each year before they reach the age of one month.[1,5,6] Ninety-eight percent of neonatal deaths take place in the developing countries. Perinatal asphyxia and birth injuries together contribute to almost 29% of deaths. Most of the births in Nepal occur at home 72%, usually attended by untrained birth attendants, 64% according to Nepal Demographic and Health survey (NDHS) 2011. Failure to initiate and sustain breathing immediately after delivery has been associated with hypoxic-ischemic injury to the central nervous system and the clinical manifestations of this injury have been termed as Hypoxic Ischemic Encephalopathy (HIE). HIE is of concern in an asphyxiated neonates because it can lead to serious long-term neuro-developmental sequelae among survivors[7].

Perinatal asphyxia is defined as the presence of hypoxia, hypercapnia, and acidosis leading the newborn with systemic disturbances.[8,9] When a neonate suffers asphyxia, series of cinical [10] and biochemical[11] alterations occur which can adversely affect the outcome[1]. American Academy of Pediatrics (AAP) and American College of Obstetrics and Gynecology (ACOG)[12] proposed the criteria for birth asphyxia: viz. profound metabolic or mixed acidemia, persistence of Apgar scores 0-3 for longer than 5 minutes,neonatal neurologic HIE (e.g.,seizures, coma, hypotonia) and multiple organs(of kidney, lungs, liver, heart, intestine) involvement.

In a developing country like Nepal, majority of deliveries takes place in rural area or during transport on the way to hospital and mostly unattended. As a result

neonates often suffer birth asphyxia and brought to the hospital in moribund stage. As such outcome of birth asphyxia was reported a decade ago.[13]. However, with development of recent *Neonatal Resuscitation Program (*NRP) guidelines and better infrastructure facilities in present NICU, there may be change in the course and outcome of these cases. Therefore, we present our observations on clinico- biochemical profile of neonates who suffered from birth asphyxia and its outcome.

Materials and Methods

This was a prospective hospital based observational study performed during the period of February, 2010 to January, 2011. The protocol of the study was approved by the Institute Ethics Committee and written informed consent was obtained from the parents of each neonate. Sixty inborn term neonates who suffered from birth asphyxia and progressed to HIE (as classified by Levene staging[13] using consciousness, tone, seizures, sucking/ respiration)) were included in the study. Birth asphyxia was defined by Apgar score of ≤ 6 at 1 min. All neonates were resuscitated as per NRP guidelines[12]. Cases with positive septic screening and gross congenital malformations were excluded. Detailed history and general physical and systemic examinations were recorded in a pre-designed proforma.

The hematological parameters included hemoglobin, hematocrit, total leukocyte and differential counts, platelet count and micro ESR. Blood glucose, calcium, sodium, potassium, urea, creatinine, bilirubin and arterial blood gas monitoring were also performed. Blood glucose < 40 mg/dl, serum ionized calcium less than 1 mmol/L and sodium < 135 meq/L was taken as hypoglycemia, hypocalcemia and hyponatremia. Repeat monitoring was done, if the parameter was abnormal on initial test, after taking corrective measures.

Statistical analysis

Differences in mean of quantitative data among birth asphyxia were compared by Analysis of Variance (ANOVA) and Kruskal Wallis and proportions by Chi-Square tests. A p value of < 0.05 was considered as statistically significant.

Results

Clinical and biochemical profile of neonates with birth asphyxia are presented in Table 1 and 2. According to HIE staging, 13 (21.7%) were in mild, 27(45%) in moderate and 20 (33.3%) belonged to severe HIE group. Seizures were present in 68.3%; majority of subtle variety (75.6%). Respiratory distress, shock and congestive heart failure were found in 53.3%, 48.3% and 1.7% of cases, respectively. Features of meconium aspiration syndrome were seen in 13.3% and raised intracranial pressure in the form of full anterior fontanel in 10% neonates. Three (5%) neonates developed hypothermia. Hypoglycemia 11(18.3%), hypocalcaemia 7(11.7%), hyponatremia 14 (23.3%) and hyperbilirubinemia in 9(15%) were associated biochemical features. Twenty cases (33.3%) had acute renal failure and oliguria was present in 14(23.3%) cases even after 72 hour of post natal life.

Table1: Clinical profile of neonates with birth asphyxia

Clinical details	Categories	n	%
HIE staging	1	13	21.7
	2	27	45.0
	3	20	33.3
Types of seizures	Subtle	31	75.6
	Multifocal clonic	9	21.9
	Tonic	8	19.5
Seizures (single/multiple)		41	68.3
Respiratory distress		32	53.3
Shock		29	48.3
Congestive heart failure		1	1.7
Full anterior fontanel		6	10.0

Table 2: Biochemical profile of neonates with birth asphyxia

Biochemical details	n	%
Hypocalcemia	7	11.7
Hyponatremia	14	23.3
Hypothermia	3	5.0
Hyperbilirubinemia	9	15.0
Acute renal failure	20	33.3
Meconium aspiration syndrome	8	13.3
Oliguria-day 1	35	58.3
Oliguria-day2	18	30.0
Oliguriat-day3	14	23.3

Various clinical and biochemical parameters were analyzed in relation to HIE staging and observations are shown in Table 3. Seizures were present in 41(68.3%) neonates; of these 27 in moderate whereas 14 cases in severe HIE had seizures (Fig.1). Seizures (P< 0,001), respiratory distress (P=0.015) and shock (P<0.001) were found to be highly significant among different HIE stages. Of various biochemical tests, serum creatinine was the only parameter which differed significantly (P=0.004) with maximum value in HIE stage III. Although the mean blood urea level was higher in severe stage in comparison to mild to moderate stages, but it failed to reach the level of statistical significance.

Table 3: Clinical and biochemical parameters according to HIE staging

Parameters	Categories	HIE Stages			P
		Mild n=13(%)	Moderate n=27(%)	Severe n=20(%)	
Seizures		0(0)	27(45)	14(55)	<0.001*
Types of seizures	Subtle	0(0)	15(25)	9(15)	
	Subtle+clonic	0(0)	2(3.3)	1(1.6)	
	Subtle+tonic	0(0)	2(3.3)	1(1.6)	
	Multifocal Clonic	0(0)	5(8.3)	1(1.6)	
	Tonic	0(0)	2(3.3)	2(3.3)	
	Tonic+subtle	0(0)	1(1.6)	0(0)	
Respiratory distress		8(13.3)	9(15.)	15(25)	0.015*
Shock		0(0)	9(15)	20(33.3)	<0.001*
Congestive heart failure		0(0)	0(0)	1(1.6)	0.362*
Hypoglycemia		1(1.6)	6(10)	4(6.6)	0.524*
Hematocrit (%)		52.4±4.3	47.9±7.5	47.3±7.0	0.097**
Tolal leucocyte count (mm^3)		16815.3 ±2927.9	20081.4±7362.9	20820±7130.8	0.216**
Urea (mg/dl)		38±26.4	31.9±16.0	51.9±46.6	0.105***
Creatinine(mg/dl)		1.0±0.4	1.1±0.4	1.8±1.2	0.004***
Na(meq/L)		140.4±3.4	138.7±6.5	140±16.1	0.855**
K(meq/L)		4.9±0.6	5.0±0.6	5.3±1.2	0.49**
Calcium(mg/dl)		1.1±0.1	1.5±0.1	1.1±0.1	0.606**
Blood sugar(mg/dl)		84.1±26.0	87.2±54.2	92.7±46.6	0.864***

Discussion

The higher neonatal mortality rate due to various causes is a major concern among all health professionals in Nepal. Birth asphyxia is a significant contributory factor as most of the deliveries are conducted by untrained personnels and that too in rural and hilly areas. By the time a sick neonates arrive at a tertiary care center, the babies have already progressed to various stages HIE with multi organ dysfunctions. This is clearly evident that 47/60 (78.3%) neonates in our study had moderate to severe grades of HIE. Majeed et al.[14] reported moderate to severe HIE in 28%, mild in 36% and no HIE in 34% of their cases. The difference of our findings from this study is because of the fact that we had included only those cases of birth asphyxia that developed HIE. The development of cardiac complications in asphyxiated neonates is due to hypoxic injury to myocardium. The most common feature was respiratory distress present in 32 (53.3%) and shock was present in 29 (48.3%). The predominant features of cardiac dysfunction were respiratory distress (53.3%), shock (48.3%) and congestive heart failure 9 (1.7%) in our study. Rajakumar et al[4] found respiratory distress (66.7%), cardiac failure (36.7%) and cardiogenic shock in 5 (16.7%) neonates in their study. The proportion of neonates having shock in our study is comparable with the finding of Mandal et al (44%)[15].

Respiratory distress could be mainly due to meconium aspiration syndrome and/or brain edema. Seizures were noted in 68.3% of cases and were mainly due to brain edema, birth trauma and metabolic complications. Among various metabolic changes, hyponatremia, hypocalcemia and hypoglycemia were major alterations seen in our study. Kumar et al[16] also found these abnormalities in 37.5%, 12.5% and 25% of their cases with birth asphyxia and emphasized the fact that these factors are often the causes of seizures in these cases.

Further, it was found that seizures, respiratory distress and shock had significant associations with increasing severity of HIE stages. Hyperbilirubinemia was seen in 15% of neonates and birth asphyxia per se is an independent risk factor for development of jaundice[17]. Thus, it is evident that multi- organ involvement mainly in moderate to severe grades of HIE complicates the clinical course of these neonates requiring NICU admission. Hypoxic injury to kidney is another complication which poses further problem and found in 33% of neonates and showed increasing in severity with increasing grades of HIE. Serum creatinine differed significantly among different grades of HIE with higher values in moderate and severe stages. Gupta et al. (18) reported acute renal failure in 33 (47.1 %) cases,

of which non-oliguric type in 78 % and oliguric type in 22% cases. Oliguria was present in 14 (23.3%) patients after 72 hours of postnatal age. However, all our cases improved with supportive treatment and none required peritoneal dialysis or exchange transfusion.

Conclusions

The birth asphyxia is the leading cause of neonatal morbidity, mortality and NICU admissions in developing countries. Neonates with HIE develop multi-organ dysfunctions which can be diagnosed by clinical and biochemical alterations. Early detection of multiorgan dysfunction helps in intensive monitoring and appropriate management so that their outcome can be further improved.

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