Original Article

To compare the outcome (early) of neonates with birth asphyxia in-relation to place of delivery and age at time of admission

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Abstract

Objective: To determine the frequency of birth asphyxia and short term (early) outcome in relation to age at admission and place of delivery.

Methods: A descriptive cross-sectional study was conducted in the Paediatric Department, Neonatal Ward of Liaquat University Hospital (LUH) Hyderabad from January to December 2009. All babies were received at our nursery or delivered in LUH with birth asphyxia were included, while babies having major congenital abnormalities, with birth weight < 1800 gm or preterm were excluded.

After consent and enrollment their detailed history including peri-natal history, Apgar score, resuscitation measures, problems and outcome were recorded on a pre-designed study proforma. Short term outcome was measured after 7 hours as clinically improved, developed neurological disability (Hypoxic Ischaemic Encephalopathy stage II or III) or death.

Results: The frequency was (n=600; 25%) of LUMHS born and (n=310; 61.63%) were received within 6 hours, (n=272 45% were LUMHS born and n=7 7% were out born), (n=37; 38.95%) within 24 hours and (n=9; 10.3%) after 24 hours. On initial neurological evaluation (n=90; 15%) were normal while clinical signs of HIE were present in 85%, with (n=180; 30%) in stage I, (n=210; 35%) in Stage II and (n=120; 20%) in stage III of HIE.

Outcome was measured after 72 hours, around 53.3% (320) were normal, 31.6% (190) developed neurological disability, while 15% (90) babies expired.

Outcome was better in Liaquat University of Medical Health Sciences (LUMHS) born than out-born with statistically significant difference in terms of disability (Chi-square test P-value <0.0001) but no difference was noted in terms of disability to death. There was a statistically improved outcome for babies received within 6 hours than those after 6 hours of birth (Chi-square test P-value <0.0255).

Conclusion: Early recognition of birth asphyxia and timely referral to tertiary center can reduce morbidity and mortality.

Keywords: Birth Asphyxia, Early referral, Neuro-developmental delay. (JPMA 62: 1277; 2012)

Introduction

Birth asphyxia is an important cause of acute neurologic injury, occurring in 2 to 3 cases per 1000 term live births in developed countries, with a higher incidence in less developed countries. Birth asphyxia related neonatal mortality and morbidity including long-term neuro-developmental disorders was seen in 25%-60% of survivors.[1]

There has been reduction in under-five mortality in the past two decades but relatively little change has been seen in newborn mortality. It is estimated that around 23% neonatal deaths are due to birth asphyxia, with a large proportion of stillbirths.[2] Though the improved obstetric care has reduced the incidence of birth asphyxia in developed countries, but the developing countries, still have a higher rate, ranging from 4.6 per 1000 in Cape Town to 26 per 1000 in Nigeria, with case fatality rates around 40%.[3]

According to the World Health Organization (WHO), incidence of birth asphyxia is around 3% that is from 130 million newborns each year globally, around four million develop birth asphyxia, and from asphyxiated babies around 1.2 million die and the same number develop severe consequences, such as epilepsy, cerebral palsy, and developmental delay.[4]

Regarding the definition according to American College of Obstetricians and Gynaecologists and the American Academy of Paediatrics, a neonate is labeled to be asphyxiated if the following conditions are fulfilled: (1) Umbilical cord arterial pH < 7; (2) Apgar score of 0 to 3 for longer than 5 minutes; (3) Neurological manifestations (e.g., seizures, coma, or hypotonia); and (4) Multisystem organ dysfunction, e.g., cardiovascular, gastrointestinal, haematological, pulmonary, or renal system.[5]

Risk factors seen in different studies were post

maturity, low birth weight, and eclampsia. According to a study conducted at Neonatal Unit of King Chulalongkorn Memorial Hospital, Thailand inappropriate antenatal care, post-maturity, vacuum extraction, male sex, prolapsed cord and 1 and 5-minute low Apgar scores, ($p < 0.0001$) were significant risk factors for hypoxic ischaemic encephalopathy (HIE).[6]

Outcome of birth asphyxia depends on apgar score at 5 minutes, heart rate at 90 seconds, time to first breath, duration of resuscitation arterial blood gases and acid -base status at 10, and 30 minutes of age.[7] It is measured as short-term (early) and long-term outcome. The early outcome is either death/or presence of hypoxic ischaemic encephalopathy (HIE) grade I, II or III, according to Sarnat staging.[8] According to a study done in Nepal incidence was 2.9 per 1000 live born of whom 20% had severe (Apgar score: 1-3) and 80% moderate birth asphyxia (Apgar score: 4-6). Staging of HIE was performed by Sarnat's staging and 30% were found with various stages of HIE with higher incidence in low Apgar score group. Most of the HIE cases presented with depressed neonatal reflexes, seizures, lethargy, and pupillary abnormalities. The common acid base disturbance was metabolic acidosis, observed only in babies with HIE-III.[9]

In spite of improvements in the obstetric and neonatal care the incidence of birth asphyxia is similar in the developing countries. The neonatal mortality is little bit decreased but morbidity after birth asphyxia in the form of neurologic damage is same or even increased due to survival of asphyxiated babies.[2,3] Despite the available information there are only a handful of published studies from developing countries and to date no such study has been done in our institute. In this study we have co-related the early outcome of asphyxiated babies with the age in hours at admission and place of delivery (whether born in LUH or outside).

We postulate that probability of survival is better in asphyxiated babies born at tertiary centers or when the baby reaches the center within initial 6-12 hours of life.

Methodology

A descriptive cross sectional study was conducted from January to December 2009 at the Neonatal Ward of Liaquat University Hospital Hyderabad to know the frequency of birth asphyxia at this institution and to assess the immediate outcome in relation to age at admission and place of delivery in asphyxiated babies. The city campus has three obstetrics units and two paediatric units. Neonates born at obstetrics unit were received and resuscitated by a senior resident trained in neonatal resuscitation.

Inclusion criteria of our study were full term newborns having clinical history consistent with perinatal asphyxia or 5 minutes Apgar score < 7, or history of delayed cry or need of resuscitation for > 10 minutes. While the exclusion criteria were babies having low Apgar score for other reasons : birth weight <1000 g, prematurely, Opium or anaesthesia-related low Apgar score or babies with lethal anomalies, hydrops, cyanotic congenital heart defects, congenital or chromosomal malformations and congenital infections.

Sample size of 450 was used taking the frequency of birth asphyxia as 3%.

(If the incidence of birth asphyxia was 3%, a measured asphyxia proportion of 30 per 1000 would have a 95% confidence interval of 27-33 per 1000. If the minimum annual number of deliveries conducted at LUH Hyderabad to around 5 thousand, then a sample of 450 newborn with birth asphyxia was expected to be enlisted for study).

For enrollment the operational definition of birth asphyxia was failure or delayed onset of spontaneous breathing after delivery or when there was need of positive pressure ventilation for > 1 minute, because due to limited laboratory support, fulfilling biochemical parameters defining birth asphyxia were not possible. Severity of Asphyxia was assessed by APGAR scoring, consisted of the five physical signs of heart rate, respiratory effort, reflex irritability, muscle tone and color. Babies were classified as mild with score 5-7, moderate having score 3-5, and severe Asphyxia with Apgar score < 3.[10]

For the LUMHS born babies we have an intermediate nursery adjacent to the labour room. Our resident medical officers trained in the neonatal resuscitation, received all babies delivered there. Babies who failed to develop spontaneous breathing were resuscitated. The duration of resuscitation was measured from delivery until the infant had spontaneous breathing with a heart rate >100 beats , and resuscitation was withdrawn after 20 minutes if spontaneous breathing had not been established as suggested by the American Heart Association.[11] After initial stabilization and resuscitation the babies who maintained their APGAR > 7 at 5 minutes were kept in postnatal ward for observation and essential newborn care for 12 hours and then discharged. While those who had apgar < 7 at 5 minutes were shifted to neonatal ward for further management.

Clinical examination of all admitted babies was done at 6, 24 and 48 hours of age. The evaluation included the general examination (such as temperature, assessment for pallor, cyanosis) and anthropometry. In the respiratory system, signs of respiratory distress and changes in breathing pattern were sought. Signs and stages of hypoxic ischaemic-encephalopathy (HIE) as proposed by Sarnat[8] were assessed. According to this classification, HIE grade I (mild) includes irritability, hyper alertness, mild hypotonia, and poor sucking; grade II (moderate) includes lethargy, seizures, marked abnormalities of tone, and requirement of tube feeding; and grade III (severe) includes coma,

prolonged seizures, severe hypotonia, and failure to maintain spontaneous respiration.[12] Routine investigations advised in all cases included blood sugar, calcium, electrolytes, and serum creatinine. Ultrasound brain preferably done on 3rd day and repeated on at one week of age if required. While CBC and blood and urine culture were advised in suspected cases of sepsis, and serum bilirubin and blood group of baby and mother for icteric babies. Other investigations like Prothrombin time, APTT, EEG and CT scan brain were advised depending on complications and clinical presentation.

The early outcome was recorded after 72hours of admission. It was measured as clinical improvement, death and/or presence of HIE, grade I, II or III. Secondary outcomes were RDS, hypothermia, hypoglycaemia and hypocalcaemia and sepsis, DIC and meningitis.

Data was analyzed by using SPSS version 16. Frequency of birth asphyxia were measured as percentage. Analysis for the relationship between dependent variable (outcome variable) and place of delivery and age at admission was measured with P-value by chi square test, and odd's Ratio with 95% confidence interval.

Results

The frequency of birth asphyxia at neonatal ward was 25% (600/2400 neonatal admissions). Male were (n=384; 64%) and (n=216; 36%) were females with 272 (45.4%) born in LUMHS. Frequency of birth asphyxia in LUMHS born babies was around 4% (272/7500 total deliveries). Regarding the mode of delivery (n=86; 31.5%) babies were born by caesarean section while (n=186; 68.5%) were by normal vaginal delivery (NVD) and around (n=135; 54.3%) were received within 6 hours (n=125; 89.25) were LUMHS born and (n=15; 10%)

Table-1: Outcome in relation to place of birth (normal to disability).

Place of delivery	Improved	Discharged with disability	Total	p-value	Odd ratio & CI
LUMHS born (272)	200 (73.5%)	55 (20%)	255	<0.0001	OR=4.615 with 95% CI=3.084-6.908
Out-born (328)	120 (36%)	135(41%)	255		
Total 600 *	320	190	510		

N-510 *{as 90 patients expired}

Table-2: Outcome in relation to place of birth (disability to death).

Place of delivery	Discharged with disability	Expired	Total	p-value	Odd ratio & CI
LUMHS born 272	55(20%)	27(9.9%)	82	0.46	OR=0.778 with 95% CI=0.4428-1.36
Out-born 328	135 (41%)	63(19%)	198		
Total	190	90	280		

N=280 {320 patients improved}.

Table-3: Outcome in relation to age at admission (normal to disability) N-503.

Age in hours at admission	Improved	Discharged with disability	Total	p-value	Odd ratio & CI
< 6 Hours	185	125	310	<0.0255	OR=0.6359 with 95% CI=0.4338-0.9321
>6 Hours	135	58	193		
Total	320	183	503		

Table-4: Outcome in relation to age at admission (disability to death) N=235.

Age at admission	Discharged with disability	Expired	Total	p-value	Odd ratio & CI
< 6hours	125	15	140	<0.0001	OR=21.879 with 95% CI=8.276-57.844
> 6hours	58	37	95		

were out-born), (n=37; 38.95%) within 24 hours and (n=7; 7.3%) after 24 hours of birth in the neonatal ward.

On neurological evaluation done within 24 hours of admission, 90 (15%) were found to be normal while clinical signs of HIE were present in 510 (85%) babies, out of those 180 (30%) babies were in stage I, 210 (35%) in Stage II and 120 (20%) in stage III of HIE.

The early outcome was measured after 72 hours of admission in terms of clinically improved, having features of HIE, or expired. Almost all the babies in stage I HIE improved while those in stage III either expired or discharged with disability. Around 320 (53.3%) were normal at time of discharge, 190 (31.6%) were discharged with neurological disability, while 90 (15%) babies expired.

To correlate the outcome with place of delivery and measure the outcome in terms of neurologically normal to disability there was statistically significant difference between LUMHS born and out born babies. P <0.0001; (57.737 (DF=1); OR= 4.615with 95% CI= 3.084-6.908).

On the other hand no statistically significant difference was noted when the outcome was in terms of correlated disability to death. (P <0.46 =0.5327 with DF=1, OR=0.7778 with 95% CI 0.44-1.36) (Table-1, 2).

Regarding the age in hours at time of admission when we analyzed the data and measured the outcome in terms of neurologically normal to disability, there was statistically significant difference between babies who were received within 6hours and those received after 6 hours of birth.(P-<0.0255; chi-square statistics 4.986 (DF=1) ; OR= 0.6359 with 95% CI= 0.4338-0.9321). Also statistically significant difference was noted when we correlated the outcome in terms of disability to death in relation to age in hours at admission (P-<0.0001, chi-squared statistics=58.447 with DF=1, OR=21.879 with 95% CI=8.276-57.844) (Table-3, 4).

Discussion

This descriptive cross sectional study determined the short term outcome of asphyxiated babies in relation to place of delivery and age at admission. Frequency of birth asphyxia was 25% in our study while it varies from 9%[13] to 22%[14] in different studies. This variation was due to different operational definitions for birth asphyxia adopted by different researchers; apgar score at 1 minute or 5 minute apgar score, duration of resuscitation, breathing effort at 1 minute etc. Although Apgar score does not exactly predict the neuro-developmental outcome, but it is still the most feasible and practical to perform. Therefore 5 minute Apgar score is still the valid index for assessing the effectiveness of resuscitation and vitality of newborn.[1]

In our study the male to female ratio was 1.8:1other studies have also shown similar ratio.[13,15] Regarding the place of delivery 45.5% babies were LUMHS born with only 20% having history of regular antenatal check-ups and > 80% mothers were referred with prolonged labour or prolonged rupture of membranes. On the other hand in one hospital based study 60% babies were born in hospital.[15] This reflects the delayed referral to tertiary care center in our set-up and lack of awareness for antenatal check-ups.

Regarding the mode of delivery 68.5% babies were delivered by spontaneous vaginal delivery and 31.5% by caesarian section, while other studies have shown 76%[13] and 51%[14,15] deliveries by caesarian section. In our study majority of caesarian section were due to prolonged rupture of membrane, foetal distress and obstructed labour. Timely intervention with caesarian section could have saved many of those unfortunate babies from being asphyxiated at birth (born with intrapartum asphyxia).

In our study around 54% asphyxiated babies were admitted in the neonatal ward within 6 hours (45% LUMHS born and 9% out-born), 37% within 24 hours and 8% were received within 24-48 hours of age. According to a study conducted in Bangladesh the mean age of babies on admission was 13.8 hours in asphyxiated group and 2.6 days in the control group, while the Indian study has shown that 71.6% babies arrived at <24 hours, 24% between 24 to 72 hours and rest >72 hours of age.[16] The difference is due to fact that other studies had included all neonatal admissions while our study was based on only asphyxiated babies who needed earlier admission for resuscitation or parents had the fear of other serious complications.

The early outcome measured after 72 hours in terms of clinically improved, had developed neurological disability (HIE) or expired; and correlated with place of delivery and age at admission. Neurological evaluation to assess the HIE was done daily by a consultant but outcome was measured after 72hours of admission.

The clinical improvement was labeled when the baby was able to maintain body temperature (outside the incubator), normal oxygen saturation (without supplemented oxygen), having stable vitals and no sign of HIE.

The relationship of neurological evaluation initially with place of delivery and age at time of admission was statistically significant in our study.

After 72 hr when we assessed the outcome, almost all the babies in stage I HIE had improved while those in stage III either expired or had developed neurologic disability. Around 53.3% (320) were normal at time of discharge, 31.6% had neurological disability, while 15% babies expired. If these results are compared with a study conducted at King Edward

Medical University Lahore in 2009; our figures are very much similar in terms of discharged normally (53.3% vs 59%) but not in terms of mortality 15% vs 40.3%).[17] Mortality figures due to birth asphyxia vary from 6%[18] to 16%.[19,20]

Our main objective was to measure the outcome in relation to place of delivery and age at admission. For place of delivery when we analyzed the data; there was statistically significant difference between LUMHS born and out born babies in terms of neurologically normal to disability. This showed that the probability of neurological disability due to HIE after birth asphyxia was 4.615 times more in out-born babies. On the other hand no statistically significant difference was noted when we correlated the outcome in terms of disability to death within 72 hours of admission. This might be due to fact that LUMHS born babies were admitted earlier (within 6 hours) as compared to out-born babies. It means if the asphyxiated neonate reaches the facility early, there are better chances to recover without sequelae. Delayed referral end either with morbidity or mortality irrelevant to place of delivery. This observation was also confirmed when we assessed the outcome in relation to age at admission. The delay in reaching hospital caused more neurological disability. This was also found to be statistically significant when considering mortality.

Referring high risk pregnancies to tertiary care hospitals is not enough because these centers and neonatal units have their own limitations. It could be possible to reduce the occurrence of asphyxia and its complications by improving antenatal, intrapartum and neonatal care services in the community. More attention should be paid to the training of LHVs and midwives and other community health workers in neonatal resuscitation, essential newborn care and EMONC for better obstetric and neonatal care in the community.

Conclusion

This study found birth asphyxia was more common in term babies than preterm babies. Most of the identified maternal risk factors were significantly related to asphyxia. Among the serious neonatal complications HIE was commonest in asphyxiated neonates and mortality was higher in neonates with HIE.

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