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Correlation of Thompson Score in Predicting Early Outcome of Newborn with Birth Asphyxia

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ABSTRACT

Background: Birth asphyxia is one of the important causes of neonatal morbidity and mortality, accounting up to 30% of neonatal death in Nepal. It is also an important cause of long term neurological disability and impairment. Thompson encephalopathy score is a clinical score which can be used to assess the newborn with hypoxic ischemic encephalopathy for the prognosis and their neurodevelopmental outcome. The aim of the study was to assess the role of Thompson score in predicting the early outcome of neonates with birth asphyxia.

Methods: A prospective study was conducted from May 2019 to April 2020 in Nepal Medical College. All the term babies during the period with Apgar score of less than seven at five minutes were considered to have birth asphyxia and included in the study. Neurological examination was done on first, second and third day using HIE score proposed by Thompson and severity of hypoxic ischemic encephalopathy was classified accordingly. Outcome was measured as normal, morbidity with encephalopathy, seizure, organ dysfunction and death.

Results: Out of 391 newborn admitted to neonatal unit, 84 (21.4%) had birth asphyxia. Mild Thompson score on day 1,2,3 were 49(58.3%), 49 (58.3%), 51(60.7%); moderate Thompson score on day 1,2,3 were 21 (25%), 21 (25%), 18(21.4%) and severe Thompson score on day 1, 2, 3 were 14 (16.7%), 14 (16.7%), 15(17.9%) respectively. Out of 14 babies who had severe Thompson score on day 1, 11(91.7%) expired and 3 (16.7%) developed encephalopathy.

Conclusions: There was strong correlation of severity of Thompson score with the outcome.

Keywords: Birth asphyxia; hypoxic ischemic encephalopathy; thompson score

INTRODUCTION

Birth asphyxia is defined as the full-term baby who is not breathing and in poor condition at birth with an assumed association with acute intrapartum events.[1] Abnormal neurobehavioral state following birth asphyxia is referred as hypoxic ischemic encephalopathy (HIE).[2] Approximately 20-30% newborn with HIE die in the neonatal period and 33-50% of survivors are left with permanent neurodevelopmental abnormalities.[3] Incidence of birth asphyxia in Nepal Medical College was 15.9%.[4] Thompson encephalopathy score can be used for assessment of infants with HIE and for prognostication of neurodevelopmental outcome in places where sophisticated technology is not available.[5] There is significant correlation between day 1 Thompson score with morbidity and mortality of the asphyxiated newborn.[6] Increasing survival of children with different developmental disabilities have emerged as a challenge for the baby, family and physicians.[7] This study was conducted to assess the association of Thompson score and early outcome of neonates with birth asphyxia.

METHODS

It was a prospective observational descriptive study conducted in the Neonatal Intensive Care Unit (NICU) of Nepal Medical College Teaching Hospital (NMCTH) during the period of one year from May 2019 to April 2020. All the full term neonates who had Apgar score at five minute of less than seven were considered to have birth asphyxia and included in the study. The preterm babies and the babies with congenital anomalies were excluded from the study.

The detailed antenatal and natal history of the mothers were obtained including antepartum hemorrage, eclampsia, prolong rupture of membrane, meconium stained liquor, the mode of delivery, mal-presentation and prolonged labour; which are considered as the risk factors for birth asphyxia .

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Informed consent was obtained from all the parents. All the consecutive neonates who fulfilled the inclusion criteria were observed for the clinical signs and symptoms of HIE. Apgar score was taken at 1 minute and 5 minute of birth. It is considered moderate when Apgar score is between 4-6 or severe when the score is less than 4.[8] The babies were subjected to complete physical examination including neurological examination and assessed for organ dysfunction associated with birth asphyxia. Outcome was assessed in relation to the Thompson score.

Neurological examination was done on first, second and third day using HIE score proposed by Thompson and severity of HIE was classified accordingly. In the scoring system, infants scoring 1-10 was considered to have mild HIE, 11-14 to have moderate HIE and15-22 to have severe HIE.[5] The chart was filled in detail for three consecutive days by the investigator. The highest score attained on any of the 3 days was used to assess severity of birth asphyxia.

Cord arterial blood gas analysis was done at birth. Arterial cord blood sample was collected from umbilical cord using heparinized disposable syringes and the samples were analyzed by Blood Gas Analyzer. Outcome was measured as normal, morbidity with encephalopathy, seizure, organ dysfunction and death.

Ethical approval was obtained from Nepal Medical College Institutional Research Committee. Data collection was done in the preformed data entry sheet. SPSS 16.0 software was used for data analysis. The data were expressed in terms of means, standard deviation and proportion, followed by comparison between groups through Chi-square test. p value of less than 0.05 was considered as statistically significant.

RESULTS

During the study period, out of 391 newborn admitted to NICU, 84 (21.4%) had birth asphyxia. Total number of newborn expired was 26. Among them 14 (53.8 %) was due to birth asphyxia. Meconium stained liquor was the most common intrapartum risk factor seen in 11 (13%) whereas disseminated intravascular coagulation was the most common systemic dysfunction seen in 12 (14.2%) babies. Seizure was seen in 46 (54.8%) babies. Mild Thompson score on day 1, 2, 3 were 49 (58.3%), 49 (58.3%), 51 (60.7%), moderate Thompson score on day 1,2,3 were 21(25%), 21 (25%),18 (21.4%) and severe Thompson score on day 1,2,3 were 14 (16.7%),14 (16.7%),15 (17.9%) respectively (Table 1).

Table 1. Grading of Thompson Score at Day 1, 2, 3 (n=84).

Thompson Score	Day 1	Day 2	Day 3
Mild (1-10)	49(58.3%)	49(58.3%)	51(60.7%)
Moderate (11-14)	21(25.0%)	21(25%)	18(21.4%)
Severe (15-20)	14(16.7%)	14(16.7%)	15(16.7%)
Total	84(100%)	84(100%)	84(100%)

There is statically significant correlation between mortality and morbidity with Thompson score (p-value 0.001). ROC curve were plotted for Thompson score day 1 and morbidity; Thompson score day 1 and mortality. For morbidity curve, AUC (Area under Curve) was 0.873 which was highly significant (p=0.001) (Figure 1).

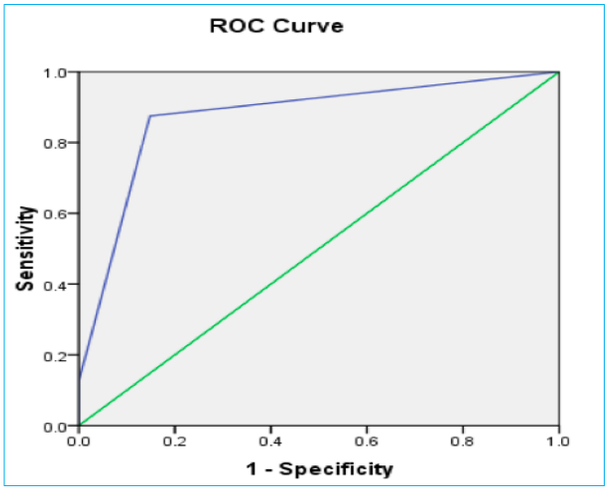

Figure 1. ROC curve (Morbidity with Thompson score).

Considering the cut off value of more than 1, sensitivity is 87.5% and specificity is 85.19%. Similarly, for mortality curve, AUC was 0.929 which was also highly significant (p=0.001) (Figure 2).

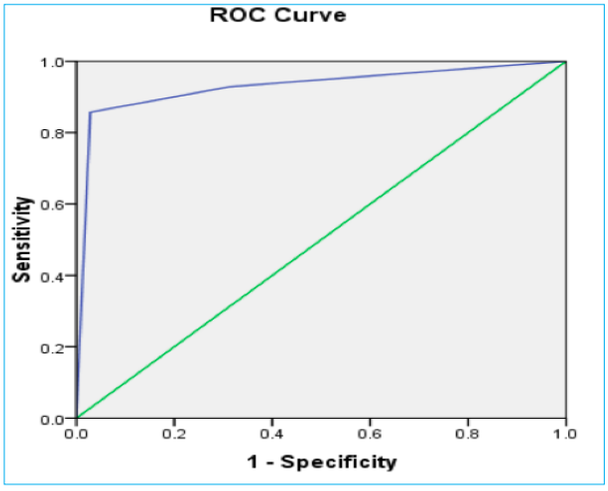

Figure 2. ROC curve (Mortality with Thompson score).

Table 2. Correlation of Thompson Score Day 1 with the outcome.

			Thompsons Score Day 1			Total	P value
			Mild (1-10)	Moderate (11-14)	Severe (15-20)		
Outcome	Death	Count	1	1	12	14	<0.001
		% within outcome	7.1	7.1	85.7	100.0	
	Improved without encephalopathy	Count	46	8	0	54	
		% within outcome	85.2	14.8	0	100.0	
	Improved with encephalopathy	Count	2	12	2	16	
		% within outcome	12.5	75.0	12.5	100.0	
Total		Count	49	21	14	84	
	% within outcome	58.3	25.0	16.7	100.0		

Table 4. Correlation of Thompson Score Day 3 with the outcome.

			Thompson Score Day 3			Total	P value
			Mild (1-10)	Moderate (11-14)	Severe (15-20)		
Outcome	Death	Count	0	1	13	14	<0.001
		% within outcome	0	7.1	92.9	100.0	
	Improved without encephalopathy	Count	48	6	0	54	
		% within outcome	88.9	11.1	0	100.0	
	Improved with encephalopathy	Count	3	11	2	16	
		% within outcome	18.8	68.8	12.5	100.0	
Total		Count	51	18	15	84	
	% within outcome	60.7	21.4	17.9	100.0		

Considering the cut off value of more than 2, sensitivity is 85.71% and specificity is 97.14%. The Pearson correlation coefficient between Thompson score and mortality at day 1 was highly significant ($r = 0.708$; $p < 0.01$). Similarly, there was highly significant correlation between Thompson score and morbidity at day 1 (Pearson correlation coefficient, $r = 0.673$; $p < 0.01$).

DISCUSSION

The prevalence of birth asphyxia was 78 per 1000 live birth with asphyxia specific mortality of 11 per thousand in the rural Nepal.[9] The incidence of birth asphyxia in our study was 21.4% which is similar to result of other studies where the incidence varied from 9 to 23%.[10-12] The relatively higher incidence of birth asphyxia in this study may be due to recent rapid increase in number of patients provided with obstetric care resulting in some compromise in the level of care provided to parturients. A population based cohort study in Southern Nepal showed 30.0% of neonatal death due to birth asphyxia.[13] In our study neonatal death due to birth asphyxia was 53.8% which is quite high compare to the previously study done in NMCTH where the incidence was only 19.0%.[14] This may be due to sicker neonates managed in our tertiary level center. In a similar study, there was 50% mortality among the neonates who developed HIE III.[4]

Out of 14 newborn who expired due to birth asphyxia, 12 had severe,1 had moderate and 1 had mild Thompson score on day 1. There were 14 babies who had severe Thompson score on day 1. Out of them, 11 (91.7%) expired and 3 (16.7%) developed encephalopathy. There was strong correlation of severity of Thompson score with outcome, with high statistical significance (p=0.001) (Table 2, 3 and 4).

In another study, there was statistically significant correlation between morbidity and day 1 Thompson score (p value=0.024); mortality and day 1 Thompson score (p value=0.001). There was a tendency for better predictive capacity of Thomson score in regard to mortality with sensitivity of 93%, specificity of 90%, positive predictive value of 50% and negative predictive value of 99%.[6] The neonates who develop HIE I had good outcome with survival of 95% but HIE III had poor outcome with survival rate of only 25%.[11] Birth asphyxia survivors account for almost a quarter of NICU survivors in a developing country and 31% had an abnormal neurologic examination during the clinic visit.[15] Out of

those term newborn who survived encephalopathy 13% had cerebral palsy (CP).[16] Infant affected with HIE stage II has gross motor delay in 29.4%, fine motor delay in 18.2%, social delay in 17.1% and persistent seizures in 15.6% at 2 years of age.[17]

There is no gold standard test for birth asphyxia. Fetal distress, acidaemia and Apgar scores are the clinical markers of the process of potential intrapartum injury which have low positive predictive values.[18] In our study, out of 20 infants who had severe acidosis (pH < 7), 7 (35%) died. However, out of 61 patients with mild acidosis (pH of 7-7.35), 7 (11.5%) expired. None of the 3 patients without acidosis (pH > 7.35) expired. The values were statistically significant (p < 0.036). Out of 11 newborn who had Apgar score of ≤3 at 5 minutes, 9 (81.8%) expired. In newborns with Apgar score of 4-6, 5 (6.8%) of the 73 patients expired. The values were statistically significant (p < 0.001). The Apgar score provides an accepted and convenient method for reporting the status of the newborn infant immediately after birth and the response to resuscitation if needed. However, Apgar score alone cannot be considered to be evidence of or a consequence of asphyxia, does not predict individual neonatal mortality or neurologic outcome.[19] The HIE scoring system is a useful predictor of neurodevelopment outcome at 6 months of age in a resource poor setting. The positive predictive value (PPV) for mortality was 42.3% for moderate HIE and 93.8% for severe HIE. Thirteen infants had delayed development, the score had PPV of 63.6% for moderate HIE and 100% for severe HIE.[20] Thompson encephalopathy score ≥12 was associated with death before discharge (odds ratio: 3.9; confidence interval: 1.3 to 11.2) and with development of severe epilepsy.[21] On day 1, there was a significant correlation between Thompson score and both morbidity and mortality (p < 0.01).

CONCLUSIONS

Thompson score is a clinical scoring which can be used for predicting short term neurological status in the neonates with birth asphyxia in resource limited country like ours. It can be used as an early tool by clinicians to counsel parents/caretakers and to select the patient who will benefit from the expensive investigations and treatment. It also enabled to identify infants that may be at high risk of neurodevelopmental abnormality. There was strong correlation of severity of Thompson score with the fetal outcome.

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