Whether Poor Thoompson Score Predicts Need of Expensive and Specialized Nicu Care

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ABSTRACT

Introduction: Infrastructure required for maintaining such high-risk patients such as ventilatory support, inotropic support and intensive monitoring is still lacking at most periphery centers in our country so present research was done with the aim to study the need of ventilatory support, inotropic support, anti convulsive medication and glucose infusion support in term asphyxiated neonates with history of asphyxia and Thompson score >10 within 48 hours of life.

Material and methods: Ours is a Retrospective cohort study conducted at Tertiary neonatal intensive care unit. Study was conducted from October 2015 to March 2016 on 61 term neonates with history of delayed cry at birth admitted in NICU, LLRM medical college Meerut. Outcomes measured were need of ventilatory support (CPAP or intubatory support), need of inotropic support, anti convulsive medication, need for glucose infusion.

Results: Thompson score >10 within 48 hours of life had following results- On ventilatory support- Sensitivity 65.6% (95% C.I- 46.8%81.4%); Specificity 42.3% (95% C.I- 23.4%-63.1%); Likelihood Ratio (+) - 1.14 (95% C.I- .752- 1.72); Likelihood Ratio (-) - 0.813 (95% C.I- .422-1.57). On ionotropic support- Sensitivity 80% (95% C.I- 44.4%-97.5%); Specificity 41.7% (95% C.I - 27.6% -56.8%); Likelihood Ratio (+)- 1.37 (95% C.I 0.927-2.03); Likelihood Ratio (-)- 0.48 (95% C.I -.133-1.73). On anti convulsant medication- Sensitivity- 81% (95% C.I-58.1%-94.6%); Specificity - 48.6% (95% C.I- 31.9%-65.6%)P; Likelihood Ratio (+)- 1.58 (95% C.I- 1.08- 2.3); Likelihood Ratio (-)- 0.392 (95% C.I- 0.153- 1.00). On GIR support- Sensitivity-100 %(95% C.I- 29.2%- 100%); Specificity- 40 % (95% C.I-27%- 54.1%); Likelihood Ratio (+)- 1.67(95% C.I- 1.34- 2.07); Likelihood Ratio (-)- 0.

Conclusion: Thompson score < 10 within 48 hours of life was good indicator that asphyxiated newborns will not be needing inotropic or GIR support**.**

Keywords: Neonate, ventilator, GIR support, inotrope, anti convulsant

INTRODUCTION

Hypoxic–ischemic brain injury of the neonates remains a significant problem throughout the world. In India as per NNPD 2002, incidence of Apgar score <7 at 1 minute was found in 8.4%, Apgar score <7 at 5 minutes was found in 2.4% of births. Mortality associated with perinatal asphyxia was 28.8% of all neonatal deaths in India. Hypoxemia is defined as the 'diminished amount of oxygen in the blood supply' and cerebral ischemia as the 'diminished amount of blood perfusing the brain'; Ischemia is pathologically more significant as it leads to decrease in glucose levels in the brain which causes neuronal defect.[1] Asphyxia is the result of an impairment of exchange of the respiratory gases oxygen and carbon dioxide. Thus, in addition to hypoxia, asphyxia leads to additional damage by producing increase in carbon dioxide levels in the body which leads to acidosis and increased cerebral blood flow resulting in a number of metabolic and physiological adverse effects (CBF).[1] Pathogenesis of Hypoxia – Ischemia may have acute or chronic progression. Neonatal encephalopathy is a disease with an evolving progression associated with deterioration of the neurological signs and symptoms (seizures and impaired conscious state) in the first 24 hours and slow improvement over next few days.

Thompson et al[2] in 1997 introduced a clinical grading system to describe the neurological abnormalities directed at developing quantifiable scores with good reproducibility.

The score consists of a clinical assessment of nine signs-

LOC (level of consciousness): The assessment of LOC is as described originally by Sarnat and Samat(3). The neonates are classified as Normal if they are staring with normal spontaneous movements and are Hyper alert if exaggerated responses to minimal stimuli are present. Stu

Fits (clinically apparent seizures): The score increases with increasing frequency of seizures.

Posture: This is assessed again as described by Sarnat and Samat (3) But in Thompson method an additional score of 1 has been given to the infants who present with intermittent bicycling movements of the limbs together with fisting (which is defined as flexion of thumb which is adducted and opposed across the palms)

Moro. Grasp, Suck: (the primitive reflexes: Moro reflex. palmar grasp and suck reflex) - These reflexes are normal in the mildly affected infant, poor or partial in moderate HIE and absent in severe HIE.

Respiratory rate: In severely affected neonates respiratory rate may decrease to apnea and require ventilator support

Fontanelle tension: The progression in scoring for fontanelle tension is from normal to full to tense/ bulging fontanelle.[3-6]

How the intervention might work

Hypoxic Ischemic encephalopathy was originally described by Amiel Tison in 1969.[7] Numerous diagnostic methods have become available to diagnose and assess the extent of the cerebral damage caused by perinatal asphyxia. Though accurate, these diagnostic tests like MRI scanning, CT scanning,

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cranial ultrasound and Doppler ultrasound are still prohibitively expensive and difficult to access.

Sarnat and Samat (3), groups affected infants into one of three categories: mild, moderate and severe. The criteria of categorization of neonate into moderate or severe is at times subjective which makes it difficult for easy differentiation and also it leads to variable outcomes in neonates classified as moderate asphyxia Application of this grading system is also time consuming and requires some pediatric expertise. Thompson scoring is fast and reliable method of scoring with inter-observer reliability coefficient of 0.87.[7,8]

As reported by NNPD (2002-2003) Bag and mask ventilation was required in 6.3% and chest compressions was required in 0.8% of newborns. Paucity of data in assessing the sensitivity, specificity, positive predictive value and negative predictive value of Thompson scoring for requirement of ventilatory support, inotropic support etc. prompted us to conduct this retrospective cohort study to better arm clinicians at periphery centers to rapidly prognosticate a patient using Thompson scoring and can assist in timely referral of patients to better equipped neonatal units.

MATERIAL AND METHODS

We conducted a retrospective cohort study at a Tertiary newborn care center with 61 term newborns between October 2015 to march 2016. All enrolled full term (> 37 weeks) inborn babies had been admitted to NICU for post resuscitative care during that time period. Demographics and pertinent medical history of mother were retrieved from delivery details. During the neonates stay in NICU, babies were closely monitored and complete recording for requirement of assisted ventilation, episodes of hypoglycemia, seizures, bleeding manifestations and clinical deterioration were documented. Resident doctor on duty did Thompson scoring initially at 6th hour of life then after 24 hours. We retrieved the data from previous files and formed a cohort of enrolled neonates, based on inclusion exclusion criteria, in the time period from October 2015 to march 2016.

Inclusion criteria

- All in born full term babies (>37 weeks defined by modified ballard scoring) with APGAR score less than 4 at 5 minutes or with complain of delayed cry.
- All term babies with history of perinatal asphyxia.
- All term babies with clinical signs of perinatal asphyxia.

Exclusion criteria

- Preterm babies.
- Severe congenital anomalies.
- Newborn with coagulopathy.
- Newborns of mothers on drugs like phenytoin, warfarin, and phenobarbitone, MgSO4.
- Newborns with severe sepsis or meningitis.

Primary outcomes

1. Need of ventilatory support in neonates with Thompson score >10 within 48 hours of life

Secondary outcomes

1. Need for Inotropic support in neonates with Thompson score >10 within 48 hours of life.
2. Need for Anti convulsant medication in neonates with Thompson score >10 within 48 hours of life
3. Need for Glucose infusion for Hypoglycemia in neonates with Thompson score >10 within 48 hours of life

Sensitivity is the ability of a test to correctly classify an individual as 'diseased'. The ability of a test to correctly classify an individual as disease- free is called the test's specificity. Positive Predictive Value is the percentage of patients with a positive test who actually have the disease. Negative predictive value is the percentage of patients with a negative test who do not have the disease.[9]

STATISTICAL ANALYSIS

Microsoft office 2007 was used for making tables. Descriptive statistics like mean and percentages were used to infer results. Data was interpreted at 95% confidence interval.

RESULTS

In the need for ionotropic support arm of our study we found that Thompson score > 10 within 48 hours gave a sensitivity of 80% (95% C.I- 44.4%-97.5%) and specificity of 41.7% (95% C.I- 27.6%-56.8%) with negative predictive value 90.9% (95%, C.I-70.8%-98.9%). So our study shows that a patient with a Thompson score of <10 within 48 hours will not need ionotropic support in 90.9 % of cases (table-1).

In the need for ventilatory support arm of the our study we found that Thompson score >10 within 48 hours gave Sensitivity of 65.6% (95%, C.I-46.8%-81.4%) and specificity of 42.3 (95% C.I- 23.4%-63.1%). Negative predictive value of 50% (95% C.I- 28.2%- 71.8%) and PPV of 58.3% (95% C.I - 40.8%-74.5%) for need of ventilatory support. So we concluded that Thompson score >10 within 48 hours is not a good indicator of need of ventilatory support in the patient (table-2).

In the need for Anti Epileptic drugs arm of our study we found that Thompson score >10 within 48 hours had sensitivity of 81% (95% C.I - 58.1%-94.6%), specificity of 48.6% (95% C.I-

Prevalence	55%	42%	68.3%
Sensitivity	65.6%	46.8%	81.4%
Specificity	42.3%	23.4%	63.1%
Roc area	0.54	.412	0.668
Likelihood ratio(+)	1.14	0.752	1.72
Likelihood ratio(-)	0.813	0.422	1.57
Odds ratio	1.4	0.489	4.01
Positive predictive value	58.3%	40.8%	74.5%
Negative prdictive value	50%	28.2%	71.8%
(95% Confidence interval)			

Table-1: Ventilatory support for thompson score >10 within 48 hours of life

Prevalence	17%	8.6%	29.4%
Sensitivity	80%	44.4%	97.5%
Specificity	41.7%	27.6%	56.8%
Roc area	0.608	0.46	0.757
Likelihood ratio(+)	1.37	0.927	2.03
Likelihood ratio(-)	0.48	0.133	1.73
Odds ratio	2.86	0.606	-
Positive predictive value	22.2%	10.1%	39.2%
Negative prdictive value	90.9%	70.8%	98.9%
(95%Confidence interval)			

Table-2: Ionotrpic support for thompson score >10 within 48 hours of life

31.9%-65.6%), Positive predictive value of 47.2%(95%C.I-30.4%-64.5%) and Negative predictive value of 81.8% (95% C.I - 59.7%-94.8%) which means that Thompson score >10 within 48 hours had good sensitivity and the clinician should closely observe for seizure episodes especially subltle seizures in newborns with Thompson score of >10 within 48 hours. And as the Negative predictive value is >80% it shows that patients with Thompson score <10 will not need Anti convulsive medication (table-3).

Hypoglycemia is a common complication of hypoxia- ischemia (Boardman et al 2015).[10] Intensive. Management of persistent hypoglycemia is by institution of glucose infusion which is an intensive modality. In the need for Glucose infusion arm of our study we found that Thompson score >10 within 48 hours had sensitivity of 100% (95% C.I- 29.2%-100%), specificity of 40% (95% C.I- 27%-54.1%), positive predictive value of 8.33% (95% C.I-1.75%-22.5%) and negative predictive value of 100% (95% C.I- 84.6%- 100%). This means that Thompson score <10 at 48 hours was 100% predictive of not requiring glucose infusion in the patient (table-4).

DISCUSSION

Most experts agree that HIE is not a single clinical event but is a disease process which is evolving over time. The clinical signs and symptoms of the insult are a reflection of the biochemical and molecular changes occurring in the brain following the initial insult. MRI studies have shown that the initial area affected by the asphyxia is usually less extensive and the size of the lesion progresses over the first few days after injury.[4] Both Diffusion weighted imaging and MR spectroscopy show similar progression of the CNS involvement with brian injury initially being localized to Putamen and Thalami and later involving extensive areas of the brain.[5-10]

In animal models it has been proven that apoptosis induced by experimental hypoxia-ischemia has prolonged role and apoptosis causing mediators like caspase are present in high levels as late as 7 days after initial insult.[11] The initial hypoxic-ischemic injury results in an area of infarction. The penumbra continues to show adverse changes in the form of neuronal necrosis or apoptosis (programmed cell death) even after the hypoxic insult is over.[6] The area which can be later involved and the time taken for the changes to occur is still unclear.

Also it is very well known that due to electro-clinical dissociation in newborns many times electric seizure activity in the brain may not have any or may have very subtle clinical manifestations which can be easily missed if the clinician is only monitoring for seizure activity.[12] Optimal management of HIE in newborns includes adequate resuscitative measures in the delivery room, with regular monitoring and management of seizure acitivity and supportive for complications like hyperthermia, hypoglycemia etc.[8]

What all this means for a clinician is that even if a neonate presenting with history of asphyxia does not have any clinical features suggesting extensive cerebral brain damage, regular monitoring of the neonate should be done using objective clinical scoring method like Thompson scoring. Magnetic resonance spectroscopy is one of the few diagnostic tests, which can accurately prognosticate neonate with asphyxia episode, but these tests are expensive and are rarely available in periphery centers. Also management of such patients needs high technical expertise. So in view of the lack of diagnostic testing we conducted our study to arm the clinician with data which can help him confidently apply Thompson scoring to decide whether a particular neonate would be requiring further intensive support and help make better informed judgment regarding timely referral of the patient.

Prevalence	36%	24%	49.9%
Sensitivity	81%	58.1%	94.6%
Specificity	48.6%	31.9%	65.6%
Roc area	.648	.529	.767
Likelihood ratio(+)	1.58	1.08	2.3
Likelihood ratio(-)	.392	.153	1
Odds ratio	4.03	1.18	13.6
Positive predictive value	47.2%	30.4%	64.5%
Negative prdictive value	81.8%	59.7%	94.8%
(95%Confidence interval)			

Table-3: Anti convulsant medication for thompson score >10 within 48 hours of life

Prevalence	5.2%	1.1%	14.4%
Sensitivity	100%	29.2%	100%
Specificity	40%	27%	54.1%
Roc area	0.7	0.635	0.765
Likelihood ratio(+)	1.67	1.34	2.07
Likelihood ratio(-)	0	-	-
Odds ratio	-	0.485	-
Positive predictive value	8.33%	1.75%	22.5%
Negative prdictive value	100%	84.6%	100%
(95% Confidence interval)			

Table-4: GIR support for thompson score >10 within 48 hours of life

CONCLUSION

Perinatal Asphyxia in neonates is a cause of significant mortality and needs timely management with sophisticated methods and machines which are not readily available at a peripheral centre. What our study adds is that Thompson score is a rapid scoring method with little inter observer variability which can assist physicians in accurately prognosticating an asphyxiated neonate and do timely referral to a tertiary care centre.

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