Original Research Article

Study of brainstem evoked response audiometry changes in neonates with unconjugated hyperbilirubinemia - Before and after therapy

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Abstract

Background: Neonatal hyperbilirubinemia is a common problem in the newborn with significant morbidity and mortality. Unconjugated hyperbilirubinemia is neurotoxic, and is particularly toxic to the auditory pathway and may result in sensorineural hearing loss. Brainstem Evoked Response Audiometry (BERA) is an effective and non-invasive means of assessing the functional status of the auditory nerve and brainstem auditory sensory pathway. Signs of bilirubin encephalopathy can alter the various waveforms in BERA thus is an important method to assess the severity of jaundice. **Objectives:** To study the BERA changes in neonates with unconjugated hyperbilirubinemia and to compare changes before and after therapy. **Materials and Methods:** Fifty consecutive term Appropriate For Gestational Age neonates presenting to the hospital with bilirubin levels needing phototherapy or exchange transfusion. All septic, preterm, sick or with any syndrome were exculuded. All neonates presenting with icterus bilirubin estimation was done, followed by BERA after intial assessment followed by phototherapy or exchange transfusion and one more BERA at 4months. Results; In our study, it was observed that 8 out of 50 cases had BERA changes at peak level of bilirubin. The most common abnormality was raised threshold seen in all the 8 cases (16%). All cases were reviewed with a follow up BERA after a period of 4 months. Out of the 8 cases with significant BERA changes 3 cases had permanent abnormalities at the end of 4 months. **Conclusion:** BERA is a simple non invasive test to determine the effect of bilirubin toxicity to the auditory pathway. There is a significant correlation between Serum bilirubin more than 22mg and presence of significant BERA changes.
Key Word: BERA, Hearing loss and hyperbilirubinemia.

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INTRODUCTION

Neonatal jaundice is a common problem seen in the newborn. It is observed during the first week of life in approximately 60% of term and 80% of preterm[1-6]. The yellow color usually results from the accumulation of unconjugated, nonpolar, lipid-soluble bilirubin pigment in the skinAlthough most jaundiced newborns are otherwise healthy, they make the neonatologist anxious because bilirubin is potentially toxic to the central nervous system[5]. The terms bilirubin encephalopathy and kernicterus represent clinical and pathological abnormalities resulting from bilirubin toxicity in the central nervous system[5]. Besides other sequelae, unconjugated hyperbilirubinemia is found to be particularly toxic to the auditory pathway resulting in sensorineural hearing loss. Auditory neuropathy is noted in one third to one half of infants with significant hyperbilirubinemia[5]. Unbound bilirubin, because of its lipophilic nature can cross the blood brain barrier and exert toxicity at cellular level. Interruption of normal neurotransmission has been proposed to be one of

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the mechanisms of toxicity[5]. There is no level of bilirubin that definitely predicts kernicterus and also, the bilirubin levels that are toxic to one infant may not be toxic to another or even to the same infant in different clinical circumstances[34, 35]. The duration of exposure needed to produce toxic effects is also unknown. The imprecise relationship between total serum bilirubin and adverse neurological outcome has encouraged research, seeking more accurate markers of bilirubin toxicity. Brainstem Evoked Response Audiometry *(BERA)* is an effective and non-invasive means of assessing the functional status of the auditory nerve and brainstem auditory sensory pathway[5]. It is not significantly altered by the state of consciousness, drugs and variety of environmental factors. The BERA changes in response to hyperbilirubinemia include loss of one or more peaks of waves I to V, raised threshold, increase in latency of waves I, III or V or increased inter peak interval[51]. BERA can detect subclinical bilirubin encephalopathy even before the appearance of any signs or symptoms of kernicterus. The present study was undertaken to evaluate the effect of hyperbilirubinemia in term newborns on Brainstem evoked response audiometry (BERA) and change, if any, in BERA after therapy.

METHOD OF COLLECTION OF DATA

Study Design- This was a Cross Sectional Study with one follow up.

Inclusion criteria:

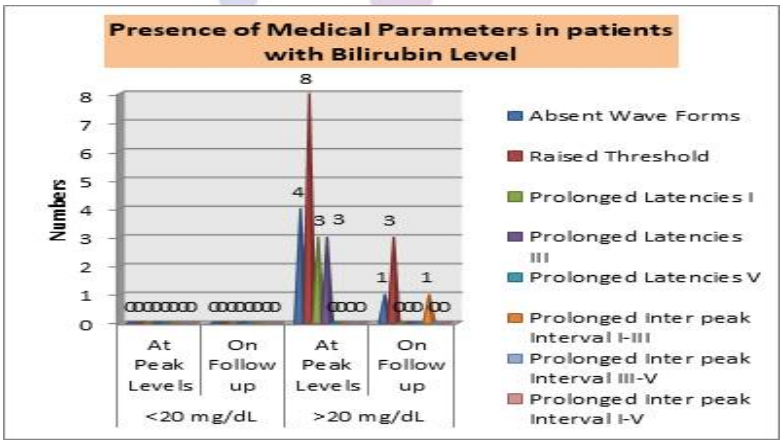
Fifty consecutive term AGA (Appropriate For Gestational Age) neonates presenting to the NICU of AVMC and H Pondicherry, with total serum bilirubin requiring intervention were included in this study.

Exclusion criteria:

- Intrauterine infections
- Sepsis
- Craniofacial malformation
- Preterm

Mode of collection of data: All neonates presenting with icterus to the NICU of AVMC and H Pondicherry were subjected to total bilirubin estimation. (Direct and indirect both). Term neonates meeting the inclusion criteria were included as cases. Data regarding the antenatal, birth history and detailed examination of the newborn were collected in a pre tested proforma. Weight was recorded. Gestational age assessment was done by using modified ballard score. Consent was taken from the parents. Initial BERA was done within 3-4 hours of hospitalization. BERA was performed after giving sedation to the neonate Triclofos (20mg/kg) was used orally. BERA measures considered for diagnosis were Absolute latencies of wave I, III, V peaks in both ears at different intensities. Inter peak intervals of I – III, III – V, and I – V Amplitude of V peak Neonates were treated for hyperbilirubinemia according to the standard treatment protocol of the NICU ,(Phototherapy and Exchange Transfusion). Repeat BERA was done in all cases after a gap of 4 months.

RESULTS



Our study included a total number of 50 cases of Children. We have analyzed by comparing Absent Wave Forms, Raised Threshold, Prolonged Latencies I, Prolonged Latencies III, Prolonged Latencies V, Prolonged Inter peak Interval I-III, Prolonged Inter peak Interval III-V and Prolonged Inter peak Interval I-V. The p value of raised threshold is 0.11 which is greater than 0.05 shows that raised threshold does not affect the improvement significantly. The p value of Prolonged Latencies I is 0.153 which is greater than 0.05 shows that Prolonged Latencies I does not affect the improvement significantly. But the p value of Prolonged Latencies III is 0.048 which is lesser than 0.05 shows that Prolonged Latencies II affects the improvement significantly. Similarly the p value of

Prolonged Latencies V is 0.048 which is lesser than 0.05 shows that Prolonged Latencies V affects the improvement significantly. Also the p value of Prolonged Inter peak Interval I-III is 0.314 which is greater than 0.05 shows that Prolonged Inter peak Interval I-III does not affect the improvement significantly. Similarly Prolonged Inter peak Interval III-V and Prolonged Inter peak Interval I-V didn't make any changes in the improvement of the patients. It also shows that all medical parameters are presence in patients who have bilirubin level of more than 22 mg/dL.

DISCUSSION

Neonatal unconjugated hyperbilirubinemia is neurotoxic. Besides other sequelae, it is found to be particularly toxic to the auditory pathway and may result in sensorineural hearing loss. BERA provides an accurate and non invasive evaluation of the auditory pathway. The BERA changes in response to hyperbilirubinemia includes loss of one or more peaks of waves I-V, raised threshold, increase in latency of wave I, III or V or increased inter peak interval. Some of the earlier observations of BERA have demonstrated the reversible effects of bilirubin toxicity. This study was undertaken to evaluate the effect of hyperbilirubinemia in term newborns on BERA and change if any after therapy. n our study, it was observed that 8 out of 50 cases had BERA changes at peak level of bilirubin. Among the changes, most common abnormality was raised threshold seen in all the 8 cases (16%). The frequency of BERA abnormalities noted in our study was slightly less compared to other study. The commonest abnormality observed in our study was raised threshold seen in 8 (16%) cases which was comparable with other studies. The other commonest abnormalities noted was prolonged latencies (14.7%) and absent wave forms (17.6%) which were also comparable with other studies. Prolonged latencies of waves and inter peak interval indicated prolongation of nerve conduction at auditory nerve and brain stem level. All cases were reviewed with a follow up BERA after a period of 3 months in our study and in other studies by Sharma *et al*, Gupta *et al* and Agrawal *et al*. Whereas Deorari *et al* followed up the cases till 1 year. Bhandari *et al* did not follow up the cases. Out of the 8 cases with significant BERA changes, it was 3 cases were found to have persistent abnormalities at the time of follow up after 3 months.

CONCLUSION

Hyperbilirubinemia is one of the common problems encountered in the neonatal period. Auditory neuropathy is noted in one third to half of infants with significant hyperbilirubinemia and may result in sensori-neural hearing loss. Early intervention by phototherapy and exchange transfusion significantly lowers the risk of Billirubin encephalopathy. BERA can be used as an effective and non invasive means of assessing the functional status of the auditory pathway. Neonates with BERA changes need to be followed up over a period, an essential aim being the early identification of infants with impaired hearing so that rehabilitation can be initiated at a time when brain is still sensitive to the development of speech and language. Correlation of the findings of this study with previous few studies indicates that BERA can be used as a useful non invasive tool to determine auditory functions in the neonate especially changes of early bilirubin toxicity.

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