Original Article

Access this article online
Quick Response Code:

Website: www.jehp.net
DOI: 10.4103/jehp.jehp_895_23

Developmental outcome of neonates underwent exchange transfusion due to hyperbilirubinemia: A single-center experience

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Abstract:

BACKGROUND: Exchange transfusion due to hyperbilirubinemia is performed in neonates with signs of encephalopathy or if the level of bilirubin is more than the exchange threshold and not responding to intensive phototherapy. Bilirubin passage through the blood–brain barrier can cause injury to different sites of the brain and may have long-life effects. In this study, we aimed to evaluate the neonates who underwent exchange transfusion and investigated their developmental problems. By recognizing their developmental delay, we can recommend screening time and early occupational therapy if needed.

METHODS AND MATERIAL: This is a retrospective study on neonates who underwent exchange transfusion due to hyperbilirubinemia in Namazi and Hafez hospitals, in Shiraz, Iran, between 2016 and 2021. The exclusion criteria were the unwillingness of the parents to participate in the study or incomplete data. Children who died were also excluded from the study. Demographic and clinical data were obtained from hospital records. Children were invited to the clinic for examination, and development was assessed by Ages and Stages Questionnaires (ASQ). All neonates had done auditory brainstem response. The result was obtained. Quantitative data are reported as mean standard deviation (SD) and qualitative data with frequency and percentage. Spearman's correlation coefficient and Chi-square test were used, and the *P* value was significant below 0.05.

RESULTS: Eighty-seven neonates were enrolled. Forty-nine (56.3%) were female, and 38 (43.7%) were male. Glucose-6-phosphate dehydrogenase(G6PD) deficiency was the most prevalent hematologic cause of hyperbilirubinemia (23%). Auditory disorder, speech disorder, motor disorder, and encephalopathy were seen in four (4.6%), two (2.3%), three (3.4%), and four infants (4.6%), respectively.

CONCLUSION: Bilirubin neurotoxicity can cause developmental impairment including auditory, speech, and motor disorders besides encephalopathy. Early recognition and proper early intervention can lead to better outcomes for the child, family, and society.

Keywords:

Development, disorder, exchange transfusion, hyperbilirubinemia

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Received: 24-06-2023
Accepted: 23-07-2023
Published: 11-07-2024

Introduction

Bilirubin neurotoxicity is a major concern in the neonatology field as hyperbilirubinemia is the most common problem during infancy. It occurs when the total bilirubin level reaches more than the ability of neuroprotective defenses.[1] Neuroinflammation—release of inflammatory mediators and immune response—plays a role in brain injury and the neurodevelopment of neonates with severe hyperbilirubinemia.[2] Bilirubin injury mostly affects the basal ganglia, brain stem, hippocampus, and cerebellum.[3]

How to cite this article: Najib KS, Ostovar L, Rezaei M, Barzegar H. Developmental outcome of neonates underwent exchange transfusion due to hyperbilirubinemia: A single-center experience. J Edu Health Promot 2024;13:209.

The present study has several strengths that contribute to its scientific value. One of the strengths is the long-term follow-up of infants, which provides valuable insights into their developmental outcomes following exchange transfusion. Another one was the inclusion of a pediatric neurologist in the assessment of developmental outcomes. The neurologist employed standardized neurodevelopmental assessments, which are widely recognized and accepted in the field, ensuring the reliability of the findings. Furthermore, the use of an age-appropriate ASQ questionnaire enabled us to gather detailed and objective information about the infant's developmental milestones and identify any potential delays or disabilities.

Limitation and recommendation

Some limitations should be acknowledged. Firstly, our study did not explore other potential contributing factors to the developmental outcomes, such as specific medications administered, length of hospital stay, and concurrent illnesses. These factors could have influenced the developmental trajectory of neonates and should be considered in future research. Another limitation is the relatively small sample size, which may have limited the generalizability of the findings. To obtain more robust and representative results, future studies should aim for larger sample sizes and include a more diverse population.

In addition, it is essential to determine the optimal timing for auditory and developmental screening in future studies. Identifying the most appropriate age for screening and auditory assessments can contribute to the early detection and intervention of potential issues. By establishing specific guidelines for screening protocols, healthcare professionals can ensure timely and accurate identification of developmental and auditory impairments in neonates who underwent exchange transfusion.

Conclusion

In conclusion, our study highlights the potential long-term consequences of neonatal hyperbilirubinemia on individuals, their families, and society as a whole. The neurotoxicity associated with high levels of bilirubin can result in developmental and auditory impairments that can significantly impact the quality of life. Our study revealed that 14.9% of neonates who underwent exchange transfusion exhibited developmental or auditory difficulties. Further studies are needed to investigate the prevalence of developmental problems related to extreme hyperbilirubinemia and its long-term effects. More research should be conducted to find early interventions that would reduce these complications.

Acknowledgement

The authors would like to thank Shiraz University of Medical Sciences, Shiraz, Iran, and also the Center for Development of Clinical Research of Namazi Hospital and Dr. Nasrin Shokrpour for editorial assistance.

Ethical statement

The Medical Ethics Committee approved the study protocol of Shiraz University of Medical Sciences (Ethics Code: IR.SUMS.MED.REC.1401.111).

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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