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ORIGINAL ARTICLE

Auditory evoked potentials in a newborn Wistar rat model of hyperbilirubinemia☆,☆☆

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KEYWORDS
Hyperbilirubinemia;
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Abstract
Introduction: Hyperbilirubinemia is a common health problem in newborns. Its effects can be different according to the level and duration of the hyperbilirubinemia. The toxic effect of bilirubin on the auditory system can be seen as a sensory neural hearing loss or auditory neuropathy spectrum disorder (ANSD).
Objective: The purpose of our study was to determine the effects of toxic bilirubin level on the auditory system by using Auditory Brainstem Response audiometry.
Methods: Rats are used as animal models due to their low cost and easy attainability. Auditory Brainstem Response was used for auditory assessment. In this study, three groups were established: experimental, control and placebo groups.
Results:
Results: In the experimental group, which consists of rats with hyperbilirubinemia, sensory neural hearing loss was found bilaterally in 4 rats (66.67%) and unilaterally in 2 rats (16.67%) and auditory neuropathy spectrum disorder was found unilaterally in 1 rat (8.33%). Auditory Brainstem Response thresholds were significantly elevated compared to control and placebo groups ($p < 0.05$).

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Conclusion: Hyperbilirubinemia of newborn rats may result both in sensory neural hearing loss and auditory neuropathy spectrum disorder.

PALAVRAS-CHAVE
Hiperbilirrubinemia;
Ratos Wistar;
Deficiência auditiva neurosensorial;
Potenciais evocados auditivos

Potenciais evocados auditivos em um modelo de rato Wistar neonato com hiperbilirrubinemia

Resumo
Introdução: A hiperbilirrubinemia é um problema de saúde comum em neonatos. Seus efeitos podem variar, dependendo do nível e da duração da hiperbilirrubinemia. O efeito tóxico da bilirrubina no sistema auditivo pode ser observado na forma de deficiência auditiva sensorioneural ou de distúrbio do espectro da neuropatia auditiva.
Objetivo: A finalidade de nosso estudo foi determinar os efeitos de nível tóxico de bilirrubina no sistema auditivo, com o uso da audiometria da resposta auditiva evocada de tronco cerebral.
Método: Os ratos são empregados como modelos animais graças a seu baixo custo e fácil obtenção. Utilizamos a resposta auditiva evocada de tronco cerebral para avaliação da audição. No estudo, foram estabelecidos três grupos: experimental, controle e placebo.
Resultados: No grupo experimental, constituído de ratos com hiperbilirrubinemia, disacusia auditiva neurosensorial foi diagnosticada bilateralmente em quatro ratos (66,67%), e unilateralmente em dois (16,67%); e distúrbio do espectro da neuropatia auditiva foi observado unilateralmente em um rato (8,33%). Os limiares da resposta evocada de tronco cerebral estavam significantemente elevados, em comparação com os grupos controle e placebo ($p < 0,05$).
Conclusão: A hiperbilirrubinemia de ratos neonatos pode resultar tanto em disacusia auditiva neurosensorial como em distúrbio do espectro da neuropatia auditiva.

Introduction

Hyperbilirubinemia is a common health problem of newborns. Newborn hyperbilirubinemia has been accepted as one of the main risk factors in infants' hearing loss since the 1900s.[1] Effects of hyperbilirubinemia on hearing function can be different according to the level of hyperbilirubinemia and duration of hyperbilirubinemia.[2] It is known that a high bilirubin level is a risk factor for sensory neural hearing loss (SNHL) and auditory neuropathy spectrum disorders (ANSD).[3]

SNHL results from pathology in the cochlea, 8th nerve, brain stem or cortex level. Although 50% of SNHL in children is genetic, it can also develop depending on pathologies in the prenatal, natal, or postnatal periods (infections, metabolic disorders etc.).[4] In postnatal periods hyperbilirubinemia is the most common SNHL cause for newborns, and SNHL prevalence depending on hyperbilirubinemia in newborns and infants has been determined as 12.8%.[5]

ANSD is an issue that has many unknown aspects and it is widely studied. In some cases of ANSD, while only the inner hair cells in the inner ear are affected, in some other cases only the central auditory pathway is affected. Among the ANSD risk factors are hyperbilirubinemia, premature birth, and genetic, perinatal mechanical ventilation. ANSD related to hyperbilirubinemia is seen in 2.7% of newborns with hyperbilirubinemia.[6]

Hyperbilirubinemia may have different pathological effects on the ABR pattern of affected individuals. In newborns with hyperbilirubinemia, the ABR pattern can either go back to normal or become even more pathological after blood bilirubin levels are brought to normal with treatment.[7] Hyperbilirubinemia in the newborn period has been previously studied with rat model.[8,9]

The purpose of our study is to determine the effects of toxic bilirubin level on the auditory system by using Auditory Brainstem Response audiometry.

Method

The study has been conducted in the local Experimental Animals Research and Application Center of the Faculty of Medicine. The approval of the ethical board has been taken (number of approval of the ethics committee: G.Ü.ET-12.001).

Three groups have been included in the study, as experiment, placebo and control groups and 6 newborn rats have been used for each group. The number of rats in each group was restricted by the ethics committee. The ear