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ORIGINAL ARTICLE

Early amplitude-integrated electroencephalography for monitoring neonates at high risk for brain injury☆

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KEYWORDS
Newborn;
Brain injury;
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Early outcome

Abstract

Objective: This study aimed to correlate amplitude-integrated electroencephalography findings with early outcomes, measured by mortality and neuroimaging findings, in a prospective cohort of infants at high risk for brain injury in this center in Brazil.

Methods: This blinded prospective cohort study evaluated 23 preterm infants below 31 weeks of gestational age and 17 infants diagnosed with hypoxic-ischemic encephalopathy secondary to perinatal asphyxia, with gestational age greater than 36 weeks, monitored with amplitude-integrated electroencephalography in a public tertiary center from February 2014 to January 2015. Background activity (classified as continuous, discontinuous high-voltage, discontinuous low-voltage, burst-suppression, continuous low-voltage, or flat trace), presence of sleep-wake cycling, and presence of seizures were evaluated. Cranial ultrasonography in preterm infants and cranial magnetic resonance imaging in infants with hypoxic-ischemic encephalopathy were performed.

Results: In the preterm group, pathological trace or discontinuous low-voltage pattern ($p = 0.03$) and absence of sleep-wake cycling ($p = 0.019$) were associated with mortality and brain injury assessed by cranial ultrasonography. In patients with hypoxic-ischemic encephalopathy, seizure patterns on amplitude-integrated electroencephalography traces were associated with mortality or brain lesion in cranial magnetic resonance imaging ($p = 0.005$).

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Conclusion: This study supports previous results and demonstrates the utility of amplitude-integrated electroencephalography for monitoring brain function and predicting early outcome in the studied groups of infants at high risk for brain injury.

PALAVRAS-CHAVE
Recém-nascido;
Lesão cerebral;
EEG de amplitude integrada;
Resultado precoce

Eletroencefalograma de amplitude integrada precoce no monitoramento de neonatos com risco elevado de lesão cerebral

Resumo

Objetivo: Este estudo visou correlacionar os achados do eletroencefalograma de amplitude integrada (aEEG) com resultados precoces, medidos por mortalidade e achados de neuroimagem, em uma coorte prospectiva de neonatos com risco elevado de lesão cerebral em nosso centro no Brasil.

Métodos: O estudo prospectivo de coorte cego avaliou 23 neonatos prematuros abaixo de 31 semanas de idade gestacional (IG) e 17 neonatos diagnosticados com Encefalopatia Hipóxico-Isquêmica (EHI) secundária à asfixia perinatal, com IG superior a 36 semanas, monitorados com aEEG em um centro terciário público de fevereiro de 2014 a janeiro de 2015. Foram avaliadas a atividade de base (classificada como padrão contínuo, descontínuo de alta voltagem, descontínuo de baixa voltagem, supressão de explosão, contínuo de baixa voltagem ou traço plano), a presença de ciclo do sono-vigília e a presença de convulsões. Foram feitas a ultrassonografia craniana em prematuros e a ressonância magnética (RM) craniana em neonatos com EHI.

Resultados: No grupo de prematuros, o traço patológico ou padrão descontínuo de baixa voltagem ($p = 0,03$) e a ausência de ciclo do sono-vigília ($p = 0,019$) foram associados a mortalidade e lesão cerebral avaliada por ultrassonografia craniana. Em pacientes com EHI, os padrões de convulsão nos traçados do aEEG foram associados a mortalidade ou lesão cerebral na RM craniana ($p = 0,005$).

Conclusão: Este estudo corrobora os resultados anteriores e demonstra a utilidade do aEEG no monitoramento da função cerebral e na predição de alterações precoces nos grupos de neonatos estudados com risco elevado de lesão cerebral.

Introduction

The incidence of neurodevelopmental impairment in extremely preterm infants and those with hypoxic-ischemic encephalopathy (HIE) secondary to perinatal asphyxia remains high in spite of advances in perinatal care. Studies have estimated a global incidence of 345,000 premature infants and 233,000 infants with HIE per year with moderate/severe neurological impairment.[1,2] Both populations are considered at high risk for brain injury.

Different imaging methods can evaluate brain injury and assess neurological prognosis.[3–5] Acute electroencephalographic abnormalities result from neuronal disorganization and correlate with cognitive impairment.[6,7] Amplitude-integrated electroencephalography (aEEG) provides a clinically accessible method for continuous observation of cerebral background activity in ill infants at the bedside. Thus, the utility of early aEEG for the assessment of the severity of cerebral injury and adverse outcomes in premature infants has been investigated as a tool for assessing initial neonatal risk.[8–10]

The aEEG pattern is well correlated with conventional EEG, and results in term newborns with perinatal asphyxia showed good predictive value of short- and long-term neurological prognosis.[11–13] Other studies have shown that severe electroencephalographic abnormalities in preterm neonates evaluated during the first 72 h of life are related to neurodevelopmental impairment.[14,15]

Given the severity of brain injury, as well its high morbidity and mortality rate, the identification of prognostic factors with appropriate timing to provide early future interventions is relevant. Therefore, this study aimed to correlate aEEG findings with early outcomes, measured by mortality and neuroimaging findings, in a prospective cohort of infants at high risk for brain injury in this center in Brazil.

Methods

This study was performed in a public tertiary center in Brazil. All infants born between February 2014 and January 2015, with gestational age (GA) above 36 weeks with HIE secondary to perinatal asphyxia or with GA below 31 weeks, were prospectively included in the study after parental consent was obtained. All subjects included were inborn. The study was approved by the institutional ethics committee. Infants with genetic syndromes or congenital malformations