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ORIGINAL ARTICLE

Efficacy of passive hypothermia and adverse events during transport of asphyxiated newborns according to the severity of hypoxic-ischemic encephalopathy☆

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KEYWORDS
Birth asphyxia;
Hypoxic-ischemic encephalopathy;
Neonatal transport;
Therapeutic hypothermia;
Passive cooling;
Thermogenesis

Abstract

Objective: To determine if the efficacy of passive hypothermia and adverse events during transport are related to the severity of neonatal hypoxic-ischemic encephalopathy (HIE).
Methods: This was a retrospective study of 67 infants with HIE, born between April 2009 and December 2013, who were transferred for therapeutic hypothermia and cooled during transport.
Results: Fifty-six newborns (84%) were transferred without external sources of heat and 11 (16%) needed an external heat source. The mean temperature at departure was 34.4 ± 1.4 °C and mean transfer time was 3.3 ± 2.0 h. Mean age at arrival was 5.6 ± 2.5 h. Temperature at arrival was between 33 and 35 °C in 41 (61%) infants, between 35 °C and 36.5 °C in 15 (22%) and <33 °C in 11 (16%). Infants with severe HIE had greater risk of having an admission temperature < 33 °C (OR: 4.5; 95% CI: 1.1–19.3). The severity of HIE and the umbilical artery pH were independent risk factors for a low temperature on admission ($p < 0.05$). Adverse events during transfer, mainly hypotension and bleeding from the endotracheal tube, occurred in 14 infants (21%), with no differences between infants with moderate or severe HIE.

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Conclusion: The risk of overcooling during transport is greater in newborns with severe HIE and those with more severe acidosis at birth. The most common adverse events during transport are related to physiological deterioration and bleeding from the endotracheal tube. This observation provides useful information to identify those asphyxiated infants who require closer clinical surveillance during transport.

PALAVRAS-CHAVE
Asfixia no nascimento;
Encefalopatia hipóxico-isquêmica;
Transporte neonatal;
Hipotermia terapêutica;
Resfriamento passivo;
Termogênese

Eficácia da hipotermia passiva e eventos adversos durante o transporte de recém-nascidos asfixiados de acordo com a gravidade da encefalopatia hipóxico-isquêmica

Resumo
Objetivo: Determinar se a eficácia da hipotermia passiva e eventos adversos durante o transporte estão relacionados à gravidade da encefalopatia hipóxico-isquêmica (EHI) neonatal.
Métodos: Estudo retrospectivo de 67 neonatos com EHI (nascidos entre abril de 2009 e dezembro de 2013) transferidos para hipotermia terapêutica e resfriados durante o transporte.
Resultados: Cinquenta e seis recém-nascidos (84%) foram transportados sem fontes externas de calor e 11 (16%) precisaram de uma fonte externa de calor. A temperatura média na saída foi 34,4 ± 1,4 °C e o tempo médio de transporte foi 3,3 ± 2,0 horas. A idade média na chegada foi 5,6 ± 2,5 horas. A temperatura na chegada ficou entre 33-35 °C em 41 (61%) neonatos, entre 35°-36,5 °C em 15 (22%) e < 33 °C em 11 (16%). Neonatos com EHI grave apresentaram maior risco de temperatura < 33 °C na internação (RC 4,5; IC de 95% 1,1-19,3). A gravidade da EHI e o pH da artéria umbilical foram fatores de risco independentes para uma baixa temperatura na internação (p < 0,05). Eventos adversos durante o transporte, principalmente hipotensão e sangramento do tubo endotraqueal, ocorreram em 14 neonatos (21%), sem diferenças entre neonatos com EHI moderada ou grave.
Conclusão: O risco de super-resfriamento durante o transporte é maior em recém-nascidos com EHI grave e naqueles com acidose mais grave no nascimento. Os eventos adversos mais comuns durante o transporte estão relacionados a deterioração fisiológica e sangramento do tubo endotraqueal. Essa observação fornece informações úteis para identificar neonatos asfixiados que exigem maior vigilância clínica durante o transporte.

Introduction

Hypoxic-ischemic encephalopathy (HIE) was once a disorder orphan of an effective therapy.[1] It has become a time-dependent emergency, after clinical trials demonstrated the efficacy of cooling started within 6 h of birth in reducing the risk of death or disability and increasing the rate of disability-free survival at 18–24 months of age.[1–3] Animal models and infant studies have indicated that the earlier cooling is initiated after the injury, the more likely it is to be successful.[4–6] Furthermore, experimental evidence has shown a lack of neuroprotective efficacy of hypothermia with delayed cooling.[4,7]

Most asphyxiated infants are born in non-tertiary neonatal units and they must be transferred urgently to a center equipped with a hypothermia program to start this therapy as soon as possible. In order not to delay the neuroprotection provided by cooling, it is recommended to begin this therapeutic intervention at the referring hospital before the transfer, by turning off the external sources of heat and keeping the infant cooled during transport.[8–10]

Most asphyxiated newborn infants being transferred are passively cooled. Several reports have studied the efficacy and safety of passive cooling during transport of asphyxiated newborns.[9–16] Target temperatures are often not achieved and overcooling ranges from 11% to 34%.[9–13] However, these studies do not outline medical complications during transport nor indicate whether the efficacy in maintaining target temperatures and complications are related to the severity of the HIE in the first 6 h of life. The aim of the present study was to assess the relationship between the efficacy of passive hypothermia and adverse events during transport and the severity of the HIE.

Methods

During the five-year study period (January 2009–December 2013), the neonatal intensive care unit (NICU) of the Hospital Sant Joan de Deu – Hospital Clínic-Maternitat was one of the two regional centers offering therapeutic hypothermia for children with HIE born in Catalonia (32,000 km^2 territory, approximately 71,000 births per year). A coordinated