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ORIGINAL ARTICLE

Validation of transcutaneous bilirubin nomogram for identifying neonatal hyperbilirubinemia in healthy Chinese term and late-preterm infants: a multicenter study☆

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KEYWORDS
Hyperbilirubinemia;
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Abstract
Objective: to prospectively validate a previously constructed transcutaneous bilirubin (TcB) nomogram for identifying severe hyperbilirubinemia in healthy Chinese term and late-preterm infants.
Methods: this was a multicenter study that included 9,174 healthy term and late-preterm infants in eight hospitals of China. TcB measurements were performed using a JM-103 bilirubinometer. TcB values were plotted on a previously developed TcB nomogram, to identify the predictive ability for subsequent significant hyperbilirubinemia.
Results: in the present study, 972 neonates (10.6%) developed significant hyperbilirubinemia. The 40th percentile of the nomogram could identify all neonates who were at risk of significant hyperbilirubinemia, but with a low positive predictive value (PPV) (18.9%). Of the 453 neonates above the 95th percentile, 275 subsequently developed significant hyperbilirubinemia, with a high PPV (60.7%), but with low sensitivity (28.3%). The 75th percentile was highly specific (81.9%) and moderately sensitive (79.8%). The area under the curve (AUC) for the TcB nomogram was 0.875.

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Conclusions: this study validated the previously developed TcB nomogram, which could be used to predict subsequent significant hyperbilirubinemia in healthy Chinese term and late-preterm infants. However, combining TcB nomogram and clinical risk factors could improve the predictive accuracy for severe hyperbilirubinemia, which was not assessed in the study. Further studies are necessary to confirm this combination.

PALAVRAS-CHAVE
Hiperbilirrubinemia;
Icterícia;
Neonatal;
Bilirrubina;
Neonatos

Validação de um nomograma de bilirrubina transcutânea para identificação de hiperbilirrubinemia neonatal em neonatos a termo e pré-termo tardios saudáveis na China: um estudo multicêntrico

Resumo

Objetivo: validar de forma prospectiva um nomograma de bilirrubina transcutânea (BTc) para identificar hiperbilirrubinemia grave em neonatos a termo e pré-termo tardios saudáveis na China.

Métodos: foi realizado um estudo multicêntrico que incluiu 9174 neonatos a termo e pré-termo tardios saudáveis em oito unidades da China. Foram realizadas dosagens de BTc utilizando um bilirrubinômetro. Os valores de BTc foram traçados em um nomograma de BTc para identificar a capacidade de predição de hiperbilirrubinemia significativa.

Resultados: 972 recém-nascidos (10,6%) desenvolveram hiperbilirrubinemia significativa. O percentil 40 de nosso nomograma pode identificar todos os recém-nascidos com risco de hiperbilirrubinemia significativa, porém com baixo valor preditivo positivo (VPP) (18,9%). De 453 recém-nascidos acima do percentil 95, 275 recém-nascidos desenvolveram posteriormente hiperbilirrubinemia significativa, com VPP elevado (60,7%), porém com baixa sensibilidade (28,3%). O percentil de 75 foi altamente específico (81,9%) e moderadamente sensível (79,8%). A área sob a curva (ASC) de nosso nomograma de BTc foi de 0,875.

Conclusões: este estudo validou o nomograma de BTc, que pode ser utilizado para prever hiperbilirrubinemia significativa em neonatos a termo e pré-termo tardios saudáveis na China. Contudo, combinar o nomograma de BTc e fatores de risco clínicos pode melhorar a precisão de predição da hiperbilirrubinemia grave, o que não foi avaliado neste estudo. São necessários estudos adicionais para confirmar essa combinação.

Introduction

Hyperbilirubinemia causes severe damage in term and late-preterm infants; the American Academy of Pediatrics (AAP) has formulated methods of surveillance, prediction, and therapy.[1] In China, bilirubin encephalopathy continues to occur, and 348 cases were reported from 28 hospitals from January to December of 2009.[2] Therefore, the identification of neonates at risk of developing significant hyperbilirubinemia and prevention of bilirubin encephalopathy remain a high priority among public health institutions.

The total serum bilirubin (TSB) level after birth was plotted on an hour-specific nomogram by Bhutani et al., and is a valuable method for assessing the risk of subsequent severe hyperbilirubinemia.[3] The AAP has recommended the measurement of TSB in a predischarge newborn population for identification of severe hyperbilirubinemia, based on the Bhutani's nomogram.[1] However, measurements of TSB levels remain an invasive, stressful, and time-consuming procedure. Transcutaneous bilirubin (TcB) is less time-consuming, and can be used to screen for the need for blood sampling for serum bilirubin level, and thus reduce the measurements of TSB.[4] The values of TcB after birth have also been plotted on an hour-specific TcB nomogram to predict severe hyperbilirubinemia in term and late-preterm infants.[5] These hour-specific TcB nomograms assessed pre-test predictive ability using retrospective data from the same developed TcB nomogram.[6] Theoretically, a predictive nomogram should be developed in one sample and validated in another, and some studies prospectively assessed the post-test predictivity of TcB nomograms in different samples.[7,8] The after-effect evaluation of the constructed TcB nomogram is very important to explore the possibility for future clinical application.

In 2010, the authors developed an hour-specific TcB nomogram based on TcB levels for the first 168 h after birth in 6,035 healthy term and late-preterm infants.[9] Subsequently, they have conducted a multicenter study to verify the predictive value of the constructed TcB nomogram to identify severe hyperbilirubinemia in healthy term and late-preterm infants.

Methods

Setting

Eight hospitals, including two general hospitals and six maternity hospitals, participated in the study. They were selected because they are the main tertiary centers in