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Apnoea in infants with bronchiolitis: Incidence and risk factors for a prediction model[☆]

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Abstract
Introduction: The presence of apnoea in acute bronchiolitis (AB) varies between 1.2% and 28.8%, depending on the series, and is one of its most fearsome complications. The aim of this study is to determine the incidence of apnoea in hospitalised patients diagnosed with AB, and to define their associated risk factors in order to construct a prediction model.
Patients and method: A retrospective observational study of patients admitted to a tertiary hospital in the last 5 years with a diagnosis of AB, according to the classic criteria. Data was collected on the frequency of apnoea and related clinical variables to find risk factors in a binary logistic regression model for the prediction of apnoea. A ROC curve was developed with the model.
Results: Apnoea was recorded during the admission of 53 (4.4%) patients out of a total of 1.197 cases found. The risk factors included in the equation were: female (OR 0.6, 95% CI: 0.27–1.37), caesarean delivery (OR: 3.44, 95% CI: 1.5–7.7), postmenstrual age ≤43 weeks (OR: 6.62, 95% CI: 2.38–18.7), fever (OR: 0.33, 95% CI: 0.09–1.97), low birth weight (OR: 5.93, 95% CI: 2.23–7.67), apnoea observed by caregivers before admission (OR: 5.93, 95% CI: 2.64–13.3), and severe bacterial infection (OR: 3.98, 95% CI: 1.68–9.46). The optimal sensitivity and specificity of the model in the ROC curve was 0.842 and 0.846, respectively (*P* < .001).

Conclusions: The incidence of apnoea during admission was 4.4 per 100 admissions of AB and year. The estimated prediction model equation may be of help to the clinician in order to classify patients with increased risk of apnoea during admission due to AB.

Apneas en lactantes con bronquiolitis: incidencia y factores de riesgo para un modelo de predicción

Resumen
Introducción: La presencia de apneas en la bronquiolitis aguda (BA) varía según las series entre el 1,2 y el 28,8%, y es una de sus complicaciones más temibles. Nuestro objetivo es conocer la incidencia de apneas en pacientes ingresados con diagnóstico de BA y definir sus factores de riesgo asociados para construir un modelo de predicción.
Pacientes y método: Estudio observacional retrospectivo de los últimos 5 años de pacientes ingresados en un hospital terciario con diagnóstico de BA según los criterios clásicos. Se recogieron la frecuencia de apneas y las variables clínicas relacionadas, para encontrar factores de riesgo en un modelo de regresión logística binaria para la predicción de apneas. Para evaluar el modelo se elaboró una curva ROC.
Resultados: De 1.197 casos, se registró apneas durante el ingreso en 53 (4,4%). Los factores de riesgo incluidos en la ecuación fueron: sexo femenino (OR 0,6; IC del 95%: 0,27-1,37), cesárea (OR: 3,44; IC del 95%: 1,5-7,7), edad posmenstrual $\leq$ 43 semanas (OR: 6,62; IC del 95%: 2,38-18,7), fiebre (OR: 0,33; IC del 95%: 0,09-1,97), bajo peso al ingreso (OR: 3,06; IC del 95%: 1,23-7,67), apneas antes del ingreso observada por los cuidadores (OR: 5,93; IC del 95%: 2,64-13,3) y sobreinfección bacteriana grave (OR: 3,98; IC del 95%: 1,68-9,46). La sensibilidad y la especificidad óptima del modelo en la curva ROC fueron de 0,842 y 0,846, respectivamente (p < 0,001).
Conclusiones: La incidencia de apneas durante el ingreso fue de 4,4 por cada 100 ingresos de BA y año. La ecuación del modelo de predicción estimado puede ser de ayuda al clínico para clasificar a los pacientes con mayor riesgo de apnea durante el ingreso en la BA.

Introduction

Acute bronchiolitis (AB) is the leading cause of hospitalisation for respiratory disease in children, and apnoea is one of its most worrisome complications in infants. It is a reason for hospital admission in itself, and often for admission to paediatric intensive care units (PICUs). In recent studies, the incidence of apnoea in these patients has ranged between 1.2% and 28.8%,[1–4] although this broad variability is probably due to how apnoea is defined and the conflation of the apnoea subtypes investigated in different studies. Patients with AB may develop central, obstructive or mixed apnoeas. In young infants, obstructive apnoeas are clearly associated with the pathophysiology of bronchiolitis, where there is an increase in mucous secretions and inflammation of the airway. The mechanism by which AB produces apnoea is not well known, although it seems to be related to the facilitated release of GABA[5] following infection and the stimulation of laryngeal chemoreceptors[6,7] by the inflammatory response to the virus. The evidence also suggests that there is no difference between the different viruses that may cause AB in the incidence of apnoea,[1] and the role

in the development of apnoea of the frequent coinfections described in association with BA is still unclear.[8]

Several risk factors for the development of apnoea in the context of AB have been described, and the evidence is not uniform for all. The factors supported most strongly are preterm birth, younger age at diagnosis, absence of fever and low weight,[1,3,9] while the results on prenatal or environmental exposure to tobacco, the duration of symptoms before admission, artificial formula feeding, decreased appetite or disease severity based on a variety of scales are not consistent across the published case series.[1–3,10,11] Few studies have focused specifically on the development of apnoea in the context of AB,[12] and we did not find a study in the literature that attempted to unify the various risk factors in a specific time-and-space frame with the aim of building a prediction model.

The potential availability of an instrument with an improved capacity to predict which infants are at higher risk of developing apnoea could help clinicians anticipate complications and optimise resources that may be limited in peak AB seasons, such as apnoea monitors, pulse oximeters, high-flow nasal cannulae or CPAP machines.