

The use of piglets as experimental model of chest physiotherapy in newborn babies

O uso de suínos como modelo experimental de fisioterapia respiratória em recém-nascidos

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ABSTRACT

Aims: The purpose of the present study was to investigate the viability of the use of piglets as experimental model of newborn chest physiotherapy.

Methods: Five piglets (1-2 days old) were studied. The animals received anesthesia and analgesia and were ventilated with positive pressure, on 100% oxygen. All piglets received chest physiotherapy protocol of manual vibration.

Results: All five animals presented stable physiological parameters during the preparation phase and the physiotherapy protocol application.

Conclusions: We conclude that piglets are a viable model for studies of chest physiotherapy in mechanically ventilated newborns.

KEY WORDS: MODELS, ANIMAL; VENTILATION, MECHANICAL; RESPIRATORY THERAPY; INFANT, NEWBORN.

RESUMO

Objetivos: o objetivo do presente estudo foi investigar a viabilidade do uso de suínos como modelo experimental de fisioterapia respiratória em recém-nascidos.

Métodos: foram estudados cinco suínos recém-nascidos (1-2 dias de idade). Os animais receberam anestesia e analgesia e foram ventilados com pressão positiva, com oxigênio a 100%. Todos os animais receberam o protocolo de fisioterapia respiratória de vibração manual.

Resultados: todos os cinco animais apresentaram estabilidade dos parâmetros fisiológicos durante a fase de preparação e aplicação do protocolo de fisioterapia.

Conclusões: concluímos que os suínos representam um modelo viável para estudos de fisioterapia respiratória em recém-nascidos em ventilação mecânica.

DESCRIPTORIOS: MODELOS ANIMAIS; VENTILAÇÃO MECÂNICA; TERAPIA RESPIRATÓRIA; RECÉM-NASCIDO.

INTRODUCTION

Chest physiotherapy has been used in many neonatal nurseries around the world to improve airway clearance and treat lung collapse in newborns who needed mechanical ventilation. However, the evidence

to support its use has been conflicting. Despite the large number of studies, there is very little evidence of sufficiently good quality on which to base current practice. Additionally, there are concerns about the safety of some forms of chest physiotherapy in newborn infants.^{1,2} On that basis, we hypothesized about the use of piglets as a valid experimental model to investigate chest physical therapy for newborns in neonatal intensive care units. The purpose of the present study was to investigate the viability of the use of piglets as an experimental model of newborn chest physiotherapy.

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METHODS

Preparation of animals and measures

Five newborn pigs (1-2 days old) were studied. The piglets were positioned in supine and maintained warm with the use of a heating blanket. General anesthesia was induced and the animals received analgesia.³ After analgesia and anesthesia, a tracheostomy was performed and a cuffed endotracheal tube was inserted. After obtaining access to airway, the piglets were paralyzed with pancuronium and ventilated with timed cycled, pressure limited mechanical ventilation (Bourns BP 200, SOMA Technology Inc. Bloomfield, USA). In order to verify the tolerance of the animals during chest physiotherapy, heart rate and oxygen saturation were continuously measured by pulse oximetry (Omhedra, PA, USA).⁴⁻⁵

Experimental protocol of chest physiotherapy

The study protocol consists of positioning with the head elevated 30°, associated with the use of cushions placed on the back of the animal to help maintain the position. The animals were positioned at right lateral position followed by the left lateral position, or vice versa. After positioning, a manual vibration associated with a mild and intermittent compression of the chest wall at the end of expiration on the same amplitude done during mechanical ventilation was applied. To perform this technique, the physiotherapist placed one cupped hand over the rib cage of the animal while was produced a vibration in the upper limb through the simultaneous isometric contraction of the muscles of the forearm of physiotherapist. Moving the hand down, the physiotherapist produced a slight compression on the chest wall. This technique was applied at a frequency of 40 repetitions per minute for about ten minutes in each position, right side or left side.

Ethics

This study was approved by the Ethics Committee on Animal Studies of Pontificia Universidade Católica do Rio Grande do Sul. All procedures were conducted according to criteria established by the ethics committee and the animals received analgesia and anesthesia during all the time of the study. At the end of the study, animals were given euthanasia with an overdose of thiopental or sodium chloride.

RESULTS AND CONCLUSION

All five animals presented stable physiological parameters during the preparation phase and physiotherapy. There was no statistically significant

difference between the values of heart rate ($p=0,14$) and oxygen saturation ($p=0,20$) before and after the chest physiotherapy protocol application. The mean of heart rate and oxygen saturation persisted all the time (Table 1). Only one piglet showed lower both heart rate and oxygen saturation without clinical relevance (piglet n° 3). Considering the short sample size we do not conclude if the low weight of this piglet was responsible for this result. These animals presented a mean weight of 1492 g (range 1250 to 1800 g) at the study entry. At the visual observation, the chest wall movements were similar to intubated human newborn babies during the chest physiotherapy. Although the intensity of manual vibration was not measured due to technical limitations at the time of this study, in the researcher opinion, the manual vibration used in the piglet model is comparable to the manual vibration applied in the chest of the intubated human newborns in clinical practice. This brief communication points to a favorable experience with newborn piglets as an experimental model, and we conclude that all procedures used in this model are tolerated and reproducible, suggesting that it is a viable model for studies of chest physiotherapy in ventilated newborns.

Table 1. Physiologic parameters and weight of animal models.

Animal	Weight (g)	Preparation		Chest physiotherapy	
		Heart Rate	O ² Sat (%)	Heart Rate	O ² Sat (%)
1	1560	145	99,5	146	99,5
2	1400	142	99	142	99
3	1250	129	94	132	92,5
4	1800	149	98	149	99
5	1450	141	99	142	98

O² Sat: oxygen saturation.

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