Case Report

# Use of the respiratory physiotherapy technique selective insuflation to revert the Atelectasia in a newborn

# Usando a técnica de fisioterapia respiratória insuflação seletiva para reversão de Atelectasia em um recém-nascido

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**ABSTRACT | INTRODUCTION:** Pulmonary atelectasis is common among neonatal intensive care patients, mainly due to the anatomy of the newborn and the clinical and pathological conditions that are being exposed. **OBJECTIVE:** Describing the effectiveness of the selective insufflation technique to reverse atelectasis in a single visit. **CASE REPORT:** Premature, who present pulmonary atelectasis in the upper right lobe, with a gestational age of 35 weeks, on the seventh day of invasive mechanical ventilation received daily respiratory therapy. **CONCLUSION:** The total reversal of atelectasis in one single visit was confirmed utilizing a chest X-ray immediately before and after the maneuver. The patient was followed up until hospital discharge, with no subsequent atelectasis event, even after extubation.

**KEYWORDS:** Pulmonary atelectasis. Premature. Physical Therapy Modalities.

**RESUMO | INTRODUÇÃO:** A atelectasia pulmonar é comum em pacientes internados em unidades de terapia intensiva neonatais, principalmente pela anatomia do recém-nascido e pelas condições clínicas e patológicas a que estão expostos. **OBJETIVO:** Descrever a eficácia da técnica de fisioterapia respiratória de insuflação seletiva para reverter atelectasia em um único atendimento. **RELATO DE CASO:** Prematuro de 35 semanas de idade gestacional no sétimo dia de ventilação mecânica invasiva, apresentando quadro de atelectasia pulmonar em lobo superior direito, recebia atendimentos diários de fisioterapia respiratória. **CONCLUSÃO:** A reversão total da atelectasia em apenas um atendimento foi comprovada por meio radiografia de tórax imediatamente antes e depois da manobra. A paciente foi acompanhada até a alta hospitalar, não ocorrendo nenhum evento posterior de atelectasia, mesmo após a extubação.

**PALAVRAS-CHAVE:** Prematuro. Atelectasia pulmonar. Modalidades de fisioterapia.

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## Introduction

The atelectasis is described as a lung collapse that affects one or more regions of the lung. It can be peripheral, segmental, or cover one or both pulmonary hemispheres[1]. It is characterized by reducing lung volumes, altering the ventilation / perfusion ratio, causing a pulmonary bypass, and being one of the causes of delaying the weaning from mechanical ventilation[2]. Newborns have anatomical and physiological characteristics that predispose and favor the appearance of atelectasis, such as the imbalance between the forces of pulmonary contraction and expansion, greater resistance of the airways, absence of collateral ventilation, and high lung compliance[3].

The diagnosis is made by chest radiography and clinical manifestations. Among the ways to prevent and treat atelectasis formation, we can mention respiratory physiotherapy with its techniques that aim to eliminate secretion and restore lung volumes; and positive pressure ventilation to open collapsed areas, improving gas exchange[4,5].

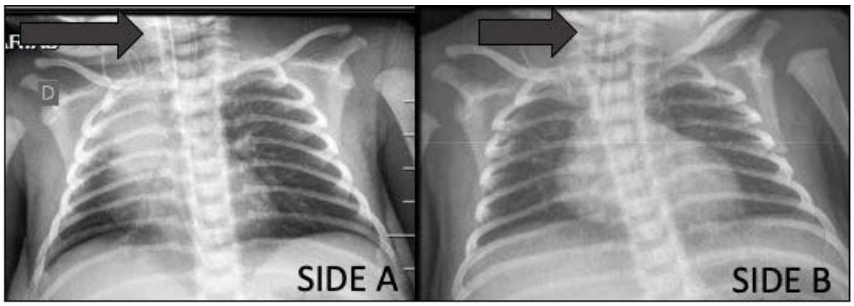
Atelectasis does not always occur in the context of bronchopulmonary hypersecretion. It can occur even in newborns who receive daily respiratory physiotherapy visits with flow increase techniques such as the Expiratory Flow Acceleration, and other techniques commonly used in neonatal ICUs. The use of associated techniques, such as positive pressure ventilation, bronchial hygiene techniques, and positioning, which are the most described resources for working with atelectasis reversal. However, the time for reversion is longer than one session. There is a need to have an effective technique for reversing atelectasis in newborns in just one or a few visits[6].

The objective of this case report is to describe the effectiveness of a respiratory physiotherapy technique to reverse atelectasis in a single visit.

## Case description

This case report was approved by the Research Ethics Committee, with opinion number 084/2017. The written informed consent was obtained from one parent. Newborn, born at 35 weeks and 2 days of gestational age, weighing 1,890 grams, with a previous diagnosis of gastroschisis, admitted to the Neonatal Intensive Care Unit, surgical correction was performed on the first day of life, remaining ventilated invasive mechanics. From the first to the third postoperative day, the newborn was maintained using a neuromuscular blocker and sedated with fentanyl in an infusion pump, receiving daily visits to respiratory physiotherapy, went through techniques for pulmonary clearance and maintenance of lung volumes without radiographic and clinical evidence of atelectasis. Until the sixth day of life, there was no clinical or radiological evidence of atelectasis. On the seventh postoperative day, still on invasive mechanical ventilation, atelectasis was observed in the right apical lobe (Figure 1, side A) on the chest radiograph.

**Figure 1.** Chest radiography of the neonate before and after respiratory physiotherapy session




Arrow: presence of endotracheal cannula
A - Atelectasis affecting the right lung, deviation of the right trachea, free costophrenic sinuses and presence of a tracheal cannula.
B - Lungs of normal transparency, free costophrenic sinuses and presence of a tracheal cannula.

In the evaluation of physiotherapy, the newborn used intermittent mandatory ventilation mode (IMV). With an inspiratory pressure of 17 cmH2O, respiratory rate of 40 rpm, inspiratory time of 0.40 seconds, PEEP of 5 cmH2O and fraction of inspired oxygen (FiO2) of 60%. Without sedation, active and reactive to management, with a symmetrical and synchronous chest with mechanical ventilation, decreased expansion to the right. Lung auscultation showed a vesicular murmur present, decreased in the right apical lobe and with diffuse bilateral snoring, heart rate (HR) of 140 beats per minute (bpm), oxygen saturation (SpO2) in 95%, and total respiratory rate (RR) 50 breaths per minute (bpm).

Respiratory physiotherapy was performed for approximately 20 minutes. The service protocol initially prioritized bronchial hygiene techniques, as needed, evaluated with pulmonary auscultation and followed by aspiration of secretion from the tracheal tube and upper airways. Pulmonary auscultation remained reduced in the right apical lobe, without adventitious lung sounds, the thoracic expansion also decreased, HR of 150 bpm, total RR of 55 bpm, and SpO2 of 96%.

The respiratory physiotherapy technique used to restore the lung volume of the collapsed area was selective insufflation, also known as chest block, which consists of total manual compression of the healthy lung area, started slowly at the beginning of one exhalation and maintained the block for up to five minutes so that all the inspired air is redirected to the atelectasis area. The maneuver can be performed several times in a row, depending on the patient's response, depending on pulmonary auscultation and thoracic expansion[4].

The newborn was placed in a supine position with the head elevated to 30º. The healthy lung areas (left hemithorax and right lung base) were blocked during exhalation, with gentle manual compression, maintained during subsequent respiratory cycles, while the apical lobe was left free and without manual chest support. Two series of 20 respiratory cycles were performed, with a rest time of 2 minutes between them. Throughout the procedure, SpO2 and HR were monitored by transcutaneous pulse oximetry, and there was no need to interrupt the technique, just as there were no changes in vital parameters.

The technique should be interrupted when hemodynamic instability occurs, such as the presence of bradycardia and a drop in oxygen saturation. As the newborn remained monitored all the time, we observed that these events did not occur, allowing the service to be carried out as planned.

## Results

Immediately after the described respiratory physiotherapy procedure, the newborn was reevaluated, and he was active and reactive to management, with HR of 141 bpm, RR of 45 bpm and SpO2 of 96%, auscultation of the lung with bilateral vesicular murmur present without adventitious lung sounds, symmetrical chest with good expandability. The newborn was submitted to a new chest radiograph, which shows the total inversion of the atelectasis area, confirmed by the radiological examination report and the doctor responsible for the case (Figure 1 - side B). Within thirty minutes after treatment, the fraction of inspired oxygen was reduced to 40%, no other IMV parameters were changed during or after treatment. The data is shown in table 1.

**Table 1.** Vital parameters before and after application of the technique

| | Before | After |
|---|---|---|
| HR (bpm) | 150 | 141 |
| RR (BPM) | 55 | 45 |
| SpO2 (%) | 96 | 96 |

HR: hate respiratory; BPM: breaths per minute; bpm: beats per minute; SpO2: oxygen saturation

The newborn did not present another event of atelectasis during hospitalization. Extubation occurred after eleven days of mechanical ventilation, without complications, and the newborn remained in spontaneous breathing. Physiotherapy sessions were continued to maintain lung volumes. Hospital discharge occurred at one month and five days old, weighing 2,625 grams, in spontaneous breathing.

## Discussion

In this case report, the newborn developed atelectasis on the seventh postoperative day after gastroschisis correction, due to some factors related to surgical and postoperative procedures and the characteristics of the newborn himself. We must remember that the respiratory mechanics are altered by the presence of pain during breathing in the postoperative period, which limits the function of the diaphragm and favors the development of atelectasis[2]. In addition, other factors related to the newborn anatomy also predispose to the appearance of atelectasis, such as the size and quantity of the alveoli, low tidal volume, increased oxygen consumption, more accommodative ribs, respiratory muscles with few resistant fibers fatigue, decrease or absence of collateral ventilation, especially Kohn pores and Lambert channels, which develop only between the second and sixth year of life[7].

Atelectasis is the second most common complication in postoperative periods, less frequently than pneumonia, but it can be present in up to 80% of cases[8,9]. The technique used proved to be effective, being able to completely reverse the atelectasis area in a short period of time, corroborating with the literature, in which respiratory physiotherapy, through this technique, was beneficial in cases of atelectasis, rapidly contributing to its reversion, another study showed similar results, which used the same technique also associating ventilation with positive pressure in the airways, finding satisfactory results in the reversal of pulmonary atelectasis[5].

In another report published in 2013, the total reversal of atelectasis of the entire right lung was described with just one physiotherapy session[10]. However, in this study, in addition to the clear maneuvers and secretion aspiration, the left lateral decubitus position was added, with the contralateral upper limb elevated and the compression / decompression maneuver, again expanding the entire collapsed area.

In a study of mechanically ventilated infants younger than 37 weeks of gestational age, the authors performed intermittent chest blocks for 10 minutes, resulting in better respiratory system compliance, and related this improvement to the recruitment of lung units by expanding the collapsed areas[11]. The same authors compared the technique with the respiratory physiotherapy maneuvers most used in another study and found that atelectasis reverses more quickly when the selective insufflation technique is used[12].

It is beneficial to use a technique within respiratory physiotherapy that can reverse an atelectasis in a single session and with a short application time, considering the need for little handling in the newborn. It is of great value to disclose the positive results that are obtained with a technique that is not widespread in the current literature. Randomized studies are needed to prove the effectiveness of this technique in the neonatal population.

## Conclusion

We concluded that the respiratory physiotherapy technique of selective insufflation was effective in reversing atelectasis in a newborn, being applied in a single visit, without presenting deleterious effects.

### Author contributions

Gomes EO participated in the conception, search, and analysis of research data, writing, revision of the scientific article. Santos AK, Nascimento TC performed a literature review, data collection, and preparation of the scientific article. Cavicchia MC, Bazílio MAA participated in the design, analysis of the research data, and review. Andreazza MG participated in the conception, search, and analysis of the research data, writing, revision, and English version of the scientific article.

### Competing interests

No financial, legal, or political competing interests with third parties (government, commercial, private foundation, etc.) were disclosed for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc.).

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