



Children with pulmonary atelectasis: clinical outcome and characterization of physical therapy

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ABSTRACT. Pulmonary atelectasis is described as a state of a given region of lung parenchyma collapsed and non-aerated. This study aimed to describe the characteristics and clinical outcome of children with atelectasis, assisted by physical therapy service. This is a case report whose information was collected from records of children hospitalized at the University Hospital of Londrina/HU, in 2009. Seventeen patients with pulmonary atelectasis were treated, aged from 11 days to 9 years old. At initial assessment, 8 (47%) children had no signs of difficulty breathing. The most used techniques were the re-expansion techniques used in all patients (100%), the clearance techniques were performed in 16 (94%) children, and the deflated techniques were used for only one child. The mean number of physical therapy sessions performed for the resolution of atelectasis was 4, ranging from 2 to 9. All 17 cases of atelectasis treated by physical therapy had rapid resolution. Outcome of children treated was satisfactory at short term with low number of physical therapy attendances.

Keywords: pediatrics, child, physical therapy.

Crianças com atelectasia pulmonar: a evolução clínica e a caracterização do atendimento fisioterapêutico

RESUMO. A atelectasia pulmonar é descrita como estado de determinada região do parênquima pulmonar colapsado e não-aerado. O objetivo do estudo foi descrever as características e a evolução clínica de crianças com atelectasia, atendidas no serviço de fisioterapia. O estudo foi do tipo relato de caso em série e a coleta de informações realizada em prontuários de crianças atendidas no ano de 2009 no Hospital Universitário de Londrina/HU. Foram atendidos 17 pacientes com atelectasia pulmonar, a idade variou de 11 dias de vida a nove anos. Na avaliação inicial, oito (47%) crianças não apresentavam sinais de esforço ventilatório. As técnicas mais utilizadas foram as re-expansivas, utilizadas em todos os pacientes (100%), já as desobstrutivas foram realizadas em 16 (94%) crianças e as técnicas desinsuflativas foram utilizadas em apenas uma criança. A média de sessões de fisioterapia realizadas para a resolução da atelectasia pulmonar foi de quatro atendimentos, variando de dois a nove. Todos os 17 casos de atelectasia atendidos pela fisioterapia tiveram resolução rápida. A evolução clínica das crianças atendidas com atelectasia pulmonar foi satisfatória em curto período de tempo e número reduzido de atendimentos fisioterapêuticos.

Palavras-chave: pediatria, criança, fisioterapia.

Introduction

Pulmonary atelectasis is described as a state of a given region of lung parenchyma collapsed and non-aerated, associated with loss of lung volume and capacity, diagnosed from clinical and complementary tests (SCHINDLER, 2005). These are signs of disease, but singly are not suggestive of specific diagnosis. The differential diagnosis should be considered, and the most useful and frequently used is the chest X-ray (JOHNSTON; CARVALHO, 2008).

Physical therapy is a relatively new specialty but has been successful in prevention and treatment of respiratory complications, resulting in recognition of

professional as indispensable in multidisciplinary staff (NICOLAU; FALCÃO, 2007). By using several techniques and therapeutic procedures, the respiratory physical therapy can work both in prevention and treatment of respiratory diseases in order to establish or restore functional breathing pattern to reduce the energy expenditure during ventilation. Physical therapy maneuvers related to respiratory care consist in manual, postural and kinetic techniques of the thoraco-abdominal components, which can be applied alone or combined to mobilize and eliminate pulmonary secretions; improve ventilation; promote lung re-expansion; improve oxygenation and gas exchange;

reduce work of breathing and oxygen consumption; increase thoracic mobility, muscle strength and endurance; re-educate the respiratory muscles; promote respiratory functional independence; prevent complications and accelerate the patient's recovery (ABREU et al., 2007).

The Physical Therapy service in Pediatrics of the University Hospital (UH) of Londrina, from the State University of Londrina (UEL), serves mostly children hospitalized with lung diseases. In 2009 occurred a significant referral of children diagnosed with pulmonary atelectasis, associated with other diseases. These patients came from Basic Health Units and Children's Emergency and were admitted at UH for treatment and physical therapy monitoring. The children hospitalized with pulmonary atelectasis submitted to clinical treatment and physical therapy had satisfactory clinical outcome at short follow-up period and time.

The present case report aimed to describe the characteristics and clinical outcome of children with atelectasis, assisted by the physical therapy service of UH/UEL.

Material and methods

The collection of information was made with medical records of children hospitalized in the University Hospital of Londrina, diagnosed with pulmonary atelectasis, monitored by physical therapy, from January to December 2009. The medical records belonged to patients admitted to pediatric surgery unit, pediatric ward, and pediatric emergency room.

Information was collected in structured protocol, containing data of identification, associated diseases, additional tests for diagnosis and outcome, site of atelectasis, auscultation, length of stay and of resolution, and physical therapy. Regarding the physical therapy approach, we gather information about the day of initiation of therapy, kinesiotherapy, orientation to patient and caregivers, bronchial hygiene maneuvers, re-expansion and reduce hyperinflation maneuvers, and use of auxiliary resources.

The present study is a report case in series and the term of commitment was approved by the Ethics Committee of UH/UEL (Title Page number 317062, Opinion No. 009/10).

Data were analyzed in tables and descriptively by means of absolute and relative frequencies.

Results

The patients ($n = 17$) with pulmonary atelectasis were attended in 2009, and one of the children was a repeat for the occurrence of the diagnosis. The age ranged from 11 days to 9 years, of both genders,

and the most frequently associated diagnosis was pneumonia (76%) (Table 1). It is noteworthy the occurrence of more than one diagnosis associated with pulmonary atelectasis in several patients. Other diagnoses were found like ear infections, anemia, malnutrition, seizure syndromes, sepsis/septic shock, conjunctivitis, prematurity, congenital syphilis, urinary tract infection, bronchiolitis, postoperative and leukemia.

Table 1. Characterization of children with atelectasis.

Variables	N	%
Gender		
Male	9	53
Female	8	47
Age group		
Infant	8	47
Preschool-age	5	29
School-age	4	24
Diagnoses associated with atelectasis *		
Pneumonia	13	76
Cerebral Palsy	4	24
Bronchospasm/Asthma	4	24
Gastroesophageal Reflux	4	24
Others	14	82

*Several children had more than one diagnosis associated.

Of the 17 children with pulmonary atelectasis, in 11 (65%) it was located in the apex of the right lung (Figure 1). In the initial evaluation, 8 (47%) children had no signs of increased work of breathing, and two cases had no description in the chart. The signs of increased work of breathing identified were: intercostal and subcostal retraction, suprasternal retraction, flaring of the nostrils, and use of accessory muscles.



Figure 1. Atelectasis in the right apex.

In the initial pulmonary auscultation, three of the 17 children had symmetrical vesicular murmur, and 14, asymmetrical vesicular murmur, reduced or absent; and 14 presented associated adventitious sounds, as for example, crepitations and rhonchi.

All the cases of atelectasis treated with physical therapy had satisfactory outcome (Table 2). The number of sessions of respiratory physical therapy for the resolution of pulmonary atelectasis ranged from 2 to 9 (mean = 4), performed once or twice a day, in the infants the number ranged from 2 to 7 (mean = 3.6), in preschool children, from 3 to 9 (mean = 4.6), and in scholar children, from 2 to 6 (mean = 4.2).

Table 2. Physical therapy performed.

Variables	n*
Breathing techniques	
Clearance	16
Re-expansive	17
Reduce hyper inflation	1
Kinesiotherapy	
Trunk rotation	8
Exercise for upper limbs	7
Manual Therapeutic Resources	
Scapular mobilization	8
'Pompage' / Traces	5
Functional activities	
Orthostatism	2
Ambulation	5
Positioning	
Right and Left Lateral Decubitus	10
Guidelines	
Positioning and functional activities	4

Although the radiological resolution of pulmonary atelectasis has been observed after the physical therapy (Figure 2), three children remained with asymmetrical vesicular murmur, but reduced, and six patients had adventitious sounds in the auscultation.

Discussion

Atelectasis modifies the lung mechanics leading to reduced residual volume, vital capacity, functional residual and total lung. Usually represents a secondary manifestation, and not an isolated disease. It can occur in three forms: compression of the parenchyma by intra- or extra-thoracic processes, increase of surface tension of the alveoli and/or bronchioles and airway obstruction (SILVA et al., 2006). In our study, most cases of atelectasis were caused by airway obstruction by secretion.

Jerre (2007) states that the respiratory physical therapy is effective and recommended for the treatment of pulmonary atelectasis in patients under mechanical ventilation. However, few studies were made on the treatment with respiratory physical therapy in children, with no gold standard yet (JOHNSTON; CARVALHO, 2008).

In the present study all the cases were solved with a short length of stay and few number of physical therapy sessions, using simple resources.



Figure 2. X-ray (before and after physical therapy).

These results corroborate the study of Bilan et al. (2009), in which 94.5% of cases of atelectasis in 90 children were reversed only with inhalation, postural drainage, and respiratory physical therapy, with on average 3.4 treatment days.

Several techniques were employed, the conventional ones such as the postural drainage (positioning) and vibration, and the most current, such as increased expiratory flow and slow and prolonged expiration, and others like the directed flow and lung re-expansion maneuver. It was also used techniques aiming to relax and stretch the accessory muscles of respiration, as for example the 'pompages' and the support described in the method of thoracic and abdominal reeducation.

The maneuvers to redirection the flow are indicated to patients that need localized pulmonary re-expansion, as for instance, in atelectasis. They consist of manual pressure to cause resistance to air flow into healthy lung, redirecting or displacing a greater amount of air to the injured lung (LUISI, 2008). In the study, it was observed that this technique was applied in 15 cases.

An interesting finding is that the chest manual percussion technique was not used for any patient,

meeting the most current studies that question its effectiveness and warn of possible risks, mainly in newborns (NICOLAU; LAHÓS, 2007). The use of manual percussion in children is questionable, especially in infants due to flexible chest that prevents the propagation of mechanical waves (RAMOS; RAMOS, 2008).

Only three patients required tracheal aspiration, since they presented ineffective cough due to neurological and biomechanical alterations caused by cerebral palsy. In the present study, the four children with cerebral palsy had been diagnosed with gastroesophageal reflux disease. The literature cites that they are more susceptible to respiratory diseases by the propensity of aspiration, scoliosis and difficulty in coughing (SCHECHTER, 2007).

The use of nebulized bronchodilators is traditionally recommended to treat atelectasis. In patients with bronchoconstriction, the use of bronchodilator may increase the airway diameter, easing the removal of secretion, meanwhile no studies evaluated its use in the treatment of atelectasis (SCHINDLER, 2005). The inhalation therapy with bronchodilator and/or mucolytic was accomplished in eight children, as medical prescribed.

In this way, Merkus et al. (2001) used successfully the nebulized recombinant human deoxyribonuclease in the treatment of atelectasis in children with bronchiolitis, because it liquefies the mucus and reduces the occurrence of plugs of secretion that can be the cause of atelectasis. However, in our service, the use of this drug is not yet standardized, so it was not used in any case.

Moreover, Silva et al (2006) employed with success hypertonic saline (HS) in the treatment of atelectasis after pediatric cardiac surgery, this because the inhalation of HS with NaCl at 6% is known to accelerate the tracheobronchial clearance in many conditions, probably by inducing osmosis to the inside of the airways, which modifies the rheology of mucus, favoring the mucociliary clearance.

The volume oriented incentive spirometer (Voldyne) was used in only four patients, school-aged children, able to use the resource for lung re-expansion. The other children received passive techniques, in which the professional does not receive cooperation from the patient (OBERWALDNER, 2000).

Bilan et al. (2009) and Rocha et al. (2008) found the greater occurrence of atelectasis in the right apex, as observed in the present study where 88% of cases were located in the right apex, and only 12% in the left bottom.

Occasionally in the assessment of patient with atelectasis one may find constant and localized

wheezing and decreased vesicular murmur, and even a reduction in expansion of the chest, muscle contraction, and approximation of the ribs above the area with atelectasis (JOHNSTON; CARVALHO, 2008; RAMAN et al., 1998). All these aspects match the data found in the medical records of the patients included in this study.

The study limitations refer to difficulties in gathering information, since not all data are described in prescription and clinical and physical therapy outcome. Moreover, there was difficulty to find the additional tests to check the control of clinical outcome. Another limitation was the small sample size due to the type of study (report case in series) and because it is a convenience sample.

Conclusion

The results showed that the most frequent associated diagnosis was pneumonia, and the most common localization was the apex of the right lung. The physical therapy was mainly based on re-expansion and bronchial hygiene, achieving satisfactory outcome with low number of sessions.

In conclusion, controlled studies comparing the existing techniques of respiratory physical therapy should be performed to ease the selection of techniques to be employed in the treatment and resolution of pulmonary atelectasis in children, including to prove their effectiveness, since are scarce studies on this subject.

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