



Review article

Development of premature newborn: review of its possible complications and physical therapy performance

Desenvolvimento do recém-nascido prematuro: revisão de suas possíveis complicações e atuação da fisioterapia

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Abstract

Objective: the present study aimed to know the main consequences that prematurity can have and how physical therapy can act to mitigate and treat its effects. **Materials and Methods:** this is an integrative literature review based on publications in journals indexed in the Medical Literature Analysis and Retrieval System Online (MEDLINE), Scientific Electronic Library Online (SciELO) and Google Scholar (Google Scholar) databases, in addition to electronic journals: Health Magazine, Physical therapy Magazine & Functional Health and Physical therapy Brazil, in addition to the book “Physical Therapy in Pediatrics and Neonatology”, using the keywords “premature”, “mechanical ventilation”, “development”, “lung injuries” and “physical therapy”. During the search, 11 scientific articles published between the years 2011 and 2020 were found. After applying the established inclusion criteria, the sample consisted of seven studies that rigorously met the guiding question. **Results:** such results could show that prematurity is directly associated with the occurrence of Ventilation-Induced Lung Injury (VILI) and delayed motor development in premature infants. **Conclusion:** the physical therapy intervention, when performed early, prevents diseases and promotes benefits that will last throughout the life of the premature.

Keywords: Premature. Mechanical Ventilation. Development. Lung Injuries. Physical Therapy

Resumo

Objetivo: conhecer as principais consequências que a prematuridade pode acarretar e como a fisioterapia pode atuar para atenuar e tratar seus efeitos. **Materiais e Métodos:** revisão integrativa da literatura a partir de publicações nos periódicos indexados nas bases de dados da *Medical Literature Analysis and Retrieval System Online* (MEDLINE), *Scientific Electronic Library Online* (SciELO) e *Google Scholar* (Google Acadêmico), além das revistas eletrônicas: Revista Saúde, Revista Fisioterapia & Saúde Funcional e Fisioterapia Brasil, além do livro *Fisioterapia em Pediatria e Neonatologia*, por meio dos descritores em saúde “prematuros”, “ventilação mecânica”, “desenvolvimento”, “lesões pulmonares” e “fisioterapia”. Foram encontrados 11 artigos científicos publicados entre os anos de 2011 e 2020. A amostra foi composta por sete estudos que atenderam de forma rigorosa à questão norteadora. **Resultados:** tais resultados puderam mostrar que a prematuridade está diretamente associada com a ocorrência da Lesão Pulmonar Induzida pela Ventilação (VILI) e do atraso do desenvolvimento motor em prematuros. **Conclusão:** a intervenção fisioterapêutica, quando realizada precocemente, previne agravos e promove benefícios que perdurarão durante a vida do prematuro.

Palavras-chave: Prematuros. Ventilação Mecânica. Desenvolvimento. Lesões Pulmonares. Fisioterapia.

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Introduction

According to the World Health Organization (WHO), a baby born before 37 gestational weeks is considered premature, having the following classification: extreme premature (less than 28 weeks); very premature (28 to 32 weeks); moderate to late premature (32 to 37 weeks). Thus, induced or cesarean deliveries cannot be planned before 39 weeks, except in cases of medical indications¹.

Premature birth can occur due to numerous factors, among them stand out: problems in uterine formation, unfavorable economic conditions, smoking, rupture of the bag before the period and multiple pregnancies. Due to the weakened body, these newborns may present loss of dexterity or even absence of voluntary and hypotonic contraction².

Early birth can cause numerous consequences, such as: decreased lung function, showing forced expiratory volume, increased residual volume, high respiratory rate and increased volume of air mobilized during a respiratory cycle, increased dead space and ventilation/minute, decreased compliance and high resistance compared to other newborns, presenting tachypnea, more likely to suffer with respiratory distress syndrome and pneumonia³. Thus, the period of hospitalization becomes longer⁴.

Many premature newborns who suffer from respiratory distress or hyaline membrane disease have positive responses to the use of exogenous surfactant but, even so, they can evolve to respiratory failure, requiring the use of invasive mechanical ventilation. This need to perform intubation and the use of positive pressure ventilation are related to the development of Ventilation Induced Lung Injury (VILI). Bronchopulmonary Dysplasia (BPD) is directly related to VILI in premature babies. The period immediately preceding the birth of a premature baby has a high risk for the development of VILI, since the lungs are partially filled with amniotic fluid, unevenly aerated and deficient in surfactant⁵.

During uterine development, there is a sequence of sensory maturation of the baby, and with early birth, the newborn's body is immature and needs to develop within the neonatal ICU. Care can be interpreted as excessive and end up causing stress in the baby, because in addition to surgical procedures to which he can be subjected, infections and the use of mechanical ventilation, all this stress can cause bradycardia, tachycardia, hypoxemia, hypertension, respiratory problems, among other factors. Thus, physical therapy intervenes early, with the aim of preventing motor and sensory complications generated by the period of hospitalization⁶.

Considering what was presented despite the complexity of the treatment of premature newborns, it is of paramount importance to know how physical therapy will act in front of this target audience. Thus, the main objective of this study was to know the main consequences that prematurity can cause and how physical therapy works to mitigate and treat its effects.

Materials and Methods

This is an integrative review of the literature. This method of study is performed through a bibliographical analysis, with the objective of obtaining a more comprehensive understanding of a proposed theme, based on previous studies that support the improvement of clinical practice⁷.

The method allows the combined inclusion of theoretical and empirical studies, providing a key role in evidence based practice. For the development of this review, we went through six distinct stages: a) elaboration of the guiding questions: how prematurity can influence the appearance of pulmonary injury induced by mechanical ventilation and motor development of premature infants? Can protective physical therapy measures prevent lung damage and motor delay? ; b) sampling or searching in the literature; c) categorization of the studies; d) critical analysis of the included studies; e) interpretation of the results; f) and presentation of the integrative review^{7,8}.

For the production of this study, selected journals were used from May to August 2020, found in the databases of Medical Literature Analysis and Retrieval System Online (MEDLINE), Scientific Electronic Library Online (SciELO) and Google Scholar (Google Scholar), in addition to electronic journals: *Revista Saúde*, *Revista Fisioterapia & Saúde Funcional* and *Fisioterapia Brasil*, also including the book *Physical therapy in Pediatrics and Neonatology*, as they had updated studies on the subject, most of the articles are in Portuguese. The following health descriptors were used in isolation: “premature”, “mechanical ventilation”, “development”, “pulmonary lesions” and “physical therapy”, inserted in Portuguese and applied in all databases. For inclusion criteria, original articles were established that included, in a clear and succinct way, the theme of the present study, that were in full and that presented information with newlypreterm infants who needed care in neonatal units aged zero to 12 months.

The initial search resulted in 11 articles, which were submitted to reading and applying the inclusion and exclusion criteria. After reading these in full, it was found that four articles did not present the selected age of life, did not clearly address the proposed problem and did not present data from the period of hospitalization in the neonatal ICU. At the end, the study consisted of seven publications that strictly met the points proposed.

The analysis of the studies was performed descriptively, then was done the elaboration of tables with analysis of the structural aspects of the articles – name of the authors, year of publication, title and type of study (Chart 1) and the methodological aspects - objectives, methodology/data collection and main results and conclusions (Chart 2). These were also numbered in a sequence ordered by year of publication and increasing order from 1 to 7 for better identification.

Results

Chart 1 shows the name of the authors, title and type of study, showing the structural aspects of the articles collected within the pre-established inclusion criteria.

Chart 1. Description of articles according to authors, year of publication, title and type of study. 2020 (n=7).

Article	Authors	Title	Type of study
1	Sandes <i>et al.</i> , 2019	Physiotherapist performance and the newborn's response to the kangaroo method: a documentary study	Documentary study
2	Antunes and Rugolo, 2019	Approach of respiratory physical therapy in neonatal intensive care unit	Study methodology and book research
3	Francisco, 2017	Physiotherapeutic approach in high-risk premature in the neonatal ICU	Case report
4	Almeida <i>et al.</i> , 2014	Behavioral assessment of premature newborns with bronchopulmonary dysplasia	Cross-sectional study
5	Araújo, Eickmann and Coutinho, 2013	Factors associated with delayed motor development of premature children hospitalized in a neonatal unit	Descriptive study
6	Duarte and Coutinho, 2012	Factors associated with bronchopulmonary dysplasia in premature infants under early mechanical ventilation	Cohort study
7	Nicolau <i>et al.</i> , 2011	Motor performance in high-risk preterm newborns	Clinical essay

The description of the articles according to the methodological aspects is shown in Chart 2.

Chart 2. Description of articles, second objective, methodology and data collection, results and conclusion. 2020 (n=6).

Article	Objective	Sample/Methodology	Results/Conclusion
1	Observe the activities of the physical therapy professional in the kangaroo method and the newborn's response to the method.	The sample consisted of 136 newborns, 75 males (55.15%) and 61 females (44.85%) with a mean gestational age of 31.01 weeks. The newborns were submitted to the kangaroo method, which consists of placing the NB in a prone position on the chest or breasts of their mothers.	It was observed in babies submitted to the method: increase in height; elevation of weight and maintenance of body temperature, thus proving the effectiveness of physiotherapeutic techniques with kangaroo method in the hospital.
3	To report the emphasis that physical therapy has today within the neonatal ICU, from the evaluation to the treatment of children with respiratory distress.	Sample consisting of PTNB, without underlying pathology, presenting as a complication only the consequences of prematurity. The data collected were obtained through photographic record, interviews with the mother of the newborn, hospital monitoring and analysis of medical records. The treatment program adopted was based on the complications that the patient had presented in the period in which he was hospitalized in the neonatal ICU.	In the developed study, there was great acceptance of the physiotherapeutic procedures used, since the patient reacted satisfactorily with the positive and progressive clinical evolution, allowing the achievement of a good prognosis. The results showed that the physiotherapeutic intervention, based on the employed conduct, is of great importance and value in the prevention and/or minimization of possible sequelae resulting from prematurity.
4	Describe the behavioral assessment of newborns premature infants with BPD.	Sample consisting of ten premature newborns with BPD, birth weight less than 1500g and gestational age less than 32 weeks. The method proposed by Dubowitz and Dubowitz was used with analysis of the seven behavioral items.	The visual and auditory orientation of the evaluated neonates was below the expected results for the corrected age of 40 weeks. The findings of the variables; irritability and consolability had a higher incidence of abnormalities in newborns with BPD, and persistent crying was observed and difficult to regulate. The behavioral evaluation of preterm newborns with BPD showed a tendency to abnormality.
5	To verify the frequency of motor development delay in premature children admitted to the neonatal unit and to identify the associated factors.	The sample consisted of 98 children born preterm with a minimum post-conceptual age of 34 weeks, during hospitalization, between January and July 2009 in a neonatal unit of a high-risk maternity hospital in Recife, Brazil. Motor development was evaluated through the Test of Infant Motor Performance (TIMP).	It was identified that hospitalized premature children may have early motor development delay, in a severe or borderline way. The factors that most influenced the outcome were birth weight, neonatal morbidities and care received in the neonatal unit.

6	Describe neonatal and care factors associated with Bronchopulmonary Dysplasia (BPD), and to verify its frequency in premature newborns submitted to Mechanical Ventilation (MV) in the first week of life.	The study consisted in analyzing 86 records of premature infants under MV in the first week of life, neonatal data, MV parameters and their relationship with BPD were recorded. To verify the association between the variables of the study and the DBP, we used the chi-square test and Fisher's exact when indicated. The t test and Kruskal Wallis were used to compare the means of continuous variables.	It was identified that they evolved without BPD 71 (82.6%) of the children and 15 (17.4%) presented the disease. MV was the respiratory support primarily used in 80% of newborns who developed BPD later, while those without BPD were initially submitted to non-invasive modes of ventilatory assistance (58.2%). It is concluded that BPD is directly related to early institution and prolonged use of MV.
7	To evaluate motor performance in preterm newborns (PTNB) at risk for motor development.	Sample consisted of 69 preterm NB, 43 males (62%) and 26 females (38%), mean gestational age of 32 weeks. For the evaluation of the motor performance of the PTNB's, the TIMP was used.	It was observed, through the TIMP, that the PTNBs that had the worst motor performance were those whose time spent in ventilatory support was prolonged.

Number 2, a study represented by a chapter of the book Physical therapy in Pediatrics and Neonatology, is not provided in the table because it does not have the same methodological applicability of a scientific article, as well as its technical characteristics.

Most of the articles aimed to show how the organism of premature newborns behaves in relation to respiratory and motor problems, emphasizing the importance that physical therapy exerts in the treatment of this public in a NICU. The target audience of the studies were premature newborns of both sexes, who required hospitalization in NICU and made use of mechanical ventilation, without associated pathologies.

Discussion

Delay in motor development

From June 2007 to December 2008, a prospective study was conducted, which consisted of evaluating the motor performance of premature infants, using the TIMP. The study was based on an analysis of 69 preterm newborns. It was found that of the 69 preterm newborns (PTNB), 56 were on average, 7 were below the average and 6 far below the average. Those who had the worst motor performance indexes were those whose ventilatory support time was longer (IMV, NIMV or inhaled oxygen). They stayed longer in the NICU, correlating the delay in motor development to prematurity associated with the use of prolonged ventilatory support⁹.

In another study conducted by 98 children hospitalized in a neonatal unit, 39 had motor development altered according to TIMP. The worst results were found in children with low weight

and older post-conceptual age, improving the clinical picture as the weight increased. Regarding neonatal morbidities, there was a significant association between the occurrence of hypoxia/perinatal asphyxia and bronchopulmonary dysplasia with altered motor development. As for the care offered in the neonatal unit, those who required hospitalization in the NICU and used the IMV presented longer hospitalization time and worse motor results¹⁰.

Mechanical ventilation and its possible consequences

In a study with 86 premature infants who required ventilatory support, 82.6% of the babies did not develop BPD and 17.4% had the disease. Of the babies who manifested the disease, the MV was the ventilatory support primarily used, and those who did not. In addition, neonates who had BPD also needed to use parenteral nutrition for longer, had lower weight in the period of hospitalization and the use of antibiotics was also longer in newborns with BPD¹¹.

In an analysis performed with a sample of ten premature newborns, it was found that they had very low birth weight, and eight of them used prenatal corticosteroids, but all had Respiratory Distress Syndrome (RDS). In addition, surfactant was also administered in nine children and all required ventilatory support, and only one was NIMV and the others used invasive support, also highlighting that two of them did not need to use postnatal corticosteroids. Several changes were found in the behavior of babies, such as eye changes (strabismus) and affected visual orientation, hearing disorders with different reactions to sound stimuli, as well as irritation and tear¹².

Physical therapy performance

In 2007, a study was conducted with a premature newborn in unfavorable conditions of vitality. The intervention and physical therapy follow-up, performed early, contributed to its good evolution. Its treatment was mainly focused on minimizing pulmonary complications and their sequelae that, if not identified early, could cause problems for life, easing the problems of functional loss of the motor part, minimizing the appearance of deformities and postural vices, helping in neuropsychomotor development. Thus, the therapy used took into account its general state and conditions at the time the therapy was exercised¹³.

In another study conducted with children who underwent the method Mama Kangaroo, it was obtained after analysis of 136 medical records, an improvement in the weight and size of the newborn, using numerous techniques of physical therapy, among them: maternal guidelines (4.41%), nasal wash (26.47%) and therapeutic position (75%), the latter being the most used. This

method provided a more humanistic service, which promoted healthy development for the beneficiaries. The main complications found were: RDS (85.29%) and jaundice (70.59%)¹⁴.

It is of utmost importance the multiprofessional monitoring of a premature newborn in a NICU and the physiotherapist contributes significantly in the care of the patient, because it is responsible for the administration and control of therapeutic gases, invasive and non-invasive mechanical ventilation, functional evaluation, preventive actions and ventilatory weaning. The main goal is to make the patient achieve normal function or improve function in three main areas: musculoskeletal, cardiopulmonary and neurological¹⁵.

Conclusion

From studies analyzed, it is noticed that prematurity is directly associated with the occurrence of VILI and motor development delay in preterm infants. Thus, it is possible to conclude that the physiotherapeutic intervention, when performed early, prevents injuries and promotes benefits that will last throughout life.

It was observed that, despite being a relevant subject, both academic and professional, there is still a shortage of studies. Thus, it is necessary to carry out new studies to improve current knowledge and innovate in techniques that can have greater effectiveness. Following the same line of reasoning, with the increase of materials addressing this theme, professionals and students will be able to expand their knowledge and, consequently, contribute positively to the treatment of premature infants and, therefore, society.

Authors' contribution

All authors approved the final version of the manuscript and declared themselves responsible for all aspects of the work, including ensuring its accuracy and integrity.

Conflict of interest

The authors declare that there are no conflicts of interest.

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