Case Report

Physiotherapeutic intervention in a child with coronavirus in a reference hospital: case report

Intervenção fisioterapêutica em uma criança com coronavírus em um hospital de referência: relato de caso

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ABSTRACT | INTRODUCTION: Despite presenting less frequently, severe cases of COVID-19 can also affect the pediatric population. Considering this fact, the effectiveness of physiotherapy is evidenced, which consists of a therapeutic specialty that plays a fundamental role in the prevention and treatment of pulmonary complications. **OBJECTIVE:** To describe the clinical picture of a child with Congenital Heart Disease with positive Coronavirus and to address pediatric physiotherapeutic activities. **MATERIALS AND METHODS:** This is a case report of a 5-year 11-month-old patient with a previous diagnosis of Congenital Heart Disease of the following types: Artery Channel Persistence and Interventricular Communication. The patient was admitted to the Pediatric Intensive Care Unit of the Couto Maia Institute, presenting tachycardia, tachypnea, with peripheral oxygen saturation (SpO2) of 85% using a non-reinalin mask, with increased ventilatory work and productive cough at the verbal command. When performing RT-PCR, he obtained a positive result for the Coronavirus. **RESULTS:** The data collected through the analysis of medical records and clinical observation of the patient demonstrated that the physical therapy intervention, when using bronchial hygiene techniques, reexpansive maneuvers and active motor conducts, contributed to the clinical evolution of the patient, showing improvement in SpO2 and ventilatory discomfort. **CONCLUSION:** Physiotherapeutic interventions applied to this patient profile have shown positive results with regard to the improvement of gas exchange and respiratory discomfort, as well as appearing to influence the reduction in the risk of functional decline.

KEYWORDS: Physical Therapy Specialty. Respiratory Therapy. Coronavirus Infections. Pediatrics.

RESUMO | INTRODUÇÃO: Apesar de apresentar-se em menor frequência, os casos graves do COVID-19 podem também afetar a população pediátrica. Considerando este fato, constata-se a eficácia da fisioterapia, que consiste numa especialidade terapêutica que exerce papel fundamental na prevenção e tratamento de complicações pulmonares. **OBJETIVO:** Descrever o quadro clínico de uma criança portadora de Cardiopatia Congênita com Coronavírus positivo e abordar a atuação fisioterapêutica pediátrica. **MATERIAIS E MÉTODOS:** Trata-se de um relato de caso de uma paciente de 5 anos e 11 meses de idade, com diagnóstico antecedente de Cardiopatia Congênita dos tipos: Persistência do Canal Arterial e Comunicação Interventricular. A paciente foi admitida na Unidade de Terapia Intensiva Pediátrica do Instituto Couto Maia apresentando-se taquicárdica, taquipneica, com saturação periférica de oxigênio (SpO2) de 85% em uso de máscara não reinalante, com aumento do trabalho ventilatório e tosse produtiva ao comando verbal. Ao realizar RT-PCR obteve resultado positivo para o Coronavírus. **RESULTADOS:** Os dados coletados por meio de análise de prontuário e observação clínica da paciente demonstraram que a intervenção fisioterapêutica, quando contou com técnicas de higiene brônquica, manobras reexpansivas e condutas motoras ativas, contribuiu com a evolução clínica da paciente evidenciando melhora na SpO2 e no desconforto ventilatório. **CONCLUSÃO:** As intervenções fisioterapêuticas aplicadas a este perfil de paciente, demonstraram resultados positivos no que diz respeito a melhora das trocas gasosas e desconforto respiratório, bem como parece influenciar a redução do risco de declínio funcional.

PALAVRAS-CHAVE: Fisioterapia. Terapia respiratória. Infecções por Coronavirus. Pediatria.

Submitted 28/10/2020, Accepted 14/12/2020, Published 01/14/2021
J. Physiother. Res., Salvador, 2021 February;11(1):227-232
http://dx.doi.org/10.17267/2238-2704rpf.v11i1.3380 | ISSN: 2238-2704
Designated editors: Sumaia Midlej, Kátia Sá e Cristiane Dias

How to cite this article: Oliveira JS, Veiga IN, Mota CS. Physiotherapeutic intervention in a child with coronavirus in a reference hospital: case report. J Physiother Res. 2021;11(1):227-232. http://dx.doi.org/10.17267/2238-2704rpf.v11i1.3380

Introduction

In December 2019, a new class of viral pneumonia, of unknown etiology, was notified by the Health Commission of Hubei province, in Wuhan, China[1]. Subsequently, the causative agent of the virus was identified by the World Health Organization (WHO) as "new coronavirus - 2019" (2019 - nCoV)[2].

Initially, there were few cases of this infection in the pediatric population, suggesting the hypothesis these individuals were not susceptible to the virus. However, after the manifestation of family aggregation, new cases gradually emerged[3]. Despite presenting themselves in a smaller proportion, children are as prone to infections in general as adults, considering that this population is particularly prone to develop respiratory disorders, due to several interrelated factors that favor this evolution, which go from anatomical peculiarities to physiological and immunological characteristics[4].

Infected children may remain asymptomatic or have fever, cough, fatigue, nasal congestion, and some patients have experienced gastrointestinal symptoms, including abdominal discomfort, nausea, vomiting and diarrhea. Most of the infected children have mild clinical manifestations, and severe cases can progress rapidly to septic shock, refractory metabolic acidosis, coagulation dysfunction and / or acute respiratory distress syndrome (ARDS)[3].

Based on the information mentioned above, the effectiveness of physiotherapy is confirmed, which consists of a therapeutic specialty, which plays a fundamental role in the prevention and treatment of pulmonary complications. Its main objective is to improve the respiratory function of patients in order to facilitate gas exchange and adjust the ventilation-perfusion ratio, through bronchial hygiene techniques, that are, techniques that facilitate mucociliary clearance and mucus removal, thus maintaining airway permeability[5]. These techniques reduce the time of exposure to mechanical ventilation (MV) and the time spent in the Intensive Care Unit (ICU)[6].

Given the above, the objective of this study is to describe the clinical condition of a child with Congenital Heart Disease with positive Coronavirus and to address the pediatric physiotherapeutic performance.

Clinical case

The present report presents the case of the first pediatric patient at the Couto Maia Institute (ICOM) diagnosed with the virus. It is a 5-year 11-month-old female child admitted to the Pediatric Intensive Care Unit (PICU) of ICOM on April 18 2020 at 8:00 pm.

This study was submitted to the Ethics and Research Committee, under number CAEE 32864620.9.0000.0046 and approved Opinion number 4,263,898, according to the ethical principles set out in Resolution number 466/2012 and 510/2016 of the National Health Council.

This is a previous functional independent patient, with a previous diagnosis of Congenital Heart Disease, of the types: Patent Ductus Arteriosus (PDA) and Intraventricular Communication (IVC). For the PDA, there was a prior correction; for IVC, it remains uncorrected. Since the last consultation, held in 2017, the patient has not been followed up with the pediatric cardiologist.

The patient was admitted to the unit with a history of fever for 8 days, hyaline rhinorrhea and respiratory distress. She was evaluated and performed RT-PCR via nasopharyngeal and oropharyngeal swab, which was positive for Coronavirus.

At the clinical entrance examination, the child was active, collaborative and communicative during handling, tachycardic 145bpm (beats per minute), tachypneic 35ipm (incursions per minute), showing peripheral oxygen saturation (SpO2) of 85% while wearing a non-rebreathing mask, considering that its baseline SpO2 in ambient air is 85% due to the history of the underlying Heart Diseases. During the evaluation, she showed signs of increased work of breathing and pulmonary auscultation revealed diffuse snoring and early crackling, and then the pervious nostrils and productive cough at the verbal command were identified.

Computed tomography (CT) showed a small pleural effusion on the right, complete consolidation of the left lower lobe, air bronchograms associated with tenuous and focal consolidations, ground-glass opacities in the upper left and lower right lobe, with

the involvement of the pulmonary parenchyma between 25-50%. Arterial blood gas analysis (HGA) indicated the following data: pH: 7.28, PCO2: 22.9, PO2: 61.2; HCO3: 10.6, BE: -13.4, SO2: 90%, Lac: 3.64.

The patient remained in the PICU for 10 days and during this period she remained in an isolation bed with negative pressure and was being monitored by the pediatric physiotherapy team, who assisted the child four times a day throughout the hospitalization period.

On the first day of hospitalization, the general condition worsened with hypoactivity, hypoglycemia (HGT = 50 mg / dl) and seizure, with diazepam and glucose being administered, as described in the patient medical prescription by the nursing team.

On the second day of hospitalization, the patient demonstrated clinical stability and underwent a Functional Echocardiogram that showed an ejection fraction of 35%, enlarged ventricle dimensions with thickening of the ventricular walls, vena cava without turgence and with good distensibility.

The physical therapy evaluation of the pulmonary system detected limitations characterized by an increase in resistive load due to mucus presence in the airway, with an impact on oxygenation. From this, the procedures were initiated playfully, aiming to promote the understanding and acceptance of the necessary treatment, as well as to reduce the stress inherent to hospitalization.

Given this situation, high-flow oxygen therapy was maintained through a non-rebreathing mask, which increased SpO2 (89%). Besides, the risk of functional decline secondary to the hospitalization period was identified, this item was assessed using the Functional Status Scale (FSS) for the pediatric population. In this analysis, a score of 7 was obtained from the moment of admission.

In addition, the following procedures were implemented: Cardiorespiratory monitoring, slow and prolonged expiration (ELPr), verbal cough stimulus, oxygen weaning to Venturi mask considering an inspired fraction of oxygen (FiO2) of 50%, and flow of 15L / m, sedastation in bed and biomechanical alignment.

Later, on the fifth day of hospitalization, the patient's condition remained stable, showing an improvement in the limitations previously identified, in which the following parameters were observed: heart rate: 114 bpm pulse, respiratory rate: 25 bpm and SpO2: 89% in high flow oxygen therapy via Venturi mask with FiO2 of 31% and flow rate of 8L / m. Based on the information collected, the following procedures were adopted: Slow accelerated expiratory flow (AFEL), reexpansive ventilatory patterns (breathing oriented exercises), kinesiotherapy, verbal coughing, mobilization in the bed, biomechanical alignment and oxygen weaning to the nasal catheter offering the flow of 3L / m.

On the tenth day of hospitalization, the patient showed significant improvement in pulmonary auscultation, presenting: the presence of vesicular breath sound without adventitious sounds, patent nostrils using low-flow oxygen therapy via nasal prongs, offering a flow of 3L / m, presenting SpO2 96 %. On this day, it was also observed that the patient did not present functional decline secondary to the hospitalization period, with the same score obtained at admission (7 points) being identified. However, she needed assistance with a pediatric cardiologist, therefore she was transferred to another hospital due to the absence of this specialty in the present unit, which held the continuation of cardiac care.

Discussion

Despite presenting less frequently, severe cases of COVID-19 can also affect the pediatric population, as is well described in a cohort study conducted in China, which included a sample of 2,143 children in which 34.1% of this public are confirmed cases of the disease[7].

In the aforementioned cohort, it is reported that about 0.4% of confirmed patients were considered serious cases, where they categorized the clinical condition, taking into account the clinical characteristics, laboratory and radiological findings, describing the serious cases as those in which the patients had: pneumonia, fever, cough, SpO2 <92% and respiratory distress[7].

Corroborating this study, the present report describes that the patient was admitted with a history of fever for 8 days and respiratory distress, as well as hyaline rhinorrhea and tachycardia. During the physical therapy evaluation, a productive cough at the verbal command and changes in pulmonary impedance by mucus presence with impact on oxygenation were also observed, with a SpO2 of 85% in the use of a non-rebreathing mask.

Also, the patient presented tomographic findings with similar features to those found in the literature related to patients diagnosed with COVID-19, with the presence of bronchograms associated with focal consolidations, complete consolidation of the left lower lobe, opacities in "ground glass" and pleural effusion.

The referred tomographic findings are in agreement with the results described in the study carried out by Ramos et al.[8], where they ratify that among the main tomographic findings observed in children infected by the virus are: irregular opacities in "ground glass" and the presence of consolidation, which may be unilateral or bilateral, varying according to the disease progression. However, the authors indicate that these results, when analyzed in isolation, are not sufficient to diagnose the case since other infections may present similar findings, in addition to the possibility of co-infections[8].

Due to the conditions in which pediatric patients have a respiratory infection, Pinto et al.[9] affirm that pediatric physiotherapy in hospitals will have as main objectives: to minimize the effects of pulmonary complications and improve children's respiratory function. In addition, even in this study, it was evidenced that in the described scenario, the applied physical therapy procedures, considering the mentioned objectives, demonstrated statistically significant results in reducing the signs of respiratory distress, assessed through the Silverman-Andersen Score.

In this report, the approached patient had a condition of ventilatory discomfort secondary to the pulmonary system changes mentioned above. In this context, the physiotherapeutic techniques performed were defined considering objectives similar to those mentioned in the study by Pinto et al.[9] and a therapeutic plan was drawn up, offering techniques that include everything from bronchial hygiene strategies to active motor management.

Regarding bronchial hygiene techniques, Gomes et al.[10] carried out a Randomized Clinical Trial (RCT) in which they evaluated the effectiveness of similar techniques to those mentioned in this report in infants with acute viral bronchiolitis (AVB). In this RCT, the results showed that the clearance maneuvers, and the cough stimulus, improve in the short term the score obtained by the Wang score, which considers the following parameters: retractions, respiratory rate, wheezing, and general condition.

As for reexpansive techniques, Tomich et al.[11] state that such maneuvers are capable of increasing residual capacity and guaranteeing greater alveolar stability, being in accordance with the goals chosen for determining the therapeutic maneuvers used in this report.

According to the data described in the studies carried out by Tomich et al.[11] and Gomes et al.[10], the present case shows that a few days after starting the therapeutic plan, the patient showed improvement related to ventilatory discomfort and hypoxemia, translated by the reduction of the oxygen offered and progressive increase in SpO2, as well as the normalization of the other functional markers of the cardiorespiratory system.

Similarly, the motor approach mentioned in the present study was applied based on data available in the current literature, where the benefits associated with performing active and passive mobilization with hospitalized children are reported, showing satisfactory results in terms of risk reduction of functional decline[12].

Among the possible instruments to assess children's functionality, the FSS stands out for utilization in hospitalized children. This scale consists of six domains (mental status, sensory functioning, communication, motor functioning, feeding, and respiratory status) and each domain can be scored in the interval between 1 and 5 points, with 1 point corresponding to the "normal" outcome and 5 points mean "very severe dysfunction". The overall score varies between 6 and 30 points, in which the scores between 6 and 7 are classified as "adequate"[13].

In the RCT performed by Rocha et al.[12] in a PICU, which analyzed the effects of early mobilization in children aged between one and five years, with a diagnosis of pneumonia associated with mechanical

ventilation, he pointed out that interventions such as sedestation, orthostasis, stretching and active and passive joint mobilizations, during the hospitalization period, prevent physical and neuropsychological impairments, in addition to improving the autonomic modulation of heart rate.

It was observed in this report, that the physical therapy approach had motor interventions since the first contact and, corroborating what was described in the above-mentioned RCT, the patient did not present functional decline from admission until her transfer to another hospital unit, with a total of 7 points in all evaluated moments of the FSS being scored.

Regarding cardiac function, Su et al.[14] carried out a retrospective study in which the analysis of clinical, laboratory and radiological findings was made, in which nine children positive for the virus and their respective families were included. Laboratory tests of six children and two adults showed an increase in cardiac enzymes, indicating that the virus may also have repercussions in this system. Therefore, the need for continuous monitoring in the care of positive patients and, more intensely, those who have previous dysfunctions of the cardiovascular system is emphasized.

According to Su et al.[14], Eastin et al.[7] affirm in their Cohort that among severe cases, those who will need hospitalization, are likely to happen in children who have a history of underlying diseases and mention cardiovascular changes. It is necessary to emphasize that the patient in question in this report, has an uncorrected IVC condition, which has not been followed up for 3 years and has hemodynamic repercussions where SpO2 tolerance> 85% is allowed, in addition to showing an ejection fraction of 35%, thus requiring specialized assistance and for this reason, she was referred to another service unit.

Among the professionals involved in the rehabilitation process of patients with COVID-19, physical therapy becomes essential, not because it directly addresses the disease, but because it is able to prevent and rehabilitate deficiencies and functional limitations caused by the virus[14].

This study has as a limitation the fact of reporting a single case, being only possible to portray the clinical case and its repercussions. However, the results found can guide physical therapy interventions in patients with similar conditions, in agreement with the literature presented. However, the need to conduct further studies in this population is highlighted, with greater methodological robustness, to highlight the physical therapy effects.

Conclusion

It is noted that the picture presented by the reported patient, is consistent with the data already described in the literature in question. Furthermore, it was observed that the physical therapy interventions applied to this patient type, demonstrated positive results concerning the improvement of gas exchange and respiratory discomfort, as well as seems to influence the reduction of the risk of functional decline.

Authors' contributions

Oliveira JS participated in the conception, design, search, and analysis of research data, interpretation of results, and writing of the scientific article. Veiga IN participated in the conception, design, analysis of research data, interpretation of results, and writing of the scientific article. Mota CS participated in the search for data for research, interpretation of results, and writing of the article.

Conflict of interest

No financial, legal, or political conflicts involving third parties (government, companies and private foundations, etc.) have been declared for any aspect of the submitted work (including, but not limited to, grants and funding, participation in advisory council, study design, preparation of the manuscript, statistical analysis, etc.).

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