

# BARRIERS AND FACILITATORS OF THE APPLICATION OF THE AIR STACKING TECHNIQUE IN PATIENTS WITH NEUROMUSCULAR DISEASES: A LITERATURE REVIEW

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## ABSTRACT

**Introduction:** Neuromuscular diseases (NMD) cause progressive and irreversible damage to the peripheral neuromuscular system, weakening skeletal, cardiac, and respiratory muscles. This leads to difficulties in locomotion, swallowing, and, in severe cases, death from respiratory failure. Coughing is crucial for protecting the airways, but it becomes ineffective in patients with NMD, increasing the risk of respiratory infections. Cough assistance techniques with insufflation and air stacking, using a manual resuscitator or mechanical ventilator, are effective for removing secretions and improving lung function. **Objective:** To review the literature in order to analyze the barriers and facilitators of air stacking techniques to improve the quality of life of patients with NMD. **Methodology:** Articles in English and Portuguese from Pubmed, Google Scholar, and Scielo were included. **Results:** The study confirmed that the technique is beneficial for patients with DMD, and the knowledge gained can be applied to these patients. However, a limitation of the study is that the data analyzed were only for the short-term benefits of the techniques, and further research is needed to evaluate the long-term effects of these maneuvers in people with neuromuscular diseases. **Conclusion:** Based on the results of the articles selected to answer the initial clinical question, it can be concluded that the air stacking technique is effective for patients with neuromuscular diseases seeking to increase peak cough flow (PCF).

**Keywords:** Neuromuscular; Air Stacking; Barriers; Facilitators.

## INTRODUCTION

Neuromuscular diseases (NMD) are identified by progressive and irreversible damage to the peripheral neuromuscular system. This can affect peripheral motor nerves, neuromuscular junctions, and spinal cord neurons. These conditions are acquired or hereditary and result in the weakening of peripheral skeletal muscles, as well as muscles of the cardiac and respiratory systems. The different forms of NMD are differentiated based on the type of muscle affected, the age of onset of symptoms, and the specific progression of the disease [1]. As a result, these diseases can lead to loss of walking ability, mobility difficulties, difficulty swallowing, and even death from respiratory failure [2].

Coughing is a fundamental mechanism for protecting the lower airways. When there is a deficiency in muscle activation, the peak cough flow (PCF) decreases, which compromises the removal of foreign bodies and excessive secretions. This ineffective coughing results in the accumulation of secretions and can lead to frequent respiratory infections, atelectasis, and, in many cases, death [3].

The cough assistance technique using insufflation and air stacking is very effective for the treatment of these diseases and can be performed with a manual resuscitator (Ambu®) or a mechanical ventilator. These deep insufflations provide additional air volume during inspiration, helping to fill the lungs to near-normal volume and improving cough efficiency by increasing peak cough flow (PCF).

The effectiveness can be enhanced with the air stacking technique, promoting better removal of secretions, improving lung function and, consequently, the quality of life of patients. Among the barriers are the difficulty in finding studies that focus exclusively on this technique, the complexity of the training required, and the limited short-term benefits. On the other hand, facilitators include the proven effectiveness of the technique in improving PFT, the cost-effectiveness of using resuscitation bags (Ambu®), and the potential improvement in patients' quality of life, making the technique a viable option, especially in healthcare systems such as the SUS [5]. Therefore, the present study aimed to review the literature to analyze and investigate the barriers and facilitators of the use of the air stacking technique to increase FVC and efficiency in patients with neuromuscular diseases, through Ambu® or mechanical ventilation [6].

## **METHOD**

The study consists of a literature review to analyze the barriers and facilitators of air stacking in NMD. The search consisted of original articles in English and Portuguese indexed in the Pubmed, Google Scholar, and Scielo databases. The difficulty of finding articles that only used the air stacking technique without association with others reduced the number of studies found. The descriptors used were neuromuscular diseases and respiratory function.

## RESULTS

The study involved the selection, observation, and analysis of two scientific articles to evaluate the application of the air stacking technique in individuals with neuromuscular diseases. The results showed a change in the peak cough flow (PCF) of the participants and compared two different techniques to improve cough effectiveness in patients with Duchenne Muscular Dystrophy (DMD). The study analyzed the effectiveness of the air stacking technique in increasing peak cough flow in individuals with neuromuscular diseases, comparing two methods: one with a resuscitation bag and the other with a mechanical ventilator. One of the selected articles used a randomized prospective method, while the other was a cross-sectional study.

The research was conducted at the Neuromuscular Center of Excellence and the Home Mechanical Ventilation Center at Inkendaal Rehabilitation Hospital in Belgium, involving 52 adults with Duchenne muscular dystrophy (DMD). The participants, with an average age of approximately 25 years, were divided into two groups to perform the air stacking technique, one using an Ambu bag and the other a mechanical ventilator.

The study included spirometry to assess lung function and measured peak cough flow. After a theoretical introduction and 2 minutes of training, participants performed the technique with a rest break. The effectiveness of the methods was analyzed based on lung function tests and peak cough flow. Increasing PFT is a crucial goal for these patients, and the use of a resuscitation bag as a method for performing the maneuver is economical, making it suitable for the Brazilian Unified Health System (SUS).

The study confirmed that the technique is beneficial for patients with DMD, and the knowledge gained can be applied to these patients. However, a limitation of the study is that the data analyzed were only for the short-term benefits of the techniques, and further research is needed to evaluate the long-term effects of these maneuvers in people with neuromuscular diseases.

## **CONCLUSION**

Based on the results of the articles selected to answer the initial clinical question, it can be concluded that the air stacking technique is effective for patients with neuromuscular diseases who seek to increase peak cough flow (PCF). Short-term effects include mobilization of secretions from the lower airways, which prevents infections progressing and improves both the quality of life and survival of these patients.

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## **BIBLIOGRAPHICAL REFERENCES**

1. Paula PB, Lasmar LMLBF, Fonseca MTM, Carvalhais MB, Machado MGR. Update on the approach to respiratory physiotherapy in neuromuscular diseases. RBPS, Fortaleza, 2009 (1):92-98.
2. Nowark KJ, Davies KE. Duchenne muscular dystrophy and dystrophin: pathogenesis and opportunities for treatment. EMBO reports, 2004 (9).
3. Brito MF, Moreira GA, Pradella-Hallinan M, Tufik S. Air stacking and chest compression increase peak cough flow in patients with Duchenne muscular dystrophy. J Bras Pneumologia. 2009;35(10): 973-979.
4. Tanyse BCM, Evaluation of peak cough flow and forced vital capacity in patients with muscular dystrophy or spinal amyotrophy undergoing air stacking training. [Dissertation]. São Paulo: Faculty of Medicine, University of São Paulo; 2012.

5. Almeida MMFD, Teodoro RDJ, Chiavegato LD. Application of maneuvers and strategies in respiratory physiotherapy: time to revisit the evidence. *J Bras Pneumol.* 2020;46
6. Marques TBC. Evaluation of peak cough flow and forced vital capacity in patients with muscular dystrophy or spinal muscular atrophy undergoing air stacking training [doctoral thesis]. São Paulo: University of São Paulo; 2012.