

# Bronchiectasis and clearance physiotherapy: emphasis in postural drainage and percussion

*Bronquiectasia e fisioterapia desobstrutiva: ênfase em drenagem postural e percussão*

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## Abstract

Bronchiectasis consists of abnormal, permanent and irreversible dilation of bronchi and bronchia, with recurrent infections, inflammation, hypersecretion and a reduction of mucus clearance. It predominantly affects women of between 28 and 48 years old and more frequently affects the inferior lobes. Clinical manifestations are chronic cough, fever and voluminous expectoration, with a fetid odor. The etiology is unspecific and is considered the final stage of diverse pathological processes. It can be classified in cylindrical, varicose and cystic, and also in respect to located and whether it affects multiple segments. Postural drainage and chest percussion are commonly used clearance techniques however, there are few published comparative population studies or reviews of techniques. In this context, this study aimed at evaluating the efficaciousness of postural drainage and chest percussion on bronchus clearance in bronchiectasis patients and to compare the effects and associations of these techniques with others reported in the literature. Recent research reported that postural drainage and chest percussion are effective therapies to mobilize pulmonary secretions as they increase the velocity of mucus transportation, improving

pulmonary function and gas exchange. This requires the assistance of a professional, which can make the necessary daily treatment difficult. For this reason physiotherapists have been choosing techniques that give more independence to patients.

*Descriptors:* Respiratory tract diseases. Bronchiectasis, rehabilitation. Drainage, postural. Posture. Physical Therapy Techniques.

## Resumo

Bronquiectasia consiste em dilatação anormal, permanente e irreversível de brônquios e bronquíolos, com infecções recorrentes, inflamações, hipersecreção e redução da limpeza mucociliar. Acomete predominantemente o sexo feminino, entre 28 e 48 anos de idade e afeta com maior frequência os lobos inferiores bilateralmente. Manifestações clínicas da doença são a tosse crônica, febre e expectoração volumosa, purulenta, com odor fétido. Etiologia é inespecífica e representada pelo estágio final de diversos processos patológicos. Pode ser classificada em cilíndrica, varicosa e sacular, e ainda, em localizada e multissegmentar. Drenagem

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postural e percussão são técnicas desobstrutivas usuais na prática clínica diária, no entanto, há escassez de estudos comparativos enfatizando-as com amostras populacionais e recursos metodológicos. Tomando por base as considerações, teve-se como objetivo verificar a eficácia da drenagem postural e da percussão na higiene brônquica de pacientes bronquiectásicos, bem como seus efeitos e associação com outras técnicas apontadas pela literatura atual. Os principais achados comprovaram que a drenagem postural e a percussão são efetivas na mobilização da secreção pulmonar, uma vez

que aumentam a velocidade do muco transportado, melhoram a função pulmonar e as trocas gasosas. A efetividade requer ajuda de um profissional, o que pode dificultar a prática clínica diária. Por esta razão, fisioterapeutas têm selecionado técnicas que propiciem independência ao paciente.

**Descritores:** Doenças respiratórias. Bronquiectasia, reabilitação. Drenagem postural. Postura. Técnicas de fisioterapia.

## INTRODUCTION

Bronchiectasis is defined as a permanent and irreversible abnormal dilation of the bronchi and bronchia with destruction of the elastic and muscle components of the walls of these structures due to recurrent infections, inflammation, excessive production of secretions, reduction in mucociliary hygiene and dilation and destruction of bronchi [1-3]. The affected airways become flaccid and tortuous with obstructions and fibrosis [2].

René Laennec in 1819 described this condition in the pre-antibiotic pre-vaccination and pre-chemotherapy era, as a common condition with high mortality rates. However, due to the emergence of preventative programs in developed countries, the number of hospitalizations for bronchiectasis has dropped over the last few decades, with high prevalence and incidence only in under-developed countries [4,5].

Bogossian et al. [6] analyzed 314 patients with bronchiectasis and concluded that it is prevalent in the fifth decade of life with a greater prominence in women (65%). Gomes Neto et al. [7] identified the involvement of individuals during their productive life with ages between 28 and 48 years old.

The physiopathology consists of colonization of microorganisms and in the interaction of several enzymes and chemical mediators that cause inflammatory reactions and destruction of the bronchial tree; there is infiltration of neutrophils in the tissue that reduce the frequency of ciliary beats, resulting in impairment of the mucociliary transport and consequent bronchial obstruction [1,4].

Bronchiectasis most frequently involves both the lower lobes; when the involvement is unilateral it affects the terminal bronchi and bronchia and is more frequently seen on the left and in the lingula and medial lobe. Clinical manifestations of the disease include chronic cough, fever and purulent voluminous expectoration with a fetid odor [1]. Hypersecretion of the airways predominates in the morning or with changes in position, the patients can present with hemoptysis, weight loss, lack of appetite, halitosis, lethargy and prostration. Hypertrophic accessory musculature, dyspnea, thoracic pain, fatigue, pulmonary auscultation with inspiratory stertor crackles and wheezes

are observed during the physical examination, [5,7].

With the evolution of the disease, there is a reduction in the expiration volume and vital capacity, the pulmonary tissue becomes retracted with pleural adhesions; the bronchiectatic segments present with purulent secretions; the mucous membrane become swollen and ulcerated and the tissue of the mucociliary lining becomes cubic [1,5].

The etiology of bronchiectasis is non-specific, represented as the final stage of several pathologic processes [2]. The majority of cases have idiopathic causes and, to a lesser degree, a congenital cause, with deficiencies in the elements of the bronchial wall and the cilia [5]. Angrill et al. [4] attributed this factor to functional immunity deficit in the production of antibodies and to dysfunction of leukocytes.

Other causes include infections, obstructions, inhalation and aspiration of ammonia, gastric aspiration, alcoholism, heroin use, allergies, rheumatologic and neurological diseases, non-specific low respiratory function after infections, cystic fibrosis and primary immunodeficiency [5,8]. Moreover, bronchiectasis is frequently seen in patients with acquired immunodeficiency virus [9]. In Brazil, the main causes are viral or bacterial respiratory infections during childhood as well as tuberculosis [7].

Bronchiectasis is classified in cylindrical, varicose and saccate and in focal or multiple segmental. The cylindrical form is characterized by homogenous dilation but maintains its form and communication with the distal parenchyma [5]. The varicose form, on the other hand, presents with greater dilation, local constrictions and an irregular format; the most severe form is represented by the saccate form, with rounded dilations and the absence of communication with the pulmonary parenchyma [1]. Gomes Neto et al. [7] attributed the term focal, when it was confined to the distal portion of a lobar or segmental bronchial source and multiple segmental when it is distributed in more than one lobe, which may be either on one or both sides.

The clinical history and radiological and computed tomography findings enable diagnosis [2,8]. Gomes Neto et al. [7] reported that studies demonstrated a good correlation between tomography with bronchography and the anatomopathology to diagnose bronchiectasis. Bronchography in isolation assesses the extent of the

disease and verifies if there is a necessity for surgery. After establishing the existence of the disease and discarding the hypothesis of surgery, conservative treatment is initiated [4] which includes bronchodilator drugs, mucolytic agents, corticoids and antibiotics, as well as hyper-dehydration and bronchoaspiration [10].

Caromano et al. [1] and Antunes et al. [2] agree that conventional respiratory physiotherapy, using clearance maneuvers, is a very commonly used resource in the treatment of bronchiectasis, as the consequence of the disease's chronic nature is retention of mucous, increases in airflow resistance and gas exchange difficulties, which makes the work of expiratory muscles excessive and facilitates re-infections, thereby highlighting the necessity of bronchial hygiene [11].

Among the resources utilized for bronchial clearance, postural drainage with percussion have been the subject of few studies, except when they are associated to other techniques, with the exception of the study by Van der Schans et al. [12] who employed the techniques with dogs. Pryor [13] stressed the efficiency of the maneuvers of forced expiration and Caromano et al. [1] proved the efficiency of postural drainage, vibrocompression and active-assisted mobilization of the thorax. Jones & Roe [14] compared manual and mechanical techniques, utilizing postural drainage, percussion, vibration, cough, forced expiratory techniques and the Flutter device. Antunes et al. [2] compared conventional respiratory physiotherapy, including postural drainage, percussion and vibrocompression with the Flutter VRP1 device. Finally, McIlwaine et al. [3] defended final expiratory positive pressure as being a better clearance technique than the Flutter device, postural drainage or percussion.

Jones & Roe [14] and Fink [15] agreed about the scarcity of studies and reported that percussion associated with postural drainage contribute to the mobilization of secretions and thus improve bronchial hygiene. Fink [15] added that in the clinical practice, percussion with postural drainage is effective in the transportation of pulmonary secretions improving the well-being of the patient. Van der Schans et al. [12] proved that the association of postural drainage with percussion, by means of studies performed in dogs, increases the velocity of mucous transportation in the trachea, improving the pulmonary function and gas exchange and this is more effective in increasing the volume of secretion expectorated than just coughing.

## OBJECTIVE

To verify the efficacy of postural drainage with percussion on the bronchial hygiene of bronchiectatic patients in recent studies as well as the effect on associations with other techniques.

## POSTURAL DRAINAGE

Postural drainage consists in using gravitational forces from the positioning of the patient so as to increase the transportation of mucous from lobes and specific sections of the lungs in the direction of the central airways, where the secretions should be removed more rapidly through coughing and aspiration [12,15]. Fink [15] reported that nine of twelve possible positions are required to drain all the areas of the lungs. The patient should remain for three to fifteen minutes in each position, giving a minimum amount of time of one hour at a frequency of three to four times per day.

Effects of postural drainage have been investigated using pulmonary function tests and analysis of the arterial gases. Van der Schans et al. [12] verified that changes in the pulmonary function and gas exchanges do not alter mucous transportation; however the transportation is altered with changes of the volume of the lungs, the gas stored, the ventilation and the perfusion. This technique has been scientifically proven to be relevant in the bronchial hygiene of patients suffering from cystic fibrosis and bronchiectasis [15].

A review of publications by Fink [15] cites Lorin & Denning (1971) who recommended postural drainage for hypersecretion of the bronchial mucous and when there are difficulties in expiration and included as contraindications the reverse 'Trendelenburg' position, hypotension and the use of vasoactive drugs. Langenderfer [11] added, following the data of the American Association for Respiratory Care (1991), that the contraindications of the 'Trendelenburg' position are: intracranial pressure higher than 20 mmHg, cerebral aneurysm uncompensated hypertension, recent hemoptysis, abdominal distension, risk of aspiration and recent eye, esophageal or neurological surgeries.

## PERCUSSION

Percussion, clapping or cupping as it is sometimes called, is defined as hitting with the hands in a concave shape on the ventral sides, lateral and dorsal of the thorax at a frequency of 3 to 6 hertz [12]. This procedure promotes the mobilization of the secretions by means of vibrations [15] and is performed with the patient in varying drainage positions [11]. Thoracic percussion also increases the intrathoracic pressure and hypoxemia, with the latter being unimportant when the technique is used for periods of less than 30 seconds and combined with three or four lung expansion exercises [13].

Van der Schans et al. [12] attributed stasis of the bronchial mucous as an indication for percussion as, due to alterations in the intrathoracic pressure and formation of globules of mucous, the secretion is easily displaced from the more distant airways and expectorated. The contraindications,

according to the American Association of Respiratory Care (1991), as reported by Fink [15] include pulmonary tuberculosis, tumoral resection from the thorax or neck, pulmonary contusion and coagulopathies. Langenderfer [11] added to these quoting Murphy et al (1983): subcutaneous emphysema, recent spinal anesthesia, bronchospasm, osteoporosis, osteomyelitis in costal arch region, thoracic pain, thoracic cutaneous graft and open thoracic wounds or infections.

#### POSTURAL DRAINAGE, PERCUSSION AND OTHER TECHNIQUES

Postural drainage and percussion predominate in the treatment of bronchial hygiene. However, today they are associated with other techniques [11,14]. Van der Schans et al. [12] included respiration exercises, percussion and postural drainage in mucous clearance treatment, reporting better results with a combination of different techniques that caused efficient mucociliary transportation.

The efficacy of percussion and postural drainage requires the assistance of a professional, which can make the daily use of therapy difficult [16]. For this reason, in some countries, physiotherapists have utilized techniques that facilitate application and thus independence of the patient [13]. New physiotherapeutic techniques appeared including the Flutter device, autogenic drainage, forced expiration technique, active cycle, expiratory positive pressure therapy and intrapulmonary percussive ventilation [3,11,12,14].

Reviews of publications and field studies emerged due to the apparent necessity of research on the cost-benefits of physiotherapeutic procedures of bronchial hygiene for bronchiectasis [17]. For Pryor [13], the forced expiration maneuvers suggest more efficacious techniques of bronchial clearance for patients with chronic obstructive pulmonary disease. Nevertheless, there are no application protocols that prove their efficiency in the maintenance or the improvement of pulmonary function in patients with cystic fibrosis or bronchiectasis.

Caromano et al. [1] verified the effects of the techniques of bronchial hygiene in ten female patients with ages between 15 and 70 years suffering from bronchiectasis. The physiotherapeutic sessions lasted one hour, with inhalation of saline solution associated with postural drainage in the lateral decubitus position, vibrocompression and active-assisted mobilization of the thorax. The results obtained demonstrated that 60% of the patients had their vital capacities increased and pulmonary auscultation improved. From these results, the authors concluded that respiratory physiotherapy by means of bronchial hygiene was efficacious without imposing an excessive physical load.

Jones & Rowe [14] evaluated 126 patients with bronchiectasis and chronic obstructive pulmonary disease

to investigate the effects of physiotherapy on bronchial hygiene and to determine whether there is a difference between the results of manual and mechanical techniques. Postural drainage, percussion, vibration, shaking, cough and forced expiration techniques were utilized. The presented beneficial effects with an increase in the expectoration and pulmonary clearance; however, statistically significant effects in the pulmonary function variables or differences between the use of manual and mechanical techniques were not observed.

Antunes et al. [2] compared the efficacy of conventional respiratory physiotherapy with the Flutter VRP1 device in patients with bronchiectasis. Ten patients were submitted to alternate sessions of the Flutter VRP1 device and postural drainage, percussion and vibration with two sessions weekly for four weeks. The mean quantity expectorated in the two programs did not give a statistically significant difference. The authors concluded that such techniques are equally efficacious in the removal of secretions from patients with bronchiectasis.

McIlwaine et al. [3] verified the effects of physiotherapy in the treatment of cystic fibrosis, a hypersecretive disease and compared final positive expiratory pressure and the Flutter device. Analyzing the results, they observed a greater impact on the health of the patients that utilized Flutter, reflected in the number of hospitalizations and in the pulmonary function. Moreover, the final positive expiratory pressure stabilized or improved the pulmonary function, a result that had already been demonstrated in another study in 1997 by the same authors, who compared the positive expiratory pressure with postural drainage and percussion with the former being more efficacious.

Physiotherapeutic interventions and clinical manifestations of the disease reflect in the psychological and social aspects of the patient, as despite of guaranteeing an improvement in the bronchial mucous transportation, the disease can have negative effects such as dependence on interventions by a professional and the necessity of making therapy every day. On the other hand, further studies are necessary to identify physiotherapeutic protocols, their duration, repetitions, frequency, number of professionals involved, description of the selected techniques and the cost-benefit ratio for the patient [12,17].

#### CONCLUSIONS

Bronchiectasis is a chronic and hypersecretive disease with retention of secretion that causes alterations to pulmonary ventilation making bronchial hygiene essential. The respiratory physiotherapeutic treatment makes conventional clearance techniques, such as postural drainage and percussion, available. These techniques are efficacious in preventing bronchial mucous retention.

Several studies indicate that postural drainage with percussion is efficacious in bronchial hygiene. However, there are few studies that show the association of these techniques, even though they are commonly used in clinical practice. There is evidence of their efficacy due to the increased velocity of mucous transportation, the gas exchange and improvement in the pulmonary function. Nevertheless, the final positive expiratory pressure technique provides a significantly greater improvement in the pulmonary function when compared to postural drainage with percussion.

Other procedures are also utilized such as the Flutter device, autogenic drainage, the positive expiratory pressure technique, forced expiration techniques and intrapulmonary percussive ventilation. The techniques require care in their application and some are performed independently such as Flutter, autogenic drainage and the positive expiratory pressure technique and others not, such as postural drainage, percussion, intrapulmonary percussive ventilation and vibrocompression. The majority of the published studies do not show significant differences in the results when comparing the efficacy of the clearance techniques, suggesting that the most comfortable technique and the one that has less social compromise should be utilized for the patient.

In the literature, only one study, published by Van der Schans et al. [12], considered the application of postural drainage with percussion. In the works by Caromano et al. [1], Pryor [13], Jones & Rowe [14], Antunes et al. [2] and McIlwaine et al. [3], associations of these techniques with others were compared. The lack of comparative studies on postural drainage with percussion, that detail the populational sample and methodological resources, make a discussion of the results and the utilization of the physiotherapeutic resources difficult. Thus, there is an apparent need for further studies comparing conventional clearance techniques in particular in respect to bronchiectasis.

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