Physiotherapy in asthma: Effects on pulmonary function and immune parameters

ABSTRACT: Asthma is a chronic inflammatory disease characterized by reversible obstruction of the respiratory airways. Nowadays, there is a great improvement in the knowledge about its physiopathogeny and treatment; even though it has a high morbidity and mortality levels in development countries. Asthmatic patients without treatment are rarely engaged in any physical activity because exercises can trigger symptoms like cough, wheeze and dyspnea. With the appropriate treatment, however, becomes possible to practice sports, including high performance sports. Since data on physiotherapy and asthma are very reduced, more studies are necessary.

Keywords: asthma, exercises, and physiotherapy.

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Asthma is acute pulmonary inflammatory disease characterized by hyperactivity of the lower airways and with variable limitations to the airway flow, spontaneously reversible or with treatment. It results from the interaction between genetic factors, environmental exposure and other unspecified factors which trigger the development and maintenance of symptoms.

In the past twenty years, this disease has increased significantly, being detected according to the methodology of ISAAC (International Study of Asthma and Allergies in Childhood) at 5 to 20% of the population, and depending on the region studied. Several factors have been speculated in order explain this increase such as pollution, modern western lifestyle and hygiene practices, to name a few. At all events, there are favorable and unfavorable evidences, indicating the multifactorial origin of it indeed.

Despite still presenting a low level mortality, in developing countries this index has increased in the past ten years, accounting for 5-10% of deaths for respiratory causes. The morbidity of this pathology is what really draws the attention of professionals of the area. In the Brazilian health public system, asthma ranks the fourth position as the main reason for hospital admission and the third position as regards costs for disease, accounting for about 400,000 hospital admissions yearly.

The high morbidity and increase in the mortality is opposed to the increase level of awareness about the physiopathogeny and the advances in relation to the disease management, both preventively and therapeutically.

Physiopathogeny of asthma

The association of asthma with allergy and atopy provided a model from which several physiopathological devices have been demonstrated. Physiopathological processes underlying these reactions have allowed understanding better the subtle cellular interactions of it.

The main physiopathological factor of this is the bronchial inflammation. Its crisis can be triggered by allergenic particles present in the home, professional, or even leisure environment. Clinically speaking, asthma is manifest by spontaneous crises of wheezing dyspnea, which occurs by the diffuse obstructions caused by edema, mucosa hypersecretion and spasm of smooth musculature.

The inhalation of antigen which the asthmatic is sensitized triggers an immediate functional pulmonary reaction. On the bronchoalveolar lavage is found an increase of the levels of histamine and triptase. Later, a slow answer is begun from 4 to 6 hours after inhalation of allergen. This can persist from 24 to 48 hours and is related to the levels of eosinophils, T lymphocytes and neutrophil.

Among the devices of immunological reaction which occur in asthma, the CD4+ T cells play an important role. These cells form a heterogeneous population of lymphocytes which consists of two subtypes: as effector T cells subgroup 1 (Th1), which consists of a property of secreting IL-2 and IFN-gamma, being important for the activation of macrophages, as well as the immune response measured by cells; and effector T cells of subgroup 2 (Th2), which are secretor of interleukins types IL-3, IL-4, IL-5, IL-10 and IL-13, having predominant role in triggering the allergic disease.

In asthmatic patients, it prevails the immunological response of Th2 type, which can be explained by the intrinsic capacity in the atopic individual of having greater expression of genes for IL-4, both for lymphocytes T and mast cells, when exposed to allergens. The physicochemical character of allergen and different standards of processing and presentation of antigens also influence in the magnitude of the immunological response. The profile of the cytokines produced by the lymphocytes Th2 includes as interleukins IL-4, IL-5, IL-9 and IL-13. Among these, IL-4 controls the synthesis of IgE; IL-13 potencizes the synthesis of IgE and in cooperation with IL-9 stimulates the growth of colonies of mast cells; and IL-5 is responsible for stimulating productions and activation of eosinophils and increase of half-life. These are the main causes of inflammation and inductions of bronchial hyperreactivity.

Classification of asthma

It is rated according to pulmonary functional parameters, symptoms and interferences which the disease brings to the individual’s daily life. Several consensus, be it national or international, are used to guide the classification and the treatment of the disease.

Among the analyzed parameters, there are the trial of pulmonary function and/or the variability of expiratory peak flow, the number...
Physiotherapy and asthma

There are few controlled, published studies relative to the effect of physiotherapy in the asthma. During the asthmatic crises, with retention of pulmonary air and high of the levels of residual expiratory volume, some complications may occur as pneumothorax, or collapsed lung, and spontaneous pneumomediastinum, which can be grown worse by the physiotherapy procedures.

For persistent asthmatic patients, the pulmonary physiotherapy is based on the respiratory functional rehabilitation by means of the adequate performance of exercises which act in the mobility of respiratory muscles, paced exercises with respiration as well as the adoption of posture which exercise the facilitating and preventive action of pulmonary ventilation. As physiotherapy procedures can be divided in the active group: sheer respiratory exercises, paced respiratory exercises with determined movement, non-paced muscular movements with respiration; and posture group, the simple and drain posture.

The rehabilitation of asthmatic patient is made as follows: adoption of correct postures, muscle relaxing (especially for the neck and scapular girdle), practice of fundamental respiratory exercise performed using correct positions, rehabilitation of low back and diaphragmatic mobility, reduction of high back and clavicular mobility and rehabilitation of the abdominal musculature.

A study which evaluated some clinical and spirometric aspects of asthmatic patients submitted to a program of respiratory rehabilitation showed some reduction in the number of crises in 60% of the patients, and reduction to zero of daily crises in 40% of the patients. The spirometric studies were performed before and after the physiotherapy treatment showed some increase of vital capacity, in 20% of the patients, increase of the forced expiratory volume in 40% of the patients. In 10% of the patients, the spirometric values did not change and 10% of them presented some reduction of the measures of pulmonary functions during the study.

Another study evaluated the effects of kinesiotherapy and hydrokinesiotherapy in asthmatic children by means of questionnaires of Life Quality and inflammatory parameters on bronchoalveolar lavage and obtained as a result some improvement in children’s quality of life, with the reduction of crises, hospital admissions and pulmonary inflammatory activity.

Despite good results, it is needed that further controlled studies are carried out in order to confirm the initial evidences.

Asthma and physical exercise

The relation between physical activity and asthma has also been the object of many investigations. Several elite professionals are asthmatic individuals who, despite the pathology, are able to carry out high performance exercises.

The appearance of symptoms (cough, wheeze and/or lack of air) generate a cycle of sedentarism, and consequently the deterioration of the physical conditioning in general which limits even more the practice of exercises. In addition to the conditioning, physical activities are essential for children because it provides basic experiences of movements, they are important for the psychomotor development. Likewise, physical activities promote the interaction among children through children’s play and games, preventing the isolation of a group in which they are inserted and improving the self-esteem. Later, in the adolescence the sports activities get more intense and competitive, which make the individual sneak through some physical activities.

These situations are an inescapable aspect, once the appropriate treatment allows the practice of physical activities. The control allows that children and adolescents take part in physical edu-

Table 1 - Classification of asthma

<table>
<thead>
<tr>
<th>Symptoms: lack of air, heart squeeze, wheeze and cough</th>
<th>Intermittent</th>
<th>Persistently light</th>
<th>Persistently moderate</th>
<th>Persistently serious</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;= 1 time/week</td>
<td>&gt; = 1 time/week and &lt;= 1 time/day</td>
<td>Daily but not continuous</td>
<td>Daily continuous</td>
<td></td>
</tr>
<tr>
<td>Generally normal</td>
<td>Limitation for great exercise. Occasional absences at work or school</td>
<td>Impaired</td>
<td>Frequent limitations at work or school. Symptoms with frequent exercise. (going upstairs)</td>
<td></td>
</tr>
<tr>
<td>Occasional(light) Controlled with bronchodilator, without going to the hospital</td>
<td>Occasional</td>
<td>Infrequent</td>
<td>Frequent-serious Needs of systemic corticoid, hospital admission or risk of life</td>
<td></td>
</tr>
<tr>
<td>Night symptoms**</td>
<td>Seldom</td>
<td>Occasional</td>
<td>Common</td>
<td>Almost daily</td>
</tr>
<tr>
<td>&lt;= 2 times/month</td>
<td>&gt;= 2 times/month and &lt;= 1 time/week</td>
<td>&gt; 1 time/week</td>
<td>2 times/week and 2 times/day</td>
<td>&gt;= 2 times/day</td>
</tr>
<tr>
<td>Bronchodilator for relief</td>
<td>&lt;= 1 time/week</td>
<td>&lt;= 2 times/week</td>
<td>&gt; 2 times/week and 2 times/day</td>
<td>=&gt; 2 times/day</td>
</tr>
<tr>
<td>PFE or VEF, in the appointments</td>
<td>pre-bd &gt; 80% foreseen</td>
<td>pre-bd &gt;= 80% or foreseen</td>
<td>pre-bd between 60% and 80% of the foreseen</td>
<td>pre-bd &lt; 60% foreseen</td>
</tr>
</tbody>
</table>

*Patients with infrequent crises, but they put their lives at risk should be rated as a carrier of serious asthma.

**Waking up at night with wheeze or cough is a serious symptom.

cation classes, trainings and games. And therefore, physical activities should be stimulated as a life quality factor for them. It is essential that professionals are able to guide and encourage their students/patients.

The first point is about individuals who have a persistent clinical picture, in which pulmonary inflammation leads to an obstructive process which limits the performance of physical activity. For these patients the control of pulmonary inflammation is essential for the improvement of expiratory volume and reduction of symptoms during the exercise.

Another point is concerned with the exercise capacity in provoking bronchospasm. Some studies indicate that physical exercises are inducer of bronchospasm in 80-90% of the asthmatic and in 40% of non-asthmatic individuals, occurring among athletes with prevalence of 10-14%. Asthma-induced exercises are characterized by the fall of 10-15% in the maximum expiratory flow between 6-8 minutes and intensity of work approximately two thirds of the maximum consumption of oxygen. These individuals need a preventive strategy, which is characterized by the use of specific drugs, as beta-adrenergic receptor agonists of long duration and leucotrien receptor antagonists, fulfillment of physical activities of 10-15 minutes warming-up (at 50% of VO2 max suitable for the age), observation about the pre-activity food, environments with smaller aggression, avoiding areas with high level of pollutions, lower dampness or extremes of temperature and, in specific cases, with smaller quantity of allergens.

Some types of exercises are deemed as of greater potential of induction of crises, mainly the long distance activities, without intervals, as running and cycling, and winter sports, which have the lungs work heavily and continuously, in some cases with cold air. This factor has a greater connection with the development of bronchospasm. Swimming is deemed as the best physical activity, once the damp environment, and generally hot and work of the respiratory musculature are beneficial and reduce the risks of crises. The sports practices which are related to periods of activities with internals of response, as group sports, are potentially less risky for the development of crises. Despite the difference among sports, asthma is no hindrance, once a suitable treatment is efficient for the control of these.

**CONCLUSION**

Asthma is a disease which has increased in the past decades. Despite the advances on studies of its physiopathology and drugs for the treatment, it continues to present a high morbidity and in developing countries which present scores of mortality on the rise.

Pulmonary inflammation is the main aspect found in the pathology of the disease, characterized by a pulmonary infiltrate with eosinophilic predominance and predominance of cytokines of the profile of lymphocyte response type Th2. The classification of the disease is established by several consensus which guide the treatment. The drug of greater efficiency as the inhaled corticosteroid can be used for all age groups safely and can be used in association with other drugs such as beta-adrenergic receptors of long duration, leucotrien receptor antagonists, phosphodiesterase inhibitors and cromones. The role of physiotherapy in asthma, although it seems favorable, needs some application of knowledge for its better characterization.

The practice of exercises can be performed by any asthmatic patient, since there is a control over the disease. It is important that a medical follow-up is carried out. For high performance athlete, the drugs used in the treatment, as bronchodilator and inhaled corticosteroid, are not deemed as doping, since they present a conformation with a notice in writing. In this document reads “Notice of medical prescription for individual treatment,” provided by the National Anti-doping Council.

Physical activity is not a treatment for asthma; it should be encouraged both for children and adults, once it develops the physical conditioning and pulmonary capacities, as well as the respiratory musculature, besides promoting the community relations and self-esteem for a better life quality.

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