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Bronchial Asthma in a Hot Climate: Interaction of Clinical Status, Lung Function and Environmental Factors

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Annotation: Bronchial asthma is a chronic inflammatory disease of the airways characterized by bronchial hyperreactivity and reversible airway obstruction. Climate conditions, particularly hot climates, can exacerbate the clinical course of asthma, affecting both symptoms and lung function. High temperatures, dry air, and increased exposure to environmental allergens (such as dust and pollen) pose significant challenges for asthma patients.

Keywords: Bronchial asthma, hot climate, clinical-functional parameters, respiratory function, exacerbations, allergens, dust storms, spirometry, asthma management.

Hot climates, often associated with dust storms and high levels of air pollutants, increase the frequency of asthma exacerbations, worsen respiratory symptoms, and lead to a greater need for medical interventions. Therefore, understanding the impact of these conditions on the clinical-functional parameters of asthma is critical for improving treatment and management strategies.

Objective

The objective of this study is to assess the impact of hot climate conditions on the clinical and functional parameters of patients with bronchial asthma.

Tasks

1. To evaluate the frequency and severity of asthma exacerbations in hot climate conditions.
2. To analyze the changes in key lung function indicators, including FEV1 (forced expiratory volume in one second), PEF (peak expiratory flow), and VC (vital capacity), during hot seasons.

3. To assess the impact of environmental allergens and air pollutants (dust, pollen) on asthma symptoms and lung function.
4. To provide recommendations for asthma management in hot climates based on the findings.

Methods

Study Population

This study included 100 patients with confirmed mild to moderate bronchial asthma, living in regions characterized by a hot climate with average temperatures above 30°C during the summer months. The sample consisted of 60 females and 40 males, aged 20 to 55 years, with a history of asthma for at least two years.

Data Collection

1. **Clinical Assessment:** Patients were monitored for six months, covering both the hot and cooler periods. The severity of symptoms, including dyspnea, wheezing, coughing, and frequency of exacerbations, was recorded through patient diaries and clinical evaluations.
2. **Lung Function Testing:** Spirometry measured key respiratory indicators, including FEV1, PEF, and VC. Testing was performed bi-weekly during both hot and cooler periods to compare lung function under different climatic conditions.
3. **Environmental Monitoring:** Levels of air pollutants, including dust, pollen, and particulate matter (PM10 and PM2.5), were measured in the living areas of participants using local environmental monitoring stations. These data were correlated with clinical and functional asthma outcomes.
4. **Statistical Analysis:** The results were statistically analyzed using paired t-tests to compare changes in lung function between hot and cooler periods. Spearman correlation tests examined the relationship between air quality data and asthma exacerbations.

Results and Analysis

Exacerbations in Hot Climate Conditions

The study found that 85% of patients experienced a significant increase in asthma symptoms during the hot season. The most commonly reported symptoms included:

- Increased shortness of breath (70% of patients),
- More frequent coughing (65%),
- Nighttime awakenings due to breathing difficulties (50%).

The average number of exacerbations per patient rose by 40% during the hot months, with an average of 2.5 exacerbations per month compared to 1.8 in the cooler period. Patients reported more frequent use of rescue inhalers (short-acting beta-agonists) and a need for higher doses of maintenance medications, particularly inhaled corticosteroids.

Changes in Lung Function

Spirometry results showed a clear decline in lung function during the hot months:

- **FEV1**: The mean FEV1 values dropped by 10-15% in the summer months compared to cooler periods ($p < 0.05$). This indicates a worsening of airway obstruction in hot weather conditions.
- **PEF**: PEF values also decreased by 12% on average during hot months ($p < 0.05$), indicating reduced airflow through the bronchial tubes, especially during the peak hours of the day when temperatures were highest.

- **VC**: Vital capacity showed a slight decline (5%) during the hot months, though the difference was not statistically significant ($p > 0.05$).

Impact of Environmental Allergens and Pollutants

Environmental monitoring revealed a sharp increase in particulate matter (PM10 and PM2.5) and airborne allergens, particularly during dust storms, which coincided with the worsening of asthma symptoms. The correlation analysis showed a significant positive relationship between increased levels of dust and pollen and the number of asthma exacerbations ($r = 0.63$, $p < 0.01$).

The combination of high temperatures, low humidity, and increased particulate matter led to more frequent bronchospasms and exacerbations. Patients residing in areas with frequent dust storms reported more severe symptoms compared to those in less affected regions.

Asthma Management in Hot Climates

Patients showed some degree of adaptation to the climate through increased reliance on air conditioning and avoidance of outdoor activities during the hottest times of the day. However, despite these measures, the need for medication increased during the hot months, particularly in response to the higher burden of environmental triggers.

Conclusion

This study demonstrates that hot climate conditions significantly worsen both the clinical and functional status of patients with bronchial asthma. High temperatures, increased levels of environmental allergens and pollutants, and frequent dust storms exacerbate respiratory symptoms and lead to a decline in lung function.

The findings suggest that asthma management plans need to be adapted for patients living in hot climates. Recommendations include:

- **Adjusting medication regimens** during hot months, increasing the use of inhaled corticosteroids and bronchodilators.
- **Using air purifiers and air conditioning** to reduce indoor exposure to allergens and pollutants.
- **Limiting outdoor activities** during high-temperature periods and dust storms.
- **Implementing stricter environmental controls**, such as minimizing the presence of allergens and particulate matter, to reduce the burden on asthma patients.

Further research is needed to develop more targeted strategies for managing asthma in extreme climate conditions, including the long-term impact of repeated exposure to environmental pollutants in hot climates.

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