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PREDICTORS OF BRONCHODILATATION RESPONSE IN ASTHMATIC PATIENTS

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ABSTRACT: Bronchodilatation response is frequently used in the assessment and the diagnosis of bronchial asthma. Many clinics and peripheral hospitals have no facility for spirometry and post bronchodilatation response (PBR) assessment. To evaluate the predictors of PBR in asthmatic patients we retrospectively reviewed 100 cases of asthmatic patients followed by our out-patient department. All patients had pulmonary function tests (PFT) on initial presentation, 45% M, 55% F, Mean age ±SD was 38.5±18 (range: 9-86 years), 92% of the cases were using medication: 89% inhaled beta agonists, 65% inhaled steroids, 7% Ipratropium, 32% oral theophylline, 4% sodium Cromoglycate, and 8% oral prednisone. 82% had shortness of breath, 62% wheezing, 71% cough, 51% nocturnal symptoms, 22% had associated allergic symptoms, and 33% had positive family history for asthma. 48% of the cases had significant PBR (ATS standards). Analysis of the above variables, revealed that there is a significant association between the bronchodilatation response and the use of medication (Odd Ratio {OR}=7.2, $p < 0.05$), nocturnal symptoms (OR=8.4, $p < 0.001$) and family history (OR=2.9, $p < 0.05$).

Conclusion: in asthmatic patients, current use of medications, presence of nocturnal symptoms, and positive family history of asthma , may predict the possibilities of the presence of a significant response post bronchodilatation. **Vixra JGSP 2013 (4): 69-75.**

Key words: Asthma, COPD, Spirometry, Bronchodilatation response, Nocturnal asthma, prevalence, wheeze, childhood asthma, history, Saudi initiative, Riyadh, Saudi Arabia

Abbreviations used: pulmonary function tests (PFT), post bronchodilatation response (PBR), American Thoracic Society (ATS), Occupational Safety and Health Administration. (OSHA), forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), Peak Expiratory Flow Rate (PEFR), mid expiratory flow rate (MEF), total lung capacity (TLC), residual volume (RV), functional residual capacity (FRC), diffusing capacity of lung for carbon monoxide (DLCO), inhaled corticosteroids (ICS), chronic obstructive pulmonary disease(COPD), odd ratio (OR).

INTRODUCTION

Asthma remains one of the most prevalent lung problems faced by health care systems around the world, including Saudi Arabia[1]. The prevalence of asthma is even higher among children, making it a potential global future health problem. This increased prevalence is also translating into higher mortality rates. Contributing factors to higher morbidity and mortality rates include "delay in the diagnosis of the condition, increased use of bronchodilators, underestimation of chronic inflammation of airways leading to underuse of anti-inflammatory medications and poor patient education" respectively[1].

Stated causes of high asthma prevalence in the recent decades include "increasing air pollution, fast modernization, widespread construction works poor access to medical services, high prices of effective drugs and poor health education among those suffering from asthma" [2] .

A study carried out by Al Frayh et al in 2001 revealed an increase in the number of children suffering from asthma. This study showed a remarkable increase in asthma prevalence among children, from 8% in 1986 to 23% in 1995[4]. Alongside, the study also showed an increase in the prevalence of allergic rhinitis, which is associated with frequency of asthma[4].

Another study shows that childhood asthma is on the rise in Saudi Arabia, with 11.5% of children showing wheeze, while 10 to 15% of the school going children showing true asthma [1]. This situation is expected to increase, with higher mortality rates among elderly and children affected by asthma[1] .

Another study in Saudi Arabia has shown that children living at sea level are more likely to suffer from asthma than those children who live at higher altitudes. Al-Ghamdi et al in 2008 compared two primary health care centres, one at a higher and one at a lower altitude [5] . The study showed that other economic and social factors may also be contributory towards asthma, such as illiteracy, low income, use of coal and such materials for heating or cooking in the house, having mud houses, lack of electricity and the presence of animals such as sheep [5,3].

In Saudi Arabia, the need to integrate the most economical, yet effective treatment plans for asthmatics is needed due to an increase in the number of patients suffering from asthma [6]. One primary objective is to create health care systems that are well

organized to provide quality asthma care. Researches show that current asthma health care systems are not well equipped to handle the increasing burden of patients [6, 7]. Researches back up this statement reporting that of the total asthma cases "5% were controlled, 31% were partially controlled, and 64% were uncontrolled" [7] . Studies show a variety of missing elements essential in an asthma care clinic, ranging from asthma registers, to peak flow meters, to doctors and medical staff well trained in the management of acute and chronic asthma cases respectively [5].

Currently there are many medications being prescribed in Saudi Arabia. For adults, the most common drugs being used include beclomethasone, budesonide, fluticasone propionate and ciclesonide respectively. for children, the most common medications currently under use are beclomethasone, budesonide and fluticasone respectively [7]. The main concern is to introduce non pharmacological methods in the treatment of asthma as well. For example, physicians dealing with asthma patients need to create a partnership with them in order to achieve the desired results. alongside, they must educate the patients to identify what factors lead to exacerbation of their asthma symptoms and finding ways to eliminate or control them. Such factors can include outdoor and indoor allergens, food, drugs, and influenza exposure respectively [7].

Many initiatives have been undertaken termed as the "Saudi Protocol" for asthma management. Some of the salient features of these protocols include preference of anti-inflammatory therapy, inhalation therapy over oral therapy, use of sodium cromoglycate for children than steroids, reserving the latter for adults only, and decreasing the use of ketotifen which has shown no beneficial effects on asthma management and control [1]. The same study undertook practical teaching initiatives to teach physicians how to utilize the most current asthma management practices and the correct methods to use them. The results showed improvements in the physicians' approach towards treating asthma and utilizing newer methods to treat and manage them [1].

In such situations where there is a lack of advanced technologies in asthma care and diagnostics, as well as the resources available, the use of PFT can be of immense value. PFT can be a very helpful diagnostic tool and shows accuracy of "variability over 15% between the morning and evening peak expiratory flow rate" respectively [6].

Spirometry is an essential tool in the diagnosis of asthma and other respiratory conditions. it is able to accurately indicate the severity of obstruction. The peak expiratory flow or PEF measurements help in identifying and diagnosing the severity and presence of asthma [7].

Spirometry is fast becoming a preferred method for diagnosis and treatment of asthma cases and in clinically differentiating between asthma and other respiratory conditions such as COPD [8]. It already is a prevalent method of diagnosis in OSHA or Occupational Safety and Health Administration.

There are many benefits to the use of spirometry. These include the simplicity and accuracy of use, its affordability, sensitivity and specificity, along with early diagnosis in asymptomatic patients [7].

In addition to this, there are now numerous researches that are showing that use of bronchodilatation response can be helpful for the assessment, the diagnosis and treatment of bronchial asthma. Research by Oy (2007) was aimed at patients with obstructive ventilator impairment as per diagnosed with spirometry tests. These patients were then given bronchodilators and

reassessed on spirometry [9]. Standards maintain that in order for the spirometry and bronchodilator responses to be truly effective, there must be at least a 12% improvement in the FVC or FEV1 values [9]. Prolonged use can help identifythe benefits of using spirometry, and help in improving the treatment of asthma cases respectively [9].

Even with extensive information, in most of the primary healthcare setups and clinics, spirometry is not available. Another challenge is that the health care workers lack the training and experience to utilize spirometry as an important tool to adjust the treatment of asthma. by identifying the predictors of bronchodilatation responses from the history of the patients, asthma can be managed effectively, even with or without the presence of spirometry.

Many researches are pointing towards the underutilization of inhaled corticosteroids or ICS. A study in UAE documented less than 6% of the asthma patients using it [10]. Patients were either ignorant of the use of these drugs or considered them to be more harmful than beneficial. This trend may be a very strong contributor to the rise in the severity of asthma among patients, and may be preventing proper treatment and full quality of life for many asthma patients in the region[10].

Bronchodilator therapy is currently being employed with success for specific cases of cough that usually do not fall in to classic asthma variety. However, since cough is one of the presenting signs of asthma, many physicians have considered such cases as the cough variant asthma and given such patients bronchodilators with success [11].Bronchodilators have shown positive responses in asthma control both in the short as well as long term. There can be at least 15% reversibility of forced expiratory volume in one second or FEV1, simply by inhaling 200µg of salbutamol [11]. Such patients also exhibit "a higher wheezing threshold to inhaled methacholine" [11]. Again, studies show that by constant use of bronchodilators, patient with cough variant asthma are likely to have a slower rate of onset of typical asthma, thereby showing its preventive applications to susceptible individuals [11].

METHODS

Ethical considerations were taken into consideration before commencing on the study. the ethical considerations were in accordance to those laid down by Helinski Declaration of 1975, as well as the ethical rules laid down by Research ethical committee at King Fahad National Guard Hospital. The confidentiality of the patients was maintained, and all material that could be identify a patient were kept secret. The study was a retrospective study carried out at the King Fahad National Guard Hospital (Riyadh) Saudi Arabia from Sept 1995 to July 1997. Patients were selected randomly on the basis of presentation in the outpatient clinic of asthma and positive history and diagnosis of asthma. The ages of the patients ranged from nine years to 86 years, with a mean age of 38.5 years in the outpatient department. All patients were advised pulmonary function tests or PFTs on initial presentation. The inclusion criteria for the patients were positive history and diagnosis of asthma, and patients who were administered one or the other form of treatment specified at asthma. The patients were a sample of the Saudi population which presented itself at the outpatient department clinics of pulmonary medicine.

The patients were previously or newly diagnosed with asthma. This diagnosis was carried out on the basis of history, general

physical examination, medical records, and pulmonary function tests. Exclusion criteria for the patients were those who did present to the outpatient pulmonary but did not suffer from asthma. Data was collected about the medications prescribed by doctors earlier, their current medications, or the medications that were advised by the doctors in the clinic itself.

The names of the medicines that were being used by these patients with asthma included inhaled beta agonists (89%), inhaled steroids (65%), Ipratropium (7%), oral theophylline (32%), sodium chromoglycate (4%), and oral prednisolon (8%) respectively.

Patients presented with the symptoms of shortness of breath (82%), wheezing (2%), cough (71%), nocturnal symptoms (51%), associated allergic symptoms (22%), and positive family history of asthma (33%).
PFTs were carried out for each patient, and these results were then compared and relationship established with medication as well as symptoms.

RESULTS

PFT revealed the following (mean percent predicted ±SD): FEV_1: 82.1±19%, FVC:87.8±16% , PEFR:84.4±22%, MEF:62.3±30%, TLC:92.8± 16%, RV:114.4±45%, FRC:95.5±28%, DLCO:100.7±19%. 48% of the cases had significant PBR (ATS standards). Analysis of the above variable s, revealed a significant association between the PBR and the use of medication (Odd Ratio {OR}=7.2, $p < 0.05$), nocturnal symptoms (OR=8.4, $p < 0.001$) and family history (OR=2.9, $p < 0.05$).

The results strongly suggest that in asthmatic patients, current use of medications, nocturnal symptoms, and family history of asthma, may predict the presence of a significant response post bronchodilatation.

DISCUSSION

Recent increase in the number of asthma patients in Saudi Arabia is attributed to a combination of factors. The most recently proposed among these include the increased use of tobacco and indoor animals respectively. Almost all hospital areas in Saudi Arabia are experiencing an increase in the number of asthma patients [7].

In the past the use of spirometry was mainly for screening purposes. However, the application of spirometry in locations that are not clinics or hospitals have led to erroneous beliefs that COPD and other respiratory conditions are prevalent [12]. This is the potential fault of spirometry systems and therefore, providing the right medical facilities where testing is done by trained and proper staff is imperative. In order for spirometry to be a success, the staff must be well trained and the equipment must meet the desired international and local medical standards [8]. The spirometry apparatus must be simple to use and show reliability in accuracy of readings. Alongside, it should also provide standard temperature and pressure correction based on exhaled temperature [8]. Such systems of diagnosis prevent both false positive diagnosis, as well as prevent faulty diagnosis of mild restriction as early COPD [12]. On the other hand, there is much evidence to show that spirometry is being underused in clinical situations. Spirometry is a very cheap and effective diagnostic tool; therefore, its use in a proper fashion will be very beneficial. Current international guidelines now emphasize the use of spirometry in asthma clinics, making it an essential part of the clinical setup [12]. Spirometry can help

distinguish between true cases of asthma and COPD. Asthma patients will demonstrate a low FEV1 value, indicative of asthma exacerbation [12].

However, spirometry still remains unavailable in many primary health care centers in Saudi Arabia, making it important to find other ways to improve asthma. The recent treatment emphasis, of focusing on the response of the patient to asthma therapy rather than the severity of asthma as a treatment guide is a definitive positive shift in asthma management [13]. This allows for the physicians to take steps in treatment with more assurance, and prescribe doses of medicines accordingly [13].

CONCLUSION

The presence of significant post bronchodilatation response indicates the need to maximize inhaled corticosteroid dosage. Hence this study gives the health care personnels the predictors of such bronchodilatation response from history to help adjusting the medication doses without using spirometry.

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