CLINICAL & BASIC RESEARCH

Management and Control of Asthma in Patients Attending a Specialist Centre in Oman

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علاج الربو والسيطرة عليه بمركز تخصصي في عمان

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الملخص: الهدف: تكون الطريقة التي يستخدمها الاختصاصيون لعلاج الربو أكثر استنادا على الأدلة عادة. في هذه الدراسة قمنا بتحليل خواص المرضى المراجعين لعيادتنا التخصصية من النواحي الديمغرافية ونوع الأدوية المستعملة ومدى السيطرة على المرض. الطريقة: أجريت هذه الدراسة مابين ديسمبر 2005 ونوفمبر 2006 وشملت كل المرضى البالغين المصابين بالربو في مستشفى جامعة السلطان قابوس وذلك باستخدام بروتوكول مكتوب للتقييم. النتائج: شملت الدراسة 207 مرضى متوسط أعمارهم (40.64 ±14.8) سنة. وكان معظمهم من النساء (72%). كما كان غالبية المرضى (83.1%) يعاني من الربو متوسط الشدة. بلغت نسبة حدوث حساسية الأنف والجلد بين المرضى (58.0%) و (11.1%) على التوالي، فيما بلغت نسبة الإصابة بالحساسية عند العائلة (50.7%). كان مستوى الغلوبيولين المناعي الكلي نوع (E) في المصل مرتفعا (66.7%). بينما كان فحص حساسية الجلد ايجابيا لأكثر من مستضدين عند (52.3%) من المرضى . وكان مستضد غبار البيت فعالا في (49%) . بلغت نسبة العلاج بالستيرويدات المستنشقة (94.2%) وموسعات الشعب الهوائية طويلة المفعول (ناهضات بيتا) (85%) ومضادات الهستامين (54.5%) ومضادات مستقبلات ليوكوترين (11.6%). الغالبية (40.1%) استعملت الستيرويدات المنشقة بجرع متوسطة . وعلى الرغم من السيطرة على الربو في الشهر السابق بنسبة (78.3%)؛ فإن (31.9%) من المرضى راجعوا قسم الطوارئ و (15%) تم إدخالهم المستشفيات على الأقل مرة واحدة في العام السابق. ظهران (30.4%) من المرضى فقط يستعملون البخاخ بطريقة صحيحة بينما اتبع (25.6%) فقط النصائح الطبية بدقة باستخدام المنشقات الستيرويدية. الخلاصة: كانت المراضة المرافقة المتميزة بالطابع الارجي واسعة الانتشار كما هو الحال في وجود تأريخ عائلي موجب للربو . على بالرغم من أن نسبة السيطرة على الربو في الشهر السابق كانت عالية . إلا أنها أقل بكثير على المدى الطويل . وهذا يستدعي إعادة النظر في أساليب قياس معدل السيطرة على الربو على المدى القصير والطويل.

مفتاح الكلمات: ربو، عمان، رعاية متخصصة، السيطرة على الربو.

ABSTRACT: *Objectives:* The management of asthma by specialists is likely to become more evidence-based. This study analysed the characteristics of patients reporting to a specialist clinic including demographics, dispensed medications and the level of asthma control. *Methods:* All consecutive stable asthmatics seen in the adult pulmonary clinics of Sultan Qaboos University Hospital, Oman, between December 2005 and November 2006 were prospectively evaluated using a structured assessment protocol. *Results:* Of the 207 patients, (mean age 40.64 ±14.8), 72% were females. The majority, 83.1%, had moderate persistent asthma. A positive history of allergic rhinitis, eczema and a family history of asthma were obtained in 58.0%, 11.1%, and 50.7% of patients respectively. Total serum immunoglobulin E (IgE) was elevated in 66.7%. Skin testing was positive for more than 2 antigens in 52.3%, with the house dust antigen being reactive in 49%. Inhaled steroids, long-acting beta agonists (LABA), antihistamines and leukotriene receptor antagonists were prescribed in 94.2%, 85%, 54.5% and 11.6% of cases respectively. The majority (40.1%) was receiving medium dose inhaled steroids. Although asthma was controlled in 162 (78.3%), during the previous month 66 (31.9%) patients had visited the emergency department and 31 (15.0%) patients were hospitalised at least once during the previous year. Only 63 (30.4%) patients were using their inhalers correctly. Good compliance with inhaled steroids was observed in only 53 (25.6%) patients. *Conclusion:* Allergic comorbidities and a strong family history of asthma were common. Although the level of asthma control in the previous month was high, it was much lower in the long term. The concepts of short term, long term and total control of asthma need to be explored.

Keywords: Asthma; Oman; Specialist care; Asthma control.

ADVANCES IN KNOWLEDGE

1. First report from Oman describing the characteristics of patients with asthma and the management practices in a specialist centre.

2. Allergic comorbidities and a strong family history are common in patients with asthma in Oman.

3. Concepts of short term and long term control in asthma introduced.

APPLICATION TO PATIENT CARE

1. Goals of asthma treatment can be achieved if the international guidelines are followed properly.

2. More time needs to be spent on asthma education especially in the training of inhaler techniques and explanation of the need for regular use of controller medications.

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Current asthma management is focused on asthma control.[1] The management of asthma in a tertiary care centre by specialists is expected to be more scientific, following international or local guidelines more strictly. However, Gaga *et al.* [2] reported that the goals of asthma treatment were not achieved, even under specialist care, as some patients were found not to follow prescriptions despite the distressing nature of their symptoms.

In Oman, no published data are available on the magnitude of asthma in adults, but the prevalence of allergic conditions in children, including asthma, was found to be higher than in neighbouring countries and that too with significant morbidity.[3] A study among private practitioners in Oman, undertaken a decade ago, showed that the treatment of both acute and stable asthma was sub-optimal.[4] Interestingly, a more recent survey among asthma specialists in the Chicago area revealed that the care is consistent with national guidelines with certain differences and that the asthma care differed between the two subspecialty groups of allergists and pulmonologists.[5] In this context of a higher prevalence of asthma and the reports of differences in the care rendered, it is important to study patients under the care of specialists in our area in order to plan optimal asthma control. The aim of this study was to document the characteristics of adult patients reporting to the specialists at Sultan Qaboos University Hospital (SQUH) including demographics, dispensed anti-asthma medications and the level of asthma control.

Methods

All consecutive patients referred to or followed up in the adult pulmonary clinics of SQUH between December 2005 and November 2006 with a diagnosis of asthma, were considered for enrolment in the study and were prospectively evaluated using a structured assessment protocol. SQUH is a teaching tertiary care hospital which receives referrals from all over Oman. The diagnosis of asthma was made by the physician on the basis of typical history of wheezing, breathlessness, recurrent exacerbations, a previous response to asthma medications, spirometry results and peak expiratory flow rate (PEFR) variability. A positive family history, elevated total serum immunoglobulin E (IgE) and

positive skin tests were also factors confirming the diagnosis.

At the time of the evaluation, the patients were in their usual state of health, stable and with no evidence of asthma exacerbations. During assessment in the clinic, the following information was obtained: duration of asthma, smoking and family history, the degree of asthma control based on asthma symptoms, frequency of exacerbations, hospital admissions, emergency visits, and use of asthma medications. Patients' compliance with the medications and inhaler technique were also assessed and documented. Current and ex-smokers were excluded from the study. Patients with a history or evidence of co-existing chronic lung disease, heart disease or any other illness were not included. Asthma severity was assessed by a composite score based on Global Initiative for Asthma (GINA) guidelines.[6]

Plain chest radiographs were performed for all patients, and only those with normal or minor changes consistent with asthma like hyperinflation and increased lung markings were included. The forced vital capacity (FVC), the forced expiratory volume in the first second (FEV1) and the response to bronchodilator administration were measured using a spirometer according to the European Respiratory Society guidelines.[7] Skin prick tests were performed using the Bencard system with a panel of 25 allergens. Positive skin reactions were assessed as wheal and flare reactions greater than 3mm. Serum IgE was measured using a microparticle enzyme immunoassay (Abbot Laboratories, IL 60064, USA).

Atopy was defined as having an elevated serum level of total IgE or having positive skin tests for more than two allergens. The body mass index (BMI) was calculated for each patient from their recorded height and weight. It was then classified as normal, overweight and obese as per the published criteria.[8] A diagnosis of gastro-oesophageal reflux disease (GERD) was entertained by the presence of oesophageal symptoms such as heartburn and regurgitation and was confirmed after a gastroenterologist reviewed the patient.

Compliance for the study was categorised as good, partial or poor. Good compliance was defined as self-reported meticulous adherence to the dose and frequency of the prescribed steroid inhalers. Partial compliance was recorded when they reported

Table 1: Baseline characteristics of patients with asthma

		n	%
Asthma severity	Mild intermittant	12	5.8
	Mild persistant	23	11.1
	Moderate persistant	172	83.1
Comorbidities	Allergic rhinitis	120	58.0
	Eczema	23	11.1
	GERD	28	13.5
Investigations	Abnormal chest radiograph n=207	46	22.2
	SPT with > 2 allergens n=148	78	52.3
	High IgE	138	66.7
Medications	Inhaled steroids	195	94.2
	LABA	176	85.0
	Theophylline	42	20.3
	Montelukast	24	11.6
	Antihistamines	112	54.5
	Nasal steroids	79	38.2
BMI Class	Normal	63	30.4
	Over weight	64	30.9
	Obese	79	38.2

GERD = Gastro-oesophageal reflux disease; SPT = Skin prick test; IgE = Immunoglobulin E; LABA = Long-acting beta agonists; BMI = Body mass index

regular usage as per their prescription, but with occasional irregularity (mainly forgetting doses). All other patients who were not using the prescribed inhaled steroid, using them as and when needed or using them with frequent or regular omissions (e.g. using one puff instead of the prescribed 2 puffs daily or once instead of twice daily) were labelled as having poor compliance. The inhaler technique was assessed by a qualified respiratory therapist by a uniform protocol as outlined by Hilton *et al*.[9] Each step of adequate preparation, adequate expiration, adequate inspiration and holding the breath was given one point. The above steps were clearly defined for different devices separately. Though they used three categories, we defined only two groups: adequate and inadequate. Only beclomethasone and salbutamol were available as metered dose inhalers (MDI). Dry powder inhalers (DPI) were available as single dose dispensers for formoterol and multidose dispensers like turbohalers for budesonide and disk halers for fluticasone. For comparison, the doses of all inhaled steroids were converted to beclomethasone equivalent as given in the GINA guidelines.[6]

The data were tabulated and analysed using the Statistical Package for the Social Sciences software (SPSS, PC Version 11.0). The various variables were cross-tabulated and the Chi Square test or Fischer's exact test were used to see if any association existed or proportions were significantly different. The non-parametric Mann-Whitney test was used in analysing the age difference between male and female patients.

Results

There were 207 patients with a diagnosis of asthma without any other illness or a smoking history during the study period. One hundred and forty-nine (72.0%) were females and 58 (28.0%) were males. The mean age of the study population was 40.64 ±14.8 years. The baseline characteristics of the patients are given in Table 1. A positive family history of asthma was obtained in 105 (50.7%). The mean FEV1 was 2.0 ±0.72 liters and the FEV1 percentage was 71.92 ±19.2. Minor changes like hyperinflation, increased lung markings and some linear shadows were found in 46 (22.2%) patients.

Total serum IgE was elevated in 138 patients (66.7%) and skin prick tests were positive for more than two antigens in 78 of the 148 patient who did this test (52.3%), indicating an atopic status. Skin prick tests were positive for the house dust antigen in 76 (49%), grass antigen in 36 (23.2%), shrimp antigen in 41 (26.4%), cat fur antigen in 23 (14.8%) and feather antigens in 22 (14.2%).

The details of asthma medications are given in Table 1. One hundred and ninety-five patients

Table 2: Details of prescribed inhalers and the compliance achieved

		n	%
Generic	Beclomethasone	40	20.5
	Budesonide	67	34.4
	Fluticasone	88	45.1
Devices	Metered dose inhaler	40	20.5
	Dry powder devices	155	74.9
Dose	Low dose	47	22.7
	Medium dose	83	40.1
	High dose	65	31.4
Compliance	Good	53	25.6
	Partial	82	39.6
	Poor	72	34.8
Inhaler Technique	Adequate	63	30.4

(94.2%) were prescribed inhaled corticosteroids (ICS); 176 (85%) were receiving long acting beta agonists (LABA), and 112 (54.5%) were receiving oral antihistamines. Some of the patients were receiving ICS and LABA through the same device. In most of the patients, asthma was controlled as 162 (78.3%) were using salbutamol inhaler less than twice per week and only 26 (12.6%) were using it daily. The details of the steroid inhalers, the type of medication, the type of devices used and the dose converted to beclomethasone equivalent are given in Table 2. Most patients were on dry powder inhalers (DPI), and the majority was receiving medium dose inhaled steroids. Only one patient was using ipratropium bromide inhaler. Twenty eight (13.5%) were taking treatment for GERD.

Sixty-six (31.9%) patients reported an exacerbation requiring a visit to the emergency department at least once during the previous year. Thirty-four (51.5%) had visited the emergency department three times or less, while 32 (48.5%) reported more than 3 visits. Thirty-one (15.0%) patients were hospitalised at least once in the past year.

The mean age of the females (41.32 ±13.6 years) was slightly higher when compared to the males, 38.91 ±17.7 (p = 0.164). Patients with mild asthma were younger. The mean age of patients with mild intermittent, mild persistent and moderate persistent asthma were 31.92 ±11.5, 35.4 ±12.5 and 41.96 ±15.02 years respectively.

Only 63 (30.4%) patients were using their inhalers correctly: 22 (37.9%) males and 41 (27.5%) females (p = 0.178) [Table 3]. In addition, only 53 (25.6%) were fully compliant with regular inhaler medications,

whereas 82 (39.6%) were partially compliant and 72 (34.8%) showed poor compliance with no significant difference between the different types of inhalers (p = 0.906) [Table 2]. The compliance was good in 9 (22.5%), partial in 17 (42.5%) and poor in 14 (35.5%) patients using MDI compared to good in 38 (24.5%), partial in 60 (38.7%) and poor in 57 (36.8%) of the patients using DPI.

The distribution of patients with high IgE was similar in patients with normal BMI, in overweight or in obese persons (p = 0.716). In the same way, the distribution of patients with different levels of asthma severity was also similar in the above groups

Discussion

This report presents the characteristics of asthma patients receiving specialist care in our centre. The majority was female and had moderate persistent asthma. Allergic comorbidities were common in our patients. The level of asthma control was relatively high, in spite of suboptimal compliance and inadequate inhaler technique.

Only a few patients had mild intermittent asthma, the majority had moderate persistent asthma. This was expected as the study was performed in a tertiary centre and the patients' access to the services was only through referral. Likewise mild intermittent asthma was seen in only 7.5% of patients reporting to large outpatient clinics of four teaching hospitals in Greece.[2]

A positive family history of asthma was obtained in virtually half of the patients. Asthma definitely has a heritable component the exact nature of which is

Table 3: Gender differences in asthma severity, body mass index (BMI) class, steroid inhaler technique and the compliance

Characteristics	Males n=58	Females n=149	*p* value
Asthma severity			
Mild intermittant	6 (10.3)	6 (4.0)	0.142
Mild persistant	8 (13.8)	15 (10.1)	
Moderate persistant	44 (75.9)	128 (85.9)	
BMI Class			
Normal	28 (48.3)	35 (23.6)	0.001
Over weight	17 (29.3)	47 (31.8)	
Obese	13 (22.4)	66 (44.6)	
Compliance			
Good	17 (29.3)	36 (24.2)	
Partial	22 (37.9)	60 (40.3)	0.746
Poor	19 (32.8)	53 (35.6)	
Inhaler Technique			
Adequate	22 (37.9)	41 (27.5)	0.178

not clearly defined. Bjerg *et al*.[10] found that asthma in both parents conferred a multiplicative risk, whereas the effect of parental atopy was additive indicating that asthma and atopy, despite their causal relationship, may be separate entities and could be inherited differently. In a study from Qatar, where consanguinity is as prevalent as in Oman, it was found that 21.6% of asthmatic children had mothers with asthma and 18.2% had fathers with asthma.[11] Allergic rhinitis, but not eczema, was seen in a significant number of our patients. More than half had an atopic status with either a high total IgE or positive skin prick tests. Similar results were reported by Cengizlier *et al*.[12] where 57.6% of their patients had a history of atopy. Farhoudi *et al*.[13] noted that the most common risk factors were an elevated total IgE and a positive family history of atopy. We also noted a strong family history of allergy. The total IgE was elevated in more than 60% of our patients as well. Like elsewhere, house dust was the main allergen in majority of our cases.

Minor non-specific chest radiographic abnormalities were recorded in 22.2%. Similarly, Hodson *et al*.[14] reported that in nearly 81% of their patients with stable asthma the chest radiographs were normal. At the same time, in another study on acute asthma, only 50% of the chest radiographs were totally normal.[15] Most of our patients were overweight or obese which was more evident among females. This is of particular importance as obesity is known to be associated with increased asthma severity and a decreased response to

inhaled corticosteroids.[16,17] However, there was no significant correlation between BMI and asthma severity and control in our patients.

The majority of the patients was prescribed inhaled steroids and LABA. Prescriptions of antihistamines were high which probably reflects the presence of allergic co-morbidities. Additional controllers like montelukast or bronchodilators like theophylline were prescribed frequently which indirectly may suggest the severity of the disease. GERD was diagnosed in 13.5% and they were on regular treatment which is in keeping with previous reports.[18,19]

In the first multinational survey in Western Europe, the Asthma Insights and Reality in Europe (AIRE) study,[20] only 5.3% of patients met all the GINA criteria for asthma control. Urgent care needs were reported by 27.9% and emergency visits by 11% of the adults. The most significant findings were the high levels of unscheduled emergency visits and hospitalisation by these patients and the major discrepancy between the patients' perceived control and reported symptom severity. Using the presence of symptoms and the frequency of salbutamol use during the previous month in our patients, asthma appeared to be controlled as the majority (78.3%) was using rescue doses of salbutamol less than twice a week. However, when we consider the hospital admissions (15%) or emergency visits (31.9%) over the previous one year this was not the case. This may be due to the fact that these patients referred to specialists had a moderate or severe spectrum of the

disease. It is also possible that there was reluctance on the part of the patients to use rescue doses of inhaled salbutamol frequently in spite of having symptoms. The difference between the measures of control using symptoms or rescue medication use in the past month and the emergency visits or admissions in the same year brings up a need for recording short term and long term control of asthma separately.

Adherence with controller therapy poses a major challenge to the effective management of persistent asthma. The data from the European Community Respiratory Health Survey documents that compliance to the treatment of asthma is poor worldwide and that there are large variations between countries.[21] The compliance rates often are below 50%, the reasons for noncompliance being multiple and complex and not always clearly understood.[22] Only 25% of our patients were fully compliant with regular use of the prescribed steroid inhalers. Nearly 40% were not using the steroid inhalers in the prescribed doses all the time. The rest of the patients (35%) were using them only when they had symptoms, or were not using them at all. This may reflect the lower perceived need for ICS therapy in our patients or the patients own cultural beliefs preventing them from using medications, especially inhalers, regularly. Non-adherence is usually associated with lower baseline rescue medication use, younger age, female sex, lack of symptoms, physical and psychological comorbidities or difficult social and economic circumstances.[23-25] Adding to this may be the fact that patients often underestimate the severity of their asthma.[26] Interestingly, a recent report from Italy concludes that most people in the general population do not use drugs, in spite of reported respiratory disorders, though to a certain extent asthma was an exception.[27] A more regional study documents that the most common fears hindering regular ICS use were their potential to lead to addiction and the worry about steroid side effects.[28]

Hilton *et al.*[9] report that only 25% of their patients had inadequate technique, the turbohaler being the easiest inhaler to use and metered dose inhalers being the most difficult. The relatively low level of performance was unexpected in our patients as they were instructed in the proper technique more than once. It is also important that the prescriber is fully aware of the characteristics of the different types of DPI, so that the most appropriate one is suggested.[29] This is often not the case as a review of 20 studies highlighted the lack of skill among healthcare professionals in using different inhalation devices.[30] This was also documented from Oman earlier where only 15% of the health care providers who participated in the study performed all the steps correctly.[31] Boys are consistently reported to have more prevalent wheeze, but after childhood it is more common and more severe in females.[32-34] Females also have significantly more asthma control problems and a lower asthma-related quality of life. The sex hormones are major determinants of these biological gender differences.[35] However, despite their overall worse health outcomes, in another study, female subjects demonstrated better lung function, had similar treatment patterns, and showed no differences in physician approach.[36] In our study, there were more females and they were older and heavier than the males. However, neither the asthma control nor the compliance were different between the sexes. Though the inhaler techniques in females were inferior, the difference was not statistically significant.

The limitations in our study are probably few, the first being the strict inclusion criteria. A large number of patients with other even minor associated illness were not included. Asthmatics who smoke also were not included. The second limitation may be the fact that the some of the information, like compliance and the frequency of health care visits, were self-reported.

In conclusion, most of the patients seen in our centre had moderately severe asthma with a high prevalence of atopy. Although the majority appeared to be controlled on standard forms of treatment, we have identified areas where considerable improvement is needed. More effort is needed to teach the correct inhaler technique and more time needs be spent on educating the patients and ensuring proper compliance. We also would like to suggest that there should be separate indicators to assess long term and short term control of asthma which in turn would contribute to assessing total control.

Conflict of Interest

The authors report no conflict of interest.

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