Clinical characteristics of childhood asthmatics in Johannesburg

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Objectives. To describe the clinical features of Caucasian childhood asthmatics in Johannesburg in order to compare these with a similar population of black asthmatic children resident in Soweto.

Design. In a prospective study, a history was obtained by means of an investigator-administered questionnaire.

Main outcome measures. Presenting asthma symptoms, precipitants of symptoms, concomitant diagnoses, individual and family background of allergy and 'delay to diagnosis' of asthma (age at symptom onset subtracted from age at diagnosis) from history and allergen sensitivity as assessed by skin-prick tests (SPTs).

Results. Of the 468 (297 boys) asthmatics studied, 456 (97.4%) presented with cough, 362 (77.3%) with wheeze, 286 (61.1%) with a tight chest and 277 (59.2%) with breathlessness. Cough as sole symptom occurred in 102 (21.8%) while only 8 (1.7%) wheezed and did not cough. Commonest symptom triggers were upper respiratory tract infections and activity/exercise. An individual atopic background was common — allergic rhinitis in 413 (88.2%) — as was a family history of atopy, present in 390 (83.3%). Prolonged symptomatic periods occurred in most patients before asthma was diagnosed (among children diagnosed after the age of 4 years, 50% had been symptomatic for more than 3 years). 'Delay to diagnosis' was not influenced by presenting symptoms or by previous hospitalisation for asthma. Other respiratory diagnoses of bronchitis and pneumonia were common, possibly because of misdiagnosis. Commonest allergens on SPT were corn pollen, Bermuda and 5-grass mix, and standardised mites. Aside from wheat, food allergy was uncommon.

Conclusions. Cough was the commonest presenting symptom despite its still being regarded as a less classic symptom of asthma that may account for misdiagnosis and a high frequency of other respiratory diagnoses. Associated allergy, especially allergic rhinitis, occurred frequently. Many aspects of presentation in whites were similar to those in Soweto children, although the latter had a more frequent concomitant diagnosis of tuberculosis, and recognised dust and cold weather as more frequent triggers. Differences might be influenced by the care-giving situation.

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Recent international epidemiological studies have reported increases in the prevalence of asthma.[1-5] In South Africa there is a paucity of epidemiological information available as only a few prevalence studies have been conducted.[6] However, despite this lack of evidence from community-based prevalence estimates, physicians working in asthma clinics have noted increases in the numbers of children attending these clinics. Furthermore, asthma is frequently missed — symptoms being attributed to other chest conditions like bronchitis or tuberculosis — and hence inappropriately treated. The gravity with which both local and international experts regard both underdiagnosis and undertreatment is reflected in the number of consensus statements published to date.[7-15]

The prevalence and management components of asthma have therefore been well researched and described, but failure to attribute symptoms or symptom complexes is the reason for misdiagnosis of asthma and it is in this area that there is a relative paucity of information. We recently described the clinical characteristics of black asthmatic children from Soweto attending the asthma clinic at Baragwanath Hospital.[16] This study was undertaken to describe the presenting clinical features in a similarly aged primarily Caucasian population of childhood asthmatics living in the suburbs of Johannesburg, and to compare their symptom presentation with that of the Soweto children.

Subjects and methods

We prospectively studied 468 children (297 boys) from the suburbs of greater Johannesburg, excluding Soweto, referred to a specialist paediatric asthma and allergy practice over the 12-month period starting in October 1994. The subjects studied were clearly a select group, as they were referred specifically for suspected or confirmed allergic disease. The population sample was therefore a convenience and not a random sample.

The diagnosis of asthma was ascertained from the initial parental history and from subsequent response to anti-asthma treatment. Confirmatory factors such as a history or clinical evidence of other atopic conditions (allergic rhinitis and eczema) were also considered. Patients over 7 years old who were able to perform repeatable pulmonary function tests (peak flow rates and spirometry) underwent these and, where necessary, airway reversibility was assessed to confirm the diagnosis.

The clinical data were recorded at each patient's initial clinic visit by means of an investigator-conducted questionnaire. The questionnaire recorded demographic data such as address, age and sex; the patient's respiratory history, including presenting symptoms (cough, wheeze, breathlessness, tight chest) and their precipitants (upper respiratory tract infections, exercise/activity, food or drink, dust, grass/pollens, animals, birds, cold weather); previous respiratory diagnoses (tuberculosis, haemoptysis, bronchiolitis, pneumonia, bronchitis); other atopic conditions (hay fever, conjunctivitis, eczema, food allergy) in the child and a family history of atopy in first-degree relatives.

The questionnaire also determined the age of onset of symptoms and the age at which asthma had been diagnosed. If asthma had not yet been diagnosed, the current age was regarded as the age of diagnosis. The 'delay to diagnosis' was therefore computed by subtracting the age at symptom onset from the age at diagnosis.

Skin-prick tests (SPTs) were performed in 107 patients where indicated. Only children over 4 years old were tested. Children referred after previous allergy tests (either SPTs or the radio-allergosorbent test) were not retested and their results were not included in the analysis. We used the Hollister-Stier allergen extracts (Bayer Miles) with 0.5% phenol as negative control and with 1% histamine as positive control. The allergen extracts used were: corn culture Zea Mays (pollen), Bermuda grass, 5-grass mix, tree mix, mould mix (*Alternaria tenuis, Aspergillus* mix, *Hormodendrium cladosporioides, Penicillium* mix), dog-hair dander, cat-hair dander, feather mix, standardised mite *Dermatophagoides pteronyssinus*, cow's milk, whole-grain soybean, peanut mix, whole egg, fish mix and wheat. Reactions were measured according to wheal size at 10 minutes, and a wheal 2 mm greater than the negative control was regarded as a positive reaction.

Results

Johannesburg patients

Of the 468 patients seen, 297 (63.4%) were boys, which gave a male/female ratio of 1.74:1. Patients ranged in age from 1 month to 18 years.

The rates of presenting symptoms were as follows: cough in 456 (97.4%) patients, wheeze in 362 (77.3%), a tight chest in 286 (61.1%) and breathlessness in 277 (59.2%). Cough and wheeze together were reported in 354 (75.6%), cough only in 102 (21.8%), wheeze only in 8 (1.7%) and neither in 4 (0.8%) patients (Fig. 1).

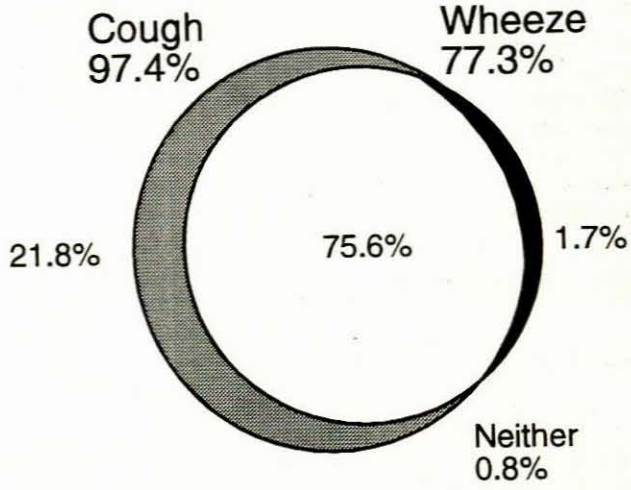

Fig. 1. Presenting symptoms in the asthmatic children.

Precipitants of both cough and wheeze are shown in Table I. Previous respiratory conditions were reported in 5 (1.0%) patients for tuberculosis, 2 (0.4%) for haemoptysis, 183 (39.1%) for bronchitis, 151 (32.2%) for pneumonia and 50 (10.6%) for bronchiolitis.

Other atopic conditions were prevalent with the patient's asthma as follows: 413 (88.2%) had allergic rhinitis, 165 (34.8%) had a history of current or previous eczema, 43 (10.6%) had conjunctivitis, and drug allergy and bee allergy were reported in 4.3% and 1.9%, respectively. A family history of atopy (asthma, allergic rhinitis or eczema) was present in 390 (83.3%) patients.

Table I. Rates at which precipitants triggered the symptoms of cough and wheeze

Precipitating factor (patient perceived)	Symptom: Cough (*N* = 456) No.	(%)	Wheeze (*N* = 362) No.	(%)
Upper respiratory tract infections	328	(71.9)	239	(66.0)
Exercise or activity	298	(65.3)	214	(59.1)
Food or drink	108	(23.6)	81	(22.3)
Dust	60	(13.1)	39	(10.7)
Grass or pollens	19	(4.1)	46	(12.7)
Animals	22	(4.8)	49	(13.5)
Birds	2	(0.4)	3	(0.8)
Cold weather	48	(10.5)	20	(5.5)

Parents were able to recall accurately the age of symptom onset and the age at asthma diagnosis in 299 children. Table II illustrates the computed 'delay to diagnosis' in these patients. The results are expressed in 6-monthly age groups at age of diagnosis as *possible* duration of delay will clearly be influenced by the patient's age. 'Delay to diagnosis' was not influenced by either presenting symptoms or whether the patient had been admitted to hospital with respiratory problems. As only 8 subjects presented with wheeze without cough, comparison between wheeze and cough was not possible as the wheeze sample size was too small. Therefore when the influence of presenting symptoms was assessed, patients presenting with either wheeze or cough (not both) were compared with those who presented with both symptoms. The mean (SD) 'delay to diagnosis' in these respective groups was 18.21 (23.76) and 21.12 (18.96) months; for subjects with and without a previous history of admission it was 19.30 (24.39) and 18.70 (21.58), respectively.

The results of the SPTs are shown in Table III. One hundred and seven children (62 boys) were tested with the commonly used standard eight aero-allergens. In addition to asthma, 97 of these had allergic rhinitis, 36 had a history of eczema, 2 of conjunctivitis and 1 of food allergy. Subsequently, the test was expanded to include the mould mix and the six food allergens.

Table III. Results of skin-prick tests

Allergen	No. tested	No. (%) positive	
Inhalant allergens			
Corn pollen	107	47	(43.9)
Bermuda grass	107	48	(44.8)
5-grass mix	107	43	(40.2)
Tree mix	107	30	(28.0)
Mould mix	62	33	(53.2)
Dog-hair dander	107	31	(29.0)
Cat-hair dander	107	37	(34.6)
Feather mix	107	17	(15.9)
Standardised mite	107	44	(41.1)
Food allergens			
Cow's milk	55	3	(5.4)
Whole-grain soybean	55	7	(12.7)
Peanut mix	55	10	(18.2)
Whole egg	58	4	(6.9)
Fish mix	53	8	(15.1)
Wheat	56	17	(30.4)

Discussion

This study examines the clinical features of childhood asthma in white children to compare these with a like group of black children from Soweto. The presenting symptoms of a disease will be influenced not only by the disease *per se* but also by the way in which the symptom complex is perceived by the patient, his or her parents and the attending doctors. The patients' socio-economic and cultural backgrounds will impact more on the latter than the former, although these will also influence the disease itself. Living conditions in many areas of Soweto are very different from those of suburban Johannesburg and these are likely to influence respiratory conditions, as are the socio-

Table II. Delay to diagnosis of asthma (No. (%))

Age at diagnosis (mo.)		Delay in months: No delay	< 6	7 - 12	13 - 24	25 - 36	36+
0 - 6	(*N* = 17)	12 (70)	5 (30)				
7 - 12	(*N* = 33)	10 (30)	14 (42)	9 (27)			
13 - 18	(*N* = 26)	3 (12)	5 (19)	12 (46)	6 (23)		
19 - 24	(*N* = 33)	14 (42)	8 (24)	2 (6)	9 (27)		
25 - 30	(*N* = 22)	5 (23)	2 (9)	0 (0)	10 (45)	5 (23)	
31 - 36	(*N* = 31)	8 (26)	3 (10)	3 (10)	9 (29)	8 (26)	
37 - 48	(*N* = 46)	8 (17)	2 (4)	5 (11)	11 (24)	17 (37)	3 (6)
49 - 60	(*N* = 27)	4 (15)	2 (7)	6 (22)	5 (18)	4 (15)	10 (37)
61 - 72	(*N* = 24)	6 (25)	4 (17)	2 (8)	1 (4)	1 (4)	10 (42)
73 - 84	(*N* = 10)	0 (0)	2 (20)	1 (10)	1 (10)	1 (10)	5 (50)
84+	(*N* = 30)	0 (0)	0 (0)	5 (17)	3 (10)	3 (10)	19 (63)
All	(*N* = 299)	70 (23.4)	45 (15.1)	45 (15.0)	64 (21.4)	39 (13.0)	47 (15.7)

economic status of the family; a poorer family might, for example, present to the doctor much later with more advanced or severe disease because of lack of funds for travel or medical fees. Therefore the clinical presentation of a disease, although generally similar from population to population and country to country, is specific to each community. It is therefore appropriate to study the disease in the communities in which we work.

The gender distribution of asthma showed a male preponderance; more than 60% of the study population were boys. A greater proportion of male asthmatics was also seen in the children from Soweto, a finding in keeping with international experience.[17]

The commonest presenting symptom was a chronic or recurrent cough, which was reported in all but 12 of the 456 children studied — 8 of these presented with wheeze only and 4 with neither wheeze nor cough. Furthermore, cough was the sole presenting symptom in more than 1 in 5 of the subjects. Wheeze occurred less commonly than cough in 3 out of 4 children, mostly in combination with cough. These figures mirror almost precisely those of the Soweto children where cough was reported in 93.6%, wheeze in 76.3%, cough and wheeze in 73.2% and cough alone in 20.4%. Like the Baragwanath study, this survey again refutes the misconception that cough is a 'less classic' presenting symptom in asthma than wheeze — indeed it would seem to be the most classic presenting symptom for asthma. Therefore in paediatric patients, the absence of wheeze does not exclude the diagnosis of asthma, as 1 in 5 of them will never wheeze.

Failure to recognise the presenting symptom complex of asthma as asthma has resulted in misdiagnosis and consequent undertreatment. In this study we showed that in most patients there was a period in which symptoms were present before the diagnosis of asthma was made. This period had to be shorter in the younger children, whereas some of the older children had been symptomatic for prolonged periods before their asthma was recognised. Indeed, of the 91 children who were diagnosed when older than 4 years, half had been symptomatic for more than 3 years, and this has also been reported from the UK.[18] The importance of recognising cough as the commonest presenting symptom has been discussed. Because so few patients presented with wheeze only, it was not possible to compare the two symptoms (cough and wheeze) in isolation and their influence on the 'delay to diagnosis'. However, presentation with cough and wheeze, whether alone or together, did not influence the 'delay to diagnosis'; neither did previous hospitalisation for chest problems. The study also highlights the common occurrence of a productive cough in asthma given that of those experiencing symptoms of cough, 45.3% reported the cough to be productive of mucus. This suggests that the classically described dry or non-productive cough is not necessarily the only type of cough to occur in asthma.

A high proportion of children had experienced previous respiratory problems or had had previous respiratory diagnoses — nearly 40% had had bronchitis and one-third pneumonia. These may be alternative diagnoses for persistent or recurrent symptoms which were not recognised as asthma. In the study at Baragwanath Hospital, a smaller proportion had had bronchitis (21.5%) and pneumonia (16.5%) but many more — 34 versus 5 in this study — had had tuberculosis. This is possibly because of a greater tendency to diagnose tuberculosis in black children with persistent or chronic respiratory symptoms than in white children. Hence, as mentioned above, the environment in which the patient's symptom complex presents may well influence the manner in which it is perceived by patients and doctors and therefore how it is managed.

Upper respiratory tract infections and exercise/activity were most frequently reported as trigger factors for both cough and wheeze. Similar observations have been reported in other studies as well as among the Soweto children. The rates at which various trigger factors precipitate symptoms are thought to be reflective of the environment under study. Interesting differences between Soweto and Johannesburg included the following: cold weather was a frequent trigger in Soweto (64.6%) but an infrequent trigger in Johannesburg (10.5% for cough and 5.5% for wheeze); and dust which was ascribed to symptoms in 38.6% of children in Soweto was regarded as a trigger in only 13.1% of Johannesburg children for cough and 10.7% for wheeze. The poorer living conditions in Soweto, with greater exposure to cold and to the dusty untarred roads, may explain these differences despite the similar climates of these two neighbouring cities. Similar prevalences were reported in these two communities for the remaining triggers, although food was implicated slightly more commonly in Soweto. The questionnaire did not detail specific foods and was therefore not able to differentiate between the two communities in respect of diet.

Moulds were the commonest allergens, with SPT positivity occurring in more than 50% of the patients tested. In the Baragwanath study, the mould extracts used were *Candida albicans* and *Aspergillus fumigatus*. As these differ from the mould mix used in this study a direct comparison was not possible. However, it is important to note that mould sensitivity was much less common in the children from Soweto, with SPT positivity rates of 16.5% and 9.9% for *A. fumigatus* and *C. albicans*, respectively. Moulds thrive in cold moist surroundings, and the difference in sensitivity between the two communities must reflect differences in living conditions, as the climate is the same. Possibly the more affluent Johannesburg homes are better insulated, thereby retaining moisture and allowing mould to grow while the indoor environments in Soweto are less well insulated and drier, and thus inhibit mould growth. Corn pollen, Bermuda grass and 5-grass mix and house-dust mite were the next most common allergens to cause SPT positivity, as the positivity rate was greater than 40% in all subjects. The Soweto children displayed almost identical responses and, in that study as in this, it must be concluded that high allergenicity to pollen and grass is evidence that the major components of the highveld's vegetation are natural grasses and cultivated cereals. The high rate of house-dust mite SPT positivity is more difficult to explain, as these creatures thrive in warm humid conditions and not in the colder drier climes experienced on the highveld. Acquiring sensitivity at the coast is more likely in these children as most had at some time spent holidays at the coast but only 9 had at any one time lived at the coast. Most of the Soweto children had not visited the coast. Sensitivity to dog-hair and cat-hair danders were, as with the children studied by Mercer and Van Niekerk,[19] more common than among the Soweto children, reflecting the frequency with which the respective communities keep household pets.

Aside from sensitivity to wheat, the rates of SPT positivity to food allergens were much lower than those to the inhalant allergens. It is interesting to note that milk sensitivity occurred least commonly, even though it is the one food which parents most frequently implicate as being responsible for food-induced symptoms. In addition, soya, the milk these children use after discontinuation of cow's milk, caused twice as many positive reactions as the latter. Sensitivity to peanuts, eggs and fish was also infrequent.

Conclusion

This study has allowed us to compare asthma presentation in two different ethnic communities from neighbouring cities. The similarities in presentation are striking, in particular the high prevalence of cough as the commonest presenting symptom. A disturbing finding was the misdiagnosis or failure to diagnose asthma and the high frequency with which other diagnoses are made, leading to unnecessary and costly treatment. In addition, three studies have now reported irreversible reduction in lung function parameters if there is delay in asthma diagnosis and treatment.[20-22] A survey of this nature highlights the manner of asthma presentation to the practising physician and will hopefully result in earlier diagnosis with the introduction of the correct medicines.

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