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Prevalence of asthma and hay fever in England and Wales

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Abstract

The results concerned with the prevalence of asthma and hay fever in the large surveys of morbidity in general practice in 1970-1 and 1981-2 were compared. In data standardised for age the prevalence of asthma in men increased from 11·6 to 20·5 people consulting per 1000 population ($p<0·001$) and in women from 8·8 to 15·9 per 1000 population ($p<0·001$). Similar increases were also evident in data analysed from the 19 practices contributing to both surveys. The prevalence of asthma increased in each age group examined. Increases of similar magnitude were reported for hay fever—the prevalence in men increased from 10·8 to 19·8 people consulting per 1000 population ($p<0·001$) and in women from 10·3 to 19·7 per 1000 population ($p<0·001$) and occurred in all age groups. The prevalence of acute bronchitis was reduced significantly in the age group 5-14 and increased among the elderly. The prevalence of chronic bronchitis was reduced substantially in 1981-2.

The reported increased prevalence of both asthma and hay fever represented a real increase and was not accounted for by changes in diagnostic preference. Only in the age group 5-14 was there any likelihood that some of the increased prevalence of asthma might have resulted from a reduction in the prevalence of acute bronchitis.

Introduction

The annual period prevalence of asthma reported in three large morbidity surveys in general practice increased from 8·5 people consulting per 1000 registered population in 1955-6[1] to 10·2 in 1970-1[2] and to 17·8 in 1981-2.[3] The corresponding prevalence of hay fever was 5·1, 10·6, and 19·7. Each of these surveys was based on a population of about 300 000 and a nationwide distribution of practices in which total recording of morbidity from every consultation was sustained over 12 months.

During recent years several reports, taken together, have suggested that the prevalence of asthma has increased. The sales of drugs for treating asthma increased consistently from 1975 to 1981.[4] Rates of hospital discharge of men with asthma increased from 7·0/10 000 in 1975 to 8·7 in 1978 and 12·3 in 1981. Corresponding rates for women were 6·7, 8·1, and 10·3. In each year there was a distinct excess of men in the age group 0-14 years.[5] Social security claims for absence from work owing to asthma doubled between 1968 and 1982.[6]

In 1960 there were 1188 deaths from asthma in England and Wales, and this figure increased to a maximum of 1927 in 1965, returning to 1245 in 1970. The increase and decline prompted much speculation about the possible role of aerosol inhalers as a contributory factor, and this matter never has been fully resolved.[7] In a study of published national mortality statistics for England and Wales from 1974 to 1984, in which account was taken of the impact of the ninth revision of the *International Classification of Diseases* in 1979, Burney concluded that mortality for asthma was increasing.[8] The trend occurred during a period in which most doctors would accept that substantial advances had been made in the management of asthma.

The difficulties of defining asthma and of its epidemiological study are well known.[9,10] Among these the preferences of doctors in their choice of diagnostic label may change, resulting in diagnostic transfer between the classificatory headings. Opinions on management vary considerably among both consultants[11] and general practitioners.[12] Among children underrecognition of the condition leads to avoidable suffering.[13] Response to histamine challenge has been used as a diagnostic test, but this is not uniformly reliable.[14]

In the study reported here data about asthma and related illnesses during 1981-2 were compared with data obtained in a similar survey about 10 years before to try to discover if the prevalence of asthma and hay fever is increasing.

Methods

Data for this study were obtained during the national morbidity surveys in general practice in 1970-1[2] and 1981-2.[3] Figure 1 shows the geographical distribution of the participating practices. Data available in the material

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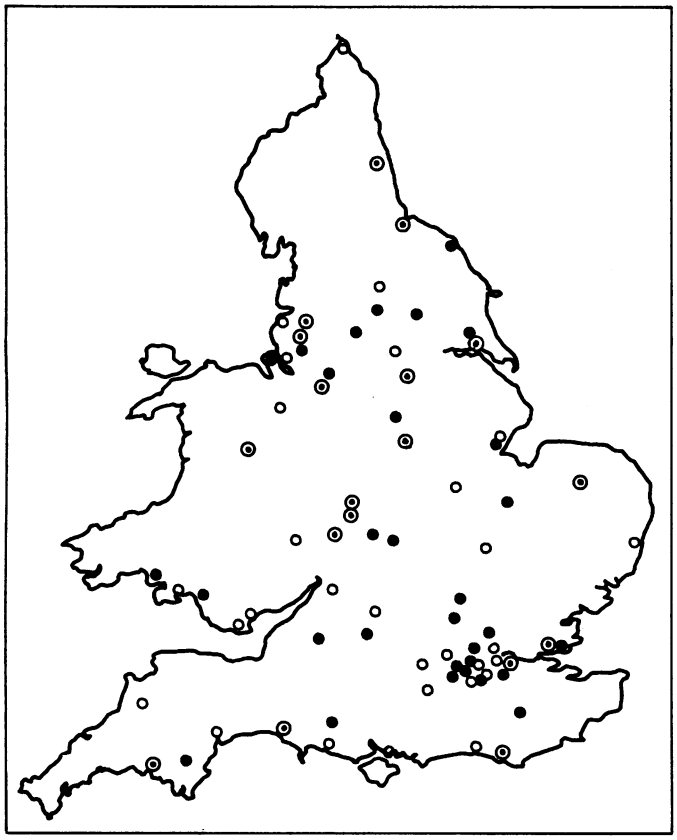

FIG 1—Locations of practices participating in morbidity surveys. ●=1970-1. ○=1981-2. ◉=1970-1 and 1981-2.

included the number of people suffering from specified conditions, the number of episodes of illness experienced, and the number of consultations undertaken during the year of the survey. The study reported here is concerned chiefly with people consulting their doctors about asthma, hay fever (including allergic rhinitis), acute bronchitis (including bronchiolitis), and chronic bronchitis. The allocation of an illness to a heading of the classification was made at the time of consultation. Further information about the survey method is available in the publications already mentioned.

The prevalence of asthma and the other illnesses in each survey were examined for each sex separately and by age. We evaluated the significance of the differences with the χ^2 test. Nineteen practices participated in both surveys and for these prevalences were standardised for age by the direct method to the national population structure in 1981. Differences between the standardised practice prevalences of the two surveys were evaluated by Cochran's method,[15] which is an extension of the χ^2 test, weighting for the differences occurring in the constituent practice populations.

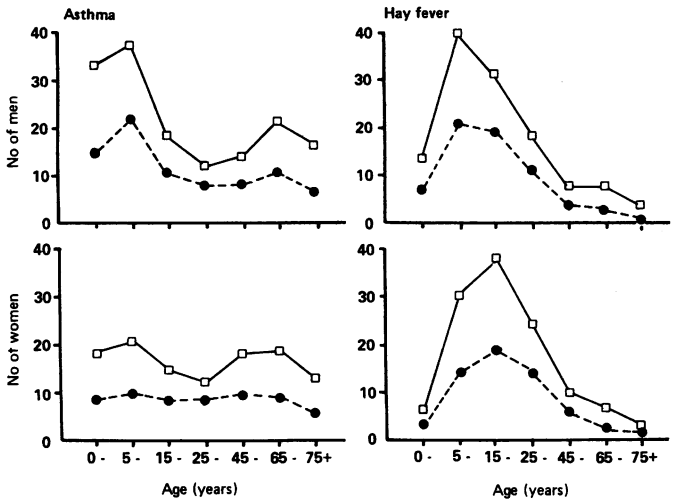

FIG 2—No of people in all practices consulting for asthma and hay fever per 1000 population by age and sex. ●=1970. □=1981.

Results

Figure 2 shows the prevalence, obtained from the two surveys, of asthma and hay fever by sex and by age. In both surveys asthma was more prevalent among men, largely because of a roughly twofold excess of boys. The differences between the prevalences in 1981 and 1970 were highly significant ($p<0{\cdot}001$), with increases seen in all age groups and in both sexes. The prevalence of hay fever in males was at its maximum in the age group 5-14 in both surveys, whereas for women the maximum prevalence occurred in the age group 15-24. The prevalence was also higher in boys aged 0-4. The general pattern of results in men, however, was broadly similar to that in women in each of the surveys. There were highly significant increases ($p<0{\cdot}001$) between the surveys in both sexes and for all age groups.

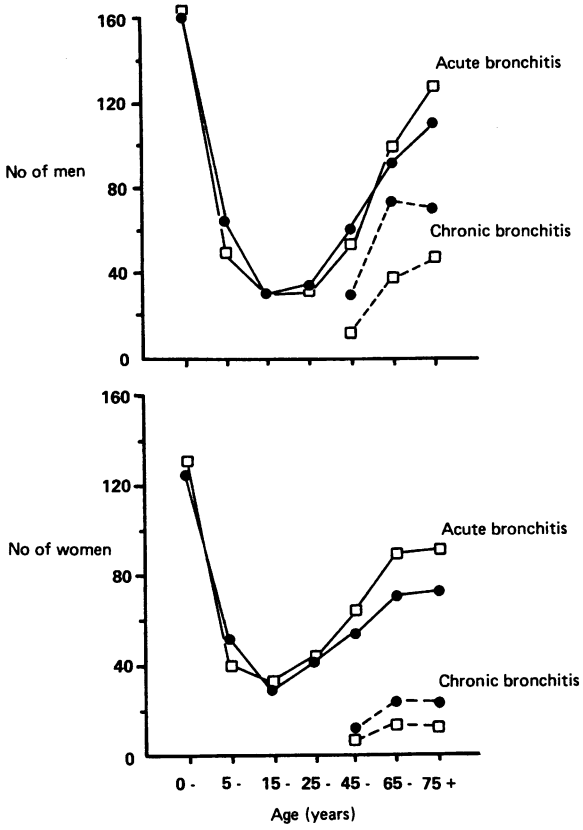

FIG 3—No of people in all practices consulting for acute bronchitis and chronic bronchitis per 1000 population by age and sex. ●=1970. □=1981.

Overall the prevalence of acute bronchitis was similar in both surveys, but there were differences in the groups divided by age and sex (fig 3). The prevalence in men increased significantly only in the age group 75 and over, whereas in women the prevalence increased in the age groups 45-64, 65-74, and 75 and over. The prevalence decreased significantly in males aged 5-14, 25-44, and 45-64, whereas in women it decreased only in the age group 5-14. The prevalence among children aged 0-4 was similar in both surveys. In the age groups 5-14, 65-74, and 75 and over the prevalence in males was about 25% greater than that in women in both surveys. For chronic bronchitis there was an approximate twofold difference between the sexes and highly significant reductions in the prevalence in 1981 compared with that in 1970.

Table I summarises the practice data standardised by age for the 19 practices that participated in both surveys and for each of the diseases. The differences between 1970 and 1981 in the prevalence of both asthma and hay fever (increased) and also of chronic bronchitis (decreased) were substantial and were highly significant. A highly significant decrease in the prevalence of acute bronchitis occurred in men, but the prevalence in women increased significantly. Four of the 19 practices reported a significantly

increased prevalence in men (χ^2 test on data from people consulting), and 10 practices reported decreases. For women there were five and four practices, respectively.

About 90% of patients consulting about any of the four conditions studied were recorded in only one of these diagnostic categories (table II). This proportion was similar in each of three age groups examined separately (0-4, 5-44, and 45 and over). The proportion of patients with hay fever and acute bronchitis (about 85%) was similar in both surveys, notwithstanding the significant decrease in women because of the very large number of patients in the study. In 1970, 942 men were diagnosed as suffering exclusively from asthma compared with 1863 in 1981; for women the numbers were 754 in 1970 and 1623 in 1981. Not only were significantly more people diagnosed as suffering exclusively from asthma but the proportions of both men and women so diagnosed were significantly greater in 1981 than in 1970 ($p<0.001$). In 1970, 545 men were reported as having asthma and acute bronchitis (33% of all patients with asthma) compared with 723 (25%) in 1981 ($p<0.001$). The corresponding values for women were 432 in 1970 (32%) and 682 in 1981 (27%). These trends, showing small increases in the proportion of people diagnosed as suffering exclusively from asthma and small decreases in the proportion who also had acute bronchitis, were evident on separate examination of the age groups 0-4, 5-44, and 45 and over. The proportion of men with asthma who also had hay fever increased from 7% to 12% and the proportion of women from 8% to 10%. There were small but significant reductions in the proportions diagnosed as suffering exclusively from chronic bronchitis.

The total number of referrals from general practice to hospital based care reported in these surveys was 186 in 1970 and 292 in 1981 (not including self referrals by patients). The increase was virtually confined to referrals requiring emergency admission—75 in 1970 and 160 in 1981. The proportion of patients consulting about asthma and referred to outpatient clinics showed a reduction between 1970 and 1981, while the proportion referred for admission to hospital increased.

The numbers of episodes of asthma and consultations for asthma reported in the 1981 survey exceeded those reported in 1970 (table III), but when expressed as mean rates per person consulting both rates decreased slightly.

TABLE I—*Prevalence of asthma, hay fever, acute bronchitis, and chronic bronchitis standardised for age/1000 population*

Condition	Men		Women	
	1970	1981	1970	1981
		Asthma		
Mean from total survey	11·6	20·5	8·8	15·9
Mean from 19 practices	11·2	18·4	8·0	15·8
Weighted mean (SE) difference	7·26 (0·77)		7·54 (0·66)	
		Hay fever		
Mean from total survey	10·8	19·8	10·3	19·7
Mean from 19 practices	11·1	19·0	9·6	19·1
Weighted mean (SE) difference	7·73 (0·77)		9·47 (0·73)	
		Acute bronchitis		
Mean from total survey	64·6	62·2	53·4	58·3
Mean from 19 practices	64·1	59·2	52·2	55·0
Weighted mean (SE) difference	−5·27 (1·52)		3·54* (1·36)	
		Chronic bronchitis		
Mean from total survey	19·5	9·7	7·6	4·0
Mean from 19 practices	17·4	11·1	5·8	4·2
Weighted mean (SE) difference	−6·07 (0·75)		−1·66 (0·43)	

* All differences were very highly significant ($p<0.001$) except for acute bronchitis in women ($p<0.01$).

TABLE II—*Patients in all practices consulting classified by diagnosis and sex and number (%) in whom only one condition was diagnosed*

	Patients consulting		No (%) in whom only one condition was diagnosed	
	1970	1981	1970	1981
Asthma:				
Men	1 647	2 850	942 (57)	1 863 (65)***
Women	1 346	2 560	754 (56)	1 623 (63)***
Hay fever:				
Men	1 526	2 888	1 278 (84)	2 387 (83)
Women	1 556	3 179	1 320 (85)	2 680 (84)
Acute bronchitis:				
Men	8 659	8 490	7 404 (86)	7 297 (86)
Women	8 246	9 409	7 400 (90)	8 318 (88)**
Chronic bronchitis:				
Men	2 233	1 188	1 498 (67)	746 (63)*
Women	1 127	646	713 (63)	370 (57)**
Total				
Men	12 539	13 801	11 122 (89)	12 263 (89)
Women	11 197	14 340	10 187 (91)	12 991 (91)

* $p<0.05$, ** $p<0.01$, *** $p<0.001$ (χ^2 test).

TABLE III—*Number of patients consulting, episodes, and consultations for asthma per 1000 population, and number of episodes and consultations per person consulting in all practices*

	Men		Women	
	1970	1981	1970	1981
No per 1000 population:				
Patients consulting	11·7	20·0	8·9	15·9
Episodes	15·5	23·9	11·4	19·2
Consultations	37·9	52·3	31·0	44·9
No per person consulting:				
Episodes	1·32	1·20	1·28	1·21
Consultations	3·24	2·62	3·48	2·82

Discussion

The comparisons examined in this paper are based on patient consulting rates. Much of the research work using hospital statistics of admission and discharges is of limited epidemiological value because it is based on events and not people. One person may experience several events. Using samples based on events rather than people makes procedures for linking information about one illness with another much more difficult. In the morbidity surveys that provided the material for this study person specific data were analysed showing the linkage between conditions. By collecting comprehensive data of this type on a total defined population we have been able to assess the effects of diagnostic transfer and multiple diagnoses in one person. It should also be recognised that the comparison uses a large database with a population that is representative of the national population structure by age and sex[3] and that included more than 5000 patients with asthma in the 1981 survey.

The increased prevalence of hay fever in 1981 compared with 1970 indicates at the very least that more people are resorting to treatment. The heading of hay fever in the disease classification includes allergic rhinitis, and sufferers in either survey had little opportunity to be assigned to any alternative. Treatment did improve during the decade, and the response to treatment may have been used as a diagnostic test, thus bringing more patients into this diagnostic category by the time of the 1981 survey. Against this, however, the prevalence of hay fever had doubled between the times of the first and second morbidity surveys before any great advances in treatment had been realised. The continuing trend, the magnitude of the increase, its uniformity in both sexes and all age groups, the related increase in the prevalence of asthma, and the wide consensus across all practices all support the idea that it represents true increased prevalence.

The apparent increased prevalence of asthma is more difficult to interpret. The broad perspective of asthma has not changed, its high prevalence and male sex bias in children being features of other surveys.[16,17] Detailed comparisons of the results from different surveys are not possible because of the different methods used. Our study is based on a comparison of annual period prevalence determined by the need to consult and the diagnosis made by the doctor consulted. Community surveys use other methods and generally quote cumulative prevalence. The most difficult problem in interpreting data about asthma concerns the change in diagnostic preference over time. Is the condition that was called acute bronchitis in 1970 now called asthma? In a regionally based study of children admitted to hospital with asthma from 1970 to 1978 Anderson *et al* concluded that the increase in the number of patients admitted to hospital was not attributable to changes in diagnostic fashion.[18] Khot *et al* reached the same conclusion.[19] This study, showing a considerably increased prevalence of asthma during a

period in which no overall change in the prevalence of acute bronchitis occurred suggests that there was no overall change in diagnostic practice between the surveys. Two observations, however, need further consideration: the reduced prevalence of acute bronchitis in children of both sexes aged 5-14 and the reduced prevalence of chronic bronchitis.

In an overview of the 1981 survey results for total morbidity compared with those for 1970 consultation rates increased among women in all age groups and among all men except those aged 15-44 and 45-64. The data on upper respiratory tract infections (coryza and so on) follow the same general trends, with particularly large increases in prevalence among children of both sexes aged 0-4 and 5-14. The bias towards boys seen in the statistics for asthma was not present in those for upper respiratory infections, though a male bias was present in the results for acute bronchitis and was of comparable magnitude in both surveys. Such a bias suggests misdiagnosis and confirms suspicions that confusion over diagnosis exists, especially in this age group. These data, however, suggest that the confusion in 1981 was hardly different from that in 1970. Though some cases diagnosed as acute bronchitis in 1970 may have been diagnosed as asthma in 1981, we suspect that more would have been diagnosed as infections of the upper respiratory tract.

Among the elderly chronic bronchitis may cause confusion. The reduced prevalence of chronic bronchitis accords with our own clinical experience, in which recently we have seen fewer patients crippled by irreversible airways obstruction than we did 10 or 15 years ago. We accept that this is a real decrease. The number of elderly patients with acute bronchitis has increased as well as the number of patients with asthma and may hide some of the true increase in prevalence of asthma. We think that it is unlikely that any change in diagnostic preference occurring during the period between the surveys could account for any substantial part of the increased prevalence reported.

Some patients with asthma also experienced hay fever or acute bronchitis in the same year. It is conceivable that during the period between the surveys a change in diagnostic practice may have resulted in more patients being recorded in multiple diagnostic categories, thereby spuriously suggesting an increased prevalence. The data presented here, however, show that not to be the case. Multiple diagnoses were made during both surveys and in both sexes in about 10% of cases, suggesting a consistency in the diagnostic process. The number and proportion of patients diagnosed as suffering exclusively from asthma increased, whereas the number and proportion of those with acute bronchitis were virtually the same. Thus among patients diagnosed as suffering exclusively from one disease there is no evidence of a change in diagnostic preference during the period between the surveys.

The significant change in the prevalence of acute bronchitis in men aged 45-64 may indicate a declining prevalence of acute bronchitis in middle aged men, but it is more likely to reflect a changing pattern of consultation resulting from the gradual relaxation of requirements for sickness certificates during recent years. The contrasting increase in women accords with a general increase seen both in patient consulting rates and mean consultation rates, which extend across the entire range of morbidity.

Data from the Hospital In-Patient Enquiry in 1981 provided an estimate of 11·3 hospital discharges/10 000 population—a figure that in any case must exceed an estimate based exclusively on patients discharged—whereas the prevalence of asthma reported here for 1981 was 178/10 000. Whatever changes have taken place in the policy of admission to hospital and in arrangements for self referral they have little effect on the statistics for prevalence derived from a total population study in general practice. From this study, however, it can be seen that more patients were referred to hospital in 1981 than in 1970 and that this increase was confined to referrals for admission. Even so, referral is comparatively rare, and any appraisal of the prevalence of asthma must be made in a population based study.

Both asthma and hay fever are highly variable conditions and are at least partly influenced by environmental factors. The years 1970 and 1981 may therefore represent "good" and "bad" years, respectively, for these conditions. In a similar national morbidity survey available for 1971-2 the prevalence of asthma and hay fever was similar to that in 1970-1. From data from the weekly returns service of the Royal College of General Practitioners[20] (a group of practices keeping records that overlap considerably with those included in the national morbidity surveys) Ayres showed that the prevalence of both conditions was similar in the years immediately before and after the 1981-2 survey reported here.[6]

The analysis within the practices is especially important because it minimises the effect of confounding variables. The practices are in the same place; topographical, meteorological, and demographic characteristics scarcely change within a decade. A substantial proportion of the population registered with the practice would have been present at both surveys. Most doctors contributed to both, though there were some changes. Important local changes will have occurred: some factories will have closed, in other regions unemployment may have increased, weather conditions in the critical hay fever season may have been very different in the two years of the survey, and the prevalence of viral disorders that predispose a patient to acute bronchitis may have varied widely. These local changes, though accounting for variation in individual practices from the general pattern of results, are lost in the analysis of data from 19 widely distributed practices and in the data from all the surveys. In this regard the increases in the prevalence of asthma and hay fever were remarkably uniform whereas changes in the prevalence of acute bronchitis in individual practices were haphazard, with both substantial increases and decreases among the 19 practices.

We conclude from this analysis that the true prevalence of both asthma and hay fever has increased. The increases have been of a similar magnitude, with uniform effects in both sex and age groups, but each of these illnesses remains different with regard to the age and sex distribution of the sufferers. Many people have expressed the opinion that the prevalence of both conditions is increasing, but few so forcibly as Morrison-Smith who, reflecting on his lifetime experience as a chest doctor, noticed that when he was aged 20 no doctor recognised the condition of hay fever from which he was suffering and that patients diagnosed as suffering from asthma were few and far between.[21] More recently there has been well documented evidence of increased prevalence in New Zealand and other parts of Australasia.[4] In their analysis of trends in the hospital care of childhood asthma Anderson *et al* identified the need to seek epidemiological evidence to distinguish between an increase in the number of people who have asthma and an increased frequency of asthmatic episodes.[18] They also lamented the paucity of data about non-fatal conditions such as asthma. The value of the general practice survey based on a large population is easily overlooked. Although this study was largely concerned with the number of patients consulting, small reductions in the mean number of episodes per person consulting about asthma and in the mean number of consultations per peson consulting were also seen. Such reductions may be partly explained by increased recruitment of patients who are less severely ill or by improvements in management by the general practitioners concerned.

The increased prevalence of asthma and hay fever occurred in all age groups and hence is not likely to relate to some change in genetic predisposition. Increases were evident in widely scattered practices, suggesting a national rather than local explanation. We can only speculate that our response mechanism to airborne irritants is being modified gradually by dietary factors, by disease processes, or by other factors that we do not understand; alternatively, contamination of the environment by potential irritants (new or existing) may have increased. The patterns of increase for both asthma and hay fever are similar, suggesting a common explanatory factor.

National morbidity surveys require collaboration among the Office of Population Censuses and Surveys, the Department of Health and Social Security, and the Royal College of General Practitioners. From the Birmingham research unit of the Royal College of General Practitioners we acknowledge the good will that exists in the prosecution of these surveys. Most important, however, is the discipline required for recording the information in the participating practices, and we are grateful to the participating doctors and the research secretaries. Most of the analytical

work and the statistical interpretation have been undertaken by Mrs C A Norbury (Birmingham research unit) and Dr K W Cross (department of social medicine, Birmingham University), and we are especially grateful to them. We also thank the Office of Population Censuses and Surveys for the subsidiary analysis of the original material to provide the data for table II.

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Atrial fibrillation precipitated by acute hypovolaemia

J D EDWARDS, R G WILKINS

Abstract

Six patients with varying degrees of acute cardiorespiratory failure were seen. All patients deteriorated noticeably when rapid atrial fibrillation developed. In all patients intravenous digitalis failed to slow the ventricular response, and in three patients misguided attempts at electrical cardioversion failed. Haemodynamic monitoring showed a normal or low pulmonary artery occlusion pressure in all patients. Controlled expansion of plasma volume was associated with an immediate slowing of the heart rate in all patients, and the heart rate in all patients returned to sinus rhythm within 30 minutes of transfusion.

It is suggested that hypovolaemia in critically ill patients may contribute to the development of atrial fibrillation.

Introduction

Atrial fibrillation is a recognised complication of acute non-cardiac illness[1] and in normovolaemic patients with underlying left ventricular dysfunction usually results in dangerous falls in cardiac output and perfusion pressure associated with a deterioration in gas exchange due to rises in pulmonary artery occlusion pressure.[2] It has been suggested that hypovolaemia may precipitate atrial fibrillation in a critically ill patient and should be excluded,[3] but this has never been documented adequately. Over two years we saw six patients who developed rapid atrial fibrillation in association with severe hypovolaemia which was shown by invasive monitoring.

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Patients and methods

Case 1—A 56 year old man underwent emergency repair of a leaking aortic aneurysm. Postoperatively his central venous pressure was maintained at 10 cm H_2O from the sternal angle. He remained oliguric (urine output 10-15 ml/h) and hypotensive (systolic blood pressure 100-105 mm Hg). Thirty six hours after surgery he suddenly became breathless, and his systolic blood pressure fell to 60 mm Hg. He was found to be suffering from rapid atrial fibrillation. Two attempts at cardioversion with direct current shocks of 150 and 400 joules failed. He subsequently developed adult respiratory distress syndrome, which necessitated mechanical ventilation for 10 days.

Case 2—A 48 year old man was admitted suffering from alcohol withdrawal, as evidenced by delirium tremens. On the day of admission he became progressively breathless. Fluid replacement seemed adequate (2·4 litres of crystalloid over seven hours), but he developed sudden circulatory collapse, worsening respiratory distress, and rapid atrial fibrillation. This did not respond to two attempts at cardioversion (200 and 400 joules, respectively). After resuscitation he was found to have bilateral bronchopneumonia.

Case 3—A 64 year old woman developed circulatory collapse and was found to be suffering from rapid atrial fibrillation 14 hours after a carotid endarterectomy. Three attempts at cardioversion (100, 200, and 400 joules) failed, and she developed progressive respiratory distress. After resuscitation she was found to have a staphylococcal septicaemia.

Case 4—Two days after surgery for a perforated duodenal ulcer a 62 year old man developed progressive hypotension (systolic blood pressure falling from 110 to 75 mm Hg over six hours). Soon afterwards he became breathless, and the rhythm changed to atrial fibrillation. His respiratory distress was thought, on clinical and radiological grounds, to be due to left ventricular failure. He was subsequently shown to have septicaemia due to *Escherichia coli* and adult respiratory distress syndrome.

Case 5—A 46 year old woman was admitted with dyspnoea, which had developed over 24 hours. On examination she was found to be hypotensive and suffering from rapid atrial fibrillation. Chest radiography showed infiltration in the left lower lobe, which later became generalised. After resuscitation she was found to have pneumococcal pneumonia and septicaemia.

Case 6—A 64 year old man became hypotensive and breathless after a viral type illness that had lasted for 48 hours. On admission he was hypotensive and in extreme respiratory distress. He was suffering from rapid atrial fibrillation and had bilateral crepitations. Though he was initially thought to be suffering from left ventricular failure, haemodynamic studies and