A confidential enquiry into certified asthma deaths in the North of England, 1994–96: influence of co-morbidity and diagnostic inaccuracy

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To understand more fully the nature of events leading to asthmatic death, we conducted a confidential enquiry prospectively throughout 1994–96 among the surviving relatives and respective general practitioners of subjects whose deaths could be attributed to asthma, whether wholly or partly. We also reviewed relevant hospital records and autopsy reports, and we submitted all the gathered information to an enquiry panel for evaluation. The subjects were identified from death certificates issued in five districts of the Northern Health Region of England (population 1 million) on which asthma was recorded as the primary cause of death.

The enquiry panel agreed that asthma had been a critical factor in causing death in only 33 of the 79 certified cases for which there were sufficient data. The level of concordance was substantially greater for subjects aged < 65 years (76%) than for those who were older (17%). In 16 of the 33 cases asthma alone appeared to be responsible for death, but in 17 cases a wide variety of additional, co-morbid, disorders appeared to have contributed. They included, during the 24 h preceding death, gastric aspiration, septicaemia, a single dose of a beta-blocker, the abuse of organic solvents or illicit drugs and possibly, an inadvertent exposure to horse allergen. More chronic causes of co-morbidity included ischaemic heart disease, chronic obstructive pulmonary disease (COPD), thoracic cage deformity and alcohol abuse. There were possible errors of judgement in two cases by the supervising physician (6%) and in three cases by the patient (9%). Poor compliance and psychosocial disruption probably exerted an additional adverse influence in nine cases (27%).

We conclude: (1) that asthma death certification in subjects aged 65 years or more is very unreliable, (2) that for approximately half of the deaths in which asthma exerted a critical role there were critical co-morbid disorders and (3) that errors of judgement, poor compliance, or psychosocial disruption are likely to have exerted an additional adverse influence in an important minority of cases.

Introduction

Asthma mortality has provoked much debate over the past two decades, chiefly in relation to its prevention but also because of doubts concerning the accuracy of reported statistics. Evidence of both false positive and false negative diagnostic labelling has complicated the evaluation of factors which may exert an important influence, and this may have hampered the development of effective strategies for prevention (1–5). It has become evident, nevertheless, that in many asthmatic deaths in Britain, potentially preventable factors probably exerted a critical influence.

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advice/assistance, geographic distance, telephone communication, transport), the level of perception by both patient and physician that exacerbations may be of life threatening degree, the adequacy of emergency medical care and a variety of psychosocial issues (11-14).

In order to evaluate the wide variety of potentially relevant factors and to obtain a measure of perspective, there is a role for confidential enquiries among surviving relatives and the healthcare professionals who were involved in managing the individual cases. Such enquiries may allow information of relevance to emerge more readily and more fully than would otherwise be possible. A confidential approach was consequently adopted by the Mortality and Severe Morbidity Working Group of the U.K. National Asthma Task Force when it was formed in 1991 with support of the National Asthma Campaign, the British Thoracic Society, the Royal College of Physicians and the Royal College of General Practitioners. Its primary aim was to review certified asthma deaths in subjects aged less than 65 years, in whom inaccuracy of death certification was thought not to be a major problem.

The present paper reports the findings from one of the contributing regions, the Northern Region of England, but it considers certified asthma deaths at all ages and it particularly reviews the accuracy of the certified cause of death in relation to the nature of the events leading to death.

Methods

The enquiry reviewed the circumstances leading to death, for which asthma was certified to be the direct cause, during the 3 yr period 1st January 1994 to 31st December 1996. The parent population comprised approximately 1 million people living in five districts (three rural, two urban) within the Northern Health Region of England—Northumberland, Newcastle upon Tyne, North Tyneside, East Cumbria and West Cumbria.

The study was prospective in nature and involved a number of phases, all under the understanding of strict confidentiality: (1) identification of cases from death certificates and a reporting network, (2) informal contact with the patient's general practitioner followed by a more formal interview and the completion of a standardized questionnaire, (3) review of hospital case notes and autopsy details whenever available, (4) interview and questionnaire completion with the patient's closest surviving relative whenever possible and appropriate and (5) an annual assessment of new cases by an enquiry panel of two consultant respiratory physicians, a senior lecturer in primary healthcare, two general practitioners, a practice nurse and a research nursing sister. Inevitably full details were not always obtainable, particularly concerning the deaths of the more elderly subjects.

The panel first separated the cases into three groups according to whether asthma was judged to be the sole cause of death (uncomplicated asthma death), whether asthma contributed critically to death but another disorder (or disorders) contributed also (complicated asthma death), or whether asthma did not contribute to death (non-asthma death). Particular attention was paid to the age at death, since the accuracy of asthma death certification has been reported to differ before and after the age of 65 years.

Results

A total of 80 cases were identified for which the death certificate reported asthma to be the primary cause of death, and sufficient data were obtained for 79 for the enquiry panel to make a judgement as to whether or not asthma had played a critical role. By 'critical' the panel considered that had it not been for asthma, death would probably not have occurred. Table 1 shows the distribution by age according to the panel's judgement. The panel agreed that asthma had been critical to death in 25 of the 33 cases with age < 65 years (76%) but in only eight of the 46 with age ≥ 65 years (17%). This age difference in the level of concordance between the panel and the physician certifying death was highly significant ($\chi^2 = 24.2, P < 0.0001$).

<table>
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<tr>
<th>Age</th>
<th>Uncomplicated</th>
<th>Complicated</th>
<th>Non-asthma</th>
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<tr>
<td>&lt;65 years</td>
<td>13</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>(n = 33)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥65 years</td>
<td>3</td>
<td>5</td>
<td>38</td>
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<tr>
<td>(n = 46)</td>
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<td></td>
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<tr>
<td>Total</td>
<td>16</td>
<td>17</td>
<td>46</td>
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<tr>
<td>(n = 79)</td>
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UNCOMPPLICATED ASTHMA DEATHS

The panel considered that in 16 cases death was a consequence of asthma alone (48% of the 33 deaths in which asthma had been critical). Seven of the subjects were male (44%), 13 were aged < 65 years (81%) and 11 underwent post mortem examination (69%). The following case histories provide illustrative examples:

Case 1: A 36-year-old man with asthma since the age of 1 yr died in his car shortly after having dinner with his girlfriend. He had appeared normally well at that time, and there was no recognized immediate provoking trigger. He had had several admissions to the local general hospital because of acute attacks of asthma, but had failed to attend a number of nurse-run Asthma Clinics within the general practice. Furthermore, he had only recently returned from holiday in Greece where he had had to use his inhaler medication (salbutamol and high dose beclometasone). He had not, consequently, taken this with him. Autopsy showed over-inflated lungs with mucus plugging.

<table>
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of the smaller bronchi. The heart appeared normal and no other abnormality was found.

Case 2: A 55-year-old nurse, who attended the local general hospital's Chest Clinic regularly with well-documented atopic asthma and aspirin sensitivity, died suddenly in an asthma attack. Her asthma had been regarded as 'brittle' by her supervising respiratory physician and she had required treatment with high doses of inhaled steroid, frequent intermittent courses of oral steroid and, at times, maintenance oral steroid. She was thought to be a 'poor perceiver' of breathlessness. Her outpatient supervision and her clinic attendance appeared exemplary.

In only one case was longstanding asthma in a never-smoker associated with severe and progressive fixed airways obstruction and cor pulmonale, though in several a high-risk for asthmatic death was readily evident.

**COMPLICATED ASTHMA DEATH**

The panel considered that in 17 of the 33 cases of asthma death (52%) there was a relevant 'co-morbid' disease which was also critical to death. Eleven of the subjects were male (65%), 13 were aged <65 years (76%) and 14 underwent post-mortem examination (82%). The following case histories provide illustrative examples:

Case 3: A 57-year-old man with atopic asthma since childhood was found dead, slumped over the bedroom floor apparently trying to use his nebulizer. Two days previously he had phoned a friend to say he was feeling too unwell to visit. Post-mortem examination showed both lungs to be moderately hyperinflated but additional findings included severe kyphoscoliosis and an 80% stenosis of his left anterior descending coronary artery, as well as severe atheromatous change in other coronary vessels. It seemed unlikely that asthma alone was responsible for death, though it probably contributed to it.

Case 4: A 61-year-old woman, not known to have asthma but having neglected diabetes, hypertension, obesity and previous cardiac failure, became acutely breathless and was found to be dead on arrival at the nearest hospital. Post-mortem examination showed long tenacious plugs in her bronchi and severe left ventricular hypertrophy, but the pathology report made no mention of pulmonary oedema. Again, it seemed unlikely that asthma had been the sole cause of death. Although she had been in respiratory distress, her death was sudden and unexpected, and may have been precipitated by a cardiac dysrhythmia consequent to the metabolic effects of the acute asthmatic attack and, perhaps, the diabetes.

Case 5: A student aged 19 years had become unduly anxious over college examinations. He consulted a new general practitioner, and reported mild asthma which was only intermittently troublesome. At the time he was using no regular asthma medication. The practitioner considered the use of beta-blocker to be justified, but an hour or so after the first dose the student became wheezy and moderately distressed. He sought assistance at a local cottage hospital which had limited facilities for emergency care. Another practitioner was summoned and went directly from her horse stable to administer intravenous and nebulized bronchodilator therapy, but the student deteriorated and died before he could be transferred to the nearest general hospital. By an unfortunate chance he was allergic to horses, which might possibly have been a further contributory factor to his death.

Case 6: A 13-year-old asthmatic boy, treated with regular inhaled steroid, had been hill-climbing during the day, but then collapsed suddenly and died during the early evening. Post-mortem examination showed hyperinflated lungs with extensive mucus plugging. There was also evidence of minor aspiration of gastric contents and a blood sample taken at the autopsy suggested that solvent abuse had probably occurred. This possibly stimulated vomiting, aspiration and the fatal asthmatic episode.

One death was associated with the use of illicit drugs, one was associated with alcoholism and one was the result of septicaemia following lung transplantation for severe asthma.

**NON-ASTHMA DEATH**

The panel considered that in 46 cases asthma had neither caused nor contributed to death. Eighteen of the subjects were male (39%), eight were aged <65 years (17%), and nine underwent post-mortem examination (20%). In five cases the panel considered that COPD was the primary cause of death, with or without a cardiac component, in one, death appeared to have been a consequence of pneumonia and in another (an infant), post-mortem examination favoured bronchiolitis as the probable cause of death, not asthma. In many of the older subjects (the great majority) the immediate cause of death was not evident from the information available, though this was sufficient for asthma to be considered improbable. The following histories provide illustrative examples:

Case 7: An 84-year-old man had first been diagnosed as having asthma when aged 76 years, which the general practitioner later reported 'was always well controlled'. He had also been thought to have farmer's lung, but there was no available smoking history. Increasing breathlessness led to an emergency hospital admission where investigation revealed cardiac failure, atrial fibrillation and pulmonary oedema, together with mild renal failure and a raised level of cardiac enzymes suggesting a small infarction. At discharge, following appropriate treatment, there was still radiological evidence of heart failure. Two subsequent emergency admissions within 4 months culminated in death. Severe cardiac failure and uncontrolled atrial fibrillation during the terminal admission resisted intensive therapy (including intravenous steroids because of the history of 'possible asthma') and a very high level of serum cardiac enzymes was measured. The admission summary recorded three diagnoses—myocardial infarction, ischaemic heart disease and COPD—but gave no respiratory data. The death certificate nevertheless recorded asthma as the primary cause of death.

Case 8: A 56-year-old woman, who smoked heavily, was noted in the general practice records to have 'bronchitis' in
1986 and 'asthma plus chest infection' in 1990, at which time peak expiratory flow measurements varied from 140 to 180 min$^{-1}$. In 1991 she was noted not to have benefited subjectively from prednisolone and nebulized salbutamol. In 1992 she was seen by a local respiratory physician who diagnosed 'chronic bronchitis and emphysema'. The precise circumstances of her death in 1995 were uncertain but were thought to have followed a gradual deterioration.

ERRORS OF JUDGEMENT, POOR COMPLIANCE, AND PSYCHOSOCIAL DISRUPTION

Among the subjects whose death the panel attributed to asthma (whether wholly or partly) there were a number of additional factors, apart from co-morbidity, that may have exerted an important influence.

Patient error of judgement probably contributed to the deaths of three subjects. They comprised a 54-year-old woman with recognized brittle asthma who went home to use her nebulizer after developing a severe asthma attack while shopping, rather than seek emergency care from the nearest hospital as she had been advised; the 36-year-old man who died soon after returning home from an overseas holiday where he had discontinued his inhaler medication because he had felt so well; and a 63-year-old man who had suffered increasing nocturnal respiratory discomfort but had apparently not wished to disturb his wife by calling his general practitioner until he had lapsed into an extreme and irrecoverable state. His death occurred a week after his daughter had delivered stillborn twins after 37 weeks of pregnancy, and this had already caused his wife (and the rest of the family) considerable stress.

In two cases, including that of the student given a beta-blocker, there was a suggestion of judgement error by the supervising physician. The other case involved a 62-year-old man, apparently known to have had asthma for several years, who had died from an asthmatic attack just nine months after being prescribed no more than a dose of a bronchodilator inhaler as required. There was no evidence that he had received any functional assessment or regular supervision, but nor was there evidence that he had sought further advice when his symptoms deteriorated.

In five cases there were clear written references to poor compliance with medication or to multiple failures to attend clinic appointments, and in four emotional stress or social factors were prominent. One man had just left the family home as a consequence of marital disruption and had his fatal episode within the unfamiliar environment of a Salvation Army hostel.

Discussion

The enquiry helped clarify three major issues of interest. Firstly, it suggested that the certification of asthma death in subjects aged 65 years or more is associated with a substantial degree of inaccuracy. Secondly, it revealed that for the majority of deaths in which asthma is likely to have played a critical role, a variety of co-morbid disorders played a critical contributory role. Thirdly, it identified among the cases of both uncomplicated and complicated asthma death, a meaningful minority for which errors of judgement, poor compliance, or psychosocial disruption are likely to have exerted an important adverse influence.

The panel agreed that asthma had played a critical role in causing death in only 33 of the 79 cases of certified asthma death over the 3 yr surveillance period, for which there were sufficient data. This implies an annual mortality rate from asthma of about 11 million$^{-1}$, but it ignores false negative certification. The rate of 11 million$^{-1}$ (approximately a third of that recorded nationally) therefore represents a minimum. False positive certification appeared particularly common in subjects aged 65 years or more, thereby supporting the conclusions of other investigations that asthma death certification is very unreliable in this age group (4,5). It is only when there is confidence in accepting asthma as the cause of death, whether it be the sole or partial cause, that meaningful strategies for prevention can be considered.

In fact asthma was judged to be the sole cause of death in 16 of the 33 cases (48%). For the majority, co-morbid disorders were considered to have exerted a critical contribution. Most prominent were other common chronic disabling diseases, ischaemic heart disease and COPD, but the investigation was notable for identifying a variety of additional sources of co-morbidity—thoracic cage deformity; aspiration of gastric contents; septicaemia; abuse of alcohol, organic solvents and illicit drugs; anxiety and the prescription of a beta-blocking drug; and (possibly) inadvertent exposure to horse allergens.

In two of the 33 cases (6%) there were possible errors of judgement by the supervising physician (the prescription of a beta-blocker, and the failure to prescribe regular inhaled corticosteroids), and in three cases (9%) errors of judgement could be attributed to the patients. Poor compliance and psychosocial disruption probably exerted an additional adverse influence in nine cases (27%). Among those managed according to current guidelines, the proportion of cases in which death might readily have been prevented was small. This is reassuring from the viewpoint of the guidelines, but disturbing in the sense that the guidelines were not always followed nor were they fully effective. Strong dissatisfaction with the healthcare services was expressed by a few of the surviving relatives, and it was evident that the possibility of death had been poorly perceived by the relatives and physicians of some of these subjects.

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References


