

A review of radiological abnormalities in 135 patients presenting with acute asthma

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SUMMARY

Six hundred and ninety-five attendances were made to the Accident and Emergency Department of a district general hospital over a 6-month period by patients with acute asthma. On hundred and thirty-five chest radiographs were performed, and the radiologists' reports analysed. Nineteen abnormalities were reported (14%) which may have altered the management of the patient. It is recommended that chest radiographs be considered in patients who do not rapidly respond to initial therapy.

INTRODUCTION

Some radiological abnormalities may be expected from the physiological and pathological changes which occur in severe asthma, including hyperinflation of the chest and increased perihilar markings. These appearances do not usually influence patient management. On the other hand, radiological evidence of oedema, infection, consolidation, collapse, or pneumothorax may do so (Reed *et al.*, 1985; Findlay & Sahn, 1981; Burke, 1979). These abnormalities are important to exclude, because of their potentially serious consequences.

One study (Findlay & Sahn, 1981) found that information obtained from the chest radiograph was rarely helpful in out-patient management. It concluded that radiography is only indicated when there is clinical evidence of either pneumonia, a pulmonary disorder that mimics asthma, or pneumothorax.

Conversely, Petheram *et al.* (1981), strongly recommend the use of chest radiography in adults presenting with acute asthma, because of the high incidence of

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unsuspected pulmonary collapse or consolidation, and the potential danger of a pneumothorax or pneumomediastinum (although none were reported).

The true role of chest radiography is therefore still unclear. This study documents the results of 135 chest radiographs in patients presenting with acute asthma to an Accident and Emergency department.

METHODS

This retrospective study was conducted at Ealing District Hospital between July 1st and December 31st 1987. All previously diagnosed asthmatics seeking treatment for an exacerbation of the symptoms of asthma were included. The number of chest radiographs performed was documented and the radiologists reports analysed.

The radiographs in this study were reported by six consultants and two senior registrars over the 6 months of the study. None of the above doctors were aware that the study was being carried out.

The reports were divided into five groups; normal, increased perihilar markings, hyperinflation, oedema and evidence of infection. Other complications associated with asthma, such as pneumothorax or pneumomediastinum were not found. Oedema and evidence of infection were considered to be 'significant' abnormalities as opposed to those radiographical changes which may be expected in acute asthma, such as hyperinflation and increased perihilar markings.

Several factors influenced the decision to perform chest radiography. These included the clinical assessment of the patient, (those clinically judged to be severe are more likely to have chest radiography), the time of day or night and the day of week (the casualty officer is less likely to order chest radiography at night and at weekends when radiographers have to be brought in) as well as the medical experience of the examining doctors (less experienced doctors may order more chest radiographs for fear of missing significant pathology). The large number of patients studied make these factors unlikely to affect the findings of this study.

RESULTS

Six hundred and ninety-five patients presented with acute asthma. Almost half were under 16 years of age (Table 1). One hundred and thirty-five chest radiographs were performed, representing 19% of patients included in the trial.

The proportion of normal radiographs was comparable in both adults and children (82% and 75% respectively). The proportion of significantly abnormal radiographs was also similar (13% compared with 15% respectively), although there were more abnormalities consistent with uncomplicated asthma in children (10%) than in adults (5%).

One death occurred in a 36-year-old man while in the A&E department. His chest radiograph on presentation revealed hyperinflated lungs only. Autopsy

Table 1. Analysis by age.

	Adults	Children	Total
Total number of asthmatics	349	346	695
Total number of chest radiographs	76	59	135
Normal radiographs	62 (82%)	44 (75%)	106 (79%)
Radiographs with significant abnormalities	10 (13%)	9 (15%)	19 (14%)
Radiographs with minor abnormalities	4 (5%)	6 (10%)	10 (7%)

Table 2. Analysis by radiographic abnormality.

	Adults	Children	Total
Increased perihilar markings	—	2	2
Hyperinflation	4	5	9
Oedema	3	—	3
Evidence of infection	8	9	17
Total number of abnormalities	15	16	31

(29 abnormal radiographs revealed 31 abnormalities)

revealed atelectasis of both lower lobes and thick mucus plugs in both main bronchi. There were emphysematous bullae present on the apex of both lungs, with an area of haemorrhage in the centre of the bullus on the left, indicating possible rupture.

The most commonly reported abnormalities (Table 2) were evidence of infection (reported in over half of the total number), and hyperinflation (in nearly one third). No pneumothoraces or pneumomediastina were reported.

A large number of patients (560) were not offered chest radiography. Although it is theoretically possible that some of these patients had pathology which was missed clinically, it is unlikely to have been significant, since 80% of radiographs were normal, and these would have been carried out in those patients judged to be clinically more severe.

DISCUSSION

Previous studies have highlighted the inadequacy of clinical examination and the importance of quantitative measurement in assessing response to treatment of acute asthma (Gershel *et al.*, 1983; Zieverink *et al.*, 1982). In one study (Reed *et al.*,

1985), the peak expiratory flow rate (PEFR) was measured in only 11% of patients presenting with acute asthma, even though this measurement is well recognized as a good indicator of both the severity of the attack and its response to treatment.

The proportion of normal radiographs obtained in other studies varies from 55% (Findlay & Sahn, 1981) to 94% (Gershel *et al.*, 1983), compared with 79% in this study. This wide variation may be due to differences in the diagnostic criteria for hyperinflation (Findlay & Sahn, 1981).

Pneumothorax complicating acute asthma is uncommon (0.15% in one study (Burke, 1979)), and no cases were reported in this study of 135 radiographs. Therefore, chest radiography solely to exclude this condition is unwarranted, unless there is clinical evidence to support the diagnosis.

On the other hand, conditions which require specific therapy and predispose to acute asthma (e.g. infections), are sufficiently common to necessitate chest radiography in all patients in whom there is clinical evidence of the condition, or in those who do not respond rapidly to initial treatment (Burke 1979).

Clinical improvement must be monitored by careful examination of the patient. This should include pulse and blood pressure (in particular, the presence or absence of pulsus paradoxus), assessment of air entry (absence of breath sounds being an ominous sign), and PEFR measurements, both before and after treatment.

Only if there is little or no improvement after initial treatment with nebulized bronchodilator, should chest radiography be carried out and consideration given to further treatment and the need for admission.

The indication for chest radiography in the acute asthmatic depends on many variables which may not be clearly defined. Previous studies have given conflicting advice (Petheram *et al.*, 1981; Findlay & Sahn, 1981).

This study suggests that chest radiography may be useful in the management of acute asthma, but only after careful clinical evaluation, which must include PEFR measurements, both before and after treatment, to assess the initial severity of the condition and its response to therapy.

In patients who respond well to initial treatment, the value of chest radiography is questionable.

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