A 20-year-old woman was admitted to the intensive care unit following resuscitation from respiratory arrest associated with acute severe asthma. Examination of the chest revealed marked wheezing with equal intensity of breath sounds bilaterally. She was mechanically ventilated and given intravenous aminophylline, salbutamol and hydrocortisone, as well as nebulized salbutamol. Her inspiratory airway pressure was in excess of 65 cm H₂O. The first blood gas analysis showed: PaO₂, 148 mm Hg; PaCO₂, 39 mmHg (FiO₂ = 0.4). The chest radiograph (Fig 1) showed hyperinflation of the lungs. Three hours after admission, the patient became cyanotic and hypotensive. Diminished movement of the right side of the chest was noted and breath sounds over the right lung were absent. The PaO₂ was 35 mmHg and the PaCO₂ was 42 mmHg (FiO₂ = 0.9). Another chest film was obtained (Fig 2) and subsequently an intercostal drain was inserted into the right pleural space. A small amount of air was noted to bubble through the underwater drain, the water level of which moved adequately with respiration. The patient remained cyanotic with absent breath sounds over the right lung. A diagnostic procedure was performed.

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Diagnosis: Right sided pneumothorax associated with collapse of the homolateral lung due to mucous plugging of the right main bronchus

Fiberoptic bronchoscopic examination revealed a large amount of tenacious mucoid secretions completely obstructing the right main bronchus and easily removable through the suction channel. The patient's condition improved steadily. Following re-expansion of the lung, persistent bubbling of air through the intercostal drain was noted, indicative of a bronchopleural fistula. This closed after six days, the chest film at this time showing full expansion of the right lung.

Early diagnosis of the combination of pneumothorax with atelectasis of the homolateral lung may be lifesaving. While the radiologic signs of the pneumothorax were obvious (Fig 2), the shift of the heart and mediastinum toward the side of the pneumothorax, the elevation of the homolateral hemidiaphragm and the increased radiographic density of the collapsed lung suggested associated bronchial obstruction.¹

Pulmonary collapse due to pneumothorax is not associated with a notable increase in the radiographic density of the lung until the projected area is about one-tenth that at total lung capacity.² An enlarging pneumothorax progressively diminishes both the blood and air content of the collapsing lung, the ratio of air to blood therefore remaining relatively constant.³ In addition, the pleural air anterior and posterior to the collapsed lung contributes to its relative lack of radiographic density.³ In the case of intrabronchial obstruction, reabsorption of air distal to the site of obstruction results in the assumption by the lung of radiographic density more compatible with that of fluid.¹

Barotrauma is a common complication of mechanical ventilation, especially in patients with noncompliant lungs or severely obstructed airways in whom peak inspiratory pressures often exceed 40 cm H₂O.⁴ Pneumothorax appears to be caused by alveolar rupture associated with high intra-alveolar pressure. Air tracks to the mediastinum by the interstitial route and may rupture through the mediastinal pleura as pressures rise within the mediastinum.⁵ Fatal pneumothorax has been reported in mechanically ventilated asthmatic patients.⁴

Extensive mucous plugging of both large and small bronchi is a significant complicating factor in severe asthma and may be important in the pathogenesis of arterial hypoxemia, especially in fatal cases.⁵ Widespread mucous occlusion of the airways may develop with alarming rapidity. Bronchoscopic removal of mucous secretions has therefore been advocated in acute severe asthma and is almost certainly appropriate in selected cases, especially in the presence of atelectasis.⁴

Pulmonary collapse due to intrabronchial obstruction associated with pneumothorax, as occurred in our case, will clearly not respond to measures aimed solely at the evacuation of air from the pleural cavity. Careful analysis of the chest roentgenogram is necessary if appropriate therapeutic measures are to be instituted.

References
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