



## AN UNUSUAL CASE

## NEAR-FATAL ASPHYXIATION IN SAWDUST — AN UNUSUAL TRACHEOBRONCHIAL FOREIGN BODY

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Unless rapidly relieved, complete airway obstruction is uniformly fatal. Emergency medicine protocols emphasise the need for rapid relief of airway obstruction before any other lifesaving measures are begun.<sup>1</sup> We present a case of severe and total airway obstruction where relief of obstruction was only obtained after some time, but the patient survived. We present the case to emphasise the importance of basic life support manoeuvres in sustaining life until definitive treatment is initiated, even when the outcome appears hopeless.

### CASE REPORT

A previously healthy 20-year-old man fell into a sawdust storage bin. These bins are filled with sawdust and wood shavings produced in the milling of creosote-treated timber and raw lumber. The 3-metre deep bins are inspected through a hatch in the top and are emptied via a chute at the bottom. The worker was working on the surface of the sawdust when the chute at the bottom was opened. He fell into the sawdust and disappeared from sight. He was located by workmates who pushed poles through the sawdust until they located his body. It was at least 5 minutes before he could be pulled out of the bin. He appeared lifeless, but cardiopulmonary resuscitation (CPR) was commenced and he was transferred to the nearest local hospital.

On arrival he was unconscious, with no respiratory effort, but a pulse was palpable. An endotracheal tube was passed, but ventilation with a bag ventilator was very difficult because of extremely high inspiratory pressures. It proved impossible to inflate his lungs adequately, but attempts to ventilate him were

continued using high inspiratory oxygen concentrations. He was transferred to a regional emergency unit by helicopter. Before transfer a large endotracheal tube was passed, but ventilation again proved impossible. During transfer, a pressure limited ventilator was used, but inspiratory pressures greater than 120 mmHg produced no perceptible expansion of the chest. On arrival in the emergency unit he was unconscious, with reactive pupils, but in sinus rhythm. He had a profound respiratory acidosis, with a pH of 6.88 and an arterial carbon dioxide pressure (PaCO<sub>2</sub>) of 20 kPa and an arterial oxygen pressure (PaO<sub>2</sub>) of 16 kPa. It was impossible to ventilate him effectively past the tracheobronchial obstruction. A chest radiograph (Fig. 1) revealed air trapping, but was otherwise normal. He was haemodynamically stable. Emergency rigid laryngoscopy revealed debris in the mouth and oropharynx. A rigid bronchoscope was introduced. There was a solid impaction of shavings and sawdust from below the vocal cords down both main bronchi, and all segmental orifices contained debris. Using a combination of forceps extraction and suction and concentrating on the bronchus likely to be least obstructed (left main), partial clearance and satisfactory jet ventilation to the left side were achieved after 7 minutes. A total mass of 80 g of foreign material was removed from the airways. A sample of the wood shavings is illustrated in Fig. 2.

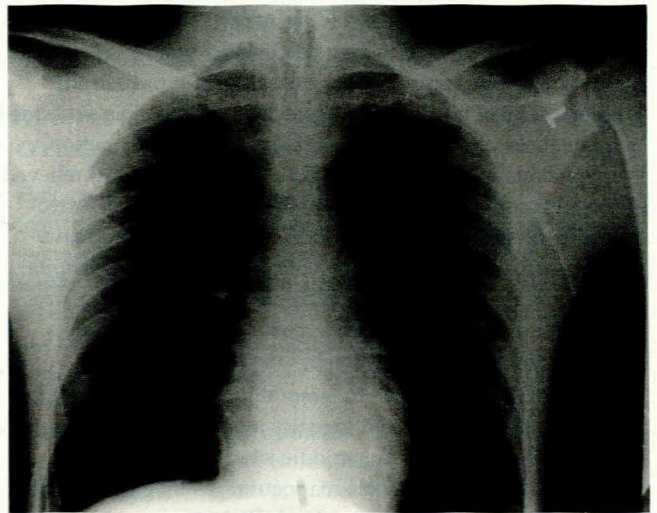


Fig. 1. Chest radiograph on admission showing air trapping.

Thereafter, each segmental orifice was thoroughly cleared of all foreign material using forceps, suction and low-volume saline lavage. The patient was transferred to intensive care for ventilation and observation. Ventilatory parameters and the results of blood gas analysis improved rapidly. A postoperative chest radiograph showed resolution of the air trapping, with minor or sub-segmental basal atelectasis. He was extubated the following morning after flexible fibre-optic bronchoscopy did not reveal any residual foreign material. Neurological examination showed no evidence of cerebral injury. He was discharged 4 days later, and returned to full employment 2 weeks thereafter. He is receiving counselling for post-traumatic stress disorder.

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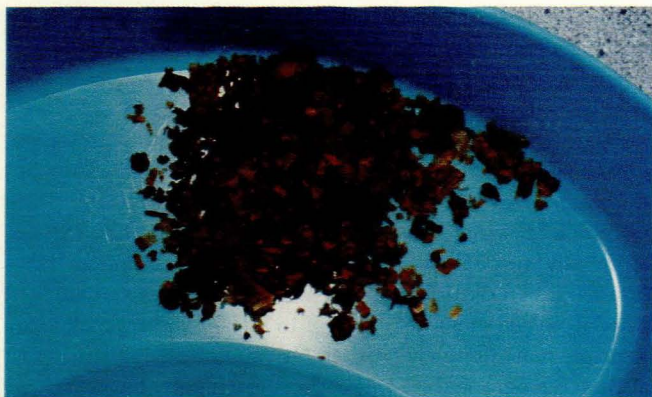


Fig. 2. Wood shavings removed at bronchoscopy.

## DISCUSSION

This patient survived despite clinically total obstruction of the upper airways with sawdust. Survival must be due to the fact that basic life support manoeuvres, although seemingly ineffective, allowed sufficient oxygenation to sustain life. The inadequacy of ventilation was evidenced by the severe respiratory acidosis, but arterial PaO<sub>2</sub> and arterial oxygen saturations remained adequate. The hypoxia induced by hypoventilation is often overshadowed by the associated hypercarbia and acidosis, and is easily corrected by supplemental oxygen to increase alveolar oxygen levels.<sup>2</sup> There was no metabolic component to the acidosis, which, in the presence of a PaO<sub>2</sub> of 16 kPa, suggested that its origin was due to inadequate ventilation, in spite of adequate oxygenation. What is remarkable is that this situation persisted until relieved at bronchoscopy. During this time the patient was extricated from the pit, transferred to the local hospital, intubated and resuscitated, and transferred by helicopter to another hospital for ongoing resuscitation. It is possible that the different sizes of wood particles, varying from sawdust to wood shavings, allowed some oxygen diffusion to take place.

Consideration was given to femoral bypass support, but the urgency of the situation and logistics involved prevented this. Gradual disimpaction with periodic jet insufflation was deemed to be the appropriate manoeuvre, as long as arterial oxygen saturations were maintained. Disimpaction in this situation would not have been possible with flexible endoscopy. In cases of a foreign body causing asphyxia, rigid bronchoscopy is the treatment of choice.<sup>3</sup> Life-threatening partial airway obstruction has been treated successfully with fibre-optic bronchoscopy, but treatment takes a long time and rigid bronchoscopy is preferred.<sup>4</sup> Debris was pulled through the rigid bronchoscope with a broad-beaked forceps until visibility was obscured. The bronchoscope was then retracted and replaced with another clean instrument, while the original one was flushed clear under running water. Bronchial lavage as a technique for removal of fine powder in the airway is superficially attractive, but has the disadvantage of potentially causing further distribution of foreign material into more distant airways. In addition, it may worsen hypoxia.<sup>5</sup>

Material aspirated into the distal airway is more likely to be found deposited in the right side due to the relatively acute angulation of the origin of the left main bronchus. It was therefore theorised that the airway obstruction would be less severe on the left side. Accordingly an attempt was made to open the left main bronchus first, and having secured that airway to proceed to clear the rest of the lungs. Apart from the immediate mechanical effects of airway obstruction, this patient did not suffer any of the other possible complications. Alveolar damage and atelectasis was minor and resolved with physiotherapy. Pulmonary oedema and infection did not occur and may have been prevented by elective ventilation and vigorous physiotherapy.

Workers chronically exposed to wood dust have an increased incidence of respiratory symptoms.<sup>6</sup> Wood dust is known to be associated with severe respiratory diseases, including extrinsic allergic alveolitis, cryptogenic fibrosing alveolitis, chronic bronchitis, and occupational asthma.<sup>7,8</sup> Extrinsic allergic alveolitis has been described in sawmill workers, with a prevalence of 5 - 10%, and is believed to be due to the combined effects of inhalation of fungal spores and dust particles.<sup>9-11</sup> It is not known whether a single episode of massive sawdust inhalation will result in interstitial lung disease. Lung function and radiological appearances have been documented in this case in order to follow up long-term effects of this massive sawdust inhalation.

In describing this case of massive aspiration and airway obstruction as a result of sawdust inhalation we wish to make the following points: (i) basic and advanced life-support protocols should continue, despite clinically ineffective ventilation, until definitive treatment is available; (ii) arterial oxygen saturation should be taken as a criterion for adequate resuscitation; (iii) when faced with a totally obstructed airway of this nature, an attempt should be made to open the left main bronchus first, since this might be less obstructed than the right side; and (iv) facilities should be available for ventilation post procedure to prevent postoperative hypoxia and to minimise cerebral hypoxic complications.

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