

lung fibrosis due to Thorotrast despite the many thousands of patients injected with it.^{2,3,9} The type of injection (thoracic fistulography), however, appears to have been rare. Among 168 patients described by Boyd *et al*³ who received Thorotrast, 141 had intra-arterial injections and 27 cerebral ventricular or sub-arachnoid injections.

Particles were found in the liver and spleen of our patient and microscopy of the lung tissue suggested transendothelial passage. Probably thorium particles were resorbed by lymphatics from the tissue around the fistulas and passed into the bloodstream. The presence of thorium particles in the blood vessel walls suggests that this "embolisation" process was continuing at the time of lung biopsy, which is consistent with the episodes of pulmonary oedema that characterised our patient's illness. It is also possible that thoracic lymphatic drainage was impaired by adhesions between the parietal and visceral pleura, and by obstruction due to thorium induced fibrosis¹³ in thoracic lymph nodes, thus reducing the clearance of lung particles and increasing their retention in the interstitium of the lung.

We conclude that lung fibrosis should be considered as a late complication of thoracic fistulography with Thorotrast.

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Adult respiratory distress syndrome after limited resection of adenocarcinoma of the lung

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Abstract

Two cases of the adult respiratory distress syndrome developed after limited resection for lung carcinoma. No other known precipitants were evident. The adult respiratory distress syndrome is a clinical expression of acute lung injury¹ that may arise from various insults and include air and blood borne factors.² Tumour related blood borne factors may have contributed to lung injury in these cases.

Case reports

CASE 1

A 71 year old woman with a history of obstructive airways disease underwent resec-

tion of a mass in the right lung. Preoperative pulmonary function tests showed a one second forced expiratory volume (FEV₁) of 0.96 litres (60% predicted) and a forced vital capacity (FVC) of 1.62 l (70% predicted). When she was breathing air her pH was 7.40, arterial carbon dioxide tension (Paco₂) 4.0 kPa, and arterial oxygen tension (Pao₂) 8.5 kPa. No evidence of mediastinal disease was seen on a chest computed tomogram or at mediastinoscopy. Right upper and middle lobectomies were performed. She was extubated without difficulty two days later. On the third post-operative day she developed mild dyspnoea. This rapidly progressed in severity and diffuse bilateral alveolar infiltrates were noted on her chest radiograph.

Her temperature was 38°C and white blood cell count $12.2 \times 10^9/l$ (90% segmented forms, 4% lymphocytes, 3% band forms, and 3% monocytes). Arterial blood gas analysis while she breathed oxygen (fractional inspired oxygen (Fio₂) 60%) showed: pH 7.40, Paco₂ 5.3 kPa, and Pao₂ 4.9 kPa. She was intubated; urine, blood, and sputum were cultured; and empirical treatment with gentamicin and mezlocillin was started. Pulmonary capillary wedge pressure was 8 mm Hg and cardiac output was 5.90 l/min. Bronchoscopy showed scanty mucus in the left lower lobe bronchus and an intact anastomotic site. She did not respond to treatment and died on the seventh postoperative day. At necropsy the lung showed changes consistent with the adult respiratory distress syndrome with no

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evidence of tumour or of systemic or local infection. All cultures were negative.

CASE 2

A 50 year old woman with systemic sclerosis underwent sleeve lobectomy of the right upper lobe for a well differentiated adenocarcinoma. Her preoperative assessment showed no metastatic disease; her FEV₁ was 90% and FVC 86% predicted. She was a heavy smoker (two packs a day for over 20 years), and had a history of alcohol misuse in the distant past. On the second postoperative day, after extubation, arterial blood gas analysis showed: pH 7.36, PaCO₂ 5.1 kPa, and PaO₂ 11.6 kPa while she was breathing oxygen (FIO₂ 0.3). The next day she developed rapidly progressive respiratory failure requiring reintubation. Pulmonary capillary wedge pressure was 10 mm Hg and cardiac output 5.97 l/min. A chest radiograph showed diffuse alveolar infiltrates and right lower lobe collapse. A small amount of mucus was cleared at bronchoscopy. No cultures, including those for *Legionella pneumophila* and mycobacteria, showed any growth. Empirical treatment was started with gentamicin and mezlocillin, and later erythromycin was added. A positive end expiratory pressure of 5 cm and an FIO₂ of 0.5 were needed to maintain a PaO₂ of 8.7 kPa. She recovered after a long stay in the intensive care unit.

Discussion

The development of the adult respiratory distress syndrome in various clinical settings has led to the idea that it represents a final common expression of diffuse lung injury.¹ For most precipitants injury can be attributed to exposure to inhaled or blood borne factors.² Our cases differ in that the adult respiratory distress syndrome developed in the absence of detectable systemic illness. Both cases followed routine thoracotomy for tumour resection and were uncomplicated by infection, haemodynamic disturbances, or toxic exposure.

The adult respiratory distress syndrome has been reported after systemic chemotherapy³ and limited thoracic radiotherapy for pulmonary malignancy,⁴ and in association with lymphangitic spread of malignancy.^{5,6} Faber *et al* reviewed 101 patients who underwent sleeve lobectomy and reported one case of the adult respiratory distress syndrome,⁷ but did not detail the surrounding events. Neither patient reported here had received chemotherapy or

radiotherapy and no malignant lymphangitic spread was found at operation in either case or at necropsy in the first case. We cannot completely exclude an untoward "drug" reaction to an anaesthetic agent or to an antibiotic or other routine medication; but the absence of other clinical indicators argues against the latter type of reaction and anaesthetic agents as a cause of the adult respiratory distress syndrome have not been reported before.

There may be an aetiological association between the adult respiratory distress syndrome and mediators such as cachectin (tumour necrosis factor), interleukins, leukotriene B₄, interferons, and prostaglandins.² These factors are released by macrophages or lymphocytes, or both, frequently as a result of their interaction; and both cell types play a part in the host response to malignancy.⁸ Tumour necrosis factor is a mediator of tissue injury⁹ and could be produced by the cell mediated immune response to malignancy.¹⁰ Release of tumour necrosis factor (and other tumour induced immune response mediators) by tumour manipulation at surgery may have played a part in the development of the adult respiratory distress syndrome in our patients. We hope that these cases will alert others to the possibility of the adult respiratory distress syndrome after thoracotomy for tumour resection and encourage further investigation of its pathogenesis.

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