Pulmonary alveolar proteinosis treatment by whole-lung lavage

Pulmonary alveolar proteinosis (PAP) is a rare condition which is characterised by the abnormal accumulation of proteinaceous material in the alveolar spaces, with resulting impairment in oxygen exchange across the involved alveoli. The diagnosis of PAP can be established by the classic 'milky' effluent bronchoalveolar lavage fluid (BALF). The current effective treatment for PAP is whole-lung lavage (WLL). We offer one case of PAP with apparent presentations and the clinical course. This report provides some information about the diagnosis and treatment of PAP (see PAP video online).

A 39-year-old man, an ex-smoker, was brought to our respiratory department due to dry cough and progressive exertional dyspnoea for 7 months. He had been an antimonial worker for 6 years. Physical examination was significant for perioral cyanosis, mild clubbing and diffuse rales. Arterial blood gas analysis on room air showed oxygen partial pressure (PaO_2) 71.5 mm Hg. The serum lactate dehydrogenase level was elevated at 301 U/l (normal range: 135–225 U/l). The pulmonary function test exhibited moderate restriction and severe decrement in diffusing capacity. The total lung capacity was 3.43 l (60.1% pred) and diffusing capacity of lung for carbon monoxide (DLco) was 3.32 mmol/min/kPa (36.5% pred). Serial chest high resolution computerised tomography (HRCT) revealed progressive bilateral ground glass opacities consistent with 'crazy paving' configuration, extending but sparing some areas (figure 1A,B). The bronchoscopy showed normal endobronchial anatomy. Histological examination of the transbronchial lung biopsy showed chronic inflammation, which was negative for PAP. But the BALF revealed a turbid fluid. BALF light microscopy revealed periodic acid-schiff positive amorphous

Learning points

- Pulmonary alveolar proteinosis (PAP) is a rare condition, which can be diagnosed by the characteristic chest HRCT appearances and classic 'milky' bronchoalveolar lavage fluid findings.
- Whole-lung lavage can be considered to be a safe and effective treatment for PAP.

proteinaceous material. Electron microscopy showed intra-alveolar debris containing lamellar bodies (figure 2A–D). The definitive diagnosis of PAP was made upon the pathognomonic HRCT appearance and BALF examination.

After comprehensive consultation with specialists and the family, therapeutic WLL was performed first on the left lung. Under general anaesthesia, the two lungs were separated by double-lumen endobronchial tube. The left lung was flooded with 37°C warm saline, with manual chest percussion.¹ A total of 10–15 cycles and about 15 l saline was used for each lung. The right lung was lavaged 1 week later. The patient was kept haemodynamically stable and there was no hypoxaemia during the lavage procedure; oxygen saturation can rise up to 100% sometimes. After both lungs lavage, the PaO_2 on room air increased up to 86.5 mm Hg, the DLco improved to 53.6% pred and HRCT findings showed apparent clearing of the lungs (figure 1C,D).

Following discharge, this patient was free of respiratory symptoms and there was no indication for further lavage. In view of the rare occurrence, long-term follow-up is necessary.²

The aetiology and pathogenesis of PAP remain unclear. The suspected causes are associated with occupational exposures, which may result in impaired alveolar macrophage function and surfactant clearance.¹ Progressive dyspnoea and dry cough

Figure 1 Changes in serial chest HRCT image features. Images (A, B) during 8 months without any therapy showed a strong worsening of diffuse ground-glass opacification and interlobular septa thickening, a characteristic 'crazy paving'. Image C after left whole-lung lavage (WLL) and D after right WLL. Note the marked clearing of the infiltrates in both lungs after lavage.

Figure 2 Lung histopathology, bronchoalveolar lavage fluid (BALF) appearance and cytology, and ultrastructure. (A). Transbronchial biopsy appeared as chronic inflammation ($\times 100$). (B). Cytospin of BALF showed alveolar macrophages containing abundant PAS-positive material in a background of PAS-positive granular lipoproteinaceous material ($\times 400$). (C). BALF appearance from whole-lung lavage (up) and bronchoscopic lavage (lower). Note the 'milky' effluent. (D). Ultrastructure of BALF showing cellular debris and concentrically laminated phospholipid lamellar bodies ($\times 20\,000$). PAS, periodic acid-schiff stain.

are common symptoms. The diagnosis can be established by the classic milky BALF, and lung biopsy is not the diagnostic gold standard. WLL is the current mainstay of treatment for PAP. The minority can be spontaneous cure, but there are no simple biochemical parameters to predict the prognosis (see supplementary material online).

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