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CASE REPORT

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Effectiveness of Bronchoalveolar Lavage in Diagnosis and Evolution of Coal Worker's Pneumoconiosis — Case Report

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ABSTRACT

Introduction: Our article offers a deeper insight into an important occupational disease — coal workers' pneumoconiosis, with all its diagnosis difficulties, treatment steps, and strategies. **Case presentation:** A 33-year-old male patient, smoker, with 16 years of outside exposure to coal dust, presents shortness of breath and cough, which existed 4 months prior to presentation and progressed in time. The first chest X-ray has raised differential diagnosis difficulties with miliary tuberculosis, despite the patient's exposure history. All the investigation procedures performed afterwards (clinical examination, fibrobronchoscopy with microlavage and cytological examination, chest computed tomography, and routine laboratory investigations) were not enough to provide a certain and final diagnosis. Exploratory thoracotomy with lung biopsy was needed, and its findings started to sustain the professional disease diagnosis that had already taken shape. To exclude a disease which can evolve hand in hand, but also as a therapeutic application, we decided that a whole lung lavage was needed. **Conclusion:** Although whole lung lavage could not be accomplished completely, the performed right middle lobe bronchoalveolar lavage had a huge impact, not only on the patient's symptomatology, but also on the paraclinical results.

Keywords: coal workers' pneumoconiosis, bronchoalveolar lavage, inorganic dust

INTRODUCTION

Coal worker's pneumoconiosis (CWP), also known as black lung disease, is a chronic occupational lung disease caused by long-term inhaling of dust from coal or graphite.[1,2] The inhaled dust resides in the lungs, where it progressively accumulates over time if the patient is subjected to prolonged exposure, because the lungs are unable to excrete the dust from the alveoli, leading to inflammation, fibrosis, and in more severe cases, necrosis.[1] Two types of CWP have been described, the simple and massive form. Simple CWP is characterized by diffuse nodular opacities,[3] it is usually asymptomatic, but may develop into progressive massive fibrosis (appears as large masses of dense fibrosis),[4] which often leads to

respiratory insufficiency and secondary cardiac complications.[5]

Symptomatically, it is described by the presence shortness of breath, chronic cough, and black sputum, developing slowly towards clinically important respiratory dysfunction, pulmonary hypertension, and heart problems.[1,5]

Bronchoalveolar lavage (BAL) recovers dust, cells, and proteins present on the epithelial surface of the lower respiratory tract, which is why it should be divided into samples for cytological, hematological, biochemical, and microbiological examinations.[6] This method has been used to describe inflammatory and immune responses of the lower respiratory tract in destructive, infectious, neoplastic, and interstitial lung disease, in our case in CWP.[7] The presence of inflammatory cells and enzymes involved in collagen degradation may lead to the advancement of more chronic modifications, secondary to exposure to harmful dusts.[8] Besides all these, BAL is also considered a therapeutic procedure,[9] having the capability to remove non-adherent cells and lung lining fluid from the mucosal surface, and also to analyze toxin-induced changes in pulmonary epithelial integrity, cellular damage, and surface release/accumulation of cellular inflammatory citokines.[10] Whole lung lavage (WLL) is considered to be an effective addition to etiological therapies in pneumoconiosis, which can remove the dust accumulations and dust cells in the lungs and also several fibrosis-related active substances. WLL can remove inorganic or organic dust and macrophages from the alveoli and also from the lung interstitial tissue, as it was demonstrated before it can improve not just the patient's clinical symptoms, but it also delays the development of pneumoconiosis.[11]

CASE PRESENTATION

We present the case of a 33-year-old male patient, smoker, coal worker (coal burner — an outside process) for 16 years, without any significant personal pathological history, who appeared at the general practitioner's office in early August 2016 with productive cough that existed 4 months prior to presentation.

The chest radiograph suggested the presence of miliary tuberculosis for which he was guided for further investigations to the Regional Pneumology Hospital. The routine laboratory investigation results did not show significant pathological modifications, except an increased erythrocyte sedimentation rate (ESR = 50 mm/h).

In August 2016, fibrobronchoscopy was performed, which revealed hyperemic mucous membranes in the right and left bronchi, with minimal mucus secretion. The cytologic evaluation from the microlavage fluid acquired during the procedure came back negative for tumor cells, and it was also negative for Ziehl-Neelsen staining.

Native and contrast chest computed tomography (CT) was performed in the same month, which showed irregular nodular images with reduced dimensions and perilymphatic distribution in each bronchopulmonary segment on both sides. Thickened interalveolar septums in the apical area were also described. The final results of the CT imaging were established as being inconclusive (Figure 1 and Figure 2).

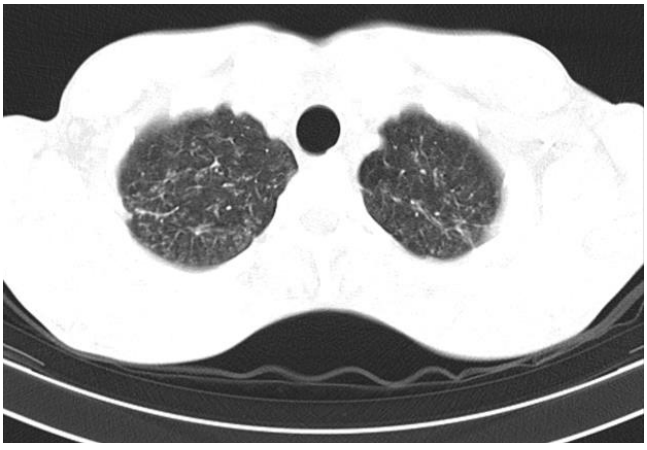

FIGURE 1. Section of upper lobe chest CT scan: interlobular and interalveolar septum thickening

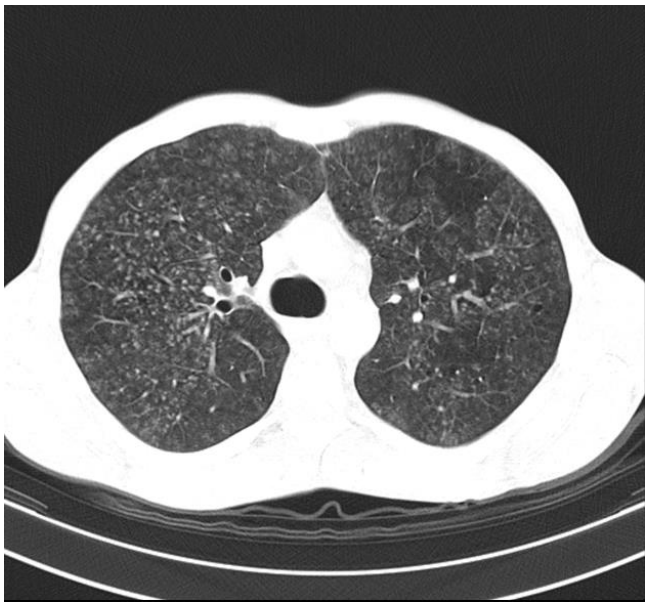

FIGURE 2. Section of chest CT scan many of regular and irregular small opacities dispersed in both pulmonary areas

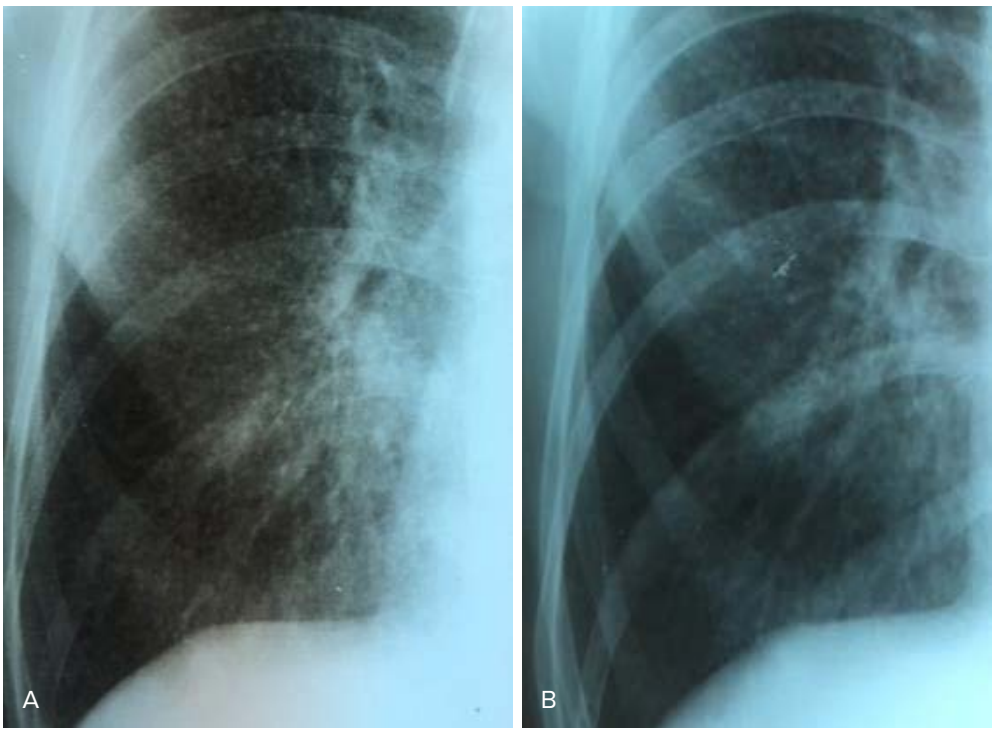

FIGURE 3. **A** – right middle lobe projection with large number of regular and irregular opacities before BAL; **B** – the same lung area in 6 weeks after the BAL

The inconclusiveness of the CT results led to performing an exploratory thoracotomy with lung biopsy. The histopathological result revealed peribronchiolar, alveolar, and interstitial macrophages with black pigment inclusions, suggestive for CWP. There was no local emphysema detected.

Given the patient's personal history of professional exposure, he was hospitalized at the Occupational Medicine Department for further investigations and therapy.

Given the presence of extensive bilateral lesions and their density, as well as the patient's age, an extensive bronchoalveolar lavage was indicated, on segments, both as a therapeutic measure and for diagnostic purposes.

In December 2016, right middle lobe bronchoalveolar lavage was performed, with the following results: the cytological examination showed macrophages 84.6%; lymphocytes 8.6%; elevated granulocytes 6.4% (neutrophils 5.0% and eosinophils 1.4%); mastocytes 0.4%; negative for tumor cells, negative for Ziehl-Neelsen staining. Coniophages, but also asbestos bodies (AB), pseudoasbestos bodies, and rare siderophages were present in the lavage fluid, thus revealing a definitive diagnosis: massive exposure to mixed dust.

The chest radiograph was repeated 6 weeks after this procedure, showing a satisfying result: decreased density of the micronodules (Figure 3).

After the first clinical evaluation and after each interventional procedure, empiric antibiotic therapy had been administered, but without any significant modifications in clinical or paraclinical aspects.

The patient agreed to the publication of his data, and the institution where the patient had been admitted, approved the publication of the case.

DISCUSSION

From all the described CWP types, the patient presented the simple form of pneumoconiosis, but the danger of a massive pulmonary fibrosis was still present.

In the case presented above, a bronchoalveolar lavage was the procedure of choice, since it is not just a diagnostic method, but it has also been used for therapeutic applications.[9,12]

In the presented case, the important factor for a certain diagnosis was not just the presence of coniophages, but also the asbestos bodies which were identified during the BAL. Their presence can be related with the septum thickening in the superior pulmonary lobe, but this is not characteristic for CWP; similarly, siderophages appear specifically after iron exposure. The importance of the asbestos bodies is given by their carcinogenic properties, which require precise and regular check-ups.

The goal-oriented medical management in this case placed emphasis on the improvement of the patient's quality of health and well-being. The patient did not only present symptomatic improvement, but the chest radiographs also showed a major improvement: the first X-ray in November 2016 showed diffuse nodular opacities that were first described as miliary tuberculosis; 6 weeks after the procedure, in January 2017, the X-ray showed decreased density of the opacities. As a conclusion, we can declare that bronchoalveolar lavage has proved to be a therapeutic procedure in this case.

Particularity of the case

One of the most important particularities of the presented case is the patient's age. Studies showed that most of the patients with CWP are 40 years old or older,13 in our case the patient was only 33 years old.

Another particularity is the fact that the subject is not an underground coal miner; he worked on the surface, where ventilation conditions are significantly better then in a closed, underground environment with dangerous conditions and no natural ventilation provided.

CONCLUSIONS

Young age and significantly better working conditions did not prevent the patient from developing coal worker's pneumoconiosis after 16 years of exposure, which presented with sudden onset of symptomatology. In the presented case, despite the encountered difficulties in performing whole lung lavage, the patient presented clinical and radiological improvement of CWP even after a simple bronchoalveolar lavage.

CONFLICTS OF INTEREST

Nothing to declare.

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