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Whole Lung Lavage In a Patient With Pulmonery Alveolary Proteinosis

Pulmoner Alveoler Proteinosis'li Bir Hastada Tüm Akciğer Lavajı

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Abstract

42 year-old female with 4 months history of dyspnea was referred to our hospital for further examination with bilateral alveolar infiltration on chest X-Ray. For differential diagnosis, a bronchoalveolar lavage (BAL) was performed. The BAL fluid had a milky appearance and prepared smears showed proteinous material which contains periodic acid-Schiff (PAS) positive and diastase-PAS resistant globules. The patient was diagnosed as pulmonary alveolar proteinosis (PAP). Nine consecutive BAL was performed by a team including an anesthesiologist, a pulmonologist, and a thoracic surgeon. In this case report, we aimed to share our experiences on sequential whole lung lavage in a patient with PAP.

Keywords: Pulmonary alveolar proteinosis, whole lung lavage.

Özet

Kırk iki yaşındaki bayan hasta, 4 aydır devam eden nefes darlığı yakınması ve akciğer radyogramında bilateral alveoler infiltrasyon görünümü nedeniyle ileri tetkik için hastanemize gönderilmişti. Göğüs hastalıkları kliniğimizde yapılan tetkiklerle alveoler görünüm yapan hastalıklar yönünden incelemeler ve bronkoalveolar lavaj (BAL) yapıldı. BAL sıvısının süt görünümünde olduğu, hazırlanan yaymalarda PAS (periodic acid-Schiff) pozitif ve d-PAS rezistan globüller içeren proteinöz materyalin görülmesi üzerine hastamız "Pulmoner alveoler proteinozis" tanısı aldı. Ardışık uygulamalar şeklinde toplam 9 kez tüm akciğer lavajı göğüs hastalıkları, anesteziyoloji ve göğüs cerrahisi doktorlarından oluşan bir ekip tarafından gerçekleştirildi. Bu olgu sunumunda, süreç içinde kazanılan deneyim ve işlem protokolünün hastamızın son durumu ile birlikte paylaşılması amaçlanmıştır.

Anahtar Kelimeler: Pulmoner alveoler proteinozis, tüm akciğer lavajı.

Introduction

Pulmonary alveolar proteinosis (PAP) is a rare lung disease with an unknown etiology that was first described by Rosen, Castseman and Liebow in 1958. In this disease, the alveoli are filled with periodic acid-Schiff (PAS) positive lipids and proteinaceous material (1,2). Macrophage dysfunction and an imbalance between the surfactant production and removal of the infiltrating material may play a role in the pathogenesis of the disease (3,4).

In most cases, the underlying etiology of PAP cannot be detected. PAP can be seen in both its congenital or secondary forms. As previously reported, secondary PAP is associated with acute silicoproteinosis, hematologic malignancies, and AIDS (5, 6). Males are affected at least twice as often as females. PAP is generally seen in patients between the ages of 20 and 50 years (1). Slowly progressive dyspnea is the presenting feature of PAP (7). Clinicians use transbronchial biopsy and bronchoalveolar lavage (BAL) to diagnose PAP. In this disease, the BAL fluid is found to be milky (5). Whole lung lavage is the only effective and proven treatment modality that provides mechanical debridement of proteins and lipids in the alveoli (8).

In this case report, we share our experiences with sequential whole lung lavage performed on a patient with PAP by a team, which included an anesthesiologist, a pulmonologist, and a thoracic surgeon.

Case Report

A 42-year-old female with dyspnea, cyanosis, and tiredness was referred to our chest disease department. She was a heavy-smoker who had smoked 20 pack/years until two months prior to the time she was applied to in our department. From her medical history, we learned that the dyspnea was slowly progressive; consequently,

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she had been unable to engage in daily activities for the prior month. The thoracic computed tomography (CT) taken four months prior to her visit to our department showed that her lungs had a ground glass appearance. With these findings, she was admitted to the hospital for further examination.

Upon examination her vital signs were stable. Her auscultation were normal except for inspiratory crackles on the inferior zone of her left lung. The systemic examination was normal except for the presence of clubbing. Her chest X-Ray showed bilateral diffuse infiltration particularly in the left lung (Figure 1). The thoracic CT showed diffuse interlobular septal thickening on both lung parenchyma and her lungs had a ground glass appearance (Figure 2).

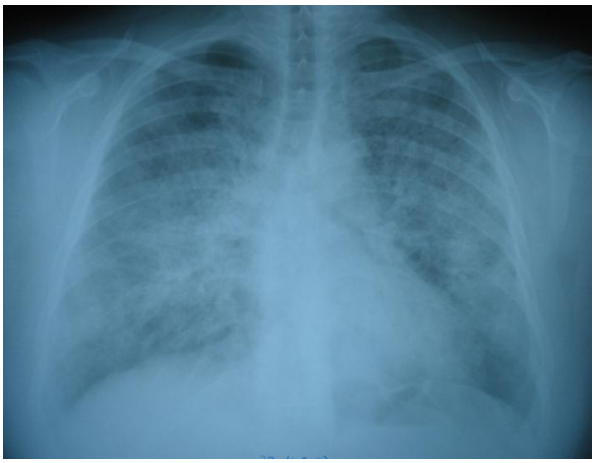

Figure 1. Chest X-Ray (at the time of diagnosis): Diffuse parenchyma aeration deficiency on both side which was more subtle on the apex and perihilar infiltrates.

The patient's first admission, blood samples, blood samples were taken and analyzed. The following results were found: WBC:14070/mm3; Hb: 14.5 g/dl; Htc: 42 g/dl; Plt: 77.000/mm3; ESR: 51 mm/1h; LDH: 302 IU/L; BUN: 12 mg/dl; Cr: 0.73 mg/dl; protein: 7.9 g/dl; Alb: 3.6 g/dl; AST: 18 IU/L; ALT: 18 U/L; Na: 140 mmol/L; K: 4.56 mmol/L; Cl: 105 mmol/L; and CRP: 1.59. The arterial blood gas results were: pH: 7.44; pCO2: 26 mmHg; pO2: 40 mmHg; HCO3: 18 mEq/L; SatO2%: 78%. The SpO2 measured by pulse oxymetry under 8-10 lt/min O2 therapy was 90%. The respiration function test results were: FVC: 1.91 L (65% of anticipated); FEV1: 1.76 L (70% of anticipated); FEV1/FVC: 92%; PEF: 5.75 L/sec (93% of anticipated); and FEF 25-75: 2.88 L/sec (84% of anticipated). A restrictive respiration dysfunction was found.

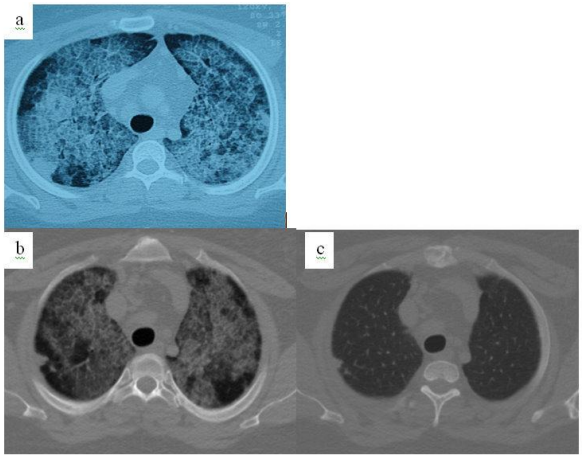

Figure 2. Thorax CT: a. Ground-glass density with significant interlobular septate on both lung paranchimes (crazy-paving configuration). b. Thorax CT after a year and consecutive 7 BAL procedure; minimal regression was determined. c. Significant regression during the last follow-up visit.

No endobrochial lesion was detected during the bronchoscopy. The BAL fluid collected from the left lung lingula was milky. Pathologic and microbiologic examinations were performed. The BAL fluid culture showed Stenotrophonas maltophilia overgrowth. We began trimetoprim-sulphametoksazol therapy, testing for antibiogram. Histopathological examination of the BAL fluid showed proteinaceous material, which contained PAS (+), diastase-PAS resistant globules, a few bronchial epithelial cells, alveolar macrophages, and neutrophils. These findings were consistent with PAP. The acid resistant bacilli (ARB) and polymerase chain reaction (PCR) were negative and the culture did not show mycobacterium overgrowth. The patient was referred to the hematology and rheumatology departments and no abnormality was detected. Primary PAP was diagnosed and whole lung lavage treatment was planned.

As part of the treatment, the patient underwent BAL under general anesthesia. Intubation was performed using a left tube with a double lumen. After successful intubation, the location of the

tube was detected using auscultation and pediatric fiberoptic bronchoscopy. When both tubes were open, 100% O2 was inhaled for 10 min. The left tube was then clamped for 5 min and a collapse of the lung was observed. One liter (1 L) of isotonic physiological serum, heated to body temperature, was given to the patient through the left main bronchus tube. Passive removal of the fluid was performed by a nelaton catheter, which was incorporated into the intubation tube through the empty bottle placed on the floor (Figure 3).

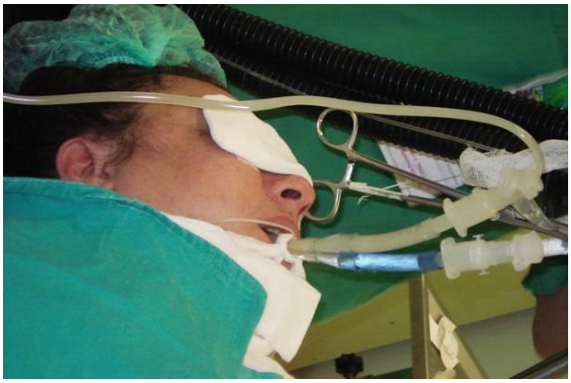

Figure 3. Passive removal of fluid which was given through endotracheal tube

In all, a total of 14 L of isotonic physiological serum were given and 13.5 L were aspirated. The aspirated fluid was initially milky and the last aspirate was clearer. Decreased precipitates in the bottle were observed as well (Figure 4).

Figure 4. Gradual decrease in density of the BAL fluid and precipitate amount in the same session (right bottle indicates the first lavage fluid and the left bottle indicates the last one).

The procedure was terminated because the O2 saturation decreased to 48% after 14 L of the isotonic physiological lavage had been administered. The first and the last aspirate samples were analyzed. The results of the first aspirated fluid analysis showed: protein: 0.9 g/dl; albumin: 227 g/dl; LDH: 1473 IU/L; total cholesterol: 25 mg/dl; and triglyceride: 25 mg/dl. Analysis results of the last aspirated fluid showed: protein: 0.1 g/dl; albumin: 2 g/dl; LDH: 26 IU/L; total cholesterol: 2 mg/dl; and triglyceride: 2 mg/dl. The patient's dyspnea decreased during the hospital follow-ups. The patient's necessity for O2 also decreased. When she was on 2 L/min O2, her arterial blood gas results showed: pH: 7.48; pCO2: 26 mmHg; pO2: 69 mmHg; HCO3: 19.6 mEq/L; and SatO2%: 95.2%. After five days of observation in the clinic, she was discharged from the hospital with an O2 concentrator for Long Term Oxygen Therapy (LTOT).

During the follow- up visit one month later, the patient reported that she was gradually feeling better and her effort capacity had increased so that she was able to climb two flights of stairs. Physical examination showed inspiratory crackles on the inferior zones of the both lungs, but was more significant on the right lobe. At room temperature air, her arterial blood results showed: pH: 7.42; pCO2: 27 mmHg; pO2: 40 mmHg; HCO3:17.8 mEq/L; and SatO2%: 77%. Her respiratory function test results were: FVC: 1.80 (62%); FEV1: 1.67 (67%); and FEV1/FVC: 93%. Due to the radiological findings and the patient's clinical status, right lung lavage was performed. In that session, 12 L of isotonic physiological serum were administered using the same method described above. A microbiologic culture of the BAL fluid showed Acinetobacter baumannii overgrowth and an antibiotic was started based on the antibiogram test results. Although the ARB and PCR were negative, atypical mycobacterium overgrowth was detected in that fluid. Therefore, the patient underwent triple antituberculosis (TB) therapy for six months. During subsequent BAL procedures no bacterial overgrowth was detected. Homogeneous density on the apical segment of the right superior lobe, which was seen on the first CT, was resolved.

During the follow-up periods, a total of nine sequential BAL (left-right-left-right-right-left-

right-left-right) procedures were performed. The administrated irrigation fluid amounts were: 9 L, 18 L, 27 L, 27 L, 24 L, 23L, and 32 L, respectively. The patient's dyspnea improved during the 12-month follow-up period at which time her O2 saturation with pulse oxymetry was found to be 98%. Her respiratory function tests results were: FVC: 2.34 L (82%); FEV1:1.86 L (76%); and FEV1/FVC: 79%. The Thoracic CT sections are displayed in Figure 2.

Discussion

PAP was first described in 1958. The pathophysiology of PAP involves the exaggerated surfactant production of type II pneumocytes and/or insufficient removal of the surfactant from the media by the alveoli macrophages (1). Primary, secondary, and congenital forms of PAP are described in the literature (9). Secondary PAP can be caused by exposure to gases (i.e., silica, aluminum, and titanium) and inorganic dust and insecticides, as well as by chronic infections, hematologic malignancies, and myeloproliferative diseases (3,4). In our case study, no gas or dust exposure was detected. At the end of the etiologic studies, and after 26 months of follow-up examinations, we could not detect the underlying cause. Therefore, primary PAP was diagnosed. Because we found a lack of microbial overgrowth during the first diagnostic examination and the sequential therapeutic BALs, we excluded secondary PAP due to an atypical mycobacterium infection.

Even though patients with PAP may sometimes be asymptomatic, they may complain about dyspnea, persistent dry cough, pleuritic chest pain, weight loss, intermittent low-grade fever and/or night sweats (4). Upon physical examination, inspiratory crackles can be detected in 20% of cases. Cyanosis and clubbing may rarely accompany the clinical picture (5). In our case study, dyspnea, cyanosis, and cough complaints were present at the initial examination. Inspiratory crackles with auscultation, especially on the left side of the lungs, and clubbing were also present. The clinical findings, which can detect most forms of interstitial lung disease, were not diagnostic; however, clinical findings play a guiding role for physiologic and radiologic studies.

Shunt develops in patients with PAP due to the accumulation of lipids and protein rich granular material in the alveoli. Eventually, a resistance to hypoxemia treatment develops (10-13). In the present case, hypoxemia, which was confirmed by laboratory findings, was present even when the patient was taking 8-10L/min O2 and her arterial blood gas pO2 was 40 mmHg.

LDH levels are high in 80% of PAP patients. After cardiac, renal, and muscle diseases have been excluded, an increase in LDH values may provide clues about the severity level of PAP (3). In our patient, the serum LDH level was 302 IU/L and cardiac, renal, or muscle pathologies were not detected. The LDH level in the whole lung lavage fluid was 1473 IU/L and that level decreased to 261 IU/L during the final procedure to remove the irrigation fluid.

Characteristic radiographic findings of PAP patients show patchy and confluent nodular infiltrations, bat-wing configuration, and areas of ground glass density (3, 4). The literature reported superior and inferior zone affinity in the lesions. A high resolution thoracic CT may show reticulonodular and ground glass density, septal thickening, and a cobblestone appearance (14). This appearance is described as "crazy-paving." In the present case study, a chest X-Ray showed bilateral diffuse infiltration, which was more prominent on the left side. The thoracic CT showed diffuse and uniform interlobular septal thickening on the lung parenchyma, a ground glass appearance, and a crazy-paving configuration.
Spontaneous remission in PAP can be observed in up to 20% of patients. Currently, the treatment for PAP is therapeutic BAL of the lungs over the course of several sessions. Sequential lavages produce a fluid color that is more clear than milky. However, this treatment is not necessary for all patients. Close follow-up of patients may sometimes be sufficient. Treatment is indicated when the following parameters are found: PaO2< 65 mmHg; PO2> 40 mmHg; shunt fraction >12%; and the presence of dyspnea with minimal effort (15). In our case, the patient's clinical status and blood gas values met the treatment indication criteria. After BAL, the patient's clinical status and her laboratory values improved significantly.

In conclusion, whole lung lavage is the most effective method and the only proven treatment modality for PAP. Whole lung lavage can be performed easily by clinicians working as a team utilizing careful preoperative management.

REFERENCES

1. Wang BM, Stern EJ, Schmidt RA, Pierson DJ. Diagnosis pulmonary alveolar proteinosis. Chest. 1997;11: 460-6.
2. Kariman K, Kylstra JA, Spock A. Pulmonary alveolar proteinosis: Prospective clinical experience in 23 patients for 15 years. Lung. 1984;162:223-31.
3. Menard KJ. Whole lung lavage in the treatment of pulmonary alveolar proteinosis. J Perianesth Nurs. 2005;20: 114-26.
4. Fraser RS, Müller NL, Colman N, Pare PD, eds. Fraser and Pare's Diagnosis of Diseases of the Chest. 4th ed. Philadelphia, Pa: W.B. Saunders; 1999:2700-8.
5. Tazi A, Soler P. Proteinose alveolaire. İn: Pneumologie, De Aubier M, Pariente R, eds. Paris, Flammarion: 1996;961-4.
6. Reyes JM, Butong PB. Association of pulmonary alveolar lipoproteinosis with mycobacterial infection. Am J Clin Pathol. 1980;74: 478-85.
7. Prakash UB, Barham SS, Carpenter HA. Pulmonary alveolar phospholipoproteinosis: Experience With 34 Cases And A Review. Mayo Clin Proc. 1987;62: 499-503.
8. Kay: Kavuru MS, Tracey L, Thomassen MJ. Pulmonary alveolar proteinosis. In: Murray JF, Nadel AJ; eds. Textbook of Respiratory Medicine. 4th ed. USA, W.B. Saunders; 2005:1716-31.
9. Hamvas A, Cole FS, deMello DE, Moxley M, Whitsett JA, Colten HR, Nogee LM. Surfactant protein B deficiency: antenatal diagnosis and prospective treatment with surfactant replacement. J Pediatr 1994; 125:356-61.
10. Persson A. Pulmonary alveolar proteinosis. In: Fishman AP(ed). Pulmonary diseases and disorders. New York, Mc Graw Hill Book Company; 1998:1225-30.
11. Seaton A, Seaton D, Leitch AG. Some less common pulmonary diseases. Crofton and Douglas. Respiratory Diseases. 4th ed. Oxford, Blackwell Scientific Publications: 1989:1043-61.
12. Wasserman K, Mason GR. Pulmonary alveolar proteinosis. In: Murrey JF, Nadel JA (eds). Textbook of Respiratory Medicine, 2th ed. Philedelphia, W.B. Saunders Company: 1994:1933-46.
13. Claypool WD, Rogers RM, Matuschak GM. Update on the clinical diagnosis, management and pathogenesis of pulmonary alveolar proteinosis. Chest. 1984; 85:550-8.
14. Gülsün M, Arıyürek M, Demirkazık FB, Fırat P. Yüksek rezolüsyonlu bilgisayarlı tomografide Arnavut kaldırımı görünümü oluşturan bronkoalveoler kanser ve pulmoner alveoler proteinozis: iki olgu sunumu. Bilgisayarlı Tomografi Bülteni: 2002;7:38-40.
15. Ulukavak Çiftçi M, Şipit T, Apaydın Z, Çoban G, Oğuz D. Pulmoner Alveoler Proteinozis. Solunum Hastalıkları. 2001;12:71-4.