

ROLE OF MULTIPLE INDUCED SPUTUM EXAMINATION IN THE DIAGNOSIS OF *PNEUMOCYSTIS CARINII* PNEUMONIA

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Abstract. We evaluated the usefulness of repeated nebulized saline induced sputum examinations among 60 HIV infected patients clinically suspected to have *Pneumocystis carinii* pneumonia (PCP). We found that the first sample was positive for 15 episodes (21.4%); the second sample was positive in 33 episodes (47.1%); the third sample was positive in 22 episodes (31.4%). Repeated nebulized saline induced sputum examination improved the yield of *Pneumocystis carinii* and enhanced the sensitivity of a positive result. This technique is simple, cost-effective, non-invasive, and reliable. We recommend the examination of multiple induced samples of nebulized saline induced sputum in all HIV infected patients with suspected PCP. This recommendation may decrease the need for invasive procedures.

INTRODUCTION

Pneumocystis carinii pneumonia (PCP) is one of the most common opportunistic infections in HIV positive patients. Approximately 50% of patients with HIV infection experience at least one bout of PCP during the course of the disease (Goodman, 1993). Patients typically present with exertional dyspnea, a non-productive cough and a fever of several days duration that is associated with the sensation of inability to take a deep breath. Chest examination is usually unremarkable; in a few cases there may be scanty end-inspiratory basal crepitations. Chest radiograph may show evidence of diffuse peri-hilar interstitial infiltrates, which in late stages may show diffuse alveolar consolidation resembling pulmonary edema. Atypical presentations may be seen in up to 20% of patients with PCP. Abnormal arterial blood gases, a drop in arterial oxygen saturation as measured by pulse oximeter during exercise, abnormal pulmonary function tests, raised serum LDH may all be corroborative evidence of PCP (Miller, 2003).

Sputum that is obtained after inhalation of an aerosol of 3% hypertonic saline improves the collection rate and yield of *Pneumocystis carinii*. Staining for cysts is done using toluidine blue, methanamine silver, Giemsa's, and immunofluorescent stains. Broncho-alveolar lavage (BAL) and transbronchial biopsy are the gold standard in the diagnosis of PCP. Recently, technetium diethylene triamine pentacetic acid (PTPA) clearance and Gallium 6% citrate scanning have been found to be helpful but their clinical usefulness is limited. We sought to evaluate the usefulness of examining repeated nebulized saline induced sputum in HIV infected patients clinically suspected of having PCP.

MATERIALS AND METHODS

We evaluated 100 episodes of PCP in 60 HIV infected patients who were diagnosed by ELISA/Western blot and the patients were under the care of infectious disease clinic of Kasturba Medical College Hospital, Mangalore, South India. During each exacerbation, a clinical examination, routine blood counts, a chest x-ray, exercise oximetry, and sputum examination after saline nebulization were conducted. The procedure for the induction of sputum was explained to the patients. After a vigorous gargle with water to reduce con-

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tamination with oral debris, patients inhaled a mist of 3% hypertonic saline that was generated by nebulizer for 10-15 minutes. Patients invariably coughed vigorously during nebulization and they were encouraged to provide as much sputum as possible. The sputum was stained with toluidine blue and the results were tabulated. A minimum of 3 sputum samples were examined during each exacerbation.

RESULTS

Of the 100 episodes of PCP studied, either one or more of the three sputum samples were positive in 70 cases. In the remaining 30 episodes, a clinical diagnosis of PCP was based on symptoms, a suggestive chest x-ray, and oxygen desaturation on exercise oximetry. The clinical symptoms and various parameters of the study population are summarized in Table 1.

Of the 70 episodes in which sputum was helpful, the first sample clinched the diagnosis in 15 episodes (21.4%); the second sample was positive in 33 episodes (47.1%); and the third sample was positive in 22 episodes (31.4%). Table 2 shows sensitivity of single sample, double sample, and triple sample, sputum examination in PCP diagnosis.

DISCUSSION

Sputum induction is a well established technique in the diagnosis of PCP (Liegh *et al*, 1990) and other respiratory infections (Miller *et al*, 1991) in HIV positive patients. Success depends upon high clinical suspicion and a proper technique of induction. Various studies have shown that chances of isolation of organisms from sputum vary from 30%-80% (Carmichael *et al*, 1991; Miller, 1991). In a study to evaluate the usefulness of induced sputum in the diagnosis of PCP with acquired immuno deficiency syndrome (AIDS) involving 32 patients, 14 cases were detected by examination of induced sputum (56% sensitivity) (Bigby *et al*, 1986). In another study (Carmichael *et al*, 1991) using more than one staining method, 46 induced sputum specimens were stained using both Grocott's modified Gomori methanamine silver nitrate (GMS) and

Table 1
Profile of symptoms and results of sputum examination.

Symptoms	Percentage of PCP episodes n= 100 (episodes)
Cough	67
Sputum	34
Dyspnea	34
Fever	60
Asymptomatic	14
Desaturation on exercise	89
Suggestive chest x-ray	75
Total episodes with sputum positivity for PCP	70
First sample positive	15 (21.4%)
Second sample positive	33 (47.1%)
Third sample positive	22 (31.4%)

Table 2
Sensitivity of single sample, two sample, and three sample sputum examinations for PCP.

No. of samples	No. of positivity
Single sample sensitivity	15
Two sample sensitivity	48
Three sample sensitivity	70

immunofluorescent stains. In 12 specimens, *Pneumocystis carinii* were detected by both methods; in 4 specimens by GMS staining only; and in 5 specimens by immunofluorescence only, implying that the sensitivity of induced sputum examination in the diagnosis of PCP was increased by using both the staining methods which also reduced the need for invasive methods. In a Norwegian study, 31 patients with suspected PCP were examined both with induced sputum and BAL. *Pneumocystis carinii* was found in 24 patients. In 68% of the samples obtained by induced sputum method, the microorganism was found after Giemsa or methanamine silver staining; in 32% the diagnosis was established by lavage fluid only (Von der Lippe *et al*, 1995). Sputum induction utilizes outpatient facilities and reduces the need for bronchoscopy (Ng *et al*, 1989). Sputum induction, when compared to broncho-alveolar

lavage (BAL) and transbronchial biopsy, is less sensitive (Mahon and Manuselis, 1995). However, the later two methods are expensive, require considerable expertise, and carry the risk of complications. In our study, we found that repeated sputum examination of three nebulized saline-induced samples could detect 70% of cases of PCP. This technique is simple, cost-effective, non-invasive, and reliable. We recommend the examination of multiple samples of induced sputum in all patients with HIV in whom PCP is suspected; this recommendation may decrease the need for more invasive procedures.

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