A Modified Abrams Needle Biopsy Technique*

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Study objective: To compare the diagnostic sensitivity of a modified Abrams needle pleural biopsy technique (A1) with the standard Abrams (A2) and Cope needle biopsy methods. The modified Abrams pleural biopsy technique consisted of suctioning each tissue sample into a syringe without removing the needle completely from the chest until the completion of the entire procedure. Both the standard Abrams and Cope needle techniques required needle removal from the chest after each pleural biopsy.

Design: Retrospective chart analysis.

Setting: Community teaching hospital affiliated with Stanford University.

Patients: Forty-seven patients (30 men and 17 women) with a mean age of 44.5 years (range, 19 to 81 years) who were referred to a pulmonary consultation service for pleural biopsy.

Interventions: Two of us (C.M.K. and F.T.K.) used the modified Abrams technique and two of us (W.A.J. and A.C.C) used the standard Abrams technique. The Cope needle was used as originally described.

Measurements: We recorded the type of pleural biopsy needle and technique used in each patient. Biopsy specimen diameter and number of tissue samples obtained, final diagnoses, and complications were recorded.

Results: The diagnostic sensitivity for tuberculous pleurisy was 82% for the modified Abrams method, 71% for the standard Abrams method, and 88% for the standard Cope technique (p=0.3). There was no difference in size of tissue sample obtained (A1 vs A2), number of biopsies, or complications among the three methods of pleural biopsy.

Conclusions: The modified method of Abrams needle biopsy demonstrates a diagnostic sensitivity for pleural tuberculosis (82%) that is equivalent to that for the standard Abrams or Cope methods.

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Key words: Abrams needle; pleural biopsy; pleural TB

Percutaneous needle biopsy of the parietal pleura, using a Vim-Silverman needle, was originally described by DeFrancis et al1 in 1955. Since that time, closed needle pleural biopsy has been of proven use in the diagnosis of both tuberculous pleurisy and pleural carcinomatosis.2,3 Many different needle designs have been used,4-6 but the two most popular are the Cope7 and the Abrams8 needles (Harel's Inc; Cincinnati, Ohio). The outer diameter of the Abrams needle (4 mm) is larger than that of the Cope (3 mm) and it is reported to yield larger biopsy samples.9 Most operators take multiple pleural biopsy specimens at one intercostal space.10 The original description of the Abrams needle technique,9 and subsequent descriptions,3,9-15 indicate that the needle is withdrawn from the chest after each biopsy to extract the tissue sample. We believe that it is unnecessary to remove the Abrams needle from the chest after each biopsy specimen is removed. Two of us (C.M.K. and F.T.K.) routinely perform Abrams needle biopsies of the parietal pleura by suctioning each biopsy specimen, along with a small amount of pleural fluid, into a syringe at the hub of the needle without removing the needle from the chest after each sample. The ability to retrieve tissue specimens and the diagnostic sensitivity of this modified Abrams technique have not been carefully studied. We therefore reviewed our data from the modified Abrams method and compared the results with the standard Abrams and Cope techniques.

METHODS

We retrospectively reviewed all needle biopsies of the parietal pleura done by the Division of Respiratory and Critical Care Medicine at a 350-bed county hospital facility from 1988 to 1994. Needle biopsy of the parietal pleura was done exclusively in patients with radiographically demonstrable pleural effusions. Two of us (W.A.J. and A.C.C) used the Abrams needle in the traditional manner initially described.8 This required that the Abrams needle be completely removed from the chest each time a tissue sample was obtained. The tissue sample is found in the tip of the needle and can be extracted with the needle obturator, syringe needle, or forceps (A2 method). Two of us (C.M.K. and F.T.K.) used the Abrams needle exactly in the same way up to the point of tissue retrieval.

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Rather than complete needle removal after each biopsy, the needle was reopened with a counterclockwise turn of the hub and reinserted into the chest just enough (about 1 cm) to enable free aspiration of pleural fluid into a 35- or 50-mL syringe placed onto the outer hub. The biopsy sample was aspirated into the syringe along with pleural fluid. Once the tissue sample was seen in the syringe, the Abrams needle was reinserted the same small distance into the pleural space and another biopsy specimen was obtained. The Abrams needle was not completely withdrawn from the chest until all tissue samples were obtained (A1 method). Some investigators suggest that the diagnostic yield of Abrams needle biopsy can be increased by suctioning pleura into the biopsy notch prior to tissue resection.\(^2,\(^3\) We did not apply suction to the Abrams needle at the time of biopsy. The Cope needle was used to obtain parietal pleura as originally described.\(^7\) We reviewed all sputum and pleural fluid stains/cultures and classified pleural effusions as exudate or transudate according to standard criteria.\(^17\) We graded the size of pleural effusions seen on chest radiograph as small (fills up the costophrenic angle), medium (fills up to half of the chest), or large (fills up more than half of the chest). We reviewed all pleural biopsy reports to determine specimen adequacy as well as histologic and culture results.

Tuberculous pleurisy was diagnosed if the patient satisfied any one of the following criteria: (1) *Mycobacterium tuberculosis* grew from either sputum, pleural fluid, pleural tissue, or culture of any other body site (eg, cervical lymph node); (2) the pleural biopsy specimen showed granulomatous and acid-fast bacilli (AFB); and (3) the patient had a positive purified protein derivative (PPD) skin test (≥10 mm) and pleural biopsy specimen showed granuloma.

Pleural carcinomatosis was diagnosed in the patient with a pleural effusion if sputum or pleural fluid cytologic studies were positive or pleural biopsy specimens showed malignancy. In the absence of definitive diagnoses, presumptive diagnoses were based on a constellation of clinical signs, laboratory data, clinical course, and response to therapy. We made presumptive diagnoses of parapneumonic effusion, autoimmune disease, tuberculous and nontuberculous mycobacterial pleurisy, and mesothelioma.

We recorded all data on a standard worksheet and all numeric data are reported as mean ± SEM. Statistical comparisons of continuous data were done with Student’s t or Mann-Whitney tests. Categorical data were compared with χ² or Fisher’s exact test. Comparisons of more than two groups of continuous data were done with parametric analysis of variance or Kruskal-Wallis test and the Scheffé test was used for post hoc analysis. We accepted a p < .05 as statistically significant.

**Results**

There were 48 pleural biopsy procedures done in 47 patients with exudative pleural effusions over a 6-year period. One patient had both a nondiagnostic Abrams (A1) and a nondiagnostic Cope needle biopsy. There were 30 men and 17 women with a mean age of 44.5 years (range, 19 to 81 years). Regardless of whether the Abrams or Cope needle was used, only one intercostal site was chosen for needle insertion. There were 20 procedures done with the A1 method, 12 with A2 method, and 16 with the Cope method. The number of tissue samples obtained at the end of each procedure was 7.0 ± 0.4 for method A1, 6.5 ± 0.3 for method A2, and 7.3 ± 0.5 for method C (p=.04) (Fig 1). All A2 procedures (12) obtained pleural tissue; however, pleural tissue was not obtained after two C (2/16) and three A1 (3/19) procedures (p=.03). Review of pathology reports showed that most tissue specimens were aggregated and then measured for overall size. Eleven patients’ reports indicated the size of the largest tissue specimen and these data were then analyzed. Four of the 11 patients underwent procedure A1 (5.8 ± 1.4 mm), 6 patients underwent procedure A2 (4.5 ± 0.4 mm), and 1 patient had a Cope needle biopsy (2 mm) (p=.05 for A1 vs A2) (Fig 2).

Overall, there were 27 patients with a diagnosis of tuberculous (TB) pleurisy. Needle biopsy was diagnostic of TB pleurisy if tissue showed granulomas in a patient with a positive PPD (≥10 mm), if granulomas had AFB, or if the biopsy specimen grew *M tuberculosis* on culture. The diagnostic sensitivity for tuberculosis pleurisy, using all needle procedures, was 81% (22/27). The diagnostic sensitivity for tuberculous pleurisy was 82% for method A1 (9/11), 71% for method A2 (5/7), and 88% for method C (8/9) (p=.03). All patients who grew *M tuberculosis* from a pleural biopsy specimen, regardless of the type of biopsy procedure, had granulomas demonstrable on histologic

![Figure 1. Number of tissue samples obtained for each biopsy technique. Abrams 1 (7.0 ± 0.4) is the modified method, Abrams 2 (6.5 ± 0.3) and Cope (7.3 ± 0.5) are the standard methods (p=0.4).](http://journal.publications.chestnet.org/pdfaccess.ashx?url=/data/journals/chest/21722/)

![Figure 2. Diameter of the largest tissue sample for modified and standard Abrams techniques. Abrams 1 (n=4; 5.8 ± 1.4 mm) is the modified and Abrams 2 (n=6; 4.5 ± 0.4 mm) is the standard technique (p=0.8).](http://journal.publications.chestnet.org/pdfaccess.ashx?url=/data/journals/chest/21722/)
analysis. Only 9 of 24 patients with granulomata on pleural biopsy specimen had AFB seen microscopically (A1, n=4; A2, n=1; C, n=4). All patients who had a small pleural effusion (n=5) had TB pleurisy: zero of one was detected by procedure A1, one of two was detected by procedure A2, and two of two were detected by procedure C. The five patients with a false-negative pleural biopsy specimen for TB had conditions diagnosed with sputum (n=4) or pleural fluid culture (n=1). Overall, TB pleurisy was associated with positive sputum cultures in 48% of patients (13/27) and positive pleural fluid cultures in 30% of patients (8/27).

There were seven patients with metastatic pleural carcinomatosis and only two of the seven patients had diagnostic pleural fluid cytologic studies. Three of the seven patients had their only diagnostic material obtained by needle pleural biopsy (A1, n=2; A2, n=1), one by open pleural biopsy, and one by sputum cytology. Two of four patients with pleural carcinomatosis had their conditions diagnosed by method A1, two of two by method A2, and zero of one by Cope needle (p=0.3).

One patient with AIDS had a pleural biopsy (A1) and blood culture that grew Mycobacterium avium complex and his pleural effusion was attributed to this organism. There were 12 patients with nondiagnostic pleural biopsy specimens. Of these patients, three had aspiration pneumonia with parapneumonic effusion (A1, n=2; A2, n=1), two patients had no pleural tissue on histologic study (one Cope and one patient had both A1 and Cope without tissue), one patient with a negative PPD was treated empirically for TB after a Cope needle biopsy specimen showed granulomata without diagnostic AFB on smear or culture, one patient had systemic lupus erythematosus (A1), two patients had a rheumatoid pleural effusion (A1, C), and three patients had no clinical diagnosis established (A2, n=2; C, n=1). Only one patient, on follow-up, showed features of carcinoma or TB that were missed on the original evaluation. This patient had a diagnosis of TB pleurisy based on a positive PPD, a lymphocytic exudative pleural effusion, and granulomas with AFB seen on pleural biopsy specimen (method A1). He was completely treated for TB but his pleural effusion persisted and he died 22 months later from presumed mesothelioma after repeated thoracentesis showed an elevated hyaluronic acid level (58,000 ng/mL; normal (120). This patient was presumed to have both pleural TB and mesothelioma. A total of 4 patients had a nondiagnostic pleural biopsy specimen with method A1 (4/20 procedures=20%), 3 with method A2 (3/12 procedures=25%), and 5 with the Cope needle (5/16 procedures=31%) (p=0.5).

There were four patients in the whole group who developed pneumothorax (three due to procedure A1, 15%, and one due to procedure C1, 6%) (p=0.3) but none required chest tube drainage. No patient developed significant pleural space hemorrhage or other complication.

**Discussion**

Since its original description in 1955, closed needle biopsy of the parietal pleura has been of proven utility in the diagnosis of both TB and metastatic carcinoma. Needles for closed pleural biopsy have evolved through many designs in order to improve diagnostic sensitivity and decrease complications. In fact, closed pleural biopsy has even been described using the "needle-less" system of thoracoscopy with direct visual pleural forceps biopsy. However, the two most common needles in use today are the Abrams and Cope designs.

The Cope needle was described in 1958 and originally consisted of three parts to which an obturator was later added, an outer cutting cannula, an inner curette (hook), a needle that fits into the cannula, and an obturator that fits into the needle. The Abrams needle was initially described by Mestitz et al in 1957 and again by Abrams in 1958 and has been occasionally named the Harefield needle after the hospital where it was first used. The Abrams needle consists of three parts: an outer tube with a notch, a concentric inner cutting tube that moves to and fro on a spiral guide with a clockwise/counterclockwise rotation, and an obturator.

Both needles are inserted into the pleural space in a similar manner and pleural fluid is aspirated with a syringe attached to the needle hub to assure proper pleural location. The Cope needle system then requires that the inner needle and obturator be exchanged for the curette so that parietal pleura can be snagged by removing the whole assembly until the hook engages tissue. At this point, the outer cutting cannula is pushed into the chest over the hook to cut tissue and the sample is removed with the hook. Abrams needle placement in the pleural space is assured by rotating the inner cutting cannula counterclockwise to open the outer notch in order to aspirate pleural fluid into a syringe placed at the hub. After proper pleural space placement is assured, the Abrams needle is withdrawn until tissue is snagged and the inner cutting tube is rotated clockwise to cut tissue. The original description and later investigators indicate that the Abrams needle is then removed from the chest to retrieve the tissue sample.

We used a modification of the original Abrams method: instead of needle removal, it is pushed back into the pleural space (about 1 cm), the biopsy notch is opened by counterclockwise rotation of the inner cutting cannula, and pleural fluid with the tissue sample is aspirated into the syringe. Although this method has been mentioned in the past, it has neither been...
carefully described previously nor studied for diagnostic sensitivity. The advantage of this modification to the original Abrams technique is the ability to keep the needle in the chest until the end of the procedure, which may be more comfortable for the patient.

There was no difference in the number of individual tissue samples obtained with any of the three pleural biopsy techniques (Fig 1) and there was no difference in size of largest tissue sample obtained with Abrams or modified Abrams methods (Fig 2). Although the Abrams needle is said to yield larger tissue samples,\(^9\) other studies have failed to show a difference in biopsy tissue size between the Cope and Abrams needles.\(^{14}\) The modified Abrams method produced 15% (3/20) pneumothoraces and the Cope method produced 6% (1/16) pneumothoraces that did not require treatment and that were in the incidence range described previously.\(^{2,24}\) In addition, there was no difference in nondiagnostic pleural biopsies among the three techniques (p=0.5).

The diagnostic sensitivity for pleural TB was 71 to 88% for the three techniques and there was no statistically significant difference among them (p=0.3). In fact, the modified Abrams method had a sensitivity for pleural TB that was very close to that for Cope needle biopsy (81% vs 88%) and is in the range of 60 to 95%, which is described in the literature.\(^{2,12,21,24,28}\) The number of patients in our study with small pleural effusions (n=5) is insufficient to make any distinction for diagnostic sensitivity among these three techniques in this subgroup. Of note, patients with false-negative pleural biopsy specimens for TB (n=5) had diagnoses made by sputum (n=4) or pleural fluid (n=1) culture and 48% of all patients with pleural TB (13/27) had enough parenchymal lung disease to yield positive sputum cultures. Although we made some diagnoses of pleural TB with a combination of positive PPD and granulomatous pleural biopsy, culture of \textit{M tuberculosis} on sputum, pleural fluid, or pleural biopsy specimen was very helpful in proving the diagnosis, detecting drug-resistant organisms, and designing effective medical therapy. We found that the only patients who grew \textit{M tuberculosis} from their pleural tissue also had granulomata demonstrable on histologic study, but only 9 of 24 patients with granulomata had AFB seen in tissue. Therefore, the diagnosis of pleural TB, using any of the three pleural biopsy methods, is optimized when pleural tissue is subjected to both histologic analysis and culture\(^{25}\) and when pleural fluid and sputum are also cultured.\(^{25}\)

The number of patients with pleural carcinomatosis was small (n=7), but sensitivity for the modified Abrams method (two of four) is well within the range of 30 to 70%, which is described in the literature.\(^{2,12,21,22,24,27,28}\) Despite the fact that pleural biopsy is said to add little diagnostic sensitivity to cytologic studies\(^3\) two of our patients with normal results pleural fluid cytologic studies had their only diagnostic material obtained with the modified Abrams pleural biopsy method. The diagnostic sensitivity for pleural carcinomatosis can be enhanced when pleural biopsy is combined with pleural fluid cytologic studies.\(^{29}\)

Twelve of 47 patients had nondiagnostic pleural biopsy specimens and had clinical diagnoses of pneumonia, presumptive pleural TB, and autoimmune disease based on a constellation of evidence and were treated accordingly. There was no difference among the rates of nondiagnostic pleural biopsy specimens with method A1 (20%), A2 (25%), or Cope (31%) (p=0.5).

We conclude that the modified method of Abrams needle biopsy demonstrates a diagnostic sensitivity for pleural TB (82%), which is no different than that for standard Abrams or Cope techniques. The number of tissue samples, tissue size, nondiagnostic biopsy specimens, and pneumothoraces is comparable to results from the standard Abrams method. The advantage of the modified Abrams method is the ability to keep the needle in the chest until the procedure is completely done.

**REFERENCES**


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