

Ultrasound Assisted Pleural Biopsy with Abram Needle is a Valuable Tool in diagnosing Exudative Lymphocytic Pleural Effusions

Abdul Rasheed Qureshi¹, Hamid Mehmood², Muhammad Irfan³, Adnan Mushtaq⁴, Hina Mushtaq⁵

Author's Affiliation

^{1,3}Assistant professor, Pulmonology department, Gulab Devi Chest Hospital Lahore, Pakistan

²Professor of Biochemistry Federal Medical and Dental College/ Registrar, Shaheed Zulfiqar Ali Bhutto Medical University, Islamabad

³Islamic International Medical College, Riphah University, Islamabad

Author's Contribution

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Address of Correspondence

Prof Hamid Mehmood
drhamidmehmood373@gmail.com

ABSTRACT

Objectives: To evaluate the efficacy and safety of US assisted pleural biopsy using Abram Needle.

Study Design: A non-randomized prospective study. The study was approved by Ethical Board of Gulab Devi Chest hospital Lahore.

Methodology: The study was conducted at the Department of Respiratory Medicine, Gulab Devi Chest Hospital Lahore. 141 male patients with undiagnosed, unilateral, exudative, lymphocytic pleural effusion were included in the study during Jan. 2014 to Nov. 2015. Pleural biopsy was performed with Abram needle after an informed consent, having localized the biopsy point by chest radiographs & sonography. Tissue samples underwent histopathological evaluation. Diagnosis was made on histopathology reports. Statistics was applied.

Results: Six samples were inadequate while 135 were adequate. 31.11% cases were malignant while 68.88% were nonmalignant. Out of 93 nonmalignant cases, 7.52 % were normal pleurae, 46.23% were caseous granulomatous inflammation, 25.80% were chronic nonspecific pleuritis, 10.75 % cases were chronic pleuritis with fibrous thickening, 9.67 % cases were acute pleuritis. Biopsy success rate was 95.74%. All patients tolerated the procedure well. No serious complication occurred.

Conclusions: Abram needle pleural biopsy using ultrasound assistance is very safe and excellent diagnostic tool in diagnosing exudative lymphocytic pleural effusions.

Keywords: Abram Needle – Ultrasound Assistance – Biopsy – Pleural Effusion.

Introduction

Exudative, lymphocytic pleural effusions are frequently encountered in daily pulmonology practice. When there is no evidence of an acute infection, further investigations are mandatory to exclude malignancy or tuberculosis. Common cause is tuberculosis in high prevalence areas where as malignancy is more common in industrialized societies. However, the increasing trend of smoking and environmental pollution is continuously changing this proportion. Sensitivity index for pleural fluid cytology is low and the diagnostic yield improves when combined with pleural histology.^{1,20} That is why pleural biopsy is a standard procedure in the investigation of pleural tuberculosis and malignancy.^{2,9,21-25} The first closed pleural biopsy was done by Defrancis in

1955 using Vim Silverman needle. Pleuroscopic biopsy is the Gold Standard^{3-8,25}, but it is extensively invasive & requires sufficient fitness of the patient, costly equipment and adequate mandatory training for the operators. In the absence of a pleuroscopic procedure, CT guided biopsy is advised but its availability is also limited.^{3-4,15,17} A close pleural biopsy is a minimally-invasive procedure but diagnostic yield is not attractive.¹⁶

Internationally, a lot of work has been done for pleural sampling in context with the evaluation of exudative pleural effusions^{3-4,15-19}. In 2004, Rauniyar SK stressed upon the need of performing pleural biopsy in pleural effusions¹. The role of close pleural biopsy was also highlighted in 2008 by

Biswas and Bhattacharya.⁹ The value of ultrasound assisted Abram needle biopsy was disclosed in 2010 by Koegelenberg CF.³ Ultrasound guidance was recommended by Piqueras Olmeda RM et al with the conclusion that it must precede thoracoscopy due to its less aggressiveness.¹⁸ In 2011, Koegelenberg CF suggested that thoracoscopic technique may potentially be reserved for those cases which are not diagnosed by means of closed pleural biopsy.³ In 2013, the article of Botana-Rial M, displayed the efficacy of Abram needle pleural biopsy with the help of ultrasound.⁵ In 2014, Hallifax RJ et al. stated the role of Physician-based ultrasound-guided biopsy for diagnosing pleural disease.¹⁴ The significance of US based Abram needle pleural biopsy was uncovered in 2016 by Bibby AC and Maskell NA.¹⁵ In 2016, Parthipan Sivakumar claimed that the sensitivity of closed Abrams needle biopsy was 71.43 % compared to 75 % in the CT-guided Tru-Cut group.¹⁰ Specificity was 100 % in both groups. Our national literature is almost silent regarding the ultrasound assisted or guided Abram needle pleural biopsy.

Abrams needle pleural biopsy using real-time us guidance is not feasible. US can be used just for the biopsy site selection which can increase the diagnostic yield to > 17%.^{5,14} In such situations, ultrasound assisted pleural biopsy is a blessing and we used this technique in our study to access the efficacy and safety of this modality.

Methodology

This study was carried out at the Department of Respiratory Medicine, Gulab Devi Chest Hospital Lahore–Pakistan, from Jan. 2014 to November 2015. The study population included 141 male patients of 16–65 years of age.

141 patients with unilateral pleural effusion on chest X-ray were evaluated by history, physical examination, chest radiography, ultrasonography, pleural aspiration, pleural fluid biochemistry, cytology, and bacteriology. CBC with ESR, LFTs, S. Protein, Renal function test and viral markers for CLD were also done. The cases with exudates having lymphocytic predominance and a clinical suspicion of tuberculosis or malignancy were included in the study.

Patients excluded were those with negative informed consent, bilateral pleural effusion, transudative pleural effusion, Cardiac failure, Hypoalbuminaemia, Neutrophilic effusions, Hepatic & Renal hydrothorax, bleeding diathesis and those suspected for pulmonary embolism.

Possible Risk Factors: Any bleeding diathesis, lack of patient co-operation, skin infection, low volume effusion,

unstable medical condition and inexperienced operator are the potential risk factors.

Technique: Patients were consented and positioned in lateral position. Biopsies were performed with Abram Needle. Site of biopsy was marked by clinical examination, consulting radiographs and by deploying chest sonography. A disease-localizing preliminary ultrasound scan was done using 3.5–5.5MHz frequency, convex probe and the entry point was selected. The area showing parietal pleural abnormalities and an adequate quantity of pleural fluid was marked. Presence of pleural fluid was again confirmed by aspirating fluid during anaesthetizing the parietal pleura. A skin depth stab incision was made just above the upper border of lower rib. Needle was introduced in and advanced tangentially inward, downward and laterally until a sensation of “giving way” was felt. The patient was asked to exhale forcibly during biopsy taking. The needle was withdrawn about 0.5 cm back and biopsy was performed by rotating biopsy punch. On an average two specimens were sent in 10% formalin jar for histopathology 26-27. All patients underwent an expiratory CXR one hour after the procedure to monitor the complications.

141 patients with undiagnosed, unilateral exudative pleural effusion underwent biopsy. Diagnosis and outcome was studied following the procedure. Tissue samples with no pleural tissue or lost in histo lab. were regarded as “inadequate”. Samples with malignant histology were confirmed further by immuno-staining. All patients tolerated the procedure well. The complications were recorded and the efficacy and safety was determined by applying statistics.

After Care:

1. Simple analgesia for any pain.
2. The chest X-Ray to identify the pneumothorax.
3. The patient were advised to report for shortness of breath if any.
4. Patient was also advised to note for any signs of bleeding like decreased blood pressure, or increased pulse rate.

Results

141 male patients, 16–65 years of age were biopsied with median age 34 years. Two samples were lost in Histopathology lab. 04, samples were reported as no pleural tissue. In this way six samples were considered as inadequate while 135 samples were declared adequate with biopsy success rate 95.74%.

The left sided pleural effusion cases were 58.16% which shows the common laterality in our population. The cases with malignant etiology were 42(31.11%) while nonmalignant etiology was found in 93(68.88%) cases.

The following table shows the clinical presentation of these patients.

Clinical Features	No. of Cases	Percentage*
Cough	138	97.87 %
Fever	135	95.74 %
Shortness of Breath	121	85.81 %
Expectoration	100	70.92 %
Chest Pain	82	58.15 %
Hemoptysis	30	21.27 %

Pleural Effusion Site	Number of cases	Percentage*
Pleural Effusion Right	59	41.84%
Pleural Effusion Left	82	58.16%

Percentage calculated for total biopsied patients

Malignant Etiology	No. of cases	Percentage*
Non Small Cell CA	19	45.23 %
Small Cell CA	11	26.19 %
Malignant Cells	09	21.42 %
Ewing Sarcoma	03	7.14 %

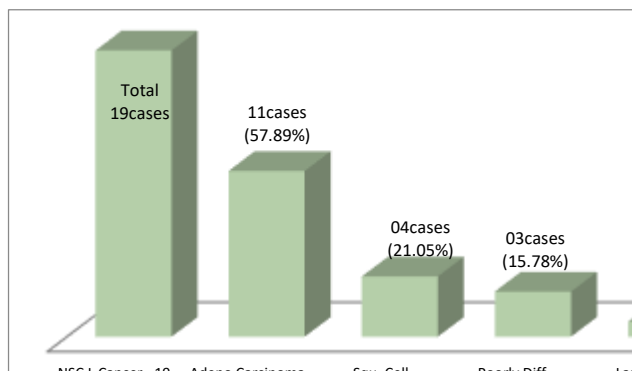


Figure 1. Distribution of Non-Small Cell Carcinoma Lesions Reports (n=19)

This is evident from Table III and Figure 1 that the sensitivity & specificity for malignant etiology is 100%. Because only 09/42(21.42%) cases were reported as "Malignant cells seen", and no specific tumors were characterized for these cases, the specific disease characterization for malignant pathologies is 78.57%. In the non-small cell group, 11/19(57.89%) cases were Adenocarcinoma which is the most common entity in this group, while 04/19(21.05%)

cases were Sq. Cell Carcinoma, 03/19(15.78%) were poorly differentiated NSCCA and 01(5.26%) case was Large cell carcinoma. Each case in this group is characterized by a specific tumor type.

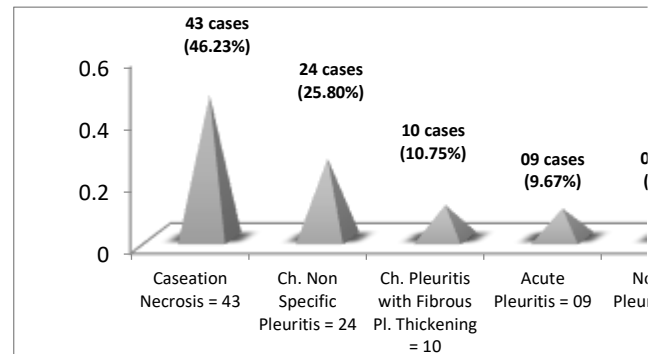


Figure 2. Distribution of Non-malignant Pathology Reports (n = 93)

Out of 93 nonmalignant biopsies, 43/93(46.23%) were diagnosed as caseous necrosis, 24/93(25.80%) Ch. Nonspecific pleuritis, 10/93(10.75%) Ch. Pleuritis with fibrous pleural thickening, 09/93(9.67%) cases of acute pleuritis were diagnosed while 07(7.52%) normal pleurae were also isolated. (Figure 2)

Complication	No. of patients Observed Cases.	Percentage*
Biopsy site Pain	24	17.02 %
Minor Bleeding at	09	6.38%

*percentages calculated for 141 cases

Discussion

Total 141 US-assisted biopsies were obtained. Age of the patients ranged from 16 to 65 years with median age of 34 years. The mean age in our study is higher than that reported by HS Hira et al. (34.0 vs 31.7 years) and lower than several studies (34.0 vs 48.0 years).⁴⁵⁻⁵¹ Our study shows that the patients diagnosed with malignant PE were older than those with tuberculous PE. Tuberculous pleural effusions in elderly are common in previously treated patients for tuberculosis which may be due to reactivation of previously healed lesions as shown by other authors as well.^{52,53}

Blind pleural biopsy by Abram's needle has varied sensitivity from 24%-66%.²⁸⁻³⁰ In our study, the adequacy of the sample by US assistance is 95.74 %. While Piqueras Olmeda RM et al. declared 93%.¹⁸ Botana et.al 91.7%⁵, James P 62.2%³⁴, Biswas et al 48.12%⁹, Walshe et al. showed a

satisfactory biopsy specimen in 76%³⁰, Maskeel et al; 47% sensitivity by un-guided procedure while 87% by CT guided biopsy³¹ and Haridas N showed 86.2% diagnostic yield by thoracoscopic biopsy.³²

Our pleural biopsy has drawn a clear-cut line of demarcation between malignant and nonmalignant processes. In our study, 42/135(31.11%) malignant cases have been successfully diagnosed. While Ihsanullah et al showed 24%²³ and James P. 29.2% malignant cases.³⁴ Our pleural biopsy has successfully differentiated between small cell & non-small cell cancers, thus providing a tremendous help in treatment planning. In NSCCA group, Adenocarcinoma, Sq.Cell Carcinoma, Large cell carcinoma and poorly differentiated carcinoma have accurately been diagnosed. Adenocarcinoma is found the most common cancer among non small cell group. Because 09/42 cases are reported as "malignant cells seen", the specific disease characterization for malignant lesions is 78.57%.

Similarly, 09 cases of acute pleuritis and 07 cases of normal pleurae and 10 cases of fibrous pleural thickening have accurately been isolated.

Our procedure has intelligently saved these (42+09+07+10) = 68/135(50.36%) cases from the treatment of chronic inflammatory processes which otherwise were going to be put on without a pleural biopsy. Because most of the patients with exudative lymphocytic pleural effusions are put on anti-TB treatment without any biopsy because of high prevalence of TB in population. Similarly, the biopsy results with malignant etiology have alarmingly directed these patients to rush to the oncology department. This modality has also protected these patients from highly sophisticated investigations like CT, MRI, thoracoscopy or open surgical procedures for further diagnosis, thus saving a lot of revenue & the time prior to start the treatment.

Out of the 93 non malignant cases, 43/93 (46.23%) cases were diagnosed as TB while 43.8% by James P³⁴ and similar results has been reported by Ihsanullah and McLeod et al.^{23,33} We were expecting much better diagnostic yield with US assistance but this could not be met because fewer tissue pieces per biopsy were taken in our study (two pieces per case), as stated by Kirsch CM(The sensitivity of Abram needle pleural biopsy for tuberculous pleurisy is highest when more than six specimens are obtained)²⁶.

In our study, Ch. Non specific pleuritis, Ch. Pleuritis with fibrous pleural thickening were 24/93(25.80%) and

10/93(10.75%) respectively. Non specific pleuritis cases are very high 24/93(25.80%)in our study, again it is due to the same reasons as described by Kirsch CM²⁶. This observation necessitates the need of another study with more number of tissue pieces per biopsy in the same scenario to estimate the diagnostic yield. However, the literature shows that more than 20% cases remains undiagnosed even after successful closed pleural biopsy.^{42-44,54-55.}

Although in 24/93(25.80%) cases of Ch. Non specific pleuritis, the malignant etiology was clearly ruled out, but specific benign disease was not described in these cases. Therefore, the sensitivity for benign nature is 100%, but specific disease characterization in benign issues is 74.19%.

For the remaining cases of uncertain diagnosis, a decision was made on individual case to case basis, these cases were followed up for a period of six to nine months. 09 cases were diagnosed as TB-pleuritis on the basis of clinical features, Lab. data, Echocardiography, ADA level, H/O contact and response to treatment. 06 cases of parapneumonic effusion, two cases of dilated cardiomyopathy and one congestive heart failure was also identified. The remaining 06 cases did not show any recurrence during follow up period.

Our study of US assisted, Abram needle pleural biopsy has appeared as highly sensitive modality with biopsy success rate 95.74%. It has successfully differentiated between normal and diseased pleura.

It has made clear cut differentiation between malignant and non malignant lesions with 100% sensitivity & specificity. The specific disease characterization for malignancy is 78.57%. It has also drawn a line between an acute and chronic infection. Even chronic infection with fibrous pleural thickening cases have also been successfully identified. Specific disease characterization for non malignant group is 74.19%. By applying Fisher exact test, our calculated "P" value for Specific Disease Characterization between malignant & benign issues is 0.0755 which is greater than 0.05 alpha level which shows that is not significant, so there is not enough evidence of difference of Specific Disease Characterization between malignant and non malignant lesions.

It has confirmed the diagnosis of malignancy, tuberculosis, acute infections, pleural thickening and normal pleurae with diagnostic efficacy of 82.22 %. The diagnostic yield in Our study is 82.22% which differ from the diagnostic yield of 62.1% by Nithya Haridas et al.³² (67%)Diacon et al³⁵ and (72%) Walz et al.³⁶ The study by Ogirala et al showed yield of 52% with Abram's needle.³⁷ Loddenkemper et al. Showed 44% yield.³⁸ Our study results are also comparable with that

of Maskeel et al.³¹ The high diagnostic yield in our study is possibly due to the use of ultrasound for biopsy site selection. Similarly, the diagnostic yield is highly influenced by the experience of the operator and the number of times the biopsy is repeated. We did not repeat the biopsy in any of our patients.

Although pneumothorax and hematoma is not uncommon when biopsy is done by Abrams needle.³⁹ But in our series, only biopsy site mild pain in 17.64 % & minor bleeding in 5.88 %, just a few drops at the biopsy site were noted and no case of pneumothorax was found. This shows very good safety which is similar to the results of Gupta et al & Dixon et al.⁴⁰⁻⁴¹

Conclusion

Just because of an excellent diagnostic yield and very good safety we conclude that Abram's needle pleural biopsy using US assistance has a pivotal role in the diagnosis of patients with indeterminate cytology.

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