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Original article

VATS versus Ultrasound-Guided Abram`S Needle Biopsy in Diagnosis of Pleural Diseases

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Abstract

Background:VATS and transthoracic ultrasound-guided Abram`s needle biopsy are important techniques in diagnosis of pleural diseases, as they are more accurate than blind closed pleural biopsies. **Patients & Methods:** This is a prospective study, which included 60 patients of undiagnosed pleural diseases who were randomly divided into two groups: group A (30 patients) who underwent VATS biopsy, and group B (30 patients) who underwent U/S guided Abram`s needle biopsy. Efficacy and safety and of both procedures were compared. **Results:** There were no perioperative mortality and both procedures were safe. A definitive histopathological diagnosis was obtained in 30 patients (100%) in group A and in 26 patients (86.7%) in group B. Complications in group A were minor bleeding in 1 (14.3%), lung collapse in 3 (42.9%), empyema in 1 (14.3%), prolonged air leakage in 1(14.3%) and wound infection in 1 (14.3%). Complications in group B were empyema in 1 (12.5%), hemoptysis in 2 (25%), vasovagal attack in 1 (12.5%) and pneumothorax in 4 (50%). **Conclusions:** VATS is a safe and accurate method for diagnosis of pleural lesions and pleural effusions and more sensitive than US guided Abram`s needle biopsy. VATS is an effective method in diagnosis of pleural effusion due to both pleural and pulmonary causes. The results of U/S guided Abram`s needle biopsy for pleural causes of pleural effusions is better than the results of U/S guided Abram`s needle biopsy for pulmonary causes of pleural effusions.

Key word: VATS; ultrasound-guided Abram`s needle biopsy: pleural diseases

Introduction

Pleural effusion is a very common clinical problem in patients with respiratory symptoms. The most common causes of exudative pleural effusion are parapneumonic effusion, malignant pleural effusion and tuberculous pleural effusion.

However, there is a limited ability to diagnose all cases by conventional investigations such as cytology, bronchial lavage, cultures, and radiological investigations. After thoracocentesis, nearly 25–40% of cases of pleural effusions remain undiagnosed; so, the next step for a definitive diagnosis is a pleural biopsy [1, ٢].

Blind closed pleural biopsy has important role in diagnosis of tuberculous pleural effusion with 85% sensitivity due to the wide spread of tuberculosis in the pleura. However, it has a low diagnostic yield in diagnosis of malignant pleural effusion with 48% to 56% sensitivity due to the patchy involvement of the pleura in malignant pleural effusion [٣]. Moreover, the malignant pleural deposits are mainly present close to the diaphragm and midline, but they are dangerous areas that can`t be reached during taking blind closed pleural biopsy to avoid injury of vital structures and vessels at these areas. So, blind closed pleural biopsy sensitivity is noticeably affected after avoiding these areas [٤].

US guided Abram`s needle biopsy and VATS are important techniques in the diagnosis of pleural diseases as they have higher diagnostic yield than closed pleural biopsy [٥]. It is clear that blind pleural biopsy is a cost-efficient option for diagnosis of tuberculous pleural effusion in the current era [٦].

The high efficacy of VATS is due to the good exposure and the extension of the exploration, the ability to discover any suspicious areas among the pleural cavity, and the ability to obtain more representative and larger biopsies [7].

Patients and methods

This study was conducted from April 2020 till May 2022, after an agreement from the institutional Ethics Committee Benha university hospital. This prospective study was done on 60 patients complaining of pleural effusion of unknown cause who were admitted in Cardiothoracic surgery department in Benha university hospital. Informed consents were taken from all patients. Patients were divided into two groups: group A and group B randomly by using a computer program. Group A included (30 patients) who underwent VATS biopsy, and group B included (30 patients) who underwent US guided Abram`s needle biopsy. Analysis of pleural fluid was done in all patients at least twice before taking the biopsy.

Before taking the pleural biopsy, clinical examination, radiological and laboratory investigations as microbiological, biochemical and cytological analysis were

done. Patients diagnosed with pleural effusion were not included in this study. The study included only undiagnosed pleural diseases.

Video-assisted thoracoscopy group (group A)

Type of anesthesia in VATS is general anesthesia and double-lumen intubation is used to collapse the ipsilateral lung. The patient is placed in the full lateral position, with the ipsilateral arm abducted 90° at the shoulder; as the same position of thoracotomy, to be easy to convert to open thoracotomy if VATS failed.

First step, sterilization and toweling, then in the 6th or 7th intercostal space at midaxillary line, 1–2 cm incision done passing through skin, muscles and pleura and it is used as a camera port. To ensure lung collapse and rule out lung adherence to parietal pleura, we introduce finger into the intercostal space before introduction of the camera through this port. Then the next trocar is entered under direct visualization through the proper space. Biopsies are taken from all suspicious areas. One or two wide-bore chest tubes are placed through the thoracoscopic port incisions. Patients are shifted from recovery room to ward for management of pain and follow up care.

Transthoracic ultrasound guided Abram`s needle biopsy (TUS-GANB) (group B)

PHILIPS EPICQ 7G is the ultrasonography machine that was used in our study. Position of patients during the procedure was sitting with folded arms across the chest and supported by a bedside table. After a full evaluation of the affected side, ultrasound examination was done by a standard 3.75 MHz sector probe. For a guarantee of successful biopsy, the ultrasound window should be good with no bone or air overlying the lesion, vital organ shouldn`t be present among the Abram`s needle pathway. Satisfactory entry angle of the Abram`s needle with a satisfactory depth of the lesion should be present. The main target is always the safety. We identify the best site for the biopsy then sterilization of the surrounding area done, then lidocaine 2% infiltration was done. 14 or 16 gauges Abram`s needle was used to take the biopsy.. At least 3 Abram`s needle biopsies were taken and transferred in 10% formalin. The biopsy that was sent for microbiological investigation was transferred in normal saline.

Statistical methods

Data management and statistical analysis were done using SPSS version ٢٨(IBM, Armonk, New York, United States). Quantitative data were assessed for normality using the Shapiro-Wilk test and

direct data visualization methods. According to normality testing, numerical data were summarized as means and standard deviations or medians and ranges. Categorical data were summarized as numbers and percentages. Quantitative data were compared between the study groups using independent t-test or Mann-Whitney U test for normally and non-normally distributed numerical variables, respectively. Categorical data were compared using the Chi-square or Fisher's exact test, if appropriate. All statistical tests were two-sided. P values less than 0.05 were considered significant.

3. Results

No significant differences were noted between both groups regarding neither the affected site (P = 0.602) nor type of lesion (P = 0.402) ***(Table 1).***

Hospital stay was significantly higher in group A (median = 4, range = 3 – 28 days) than group B (median = 3, range = 1 – 8) (P < 0.001). No significant differences were noted between both groups regarding complications (P = 0.766) ***(Table 2, Figure 1).***

Conclusive results were higher in group A (100%) than group B (86.7%) but without statistical significance (P = 0.112). No significant result was reported between the type of conclusive result and the study groups (P = 0.574) ***(Table 3, Figure 2)***.

The most frequent diagnosis in group A was pleural malignancy (33.3%), followed by metastasis (26.7%), bronchogenic carcinoma (20%), TB (10%), fungal infection (6.7%), and sarcomatoid pleomorphic sarcoma (3.3%). In group B, the most frequent diagnosis was pleural malignancy (38.5%), followed by metastasis (26.9%), TB (19.2%), bronchogenic carcinoma (11.5%), and fungal infection (3.8%) ***(Table 4, Figure 3)***

Table (1): Side affected and lesion type in both groups

			Group A (n = 30)	**Group B (n = 30)**	**P-value**
Side affected	Left	n (%)	14 (46.7)	12 (40.0)	0.602
	Right	n (%)	16 (53.3)	18 (60.0)	
Lesion	Pleural effusion	n (%)	20 (66.7)	20 (66.7)	0.402
	Pleural effusion & thickening	n (%)	6 (20.0)	3 (10.0)	
	Pleural thickening	n (%)	4 (13.3)	7 (23.3)	

Chi-square test was used

Table (2) Hospital stay and complications in both groups

			Group A (n = 30)	Group B (n = 30)	P-value
Hospital stay (days)	Median (range)		4 (3 - 28)	3 (1 - 8)	<0.001
Complications	n (%)		7 (23.3)	8 (26.7)	0.766
Type of Complication	Empyema	n (%)	1 (14.3)	1 (12.5)	NA
	Hemoptysis	n (%)	0 (0.0)	2 (25.0)	
	Lung collapse	n (%)	3 (42.9)	0 (0.0)	
	Minor bleeding	n (%)	1 (14.3)	0 (0.0)	
	pneumothorax	n (%)	0 (0.0)	4 (50.0)	
	Prolonged air leakage	n (%)	1 (14.3)	0 (0.0)	
	Vasovagal attack	n (%)	0 (0.0)	1 (12.5)	
	Wound infection	n (%)	1 (14.3)	0 (0.0)	

Mann Whitney U test was used for hospital stay. Chi-square test was used for complications. NA: Not applicable

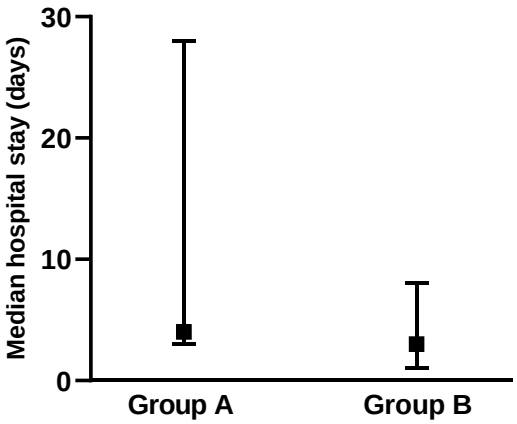

Fig. (1): Hospital stay in both groups

Table (3) Conclusive results and their types in both groups

			Group A (n = 30)	Group B (n = 30)	P-value
Conclusive result	n (%)		30 (100.0)	26 (86.7)	0.112
Type of conclusive result*	Benign	n (%)	5 (16.7)	6 (23.1)	0.574
	Malignant	n (%)	25 (83.3)	20 (76.9)	

Chi-square test was used * Percentages were calculated based on those with conclusive results

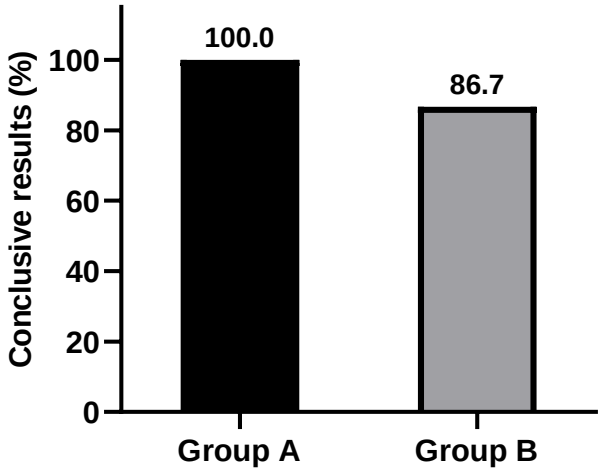

Fig. (2): Conclusive results in both groups

Table (4) Conclusive results final diagnosis in both groups

			Group A (n = 30)	Group B (n = 30)	P-value
Conclusive results diagnosis*		n (%)			
	Bronchogenic carcinoma		6 (20.0)	3 (11.5)	NA
	Fungal infection	n (%)	2 (6.7)	1 (3.8)	
	Metastatic (blood)	n (%)	8 (26.7)	7 (26.9)	
	Pleural malignancy	n (%)	10 (33.3)	10 (38.5)	
	Sarcomatoid pleomorphic sarcoma	n (%)	1 (3.3)	0 (0.0)	
	T.B	n (%)	3 (10.0)	5 (19.2)	

* Percentages were calculated based on those with conclusive results NA: Not applicable

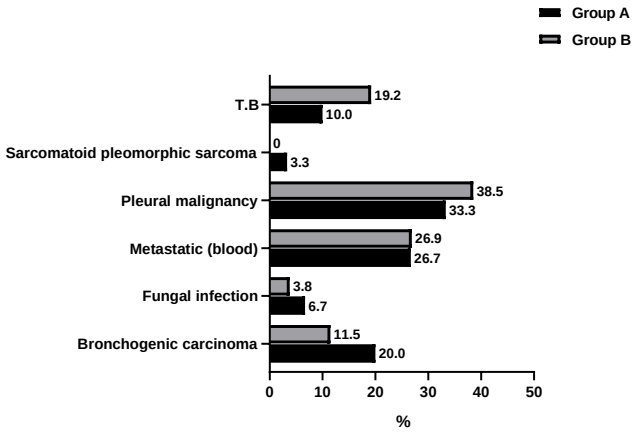

Fig. (3): Conclusive results final diagnosis in both groups

Discussion

A pleural biopsy can be obtained using a variety of techniques including blind or image guided needle biopsy or by thoracoscopy. The best method for taking pleural biopsy from patient with undiagnosed exudative pleural effusion is

still controversial [5]. Some authors suggest that blind closed pleural biopsy is still an effective method in diagnosis of exudative pleural effusion, although VATS and TUS-GANB have a higher diagnostic yield than it, due to its simplicity, lower cost and because it has high sensitivity for diagnosis of tuberculous pleural effusions [3,6]. But, with a sensitivity ranging between 48% and 56%, blind pleural biopsy can diagnose malignant pleural effusion due to the patchy involvement of the pleura in case of malignant pleural effusion, so its diagnostic yield in case of malignant pleural effusion is low [3, 8, 9].

In this study, in case of pleural effusion due to pleural disease pleural biopsy guided with US and VATS were both good methods and effective, but effusion due to pulmonary disease VATS was more accurate.

This study included ٦٠patients with plain x ray and CT chest showing recurrent pleural effusion and pleural masses or any pleural lesions who were admitted in Chest department and cardiothoracic surgery department, Benha university hospital. Their ages ranged from 1 ٢to 7 ٠years. In the following discussion we will compare the sensitivity and complications of Abram`s needle biopsy and sensitivity and complications of the VATS biopsy in our study with other studies .

In a previous study,(4) where they investigated the role of Abram's needle biopsy in the assessment of exudative pleural effusions in the period between January 1997 and 2003, blind Abram`s needle biopsy was done and patients were recognized from the hospital database. The pathology records and case notes of these patients were studied retrospectively. The presentation of all patients was exudative pleural effusion and thoracentesis was done to all patients which was non diagnostic. 75 patients underwent Abram`s needle biopsy were identified. Pleural tissue was obtained in 59 biopsies (79%), no serious complications were reported after Abram`s needle procedure (*e.g.*, pleural sepsis or sever hemorrhage). There were some complications that were recorded including pneumothorax in eight patients (11%), but only two of them (2.5% of the overall sample) required specific intervention (both required intercostal tube drainage for 2 days and 4 days, respectively). The results of this study revealed that Abram`s needle biopsy that obtained pleural tissue was diagnostic in around 50% of patients presented with malignant effusion, and all grades of medical staff could perform the biopsy with awareness to technique and supervision [4].

If we compare this study with our study we will find that our complications with Abram`s needle biopsy were in 8 patient

from 30 (26.7%) in the form of: 4 patients suffering from pneumothorax which was diagnosed clinically by dyspnea and by chest x ray, required ICT insertion and 2 patients from hemoptysis noticed shortly after the Abram`s procedure treated by medical management and didn`t require blood transfusion or any invasive procedure and one patient from vasovagal attack and transient loss of consciousness treated by rising leg up, normal saline infusion and atropine injection and one patient from empyema treated by ICT insertion and aggressive antibiotics. So, our complications were higher than the previous study.

In another study**(10)** which they studied standard pleural biopsy versus CT-guided cutting-needle biopsy for diagnosing malignant disease in pleural effusions. There were no complications reported in the group who underwent CT-guided biopsy, but in the Abram`s biopsy group, there was one moderate sized subcutaneous hematoma that needed only conservative treatment.

CT-guided biopsy sensitivity was higher for pleural malignancy than that of Abram's needle biopsy. CT biopsy 87% [13/15], Abram`s needle biopsy 47% [8/17]; So CT-guided pleural biopsy is more effective than standard Abram`s needle biopsy in diagnosing malignant pleural disease. The percentage of this difference is significant. 47% of patients were diagnosed to be malignant by standard Abram`s biopsy correctly and eventually proved to have pleural malignancy, but CT-guided biopsy accurately identified 87%. A lot of factors could help in the diagnostic advantage of CT-guided pleural biopsy in this trial. Such as the ability of imaging to become ensure that the biopsy specimen is taken from suspicious pleural tissue. Only one significant complication was noted in this study in the Abram`s group (a moderate sized hematoma). However, in other series, Abram`s biopsy has been shown to be associated with pneumothorax in 3–20% of cases, and hematoma, pleural infection, hemothorax, and vagal syncope. Sensitivity for diagnosis of malignancy with CT-guided pleural biopsy in this study was 87%, which is only slightly lower than published sensitivities from two large thoracoscopy series (95%).

An earlier study (10) recorded statistically and clinically considerable improvement of sensitivity for malignant pleural disease diagnosis with CT-guided pleural biopsy in comparison with traditional Abram`s needle biopsy. CT-guided pleural biopsy should be the preferred biopsy method in patients with suspected malignancy **(10)**.

If we compare this study with our study, we will find that our complications with US guided Abram`s needle biopsy were in 8 patient from 30 (26.7%). So, complications

in our study were higher than CT guided pleural biopsy and our sensitivity with US guided Abram`s needle was less than the CT guided pleural biopsy.

In another study**(2), they** compared between VATS and CT-Guided pleural needle biopsy in diagnosis of pleural effusion in 124 patients, metastatic pleural disease was diagnosed in 47, malignant mesothelioma in 33, benign pleural disease in 42, and two were of indeterminate origin. In the CT-guided group, the diagnostic sensitivity was 87.5%, compared with 94.1% in the VATS group; the difference was not statistically significant. Complication rates were low and acceptable. They suggested, that CT-guided biopsy is the first diagnostic evaluation after cytologic investigation of the fluid in patients with pleural thickening or pleural lesions observed in the thorax CT scan. This group comprised a significant majority of the patients with pleural pathology.

However, in patients with only pleural effusion in CT scan, VATS should be the first method used to improve the definitive diagnosis. There are other advantages of VATS, such as drainage, pleurodesis, and it can be achieved in a single session.

If we compare this study with ours, we found that sensitivity of VATS is slightly higher than the latter study **(2)** as conclusive result of VATS guided biopsy in our study was ١٠٠% as ٢٥patients had specific diagnosis of malignancy and ٥ patients are benign.

Another study (11), found that there was no statistical difference between the two groups in diagnostic accuracy, hospitalization, postoperative pain, morbidity and mortality. So, VATS is a safe diagnostic procedure in this group of patients based on these results and minimal scar and can replace limited thoracotomy **(11)**.

A former study(**12),** found that VATS allowed for direct view of the biopsy sample throughout the procedure, and examined the diagnostic yield of thoracoscopy and its utility in the therapy of pleural illness in a six-year retrospective analysis of patients who had at least one medical thoracoscopy. Malignant mesothelioma was diagnosed in 149 individuals between January 2006 and December 2012, and 19 of those patients had VATS done for therapeutic purposes. Of the 149 patients, 123 were males and the mean age standard error was 611 years (MM). Thoracoscopy had been used to make diagnoses in 120 out of 149 patients who'd already had at least one closed pleural biopsy done. In 43 of the 96 instances, thoracoscopy contradicted the diagnosis based on a closed pleural biopsy. Thoracoscopy showed malignant mesothelioma in 16 instances, adenocarcinoma in 10 cases, indeterminate

carcinoma in three cases, and pleural TB in three cases in 66 cases of nonspecific inflammation identified by closed pleural biopsy. Closed pleural biopsy diagnosis of malignant mesothelioma was made in 18 instances; thoracoscopy was used for accurate staging in 4 of these cases. Thoracoscopy identified the histologic type in seven out of the 12 instances of cancer detected with closed pleural biopsy. Thoracoscopic diagnosis was negative in 10 of 149 instances, mostly because of pleural adhesions that impeded access to the pleural cavity. Thoracoscopic diagnosis was negative in 10 cases. Six incidences of empyema and one thoracoscopy-related fatality were reported. on comparison with our results, we discovered that our VATS biopsy yield was 100% positive in all patients, which is somewhat higher than his study's **(12)**.

Dyspnea was the most common symptom in patients who had VATS because of a malignant pleural effusion, according to a previous research **(13)**. This was found in 49 out of the individuals who were studied (77 %). Cough was the second most common symptom, appearing in 33 of the cases (50 %).

In our research, we documented the signs and symptoms that some individuals were experiencing. Diarrhea was reported by 27 patients (87.5%), cough by 14, and chest pain by 9, while toxic manifestations were reported by 3, expectoration was reported by 2, and hemoptysis was reported by 5 patients (12.5%). Diarrhea was reported by 27 patients (87.5%), cough by 14, and chest pain by 9, and cough by 14 patients (42.5%).

In our investigation, the sensitivity of VATS to identify malignant tumors was 100%, compared to previous studies in which the sensitivity was in the same range. Pleural adhesions may reduce the utility of VATS in the therapy of pleural illness, although it is still an effective and safe procedure. With respect to Abram's pleural biopsy's lower diagnostic yield than that of VATS, CT-guided pleural biopsy, and US-guided Abram's pleural biopsy [9], it is impossible to assure that the biopsy specimen is collected from an area other than suspect pleural tissue. A bigger biopsy channel (now 2mm) allows for greater accuracy in diagnosis, as well as better access to the pleural cavity. When VATS was first developed in 1910 it had several benefits over open pleural biopsy, including adequate access, no huge surgical incision, rapid recovery of patients, and less problems, therefore it has progressively supplanted the open pleural biopsy in most areas of the globe. There are two scenarios in which VATS' diagnostic effectiveness should be considered: when thoracocentesis and closed pleural biopsy have failed to obtain a conclusive diagnosis.

Pleural malignancy may be accurately diagnosed with the use of VATS, which is regarded a valuable diagnostic tool for chest doctors [14]. Our findings support the use of VATS in patients with intact performance status. Procedures such as Talc powdering are safe and cost-effective, with a low morbidity rate.

Pleural biopsy should be performed in the most efficient manner possible. Increasingly, image-guided biopsies and VATS are replacing blind Abram's needle biopsy as the preferred method for diagnosing malignant illness. The operator may also see any pleural anomalies immediately using VATS, enhancing diagnostic yield and making therapeutic treatments like pleurodesis [15] easier to perform. Absence of vision is a major drawback of Abram's biopsy. US-guided Abram's needle biopsy increases diagnostic yield and reduces complications[15, 16].

5. Conclusions

VATS is a safe and accurate method for diagnosis of pleural lesions and pleural effusions and more sensitive than US guided Abram`s needle biopsy. In case of pleural effusion due to pleural disease pleural biopsy guided with US and VATS both are good methods and effective, but effusion due to pulmonary disease VATS is more accurate.

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