VATS versus ultrasound-guided Abrams needle biopsy in undiagnosed pleural effusion: Old wisdom and new insights

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Abstract

Background: Video Assisted Thoracoscopic surgical Biopsy (VATS) biopsy and transthoracic ultrasound-guided Abrams needle biopsy (TUS-GANB) are important tools in management of undiagnosed pleural effusion due to their high diagnostic yield in comparison to blind closed pleural biopsies.

Methods: From November 2015 to July 2017, a prospective study included a total number of 90 patients of undiagnosed pleural effusion who were randomly divided into two groups: group A (45 patients who underwent VATS biopsy), and group B (45 patients who underwent TUS-GANB). Safety and efficacy of both procedures were compared.

Results: Both procedures were safe with no perioperative mortality. A definitive histopathological diagnosis was obtained in 43 patients (95.6%) in group A and in 39 patients (86.7%) in group B (p = 0.266). VATS was superior to ultrasound guided biopsy in diagnosing pleural effusion due to pulmonary causes (p = 0.02). Both VATS and ultrasound guided biopsy were effective in diagnosing pleural effusion due to pleural causes (p = 0.358). Complications in group A were minor bleeding in 3 (6.7%), pain in 5 (11.1%), surgical emphysema in 1 (2.2%), prolonged air leakage in 3 (6.7%), pneumothorax in 5 (11.1%) and wound infection in 2 (4.4%). Complications in group B were minor bleeding in 1 (2.2%), pain in 2 (4.4%), surgical emphysema in 1 (2.2%), pneumothorax in 2 (4.4%) and haemoptysis in 2 (4.4%).

Conclusions: VATS was superior to ultrasound guided biopsy in diagnosing pleural effusion due to pulmonary causes. Both VATS and ultrasound guided biopsy were effective in diagnosing pleural effusion due to pleural causes.

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1. 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.

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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].

Blind closed pleural biopsy plays an important role in diagnosing tuberculous pleural effusion with a sensitivity reaching up to 85% due to the diffuse involvement of the pleura by tuberculosis. However, it has a low diagnostic yield in diagnosing malignant pleural effusion with a sensitivity ranging between 48% and 56% due to the patchy pleural involvement in case of malignant pleural effusion [2]. Moreover, the malignant pleural deposits are predominant close to the midline and diaphragm which are very dangerous areas that should be avoided during taking blind closed pleural biopsies to avoid injury of vital vessels and structures at these areas. So, the diagnostic yield of blind closed pleural biopsies for malignant pleural deposits will be markedly affected after avoiding these areas [3].

Various new techniques were used to overcome the low diagnostic yield of blind closed pleural biopsies. VATS biopsy and transthoracic ultrasound guided Abrams needle biopsy (TUS-GANB) are important tools in the management of undiagnosed pleural effusion due to their high diagnostic yield in comparison to closed pleural biopsies [1].

Thoracoscopy is reported to be the golden standard for diagnosing malignant pleural effusion. However, some studies concluded that closed pleural biopsy guided by ultrasound or computed tomography (CT) imaging has a similar diagnostic yield to that of thoracoscopy [5].

TUS-GANB could provide a safe access to the lowermost portion of the parietal pleura, where pleural metastases are more likely to be initially found, leading to improvement of its diagnostic yield [6].

2. Patients and methods

From November 2015 until July 2017, a prospective study included a total number of 90 patients with undiagnosed pleural effusion after approval from the institutional Ethics Committee. Informed consents were obtained from all patients. Patients were randomly divided into two groups: group A and group B. Randomization was done by using a computer program named Random Number Generator which generates random numbers in a random number table. Group A (45 patients who underwent VATS biopsy), and group B (45 patients who underwent TUS-GANB).

Aspiration and complete analysis of pleural fluid were done at least twice prior to biopsy in all patients. All cases of undiagnosed pleural effusion had an exudative pleural effusion.

Pleural effusion was considered as an undiagnosed pleural effusion after the failure of establishing its causes after clinical examination, radiological investigations (including chest x-ray, CT scan of the chest) and laboratory investigations (including biochemical, microbiological and cytological analysis of the pleural fluid). So, any patient with a diagnosed cause of pleural effusion (by those previous investigations) was not included in this study. The study included only those patients with undiagnosed pleural effusion after the failure of establishing its causes after clinical examination, radiological investigations and laboratory investigations.

2.1. Video-assisted thoracoscopy group (group A)

Patients were prepared for general anesthesia with double lumen intubation in this group. After intubation, patients were placed in lateral position. A 1–2 cm incision was done on the affected side in the 6th or 7th intercostal space at midaxillary line passing through skin, muscles and pleura and it was used as a camera port. After excluding lung adherence to the parietal pleura by introducing a finger into the intercostal space and ensuring lung collapse, the camera was introduced through this port. Then the next trocar was entered under direct visualization through the proper space. All suspicious areas were biopsied by biopsy forceps.

In some cases, when no specific histopathology results were obtained, patients were followed up for six months. If there were no new lesions or no recurrence of pleural effusion after this interval, the non-specific pathology would be considered as a definitive diagnosis. If a new lesion appears or there was a recurrent pleural effusion during or after this 6 months interval and it was not diagnosed by routine workup, a revision VATS was done to obtain a definitive diagnosis.

2.2. Transthoracic ultrasound guided Abrams needle biopsy (TUS-GANB) (group B)

The ultrasonography machine used in our study was PHILIPS EPICQ 7G. The procedure was done while the patient was sitting with folded arms across the chest and supported by a bedside table. Ultrasound examination was achieved by a standard 3.75 MHz sector probe after a full evaluation of the affected side. The requirements for successful biopsy were: the presence of a suitable ultrasound window with no air or bone overlying the lesion, absence of any possible vital organ along the Abrams needle pathway, and presence of a suitable angle of needle entry with a suitable lesion depth. Safety was always the main target. After identification of the best biopsy site and disinfection of its surrounding area, an infiltration of lidocaine 2% was done. TUS-GANB was performed by 14 or 16 gauges Abrams needle. At least 3 Abrams needle biopsies were obtained and transported in ten percent formalin. At least one biopsy was sent for microbiological investigation and was transported in normal saline.
The cutting aspect of the needle was directed caudally in the intercostal space to avoid injury to the intercostal vessels and nerves. Special care was taken into consideration to avoid exceeding the measured depth of the suspected lesion. For focal pleural lesions, the Abrams needle was introduced along the maximal diameter of the mass. For diffuse pleural thickening, the Abrams needle was introduced along the maximal pleural thickness. For lung masses, the Abrams needle was advanced through the lesions provided that they extended to the parietal pleura. A chest x-ray was done for all patients 1 h after the procedure to rule out any possible early complications. All patients were closely observed for 4 h after the procedure.

If no specific pathology was obtained, VATS biopsy was taken to reach the definitive diagnosis. If still there was no specific pathology after VATS, patients were followed-up for 6 months. If no new lesions appear after this interval, the non-specific pathology would be considered as a definitive diagnosis.

2.3. Statistical analysis

SPSS version 20 was used for the statistical analysis of the collected data. Results were given as mean ± standard deviations. Significance between the two groups was determined by independent t-test if data were quantitative and chi-square test if data were categorical. Fisher’s exact test was used instead if there were expected cell frequencies less than 5. A p value of less than 0.05 was considered significant. Patients’ data, histopathological results, radiological findings and complications were compared.

3. Results

The total number of patients who were included in our study was 90 patients, with 33 (73.3%) males and 12 (26.7%) females in group A; 31 (68.9%) males and 14 (31.1%) females in group B; the mean age was 47.13 ± 17.61 years in group A and 48.88 ± 16.53 years in group B. In group A there were 18 (40.0%) who were current smokers, 15 (33.3%) who were ex-smokers and 12 (26.7%) who were non-smokers. In group B, there were 14 (31.1%) who were current smokers, 21 (46.7%) who were ex-smokers and 10 (22.2%) who were non-smokers. No history of tuberculosis or malignancy was noted in any group preoperatively. These data showed no statistical significance between both groups regarding age, sex and history of smoking. Patients’ data and characteristics are shown in Table 1.

From the study design shown in Fig. 1, the 45 patients who underwent VATS biopsy were evaluated after histopathological diagnosis. The diagnostic sensitivity for tuberculous pleural effusion was 12/12 (100.0%). The diagnostic sensitivity for malignant mesothelioma was 7/8 (87.5%). The diagnostic sensitivity for malignant pleural effusion due to pulmonary malignancy was 14/14 (100.0%). The diagnostic sensitivity for pleural metastasis secondary to non-pulmonary malignancy was 10/11 (90.9%). The total diagnostic sensitivity of VATS was 43/45 (95.6%). Only 2 patients were not diagnosed by VATS for the first time. Patients were followed-up for 6 months during which the pleural fluid and the signs of malignancy become abundant again. A revision VATS biopsy was done and a definitive diagnosis was achieved in that remaining two patients. One patient was finally diagnosed as a case of malignant mesothelioma and the other patient was finally diagnosed as a case of pleural metastasis secondary to non-pulmonary malignancy (breast cancer).

The 45 patients who underwent TUS-GANB were evaluated after histopathological diagnosis. The diagnostic sensitivity for tuberculous pleural effusion was 14/15 (93.3%). The diagnostic sensitivity for malignant mesothelioma was 12/12 (100.0%). The diagnostic sensitivity for malignant pleural effusion due to pulmonary malignancy was 5/9 (55.5%). The diagnostic sensitivity for pleural metastasis secondary to non-pulmonary malignancy was 8/9 (88.9%). The total diagnostic sensitivity of TUS- GANB was 39/45 (86.7%). There were 6 patients who were not diagnosed with TUS-GANB for the first time. A diagnostic VATS biopsy was done for those undiagnosed 6 patients. A definitive diagnosis was achieved in 4 patients out of those 6 patients. These 4 patients were finally diagnosed as malignant pleural effusion due to pulmonary malignancy. No specific histopathological diagnosis was achieved in the remaining two patients after the diagnostic VATS. These two patients were

<table>
<thead>
<tr>
<th>Table 1</th>
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<tbody>
<tr>
<td>Patients’ data and characteristics.</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
</tr>
<tr>
<td>Mean ± SD</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
</tr>
<tr>
<td>Male:</td>
</tr>
<tr>
<td>Female:</td>
</tr>
<tr>
<td><strong>History of smoking</strong></td>
</tr>
<tr>
<td>Current smoker:</td>
</tr>
<tr>
<td>Ex-smoker:</td>
</tr>
<tr>
<td>Non-smoker:</td>
</tr>
</tbody>
</table>

Significance between the two groups was determined by independent t-test if data are quantitative and chi-square test if data are categorical. Data are mean ± standard deviation or numbers of patients (with the percentage in parenthesis).

N.B. No history of tuberculosis or malignancy was noted in any group preoperatively.

* Fisher’s exact test was used instead as there are expected cell frequencies less than 5.
followed-up for 6 months during which signs of malignancy became evident in one patient and a revision VATS biopsy was done and this patient was finally diagnosed as a case of pleural metastasis secondary to non-pulmonary malignancy (cancer thyroid). The remaining undiagnosed patient was diagnosed as a case of tuberculous pleural effusion after the development of an increased pleural adenosine deaminase level (72 units/dl). Comparison between the diagnostic sensitivity of VATS biopsies and TUS-GANB is shown in Table 2.

Regarding the diagnostic sensitivity of VATS biopsies for malignant pleural effusion due to pulmonary malignancy, it was 14/14 (100.0%), while, the diagnostic sensitivity of TUS-GANB for malignant pleural effusion due to pulmonary malignancy

**Table 2**

Comparison between the diagnostic sensitivity of VATS biopsies and TUS-GANB.

<table>
<thead>
<tr>
<th>Final diagnosis</th>
<th>VATS (No. = 45)</th>
<th>TUS-GANB (No. = 45)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total No. (^b)</td>
<td>No. (^c) and Sensitivity (%)</td>
<td>Total No. (^b)</td>
</tr>
<tr>
<td>Tuberculous pleural effusion</td>
<td>12</td>
<td>12 (100%)</td>
<td>15</td>
</tr>
<tr>
<td>Malignant mesothelioma</td>
<td>8</td>
<td>7 (87.5%)</td>
<td>12</td>
</tr>
<tr>
<td>Malignant pleural effusion due to pulmonary malignancy</td>
<td>14</td>
<td>14 (100%)</td>
<td>9</td>
</tr>
<tr>
<td>Pleural metastasis secondary to non-pulmonary malignancy</td>
<td>11</td>
<td>10 (90.9%)</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>45</td>
<td>43 (95.6%)</td>
<td>45</td>
</tr>
</tbody>
</table>

\(^a\) Fisher’s exact test was used instead as there are expected cell frequencies less than 5.
\(^b\) Number of cases in whom final diagnosis was reached by VATS for the first time.
\(^c\) Number of p cases in whom final diagnosis was reached by TUS-TCB for the first time.
\(^d\) Total number of cases in whom final diagnosis was reached at the end of the study.
was 5/9 (55.5%) with a significant statistical difference between both groups (p value = 0.020) denoting that VATS was superior to TUS-GANB in diagnosing pleural effusion due to pulmonary causes. The overall diagnostic sensitivity of VATS biopsies for pleural effusion due to pleural causes (tuberculous pleurisy + malignant mesothelioma + pleural metastasis secondary to non-pulmonary malignancy) was 29/31 (93.5%) while the overall diagnostic sensitivity of TUS-GANB biopsies for pleural effusion due to pleural causes was 34/36 (94.4%) (p value = 0.358).

The radiological findings in CT in both groups were also evaluated. There were 28 patients (62.2%) with moderate or massive pleural effusion and 17 patients (37.3%) with mild and mild to moderate pleural effusion in group A. On the other hand, there were 24 patients (53.3%) with moderate or massive pleural effusion and 21 patients (46.7%) with mild and mild to moderate pleural effusion in group B. There was no significant statistical difference between both groups (p value = 0.522).

There were 26 patients (57.8%) with free pleural effusion and 19 patients (42.2%) with loculated pleural effusion in group A. Meanwhile, there were 22 patients (48.9%) with free pleural effusion and 23 patients (51.1%) with loculated pleural effusion in group B. There was no significant statistical difference between both groups (p value = 0.526).

There were 18 patients (40.0%) with pleural thickness ≥ 5 mm and 27 patients (60.0%) with pleural thickness < 5 mm in group A. On the other hand, there were 23 patients (51.1%) with pleural thickness ≥ 5 mm and 22 patients (48.9%) with pleural thickness < 5 mm in group B. There was no significant statistical difference between both groups (p value = 0.397).

There were 8 patients (17.8%) and 9 patients (20.0%) with pleural nodules in group A and group B respectively. There was no significant statistical difference between both groups (p value = 1.000). There were 14 patients (31.1%) and 9 patients (20.0%) with pulmonary nodules in group A and group B respectively. There was no significant statistical difference between both groups (p value = 0.334). There were 9 patients (20.0%) and 8 patients (17.8%) with mediastinal lymph nodes in group A and group B respectively. There was no significant statistical difference between both groups (p value = 1.000). A Comparison between radiological findings in CT scan of the chest in both groups is shown in Table 3.

Regarding development of complications in both groups, there were 3 patients (6.7%) and 1 patient (2.2%) with minor bleeding in group A and group B respectively. There was no significant statistical difference between both groups (p value = 0.616). There were 5 patients (11.1%) and 2 patients (4.4%) who developed postoperative pain in group A and group B respectively. There was no significant statistical difference between both groups (p value = 0.434). There were 1 patient (2.2%) and 1 patient (2.2%) who developed surgical emphysema in group A and group B respectively. There was no significant statistical difference between both groups (p value = 1.000). There were 3 patients (6.7%) and no patients (0.0%) who developed postoperative prolonged air leakage in group A and group B respectively. There was no significant statistical difference between both groups (p value = 0.242). There were 5 patients (11.1%) and 2 patients (4.4%) who developed pneumothorax in group A and group B respectively. There was no significant statistical difference between both groups (p value = 0.434). There were no patients (0.0%) and 2 patients (4.4%) who developed hemoptysis in group A and group B respectively. There was no significant statistical difference between both groups (p value = 0.494). There were 2 patients (4.4%) and no patients (0.0%) who developed wound infection in group A and group B respectively. There was no significant statistical difference between both groups (p value = 0.494). A Comparison between complications in both groups is shown in Table 4.

4. Discussion

A pleural biopsy can be obtained blindly, image guided or by thoracoscopy. The best method for taking pleural biopsies from patients with undiagnosed exudative pleural effusion is still controversial [3]. Although VATS and TUS-GANB have a higher diagnostic yield than blind closed pleural biopsy, some authors suggest that blind closed pleural biopsy is still having a good place in diagnosing exudative pleural effusion due to its lower cost, simplicity and its high diagnostic sensitivity for tuberculous pleural effusions [7,8]. However, blind closed pleural biopsy has a low diagnostic yield in diagnosing malignant

### Table 3

Comparison between radiological findings in computed tomography (CT) in both groups.

<table>
<thead>
<tr>
<th>Amount of pleural effusion:</th>
<th>VATS (No. = 45)</th>
<th>TUS-GANB (No. = 45)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ moderate pleural effusion</td>
<td>28 (62.2%)</td>
<td>24 (53.3%)</td>
<td>0.522*</td>
</tr>
<tr>
<td>&lt; moderate pleural effusion</td>
<td>17 (37.3%)</td>
<td>21 (46.7%)</td>
<td>0.522*</td>
</tr>
<tr>
<td>Distribution of pleural effusion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free</td>
<td>26 (57.8%)</td>
<td>22 (48.9%)</td>
<td>0.526*</td>
</tr>
<tr>
<td>Loculated</td>
<td>19 (42.2%)</td>
<td>23 (51.1%)</td>
<td>0.526*</td>
</tr>
<tr>
<td>Pleural thickness ≥ 5 mm</td>
<td>18 (40.0%)</td>
<td>23 (51.1%)</td>
<td>0.397*</td>
</tr>
<tr>
<td>&lt; 5 mm</td>
<td>27 (60.0%)</td>
<td>22 (48.9%)</td>
<td>0.397*</td>
</tr>
<tr>
<td>Pleural nodules</td>
<td>8 (17.8%)</td>
<td>9 (20.0%)</td>
<td>1.000*</td>
</tr>
<tr>
<td>Pulmonary nodules</td>
<td>14 (31.1%)</td>
<td>9 (20.0%)</td>
<td>0.334*</td>
</tr>
<tr>
<td>Mediastinal lymph nodes</td>
<td>9 (20.0%)</td>
<td>8 (17.8%)</td>
<td>1.000*</td>
</tr>
</tbody>
</table>

* Fisher’s exact test was used instead as there are expected cell frequencies less than 5.
pleural effusion with a sensitivity ranging between 48% and 56% due to the patchy pleural involvement in case of malignant pleural effusion [2].

Taking the biopsy blindly is the main limitation of closed pleural biopsy. However, VATS provides direct lesion visualization which increases the diagnostic sensitivity markedly. Moreover, VATS allows drainage of effusion and pleurodesis in the same procedure. However, it is more expensive and takes more time than other procedures as it is done in the operating theatre under general anesthesia, requires an inpatient stay and has a higher complication rate [9].

Ultrasound-guided closed pleural biopsy has been used more frequently in the recent era because it has a higher diagnostic yield than a blind closed pleural biopsy and it has a relative higher safety with no radiation risk to the patient and with a real-time visualization of the biopsy needle throughout the procedure. The possible explanation of the high diagnostic yield is that ultrasound provides the ability to take biopsies from the lower part of the parietal pleura where pleural metastases are more commonly found. Blind closed pleural biopsy should be avoided in these areas due to the increased risk of complications [10]. Image guided closed pleural biopsy is the technique of choice in patients with pleural masses and diffuse or nodular thickening with a high diagnostic yield [3].

In our study, both VATS and ultrasound guided biopsy are effective in diagnosing pleural effusion due to pleural causes (p = 0.358) while the diagnostic sensitivity of VATS is superior to ultrasound guided biopsy in diagnosing pleural effusion due to pulmonary causes (p = 0.02). Metintas et al. reported no significant differences between the diagnostic sensitivity of thoracoscopy and image guided Abrams needle biopsy in patients with malignant pleural effusion. This may be because most of the patients included in their study were patients with malignant pleural effusions due to malignant mesothelioma [5]. The incidence of malignant mesothelioma in our study was low (8 patients (17.8%) in group A and 12 patients (26.7%) in group B). The diagnostic sensitivity for malignant mesothelioma was 100% in TUS-GANB group and 87.5% in VATS group while the diagnostic sensitivity in the study of Metintas et al. was 87% for image guided Abrams needle biopsy group and 94% for thoracoscopy group [5]. Stigt et al. reported a diagnostic sensitivity of 80% by ultrasound guided biopsy which was used in 14 patients with malignant mesothelioma [11].

Koegelenberg et al. reported that TUS-GANB had a significantly higher diagnostic sensitivity for tuberculous pleural effusion than results obtained by Tru-Cut needle biopsy. Moreover, they mentioned that the diagnostic sensitivity of TUS-GANB for malignant pleural effusion was 83% which is similar to the results obtained in our study which was (83.3%) [10]. These high diagnostic sensitivities can be explained by choosing low biopsy entry sites (near the diaphragm) where pleural metastases are more commonly to be found.

However, we found the limitations for ultrasound guided biopsy were: lesions in contact with chest wall for <10 mm regardless their size and location, location behind a rib and small lesions <20 mm. These limitations increased the failure rate of obtaining a good biopsy from which a definitive histopathological diagnosis can be achieved. Image-guided biopsy does not necessitate the presence of pleural effusion to ensure safety. However, the absence of pleural effusion markedly increases the risk of pneumothorax. In our study, all cases had undiagnosed pleural effusions. The size of the lesion clearly reflects the ease of the procedure. However, a pleural thickness of 5 mm was effectively biopsied by Adams and Gleeson [12].

A definitive histopathological diagnosis does not only help the oncologist to decide the treatment strategy, but it also provides important information about the patient prognosis [13].

Moreover, the diagnostic sensitivity may depend upon the type of the malignancy; adenocarcinoma, for example, has a better rate of cytological detection than squamous cell carcinoma or lymphoma. In cases of mesothelioma, only 20% of cases are diagnosed by cytology alone [14].

In our study, we found that the thoracoscopic gross appearances of the lesions were coinciding with the histopathological diagnosis where the presence of nodules is usually associated with malignancy while diffuse thickening, plaques and adhesions were usually associated with tuberculosis or other causes of pleural inflammation. These results were not in agreement with Hersh et al. who mentioned that the thoracoscopic appearance was not reliable and it is not recommended to depend upon the gross appearance of the pleura alone without taking biopsies [15]. Aiello et al. reported that malignant pleural effusion was demonstrated by VATS in nearly half of their patients [16]. Our results showed that malignant pleural effusion was found in 33 patients (73.3%) in group A and in 30 patients (66.7%) in group B.

Maskell et al. studied a group of patients with a pleural thickness less than 5 mm. The diagnostic sensitivity of image-guided cutting needle biopsy in their study was 75% [17]. Therefore, in case of minor pleural thickening, it is expected that

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### Table 4
Comparison between complications in both groups.

<table>
<thead>
<tr>
<th>Complications</th>
<th>VATS (No. = 45)</th>
<th>TUS-GANB (No. = 45)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor bleeding</td>
<td>3 (6.7%)</td>
<td>1 (2.2%)</td>
<td>0.616*</td>
</tr>
<tr>
<td>Pain</td>
<td>5 (11.1%)</td>
<td>2 (4.4%)</td>
<td>0.434*</td>
</tr>
<tr>
<td>Surgical emphysema</td>
<td>1 (2.2%)</td>
<td>1 (2.2%)</td>
<td>1.000*</td>
</tr>
<tr>
<td>Prolonged air leakage</td>
<td>3 (6.7%)</td>
<td>0 (0.0%)</td>
<td>0.242*</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>5 (11.1%)</td>
<td>2 (4.4%)</td>
<td>0.434*</td>
</tr>
<tr>
<td>Haemoptysis</td>
<td>0 (0.0%)</td>
<td>2 (4.4%)</td>
<td>0.494*</td>
</tr>
<tr>
<td>Wound infection</td>
<td>2 (4.4%)</td>
<td>0 (0.0%)</td>
<td>0.494*</td>
</tr>
</tbody>
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* Fisher’s exact test was used instead as there are expected cell frequencies less than 5.
sufficient tissue biopsy could not be obtained by image-guided cutting needle biopsy. In our study, the diagnostic sensitivity of TUS-GANB in patients with a pleural thickness less than 5 mm was 90.9% (20 out of 22 patients). Abrams needle provides the ability to obtain good tissue biopsy; so, the insufficient biopsy problems encountered with cutting needle biopsy is not encountered with Abrams needle biopsy.

VATS is not usually used as a pure diagnostic procedure and further interventions could be done in the same operation, such as extensive adhesiolysis, pleurectomy and decortication [18]. Therefore, it is not surprising that the rate of complications in VATS patients is higher than any other biopsy techniques. No major complications were reported in our study. However, major complications were reported in 1.2% of patients in a study done by Medford et al. [19]. Moreover, major complications had been reported in 15% of patients studied by Harris et al. [20]. Minor complications such as minor bleeding, pain, surgical emphysema, prolonged air leakage, pneumothorax, wound infection and transient mild hemoptysis were reported in our study (Table 4). In contrast, Hallifax et al. did not report any minor or major complications during ultrasound-guided biopsy [21]. Benamore et al. reported nearly the same incidence of pneumothorax (4.7%) like our study (4.4%) regarding patients undergoing ultrasound-guided biopsy but reported a higher incidence of minor bleeding (7.5%) at the site of biopsy while our results showed minor bleeding in only (2.2%) of patients undergoing ultrasound-guided biopsy [22].

Metintas et al. reported a conclusion which was similar to our results. They recommended that image-guided Abrams needle biopsy should be the technique of choice in patients with pleural lesions or thickening. Moreover, they recommended thoracotomy for patients with only pleural effusion in CT and also for patients with the suspected benign pleural disease, other than tuberculosis, to rule out malignancy [5].

Clinicians should be aware of the evidence supporting the use of different modalities to guide their treatment choice [23–26]. We think that there is no single biopsy technique that is appropriate for every patient presenting with pleural effusion. Each technique has specific patient targets to whom that technique is always considered to be superior. The majority of patients may have some clinical and radiological criteria which will promote themselves to a particular technique. The choice between different techniques cannot be based on a comparison of diagnostic rates and complications, but also on other factors such as the ability to control the production of pleural fluid by the chosen technique and on patient preference. By taking these issues into consideration, individualised patient management can reach a high standard of patient care [18].

Furthermore, routine daily use of prediction scores in our clinical practice could help us in discussions with patients about their prognosis and ultimately has the potential to guide us to choose the best technique [27].

5. Conclusions

VATS biopsy is superior to TUS-GANB. VATS is effective in diagnosing pleural effusion due to both pulmonary and pleural causes. The results of TUS-GANB for pleural causes of pleural effusions is better than the results of TUS-GANB for pulmonary causes of pleural effusions.

Disclosure

The authors declare no conflict of interest.

Conflicts of interest

The author has no conflict of interest to declare.

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None.

References


