

Transthoracic Fine-needle Aspiration Versus Tru-cut Biopsy Under Computed Tomography-scan Guide in Diagnosis of Peripheral Lung Lesions

Maitham Fuad Abdal-Hussain

Department of Medicine, Al-Zahraa Teaching Hospital, Wasit, Iraq

Abstract

Background: Lung cancer is the number one cause of cancer-related death in the Western world. Intrapulmonary nodules are presenting either solitary or multiples. Primary bronchogenic carcinoma is the most common malignant tumor that presents as a solitary pulmonary nodule. Fine-needle aspiration (FNA) and Tru-cut biopsy are parts from several interventional procedures that need to reach to the final diagnosis. **Aim:** This study aims to assess the comparison between transthoracic FNA results and Tru-cut biopsy results in the diagnosis of peripheral pulmonary lesions and the possibility of depending on one of them in the diagnosis of these lesions. **Materials and Methods:** FNA and true cut biopsy under computed tomography scan guided were performed to patients had peripheral pulmonary lesion and sent to the cytological and histopathological laboratory for analysis. **Results:** All patients (20) that had pulmonary lesion were evaluated. Results of FNA were; 15/20 of them were adequate samples for diagnosis while 5/20 were inadequate. Results of Tru-cut biopsies were – 17/20 were adequate for histopathological assessment while 3/20 were inadequate. Thirteen out of 20 patients had malignancy, five patients diagnosed by both Tru-cut biopsy and FNA, other five diagnosed by Tru-cut biopsy only and three patients diagnosed by FNA only. One patient had benign lesion and diagnosed by both procedures. Six out of 20 patients had other results that diagnosed by both procedures. Squamous cells carcinoma was 5/13 patients (38.46%) and adenocarcinoma was the same percentage. The concordance of FNA results with Tru-cut biopsy results was 60%. **Conclusion:** The study demonstrated that Tru-cut biopsy is moderately superior to FNA in the evaluation of peripheral malignant lung lesions. Therefore, we advise not using the FNA alone in the evaluation of peripheral chest lesions that suspected of malignancy (except if large bullae or severe emphysema present) and Tru-cut biopsy is often required together to reach the diagnosis.

Keywords: Diagnosis, Lung cancer, Pulmonary lesion, Transthoracic Fine-needle aspiration, Tru-cut biopsy

INTRODUCTION

Lung cancer is the number one cause of cancer-related death in the Western world, and it remains the leading cause of cancer mortality for both men and women in the United States.^[1] It is the commonest cause of cancer death in women in the UK.^[2] The male:female ratio equal 2:1, but recently increasing in women, because of increasing the percentage of smoking among them.^[2]

Risk factors of lung cancer are multiple which include age of the patient (incidence of malignancy increases with increasing the age), smoking (average smokers have about a 10-fold risk and heavy smokers 20-fold risk),^[3] occupational exposures (exposure to radon, asbestos, mustard gas, arsenic, nickel, and others have been identified),^[4] history of current or prior

extra-pulmonary malignancy,^[3] diet (low amount of fruit and vegetable intake during adulthood), and genetic factors (first-degree relatives have a 2–3-fold excess risk).^[4,5]

A solitary pulmonary nodule is defined as a single discrete pulmonary opacity that is surrounded by normal lung tissue that is not associated with adenopathy or atelectasis and appears white round with soft-tissue density, measures <3 cm. Nodule size is closely correlated to risks of malignancy; those under 2 cm are malignant in 20%–66% of cases. Masses which are lesions larger than 3 cm are malignant 80%–99% of cases.^[3,6]

Address for correspondence: Dr. Maitham Fuad Abdal-Hussain, Department of Medicine, Al-Zahraa Teaching Hospital, Wasit, Iraq. E-mail: maithamfuad@yahoo.co.uk

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Primary bronchogenic carcinoma is the most common malignant tumor that presents as a solitary pulmonary nodule. Histologically, adenocarcinoma and squamous cell carcinoma make up the majority of the two. Malignant nodules tend to have speculated or irregular borders and may have pleural tags, tails or a notch in the border (Rigler's sign), they have doubling times estimated at between 20 and 400 days. The eccentric calcification patterns increase suspicious of malignancy.^[3]

Benign solitary pulmonary nodules are more common in nonsmokers and in the young. They include granulomas (which include infectious such as tuberculosis, histoplasmoses, or noninfectious such as sarcoidosis and rheumatoid arthritis), hamartomas (may contain cartilage, muscle, fat, and fibroblastic tissue). They tend to be well defined, smooth margin, small, round and may have calcification such as "popcorn," central, laminar, or diffuse pattern. Usually, they are stable in size when compared to prior films.^[3,6,7]

Multiple nodules are caused by the following: malignant causes such as metastases, non-Hodgkin lymphoma, and Kaposi sarcoma or benign causes such as septic emboli, fungal infection, abscess, tuberculosis, and pneumoconiosis.^[3]

Fine-needle aspiration (FNA) and Tru-cut biopsy are parts from several interventional procedures that need to reach to the final diagnosis.^[3]

Indication of FNA and/or Tru-cut biopsy include patients need starting chemotherapy and/or radiotherapy or a noncancerous lesion is strongly suspected, or patients need confirmation of cancer before surgery or if metastasis is a high likelihood.^[8]

The major limitation of these interventions is the possibility of pneumothorax especially when parenchyma lies in the path of the needle (10%–35% overall). In addition, bleeding (5%), pain and death (0.15%) are other complications.^[2,3]

The contraindications of these interventions include limited pulmonary reserve (e.g., FEV1 under 1 L) or large bulla or blebs in the needle path or unilateral pneumonectomy. Other contraindications are those with a history of severe pulmonary hypertension or bleeding diathesis or inability to hold breath.^[3]

MATERIALS AND METHODS

From 2014 to May 2016, in Baghdad Teaching Hospital, Baghdad, Iraq, this cross-sectional study was conducted. The procedures of FNA and Tru-cut biopsy under computed tomography (CT) scan guided were performed on a radiological department by spiral CT scan (Toshiba/Aquilion CXL).

Patients who included in this study were had at least one of the following signs and symptoms: chronic cough, exertional dyspnea, weight loss, chest pain or tightness, clubbing in addition to previous chest CT-scan that showed peripheral lung lesion. We excluded the patients who have low SpO₂.

Patients took instructions and information about the procedure and its risks.

For FNA aspiration used (spinal needle gauge 19 × 3.5) [Figure 1] and for Tru-cut biopsy used Bard Magnum (disposable core tissue biopsy needle; gauge and size 14 g × 20 cm) [Figure 2] and Bard Magnum reusable Core Biopsy Instrument [Figure 3].

Two consecutive scans were made at the appropriate level, to help directing the biopsy needles during the patient's breath hold, the first one for localizing the lesion exactly and the puncture entry point was marked on the skin after the sterile preparation, then local anesthetics of 2% lidocaine was applied.

After 1–2 min, FNA introduced and before aspiration the second scan (low-dose radiation) was made to confirm the position of needle inside the lesion [Figure 4]. 60 cc syringe used with FNA for aspiration and the needle was made into different parts of the lesion during aspiration.

The FNA samples were smeared on 3–4 microscope glass slides and fixed with alcohol for 20 min, then sent to the cytological laboratory for analysis.



Figure 1: Spinal needle gauge 19 × 3.5' for fine-needle aspiration

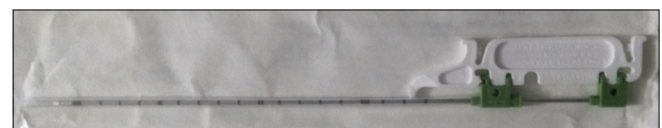


Figure 2: Disposable core tissue biopsy needle gauge and size 14 g × 20 cm



Figure 3: Bard Magnum Reusable Core Biopsy Instrument

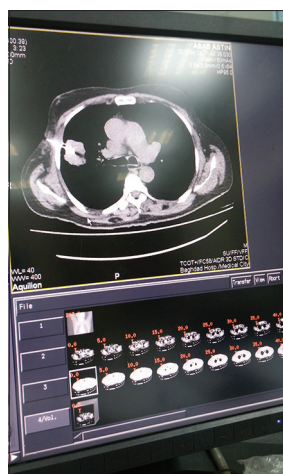


Figure 4: Second low-dose radiation scan to confirm the position of the needle inside the lesion

After that, the Tru-cut needle was introduced in the same direction for biopsy taking after expiration and holding the breath. The biopsy samples were put in 10% formalin and sent to the histopathological laboratory for analysis.

After 1 h from the procedure, Chest X-ray was done for all patients to exclude any complications. Patients with no signs of complications were discharged.

RESULTS

The age range of 20 patients was from 32 to 80 years. The male: female ratio was 4:1. About 84.2% of them were above 50 years. All cases had lesion at the periphery.

The results of FNA were; 15/20 of them (75%) were adequate samples for cytological diagnosis while 5/20 (25%) of them were inadequate (bloody samples), while the results of Tru-cut biopsies were; 17/20 of them (85%) were adequate for histopathological assessment while 3/20 (15%) of them were inadequate (necrosis or fibrous tissue) [Table 1].

From those 20 patients, 13/20 patients (65%) had malignancy, five of them diagnosed by both Tru-cut biopsy and FNA, other five diagnosed by Tru-cut biopsy only (their FNA were bloody samples), and three patients diagnosed by FNA only (their Tru-cut biopsy results were necrosis or fibrous tissue); therefore, the malignancy that diagnosed by Tru-cut were ten patients and by FNA were eight patients.

One out of 20 patients (5%) had benign lesion which revealed thyroid tissue and diagnosed by both FNA and Tru-cut biopsy while 6/20 patients (30%) had other results (two of them (10%) had organizing pneumonia and the reminders (20%) had inflammatory cells, fibrous tissue, and lung tissue) that also diagnosed by both procedures [Table 2].

The types of malignancy were as follows:

- Squamous cells carcinoma founded in 5/13 patients (38.46%), two of them (2/5) diagnosed by both FNA and Tru-cut biopsy, the other two (2/5) diagnosed by FNA only, and only one (1/5) diagnosed by Tru-cut biopsy only

Table 1: Results of fine needle aspiration and Tru-cut

Procedures	Number of adequate samples	Number of inadequate samples
FNA	15	5
Tru-cut biopsy	17	3

FNA: Fine-needle aspiration

- Adenocarcinoma founded in 5/13 patients (38.46%); three of them (3/5) diagnosed by Tru-cut biopsy only, one (1/5) diagnosed by both FNA and Tru-cut biopsy, and one (1/5) diagnosed by FNA only
- One result 1/13 (7.6%) was large cell carcinoma diagnosed by Tru-cut biopsy only
- The last two results 2/13 (15.38%) were undifferentiated non-small cell carcinoma diagnosed by both FNA and Tru-cut biopsy [Table 3].

The concordance of FNA results with Tru-cut biopsy results was 60%. In malignancy results, the concordance was 38.46% while in benign lesion and other diagnoses the concordance was 100%. In squamous cell carcinoma, the concordance was 40% and in adenocarcinoma was 20% while in undifferentiated non-small cell carcinoma were 100% [Table 4].

Two patients (10%) developed mild hemoptysis after Tru-cut biopsy and stopped after 20–30 min. One patient (5%) developed pneumothorax after the procedure and need chest tube insertion.

DISCUSSION

Results of this study found that the male:female ratio of 4:1 and this is in accordance with results obtained by several authors.^[9,10]

All bronchogenic cell carcinoma in this study were non-small cell carcinoma, which is in agreement to the experience of other studies.^[9,11,12]

Histopathological studies of FNA and biopsy in this study showed that the squamous cell carcinoma and the adenocarcinoma were the same percentage, and these were incompatible to other studies,^[9,13] that reported the adenocarcinoma was the most common, this is may be due to either some cases of adenocarcinoma was wrongly interpreted as squamous cell carcinoma and this need special stains such as immunocytochemistry and/or immunohistochemistry for differentiation as reported in Shrivasti *et al.*'s study,^[9] or due to the small number of patients in this study.

Five of FNA samples (25%) were inadequate (bloody sample), and it may be due to inappropriate aspiration, and this is in agreement to that reported in Beslic *et al.*'s study which had 20.4% of FNA with inadequate samples.^[13]

Three FNA samples were malignant while their Tru-cut biopsy results were necrotic and/or fibrous tissue and this may be because the Tru-cut biopsy and FNA were aspirated from different sites of tumor mass which may contain necrotic tissue.

The results of six patients were reported as nonspecific; two of them showed organizing pneumonia and these may be due to infection, airways obstruction or lung malignancy,^[2,4] the

Table 2: Types of fine-needle aspiration and tru-cut results

Disease	Number of patients	Dx by Tru cut (only)	Dx by FNA (only)	Dx by both Tru-cut and FNA	Total Dx by Tru-cut biopsy	Total Dx by FNA	The concordance between the results
Malignancy	13	5 Their FNA results were bloody	3 Their Tru cut results were necrotic or fibrous tissue	5	5+5=10	5+3=8	5
Benign	1	-	-	1	1	1	1
Other	6	-	-	6	6	6	6
Total	20	5	3	12	17	15	12

FNA: Fine-needle aspiration

Table 3: Differentiation of malignant results

Types of malignancy	Number of patients	Dx by both Tru-cut and FNA	Dx by Tru-cut only	Dx by FNA only
Squamous cell carcinoma	5	2	1	2
Adenocarcinoma	5	1	3	1
Large cell carcinoma	1	-	1	-
Undifferentiated nonsmall cell carcinoma	2	2	-	-
Total	13	5	5	3

FNA: Fine-needle aspiration

Table 4: Percentage of concordance

Disease	Concordance of FNA results with Tru-cut results	Percentage
In malignant cases	5	5/13×100=38.46
In squamous cell carcinoma cases	2	2/5×100=40
In adenocarcinoma cases	1	1/5×100=20
In large cell carcinoma cases	0	0
In undifferentiated non-small cell carcinoma cases	2	2/2×100=100
In benign cases	1	1/1×100=100
In other	6	6/6×100=100
In general	12	12/20×100=60

FNA: Fine-needle aspiration

other were (chronic or acute inflammatory cells, lung tissue, and fibrous tissue) which cannot exclude the possibility of presence the malignancy and this may be due to the mass was almost entirely necrotic.^[9]

The concordance of FNA results with Tru-cut biopsy results was 60% and it is low significant, it is in agreement to that in Shrivasthi *et al.*'s study which was also not significant.^[9]

The concordance in squamous cell carcinoma was 40% and it is in agreement to that in Shrivasthi *et al.*'s study (46.6%) while the concordance in adenocarcinoma was 20% and it is lower than that in the same study (65.78%).^[9]

Two patients (10%) developed hemoptysis after Tru-cut biopsy; it is in agreement to that reported in Hakan *et al.* study which was (8.8%).^[14]

One patient (5%) developed pneumothorax and it is lower than in Hakan *et al.*'s study which was (9.8%) and (24.7%) in Alexander *et al.*'s study.^[14,15]

CONCLUSION

The study demonstrated that Tru-cut biopsy is moderately superior to FNA in the evaluation of peripheral malignant lung lesions. Therefore, we advise not using the FNA alone in the evaluation of peripheral chest lesions that suspected of malignancy (except if large bullae or severe emphysema present) and Tru-cut biopsy is often required together to reach the diagnosis.

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Conflicts of interest

There are no conflicts of interest.

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