

**Experience of CT Guided Procedures in the Diagnosis of 55 patients with Intrathoracic Lesions from May 2009 to Feb 2011 at Ribat University Hospital(Sudan)**

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**Abstract:**

**Objective:** To present the experience of our center in the use of computed tomography (CT)guided Fine Needle Aspiration (FNA) and core tissue biopsy procedures as an effective way for obtaining adequate material from intra-thoracic lesions, with the aim of assessing their diagnostic yield and complications.

**Methods:** the study included 55 patients who underwent CT-guided procedures between May 2009 and February 2011. All fine needle aspirations were performed with 20-gauge needles while core tissue biopsies were performed with 14 –gauge needles under CT guidance. The diagnostic yield of these procedures, complications, and patient's feedback were studied.

**Results:** Diagnosis was malignant lesions in 18(32.1%), benign in 35(62.5%), and in 2(0.036%) patients the sample was inadequate. So the diagnostic yield of CT guided procedures was 96.36%. 16 (89%) of the malignant sample were non-small cell lung cancer and 2(11%) were small cell lung cancer. The results of both procedures (fine needle aspirations and core tissue biopsies) done on the same lesion were similar in (93.7%) of the results. Patients who underwent other procedures before this (e.g. bronchoscopy) had similar results in 25% of the samples. Complications reported were hemoptysis in 5 (9.1%), pneumothorax in 2 (3.6%) and surgical emphysema in 1 (1.8%) patient. 5 (9.2%) of the patients described the pain of the procedure as intolerable.

**Conclusions:** CT guided procedure has high diagnostic yield and is recommended for obtaining tissues for histological assessment. Tissue biopsy offers no substantial advantage over FNA in the evaluation of malignant lung lesions.

**Keywords:** Bronchoscope, Fine needle aspiration, core tissue biopsy.

**C**T guided fine needle aspiration or biopsy is a well-established method in diagnosing intra thoracic lesions<sup>1-3</sup>. and their use has reduced the need for invasive techniques which has been used to diagnose similar lesions like open lung biopsy and visual assisted thoracic surgery (VATS). It is accurate in sampling the lesion with less complication rate<sup>4</sup>. Nowadays CT guided procedures play an important role in the diagnosis of different pulmonary nodules<sup>5</sup>,

and used to obtain fresh cancer tissues for Epidermal Growth Factor Receptor (EGFR) mutation analysis<sup>6</sup>.

The diagnostic yield of CT guided procedures usually depends on the site of the lesion and the size of the needle used to obtain the specimen<sup>7</sup>. In addition to the conventional trans-thoracic route several other routes have been tried successfully, including trans-sternal<sup>8</sup>, and trans-scapular approaches<sup>9</sup> to improve the adequacy of the sampling.

Conventional CT guided lung procedures are safe and cost effective<sup>4-10</sup>, and even with the use of automated needles the rate of complications is still low<sup>11</sup>, however, complications do occur.

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Pneumothorax and hemorrhages are the most commonly encountered complications regardless of needle modality used<sup>12</sup>. Pneumothorax usually resolves spontaneously but sometimes it necessitates hospital admission and chest tube insertion<sup>13</sup>. In other occasions these complications can be delayed<sup>14</sup>. The rate of pneumothorax depends on the size of needle and the depth traversed through aerated lungs for sampling<sup>4,13</sup>.

Hemoptysis and massive intra-thoracic hemorrhages has been reported<sup>16</sup>. Rare complications have been also encountered which include air embolism<sup>17, 18</sup>, infections and tumor dissemination<sup>19</sup>.

Regarding the effectiveness of FNA in comparison to core tissue biopsy, diverse results have been published. Some considered no significant difference<sup>20</sup>, while others described more diagnostic yield of core tissue biopsy but with increased rate of complications<sup>2</sup>. In another study the combination of both FNA and core tissue biopsy revealed the highest diagnostic yield<sup>21</sup>.

In this study, we aim to present our experience of El Ribat University Hospital in the use of CT guided procedures as effective way for obtaining adequate material and reaching a specific diagnosis of intra-thoracic lesions, with the comment about the complications encountered, and the diagnostic yield of doing both FNA and core biopsy in comparison to FNA alone.

## Methods

This is a retrospective analysis of all the patients who underwent CT-guided procedures for intra-thoracic lesions at Ribat University Hospital, in Sudan between May 2009 and February 2011. In this first study in our hospital and first to be published in the country a chest physician, two radiologists and two pathologists were involved.

A total of 55 procedures had been evaluated, 14 (25.5%) were from pleural effusion while 3 (5.4 %) were from extra pulmonary lesions, including mediastinal masses and most of the samples 38 (69.1%) were pulmonary lesions.

Of these samples 14 (25.5%) underwent only FNA while 11 (20%) underwent tissue biopsy only and 16 (29.1%) underwent both FNA with tissue biopsy taken from the same lesion at the same time, the rest of the samples were loculated effusion fluid 14 (25.5%). Written informed consent was obtained from all patients.

Information was collected in a prepared form including data regarding demographic information about the patients, clinical and radiological indications for the procedure, previous procedure and results, the site, size of the lesions, duration of the symptoms, possible risk factors for the lesions, type of the specimen taken and the patient's feedback on the procedure. Other information included were investigation including the bleeding profile. Complications both immediate and delayed were also documented in this form. The duration of the procedures were also included

The procedures were performed by a senior experienced chest physician with experience in interventional pulmonology (medical thoracoscopy and bronchoscopy both diagnostic and therapeutic), with the help of two experience radiologist and pathologists.

Before the procedure, coagulation screen were routinely checked and if adequate the procedure is done using a chest CT scanning. Patients were placed in either the prone or supine position, depending on the location of the lesion. The skin was prepared using antiseptic solutions with local anesthesia (1% lidocaine) applied at the site of needle entry. At the time of biopsy localization of the lesion was determined by CT imaging. When the needle get in a new CT images were obtained so as to confirm or modify the site of the needle in relation to the lesion.

The FNAs were performed using 20-gauge needles; while the core tissue biopsies are taken using 14-gauge needles. Subsequently, the obtained materials were sent to the histopathology labs for analysis, where it was stained with hematoxylin-eosin (HE) and classified accordingly into either benign which can be an inflammatory process,

infection or tumor which can be benign or malignant. In this study, if the sample was not adequate for analysis by the pathologists we considered it as failed procedure.

By obtaining adequate samples by CT guided procedures we determined the diagnostic yield of these procedures. Comparing the results obtained from FNA with those obtained by core tissue biopsy and comparing the results obtained from previous other procedures findings with the findings of CT guided procedure we determined the diagnostic value for each procedure. We also correlated the patient feedback with the type of the procedure done. Complications have been reported as well. Descriptive statistics were used when applied. The chi-square test was applied when appropriate.

**Results:** The subjects consisted of 38 (69.1%) males and 17 (30.9%) females. The age groups included those whose age is less than 20 years old 3 (5.45%), those from 20 – 49 years 20 (36.3%) and above 50 years 32 (58.2 %). Among those patients 11 (20%) were active smokers, 34 (61.8%) nonsmokers and 10 (18.1%) were X-smokers.

With the CT guided procedure we obtain 53 (96.4%) adequate samples. The lesions were diverse and according to the CT imaging studies we found different types of lesions, the results of which are shown in table1.

Table1: the results of intrathoracic lesions according to CT scan findings.

CT findings	No (%)
lung mass	19 (34.5%)
Lung mass alone	11 (57.8%)
Lung mass with effusion	2 (10.5%)
Lung mass with cavitation	2 (10.5%)
Lung mass with consolidations	3 (15.7%)
Lung mass with nodularity	1 (5.2%)
Cavitatory consolidation	3 (5.4%)
Consolidation	4 (7.2%)
Lung fibrosis	3 (5.4%)
Pleural effusion	7 (12.7%)
Pleural thickening	5 (9.1%)
Diffuse nodularity	3 (5.4%)
Other radiological findings	11(20%)

The final diagnosis of the 55 cases was as follow: malignant in 18 (32.7%) cases and benign in the remaining 35 (63.6%), 2 (3.6%) we failed to reach the final diagnosis histologically. For the malignant tissues 2 (11%) were diagnosed as small cell lung cancer and the 16 (89%) were non-small cell lung cancer. The non-small lung cancer were diagnosed as 4 (25%) adenocarcinoma table 2

Table 2: the type of the malignant lesions

Type of the lesion	Frequency	%
Small cell Ca (SCC)	2	11
adenocarcinoma	4	25
Squamous cell Ca	2	11
Poorly defferetiated Ca	3	19
sarcoma	1	6
Unspecified non NSCC	6	38
total	18	100

Of the malignant cases 5 (27.7%) were from the age group 20 – 49 while 13 (72.2%) of malignant cases were in above 50 years old. 12 (66.6%) were males

14 (25.5%) of the cases underwent FNA alone, 11 (20%) underwent core tissue biopsy alone and 16 (29.1%) underwent both FNA and tissue biopsy at the same session. 14 (25.5%) the samples were fluid only. Among those who underwent both FNA and tissue biopsy, we found the results of FNA were similar in 15 (93.7%) to those of tissue biopsy and in 1 (6.3%) we obtained inadequate sample via FNA.

Of the 55 cases, 10 (18.1%) cases underwent previous bronchoscope, the specimen of the bronchoscope were inadequate in 2 (20%) of the samples. Among the adequate samples 2 (25%) of the bronchoscope results were similar to the final diagnosis reached by the CT guided procedures (FNA or Biopsy) both were benign.

Regarding complications; 47 (85.4%) of the procedures were uncomplicated, 5 (9.1%) developed hemoptysis one of them was massive, only 2 (3.6%) developed pneumothorax and 1 (1.8%) developed significant surgical emphysema. Of those who

developed hemoptysis 2 (40%) followed core tissue biopsy while 3 (60%) followed both FNA and biopsy. No hemoptysis has been encountered with FNA alone.

Five (9.1%) patients described the procedures as intolerably painful, 18 (32.7%) showed that it was painful but tolerable and 11 (20%) felt it was painless; the remaining 21 (38.1%) patients didn't give any feedback. When correlating patient's feedback with the type of the specimen we found that 9 (52.9%) of the FNA were painless with 0 (0.0%) painful results. While comparing effusion samples we found that 3 (60%) were painful while no (0.0%) painless results.

### Discussion

The diagnostic yield of our CT guided procedure in obtaining adequate sample for the diagnosis of intra thoracic lesions was high (96.6%) which inconsistent with other CT guided chest procedures studies<sup>1, 3, 7, 10</sup>. This finding support the evidence that CT guided chest procedure is a reliable method in obtaining biopsies from intra thoracic lesion which reduces or eliminates the need for more invasive procedure like open lung biopsy which necessitates thoracic surgeon and general anesthesia.

Training radiologist in interventional radiology is a great need for modern medicine practice, it will improve the service and make it cost effect, but short of that a team like ours could compensate for that. The integration of our team made it possible to implement this service and gave our hospital (a general semipublic hospital) the honor in becoming a referral hospital for this procedure. This procedure is practiced by other private hospital by a trained radiologist; however, there is no publish data up-to-date of their results.

Many studies showed that CT guided FNA are easier and has less complications in comparison with cutting tissue biopsy needle. Our data showed that there is 93.7% agreement in the histology result between FNA and cutting tissue biopsy (taken from the same cases). Although this a small sample but this fact has been reached by other large

studies. Greif J compared FNA and cutting tissue biopsy in 156 cases and reached the same conclusion that there was no significant difference between the two procedures<sup>20</sup>.

Bronchoscopy is a well-established procedure in the diagnosis of intra-thoracic lesions, especially the central lesions. Ten (18.1%) of our cases in this study underwent bronchoscopy beforehand with unsatisfactory results. The CT guided procedure in these cases revealed malignant lesion in six cases. This indicates that CT guided procedure is useful in peripheral lesions not reachable by bronchoscopy or when the bronchoscopy result is unsatisfactory. CT fluoroscopy guided bronchoscopy reduces the negative yield of conventional bronchoscopy<sup>22-25</sup>.

Complication is unavoidable consequences of any interventional procedure. Chest CT guided procedures –FNA and cutting tissue biopsy- are associated with both immediate and late complications<sup>25, 26</sup>. In this study we encountered two (3.6%) immediate pneumothorax that did not required intervention (aspiration or chest tube) and there was no delayed pneumothorax up to one month after the procedure. Pneumothorax is a common complication encountered in another study<sup>12</sup>. However hemoptysis was encountered in five (9.1%) of the cases one of which was sever enough to necessitate resuscitation and ICU admission. All the hemoptysis cases occurred with cutting tissue biopsy (needle size 14). The percentage of hemoptysis in other series was high in comparison with other study<sup>25</sup>. This could be due to the needle size as another study concluded<sup>26</sup> or the frequent cavitation lesions in our cases. The sever hemoptysis could be related to the INR (related to wrong laboratory reading). Comorbidities may contribute to this sever complication.

Patient feedback regarding the tolerance of the procedure was good. In fact only five (9.1) of the patients describe the procedure as intolerably painful.

**In conclusion:** Both FNA and cutting chest CT guided biopsy are valuable in obtaining specimen for the diagnosis of intra-thorax

lesions. They almost eliminate the need for more invasive procedure. We recommend the use of CT guided procedures especially FNA in obtaining tissues for diagnosis as it has a high diagnostic yield with minimum rate of complications compared with other invasive procedures. Tissue biopsy offers no substantial advantage over FNA in the evaluation of malignant lung lesions but this needs an experienced cytologist the fact that suggest there is still need for the cutting tissue biopsy in our setting. In some of the occasions more than one procedure are needed to reach a final satisfactory diagnosis.

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