

Evaluating the Diagnostic Yield of CT Guided Biopsy and FNAC in a Tertiary Care Hospital

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How to cite this article: Ram Shenoy Basti, Anston Vernon Braggs, Soujanya Mynalli, Rithi Melissa D'silva, Suresh H B. Evaluating the diagnostic yield of CT guided biopsy and FNAC in a tertiary care hospital. *International Journal of Contemporary Medicine Surgery and Radiology*. 2018;3(1):23-27.

A B S T R A C T

Introduction: CT guided core biopsy and FNA are accepted standard techniques for tissue access in chest and abdominal lesions with good diagnostic yields. Aims: To evaluate the diagnostic yield and complications of CT guided core biopsy and FNA in chest and abdominal lesions and to compare the yield based on the technique and experience of the radiologist.

Material and methods: This is a retrospective analysis of 380 patients (mean age 61, male: female - 80:20) CT guided biopsies and FNA done in our hospital between Jan 2014 – Dec 2017 using standard techniques and materials. 307 of 380 cases (80.7%) were from the thoracic sites and 256 of 380 cases (67.3%) were from the lung parenchymal lesions. 255 of 380 patients (67%) underwent CT guided core needle biopsy and 125 of 380 patients (33%) underwent FNA. 285 of 380 CT guided procedures (75%) were performed by senior radiologist with more than 5yrs experience and 95 of 380 (25%) were performed by junior radiologists.

Results: Overall diagnostic yield of the study was 83.94%, i.e. in 319 of 380 patients. The yield for core biopsies was better at 87% as against 77.6% for FNA ($p=0.0193$). The yield was better for procedures performed by senior radiologists at 87.02% as against 74.74% for junior radiologists ($p=0.0048$). Procedure related Complications were observed in 34 / 380 patients (8.95%). The complication rate was less at 6.32% when performed by senior radiologists as against 16.84% for procedures done by junior radiologists ($p=0.0019$). The complication rate in procedures done using co-axial technique was 8%, as against 9.1% for non-co-axial technique ($p=0.7999$). The diagnostic yield using co-axial technique was 86%, as against 83.63% for non-co-axial technique ($p=0.6710$). Most of the complications occurred in lesions less than 2 cm size. 11/16 cases (68.75%) in core biopsy group and 12 / 18 (66.66%) in FNA group with complications were less than 2cm ($p=0.8981$).

Conclusions: CT guided FNA and core biopsy of chest and abdominal lesions is a reliable technique, minimally invasive and accurate with high diagnostic yield and low rate of complications in the hands of an experienced radiologist. No significant difference was noted in the yield and complications done using co-axial technique.

Keywords: Diagnostic Yield, CT Guided Biopsy, FNA

INTRODUCTION

Accurate diagnosis of mass lesions in the chest or abdomen is crucial to decide the best possible further course of management. Image guided minimally invasive techniques have gained widespread popularity. The

role of ultrasonography for image guidance for deep seated lesions in the chest and mediastinum is limited by various factors. Other modalities like Thoracoscopy, VATS and CT fluoroscopy are limited by their availability. CT guided biopsy is minimally invasive, accurate, easily available and relatively low cost technique for tissue access.¹

Advances in the CT technology has made possible the detection of various chest and abdominal pathologies at an earlier stage and smaller sizes. CT guided percutaneous access to pathological lesions has become an accepted standard technique of choice to obtain tissue material for cytological and histopathological evaluation.²

CT guided biopsy and FNA have been widely performed for lesions in the chest, pleura and mediastinum for various

indications.³

CT guidance can be used with a long needle to obtain material for a fine needle cytological examination (FNA) or with an automated core biopsy needle to obtain material for a histopathological examination. Biopsy technique is supposed to be more accurate and give diagnostically better yield compared to the FNA.^{2,3}

The sensitivity, specificity and accuracy of FNA for pulmonary lesions are 82 to 99%, 86 to 100% and 64 to 97%, respectively. Core biopsy has been shown to have slightly higher overall sensitivity, specificity and accuracy, with respective values of 89%, 97% and 93%.³

For CT guided pleural biopsies Niu et al reported diagnostic accuracy and sensitivity of about 89.2% and 86.1%.¹

Petranovic et al reported Diagnostic yield of about 77% for CT guided biopsy of anterior mediastinal mass lesion. Fine-needle aspiration yielded the correct diagnosis in 60% cases and core biopsy had a diagnostic rate of 77%.⁴

Anderson et al reported overall diagnostic accuracy of 81.5%

for CT guided biopsy of lung lesions; 93% for core biopsies and 78% for FNA.⁵

Sangha et al also reported better diagnostic yield for core biopsy of 91% vs 80% for FNA.⁶

Li Y et al reported overall diagnostic accuracy of 93.5% for CT guided biopsy of small pulmonary nodules less than 20mm in size.⁷

The most common complications after CT guided chest biopsy are pneumothorax and haemorrhage. The incidence of pneumothorax has been reported to be up to 8 - 64% with an average risk of 20%.^{2,3}

Pneumothorax after biopsy procedure are often small and asymptomatic. Larger ones with symptoms may require chest tube placement. Minimal amounts of air leak can be aspirated through a needle on CT table.^{3,8}

Pulmonary haemorrhage occurs less often, with a reported incidence of about 4 - 27% with an average incidence of about 11%. Haemoptysis is rarer with an incidence of about 5%.^{2,3}

Size of the lesion, depth from the pleura, experience of the radiologist is some of the significant factors which affect the risk of complications in chest biopsies.^{2,3} Air embolism and tumour seeding are some other rare complications.³

CT guidance has also been used in retroperitoneal and pelvic mass lesions with good diagnostic accuracies. Yarram et al reported diagnostic success rate of 93.2% for CT guided biopsy of pelvic lesions with a sensitivity of 84.6% with a low complication rate of 2.7%.⁹

Tomozawa et al in their study on CT guided biopsy of retroperitoneal lesions obtained Satisfactory biopsy samples in 99% of patients and a pathological diagnosis could be made in 95% of patients with minimal complications.¹⁰

Study aims and objectives were to evaluate the diagnostic yield of CT guided biopsy and FNA in our hospital, to evaluate the diagnostic yield of core biopsy vs FNA groups, to compare the diagnostic yield and complications of CT guided biopsy using co-axial technique vs non con-axial technique, to compare the diagnostic yield and complications of CT guided procedures between more experienced senior radiologist vs junior radiologist and to compare the diagnostic yield and complications of CT guided biopsy/FNA with lesion size

MATERIAL AND METHODS

A retrospective analysis of all the CT guided biopsies and FNA done in the department of Radiodiagnosis of our hospital (Father Muller Medical College Hospital, Mangalore, Karnataka) between Jan 2014 – Dec 2017 was performed. The inclusion criteria were all the cases of pulmonary, pleural, mediastinal, retroperitoneal or pelvis mass lesions who underwent CT guided tissue biopsy during the study period. Patients whose complete details regarding the procedure, complications or pathology reports were not available were excluded from the study. The final study population consisted of 380 patients.

Standard protocol was followed for all the procedures with informed consent, review of imaging and lab investigations. The procedures were done by either a junior radiologist with less than 5yrs of experience or a senior radiologist with

more than 5yrs of experience in CT guided interventional procedures. FNA were done using 18G or 20G needle. Core Biopsy were done using 18G or 16G semi-automatic biopsy needles depending on the lesion size, depth and other patient related factors. Appropriate positioning of patient was decided by the radiologist after reviewing the images so as to traverse the shortest and safest path to the lesion. All procedures were done under local anaesthesia using 2% lignocaine under standard aseptic conditions. An onsite pathologist was available for all procedures and FNA smears were fixed on glass slides using 95% ethyl alcohol. Core biopsy specimen were sent in formalin bottle to the lab. Patient demographics, procedure techniques, any complications, FNA and histopathologic reports and other details were accessed from the patient records and tabulated in excel sheet.

STATISTICAL ANALYSIS

Overall Diagnostic yield of CT guided biopsy, yield in core biopsy and FNA groups and comparison of yield and complications between different groups were done by calculating percentages. Two-sample t-test between proportions was used to calculate p value for test of significance using online statistical calculator MEDCALC.

RESULTS

The final study population consisted of 380 patients who underwent CT guided FNA or Biopsy for various indications. Mean age of the study population was 61 +/- 12.94yrs with age range of 18-83yrs. 305 were male patients and 75 were females. 31% of patients were in the age group of 61-70yrs. Of all the 380 cases, 307 (80.7%) were from the thoracic sites and 256 (67.3%) were from the lung parenchymal lesion (table 1 (a,b)). Overall diagnostic yield of the study was 83.94%, defined as positive specimen sample for adequate reporting was obtained in 319 of 380 patients. Of the total 380 patients, 255 patients (67%) underwent CT guided core needle biopsy and 125 patients (33%) underwent FNA. The diagnostic yield for CT guided core biopsies was better at 87% as against 77.6% for CT guided FNA with statistical significance ($p= 0.0193$) (table 2 (a)). Of the total 380 CT guided procedures, 285 (75%) were performed by senior radiologist with more than 5yrs experience and 95 (25%) were performed by junior radiologists (table2(b)). The diagnostic yield of CT guided procedures performed by senior radiologists was better at 87.02% as against 74.74% for procedures done by junior radiologist ($p=0.0048$) (table 3(a)).

Procedure related Complications were reported in 34 / 380 patients (8.95%). All the complications were encountered in chest biopsies. 28 of these were pneumothoraces, of which 5 required needle aspiration on CT table for breathlessness, rest were minimal and self-resolving on follow up. None required chest tube placement. 6 cases were pulmonary haemorrhage of which 1 had minor self-resolving haemoptysis

The complication rate of CT guided procedures performed by senior radiologists was less at 6.32%, as against 16.84% for procedures done by junior radiologist ($p= 0.0019$) (table3 (c)). Co-axial technique of needle placement into the lesion

Site of biopsy	n=380
Chest wall and pleura	26
Lung parenchyma	256
Mediastinum	25
Retroperitoneum	30
Pelvic soft tissue	16
Bones and vertebrae	17
Liver	8
Renal	2
Table-1(a): Site of Biopsy / FNA	

Final histopathology diagnosis	n = 380
Adenocarcinoma lung	94
Atypical cells – lung lesion	11
Benign spindle cell tumor	1
Carcinoid tumor	3
Carcinoma	34
Chondroid hamartoma	1
Chondrosarcoma	2
Chordoma	3
Extramedullary plasmocytoma	1
Fungal abscess	4
Giant cell tumor	3
Granulomatous inflammation	11
Inflammatory lesion	5
Sarcoma	2
Lymphoma	14
Malignant mesothelioma	2
Mediastinal mature cystic teratoma	1
Metastasis	32
Myeloma	2
Neuroendocrine tumor	4
Non small cell carcinoma	2
Papillary neoplasm	2
Plasmocytoma	2
Reactive lymphadenitis	4
Round cell tumor	1
Schwannoma	1
Small cell carcinoma	10
Squamous cell carcinoma	64
Thymic neoplasm	2
Renal cell carcinoma	1
Negative	61
Table-1(b): Final tissue diagnosis	

was done in 50 of the 380 cases (13.1%). The complication rate of CT guided procedures performed using co-axial technique was less at 8%, as against 9.1% for non-co-axial technique, however the difference was not statistically significant (p = 0.7999) (table 3 (c)). The diagnostic yield of CT guided procedures performed using co-axial technique was more at 86%, as against 83.63% for non-co-axial technique, however the difference was not statistically significant (p = 0.6710) (table 3 (d)). Of the 34 cases with complications, 23 were less than 2 cm in size (67.6%), and 11 were more than 2 cm in size (32.35%).

Table 2 (a)	Core biopsy n=255	FNA n=125	Total
Positive yield	222	97	319
Negative yield	33	28	61
	87%	77.6%	380
Table 2 (b)	Senior radiologist	Junior radiologist	Total
CT core biopsy	196	59	255
CT FNA	89	36	125
	285	95	380
Table-2(a): Diagnostic yield for CT guided core biopsy and FNA groups, Table-2(b): Procedures performed by senior and junior radiologists			

Table 3 (a)	Senior radiologist n=285	Junior radiologist n=95	Total n=380
Positive yield	248	71	319
Negative yield	37	24	61
	87.02%	74.74%	83.94%
Table 3 (b)	Senior radiologist n=285	Junior radiologist n=95	Total n=380
Complications	18	16	34
No complications	267	79	346
	6.32%	16.84%	8.95%
Table 3 (c)	Co-axial n=50	Non co-axial n=330	Total n=380
Complications	4	30	34
No complications	46	300	346
	8%	9.1%	8.95%
Table 3 (d)	Co-axial n=50	Non-coaxial n=330	Total n=380
Positive yield	43	276	319
Negative yield	7	54	61
	86%	83.63%	83.94%
Lesion size Table 3 (e)	Core Biopsy n=16	FNA n=18	Total n=34
Less than 2 cm	11	12	23 (67.6%)
More than 2 cm	5	6	11 (32.35%)
	68.75%	66.66%	
Lesion size Table 3 (f)	Core Biopsy n=33	FNA n=28	Total n= 61/380
Less than 2 cm	18	19	37 (60.65%)
More than 2 cm	15	9	24 (39.34%)
	54.54%	67.85%	
Table-3(a): Diagnostic yield for procedures performed by senior and junior radiologists. 3(b) Complication rate for procedures performed by senior and junior radiologists. 3(c) Complication rate in procedures performed using Co-Axial Vs Non-Co-axial technique. 3(d) Diagnostic yield in procedures performed using Co-Axial Vs Non-Co-axial technique. 3(e) Complication rate Vs lesion size. 3(f) Negative yield Vs lesion size.			

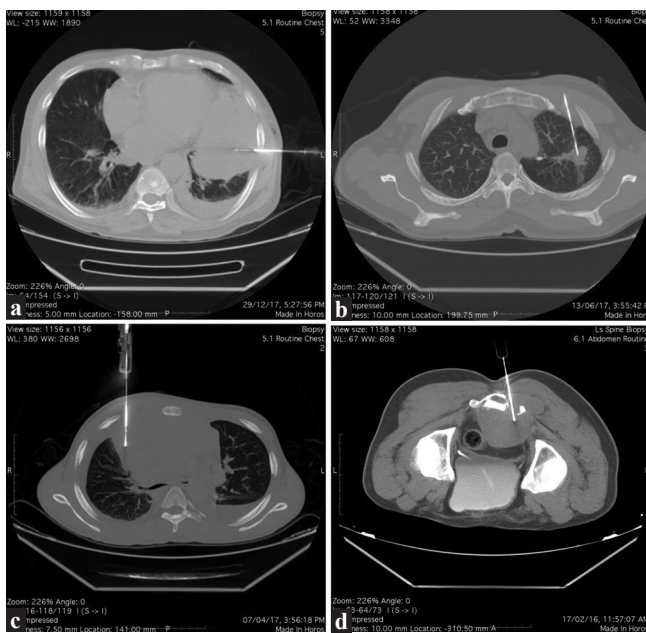


Figure-1(a): CT guided core biopsy performed from left lower lobe peripheral pulmonary mass lesion using 16G semiautomatic biopsy needle. **(1b).** CT guided core biopsy from deep seated upper lobe mass lesion, with needle traversing through lung parenchyma. **(1c).** CT guided core biopsy from anterior mediastinal mass lesion. **(1d).** CT guided biopsy from sacral bony mass lesion

Of the 16 cases of complications in core biopsy group, 11 were less than 2 cm in size (68.75%). Of the 18 cases of complications in the FNA group, 12 were less than 2 cm in size (66.66%). However, the difference was not statistically significant ($p = 0.8981$) (table 3 (e))

Of the 61 cases with negative yield, 37 were less than 2 cm in size (60.65%), and 24 were more than 2 cm in size (39.34%). Of the 33 cases of negative yield in core biopsy group, 18 were less than 2 cm in size (54.54%). Of the 28 cases of negative yield in the FNA group, 19 were less than 2 cm in size (67.85%). However the difference was not statistically significant ($p = 0.2930$). (table 3 (f))

DISCUSSION

Overall diagnostic yield of our study was 83.94%, i.e. in 319 of 380 patients good material was obtained for the pathologist to make a conclusive diagnosis. This is comparable to the diagnostic yields reported in literature.^{3,4,5}

The yield for core needle biopsies in our study was higher at 87% as against 77.6% for FNA ($p = 0.0193$), which was statistically significant. This is also in agreement with the literature results.^{3,4,5,6}

The yield was better for procedures performed by senior radiologists with more than 5 yrs. of experience in performing CT guided procedures at 87.02% as against 74.74% for junior radiologists ($p = 0.0048$), which was statistically significant. More number of procedures were performed by senior radiologist than junior radiologists in our study (285 vs 95). Procedure related Complications were observed in 34 / 380 patients (8.95%). All the complications were encountered in chest biopsies and none in biopsies from other locations. 28

of these were pneumothoraces. 5 of these were of moderate volume causing compression on the lung with developing breathlessness on table. All of these were aspirated using needle on the CT table until symptoms resolved.⁸ All of them disappeared on follow up chest radiograph. None required chest tube placement. 6 cases were pulmonary haemorrhage of which 1 had minor self-resolving haemoptysis. Complication rate in our study was slightly less than reported in literature.^{1,2,3,7,8} This could be due to careful selection of the cases as well as most procedures being done by senior radiologists. The complication rate was less at 6.32% when performed by senior radiologists as against 16.84% for procedures done by junior radiologists ($p = 0.0019$), which was significant.

The complication rate in procedures done using co-axial technique was 8%, as against 9.1% for non-co-axial technique ($p = 0.7999$). The diagnostic yield using co-axial technique was 86%, as against 83.63% for non-co-axial technique ($p = 0.6710$). Both of these were not statistically significant.

Most of the complications occurred in lesions less than 2 cm size. 11/16 cases (68.75%) in core biopsy group and 12 /18 (66.66%) in FNA group with complications were less than 2cm ($p = 0.8981$). However the results were not statistically significant between the two groups. Hence the use of co-axial technique which increases the material cost of the procedure need not be recommended in all cases.

CONCLUSION

CT guided FNA and core biopsy of chest and abdominal lesions is a reliable technique, minimally invasive and accurate with high diagnostic yield and low rate of complications in the hands of an experienced radiologist.

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 12-12-2017; **Published online:** 15-01-2018