Registration number: 515

Title of the presentation:

Comparison of computed tomography guided robot assisted and conventional manual biopsy in thoracic lesions

Introduction/ Review of Literature:

- Percutaneous transthoracic lung biopsy - invaluable tool for diagnosing lung lesions.
- CT is the most common and versatile imaging guide.
- Can be performed using conventional freehand technique or with a guidance system that assists in needle placement.
- These guidance systems can range from simple hand held devices to fully actuated, imager integrated robots.
- This study was undertaken to evaluate the utility of one of the commercially biopsy systems Maxio III, Perfinit Healthcare in CT guided lung biopsy

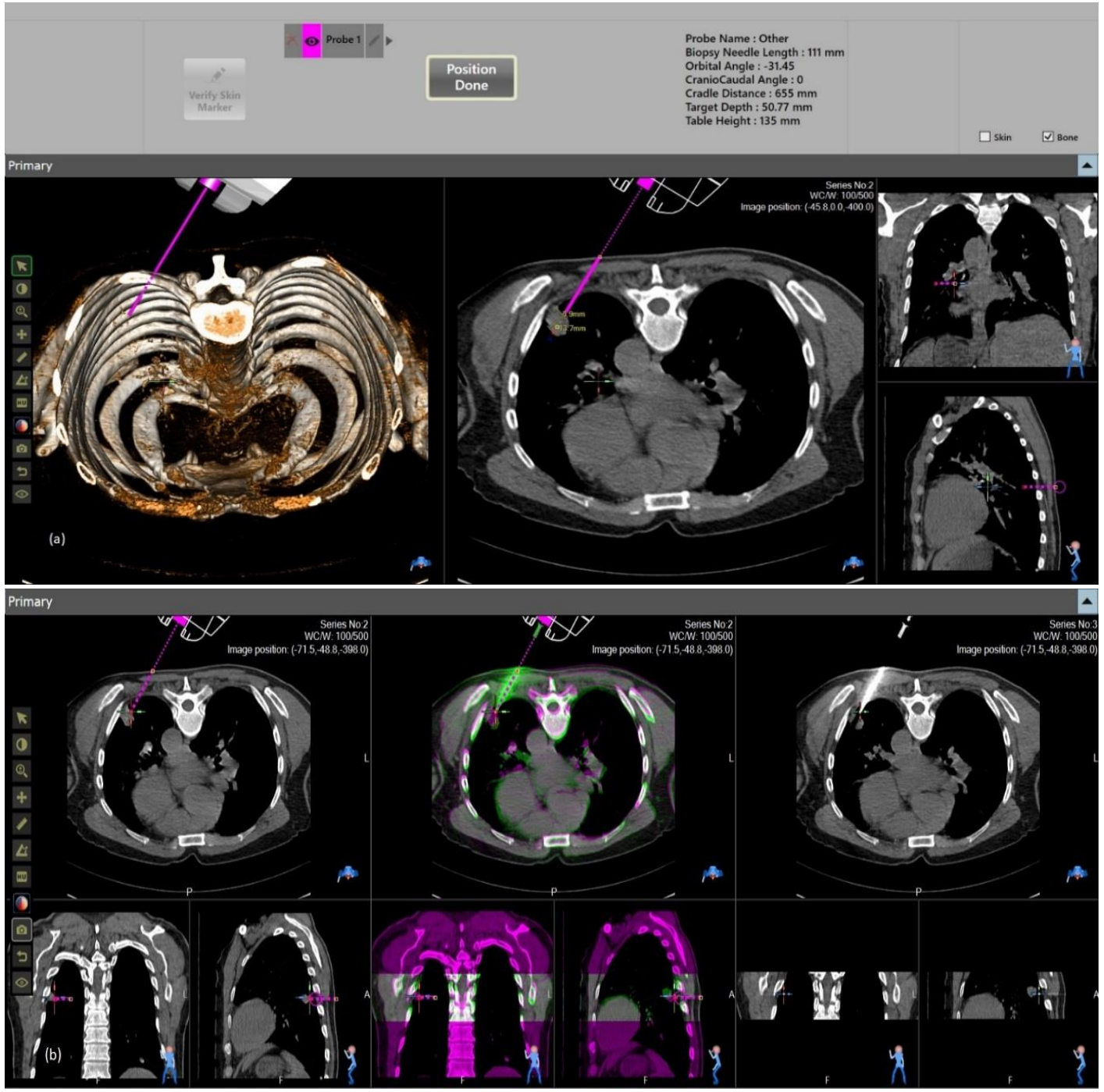
Aims/ Objectives:

- Primary objective – to compare the ***Procedure duration*** between the MAXIO III robotic assisted CT guided biopsy system and the conventional manual technique.
- Secondary objectives evaluated include :***Number of needle adjustments required, Needle deviations in x, y and z axis, Radiation dose to the patient, and Diagnostic yield of the biopsy taken***

Methodology:

Study Design: **Prospective RCT**
Sample size: **52 patients** referred for CT guided lung lesion biopsy.
Methods:

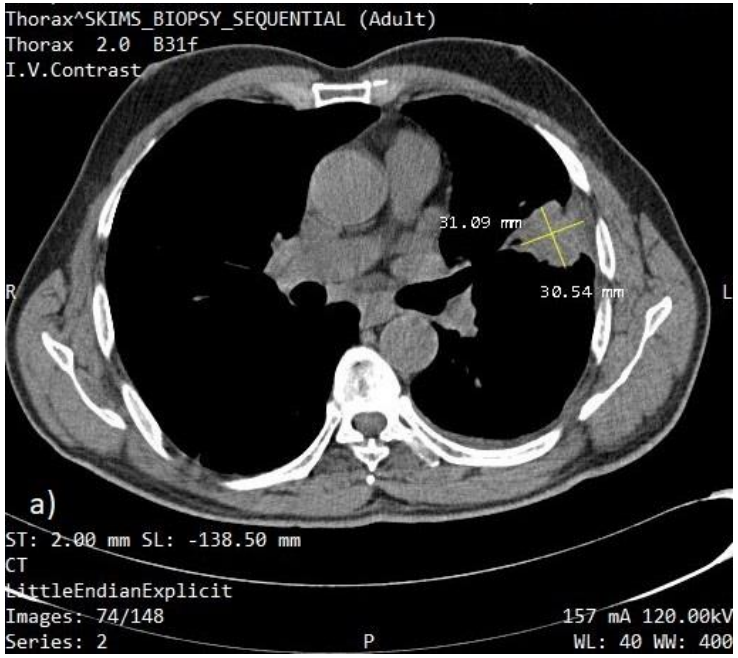
- Patients randomly assigned to undergo randomly assigned to have either a robotic or conventional procedure.
- Procedure duration calculated from time of first localization scan to removal of coaxial needle. Radiation dose calculated from DLP.
- Post procedure complications assessed by **clinical examination and CXR** at 4 hours and 24 hours.

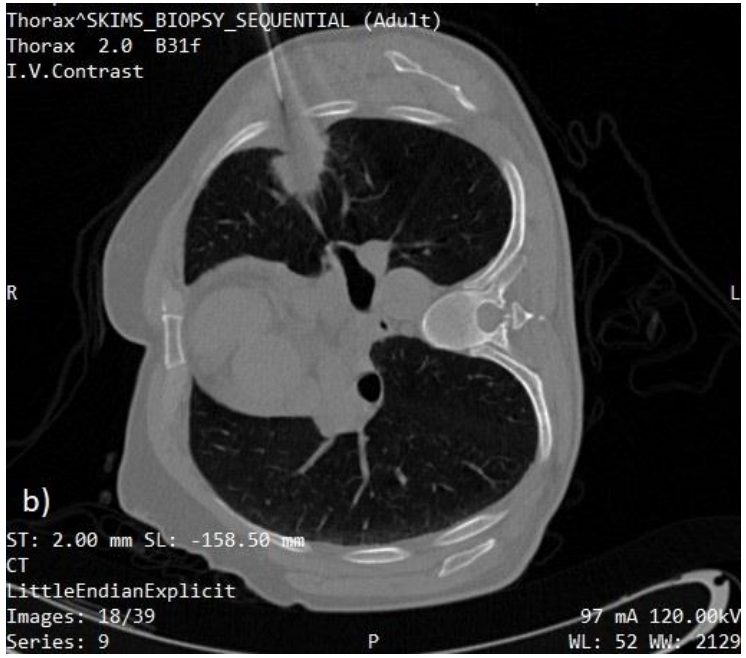


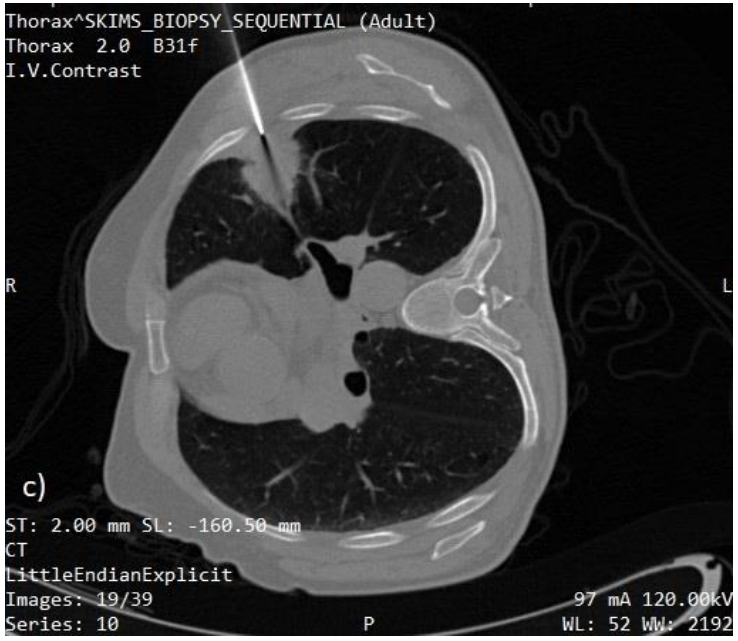
Biopsy planning on MAXIO III.

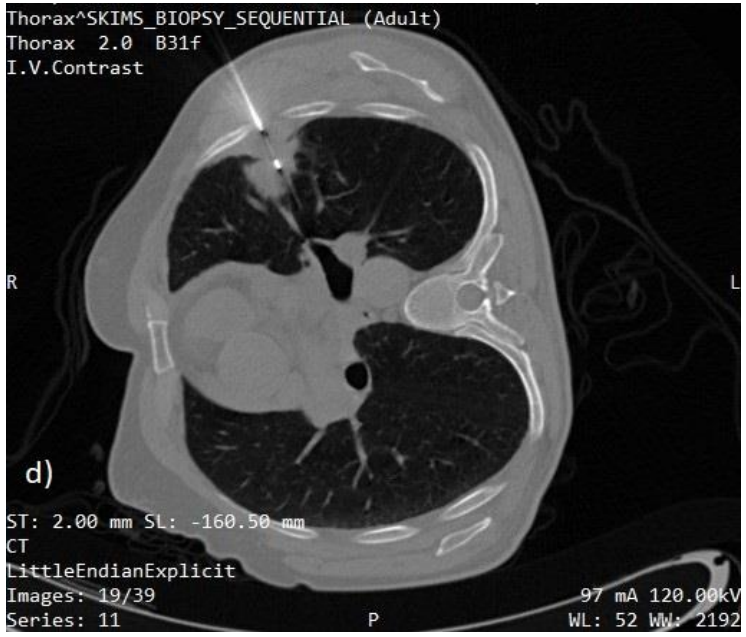
a) Shows the target lesion measuring 13*9mm with planned needle trajectory. The entry point on the skin surface and center of the target are set by the operator. The angulation, depth and insertion path of the needle are calculated automatically by the workstation and displayed in real time.

b) Shows the initial planned needle path and the actual needle position at the end of insertion.









Conventional CT guided biopsy. a) Shows a soft tissue density lesion in lingula that is abutting the pleural surface. b,c,d) Show the step and shoot technique of CT guided lung biopsy.

Results:

TABLE 1	Robot assisted CT guided biopsy	Conventional manual biopsy	p-value
Age group (years)			
≤40	0 (0)	6 (23.1)	0.066
41-50	6 (23.1)	4 (15.4)	
51-60	12 (46.2)	8 (30.8)	
>60	8 (30.8)	8 (30.8)	
Sex			
Female	12 (46.2)	10 (38.5)	0.575
Male	14 (53.8)	16 (61.5)	
Size of lesion			
Nodule (<3 cm)	16 (61.5)	22 (84.6)	0.061
Mass (≥3 cm)	10 (38.5)	4 (15.4)	
Depth of lesion			
Subpleural	16 (61.5)	18 (69.2)	0.560
Deep	10 (38.5)	8 (30.8)	
Location of lesion			
Left lower lobe	4 (15.4)	4 (15.4)	0.221
Left upper lobe	6 (23.1)	8 (30.8)	
Right lower lobe	4 (15.4)	12 (46.2)	
Right upper lobe	10 (38.5)	2 (7.7)	
Right middle lobe	2 (7.7)	0 (0)	
Position			
Left lateral decubitus	0 (0)	6 (23.1)	0.077
Prone	16 (61.5)	12 (46.2)	
Right lateral decubitus	2 (7.7)	2 (7.7)	
Supine	8 (30.8)	6 (23.1)	
Total	26 (100)	26 (100)	

Demographic, patient positioning and lesion characteristics were comparable between the two groups

Table 2. Number of needle adjustments, Procedure duration, radiation dose and needle deviations in x, y and z axis in patients

	Robot assisted CT guided biopsy N±SD	Conventional manual biopsy N±SD	p value
Number of needle adjustments	1.8±2.4	7.8±3.2	<0.001
Procedure Duration(min)	21±12.2	30.8±16.2	=0.017
Dose length product (mGy cm)	956±507.3	1944±1037	<0.001
Needle deviations(in mm)			
x axis	2.6±1.2	4.0±1.1	<0.001
y axis	2.0±0.8	3.5±0.8	<0.001
z axis	2.8±1.1	3.9±1.0	<0.001

The **procedure duration, number of needle adjustments, needle deviations, and radiation dose** to the patients were **significantly reduced** with robot assisted technique in comparison to conventional manual technique.

Table 3: Diagnostic yield and procedure complications in both the groups.

Diagnostic yield	Robot assisted CT guided biopsy N(%)	Conventional manual biopsy N(%)
Adequate	23 (88.4)	22 (84.6)
Inadequate	3 (11.6)	4 (15.4)
Complications		
Small pneumothorax	8 (66.7)	7 (75)
Minimal hemoptysis	2 (16.7)	0 (0)
Minimal hemothorax	0 (0)	2 (16.7)
Pulmonary hemorrhage	2 (16.7)	3 (25)

The **diagnostic yield** of the biopsy and **procedure complications** were **comparable** in both groups.

Conclusion:

- Robot assisted procedure reduces the needle deviations from target point, thus improving the accuracy of needle placement.
- Robot assisted procedure reduces the number of needle adjustments. Consequently, fewer confirmatory CT scans are required resulting in significant reductions in procedure duration.
- The reduction in number of scans in robot assisted procedures, resulted in significant reductions in radiation doses to the patient, indicating safer clinical practice.
- Robot assisted procedure had similar diagnostic yield and complication rates.