

Scrutinizing the efficacy of automated method over manual methods in CT-guided lung biopsies

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Authors: K. Chokkappan, T.S. Swaminathan, N. Kulasekaran, P. Umapathy, A. Chellathurai, N. Sundareswaran, S. Babu Peter, D. Ramesh, S. Kanheerat; Chennai/IN

Keywords: Ct guided lung biopsy, Automated planning, Manual planning

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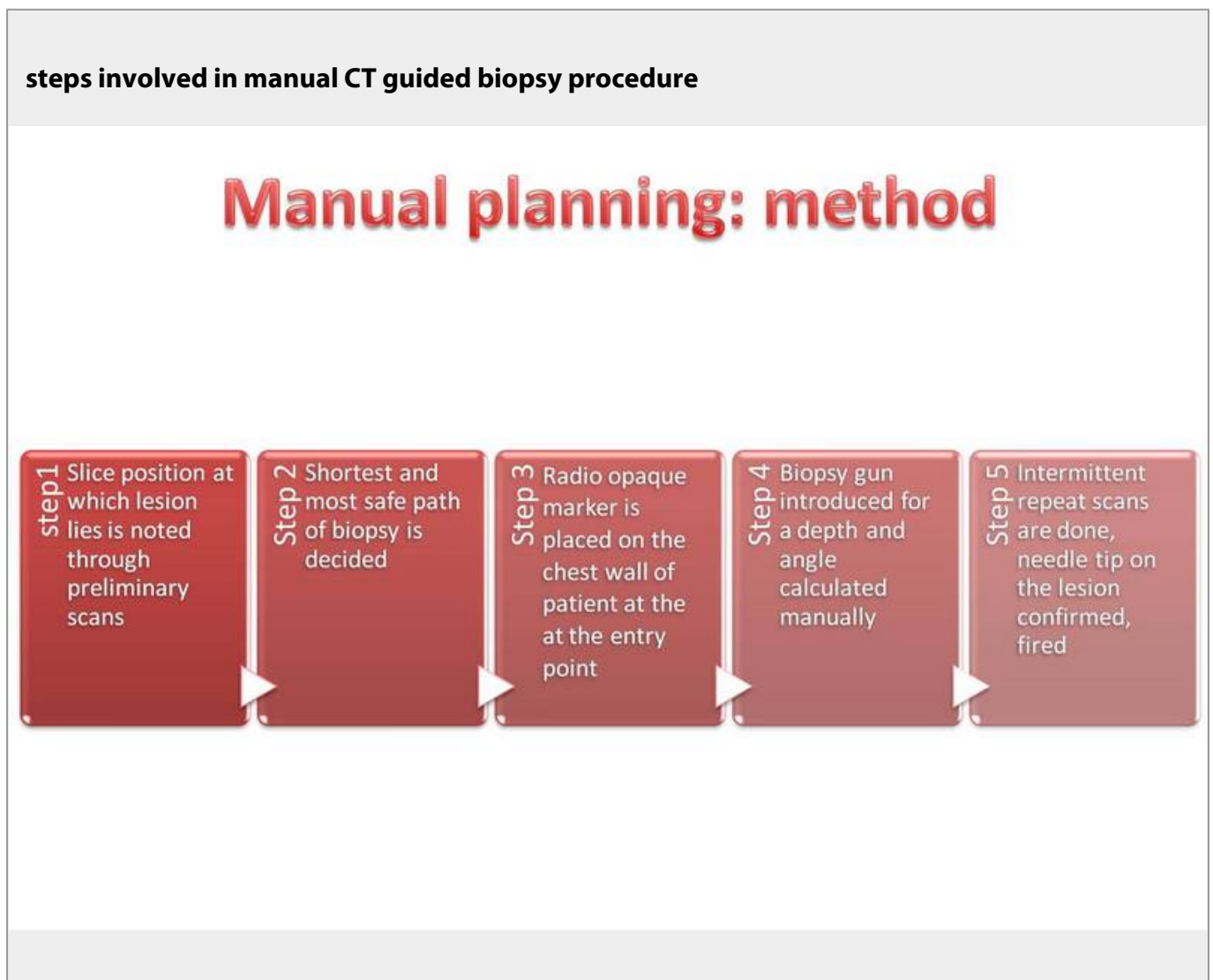
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1. Purpose

- To share our initial experience with a uniquely designed, automated planner cum guidance set-up in doing CT- guided lung biopsy.
- To compare the diagnostic accuracy and technical difficulties using conventional manual planning and automated planning.

2. Methods and Materials

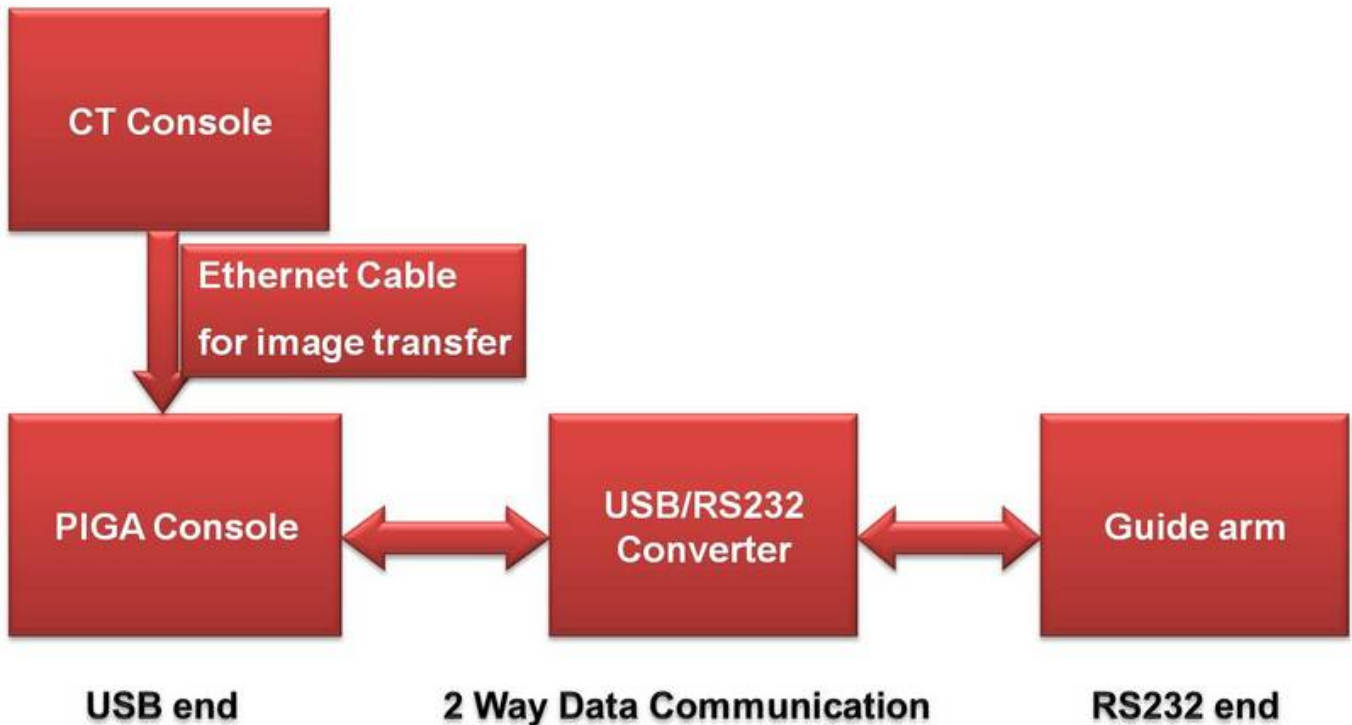
CT is indispensable tool in guiding lung biopsy. CT guided lung biopsy has a 100% accuracy in diagnosing lung carcinoma according to some studies. Manual planning is done usually. The procedure usually involves the following steps.



Though this procedure has been widely accepted and frequently performed, it is technically demanding for a beginner. The time consumed per procedure is commonly 45 to 60 min. The procedure is associated with its known complications like pneumothorax and pulmonary hemorrhage.

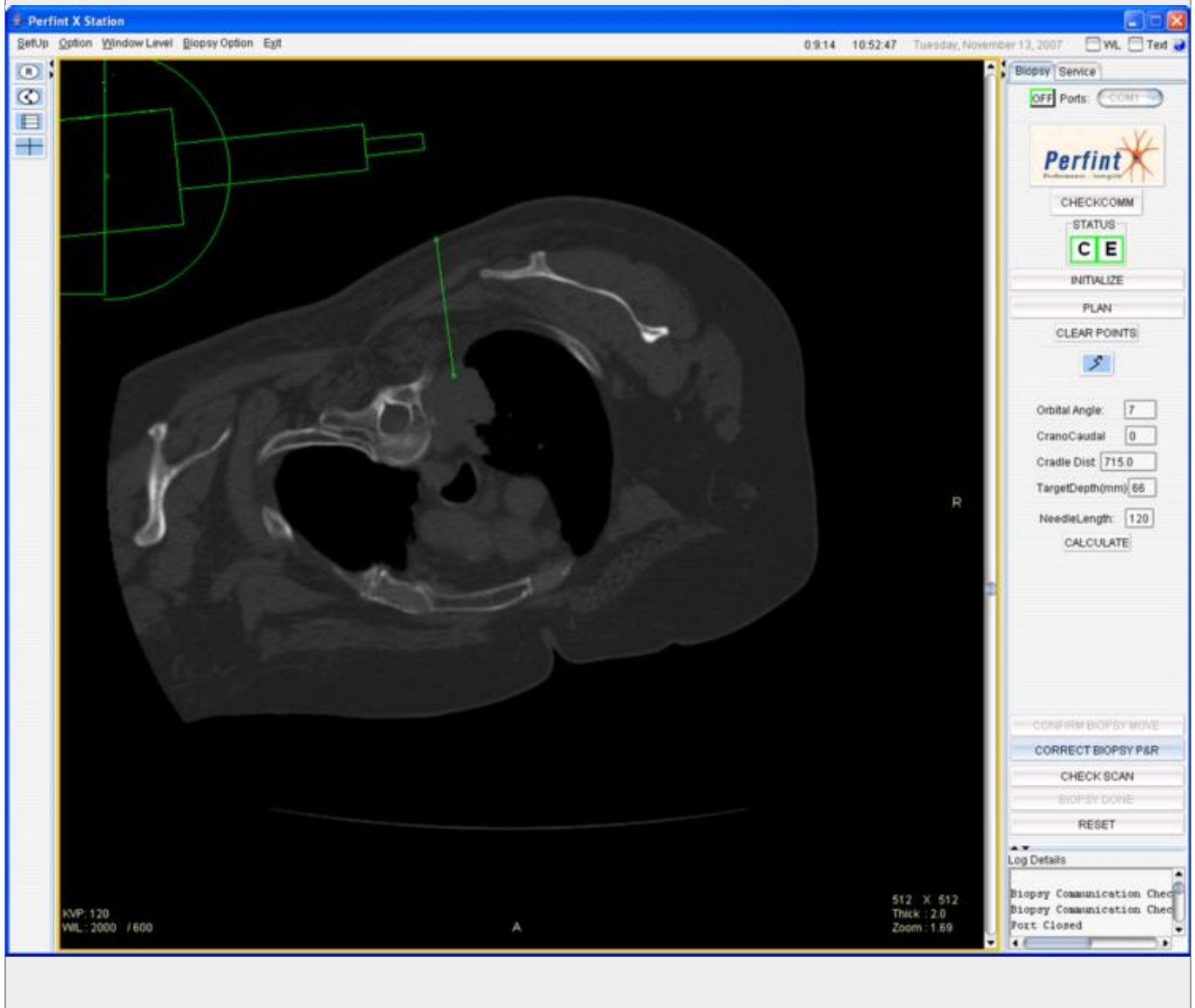
We tried doing CT guided biopsy with automated planner cum guider. The automated set up is called "PIGA-CT" by Perfint. The set up has the following functional parts.

Automated P/G set up PIGA-CT -Architecture



The console consists of a computer which is the working brain of the whole set up. It receives DICOM images from the CT console through an ether net cable. The data (depth and angulations) are calculated on DICOM images and sent to the guide arm using RS232 interface. The guide arm which is alongside the patient near the CT executes the biopsy. It is a robotic arm which moves according to the information given from the PIGA console based on the depth and angulations calculated on the DICOM images.

screen shot image of the planning in the PIGA console

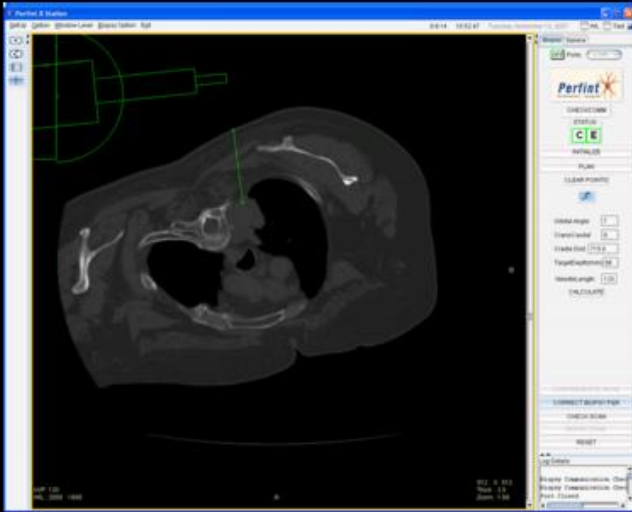


Important implication of execution through robotic arm is the facility of cephalo caudal angulation which can be useful to biopsy a lesion hiding behind the ribs.

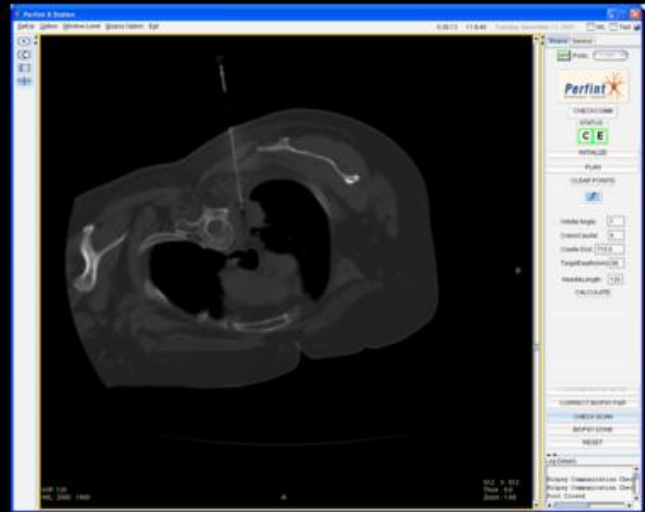
After inserting the co axial needle in to the calculated depth a single check scan is performed. The following is an example.

screen shots showing comparison of planning path and the execution of biopsy

Biopsy needle has gone exactly in the preplanned pathway



Plan



Execution

The following is another example of a case.

Plan

The screenshot displays the 'Perfint X Station' software interface. The main window shows a CT scan of a skull in a coronal view. A red line indicates a biopsy target with dimensions of 1.57 cm and 2.98 cm. The interface includes a menu bar (Setup, Option, Window Level, Biopsy Option, Exit), a status bar (0:6:11 11:57:27 Wednesday, March 19, 2008), and a right-hand control panel. The control panel features a 'Biopsy Service' section with 'OFF' status and 'COM1' port, a 'Perfint' logo, 'CHECKCOMM' button, 'STATUS' indicator showing 'CE', 'INITIALIZE' button, 'PLAN' field, 'CLEAR POINTS' button, and a 'CALCULATE' button. Below these are 'CONFIRM BIOPSY MOVE', 'CORRECT BIOPSY P&R', 'CHECK SCAN', 'BIOPSY DONE', and 'RESET' buttons. A 'Log Details' section at the bottom right shows 'Biopsy Communication Check' and 'Port Closed'.

Perfint X Station

Setup Option Window Level Biopsy Option Exit

0:6:11 11:57:27 Wednesday, March 19, 2008 WL Text

1.57 cm
2.98 cm

KVP: 120
W/L: 588 / 106

512 X 512
Thick: 5.0
Zoom: 1.89

Biopsy Service

OFF Ports: COM1

Perfint
Performance. Integrit.

CHECKCOMM

STATUS
CE

INITIALIZE

PLAN

CLEAR POINTS

Orbital Angle: -4

CranoCaudal 0

Cradle Dist: 736.0

TargetDepth(mm) 64

NeedleLength: 122

CALCULATE

CONFIRM BIOPSY MOVE

CORRECT BIOPSY P&R

CHECK SCAN

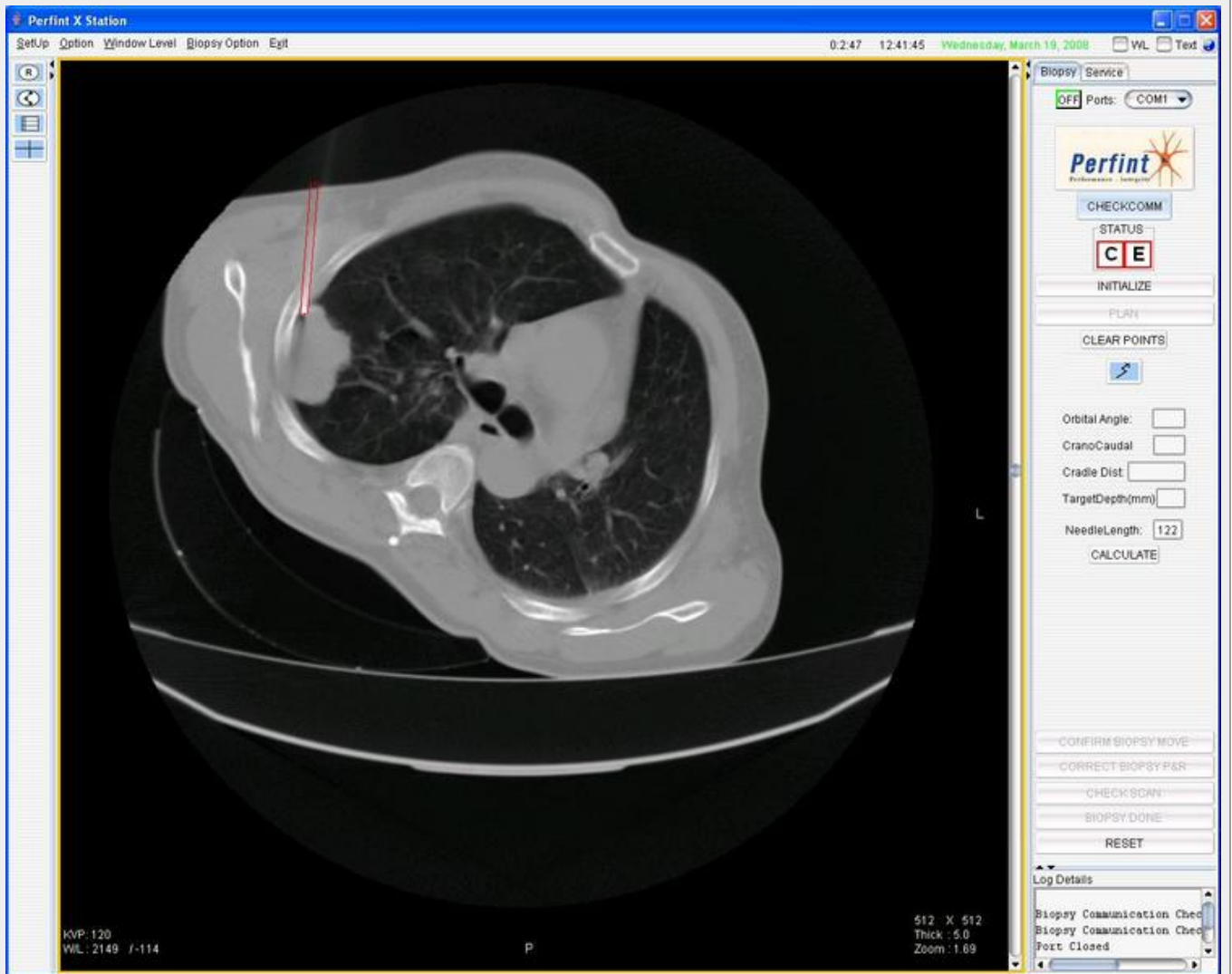
BIOPSY DONE

RESET

Log Details

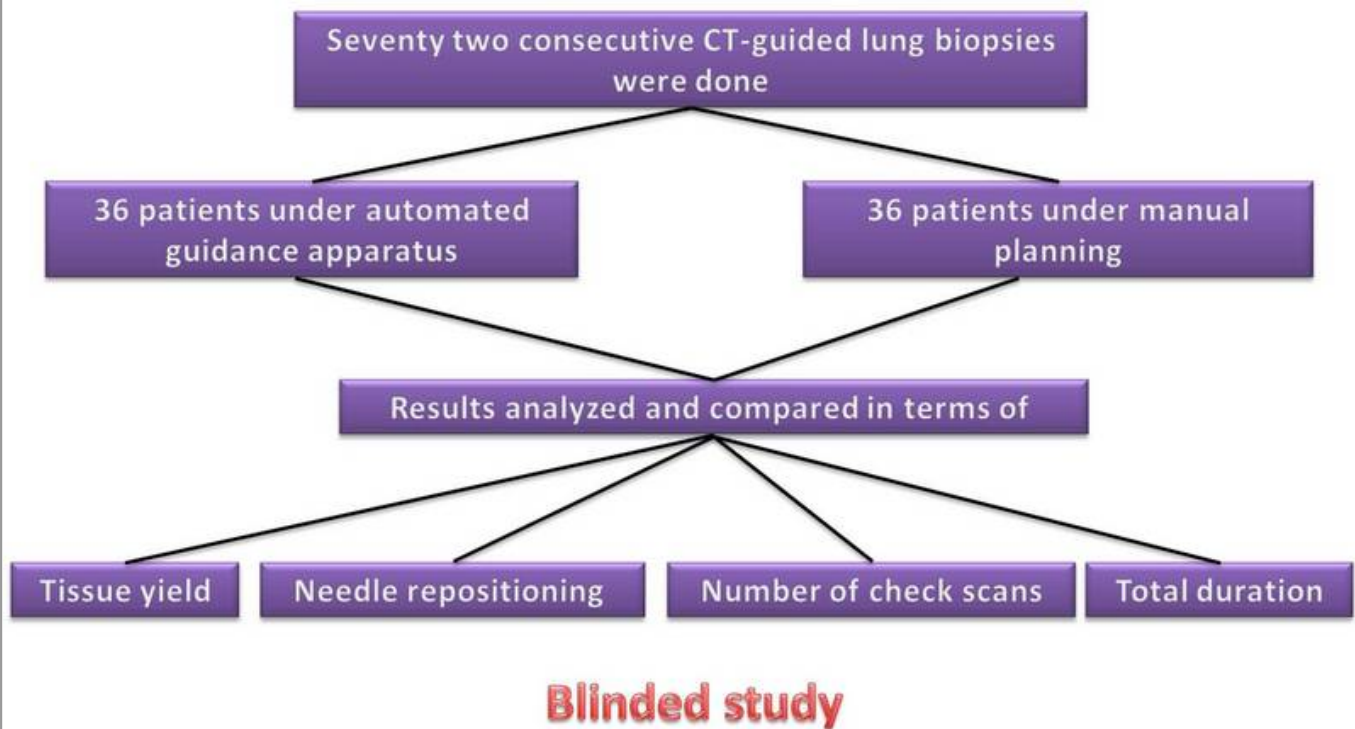
Biopsy Communication Check
Biopsy Communication Check
Port Closed

procedure



The prospective study included 77 consecutive patients and the structure of the study is as below.

Materials and method



Patient selection criteria

Inclusion criteria

- Lesions > 1 cm diameter
- Mediastinal lesion approachable without traversal of vital organs

Exclusion criteria

- Lesion size < 1 cm
- Small central lesions better approachable with bronchoscope
- Patients unwillingness

3. Results

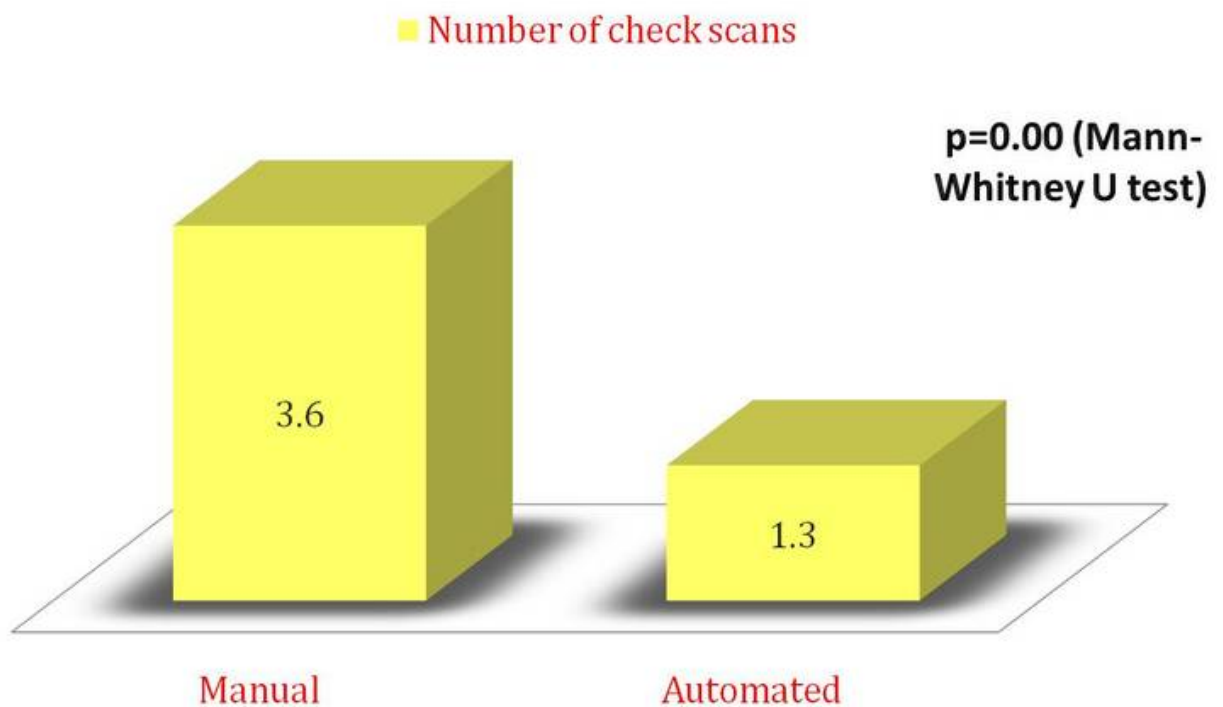
- The mean number of needle repositioning was 1.3 with automated setup and 2.9 using conventional ($p=0.00$ Mann-Whitney U test).
- Twenty five biopsies (69.4%) yielded sufficient tissue for pathologic evaluation using automated

comparing 23(63.8%) by conventional ($p=1.00$, Chi-square test).

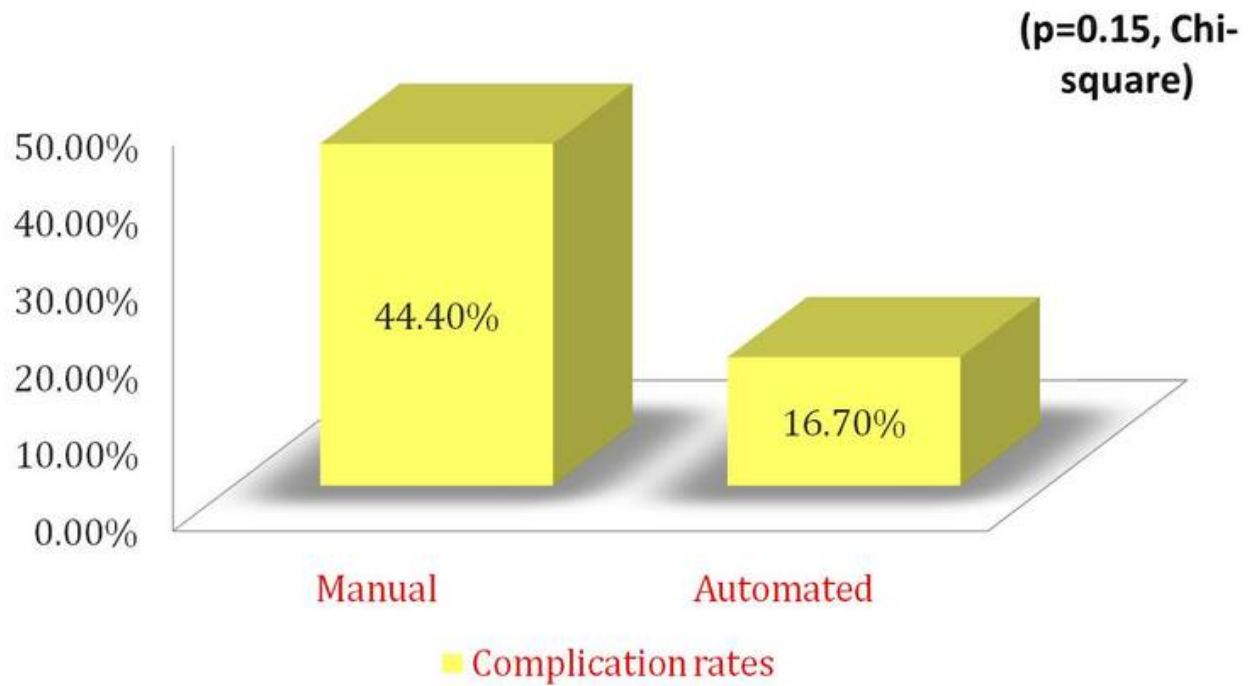
- Average number of check scans was significantly lower ($p=0.00$ Mann-Whitney U test) in automated (1.3) than in conventional (3.6).
- Total duration of time taken for completion of a procedure is also notably reduced ($p=0.00$ Mann-Whitney U test) while doing with automated (30.8min) than with conventional (58.7 min).
- The difference in complication rate using manual (44.4%) and automated (16.7%) methods was not statistically significant($p=0.15$, Chi-square test)

check scans.jpg

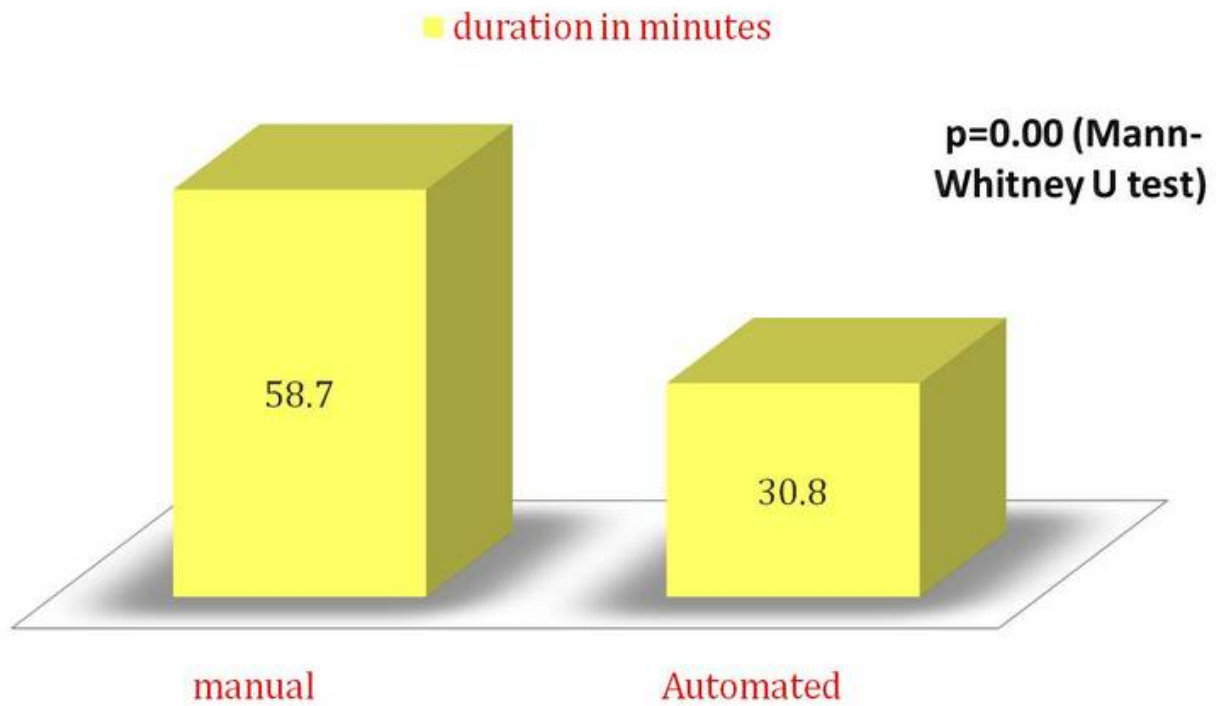
Average number of check scans



Complication rates



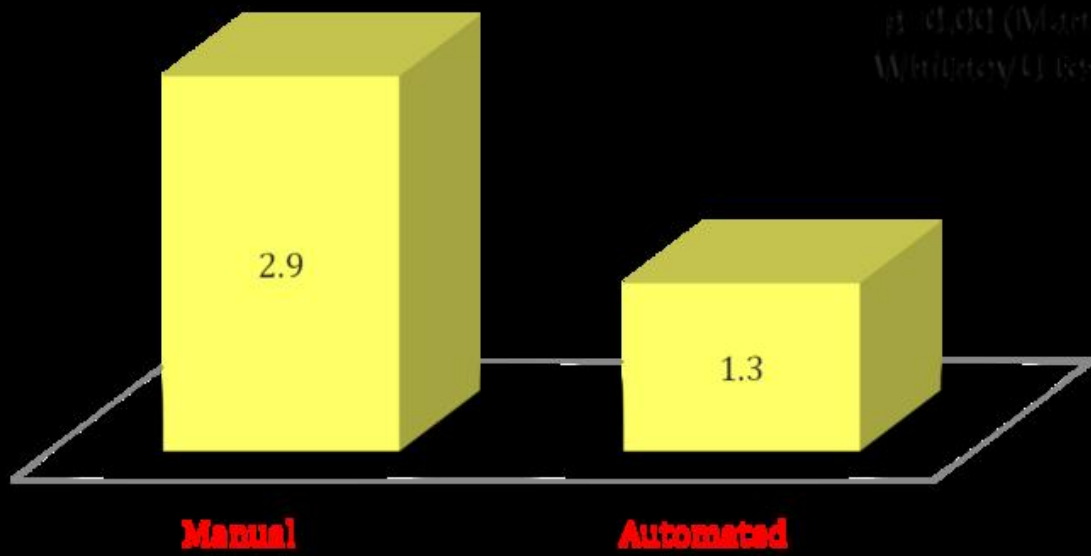
Total duration of time taken



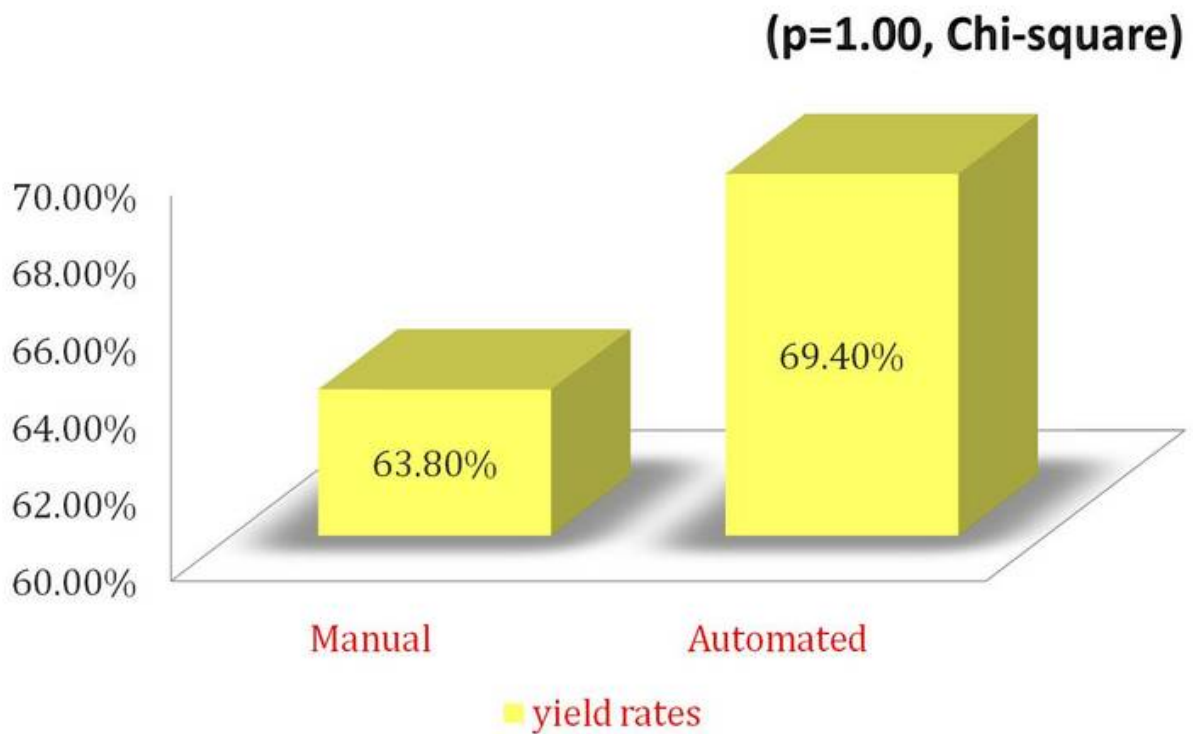
mean number of needle repositioning.png

Mean number of needle repositioning

■ mean no of needle repositioning



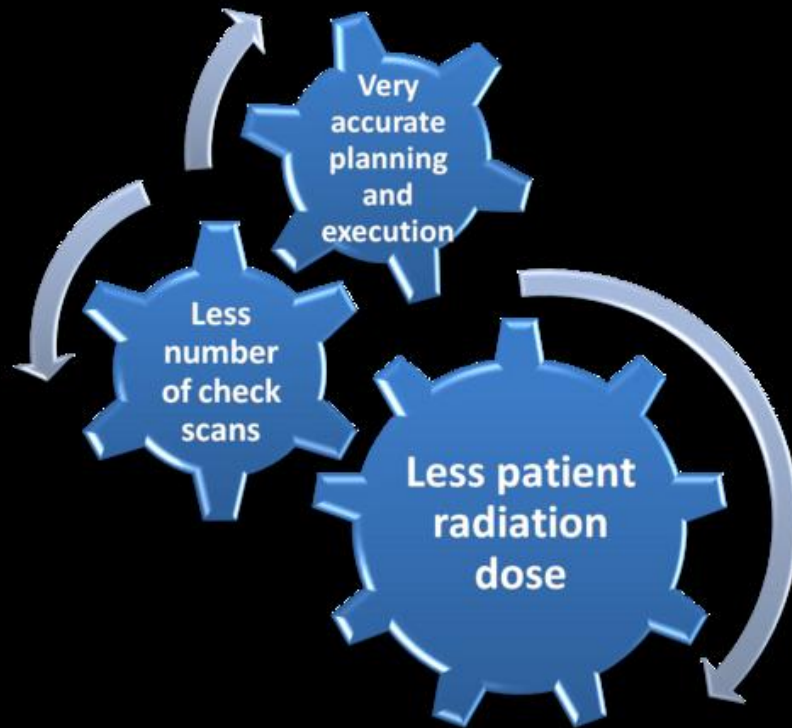
Yield rates



4. Conclusion

Both manual and automated planning offered comparable accuracy in getting sufficient tissue for pathologic evaluation and statistically equal incidence of complications. Automated setup scores over conventional method in terms of number of needle passes, time consumed, number of check scans and hence the patient's radiation dosage.

ADVANTAGES OF AUTOMATED BIOPSY PLANNING



5. Personal Information

Prof.T.S.SwaminathanM.D,DMRD,FICR: is Professor Emiratus at Barnard Institute of Radiology and past Director of the same. He is well known interventional radiologist in India and also popular for his works in vascular radiology. As a director of this teaching Institute he has revolutionized the teaching programme and met the most of what a modern Radiology curriculum needs from a resident.He is inspector of National Board of examinations and MCI.He is examiner for postgraduates of various universities allover India.He plays a vital role in organizing and upgrading radiology and imaging science in India.

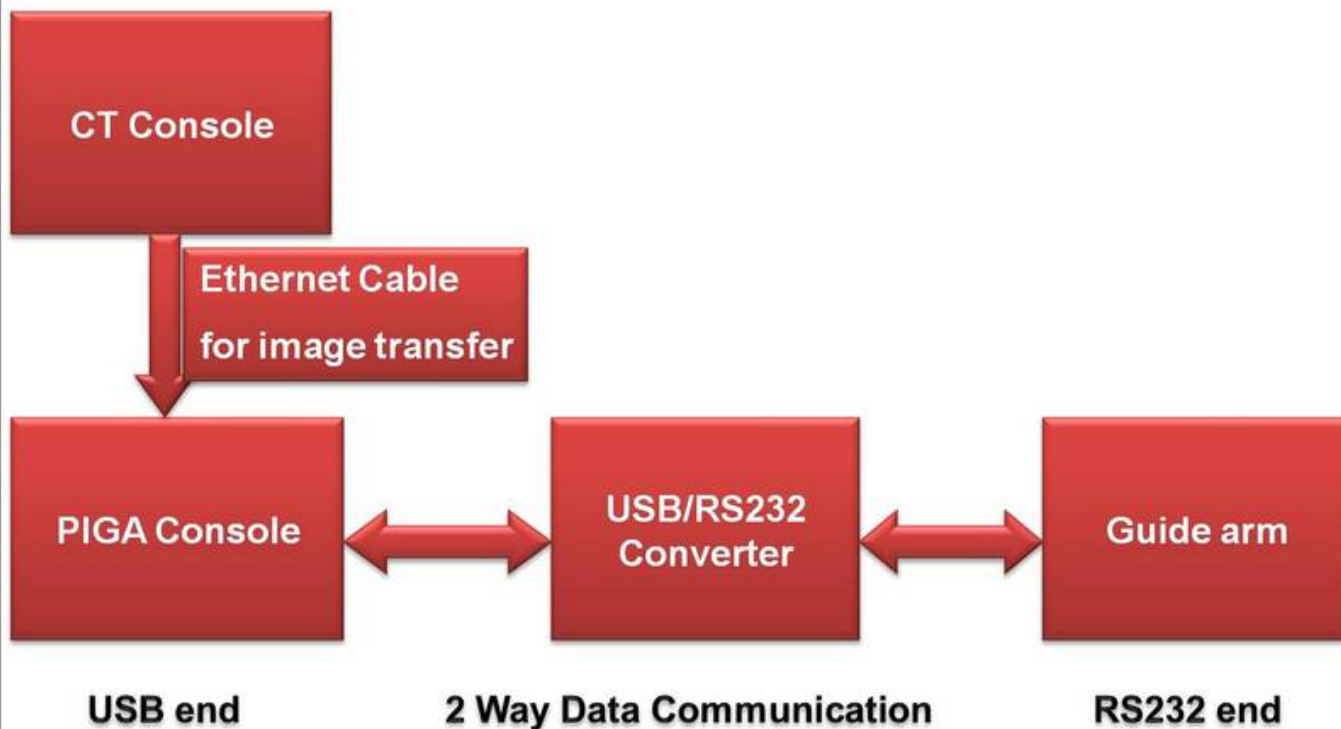
Prof.N.Kulasekaran MD,DMARD,FICR,FIMSA: is at present Professor and Director of Barnard Institute of Radiology.He is also the National president of Indian Radiological and Imaging Association during the year 2008.He was invited co-chairperson for the session of "ESR meets India" at ECR 2008.It was very well and everybody appreciated the programme.He has presented various papers in National and International conferences.He is instrumental in encouraging residents to participate in international conferences and present scientifoc papers.He is inspector of National Board of examinations and MCI.He is examiner for postgraduates of various universities allover India.He plays a vital role in organizing and upgrading radiology and imaging science in India.

Dr.Kabilan Chokkappan: Final year resident, Barnard Institute of Radiology

6. Mediafiles

Functional components of Automated planner & guidance set up

Automated P/G set up PIGA-CT -Architecture



Plan

Perfint X Station

0:6:11 11:57:27 Wednesday, March 19, 2008

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Biopsy Service

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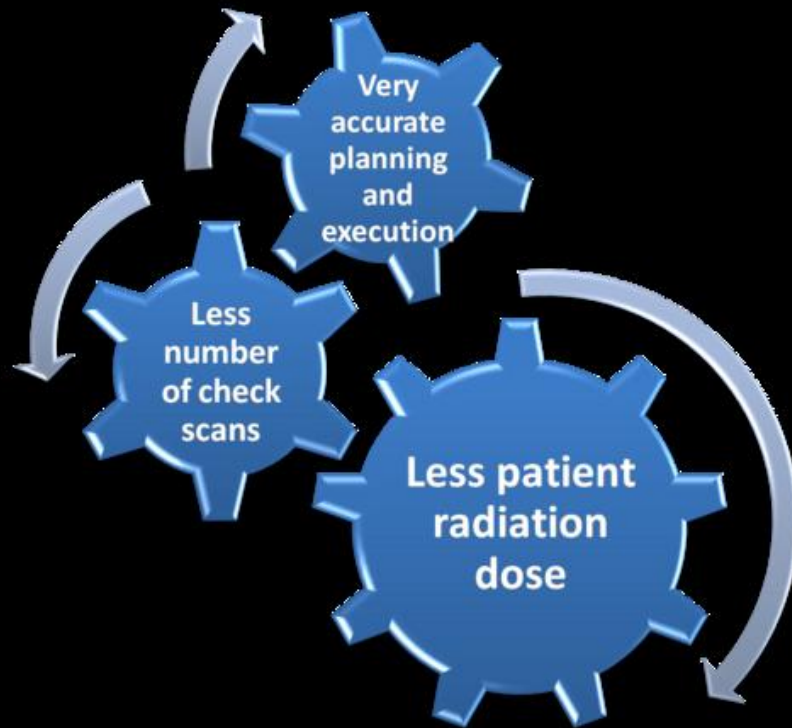


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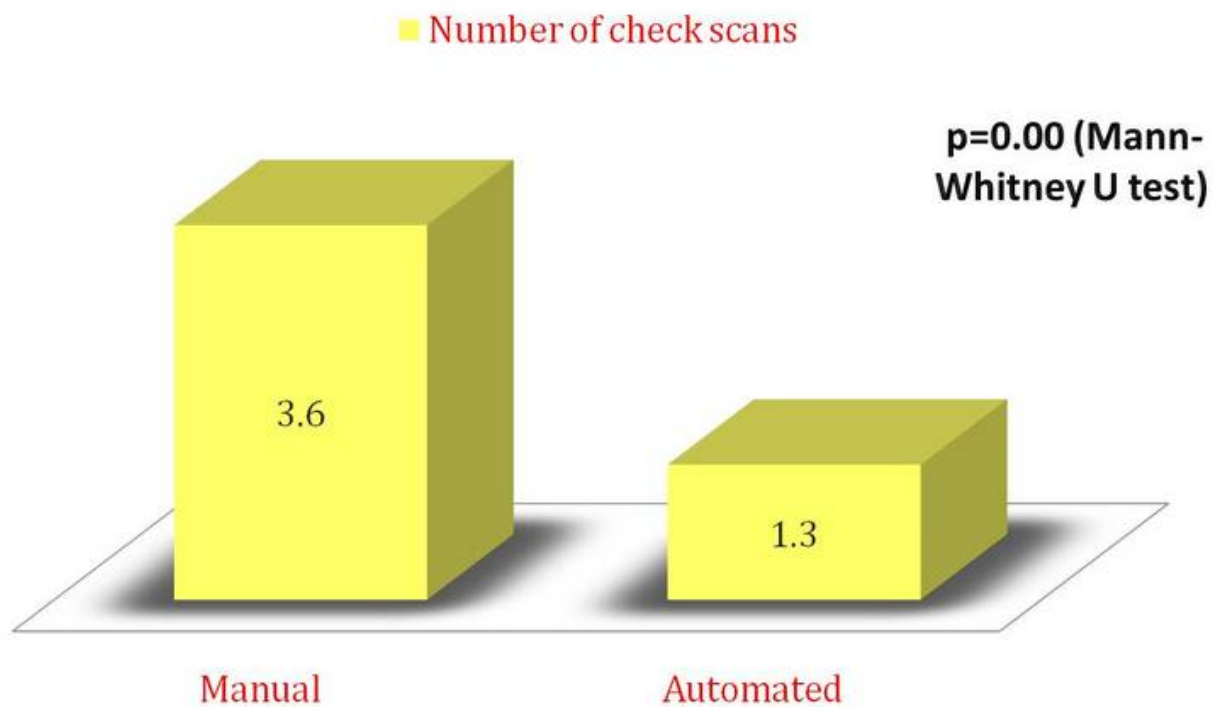
512 X 512
Thick: 5.0
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P

ADVANTAGES OF AUTOMATED BIOPSY PLANNING



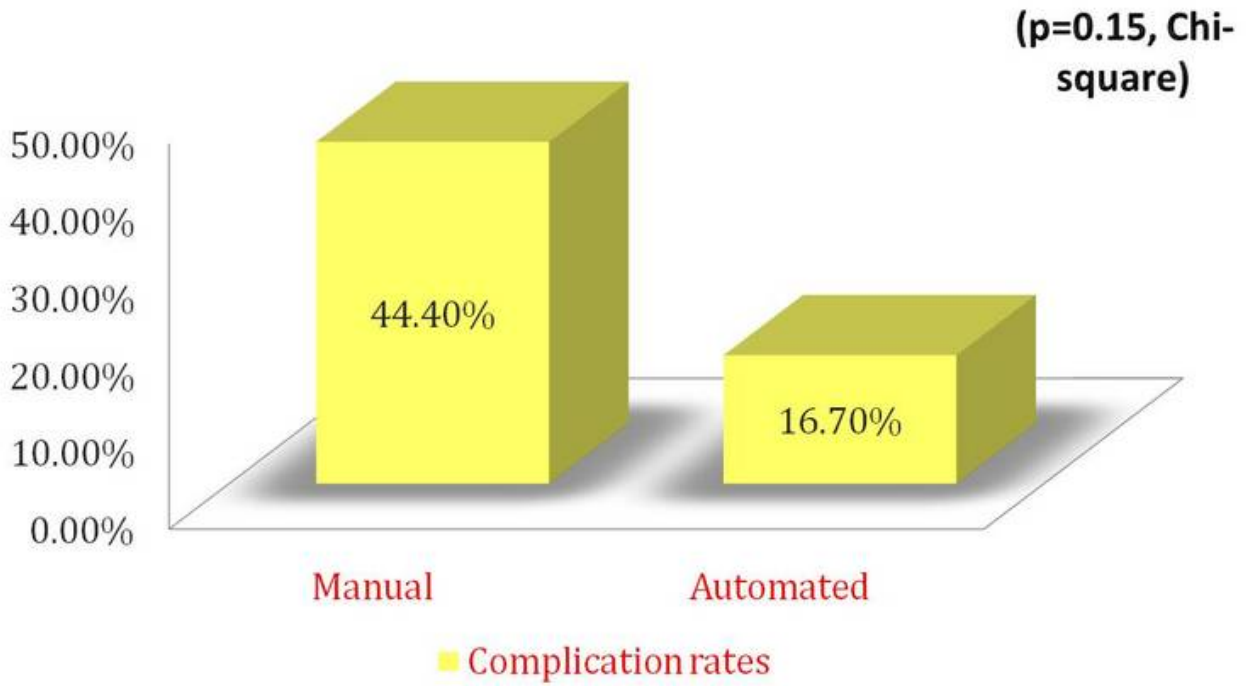
Average number of check scans



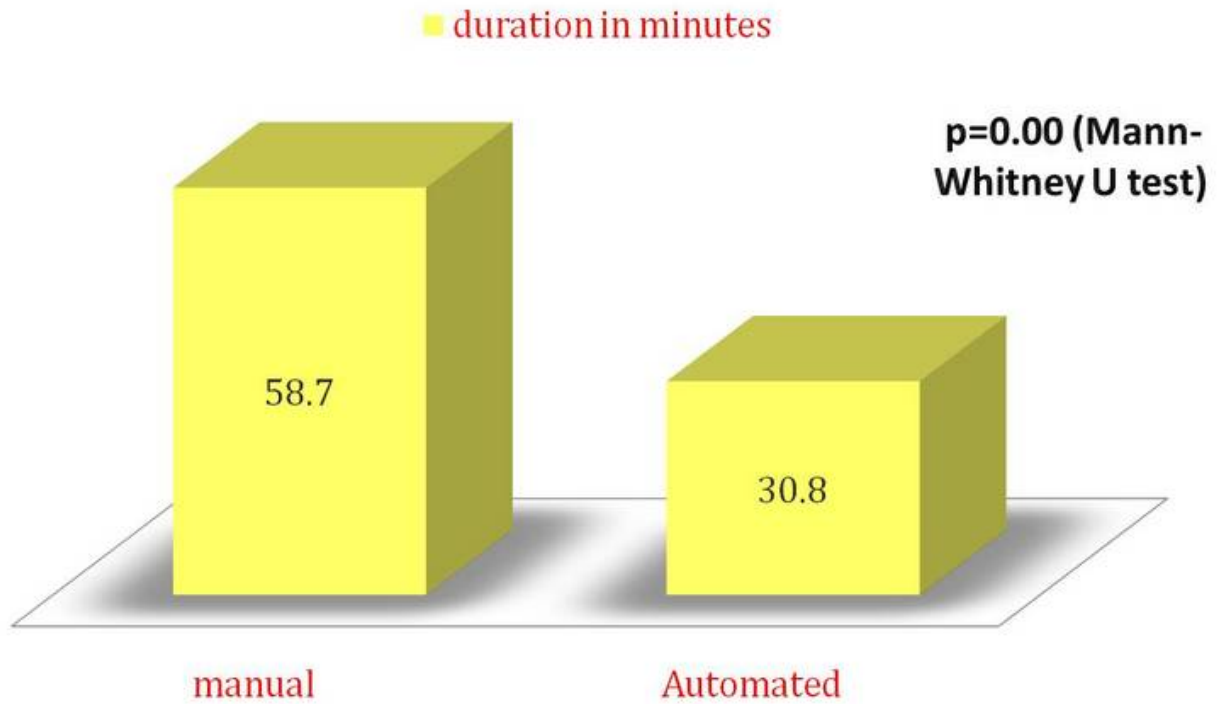
complex approach: advantage of cephalo caudal angulation



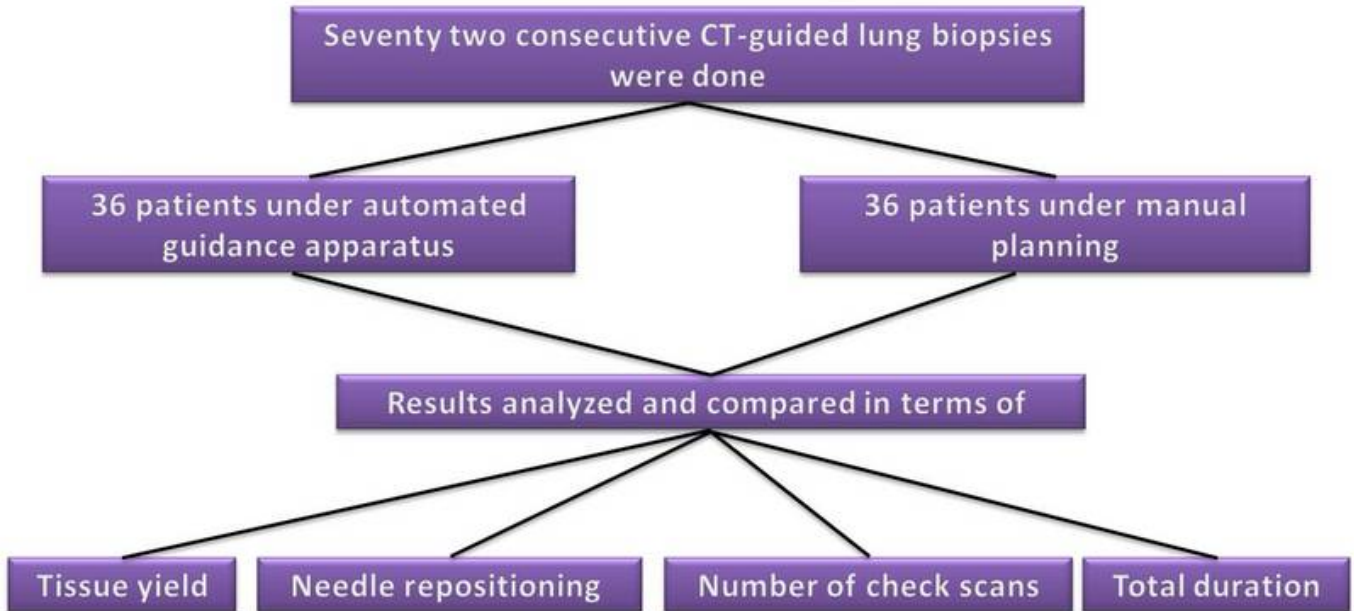
Complication rates



Total duration of time taken

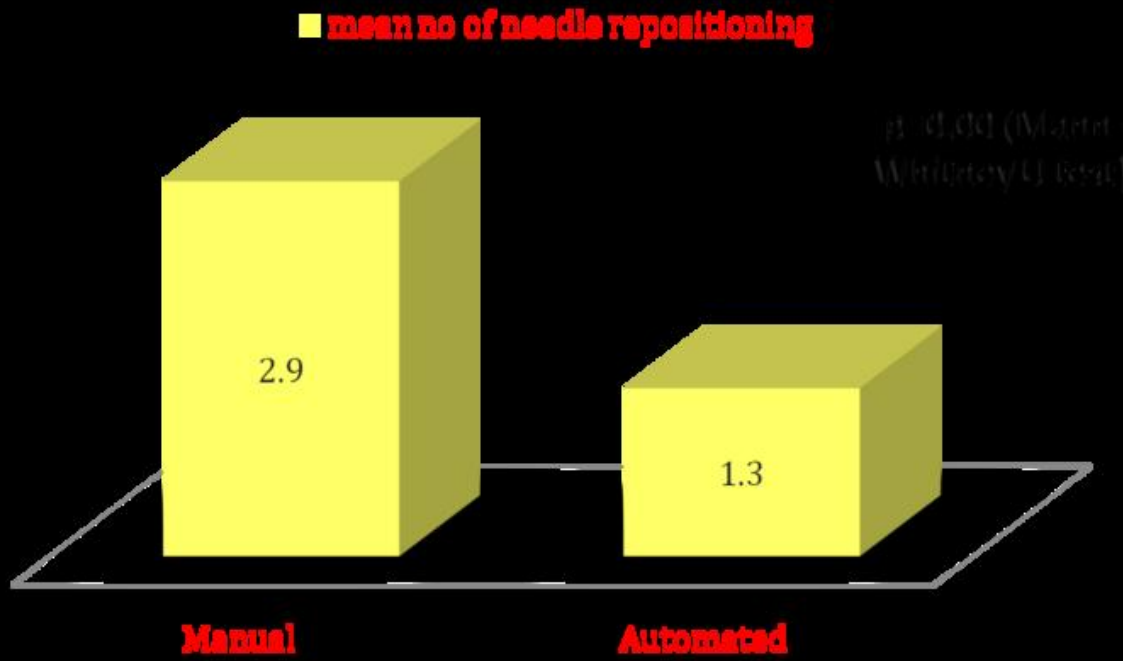


Materials and method



Blinded study

Mean number of needle repositioning



planning and execution



procedure

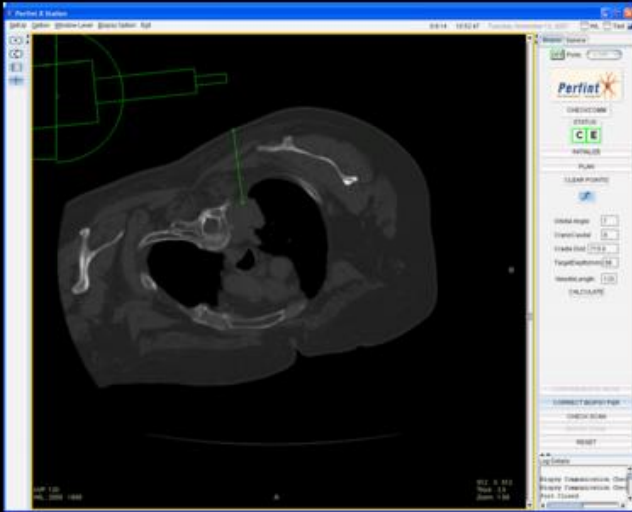


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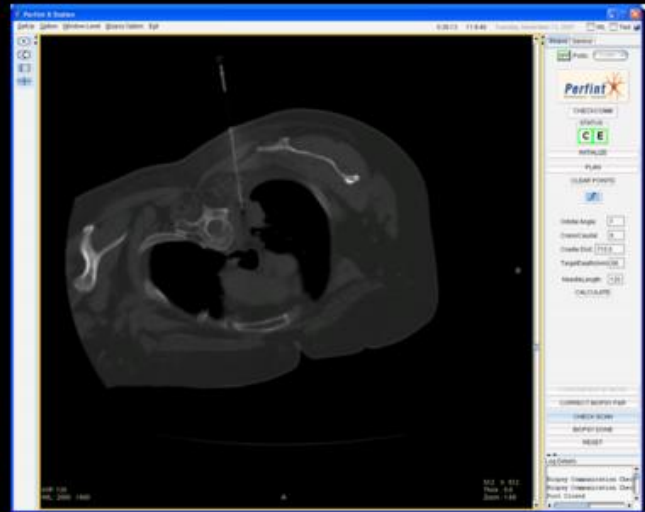


screen shots showing comparison of planning path and the execution of biopsy

Biopsy needle has gone exactly in the preplanned pathway



Plan



Execution

Manual planning: method



Yield rates

($p=1.00$, Chi-square)

