STEREOTACTIC INSTRUMENT IN CT GUIDED BIOPSY

Anuchit RUAMTHANTONG M.D., Thiti THATRINARANONTASIN Tech Gd.
Krisdee PRABHASAVAT M.D., Suwana JITBANCHUEN B.Sc.
Panida CHARNCHAOWANICK B.Sc., Supawadee KARUWANARINT B.Sc.
Venus WISESTSANG B.Sc.

ABSTRACT

We have designed a basic and simple instument for CT-guided biopsy, attached to the CT-table. The instrument is easy to be used and can be learned how to use in a short time. We use this instrument for CT-guided biopsy in 6 cases with good accuracy of 100 % and no major complications

We believe that the procedures with this instrument when used as an aid to the CT-biopsy would improve the safety, accuracy and the value of percutaneous biopsy in the radiology department.

INTRODUCTION

Computed tomographic guided needle biopsy is a well established useful procedure with a high yield of tissue diagnosis without the need for open surgery. It has the advantage over ultrasound in its ability to detect a small resolving lesion and identification of needle tip. This increases the yield of tissue diagnosis as sampling is accurately within the lesion. Its disadvantages include lack of real time imaging, expensiveness, and risk of exposure to radiation. The procedure is also time consuming, taking one to two hours per case in comparison with 45 minutes in ultrasound guided biopsy. The duration of the procedure is influenced by many factors such as radiologist's skill, type of CT machine (continuous or spiral) and characteristi of the lesion (localized or diffused, whether easily approached, etc.) All these may contribute to longer duration of the procedure.

The use of our apparatus that would aid in the localization and enhance the accuracy of needle angulation and depth of needle puncture would greatly improve CT guided biopsy procedures and as such would be of benefit to the patient. This diagnostic aid would reduce procedure time, radiation exposure and the patient discomfont. Also increasing the accuracy of every needle tip positioning would lead to lesser unnecessary needle movements and puncture and as such lower incidence of procedure related complications.

OBJECTIVE

The objective of this study is to introduce a new instrument, simple, cheap and which does not require much expertise to operate, and which would help shorten the time in the performance of CT guided biopsy.

MATERIALS AND METHODS

Steps for CT guided fine needle biopsy:

1. Simple scanning, select the area of

* Department of Radiology, Siriraj Hospital, Dhonburi, Bangkok, Thailand.

solid or confluent tissue with contrast enhancement around the necrotic area.

2. Place the skin marker on selected area above the lesion, then make single cut with CT scan.

3. From the monitor , select the skin entry point and measure the angulation of the needle and the depth of the mass from the skin.

4. Use the instrument with the needle attached which would direct the advancement of the needle to the desired position, then proceed with the actual needle puncture.

5. Rescan to see the tip of the needle making 3 cuts , 10 mm. apart ;above, at and below the tip of the needle.

6. With the needle in correct position, remove the patient from the scanner and do the biopsy.

7. After biopsy, remove the needle and rescan the patient to detect any acute complication (hemorrhage) that might occur.

8. Observe the patient in sitting position for 2 - 4 hours before sending home.

DESIGN OF INSTRUMENT

This instrument was designed to be used in 3 - dimensions (in the x-y-and z-axis) for the purpose of shortening the time of the procedure. We used the property of the opposited angle in the parallel lines of the same triangle in the same direction. (Fig.1,2,3)

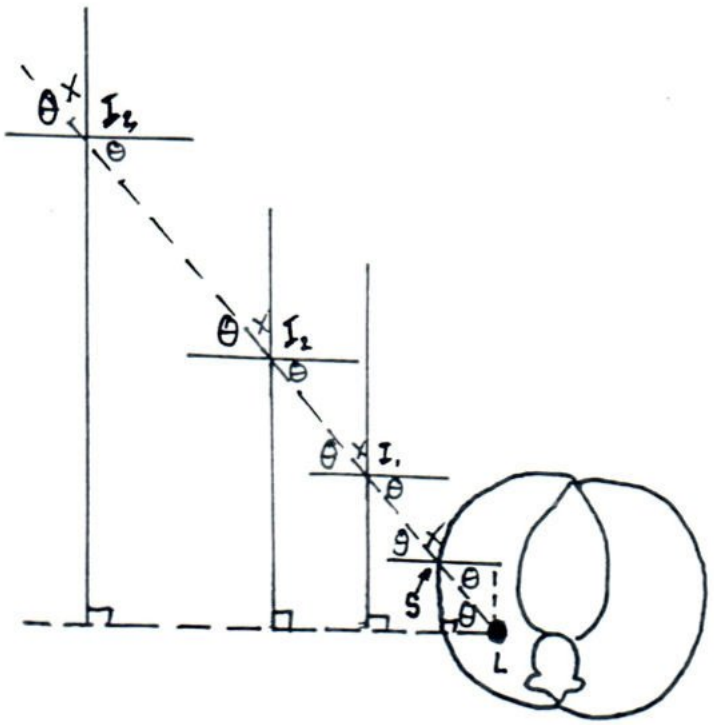


Fig. 1 Diagram of the property of the opposited angle in the parallel lines.

Θ = defined from an angle between the parallel axis and a line from center of the mass (L) to the skin marker (S).

I_1 ; I_2 ; I_3 = Imaginary points outside the patient having the same angulation (Θ)

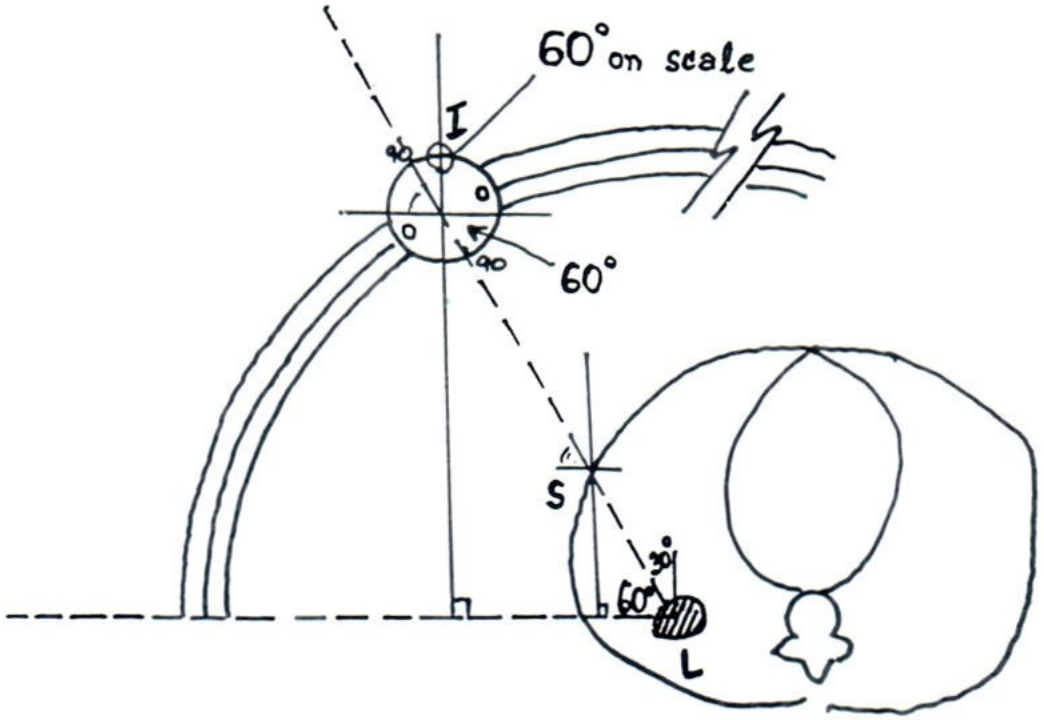
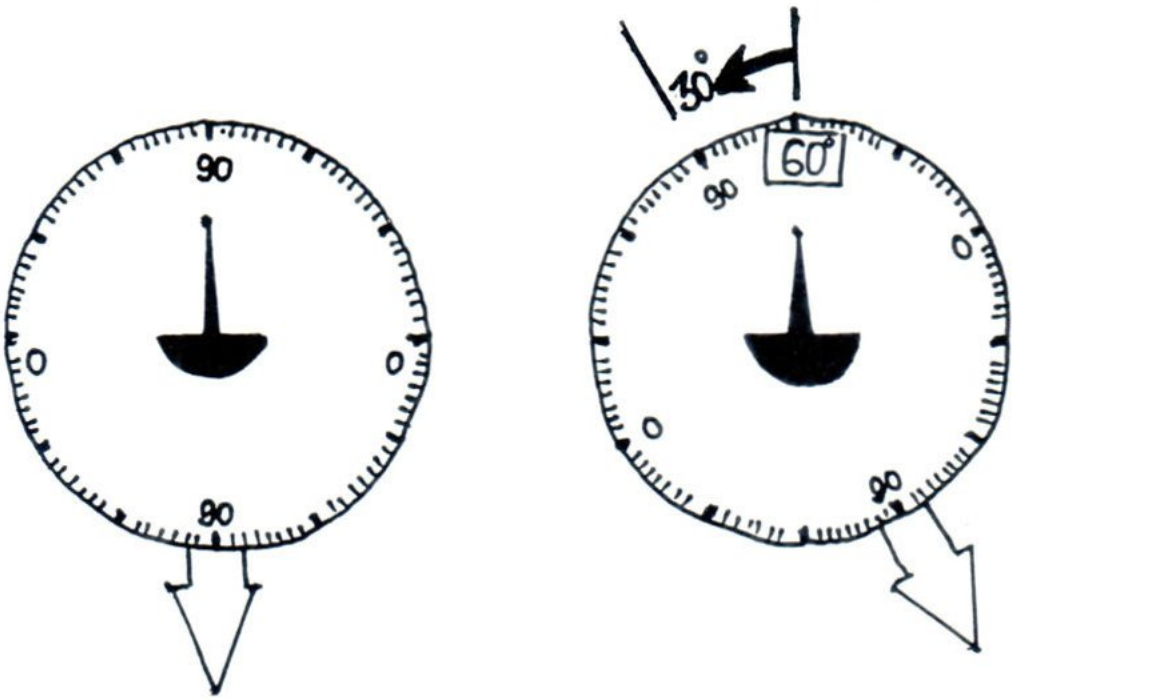


Fig. 2 After using the water - level instrument at the imaginary-point(I); adjusting to get the angulation [60°] from I to S (Skin marker).



Before Adjusting Counter Clock-wise Rotation

Fig. 3 Close-up view of the scale in Fig. 2

THE INSTRUMENTS ARE COMPOSED OF

1. Clamper to hold the semi-circular frame to the CT-table.

2. Semicircular frame which used to make the extra-axial point angulated with the skin marker in the same degree to the lesion.

3. Water-level instrument (used by the carpenter) for measuring the angle from the semicircular frame.

4. Sliding-ruler to hold and to measure the depth for the needle puncture with scale. (Fig.4)

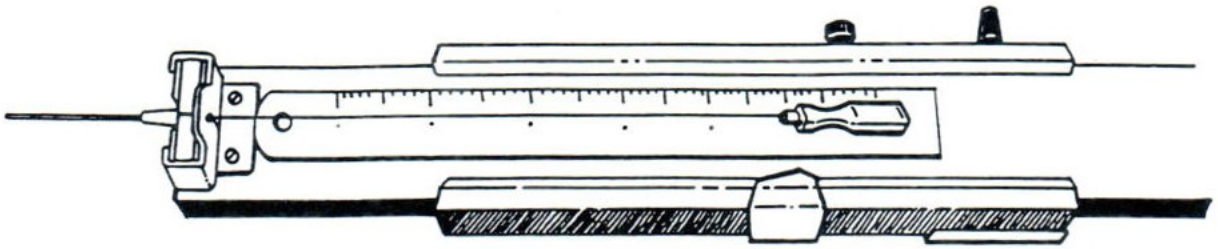


Fig. 4 Sliding-ruler with puncture-needle.

STEPS IN THE PROCEDURES

1. Select the slice of serial scans which found the lesion and may be propable to puncture and avoid the vital organ from the direction of puncture.

2. Re-scan with the skin marker at the same slice.

3. Choose the puncture point from the skin-marker ("A") to the lesion ("B") ;
At the monitor of the CT-scan we should know.

@ depth of the direction to puncture

@ angulation with the parallel level (X-axis)

4. Using sterile technique at the puncture point.

5. Construct the instrument.

6. Adjust the angle of the instrument to be the same angle seeing from the monitor (which acquired from the first scan) ; by the water-level instrument. (Fig.5)

7. Puncture with sliding-ruler.

8. Re-scan again to evaluate the complication of the procedure.

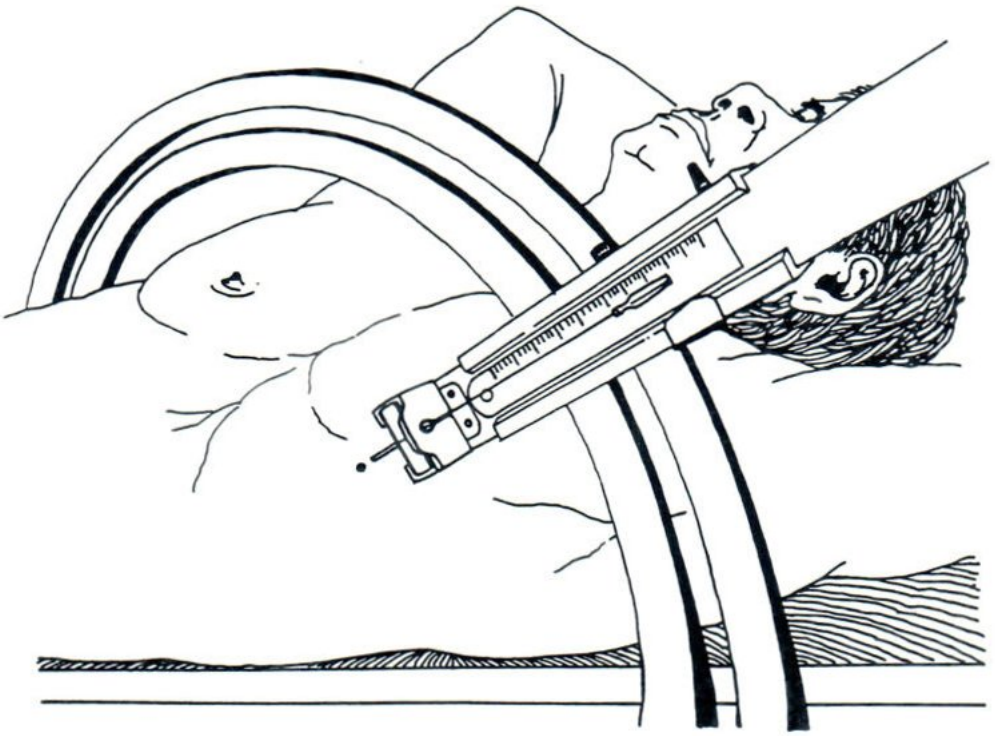


Fig. 5 Illustration of stereotactic instrument above the patient.

RESULT

In our preliminary report of 6 cases using this instrument with CT-guided biopsy, we can manage the needle to enter the mass in every case and could get enough tissue to give diagnosis by the cytologist. Only 2 cases had minor complications of pneumothorax who were admitted in the hospital for 24 hours and were discharged next day without the complication. After having some experiences, we can reduce the time in the CT-guided biopsy. In the first three cases we spent about one and a half hour per case as a learning stage in the use of this instrument. But in the latter three cases we spent not more than 45 minutes per case.

DISCUSSION

The value of a diagnostic aid to a procedure is based on its contribution to the accuracy, diagnostic yield, shortening of examination time, lowering of complication rate and attributable to patient's comfort. In percutaneous biopsy, accuracy and diasnostic yield is higly dependent on the amount of tissue sample and accuracy of biopsy sampling within a given lesion. There are two very important points that should be first and foremost for anyone performing per cutaneous biopsy. One is the exactness of the point of needle puncture and angulation which should always be the prime goal as this may be together avoiding additional or a second puncture, secondly

decreasing the time of the examinations, possible complications and enhancing patient comfort during the biopsy, likewise, accurate needle position within the lesion garantees representative histological sampling of the mass.

Our instrumental design tries to enhance the biopsy procedure by complementing the accuracy of needle puncture in depth and angulation , thereby fulfilling the other requisities for an accurate diagnosis.

It has been designed to resolve the limited angle of puncture; decreasing time for re-scan and facilitate the accuracy of the direction of puncturing.

This instrument may be openned to further improvement for use with the CT scan (conventional type) or for spiral . However cost and high radiation doses are to be considered in spiral CT .

REFERENCE

1. Andy adam, MRCP, FRCR & Robert N. Gibson, FRACR, DDU : Practical Interventional Radiology of The Hepatobiliary System And Gastrointestinal Tract; Chapt. 7 "Computed Tomographic-guided and Ultrasound-guided intra-abdominal biopsy and abcess drainage" by Eugene Y. Yeugn; p 100-117
2. Joseph T. Ferruci, Jr., M.D. & Jack Wittenberg, M.D. : Interventional Radiology of The Abdomen; Chapt. 4 Percutaneous Tumer Biopsy p. 115-155
3. Stuart G.Silverman, David A. Bloom et al. Needle-Tip Localization During CT-Guided Abdominal Biopsy : Comparison of Conventional and Spiral CT. AJR 1992; 159 : 1095 - 1097
4. Gary Onik, M.D., Eric R. cosman, PhD. et al. : CT-guided Aspirations for the Body: Comparison of hand Guidance with Stereotaxis : Radiology 1986;160:389-394
5. Gary Onik, M.D., Philip Costello et al. CT Body Stereotaxis : An Aid for CT-Guided Biopsies. AJR 1986;146;163-168
6. Eric van Sonnenberg, Jack Wittenberg et al : Triangulation Method for Percutaneous Needle Guidance : The Angled Approach to Upper Abdomen Masses : AJR 1981; 137; 757 - 761
7. Phillip R. Frederick, M.D., Thomas H. Brown, M.S., C.S. et al A Light-Guidance System to be Used for CT-Guided Biopsy: Radilology 1985;154(2):535-536
8. Joseph T. Ferrucci, Jr., M.D. & Jack Wittenbery, M.D. : CT Biopsy of Abdominal Tumors : Aids for Lesion Localization: Radiology 1978;129:739-744