

Ultrasound-guided interventional procedures. How we do it



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Ultrasound-guided interventional procedures. How we do it

Ultrasound-guided fine needle aspiration biopsy (FNAB) is currently used as an alternative combined modality, which enables accurate detection and evaluation of solid and cystic abnormal lesions. It's easily performed, with low cost and most effective as it decreases the number of unnecessary operational procedures; that take place to rule-out malignancy. The aim of this paper is to suggest the schedule of an effective protocol, easily approached by residents and physicians with minimal, or no experience on ultrasound interventional procedures.

Our tutorial is based on more than 350 fine needle aspiration biopsies that were carried-out in our Institution during the last two years. It includes images and graphics of patients preparation, needle selection, sampling and aspiration technique. On-site cytologic preparation and brief references on possible complications and common pitfalls are also described.

KEY WORDS: FNAB, Ultrasound-guided fine needle aspiration biopsy.

Introduction

Ultrasound-guided fine needle aspiration biopsy (FNAB) is currently used as an alternative modality, which enables accurate detection and evaluation of abnormal solid and cystic lesions ¹; especially non-palpable ones ². Biopsy technique uses aspiration to obtain cells or fluid from the lesion. It is quite easy to well perform (average performance time 10-20 minutes), with financial benefits as it decreases the number of unnecessary operational procedures that take place to rule-out malignancy ³.

One of major disadvantages is that the ability to well perform the technique, is experience dependent. A nurse or an assistant should always be available to help with the procedure.

In our Institution all ultrasound-guided FNAB is performed on an outpatient basis. We prefer a freehand (without built-in guidance system) approach. No local anesthesia is needed. Patient's anxiety can be decreased with diazepam.

Technique ⁴

1. PARAMETERS OF ULTRASOUND-GUIDED FINE NEEDLE ASPIRATION BIOPSY

- Type of probe: 3-10 MHz high resolution convex or linear probes should be used.
- Field of view: should be adjusted to maximize visualization of the tip of the needle and the lesion (Fig. 1A-1B).
 - never use a large field of view while attempting a biopsy of a small near-field lesion.
- Focus: the transducer should be focused at the level at which the needle will penetrate the lesion (Fig. 2A-2B).

2. MATERIAL (Fig. 3)

- Disposable syringes with Luer-Lock tip- 10, 20 ml.
- Needles 20-27 G with transparent tip-single use.
- One end frosted on one side glass slides.
- 95% alcohol in 50% alcohol and 50% water solution.
- Sterile ultrasound gel is used as an acoustic coupling agent.
- Sterile probe drape. Enough gel should be used inside the cover to achieve better visualization (Fig. 4).
- Cotton swab soaked with Betadine solution.
- Cotton swab soaked with alcohol solution.
- Sterile drapes.

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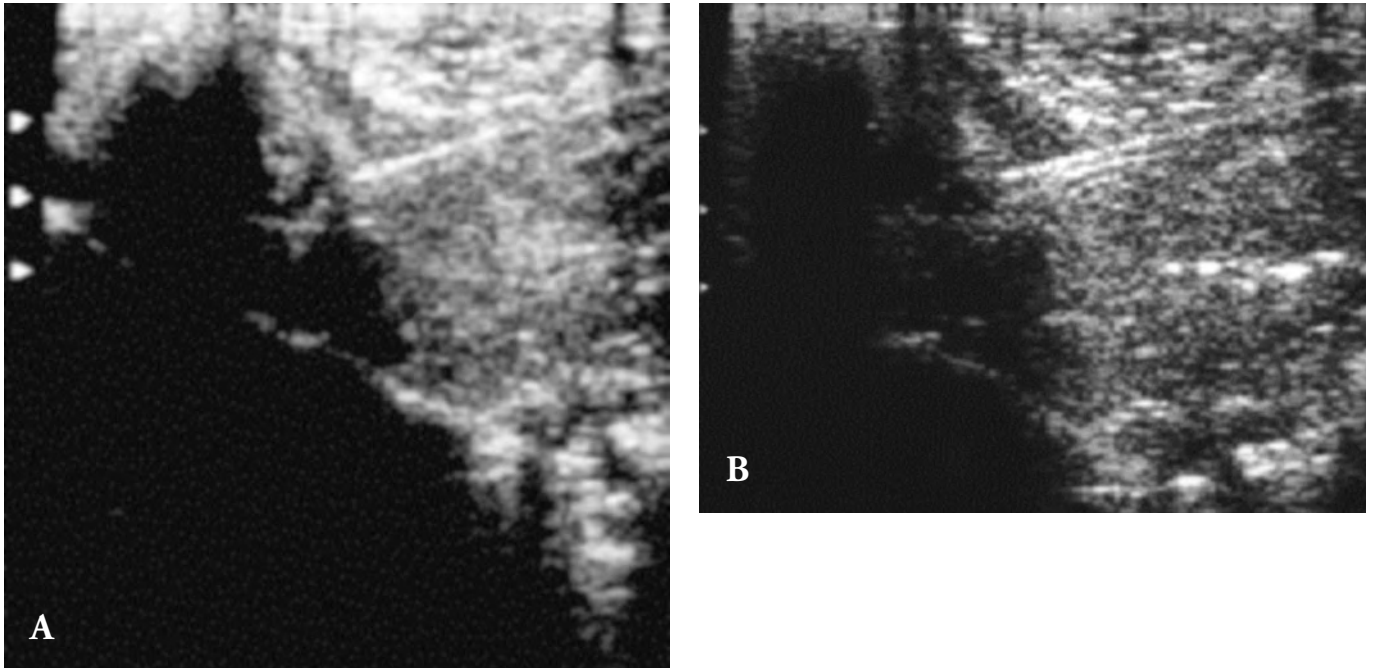


Fig. 1: A) FOV is improperly used for near field lesions; B) FOV is adjusted in order to maximize visualization.

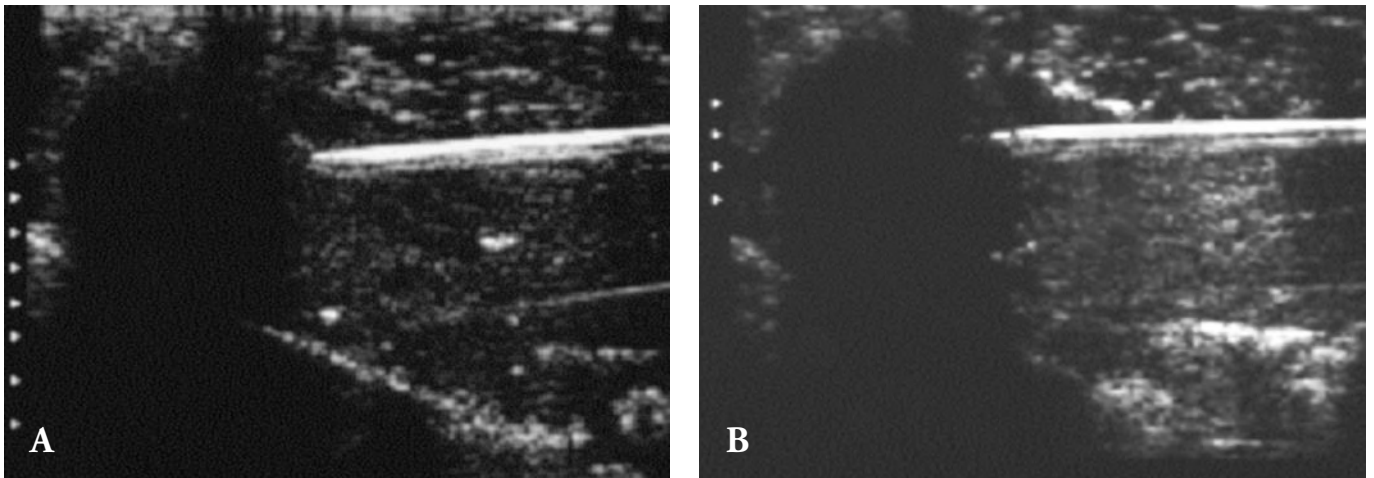


Fig. 2: A) The probe is improperly focused; B) The probe is focused at the level at which the needle will penetrate the lesion.

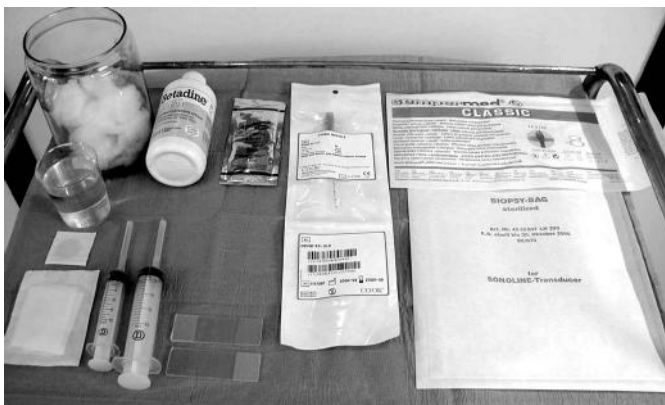


Fig. 3: Material for thyroid US-guided FNAB.



Fig. 4: Sterile probe gel.

3. PHYSICIAN AND SONOGRAPHER PREPARATION

- Hand-washing and double gloving are recommended.

4. PATIENT PREPARATION

- Explain to the patient the procedure and describe its relative risks, limitations and benefits. All the patients' questions should be answered completely.
- Ask the patient for the use of anticoagulants or aspirins and if she/he has a history of bleeding diathesis.
- Obtain informed consent.
- Palpate the patient before beginning the scanning procedure.
- Review all previous imaging studies.
- Examine the lesion in transverse and longitudinal scans.
- Determine the location of the nodule, the point of entry, and the access path.
- Color flow Doppler can be used to identify major vessels in order to avoid their accidental puncture (Image 5).
- Ask the patient not to swallow, talk, or move during needle aspiration.
- Sterilize the overlying skin with iodinated scrub, clean with alcohol and place drapes as required.
- In our institution we don't use local anesthetic to numb the injection site because we believe that this can hurt more than the actual FNAB procedure.



Fig. 5: Color Doppler flow to identify major thyroid vessels.

5. NEEDLE PLACEMENT WITH ULTRASONOGRAPHIC GUIDANCE

- Freehand puncture (the needle is inserted through the skin directly into the plane of view of the probe without a guide) allows direct visualization of the needle. During the procedure the operator has one hand on the probe and guides the needle into position with the other hand (Fig. 6).
- The needle is inserted in a quite steeply approach parallel to the short axis of the probe, while the nodule to be punctured is centrally placed in the image. The needle crosses the acoustic beam and only portion of it is seen (Fig. 7).
- If the needle approaches the lesion parallel with the



Fig. 6: Freehand technique.



Fig. 7: The lesion is approached in a steeply way from the long axis of the probe, after the probe is positioned directly over the lesion. The acoustic shadow represents the portion of the needle passing to the lesion.

long axis of the probe, the needle path can be visualized into the acoustic beam (Fig. 8).

- Visualization of the needle can be improved by needle motion (in-and-out movement with approximately a 1cm excursion) and by slight rocking motion of the probe.
- The needle position within the nodule should be always documented (Fig. 9).

6. SUCTION ASPIRATION TECHNIQUE

6.1. Solid nodules 0.0 to 1.0 cm

- Aspiration must be performed in five different regions

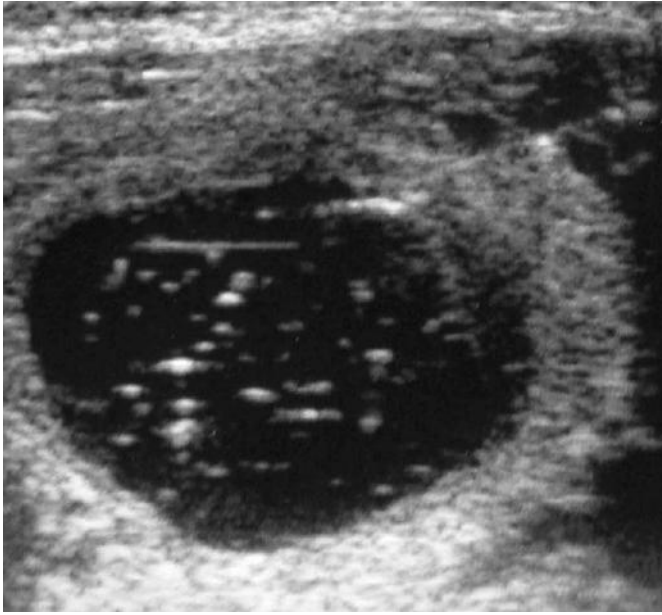


Fig. 8: The needle approaches the cystic lesion in a horizontal plane parallel with the long axis of the probe. Note that both the needle path and the lesion are visible.

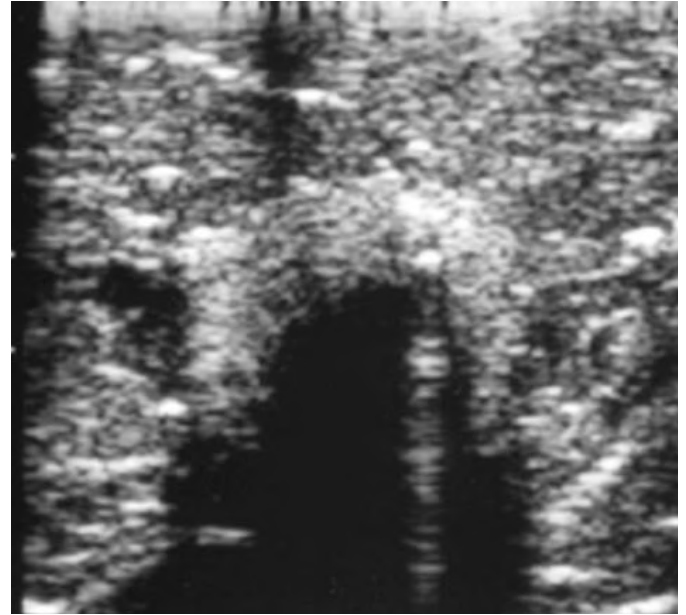


Fig. 9: The needle approaches the cystic lesion transverse with the long axis of the probe. Note that only the tip of the needle is visible within the lesion.

in sequence: center, and then four quadrants starting at 12:00 clockwise ⁵.

- We use a new needle and syringe for each aspiration.
- The needle must be moved back and forth and at the same time rotated (corkscrew drilling motion) so that a cone-shaped area of the lesion is sampled.
- A syringe is used to exert negative pressure. Suction is applied for a period of 5 to 10 seconds.
- Specimen must appear at the lucent needle tip of the needle in order to consider sampling successful.
- Suction is stopped before needle removal.

- To minimize haematoma formation, the skin entry site and region of needle sampling should be compressed between needle passes.
- Always examine the area after the procedure.

6.2. Cystic lesions

- Penetrate the wall of the cyst.
- Aspirate the fluid.
- A post aspiration image is useful for comparison in follow up studies (Fig. 10a-10b).

7. SPECIMEN PREPARATION

- Ideally, the specimen should be prepared by a cytote-

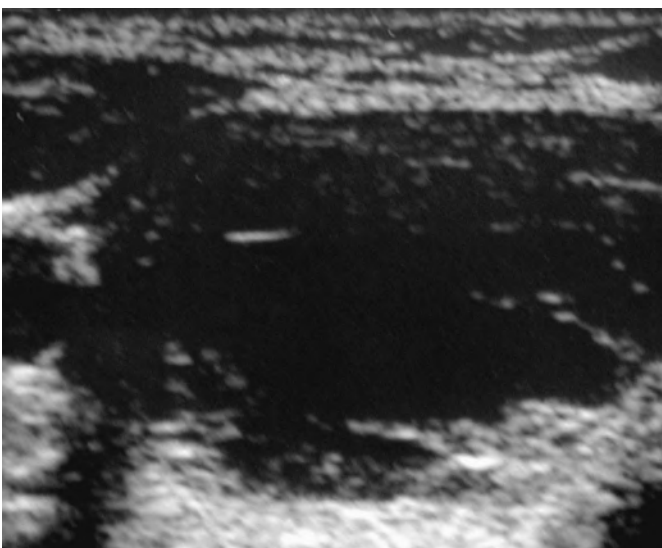


Fig. 10a: Cyst aspiration, pre-procedural image.

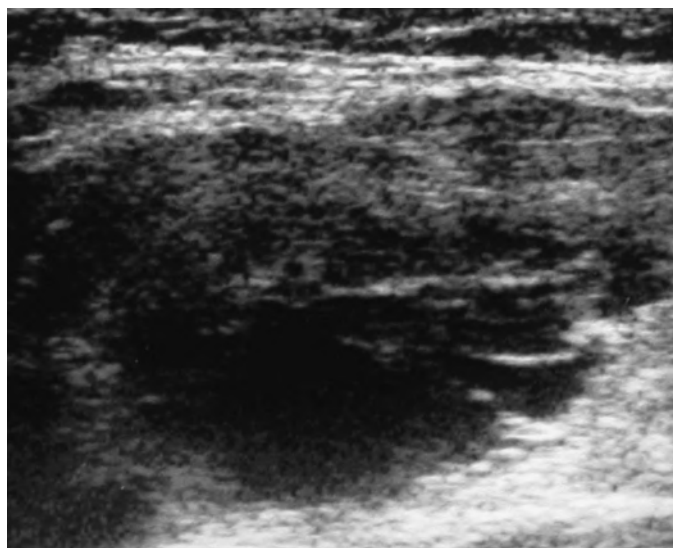


Fig. 10b: Post-aspiration image shows partial evacuation of the cyst.

chnologist, or cytopathologist. In our institution a technician is trained in this preparation.

- Patient's data should be written on the slides before specimen preparation.
- Specimen preparation should be done instantly in order to avoid contamination.
- Three to four slides should be used for each sample.
- An air-containing syringe is firstly reattached to the needle and then the needle is placed with the bevel down over the slide.
- Only one drop of the material is spread over each slide (Fig. 11).

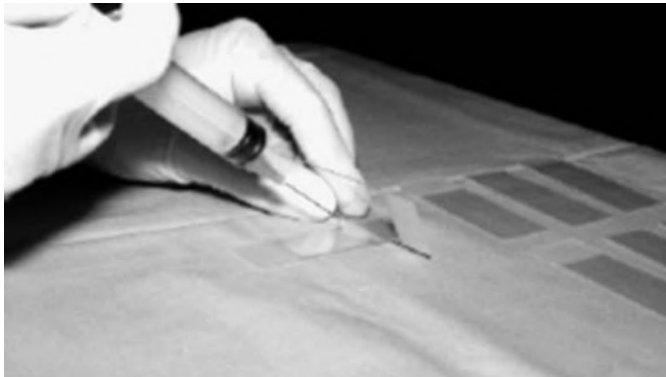


Fig. 11: One drop of the material is spread over each slide.

- A clear slide is squarely dropped on top of the drop that is placed on the first slide. The material on the first slide spreads evenly across the slides. Both slides are gently slid apart (Image 12a-12b).

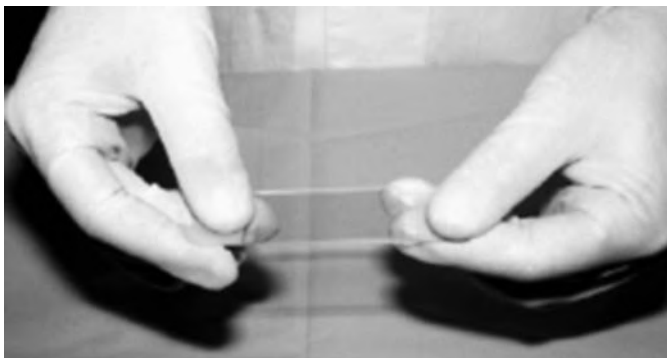


Fig. 12a-12b: Both slides are gently slid apart.

- Usually 10 slides are fixed with alcohol solution (95%).
- The container of the solution with the slides should be sent to the cytology laboratory as soon as possible after the procedure.
- Cystic material cytology is performed after centrifugation of the aspirated material.

Complications

- The method is slightly invasive and complications are rare and minor.
- The patient may have slight pain with some swelling and bruising at the injection locations, and possibly slight discomfort in swallowing after the procedure.
- Fainting and small haematoma formation, are the most frequent acute complications (Fig. 13).
- Needle tract seeding has not reported ⁶.

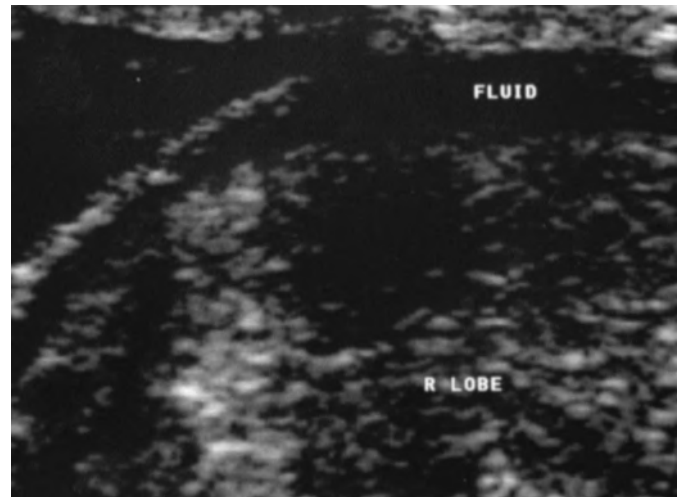


Fig. 13: Small haematoma formation after the procedure.

Pitfalls

- Although the majority of biopsies are adequate for a cytological diagnosis, up to 20% will be insufficient or nondiagnostic ⁷.
- When the patient is uncooperative, uncontrolled motion may make it difficult to direct the needle to the nodule (Fig. 14a-14b).
- False-positive diagnosis after radiation therapy may occur ⁸.

Conclusion

Ultrasound-guided fine needle aspiration biopsy of the thyroid is the only modality (in most, but not all cases) to distinguish a benign from a malignant lesions and usually should be the final diagnostic test performed.

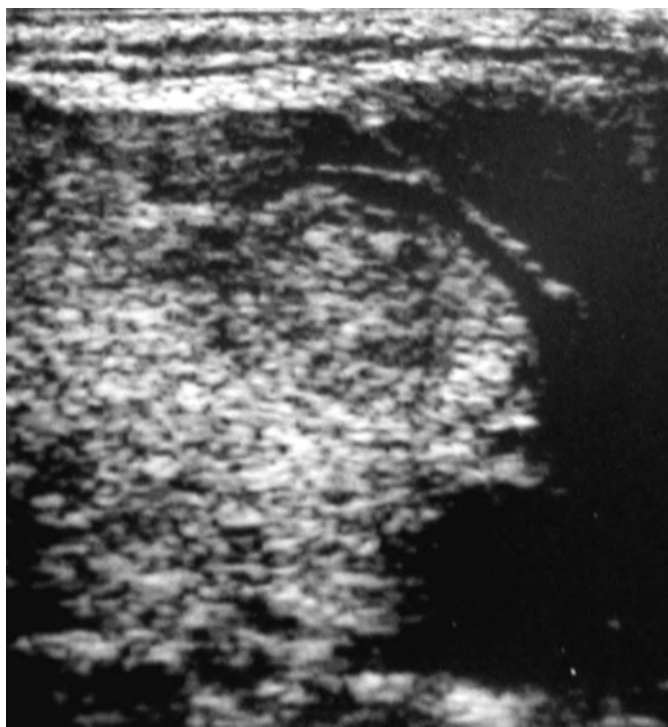


Fig. 14a: Transverse section of left thyroid lobe. Note the presence of an isoechoic nodule surrounded by a rim of decreased echogenicity (halo).

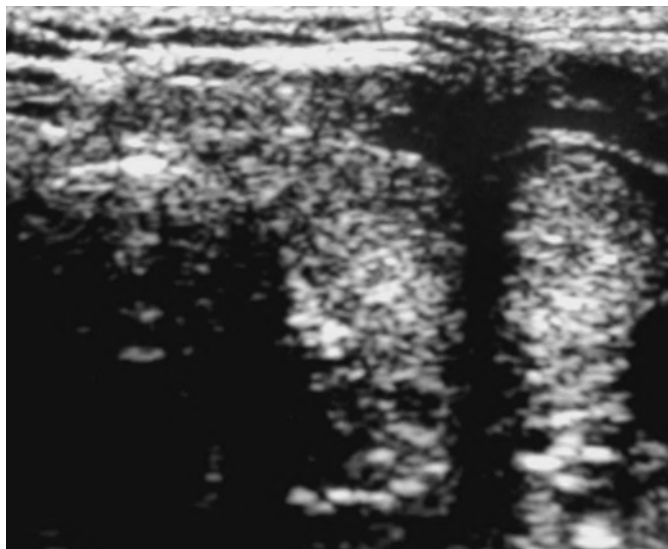


Fig. 14b: The probe is not positioned directly over the centre of the lesion. The portion of the needle (acoustic shadow) passes near the lesion's halo.

Riassunto

La biopsia ad ago fine eco-guidata, si usa oggi largamente quale tecnica alternativa diagnostica combinata che permette l'accurata scoperta, localizzazione e prelievo di

materiale per analisi anatomopatologiche, nelle lesioni solide o/e cistiche, palpabili oppure non. Si esegue in modo facile e rapido, a basso costo ed ha contribuito ad una significativa diminuzione del numero di resezioni allargate e distruttive o/e di biopsie non necessarie da parte dei chirurghi.

Lo scopo di questo articolo è quello di proporre un protocollo semplice e nel contempo efficace per l'uso della diagnostica ultrasonotomografica da parte dei medici con poca esperienza nel campo, come anche da parte dei medici di poca esperienza nel settore delle biopsie guidate.

Nel detto protocollo sono incluse tutte le necessarie istruzioni riguardo la preparazione dei pazienti candidati all'esame, la corretta scelta degli aghi da usare in base alle esigenze, il corretto prelievo dei campioni per gli esami anatomopatologici delle lesioni in studio ed anche una sufficiente descrizione delle tecniche di stratificazione e della preparazione dei vetrini portaoggetti. Si fa infine un breve cenno sulle possibili complicanze che si possono avere durante l'esecuzione dell'esame come anche sulle possibilità di falso risultato dall'esame anatomopatologico dei campioni dei tessuti prelevati.

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