

### 1: Step-by-step of ultrasound-guided core-needle biopsy of the breast: review and technique

*Abstract: Imaging guided percutaneous core needle biopsy of the breast is an accurate and cost-effective method for the diagnosis of indeterminate breast lesions. It is also useful for the preoperative confirmation of suspected carcinoma.*

Some factors increase the sensitivity of the samples and should be taken into consideration: Some studies 13 15 20 suggest that the real-time visualization of the needle within the lesion may help in reducing the number of false-negatives. The US-guided CB of breast is better tolerated than surgical biopsy, and can be performed quickly and at a much lower cost, as demonstrated in Table 2. Over the past 20 years, the present technique has demonstrated to be very safe, with rare severe complications 11 12 19 31 - No case of pneumothorax was observed in that study, despite the existence of some risk, which is higher in the cases of small breasts with axillary or medial lesions. Fistulas may occur during pregnancy or lactation, particularly in central and deep regions of the breast 19. Minor complications such as pain, edema, psychological trauma, small hemorrhages and vasovagal reactions are frequently observed 12 27. Hemorrhages are more frequent in hypertensive women and in breasts submitted to radiotherapy, whose vessels are more friable. Whenever possible, biopsies should be avoided in the perimenstrual period, where the breasts are more sensitive. As regards anticoagulant drugs, in spite of acetylsalicylic acid not being a contraindication 19 27 30, LaTrenta recommends that its use should be avoided for seven days prior to the biopsy, as well as the interruption of non-steroidal anti-inflammatory drugs for days. As regards the decision of interrupting oral anticoagulant drugs, it should only be made after multidisciplinary analysis 19, by pondering the risk for thrombotic events versus the risk for development of important hematoma. If such an interruption is considered necessary, its use may be stopped days before the procedure, and resumed soon after the procedure. According to Liberman et al. In such cases, the placement of a metal clip is suggested, to serve as a marker for later surgery. Among the factors which increase the false-negatives rate, the following factors were associated: In other study, the false-negative rate was 1. Despite the innumerable advantages of utilizing US-guided biopsy, some lesions are not visible at the method, and in such cases the utilization of stereotactic biopsy is preferable 14 17 31. Patients with suspicious microcalcifications or with breast implants may benefit from vacuum-assisted biopsy, because of the higher number of calcifications in the specimens and lower risk for implant rupture 14 20 30 34 45 - As regards simple cystic lesions, FNAB, besides being a diagnostic method may also become therapeutic as the cytological aspirate is typically benign. Routine prophylactic antibiotics are not indicated, but the sterile technique should be used, minimizing post-biopsy infections. The transducer must be of high-frequency ideally higher than 10 MHz linear type 15, and must be cleaned with antiseptics or be involved by a cover or a sterile glove. Sterile gel or the antiseptic itself will serve as ultrasound conductive agent. An automated biopsy device equipped with a long needle reaching 23 mm is preferable over the short needle reaching 15 mm. The recommended needle caliber for CB is gauge, which has demonstrated greater sensitivity than the gauge and gauge needles, without increasing complications or costs 27 34 35 49 - The professional must be experienced in manipulating the CB device and also be aware on how many millimeters the needle will advance when the device is triggered, in order to avoid transfixion of the chest wall. Before initiating the procedure itself, some items must be checked out. The patient must be duly explained on the reason for the biopsy, the technique that will be utilized, the risks and benefits, and on the existence of alternative techniques. A term of free and informed consent should then be signed by the patient. Previous images should be reviewed, and then an US scan should be performed to document the lesion and establish the technique to be utilized, confirm whether the indication for biopsy is appropriate and evaluate limitations which may negatively impact the procedure. The lesion documentation will be useful for follow-up and comparison purposes. Orthogonal measurements and localization of the lesion must be performed the clock position system is recommended and the distance between the lesion and the nipple should be measured and recorded. At that point, the physician should establish the best pathway to reach the lesion, and decide which hand he will use to hold the transducer. The

choice must lie on the one which will provide greater comfort and effectiveness for the procedure, and may vary according to the lesion site and to the dominant hand of the professional. The patient is usually positioned in dorsal decubitus, with the upper limb ipsilateral to the lesion being rested behind her head 12 19 The anterior oblique position may be beneficial in patients with large breasts or extreme lateral lesion location 19 Lesions located in the outer quadrant are usually better approached with the professional positioned at the side of the ipsilateral breast, while in lesions located in the inner quadrant the professional should be positioned at the side of the contralateral breast A sterile surgical drape should be placed on a portable table and the materials represented on Figure 1 should be positioned over that drape. The physician puts on the sterile gloves and couples the biopsy needle to the CB device. He then performs a triggering test, informing the patient that the clicking sound will be heard each time a sample is obtained. In cases of very dense breasts, the physician should pay special attention to the clicking sound, as when it sounds differently than expected, this may mean that the sample is inappropriate. Arrangement of materials required for the performance of core biopsy of breast. As regards technical standards, there are small regional variations. Review previous imaging studies and perform a well documented targeted ultrasonography scan. Evaluate whether the biopsy is appropriately indicated and its limitations Tables 1 and 2. Obtain the term of free and informed consent from the patient after having explained its entire contents. Carry out the antisepsis of the transducer and prepare the materials on a portable table. Don the sterile gloves and couple the core biopsy needle 14G to the device. Perform a triggering test, checking out the needle travel, as well as the triggering sound from the device. Positioning the patient usually in dorsal or anterior oblique decubitus. Perform the antisepsis over a wide area around the lesion, over which a sterile fenestrated drape should be placed. The antiseptic or sterile gel will serve as an ultrasound conductive agent. Sonographically identify the lesion. The palm of the hand holding the transducer and the fourth and fifth fingers exert some pressure on the breast to avoid its motion. Remember the access and entry point defined on item 4. Under US guidance, inject the anesthetic agent through the entire pathway up to the lesion. Make a mm incision on the skin over needle entry point. Insert the biopsy needle through the incision, attempting to follow the same pathway of the anesthetic needle towards the lesion border. At this point, the needle is to be directed to a position parallel to the nodule. Tell the patient that a sample is about to be obtained, and trigger the device action. Cross sectionally and longitudinally slide the transducer aiming at verifying whether the needle penetrated the nodule and that no injury occurred to the chest wall. Retrieve the sample from the needle with the scalpel blade or sterile needle, placing it in the vial with formaldehyde, briefly evaluating its characteristics. In cases of microcalcifications, at least ten samples should be collected and submitted to radiography, identifying and separating those without calcifications from the ones with calcium. Compress the lesion and incision areas for at least five minutes and apply local ice. Perform asepsis and apply compressive dressings which should be left in place for hours. Instruct the patient to avoid intense physical exertion and prescribe pain-relievers and non-steroid anti-inflammatory medication, as necessary. Clarify doubts and schedule return as soon as the histopathological results are available. The approach should be adopted according to Table 4. The presence of an assistant is valuable during the procedure. Such an assistant can perform the functions described on items 5, 8, 9, 16,18 and This will make the procedure swifter and the physician will be able to exert compression on the breast after triggering the CB device, thus decreasing the risk for development of hematoma. Figure 2 shows the main steps at US-guided breast CB. Initially, the antisepsis of the exposed area is performed by means of sterile gauze pad and antiseptic solution chlorhexidine, povidone iodine or alcohol. The lesion to be biopsied is identified with the transducer and, it is recommended that with the palm of the same hand, the fourth and fifth fingers resting on the field without exerting pressure on the breast the physician avoids the motion of the breast. By keeping the area of interest farther from the needle insertion point, it is possible to observe its entire trajectory, from the skin surface up to the lesion. Main steps of ultrasonography-guided core biopsy of breast. Identification of the suspicious lesion asterisk. Infiltration of the anesthetic through the pathway up to the lesion. The anesthetic needle is visualized as a fine hyperechogenic line wide arrows. Through the incision, the same pathway

utilized for anesthesia is utilized for insertion of the core needle thin arrows up to the lesion border. Once the CB device is triggered, one must check whether the needle penetrated the lesion asterisks. It is possible to observe the segment of the needle which advanced over the nodule space between arrows. The recommended access area is the peripheral curvature of the breast, positioning the needle at 2 to 3 cm away from the edge of the transducer, in parallel to the chest wall and perpendicularly to the transducer, allowing a better US visualization of the needle and reducing the risk for pneumothorax Figure 3A. The access through the nipple-areolar complex should be avoided. In cases of very deep or centrally and superficially located lesions, the oblique needle access may be necessary, which may impair its visualization at US. Commonly utilized approaches at US-guided core biopsy of breast. Needle parallel to the chest wall, perpendicular to the transducer. Better sonographic visualization of the needle and lower risk for pneumothorax. Needle angulated in relation to the chest wall. The transducer is guided in an attempt to maintain a perpendicular angle. Useful in very deep or superficial central lesions. The inferior movement of the CB device may help to move the lesion away as much as possible from the chest wall. Under US guidance, the anesthetic agent is infiltrated along the pathway of the needle up to the lesion. Deep lesions may benefit from posterior anesthetic infiltration, in an attempt to displace the nodule anteriorly. With a scalpel blade, a mm incision is made on the numbed skin. Gauze pads are to be left in the incision proximity, in order to facilitate breast compression and cleaning of blood. The needle is positioned parallel to the nodule, the patient is warned that the sample is about to be collected, and the CB device is triggered. In cases of mobile lesions, with the same hand that holds the transducer, pressure can be exerted against the nodule, thus decreasing the possibility of the needle pushing the nodule backwards as the device is triggered, so the collected sample is inappropriate. It is also possible to push the tip of needle into the nodule prior to triggering the CB device. Deep lesions may be better accessed with a greater needle angulation to reach the posterior border of the lesion.

**2: Table of contents for Breast pathology**

*Table of contents for Breast pathology: diagnosis by needle core biopsy / Paul Peter Rosen, Syed A. Hoda ; with contributions by D. David Dershaw and Laura Liberman. Bibliographic record and links to related information available from the Library of Congress catalog.*

Biopsy of palpable breast masses can be performed manually by palpation guidance or under imaging guidance. Based on retrospective studies, image guided biopsy is considered more accurate than palpation guided breast biopsy; however, these techniques have not been compared prospectively. We conducted this prospective study to verify the superiority and determine the size of beneficial effect of image guided biopsy over palpation guided biopsy. Over a period of 18 months, 36 patients each with palpable breast masses were randomized into palpation guided and image guided breast biopsy arms. Ultrasound was used for image guidance in 33 patients and mammographic stereotactic guidance in three patients. All biopsies were performed using 14 gauge automated core biopsy needles. Inconclusive, suspicious or imaging-histologic discordant biopsies were repeated. Malignancy was found in 30 of 36 women in palpation guided biopsy arm and 27 of 36 women in image guided biopsy arm. Palpation guided biopsy had sensitivity, specificity, positive predictive value PPV and negative predictive value NPV of Nineteen of 36 women On repeat biopsy, malignancy was found in all cases of imaging-histologic discordance. Image guided biopsy had There was no case of inadequate sample or imaging-histologic discordance with image guided biopsy. Our results showed that in palpable breast masses, image guided biopsy was superior to palpation guided biopsy in terms of sensitivity, false negative rate and repeat biopsy rates. Breast biopsy, breast cancer, image guided, palpation guided Carcinoma of breast is the most common malignancy diagnosed in women worldwide. In India, incidence of breast cancer ranged from 31 to In rural India, the incidence was lower and ranged from 7 to Unlike in developed countries where screening mammography is practiced, most of the patients in developing countries present with a palpable breast lump. Pathological diagnosis of the breast lump is established using fine needle aspiration cytology FNAC , core needle biopsy or surgical biopsy. FNAC is safe, least invasive and inexpensive. However, it is plagued by high false negative rates and insufficiency rates 3. Further, FNAC cannot distinguish in situ from invasive cancer. Immunohistochemistry analysis is also difficult with FNAC which is a deciding factor for neo-adjuvant chemotherapy. Open surgical biopsy, although an accurate method for obtaining tissue samples has to be performed in an operation theatre leading to patient anxiety and also results in local scarring and cosmetic deformity. Core needle biopsy provides adequate sample for histological analysis and compared to open surgical biopsy, it has several advantages like better patient tolerance, better cosmetic outcome and low cost 4. While non-palpable breast lesions are always biopsied under image guidance, biopsy of palpable masses can be performed either blindly with palpation or under image guidance. Image guided biopsies are considered to be more accurate than palpation guided biopsies; however, there is insufficient evidence in the literature. This opinion is largely based on personal experiences as well as a few retrospective studies 5 , 6 , 7 , 8. Most of these studies were retrospective analysis of large data in heterogeneous patient population having both palpable and non-palpable breast lesions where various biopsy techniques and guiding modalities were used. Selection bias was another pitfall in these studies, as deep seated or vaguely palpable breast lumps were more likely to be referred for image guided biopsy 6. This prospective study was conducted to verify whether image guided core biopsies were more accurate in palpable breast masses and to determine the size of beneficial effect of image guided biopsy over palpation guided biopsy. Masses which were reported as definitely benign on imaging e. During this period, 72 consecutive women, who met the inclusion criteria, agreed to participate in the study and gave informed consent. The study protocol was approved by the ethics committee of the institute. The median age was 45 yr range yr. All the patients were subjected to ultrasound examination. Mammography was not performed in 11 patients as they were younger than 30 yr of age. Patients were randomized into two arms of 36 each to palpation guided and

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image guided biopsy, using block randomization with allocation ratio of 1:

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## 4: - NLM Catalog Result

*Needle localization of lesions that have previously undergone core biopsy that resulted in complete removal of the imaging finding is a recent challenge to the breast imager. 32,33 If no marking device, such as a clip, was deployed at the time of core biopsy, localization of the biopsy site can be difficult.*

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