and architectural distortions. The overall better performance achievable with core biopsy compared to FNA is illustrated in the performance of the National Health Service Breast Screening Programme in the UK. In 1994 using FNA as the primary diagnostic technique fewer than 10% of 90 units were able to achieve the target of 70% preoperative diagnosis cancer. In 1996 the majority of units swapped to core biopsy and within three years all units were easily achieving this target.

Vacuum Assisted Mammotomy: The predominant reasons for failure to achieve accurate diagnosis by needle biopsy are sampling error and failure to retrieve sufficient representative material. These problems have been largely addressed by the development of larger directional core techniques that yield significantly greater volumes of tissue. Vacuum assisted mammotomy (VAM) is proving to be a very successful method for improving the diagnostic accuracy of borderline breast lesions and lesions at sites in the breast difficult to biopsy using other techniques. VAM has been shown to under stage both in situ and invasive cancer approximately half as often as conventional core biopsy (typically 10% compared to 20%). The VAM technique has a higher sensitivity because it allows sampling of lesions at sites that are difficult to biopsy using either FNA or core biopsy and because the amount of tissue harvested is at least five times greater per core specimen. The indications for vacuum assisted mammotomy are listed below:

- Very small mass lesions
- Architectural distortions
- Failed "conventional" core biopsy
- Microcalcifications
- Papillary and mucocele like lesions
- Diffuse non-specific abnormality
- Excision of benign lesions
- Sentinel node sampling

Core biopsy and vacuum assisted mammotomy are now the recommended techniques for sampling calcifications and mammographic architectural distortions. For calcifications it is imperative that there is proof of representative sampling with specimen radiography. If calcification is not demonstrated on the specimens radiograph and the histology is benign then the management cannot be based on this result as there is a high risk of sampling error; the procedure must either be repeated or an open surgical biopsy carried out.

Guidance techniques for breast needle biopsy: Ultrasound guidance is the technique of choice for biopsy of both palpable and impalpable breast lesions; it is less costly, easy to perform and more accurate than free hand or other image-guided techniques. Ultrasound provides real time visualisation of the biopsy procedure and visual confirmation of adequate sampling. Eighty to 90% of all breast abnormalities will be clearly visible on ultrasound and amenable to biopsy using this technique. For impalpable abnormalities not visible on ultrasound stereotactic x-ray guided biopsy is required. A few lesions are only visible on magnetic resonance imaging and require MR guided biopsy. The negative predictive value of combined normal mammography and ultrasound is extremely high; where there is a clinically palpable abnormality and mammography and ultrasound are entirely normal the likelihood of malignancy is low (less than 1%). However, in these circumstances it remains prudent to carry out freehand biopsy to exclude the occasional diffuse malignant process, such as classical lobular carcinoma or low grade DCIS, that may be occult on both mammography and ultrasound.

Vacuum assisted mammotomy: Mammotomy is usually carried out using an 11-gauge probe, which provides 100mgs of tissue per core specimen. Unlike conventional core biopsy the needle remains in the breast at the sampling site and contiguous core biopsies can be obtained. The probe can be rotated through 360o and wide sampling can be achieved and VAM should be preferred where there is expected to be diagnostic uncertainty. Because the probe does not have to pass directly through the area being sampled and a satisfactory sample can be obtained from placing the needle adjacently, this technique is also preferred for biopsy of abnormalities at sites in the breast that are difficult to reach using FNA or core biopsy (i.e. close to the chest wall).

Number of samples: A simple rule for satisfactory sampling using needle techniques is to obtain sufficient material to achieve a diagnosis. For ultrasound guided core biopsy this may simply be a single core. By knowing on ultrasound that the needle has passed through the centre of the abnormality and looking at the sample with the naked eye it is usually possible to tell if a satisfactory sample has been obtained. It is unnecessary to obtain multiple cores as a matter of routine. The number of core specimens obtained should reflect the nature of the abnormality being sampled. For ultrasound guided biopsy where there is a suspicion of carcinoma it is recommended that a minimum of two core specimens are obtained. As stereotactic biopsy is used for abnormalities that are difficult to define on ultrasound and are therefore more difficult to sample a minimum of five core specimens be obtained. Ensuring that calcification is present in at least three separate cores and/or five separate flecks of calcification are retrieved from the area of suspicion will provide accurate diagnosis. When there is still diagnostic uncertainty 8gauge vacuum assisted mammotomy can be used to obtain larger tissue volumes (approximately 300mgs per core). The 8g mammotomy probe is preferred for therapeutic removal of breast lesions such as fibroadenomas.

MR guided biopsy: A few breast lesions are only visible on MR and therefore have to be localised and biopsied under MR guidance. A number of different approaches have been developed for this procedure using both closed and open magnets. FNA, core biopsy and vacuum assisted mammotomy may all be used for MR guided sampling.

Conclusions:

- The aim should be to achieve as near as possible 100% non-operative diagnosis of breast problems
- Both palpable and impalpable breast lesions are best sampled under image guidance
- Automated core biopsy is the technique of first choice
- Ultrasound is the guidance technique of first choice
- Digital stereotactic core biopsy should be reserved for sampling lesions not visible on ultrasound
- FNA is not recommended for calcifications or stellate lesions
- 14g core biopsy can provide a definitive diagnosis in 90% of cases and should be the preferred method
- Mammotomy can provide the diagnosis in the remainder
- Stereo-guided mammotomy is particularly effective for small clusters of indeterminate microcalcifications and calcifications in sites difficult to access with core biopsy.
- Vacuum assisted mammotomy is an effective and well tolerated problem solving device for breast diagnosis and can also be used to completely excise benign lesions

It is important that the result of needle breast biopsy is always correlated with the clinical and imaging findings before clinical management is discussed with the patient. This is best achieved by reviewing each case at multidisciplinary meetings.

5 INVITED

Fine needle biopsies of breast lesions

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Fine Needle Aspiration (FNA) technique has been used at the Karolinska Hospital as a routine in the evaluation of especially palpable breast lesions since 1955. This technique proved to be fast, reliable and inexpensive. The technique confirmed a malignancy diagnosis pre-operatively and this helped for proper management of a case right from the beginning. The other benefit was to exclude suspicion of malignancy and thereby avoid unnecessary surgery.

Breast imaging techniques experienced a revolution in image quality during the last 30 years and this lead to the detection of many non-palpable breast abnormalities of which some represented non-malignant pathology. The need to differentiate malignant from the non-malignant mammographically detected breast lesions led to the development of the SFNB technique, Stereotaxic Fine Needle Biopsy Technique. SFNB has thus been used at our hospital since 1975 and to date we have performed more than 16.000 procedures. The technique has always had a technical precision of ± 1 mm to reach a target.

Sampling with FNA yields single or groups of cells that have to be diagnosed with a microscope after special staining techniques. Unlike core biopsies, that yield tissue fragments that can be read by most if not all the pathologists, the cytology specimens of FNAs demand special training of the cytomorphologists to give us proper diagnosis of the retrieved cells. One factor that is often underestimated is the technique to obtain cellular material from a non-palpable breast lesion. This very important step in the overall success of an intervention needs high volumes to attain acceptable skills. Even the preparation of the cytology smears needs special skills so that the obtained cellular material is spread on a glass slide as a single layer of cells for proper assessment.

When above-mentioned factors are optimised than the procedures show high sensitivity and specificity that lie in the upper nineties. On the other hand both sensitivity and specificity can vary depending upon both the interventionist and the microscopic reader. One morphologic detail that cytology cannot answer is whether a tumour is invasive or not. This particular aspect can on the other hand be reliably answered when both radiology and cytology is integrated. Again unlike histopathology on a core biopsy, a cytology report should always be integrated together with the radiological assessment of a lesion in order to get a correct final diagnosis. The material used for a FNA is inexpensive but access to trained specialists could be a challenge.

To conclude, when all criteria are satisfactory then the outcome is fully usable in routine diagnostics.