

REVIEW

Role of Fine Needle Aspiration Cytology in Clinical Practice

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INTRODUCTION

Fine Needle Aspiration Cytology (FNAC) is the technique employed in the diagnosis of neoplastic or non-neoplastic lesions which are either palpable or visualised by imaging techniques such as x-rays, ultrasonography, CT scan or magnetic resonance imaging (MRI).¹ FNAC has received wide acceptance in recent years with the appreciation of its accuracy, safety and cost effectiveness.² The aim of aspiration biopsy is to provide a diagnosis agreeing as closely as possible with that obtainable from histologic examination. It has proved useful in lesions that are not easily accessible for surgical biopsy. But once the aspiration biopsy has been introduced in a clinical centre its use as a rule is increasingly extended to the diagnosis of lesions which are commonly seen viz lymphnodes, thyroid, breast, salivary gland, abdominal organs, intra thoracic lesions, testis, epididymis and central nervous system etc which will be discussed subsequently in detail. The clinical experience over the past decades has shown that FNAC has a definite place in the management of neoplastic and non-neoplastic disorders.³ The infective lesions, especially the specific granulomatous lesions caused by Mycobacterium tuberculosis⁴ or fungus like cryptococcosis and histoplasmosis, can be managed without open biopsy. A specific diagnosis of malignant and benign disease allows definitive surgery, radiation or chemotherapy without

further confirmation. Mastectomy, pneumonectomy, orchidectomy, pelvic and brain radiation and other irreversible procedures are currently being carried out on the basis of cytology report.^{3,5} This communication will present the principle preparation of a smear and the indications, contraindications, advantages and limitations of the FNAC technique.

Principle

The principle of the technique is dislodgement of the cells by a needle under a negative pressure created by syringe suction. As a result of pressure differences, cellular material is drawn from the tissues into the attached needle.

Instruments

The instruments are simple: needles of various sizes, Franzen's aspiration handle, Franzen's guide for transrectal or transvaginal aspirations. The size of needle may vary from 1–25 cm and 21–25 gauge or 0.6 mm to 0.9 mm outer diameter.

Technique, Preparation of Smears and Staining Technique

The best results are obtained when the FNAC is done by the cytopathologist. The skin is wiped with an antiseptic

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(methyl spirit) and the suspected lesion is held by one hand in a position for inserting the needle. No anaesthesia is required. After entering the tumour area the piston of the syringe is retracted creating a vacuum in the system and drawing the material in the needle. In order to obtain sufficient material the needle is moved backward and forward a few times possibly directing it in different directions. Throughout this manipulation negative pressure is maintained by retracting the piston of the syringe. The piston is allowed to go back in the syringe to equalise the negative pressure. The needle is then separated from the syringe and connected again to the syringe after drawing some air into it and the contents are expelled on to the glass slides.

Preparation of Smears

Many smears are made by gently crushing the contents by firm flat pressure with another slide. The smears so prepared can be fixed by alcohol 95% or kept air dried and stained by May Gunwald Giemsa (MGG) or Papanicolgou stain. The author prefers the MGG stain. Extra smears are kept for special stains viz; PAS, mucicarmine, Alcian blue, Schmorl's for melanin and amyloid. The smears can be used for staining the enzymes viz; acid phosphatase, alkaline phosphatase and ATPase etc. Some extra slides are prepared and fixed in cold acetone at 4°C for 5 minutes to 30 minutes for immunocytochemistry.

The organs which are commonly subjected to FNAC are discussed below.

Breast: The FNAC of breast provides a rapid and reliable method of confirming the diagnosis. The accuracy as compared to histopathology varies from 90–94% and the accurate subtyping is possible in 78.3% cases. Sometimes it helps pick up the small carcinomatous lesions which are missed on initial histological examination. In a study of 2630 FNAC cases where carcinoma was diagnosed in 920 cases. The diagnosis of carcinoma initially made on FNAC was missed in seven cases. This was missed because the lesion were small and on slicing the mastectomy specimen the lesion were not encountered initially. The knowledge of cytology report helped in searching for these lesions to look for the tumor.⁶

Thyroid: The diagnostic accuracy of thyroid FNAC is 95%. The specificity 100% and sensitivity 75%.⁷ FNAC is an effective means of discriminating between simple and neoplastic lesions. This permits more appropriate patient management and a beneficial saving of simple goitre.⁸ The only limitation is the diagnosis of follicular

carcinoma. Since the diagnosis of follicular carcinoma rests on capsular, perineural and perivascular invasion by the cancer cells which cannot be visualised on smears and hence the diagnosis of follicular carcinoma be made on histological examination. Conventionally, most of the cytologist report this condition, as follicular neoplasm; advised: excision. The tissue diagnosis of various types of thyroiditis are made on FNAC along with serum profile of thyroid antibodies.

Salivary Glands: The value of FNAC in diagnosis of salivary gland is widely accepted. Almost all tumours of the salivary glands can be diagnosed on FNAC. The accuracy is around 87% and the specificity 94%.^{9,10}

Lymph Nodes: Indications for lymphnode FNAC include the diagnosis of malignant lymphoma, metastatic carcinoma and any patient presenting as persistent lymphadenopathy. The FNAC may also be employed for the staging of the disease. Lymphnode FNAC offers a convenient, rapid technique for diagnosis of benign and malignant lesions.¹¹ In countries where tuberculosis⁴ is rampant the biopsy can be avoided and the aspirated material may be subjected to culture.¹² The diagnosis of Non Hodgkins & Hodgkins lymphoma has been advocated with FNAC.^{13,14} However, some authors claim that the cytologic diagnosis of Lymphoma can be made in 50% – 70% of the cases. The accuracy being higher in Hodgkin's disease and high grade lesions.^{15,16} FNAC has a definite role in section of a representative Lymphnode for the biopsy, for the diagnosis of recurrent lymphoma, staging of the extent of the disease and monitoring treatment.¹⁷ Follicular lymphomas are difficult to diagnose on FNAC alone.

Abdominal Organs: The scope of abdominal aspirations include any palpable mass involving the abdominal wall, palpable intra abdominal masses, retroperitoneal masses and the aspirations done during surgery.¹⁸ Almost all organs including kidney, pancreas and adrenal are aspirated. The technique can also be used in monitoring the renal allograft in post transplant patients post operatively for any acute rejection.¹⁹ The whole of GIT can be subjected to FNAC of any lesion which is visualised on endoscopy.²⁰⁻²² For the detection of tumour metastasis in liver, FNAC is even more reliable or is as good as histologic biopsy.²³

Intrathoracic lesions: The diagnosis of intrathoracic lesions has significantly improved with the development of fibroptic bronchoscopy. However in peripheral lung lesions and mediastinum where it is difficult to introduce brushes or forceps by fibroptic bronchoscope, FNAC offers a definite tool for the diagnosis of these lesions. The technique can be done with the help of the radiologist but when the lesion is large and peripheral in location it can be done as a bed side procedure. Neoplastic lesions whether benign or malignant, which can be diagnosed includes carcinomas of lung, thymomas, carcinoids, lymphomas and sarcomas. The infective lesions like fungal granulomas, tuberculosis and non specific abscesses can be diagnosed and the material obtained is subjected to various culture studies. The pneumothorax is a major complication which is seen in 2.6 percent of cases which are aspirated. The hemoptysis occurs in 5.3 percent of cases and requires no treatment.²⁴

Pelvic Organs: FNAC is an effective technique to diagnose the pelvic organs tumours especially ovary which are palpable per rectum or per vaginum.²⁵ This gives the added advantage to the diagnosis of recurrent disease and monitoring the response of radiation and chemotherapy.²⁶

Prostate: The FNAC of prostate plays an important role in the management of prostatic lesions. The accuracy of the technique in the diagnosis of prostatic carcinoma is around 87-98% and the false negative rates are around 2.7%. The FNAC is done through the transrectal approach. The technique helps a lot in monitoring the response of hormonal therapy.²⁷

Paediatric Tumours: Children are most suited for FNAC since no anaesthesia and hospitalisation are required and a quick diagnosis is made which helps to alleviate the anxiety of the mothers. No serious complications are encountered. Almost all tumours to name a few lymphomas, neuroblastoma, retinoblastoma, hepatoblastoma, Wilm's tumour, soft tissue lesions, histiocytosis-X (Langerhan's cell histocytosis) can be diagnosed.²⁸

Testis & Epididymis: FNAC of the testis is usually performed to investigate the nature of the lesion whether benign or malignant. Open biopsy with frozen sectioning is regarded as contraindicated because of the danger of tumour spread to the

scrotum and inguinal lymphnodes. Therefore FNAC is regarded as the procedure of choice. The cytology report must be evaluated in terms of benign or malignant because of multiplicity of the tumours of testis.²⁹ The tumours of epididymis which can be diagnosed include the spermatocytic granuloma³⁰ and tuberculosis.⁴ The spermatogenesis can be evaluated by FNAC of testis. A normal spermatogenesis or maturation in an azoospermic male indicates obstruction in the transmission channels.³¹ No complications are encountered.

CNS: Appropriate therapeutic measures for an intracranial lesion whether benign, malignant or of infective aetiology can only be undertaken on the basis of its conclusive histological or cytological diagnosis. Using information obtained from computerised tomograms stereotactic biopsy is an effective procedure for brain lesions.³² The diagnostic accuracy of the cytologic smear examination is 80- 94%.^{32,33}

Bone: Aspiration cytology in skeletal lesions yields a variety of cell pattern and the diagnostic accuracy varies between 66% to 100%.^{34,35} The osteogenic sarcoma and Ewings sarcoma lymphoma and metastatic tumours have a diagnostic accuracy of almost 100%.³⁵

The FNAC therefore can be applied in the diagnosis of lesions almost at every site in the body. It may even diagnose lesions like sacrococcygeal chordoma,³⁶ amyloidosis by fat pad aspiration, cysticercosis,³⁷ leishmaniasis and filariasis. It has got unlimited scope to be applied in clinical practice.

Advantages

For the patient:

- FNAC is the most efficient method of obtaining a tissue diagnosis before irreversible surgery, radiotherapy or chemotherapy.
- FNAC provides staging accuracy.
- FNAC is easy, less time consuming, non-traumatic, no anaesthesia is required, cheap and almost painless. It can be practiced as an office / OPD procedure. No incision, sutures and dressings are required after the procedure. The needle can be moved in different directions.
- FNAC provides a great psychological advantage in relieving anxiety at once or by convincing the patient of the need for immediate treatment.

For the hospital:

The FNAC offers the following economic advantage:

- Rapid and accurate diagnosis reduces the need for expensive diagnostic hospitalisation.
- Pre-operative diagnosis eliminates the need for surgical procedure.
- In rural and underdeveloped areas the techniques can be practiced in the countryside since the technique is simple.

The advantages are of paramount importance when the trained cytopathologist is available for the proper interpretation of the results.

Contraindication:

There is no absolute contraindication for the technique to be applied except with bleeding disorders and for this reason a complete coagulogram must be available when the procedure is attempted in internal organs such as the lungs or the abdomen cavity.

Caution:

A negative cytology report must be interpreted along with clinical and radiological data. A biopsy must be performed when the suspicion of malignancy is very strong.

Limitations:

The limitations are similar to those encountered with formal biopsy. Sometimes special studies such as electron microscopy, immunocytochemistry as well as tissue sections are used to establish the specific diagnosis. However the ability to interpret the smear material clearly does not automatically emerge from training in pathology, exfoliative cytology and haematology. Each organ has a set of morphologic parameters with many variables. Individual cell morphology may be dramatic in one clinical disorder, cell grouping may be dramatic in another. Fairly prolonged and extensive experience is necessary to achieve optimal level of competence. Therefore the experienced cytologist must be available for the proper interpretation of the smears.

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