FINE NEEDLE ASPIRATION CYTOLOGY: A PERSONAL EXPERIENCE WITH 800 CASES

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SYNOPSIS

Fine needle aspiration cytology (FNAC) was used in 800 patients to diagnose benign and malignant lesions. The success of the technique depends upon close co-operation between the Clinician, Radiologist and Cytopathologist. Skill in processing adequate material and preparation of the smears are as important as the experience of the Cytopathologist in interpretation of the smears. The aspirated material is amenable to special histochemical and immunoperoxidase stains and electron microscopy for specific diagnosis and for microbiological culture. The three commonest lesions to be aspirated are breast lumps, enlarged lymph nodes and thyroid nodules. The major indication is to confirm a clinical suspicion of malignancy. Inadequate material was obtained in 12.8% of aspirates. The false negative rate was 4.2%. While the technique has proved to be an important addition to the diagnostic skill of the Pathologist, it has definite limitations. These must be remembered so that a valuable diagnostic technique is not discredited through injudicious use.

INTRODUCTION

FNAC is a simple and inexpensive method of obtaining a tissue diagnosis. The technique was first introduced in the 1930's by Martin and Ellis (1) and Stewart (2) in the United States and later developed by the Scandinavians (3,4). In the early days it was regarded with great scepticism by pathologists. However in recent years, this form of cytology has led to closer co-operation between clinicians, radiologists and pathologists and is now a well-accepted discipline worldwide. The growing number of articles (5) and books (6,7,8,9) is evidence of its increasing popularity. With increasing experience, it gives a reliable diagnosis in a very high percentage of cases. A positive result can be relied upon but a negative result should usually be followed by further diagnostic procedures. Since the technique lends itself to outpatient diagnosis in the majority of cases, it is said to have saved millions of dollars in the cost of hospitalization (10).

MATERIALS AND METHOD

This report described the author's personal experience with this technique in the diagnosis of a variety of tumours and other conditions in various parts of the body The 800 aspirations in this series were performed and examined over a three and a half year period from January 1982 to July 1985. During this period the demand for the procedure grew steadily until, at the present time, an average of two to three aspirations are done each day at The Queen Elizabeth Hospital.

The technique used in this series has been described in detail by various authors (7,8,10) and will not be described here. The metal syringe holder employed is the Cameco Syringe Pistol (Fig. 1) which accepts a 10 ml disposable plastic syringe. For superficial masses a 23-gauge needle, external diameter 0.63 mm and 32 mm long is used. Occasionally, for scirrhous and deep subcutaneous lesions a 21-gauge needle is used instead. The 22-gauge 10 cm spinal tap needles used for lumbar puncture and needles of greater length are used for intrathoracic and deep intra-abdominal masses. Preliminary local anaesthesia with 1% lignocaine is administered for transabdominal and transthoric masses but is not required for readily accessible superficial lesions. For prostatic aspirations, the Franzen (9) instrument consisting of a long fine needle and a needle holder is used (Fig. 2 & 3). Preparing a good smear from the aspirate is mandatory for cytological evaluation.

Both air-dried and 95% alcohol fixed smears are prepared. The air-dried smears are routinely stained with May-Grunwald Giemsa and the alcohol fixed smears with Papanicoloau or Haematoxylin-eosin stains. Appropriate special stains are also performed the commonest being periodic-acid-schiff-diastase for epithelial mucin and less commonly Masson Fontana for melanin, oil Red O for fat and Perl's for haemosiderin. Immunoperoxidase stains for various antigens, commonly prostate specific antigen, thyroglobulin, epithelial membrane antigen and the panleucocyte antigen are also performed in selected cases. Electron microscopy of aspirated material has been successful in demonstrating neurosecretory granules in tumour cells.

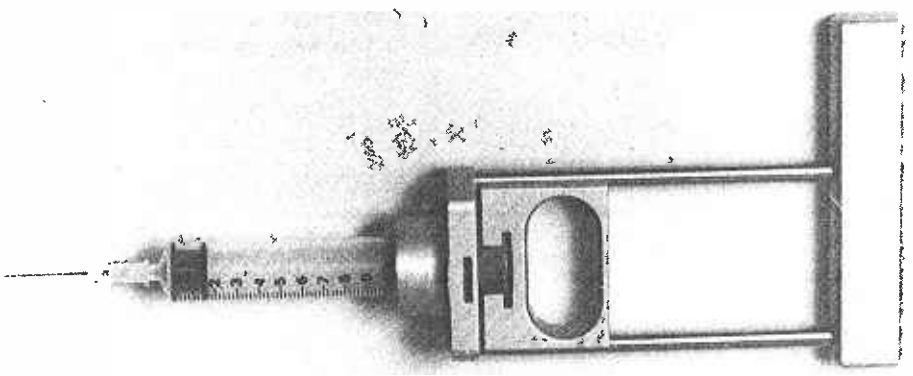

Fig. 1 Cameco syringe pistol

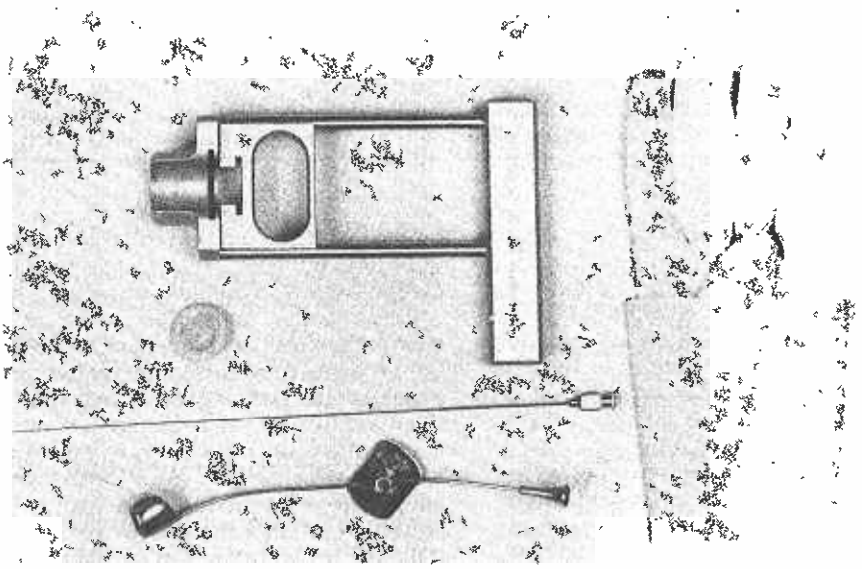

Fig. 2 Equipment for prostatic aspiration including Franzen needle holder and needle

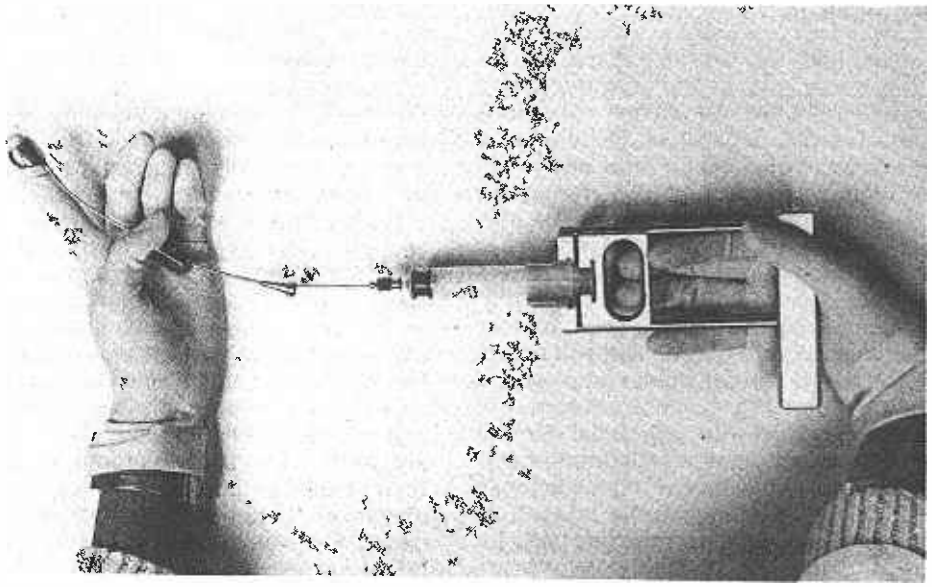

Fig. 3 Equipment set up for prostatic aspiration

RESULTS

The results of this study are summarized in Tables 1-6.

TABLE 1: FNAC — SELECTED SITES

Site	Number of Aspirations (%)	Malignant (%)	Benign (%)
Breast	260 (32.5)	84	176
Lymph node	184 (23.0)	139	45
Thyroid	104 (13.0)	7	97
Skin and subcutaneous tissue	90 (11.2)	35	55
Salivary gland	25 (3.1)	3	22
Liver	34 (4.3)	23	11
Pancreas	20 (2.5)	8	12
Kidney	13 (1.6)	3	10
Intra-abdominal masses, not specified	34 (4.3)	23	11
Miscellaneous	36 (4.5)	10	26
TOTAL	800 (100)	335 (41.9)	456 (56.1)

Breast lumps form the largest single group aspirated 32.5%, followed by enlarged lymph nodes 23% and thyroid nodules 13%. They are also the commonest lesion to be aspirated by clinicians in their consulting rooms, accounting for 63% of all their aspirations. Breast carcinoma are relatively easy to diagnose but more difficult to type. A diagnosis of malignancy is followed by definitive surgery with no frozen section in a third of the cases. Since the advent of fine needle aspiration biopsy, a conventional tru-cut biopsy is hardly ever performed at this hopsital and the rate of frozen sections for suspected breast carcinoma has significantly decreased from 36% to 12%.

Lymph node aspirations are particularly useful to determine the nature of the lymphadenopathy. A diagnosis of metastatic carcinoma is invaluable to the clinician in the overall management of the patient and often obviates further unnecessary and costly surgery. In the case of malignant lymphoma the procedure helps to select appropriate nodes for excisional biopsy for histological typing in initial diagnosis and confirmation of recurrence enables appropriate chemotherapy to commence without further surgery.

Fine needle aspiration cytology is increasingly becoming a routine procedure in the preliminary work-up of thyroid nodules, in conjunction with clinical assessment, radio-active scans and serology. Since the majority of thyroid nodules are non-malignant, this diagnostic procedure helps to select patients in need of immediate surgery from those who do not require such urgent treatment for a variety of reasons. The limitation of the technique in the interpretation of follicular proliferative lesions must be borne in mind. It is not possible to distinguish between a follicular adenoma and a well-differentiated follicular carcinoma cytologically.

Aspiration of subcutaneous lumps and bumps is mainly performed to confirm suspected cutaneous metastases. Material for microbiological culture may be obtained and the nature of clinically doubtful masses also ascertained by this simple technique.

Typing of salivary gland tumours is somewhat more difficult but the diagnosis of pleomorphic adenomas and Warthin's tumours is straight forward. Three of our false negative cases resulted from cystic degeneration in tumours. This includes a Warthin's tumour and a muco-epidermoid carcinoma of the parotid and a papillary carcinoma of the thyroid. Whilst aspiration serves both a diagnostic and a therapeutic role in cystic lesions eg in breast, thyroid, kidney, it is important to remember that an underlying more sinister lesion may be present in such instances and any residual lump or thickening must be re-aspirated and careful clinical follow-up mandatory.

The liver, pancreas and kidney are usually aspirated to cpnfirm a malignancy or abscess. With radiological assistance such as fluoroscopy, ultrasound and the CAT scan, the fine needle travels deep into the thorax, abdomen and pelvis and there are few organs that cannot be reached. Included in the miscellaneous category are lesions from the bone, lung, ovary, testis, vagina, spleen, adrenal and mediastinal, paratracheal and presacral soft tissue masses.

The major indication for fine needle aspiration in this series is to confirm a clinical suspicion of malignancy (Table 1). This was the cases in 41.9%.

TABLE 2: FNAC — WHERE IS IT DONE?

PLACE	NO.	%
Ward + Outpatients' Department	742	92.8
Radiology Department		
CAT	31	3.9
ULTRASOUND	15	1.9
FLUOROSCOPY	5	0.6
Intra-operative	7	0.8
TOTAL	800	100

One of the greatest attraction of FNAC is its simplicity, which lends itself to almost any clinical setting. The majority, 92.8%, of the aspirations are performed either in the outpatient department or in the ward at the bedside. The non-palpable, deep seated intra-thoracic and intra-abdominal masses naturally require some sort of radiological guidance and must be carried out in the Radiology Department. There are 51 (6.4%) such cases. Intra-operative aspirations (7) are almost entirely confined to pancreatic lesions, in an attempt to minimise the risks from a conventional needle biopsy.

TABLE 3: FNAC — INADEQUATE SPECIMENS

Total number of aspirations	=	800
Number of inadequate	=	102
% of inadequate specimens	=	12.8%

TABLE 4: FNAC — INADEQUATE SPECIMENS

	Total	Inadequate Specimens	(%)
Pathologists	661	49	(7.4)
Others	139	53	(38.1)

One of the major criticism against the technique has been the high rate of false negative diagnosis (11), ranging from 7.4 to 23.8%. And the main reason for this is due to failure to obtain representative specimen rather than to misinterpretation of smears. In this series, there was a 12.8% failure rate to obtain adequate material for cytological diagnosis (Table 3). A more significant factor is apparent in Figure 4 which shows that the pathologist has a 7.4% failure rate as compared to a 38.1% failure rate for the clinician. It is a well known fact that the ability to secure a good representative specimen by aspiration is largerly determined by the skill of the operator. In our hospital approximately 85% of the aspirations are performed by the author herself, whilst the rest are by various clinicians.

TABLE 5: FNAC — DIAGNOSTIC ACCURACY

Total number of aspiration	=	800
Total number of malignant cases	=	335
False – ve	=	14 (1.6% of total aspirations) or 4.2% of malignant cases
False + ve	=	3 (0.4% of total aspirations) or 0.9% of malignant cases

In this series, the false negative rate is 4.2% (14 cases out of a total of 335 malignant cases) and the false positive rate is 0.9% (3 out of 335). This compares very favourable with the figures quoted in most large series (3,8) which is of the magnitude of 5-10%. No harm came to the patient in the 3 false positive cases diagnosed as suspicious or highly suspicious of malignancy. Excision biopsy for histological confirmation was recommended in each instance. Two of those were breast lumps, and the third a lymph node. One of the two breast lumps show fibrocystic disease only on histological examination. Review of the smears showed it to be a suboptimal quality, with crush artefact. The other was an unusual breast tumour whose exact diagnostic label is still debatable, with expert opinion ranging from a peculiar variant of cystosarcoma phyllodes to a mixed tumour similar to the mixed tumour of the salivary gland.

The lymph node reported on aspiration as highly suspicious of malignant lymphoma shows atypical lymphoid hyperplasia on histology. Of the 14 cases of false positive, 10 (71%) were due to failure to obtain a representative specimen (Table 6).

Three out of these 10 were due to cystic degeneration in a tumour. Three other cases are directly attributed to failure to recognise the malignant cells and the last case was one of mistyping a poorly-differentiated adenocarcinoma for a malignant lymphoma.

TABLE 6: FNAC — FALSE NEGATIVE CASES

FNAC Diagnosis	Site	Histological Diagnosis
1. Tissue inadequate for diagnosis	Liver	Needle biopsy of liver shows no evidence of malignancy. Carcinoma of gallbladder with hepatic metastasis confirmed at autopsy
2. Tissue inadequate for diagnosis	Paravertebral mass	Malignant lymphoma
3. Tissue inadequate for diagnosis	Skin	Desmoplastic melanoma
4. Tissue inadequate for diagnosis	Cervical lymph node	Nodular sclerosing Hodgkin's disease
5. Tissue inadequate for diagnosis	Cervical lymph node (too small, 5 mm diameter, technically difficult)	Metastatis squamous cell carcinoma
6. Tissue inadequate for diagnosis	Pancreas	Adenocarcinoma
7. Tissue inadequate for diagnosis	Breast	Infiltrating duct carcinoma, scirrhous
8. Cyst diagnosis	Parotid gland	Cystic degeneration in muco-epidermoid carcinoma
9. Cyst	Partoid gland	Cystic Warthin's tumour
10 Cystic degeneration and haemorrhage in multi-nodular goitre	Thyroid	Multinodular goitre with focal papillary carcinoma of thyroid showing extreme haemorrhage and cystic degeneration
11. Reactive lymphadenitis	Lymph node	Non-Hodgkin's malignant lymphoma
12. Reactive lymphadenitis	Lymph node	Anaplastic carcinoma
13. Malignant lymphoma	Lymph node	Poorly-differentiated adenocarcinoma
14. Lymphocytic thyroiditis	Thyroid	Malignant lymphoma

DISCUSSION

There are several advantages FNAC has over a conventional needle biopsy. It is simple and inexpensive, less traumatic, may be performed as an outpatient procedure without local anaesthetic, and gives a rapid result within half an hour to one hour. The procedure may be repeated several times to obtain adequate material for cytological analysis. It contributes to the initial clinical assessment of the patient and planning of subsequent surgery. Any palpable superficial mass may be aspirated and modern imaging techniques enable the method to be extended to virtually any part of the body (6,9). Aspiration cytology is not a method of cancer detection. However, if indications are kept wide, any superficial easily accessible "lump" can be investigated and a contribution to earlier diagnosis of cancer will be made by diagnosing malignancy at a time when cancer was not clinically suspected. Contra-indications are few, amongst them a marked haemorrhagic diathesis, (prothrombin and platelet count should be performed prior to liver and splenic aspirations) and septic prostatitis (12). It is also said to be contra-indicated in the diagnosis of primary malignant melanoma because it induces inflammation which may confuse subsequent histology and may facilitate deeper spread which is crucial in the assessment of prognosis (5). Zajicek (10) found no evidence of spread in a review of 100 cases of FN aspiration carried out on malignant tumours. Likewise Franzen (3) has not observed any local seeding of tumours in the 25 years that he has been aspirating the testis.

Complications are relatively minor, usually in the form of local discomfort and mild haematoma formation at the local site. Pneumothorax is a common complication of transpleural aspiration in the range of 15-30% but this usually is minor and resolves spontaneously. Septic complications have occurred following aspiration of acute prostatitis (12). Implantation of cancer cells after this technique is very rare and Berg and Robbins have shown identical 15 year survival rates in matched groups of fine needle and surgically biopsied patients with breast cancer (18). In interpreting aspiration cytology criteria of malignancy do not always apply. For example, adenoid cystic carcinoma of the salivary gland has an entirely "benign cell pattern" and cells aspirated from normal seminal vesicle may be very pleomorphic and malignant looking. The overall pattern is often more important than individual cell features and does to a surprisingly large extent reflect histologic structure through cell arrangement and background stromal components.

Clinical information is mandatory. Criticism has been levelled at aspiration cytology because of the high false-negative rate in tumour cases. Whilst this may be true in some series, this and other reports have demonstrated very acceptable false-negative rates of malignant tumours; in the order of 5-10%. Whilst a positive diagnosis can be relied upon, a negative cytology report should, in general, be followed by further diagnostic procedures.

The limitations of the technique are well spelt out by Hajud and Melamed (19). Its optimum success requires an interdisciplinary approach, involving the clinician, the radiologist and the cytopathologist. It is an additional weapon in the armamentarium of the diagnostic pathologist and if applied judiciously adds a significant dimension to the art of tissue diagnosis. But never must it substitute for clinical judgement or compete with an indicated histopathological biopsy. As Stewart so rightly commented in 1933 and it is just as appropriate today: "Diagnosis by aspiration is as reliable as the combined intelligence of the clinician and pathologist makes it".

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