RADIOLOGICALLY GUIDED PERCUTANEOUS NEEDLE BIOPSY OF VERTEBRAL AND PARAVERTEBRAL LESIONS

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SYNOPSIS

A review was made of 9 cases of percutaneous needle biopsy of vertebral and paravertebral lesions performed over a period of thirteen months. All except one were done under fluoroscopic or ultrasound guidance. The exception was fortuitously obtained during a failed myelogram. Various imaging modalities were used to delineate the lesions before the biopsy. The technique is elaborated in the paper. There were no complications encountered in this series of cases. The value of percutaneous biopsy and potential risks are discussed.

INTRODUCTION

Through recent advances in imaging technology, it has become possible to delineate very accurately lesions in almost any region of the body. However, hopes that the newer imaging modalities will provide unequivocal aetiologic diagnoses have not been as satisfactorily fulfilled. Because the final determinant of patient management often depends on the nature of the disease, tissue diagnosis is important.

Percutaneous biopsy generally obviates the need for surgery, with its attendant risks, for obtaining tissues for histological or cytological diagnosis. Safe, transthoracic percutaneous biopsy popularised by Dalgren and Nordenstrom (1) in the 1960s has been the impetus for more widespread use of the technique. The success and safety of percutaneous biopsy lie in the accurate guidance to the lesion by the use of imaging modalities such as fluoroscopy, ultrasound and CT, small calibre needles and last but not least, improved cytological diagnostic expertise.

From the lung, percutaneous biopsy techniques have rapidly been extended to other areas such as the abdomen, pelvis, mediastinum and spine. We wish to report our experience with 9 cases of guided percutaneous biopsies of vertebral paravertebral lesions.

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MATERIALS AND METHODS

Nine cases of vertebral and paravertebral lesions were subjected to percutaneous biopsy from February 1985 to August 1986. Four patients had bony vertebral lesions, another three had paravertebral masses, one patient had both while another had a paravertebral mass which extended into the spinal canal. There was no complication following any of the procedures.

CASE SUMMARIES

Case I

LYK, a 61 year old woman complained of lumbar backache for two months associated with night sweats. ESR was 105 mm. Xrays showed erosion of adjacent L2 and L3 vertebral bodies and decreased disc space. A percutaneous biopsy was carried out under fluoroscopic control. The result was unhelpful as only degenerate fibrocartilage was obtained. Unfortunately the patient was lost to follow-up.

Case II

SN, a 45 year old man suffered from backache for a month. He also had fever and cough in the week before admission. Xray revealed destruction of the lower half of T12 vertebral body and loss of T12 — L1 disc space. There was also a small left paravertebral shadow (Fig 1). Under fluoroscopic guidance, percutaneous needle aspiration was attempted twice on the left with bloody aspirate obtained. A third attempt was made on the right side. Cytology showed numerous polymorphonuclear cells with occasional giant cells. The diagnosis was that of an inflammation; though Ziehl-Nielsen stain was negative tuberculosis could not be excluded. The aspirate was also sent for culture, and Group C Beta-streptococci were cultured. The patient subsequently had an open drainage and bone grafting. Surgical biopsy specimens showed features of chronic inflammation similar to the aspirate. (Fig. 2)

Case III

CWY, a 71 year old woman presented with fever and a left lumbar mass. CT scans showed the mass to be in the left psoas muscle. In addition nodules were present in the kidney and the spleen (Fig 3). The left ureter was laterally displaced from L3 to L5 (Fig. 4). Percutaneous biopsy under fluoroscopy was carried out from the back with an 18G Franseen needle after the ureters had been opacified with intra-venously injected contrast medium. Cheesy, soft material was aspirated and smears showed uniform sheets of large, abnormal lymphoid cells. The diagnosis made was a highgrade, large cell, non-Hodgkin's malignant lymphoma (Fig. 5) and this was confirmed by material obtained at laparatomy subsequently.

Case IV

N was a two month old girl who was not moving her lower limbs from two weeks of age. Attempts at myelography were unsuccessful because CSF could not be obtained. However aspiration with a 20G spinal needle during the second attempt obtained a few drops of bloody aspirate. Cytology revealed numerous cells with darkly staining fibrillary extensions and rosette-like formation highly suggestive of neuroblastoma (Fig. 6). CT and ultrasound showed a paravertebral mass involving the left kidney (Fig. 7).

Fig 1
Case II. Pyogenic spondylitis
lateral spine showing destructive change of T12 — L1 bodies and disc. Biopsy needle shown in position

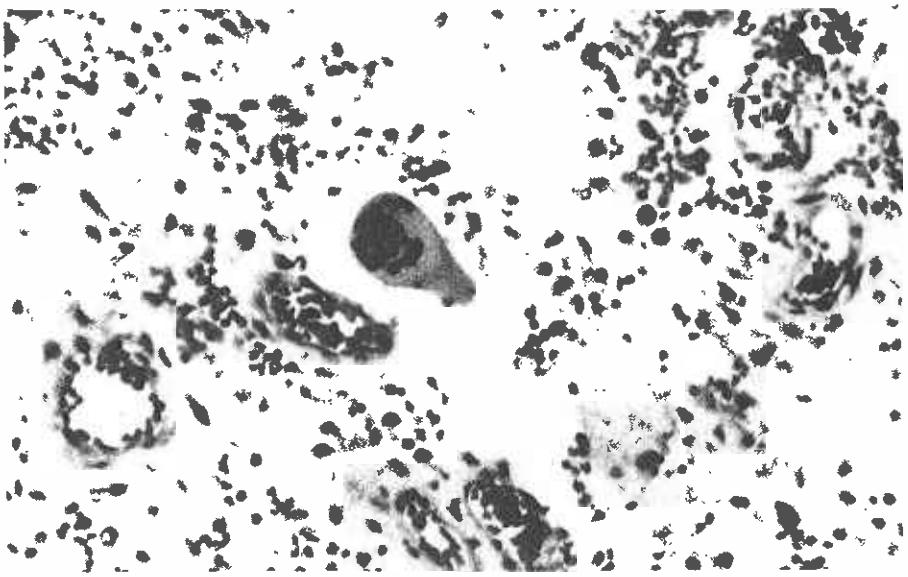


Fig 2
Case II. Pyogenic spondylitis
Histopathological section of the surgical biopsy showing chronic inflammation with presence of a giant cell
(Haematoxylin & Eosin × 66)

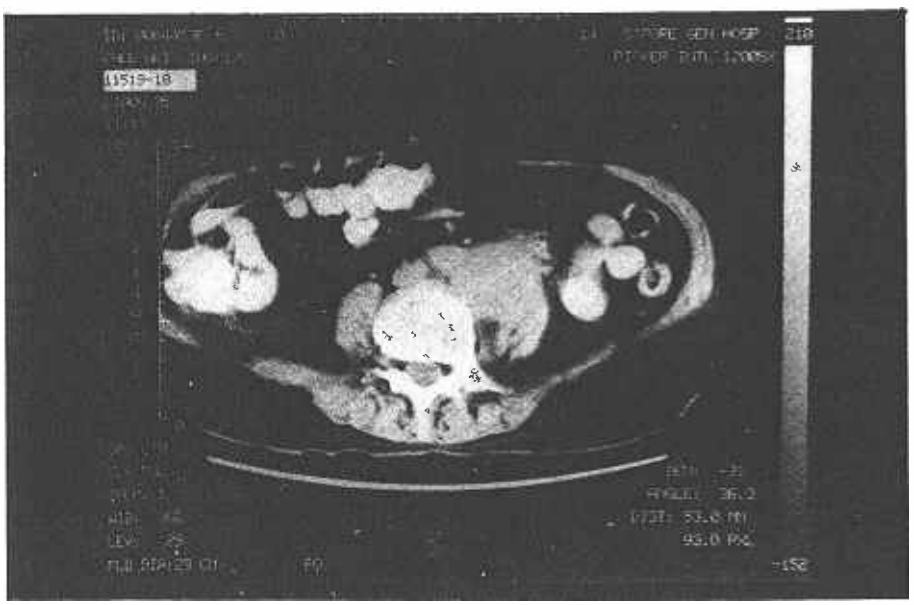
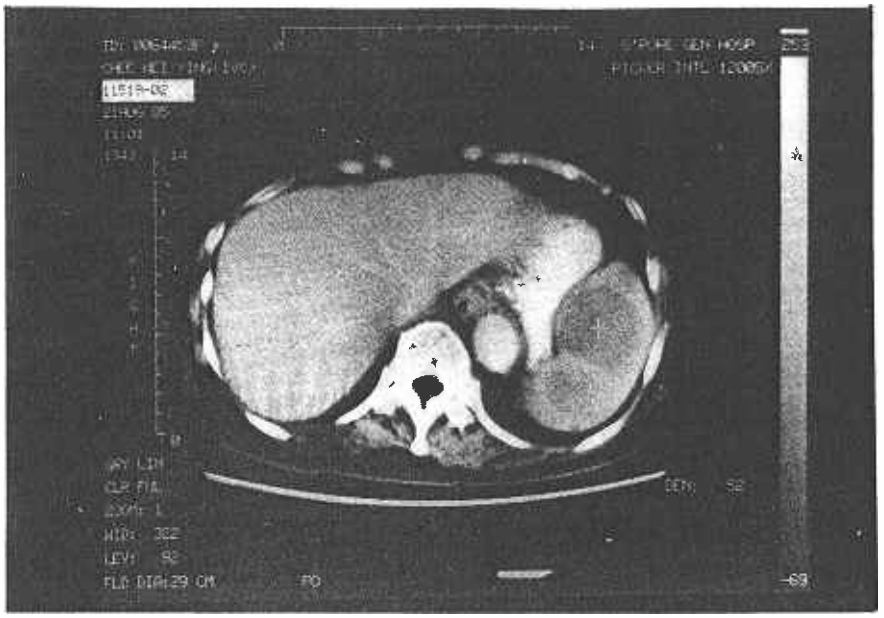


Fig 3
Case III. Non-Hodgkin's Lymphoma
CT scans showing a) left psoas mass and



b) hypodense nodules in the spleen

Fig 4
Case III. Non-Hodgkin's Lymphoma
Urogram showing lateral deviation of upper left ureter by psoas mass

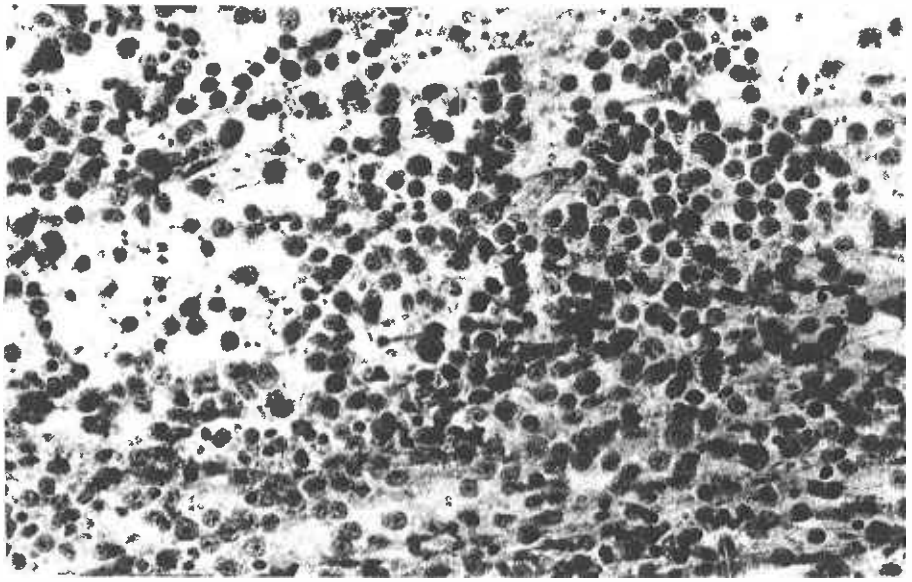


Fig 5
Case III. Non-Hodgkin's Lymphoma
Smear of aspirate showing malignant lymphoid cells with prominent nucleoli
(Papanicolaou stain × 66)

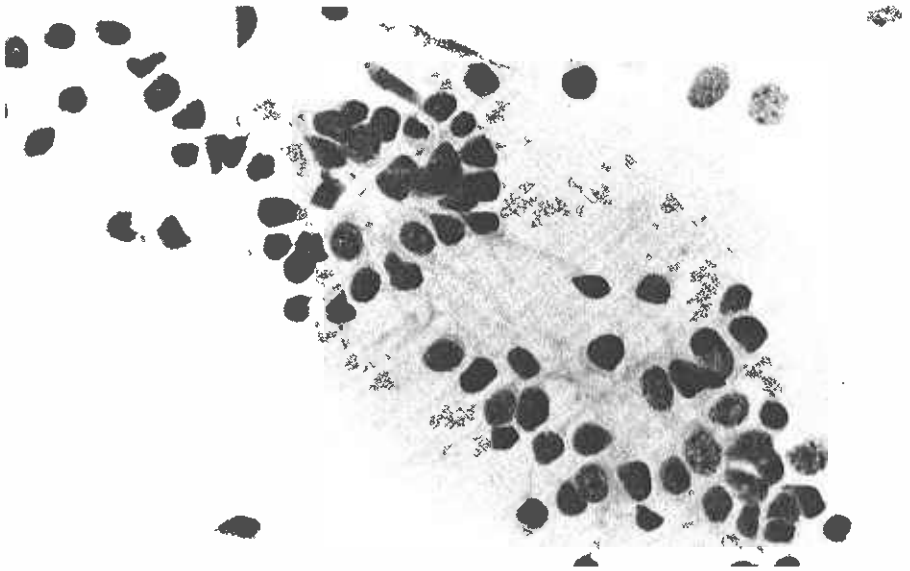


Fig 6
Case IV. Neuroblastoma
Smear of aspirate showing a poorly formed rosette composed of peripheral palisaded nuclei. Fibrillary cytoplasmic extensions are present
(Papanicolaou × 132)

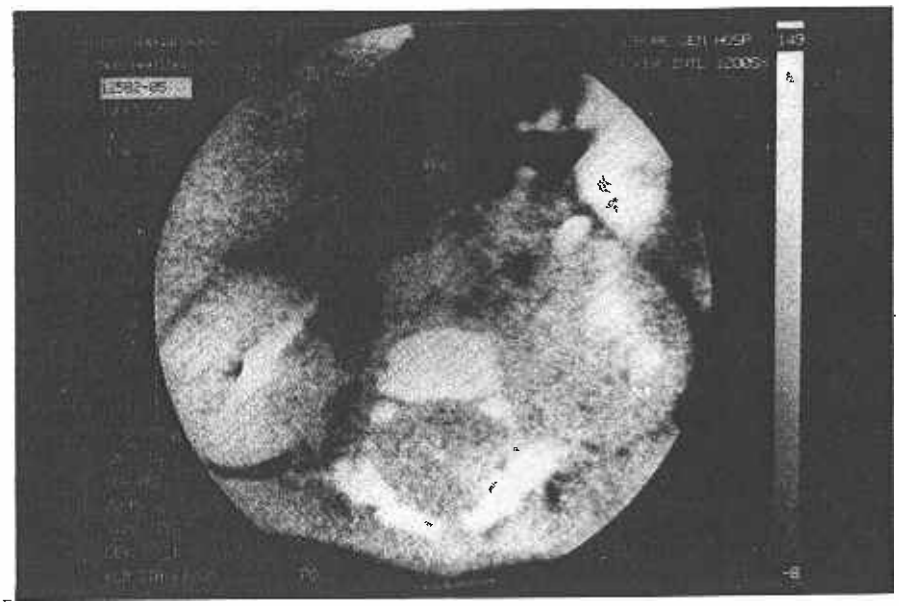


Fig 7
Case IV. Neuroblastoma
CT scan showing left paravertebral mass involving the left kidney

Case V

CSJ, an eighteen year old man was asymptomatic and picked up when a routine chest Xray showed a large paravertebral opacity in the lower left chest (Fig. 8). A sequestrated lung segment was suspected but an aortogram was negative. Percutaneous needle biopsy was carried out first with an 18G Franseen needle but no aspirate was obtained. As the mass had been shown to be avascular, this was followed by a 14G Trucut needle. A good specimen was obtained and histology showed ganglioneuroma (Fig. 9).

Case VI

FBK, a 65 year old woman presented with progressive paraplegia from an extradural mass at T2 vertebra. CT demonstrated destruction of the vertebral body and a right paravertebral mass (Fig. 10). Laminectomy was done to relieve the pressure on the spinal cord. TIssues obtained during the operation were histologically interpreted as an arteriovenous malformation. With fluoroscopic aid, percutaneous aspiration biopsy was carried out to the right of T2 vertebra. Cytology showed metastic undifferentiated carcinoma (Fig. 11).

Case VII

LSE was a 29 year old woman who had a Wertheim's hysterectomy two years earlier for cervical carcinoma. She returned with backache radiating down the left thigh. There was sensory loss in the distribution of the left L1 and L2 dermatome, and associated severe left psoas spasm. Excretory urography showed nonfuction of the left kidney and a left psoas mass. Angiography revealed that the left kidney had been displaced superolaterally by the avascular psoas mass. Needle biopsy was carried out under altrasound guidance and showed a metastic deposit compatible with carcinoma of the cervix.

Case VIII

LK, a 62 year old patient had been on treatment for sputum positive pulmonary tuberculosis for a month. She also had been experiencing pain in the right hip and weakness of the right lower limb. Chest Xray showed mottlings in both upper zones and a round opacity in the right upper zone (Fig. 12). Lumbar spine Xray revealed destruction of right anterior lower corner of L3 body and decrease of L3-4 disc space (Fi. 13). Under fluoroscopy, percutaneous biopsy was carried out of the rounded chest opacity and the spinal lesion. A 22G Turner's needle was used. Lung aspirate was non-specific. The spinal aspirate showed caseous material with polymorphs, lymphocytes and acid-fast bacilli. The patient experienced slight backache for a few days.

Case IX

II, a thirty-eight year old man was involved in a road traffic accident three months ago. At that time, he had spinal Xrays which were normal. For the last one month he had been experiencing backache. Another Xray now showed erosion of adjacent borders of T12 and L1 vertebrae with loss of the disc. There was a paravertebral shadow with calcification on the right side. ESR was 105 mm/hour. Percutaneous spinal aspiration with an 18G EZEM needle yielded an inflammatory aspirate. Subculture of the aspirate grew micrococcus. He was treated with the appropriate antibiotics and showed clinical improvement.

Technique of Needle Biopsy

The lesion is first studied on all the available imaging modalities to establish that it is not near any blood vessel or vital structure and a safe route for the needle planned. The patient is checked for any bleeding disorder before the procedure. Pre-medication is with atropine and pethidine.

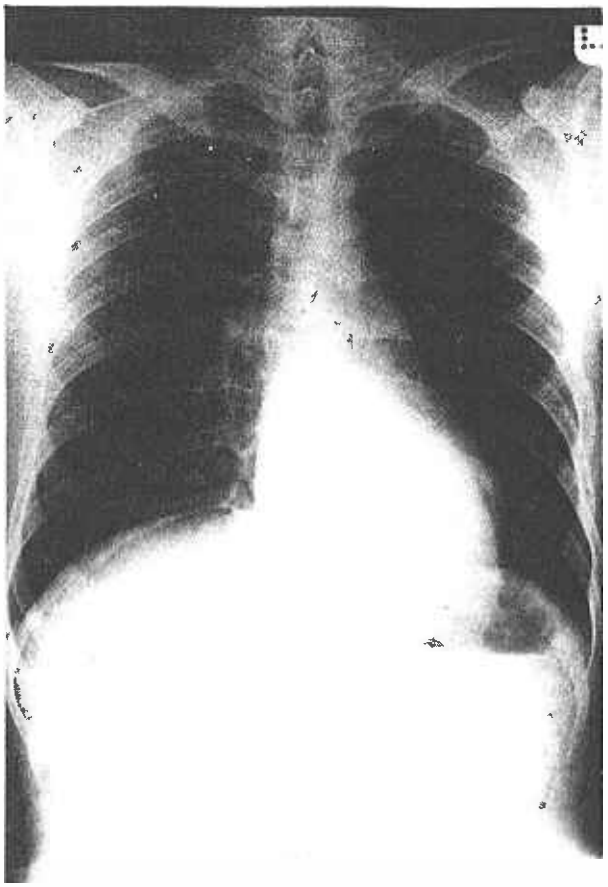


Fig 8
Case V. Ganglioneuroma
Chest xray showing a large mass behind the heart

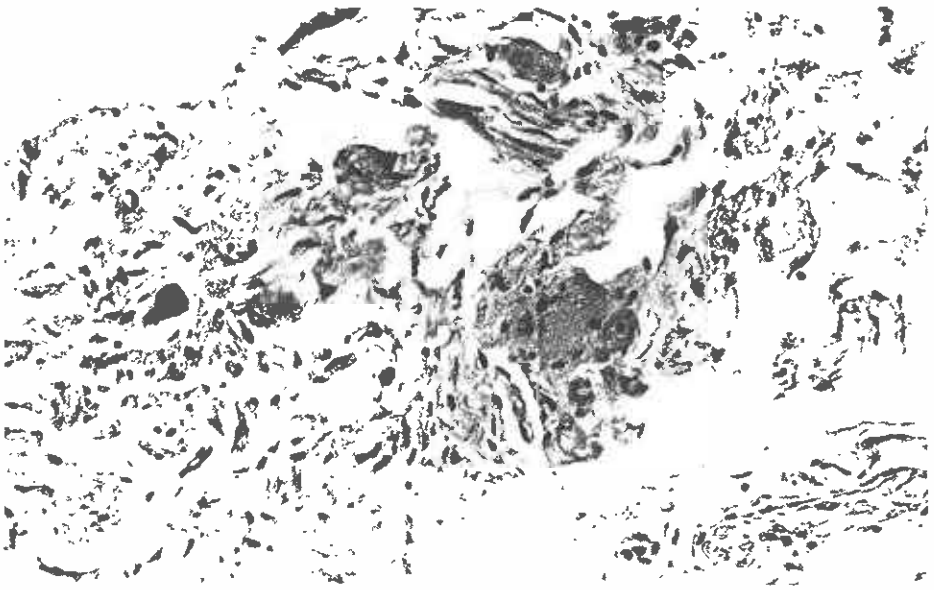


Fig 9
Case V. Ganglioneuroma
Histopathological section showing ganglioneuroma composed of Schwann cells and scattered ganglion cells
(Haematoxylin & Eosin × 66)

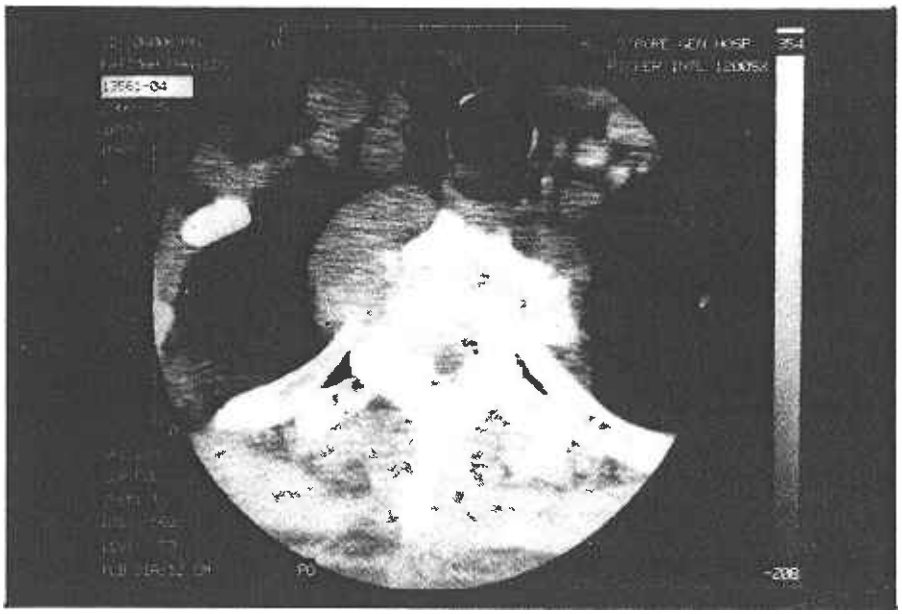


Fig 10
Case VI. Metastic carcinoma
CT scan at T2 showing a right paravertebral mass with destructive change in the adjacent vertebra

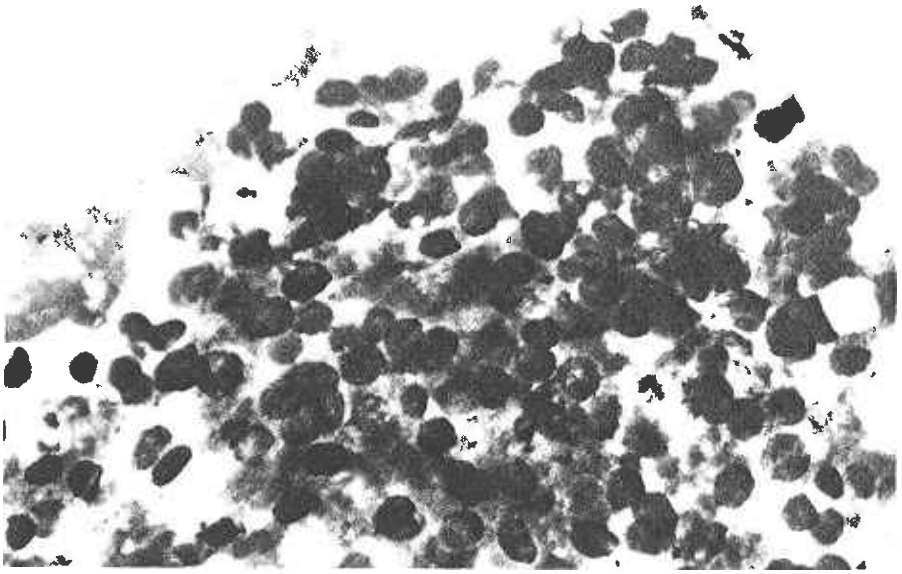


Fig 11
Case VI. metastic carcinoma
Smear of aspirate showing sheets of differentiated hyperchromatic carcinomatous cells
(Diff Quik stain × 132)

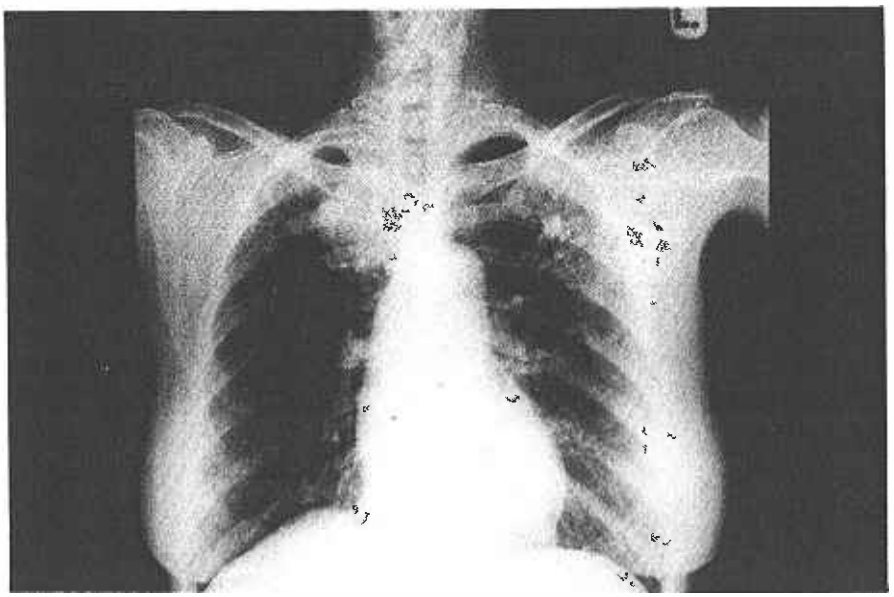


Fig 12
Case VIII. Tuberculosis
Chest xray showing mass in the right upper zone next to the mediastinum and mottlings in the left upper zone

Fig 13
Case VIII. Tuberculosis
Lateral lumbar xray showing destruction of anterio-inferior corner of the third lumbar vertebra. The disc space below it is narrowed

At the beginning of the procedure the point of skin entry is determined under fluoroscopic guidance. In Case VII, ultrasound was used. Case IV was performed as a simple lumbar puncture and no imaging control was used.

For paravertebral masses, a straight vertical entry of the needle was carried out. In the case of vertebral lesions, the skin entry was made about a hand's breath from the midline and the needle track pointed medially. When the needle tip is visualised against the vertebral body, a lateral film is exposed to confirm this.

The biopsy is first performed with a thin needle (20—22G) with a cutting tip. It is pushed into the lesion vigorously during suction with a 20 cc syringe. Should no aspirate be obtained, then a larger gauge needle may be used.

A summary of the results is given in table I.

operation or percutaneous technique. Open operation carries a higher morbidity and is not altogether free of diagnostic error (7). This is illustrated by our Case VI where tissue obtained at operation was interpreted as a vascular malformation, whereas, percutaneous biopsy of an adjacent mass revealed metastic carcinoma.

The success rates of percutaneous vertebral biopsy has ranged from 60—90% and the complication rates from 0 to 21% (8). Trauma to major neural and vascular trunks comprise the main dangers. Foot drop after lower lumbar biopsy and quadriparesis after cervical spinal biopsy have been reported (9,10). The complication rate can be kept very low by using finer needles, careful pre-biopsy planning and the use of local anaethesia and biplane fluoroscopy. In a large series of 135 cases, Stoker and Kissin (8) reported only 3 complications. Two cases were of bleeding, which

TABLE 1: PARTICULARS OF PATIENTS STUDIED

Patient	Age	Sex	Site of lesion	Diagnosis
Case I	61	F	Vertebral	Unsuccessful
Case II	45	M	Vertebral	Inflammatory, B streptococci cultured
Case III	71	F	Paravertebral	Non-Hodgkin's lymphoma
Case IV	2/12	F	Intrathecal	Neuroblastoma
Case V	18	M	Paravertebral	Ganglioneuroma
Case VI	65	F	Paravertebral	Metastic Carcinoma
Case VII	29	F	Paravertebral	Metastic Carcinoma
Case VIII	62	F	Vertebral	Tuberculosis
Case IX	38	M	Vertebral	Inflammatory, micrococcus cultured

DISCUSSION

Destruction of vertebral end plates associated with the loss of the disc space in-between indicates infection of the spine. Features favouring pyogenic infection have been described, such as marked osteosclerosis, small or no paravertebral abscess, less rarefaction, more rapid course, less destruction and collapse (2-4). On the other hand, tuberculosis of the spine exhibit more marked paravertebral abscesses and more florid bone changes, especially in non-Caucasians (5). In a study of 45 patients (6) of whom 33 were proven tuberculous and 12 pyogenic spinal infections, Allen et al (1978) found that the duration of symptoms was twice as long in tuberculosis. Sclerosis was present in both groups but marked destruction only in tuberculosis. New bone formation was noted in pyogenic infections but 3 of the 15 non-whites with tuberculosis also showed this feature. Other features did not have discrimatory value. In the individual case however, percutaneous biopsy can make a confident distinction as illustrated in three of our cases (II, VIII, IX).

Besides infections, metastasis to the spine is a frequent occurrence. In the absence of a known primary malignancy it can be very helpful to have definite histological proof. This can be done by either open resolved spontaneously during the course of the biopsy and the third case of urinary retention which also disappeared without intervention.

Percutaneous needling of the spinal canal has been of restricted practice. It has been used for aspiration of syringomyelia and spinal cord tumour (11). Complications have been few if repeated passes of the needle are not performed. In our infant with neuroblastoma, the primary aim was to perform a myelogram. However despite repeated attempts, no cerebrospinal fluid was obtained. A few drops of bloody aspirate were obtained. On the off-chance that this would reveal something, smears were made for cytological analysis which did indeed reveal the diagnosis of neuroblastoma.

Neuroblastoma is one of the most common childhood malignancies. Accurate staging is important for proper management (12). The patient is often evaluated with ultrasound, excretory urography, computed tomography, angiography and radionuclide bone scan (13,14). When neurological deficits are present, myelography is needed. Because of excellent soft tissue differentiation and multiple imaging planes, magnetic resonance imaging can replace all the other studies (15).

Stage I (confined to site of origin) and Stage II (extending to but not crossing midline) are resectable and there is no benefit in additional chemotherapy or radiotherapy. However Stage III (tumour crossing midline) and Stage IV (remote metastases to bone or lymph nodes) require combination chemotherapy and/or radiotherapy (16).

Paravertebral masses may or may not be associated with vertebral lesions. When they are not, the differential diagnosis is wide-ranging. Multiple non-invasive modalities are often used to look for distinguishing features and other associated lesions. But percutaneous biopsy is the only procedure that can give an accurate tissue diagnosis with minimal risk to the patient.

Of our three cases presenting with a paravertebral mass without vertebral involvement, one was a ganglioneuroma, one a lymphoma and the third a metastic carcinoma from the cervix. The diagnosis in each case was not suspected until percutaneous biopsy was done.

The most common cause of a posterior mediastinal (thoracic paravertebral) mass is a neural tumour (17,18). The histological types include schwannoma (neurilemmoma), neurofibroma, ganglioneuroma, neuroblastoma, ganglioneuroblastoma and paraganglimoma. In an analysis of 160 such tumours in the thorax, Reed et al (8) found that there were some distinguishing features between these histological types according to clinical and radiological criteria. Neuroblastoma and ganglioneuroblastoma are seen in the first decade of life and rarely after that. Ganglineuroma is not seen in the first year of life but thereafter there is a fairly uniform distribution over five decades. Schwannoma, neurofibroma and paraganglioma generally present after the second decade. The commonest neural tumours are ganglioneuroma and schwannoma. The former tend to be enlongated. Schwannoma and neurofibroma are usually round.

Distinction between a benign and malignant tumour is difficult. Bone involvement occurs more often in bigger lesions and in malignant ones (20). Our patient with ganglioneuroma was an asymptomatic young man. The lesion was large and slightly oval on the xray. No tissue could be obtained even with an 18G needle because of its firm consistency. A 14G Trucut needle which gave a core of tissue yielded a good result. The biopsy proved to be representative of the whole mass which was subsequently removed at thoracotomy.

A wide spectrum of diseases can affect the lumbosacral plexus. Among them are diabetes, trauma, surgery, blood coagulopathy, vasculitis, radiation, aorto-iliac aneurysms, infections and tumours. Among the tumours, over 80% are from colorectal, retroperitoneal, geniturinary and breast primary and lymphomas (21). The nerve plexus may be involved by direct extension or invasion of lymphatics and perineural spaces. Most patients experience pain initially, followed in weeks to months later by numbness or paraesthesias and weakness. Plexopathy is more frequently left sided.

Our patient with lumbar plexopathy had radical surgery for carcinoma of cervix two years earlier. After this interval metastatic spread to the left lumbar plexus became clinically overt. Percutaneous biopsy played an important role in confirming the diagnosis histologically and averting further surgery.

Our patient with lymphoma had a left psoas mass without symptoms of lumbar plexopathy. She also had nodules in the left kidney and spleen but no enlarged abnominal nodes were discovered on CT. Initial diagnosis was abscesses. Only at percutaneous biopsy was lymphoma revealed. Aspiration with an 18G Franseen needle gave an excellent yield of cells as well as small pieces of tissue from which the lymphoma could be typed.

Percutaneous lymph node biopsy with a fine needle in lymphomas have had variable results. Earlier published studies experienced difficulty in obtaining material (22,23), other investigators have been more successful (24,25). In our case, success is attributable to using a larger bore needle which is possible because of a retroperitoneal approach.

CONCLUSION

Although this is only a small series of radiologically guided percutaneous biopsy of vertebral and paravertebral lesions, it illustrates the usefulness and safety of the procedure. Appropriate guidance system, safe needle track and use of the smaller bore needles are emphasized.

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