Neuroradiology (1991) 33: 43–47

Neuro radiology

Percutaneous aspiration biopsy in cervical spine lytic lesions

Indications and technique

D. Tampieri, A. Weill, D. Melanson, and R. Ethier

Departments of Neuroradiology, Montreal Neurological Institute and Hospital, Montreal, Quebec, Canada

Received: 17 April 1990

Summary. We describe the technique and the results of the percutaneous aspiration biopsy (PAB) in a series of 9 patients presenting with neck pain and different degrees of myelopathy, in whom the cervical spine X-ray demonstrated lytic lesions of unknown origin. PAB is a useful, relatively safe technique, and leads to histological diagnosis between metastatic and inflammatory processes. Furthermore, in inflammatory lesions with negative hemoculture, PAB may help in detecting the micro-organism responsible and therefore allow a better antibiotic treatment.

Key words: Biopsy – Cervical spine – Lytic lesion – Tumour – Discitis

Although advances in imaging allow the radiologist to delineate very accurately a lesion in the cervical spine, sometimes, in the presence of a lytic process involving the vertebral body or the disc space, the differential diagnosis between a malignant or inflammatory lesion remains difficult.

Percutaneous aspiration biopsy (PAB) represents, therefore, a useful procedure since it allows the histological diagnosis in cases in whom immediate treatment has to be undertaken.

The technique as well as the results of PAB are described in a series of 9 patients presenting with neck pain and different degrees of myelopathy, in whom the cervical spine x-ray demonstrated lytic lesions of unknown origin.

In 8 of our cases a definite histological diagnosis was achieved and in case 9 the pathological report confirmed the presence of a non-specific inflammatory process.

Materials and methods

11 PAB's were carried out in 9 patients since in case 4 and 9 two procedures were done. All patients, whose medical history is summarized in Table 1, presented with neck pain and pre-vertebral soft tissue swelling. The neu-

Table 1. Table summarizing the cases of our series, their past (PMH) and present medical history (PRMH). The examination performed and the different locations of the lytic lesions are listed

Patient	PMH	PRMH	Examinations	Level
1. 56 y. ♂	None	Fell the day prior neck pain paraparesis	C-spine X-ray, CT, MRI	C4/C5
2. 69 y. ♀	Since 1 year upper neck pain	Neck pain	C-spine X-ray	C2
3. 33 y. ♂	7 months laryngitis – since then L arm weakness, neck pain	Neck pain increased arm weakness	C-spine X-ray, CT	C7
4. 41 y. ♀	Pneumonia and bacteremia 4 months before	Neck pain and arm weakness	C-spine X-ray	C3–C4
5. 71 y. ♂	Dental abscess 2 months before	Since 1 month neck pain, four limbs weakness, hand numbness	C-spine X-ray, myelography, CT-myelography	C4–C5
6. 49 y. ♂	None	Neck pain and arm weakness	C-spine X-ray	C7
7. 65 y. ♂	3 months before RLL pneumonia, since then neck pain, fever, confusion	Neck pain, bilateral hand weakness and incontinence	C-spine X-ray, CT spine	C5–C6
8. 52 y. ♂	Endocarditis	Neck pain	C-spine X-ray	C3–C4
9. 19 y. ♀	None	MVA $1^1/_2$ months before, multiple fractures septicemia, deep neck pain	C-spine X-ray	C2

PMH, past medical history; *PRMH,* present medical history

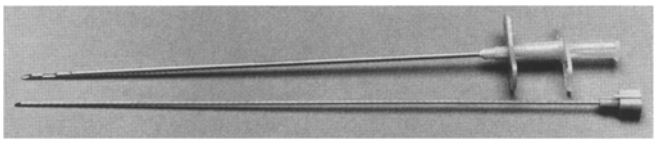

Fig. 1. The biopsy needle used is a Lee 16½ gauge 5-inch thin wall (Becton-Dickinson)

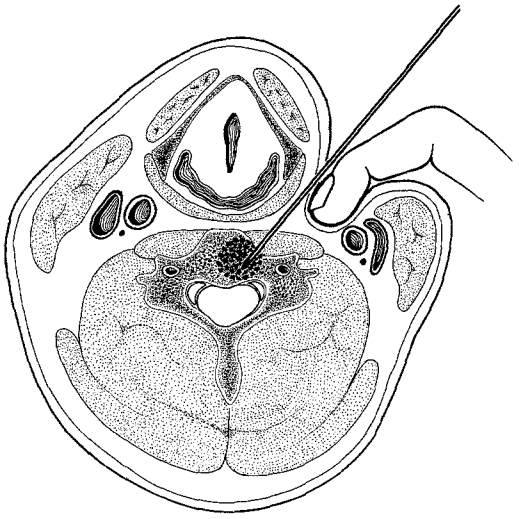

Fig. 2. Drawing illustrating the antero-lateral approach of the PAB. The needle slides between the carotid and the air-spaces. The vertebral artery is not in the way being more lateral and posterior

rological examination demonstrated bilateral arm weakness in cases 1, 3–7; case 5 also had leg weakness impairing gait and standing position. Patient 7 presented urinary incontinence. In all cases stereoscopic lateral and antero-posterior cervical spine X-rays were obtained. In cases 3 and 7 a contrast infusion CT scan of the cervical spine was done. In patient 5 a myelography and CT-myelogram were also available. Patient 1 had a CT and MRI carried out.

The procedure is performed under local anesthesia and no premedication is given unless the patient is unable to cooperate. The blood tests are checked for delay in the coagulation time, since the presence of a hemorrhagic diathesis would exclude the patient from having the biopsy.

The PAB is carried out under fluoroscopic control using a "C-arm", with the patient lying in supine position. The neck of the patient is prepared and draped in the usual sterile manner. A right or left antero-lateral approach is chosen depending on the greater extension of the lesion.

Local anesthesia is carried out using Xilocaine 1% and the tip of the needle is oriented in order to get the anesthesia along the trajectory of the biopsy needle.

A Lee 16½ gauge, 5 inch, thin wall needle (Becton-Dickinson) (Fig. 1) is then directed towards the center of the lesion. The entering point is located medially to the anterior margin of the sterno-cleido-mastoid muscle, while the latter is retracted laterally in order to displace the common carotid artery as well. Subsequently, the biopsy needle is advanced into the lesion. The needle therefore slides between the air-way spaces and the common carotid (Fig. 2).

In those cases where the lesion is located at the C2–C3 level, the site of the puncture is below the level of the lesion; therefore the needle is advanced medially and superiorly in order to slide below the jaw.

The "C-arm" helps in checking the correct trajectory and the final position of the needle, allowing a rapid view in both antero-posterior and lateral planes. When the tip of the needle is just 2–3 mm from the designated target the stylet is removed and the trocar alone is advanced toward the center of the lesion. It is then rotated and retracted in order to cut and remove the specimen. A 5 cc syringe with 2–3 ml of saline may be connected to the trocar during this procedure in order to aspirate or, at least, create a vacuum which helps obtain abnormal tissue.

The specimens are then sent for cytology and microbiology analysis.

Two radiographs, antero-posterior and lateral, document the exact location of the tip of the needle (Fig. 3). The needle is then withdrawn.

The patient should stay in a supine position and at rest in bed for 4–6 h after the procedure.

Results

The cervical spine examination demonstrated lytic lesions in all our cases. In 5, the pathological process affected the vertebral body only. In 2 (2 and 9) osteolysis involved the vertebral body of C2, in two (3 and 6) the vertebral body of C7 and in one case (4) C4. In all the other patients (4 cases), the lytic lesion extended from the vertebral body to the disc space (Table 2). 11 PAB's have been carried out since in two patients (4 and 9) two procedures were necessary.

Patient 9 was already under antibiotic therapy with Cloxaxillin and Gentamicin at the time of the biopsy since she had Staphylococcus Aureus septicemia 5 weeks before. In this patient, the culture and microbiology examinations were negative. However the histo-pathological study demonstrated severe inflammatory reaction. The patient, maintained on antibiotics therapy, improved to complete resolution of the lesion.

We observed 2 cases of osteomyelitis caused by P. Mirabilis (4) and M. Tuberculosis (3). Three cases had spondylodiskitis, two caused (5, 7) by S. Aureus (Fig. 3 a–e) and in case 3 by M. Tuberculosis. Finally there were two cases

Table 2. Location of the lytic lesions with specification of the level of the PAB and culture result

Patients	Location	Level of biopsy	Culture result
1. 56 y. ♂	C4 und C5	C5	Adeno-carcinoma
2. 69 y. ♀	C2	C2	Myeloma
3. 33 y. ♂	C7	C7	M. Tuberculosis osteomyelitis
4. 41 y. ♀	C4	C4	P. Mirabilis osteomyelitis
5. 71 y. ♂	C5–C6	C5–C6 disc	S. Aureus discitis
6. 48 y. ♂	C7	C7	Adeno-carcinoma
7. 65 y. ♂	C5–C6	C5–C6 disc	S. Aureus discitis
8. 52 y. ♂	C3–C4	C3–C4 disc	E. Coli discitis
9. 19 y. ♀	C2	C2	Negative

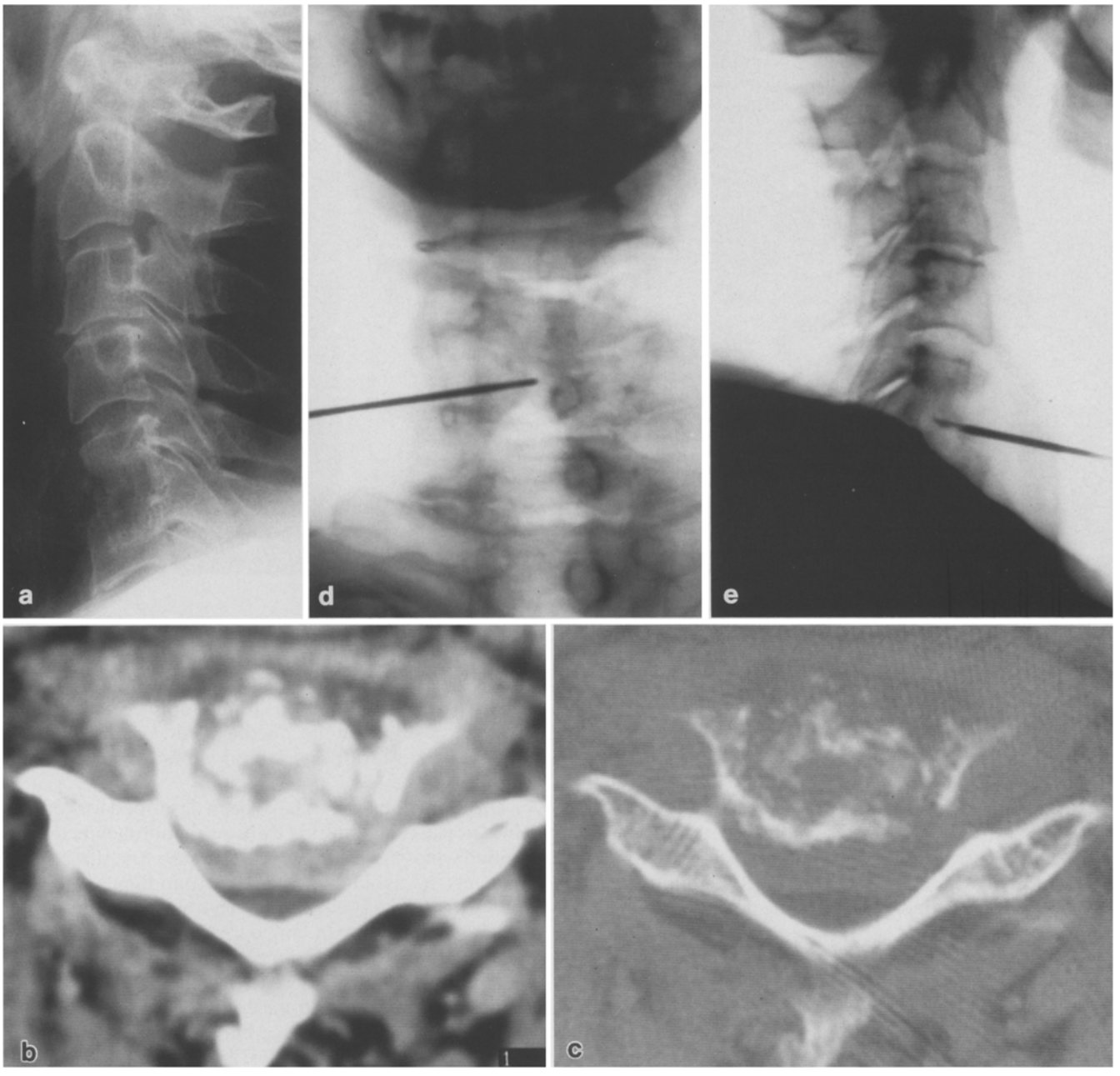

Fig. 3 a–e. Case 7. The cervical spine examination (**a**) shows a rarefaction with loss of intervertebral height at C5–6 level. The contrast infused CT (**b, c**) confirms the lytic process and shows a soft tissue component extending in the paravertebral space and into the spinal canal. The PAB is carried out and the antero-posterior (**d**) and lateral views (**e**) show the exact position of the needle

of metastatic adenocarcinoma (1, 6) (Fig. 4 a–c) and one of myeloma (2).

Discussion

The first biopsy series, including 8 cases from the musculoskeletal system, appeared in 1930 [1]. Since then, although several articles on the indications and different techniques for spinal biopsy have been published, none of them is, to our knowledge, specifically devoted to the cervical spine.

The important role played by vertebral body biopsy versus a surgical open procedure is widely accepted in cases where the differential diagnosis between a neoplastic or inflammatory lesion is difficult or when, in the presence of an osteomyelitis with negative hemoculture, the responsible microorganism has to be isolated [2]. Plain films show osteomyelitis as a rarefaction with lysis, usually involving the anterior third of the vertebral body more often secondary to discitis [3]. The vertebral body alone is more frequently a site of metastases [4–7]. These cause, similarly to infection, osteolysis and eventually spread through the disc to the contiguous vertebral body. The radiological diagnosis therefore may be difficult and ver-

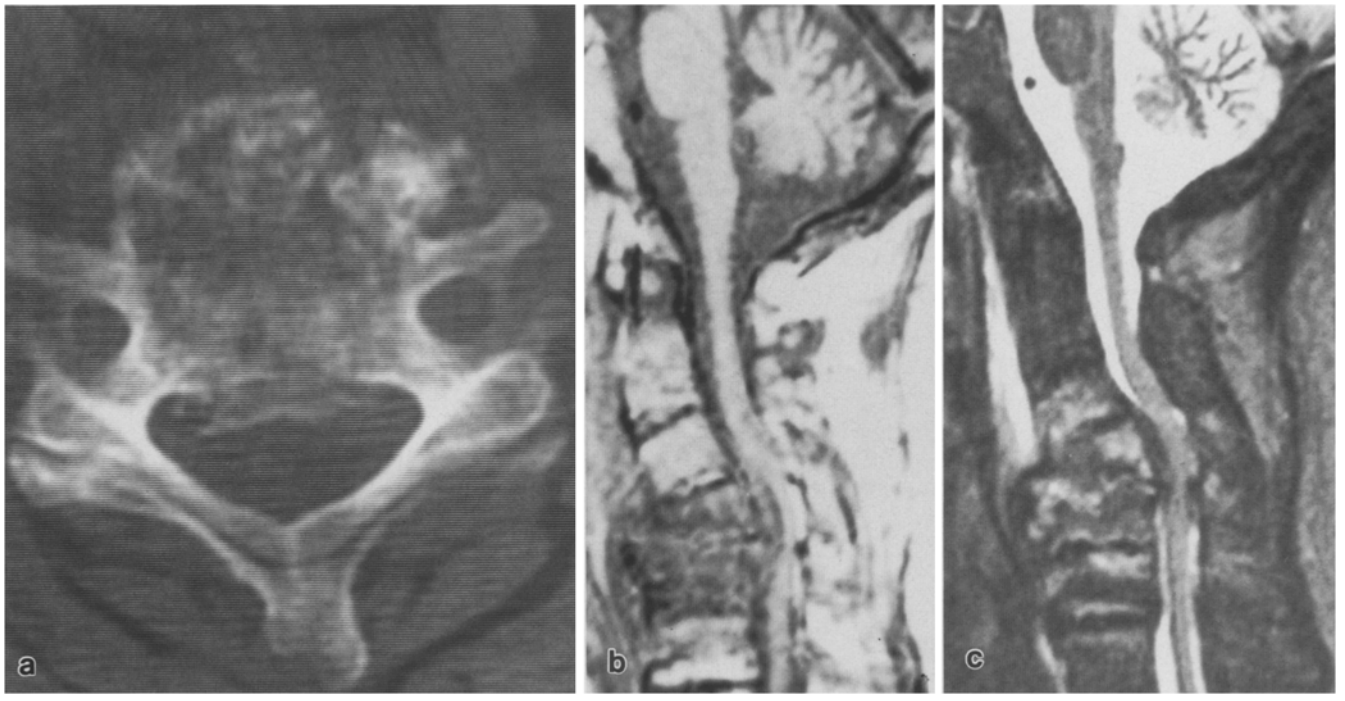

Fig. 4a–c. Case 1. The CT (**a**) shows a lytic process involving the vertebral body of C4. The MRI T1 (**b**) and T2 (**c**) weighted images confirm the lytic process extending from C4 to C6 with a soft tissue component extending into the spinal canal causing a severe extradural compression of the spinal cord

tebral body biopsy has, in these cases, its major indications. The vertebral body or disc biopsy represents a useful procedure also when, in spite of a typical radiological appearance of osteomyelitis, a guide to optimum antibiotic therapy is needed because of the negative hemoculture.

The percentage of positive good results for spine biopsy varies between 60 and 95% [10]. In our series a positive result was obtained in 89% of the patients. In patient 9, in spite of a repeated biopsy with specimen removal and a pathology report positive for inflammatory reaction, the microbiology remained negative, probably due to prior antibiotic treatment for Staphylococcus Aureus septicemia: the culture may be negative in patients already on antibiotics [2]. Spine biopsy obviates the need for surgery, this latter representing a major operation having higher morbidity, cost and lengthening the hospital stay [1, 9, 10].

The major disadvantage of spine biopsy versus open surgery is the eventuality of obtaining a specimen too small for diagnosis. This can be prevented with an adequate procedure; the success and safety of the spine biopsy rely on the accurate guidance toward the lesion and on the technique used [1, 9, 11].

Fluoroscopy or computed tomography (CT) have both been used for guidance during spine biopsy. In the cervical spine the fluoroscopic control using a C-arm is, in our experience, an excellent tool since it allows rapid verification of the position and direction of the needle in antero-posterior and lateral views. Moreover, fluoroscopic control alone is less time consuming and less expensive than computed tomography. Nevertheless the final position of the needle is always documented with antero-posterior and lateral views for future reference.

Different approaches have been described for cervical spine biopsy. The anterior trans-oral approach is recommended when the lesion is located at the first three cervical levels to avoid important surrounding anatomical structures [8]. In a previous paper a trans-oral anterior approach combined with angiography was suggested in order to prevent vessel injuries [11].

A later posterior approach, between the posterior edge of the sterno-cleido-mastoid muscle and a vertical line traced from the tip of the mastoid, was described for lesions located from C4 to C7 [12, 13]. This technique has been largely supported as less dangerous for the vessels and brachial plexus [13]. The antero-lateral approach, that we propose for lesions located from C2 to C7, allows better control of the needle. It is possible to change its direction, and it is easier to approach the anterior aspect of the vertebral body and the intervertebral disc. In particular, the latter may be entered since it is not hidden by the unco-vertebral joint, which is located more postero-laterally. Finally the vertebral artery is not in the way of the needle and the common carotid is displaced laterally with the retraction of the sterno-cleido-mastoid muscle.

For lesions located at the first three cervical levels we still prefer the antero-lateral approach. The trans-oral approach is a more complicated and expensive procedure with higher risk of dissemination.

Either a simple trephine biopsy or aspiration can be performed. When a vertebral lesion is present a simple needle biopsy has been proposed [14, 15], while in case of

disc [11] or of inflammatory lesion [16] a needle aspiration was preferred.

In case of infection from M. Tuberculosis, the needle biopsy is suggested to obtain an histological proof since the bacteriology may be negative and the culture results have a delay of several weeks [14]. The combination of the two techniques, needle biopsy and aspiration, therefore, seems to be the best way to achieve a good result [1].

The risk of any particular biopsy has always to be measured against the risk from alternative diagnostic methods or the risk of not achieving any specific diagnosis [1].

Some complications are reported during cervical spine biopsy; fine needles [17] and biplane fluoroscopic control have been suggested in order to reduce their incidence [9].

Transient quadriparesis because of acute compression of the anterior spinal artery during cervical spine biopsy has been reported [18]. Other complications, such as hemorrhage, spread of the primary lesion and pneumothorax (in biopsy performed at T1 level), have been described [1, 9]. Blood tests must be verified in order to exclude patients with a bleeding diathesis from having the procedure [19].

In the series of 11 biopsies performed with the anterolateral approach described we did not experience a single complication.

In conclusion, PAB is a useful procedure, relatively safe if performed with an adequate technique. The anterolateral approach under fluoroscopic control using a C-arm allows an easy control of the trajectory and final position of the needle.

The cervical biopsy has to be carried out as soon as possible whenever the differential diagnosis between a neoplastic or inflammatory lesion is difficult, or in case of osteomyelitis, with negative hemoculture, before starting any medical treatment.

References

1. Murphy WA, Destouet JM, Gilula LA (1981) Percutaneous skeletal biopsy 1981: A procedure for radiologists. Results, review, and recommendations. Radiology 139: 545–549
2. Armstrong P, Chalmers AH, Green G, Irving JD (1978) Needle aspiration/biopsy of the spine in suspected disc space infection. Br J Radiol 51: 333–337
3. Palacios E, Rodriguez-Carbejal J (1989) Inflammatory and parasitic processes of the spinal canal. In: Taveras JM, Ferrucci JT (eds) Radiology: diagnosis, imaging, intervention. Lippincott, Philadelphia
4. Ackermann W (1956) Vertebral trephine biopsy. Ann Surg 143: 373–385
5. Copeland MM (1931) Skeletal metastases arising from carcinoma and from sarcoma. Arch Surg 23: 581
6. Von Recklinghausen FD (1891) Die fibrose oder deformierende Ostitis, die Osteomalacie und die osteoplastische Carcinose in ihren gegenseitigen Beziehungen. Festschrift Rudolf Virchow zu seinem 71. Geburtstage gewidmet von den früheren und jetzigen Assistenten des Berliner pathologischen Instituts. Reimer, Berlin
7. Willis RA (1951) The spread of tumors in the human body. Butterworth, London 232
8. McCollister, Evarts C (1975) Diagnostic techniques: closed biopsy of bone. Clin Orthoped Rel Res 107: 100–111
9. Tan KP, Thomas A (1987) Radiologically guided percutaneous needle biopsy of vertebral and paravertebral lesions. Singapore Med J 28: 42–52
10. Wright MG, Irving JD, Armstrong P (1975) Vertebral trephine biopsy. Rheumatol Rehabil 14: 208–211
11. Foure X, Duvauferrier R, Chales G, Ramee A (1983) Biopsies percutanées rachidiennes et sacro-iliaques à visée diagnostique. J Radiol 64: 551–556
12. Ottolenghi CE (1955) Diagnosis of orthopaedic lesions by aspiration biopsy. Results of 1,061 punctures. J Bone Joint Surg 37-A: 443–471
13. Ottolenghi CE, Schajowicz F, DeSchant FA (1964) Aspiration biopsy of the cervical spine. Technique and results in thirty-four cases. J Bone Joint Surg 46-A: 715–733
14. Laredo JD, Bard M, LeBlanc G, Folinais D, Cywiner-Golenzer Ch (1985) Technique et résultats de la ponction-biopsie transcutanée radioguidée du rachis dorsal. Rev Rhumat 52: 283–287
15. Misasi N, Principe A (1985) L'Utilizzazione della biopsia transpeduncolare nella diagnosi dei tumori vertebrali. Arch Putti Chir Organi Mou 35: 355–359
16. Wagle V, Melanson D, Ethier R, Leblanc R (1987) MR in spinal tuberculous abscess. AJNR 8: 175–176
17. Joshi KB, Brinker RA (1983) Fine needle diagnosis in lumbar osteomyelitis. Skel Radiol 10: 173–175
18. McLaughlin RE, Miller WR, Miller CW (1976) Quadriparesis after needle aspiration of the cervical spine. Report of a case. J Bone Joint Surg 58-A (8): 1167–1168
19. Chevrot A, Godefroy D, Horreard P, Conquy-Langer S, Pallardy G (1981) Biopsie osseuse profonde au trocart sous radioscopie télévisée dans les infections discovertébrales. Rev Rhumat 48: 51–57

D. Tampieri, M.D.
Department of Neuroradiology
Montreal Neurological Institute and Hospital
3801 University St.
Montreal, Quebec, Canada H3A 2B4