Singapore Med J 2009; 50(8) : 834

CME Article

Clinics in diagnostic imaging (127)

Chee D W Y, Peh W C G

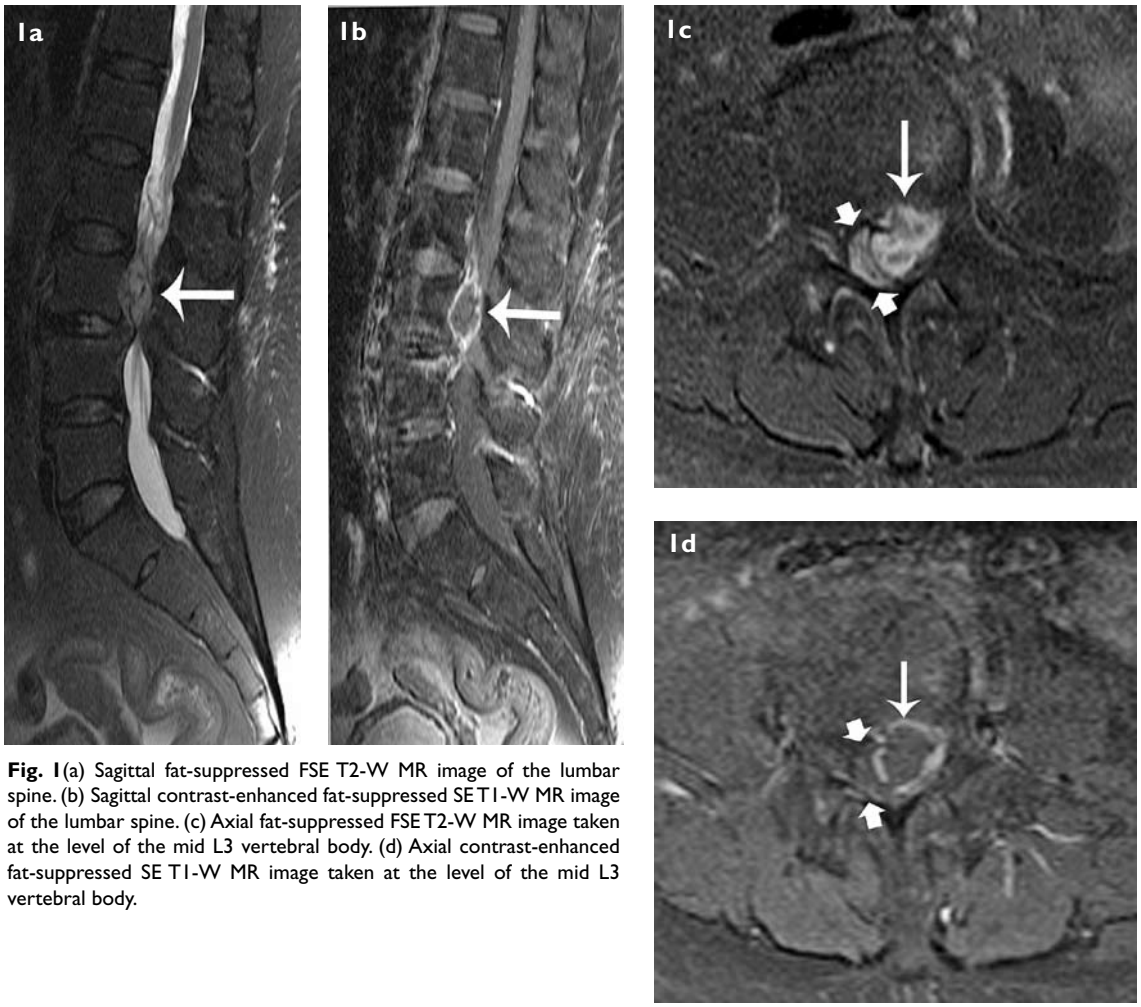

Fig. 1 (a) Sagittal fat-suppressed FSE T2-W MR image of the lumbar spine. (b) Sagittal contrast-enhanced fat-suppressed SE T1-W MR image of the lumbar spine. (c) Axial fat-suppressed FSE T2-W MR image taken at the level of the mid L3 vertebral body. (d) Axial contrast-enhanced fat-suppressed SE T1-W MR image taken at the level of the mid L3 vertebral body.

CASE PRESENTATION

An 82-year-old Chinese woman presented with left buttock pain radiating to the left anterior knee for four weeks. The pain was worse on walking and weight-bearing, and partially relieved with rest. She also gave a history of numbness over the left thigh. She denied any weakness in the lower limbs, and was still able to walk with the aid of a walking stick. There was no history of trauma. No history of fever, back pain, urinary retention or bowel incontinence was elicited. She had a background history of hypertension, hyperlipidaemia and osteoarthritis of both knees. On examination, she was able to tolerate straight leg raising to about 80° bilaterally, but complained of pain shooting down the left thigh. There was decreased sensation over the left L3 dermatome. Reflexes were intact. Laboratory findings revealed no significant abnormality. The patient was initially treated conservatively with analgesics and physiotherapy. Radiographs showed lumbar spondylotic changes with preservation of the disc spaces. Magnetic resonance (MR) imaging of the spine was performed. What are the imaging findings (Figs. 1a–d)? What is the diagnosis?

Department of Diagnostic Radiology, Alexandra Hospital, 378 Alexandra Road, Singapore 159964

Chee DWY, MBBCh, MMed, FRCR
Registrar

Peh WCG, MD, FRCP, FRCR
Clinical Professor and Head

Correspondence to:
Prof Wilfred CG Peh
Tel: (65) 6379 3283
Fax: (65) 6476 4571
Email: wilfred.peh@gmail.com

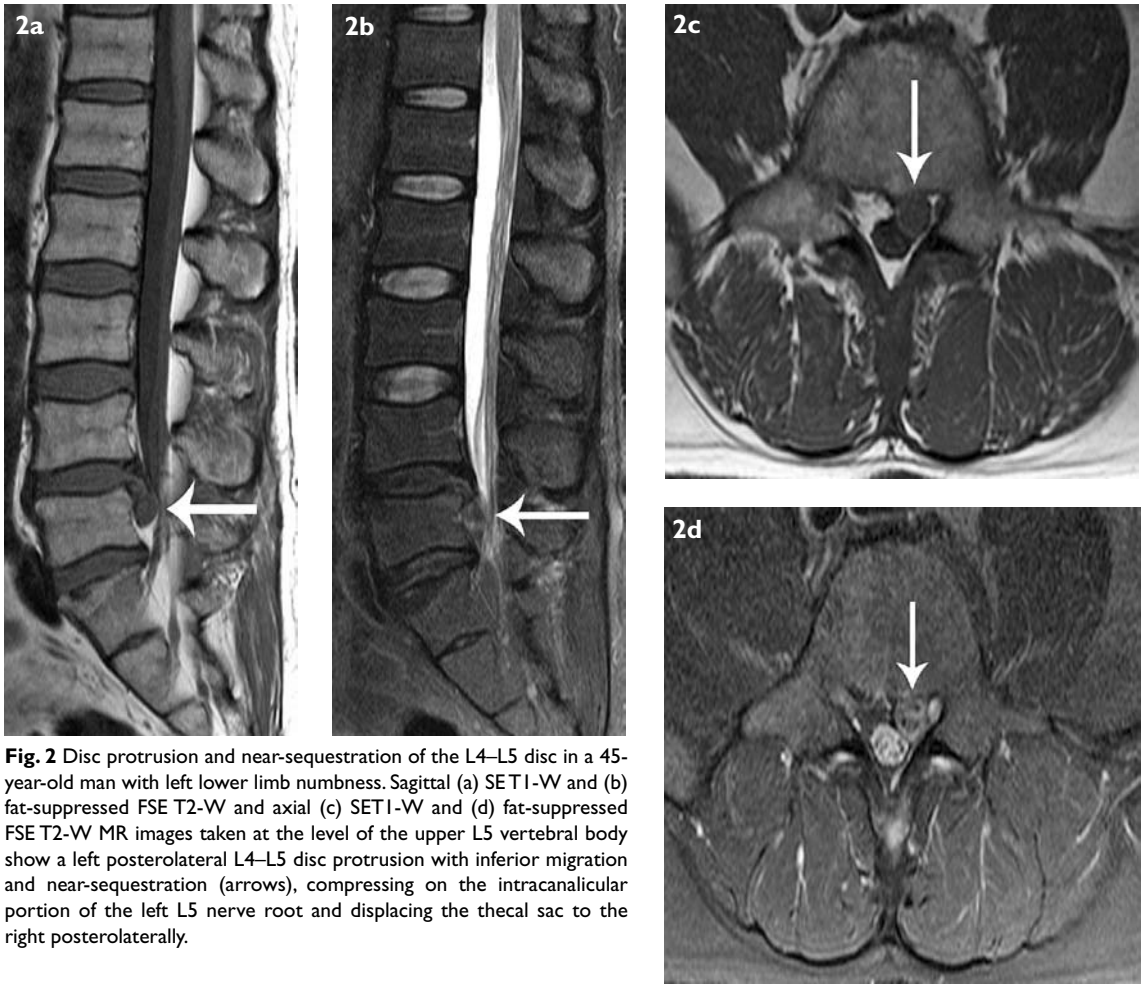

Fig. 2 Disc protrusion and near-sequestration of the L4–L5 disc in a 45-year-old man with left lower limb numbness. Sagittal (a) SE T1-W and (b) fat-suppressed FSE T2-W and axial (c) SET1-W and (d) fat-suppressed FSE T2-W MR images taken at the level of the upper L5 vertebral body show a left posterolateral L4–L5 disc protrusion with inferior migration and near-sequestration (arrows), compressing on the intracanalicular portion of the left L5 nerve root and displacing the thecal sac to the right posterolaterally.

IMAGE INTERPRETATION

Figures 1a–d show a L3–4 sequestered disc (large arrows) which had migrated cranially with its epicentre within the spinal canal at the level of the lower L3 vertebral body. The disc compresses on the intracanalicular portion of the left L3 nerve root, and displaces the thecal sac to the right posterolaterally (small arrows). Sagittal and axial FSE T2 fat-suppressed images (Figs. 1a & c, respectively) show an intermediate signal intensity mass of higher signal than the adjacent L3–4 disc demonstrating thin rim enhancement post-contrast injection (Figs. 1b & d).

DIAGNOSIS

L3–4 sequestered disc compressing on the left L3 nerve root.

CLINICAL COURSE

In view of worsening symptoms causing difficulty in ambulating, the patient subsequently underwent a decompression laminectomy. At surgery, a large sequestered L3–4 disc compressing on the left L3 nerve root was found. This was confirmed on histology. On follow-up 18 months post-surgery, the patient is walking well.

DISCUSSION

Herniated discs occur mostly in adults, and are rare in children. Approximately 90% of lumbar herniated discs occur at the L4–5 or L5–S1 levels, 7% occur at L3–4 level, and 3% occur at L1–2 or L2–3 levels.[1] A sequestered disc is a free disc fragment that is no longer in continuity with the parent disc material. The sequestered disc fragment may or may not be confined by the posterior longitudinal ligament. It may lie adjacent to the disc of origin, or may migrate cranially or caudally to a different disc space both in the midline and in the lateral recess, or in rare cases, even penetrate the dura.[2] The most common path of disc migration is in the posterolateral direction to the anterior epidural space, which most commonly produces a radiculopathy (Figs. 2a–d). Patients usually present with back pain, most often in the lumbar region, with or without the presence of radiculopathy (radiating pain to the thigh/knee). On MR imaging, the hallmark of a herniated disc

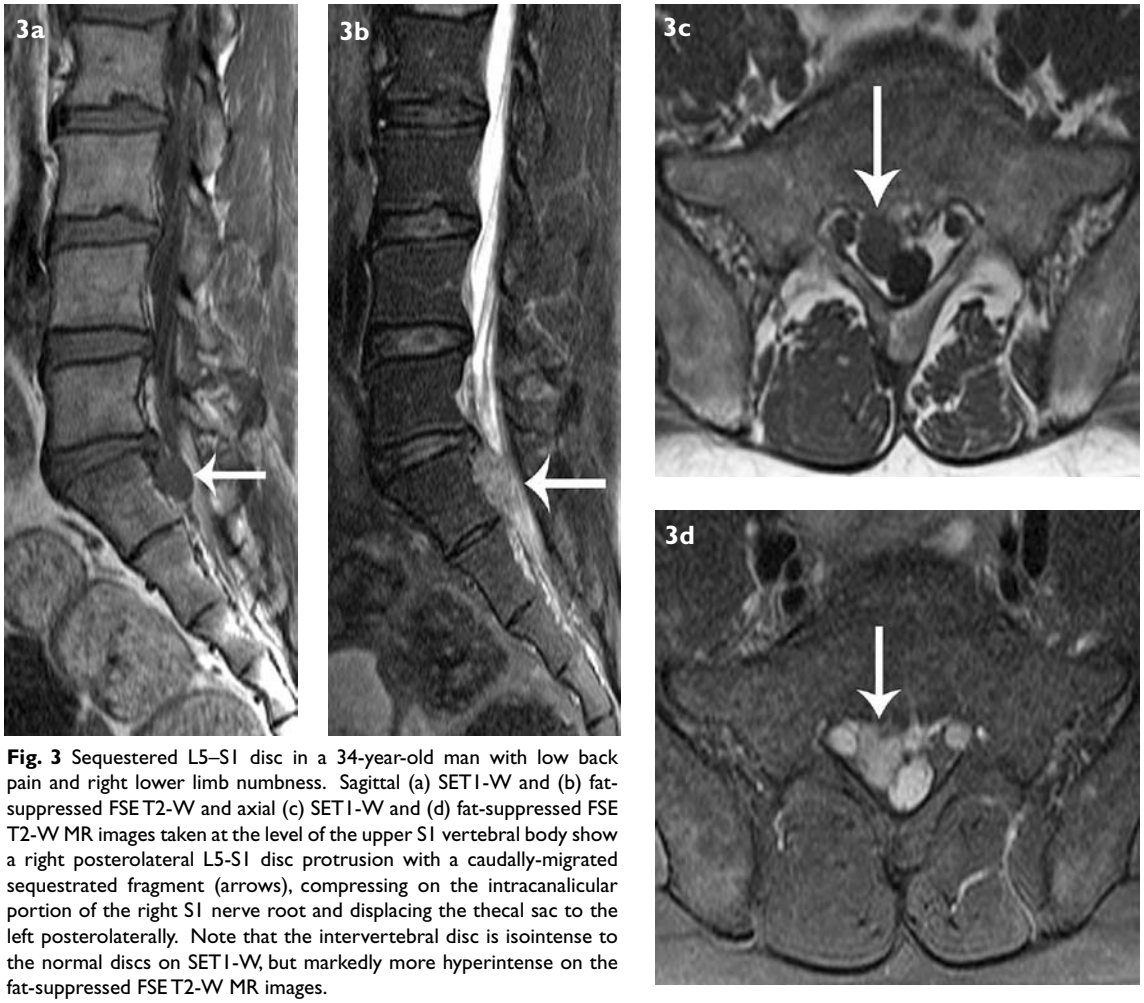

Fig. 3 Sequestered L5–S1 disc in a 34-year-old man with low back pain and right lower limb numbness. Sagittal (a) SET1-W and (b) fat-suppressed FSE T2-W and axial (c) SET1-W and (d) fat-suppressed FSE T2-W MR images taken at the level of the upper S1 vertebral body show a right posterolateral L5-S1 disc protrusion with a caudally-migrated sequestrated fragment (arrows), compressing on the intracanalicular portion of the right S1 nerve root and displacing the thecal sac to the left posterolaterally. Note that the intervertebral disc is isointense to the normal discs on SET1-W, but markedly more hyperintense on the fat-suppressed FSE T2-W MR images.

is a focal contour abnormality along the posterior disc margin with a soft tissue mass displacing the epidural fat, nerve root or the thecal sac (Figs. 1 & 2).

Free fragments tend to appear similar to the parent disc on both computed tomography (CT) and T1-weighted MR imaging, appearing low in signal. 80% of cases exhibit high signal intensity on T2-weighted images relative to the degenerated disc of origin. The high signal intensity on T2-weighted images can be explained as either the herniated material still having a higher water content than an intact disc, or a reparative process leading to a transient water gain (Figs. 3a–d). The remaining 20% has isointense signal intensity relative to the degenerated disc on T2-weighted images. Sequestered fragments at the disc level in the spinal canal often have the appearance of two or three distinct fragments.[3] After intravenous gadolinium-DTPA contrast administration, the central portion of a free fragment of a sequestered disc maintains low signal intensity, whereas the periphery enhances, producing a bull's eye sign.[4] The appearance of peripheral contrast enhancement is attributed to an inflammatory response with granulation tissue and newly-formed vessels around the sequestrated tissue[5,6] (Figs. 4a–f).

A free disc fragment that has migrated away from the disc level may mimic tumours, (e.g. epidural tumours such as neurofiboma and meningioma), epidural haematoma and infection (epidural abscess). Contrast-enhanced sequences are needed to differentiate a tumour and infection from a sequestered disc in such situations. Due to differences in the surgical approach and prognosis, it is important to distinguish a sequestered disc and epidural tumour.[7] Tumours (Figs. 5a–f) such as neurofibroma and meningioma usually have either uniform homogeneous or heterogeneous enhancement. Multiplicity and bone marrow changes in instances of metastatic disease (e.g. prostatic carcinoma with vertebral metastases) help to narrow the differential diagnosis. Findings that suggest vertebral metastases include contiguous vertebral marrow infiltration, especially of the pedicles. Imaging features show the marrow to be more hypointense than the disc on T1-weighted images, with corresponding areas of heterogeneous enhancement. The discs are usually normal in appearance unless there is coexisting degenerative disc disease.

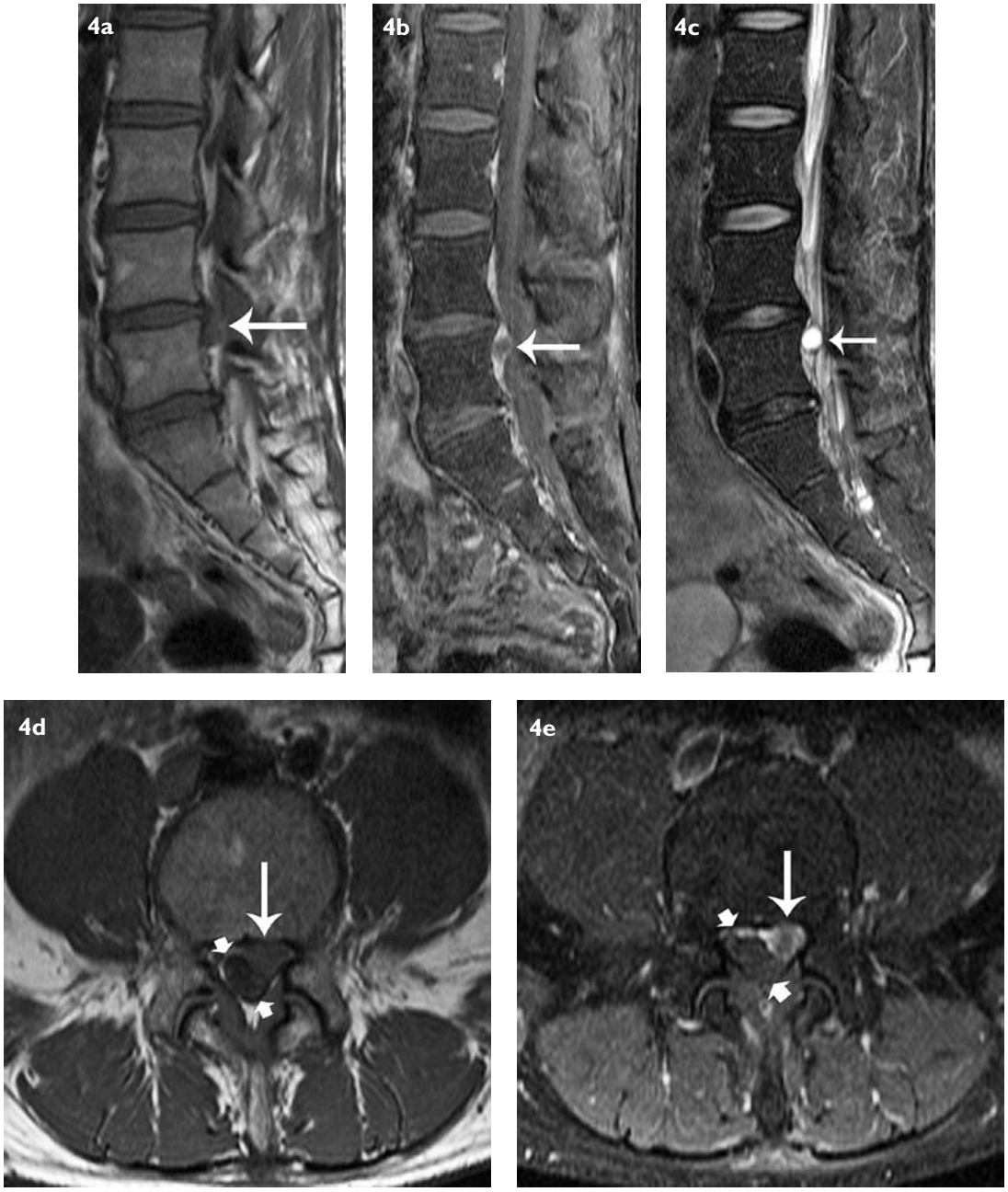

Fig. 4 Disc protrusion with a migrated cystic component in a 39-year-old man with low back pain and left sciatica. Sagittal (a) SET1-W, (b) contrast-enhanced fat-suppressed SET1-W, (c) fat-suppressed FSE T2-W, and axial (d) SET1-W, (e) contrast-enhanced fat-suppressed SET1-W, and (f) fat-suppressed FSE T2-W MR images taken at the level of the upper L5 vertebral body show a protruded near-sequestrated L4–5 disc (large arrows), connected to a large left posterolateral caudally-migrated cystic component via a narrow neck, compressing on the intracanalicular portion of the left L5 nerve root. The migrated caudal component shows thin rim enhancement. The thecal sac has been displaced to the right posterolaterally (small arrows).

An epidural haematoma is usually isointense or hyperintense on T1-weighted images, with no enhancement, and there is often an associated history of trauma.[8,9] Epidural abscesses are frequently associated with disc space infection and may be distinguished from

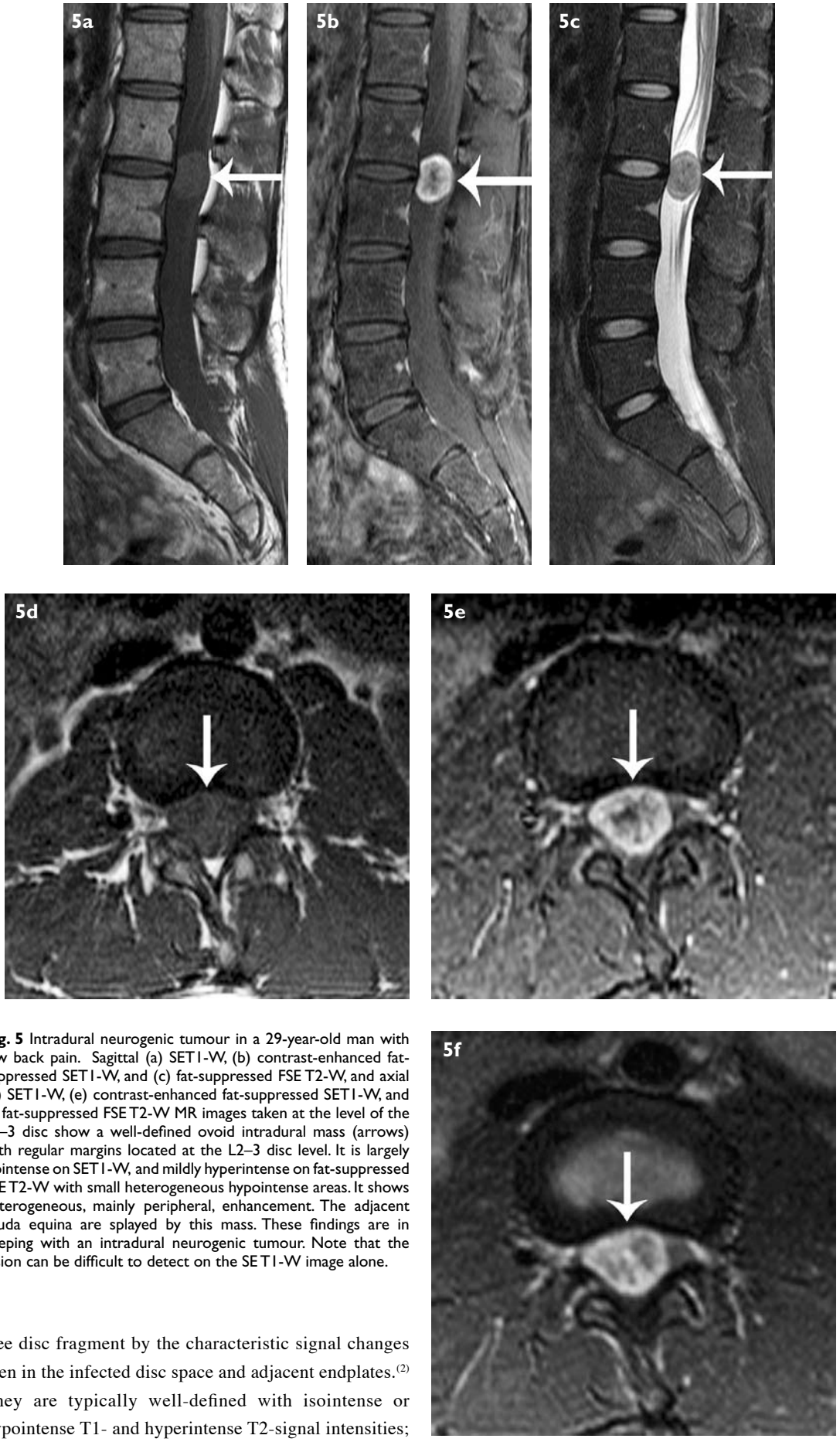

Fig. 5 Intradural neurogenic tumour in a 29-year-old man with low back pain. Sagittal (a) SET1-W, (b) contrast-enhanced fat-suppressed SET1-W, and (c) fat-suppressed FSE T2-W, and axial (d) SET1-W, (e) contrast-enhanced fat-suppressed SET1-W, and (f) fat-suppressed FSE T2-W MR images taken at the level of the L2–3 disc show a well-defined ovoid intradural mass (arrows) with regular margins located at the L2–3 disc level. It is largely isointense on SET1-W, and mildly hyperintense on fat-suppressed FSE T2-W with small heterogeneous hypointense areas. It shows heterogeneous, mainly peripheral, enhancement. The adjacent cauda equina are splayed by this mass. These findings are in keeping with an intradural neurogenic tumour. Note that the lesion can be difficult to detect on the SE T1-W image alone.

free disc fragment by the characteristic signal changes seen in the infected disc space and adjacent endplates.[2] They are typically well-defined with isointense or hypointense T1- and hyperintense T2-signal intensities;

with diffuse homogeneous or peripheral enhancement. However, the lack of associated changes in the disc and adjacent endplates, and the lack of clinical and laboratory findings of infection, should suggest a diagnosis other than infection.

ABSTRACT

A 82-year-old woman presented with left buttock pain radiating to the left anterior knee for four weeks. Magnetic resonance imaging of the lumbar spine showed a rim-enhancing mass in the spinal canal at the level of L3 vertebra suggestive of a sequestered disc, which was subsequently confirmed on decompression laminectomy. The clinical and magnetic resonance imaging features of a sequestered disc and its mimics are discussed.

Keywords: disc protrusion, sequestered disc, spine imaging

Singapore Med J 2009;50(8):834-840

REFERENCES

1. Jinkins JR, Whittemore AR, Bradley WG. The anatomic basis of vertebrogenic pain and the autonomic syndrome associated with lumbar disc extrusion. Am J Roentgenol 1989; 152:1277-89.
2. Masaryk TJ. High resolution MR imaging of sequestered intervertebral disc. Am J Neuroradiol 1998; 9:351.
3. Atlas SW. Magnetic Resonance Imaging of the Brain and Spine. 3rd ed. Philadelphia: Lippincott Williams and Wilkins, 2002: 1665.
4. Kim SJ, Song JH, Kim MH. Sequestered disc mimicking benign neurogenic tumour. Report of 2 cases. J Korean Neurosurg Soc 1997; 26:596-9.
5. Hwang GJ, Suh JS, Na JB, Lee HM, Kim NH. Contrast enhancement pattern and frequency of previously unoperated lumbar discs on MRI. J Magn Reson Imaging 1997; 7:575-8.
6. Wasserstrom R, Mamourian AC, Black JF, Lehman RA. Intradural lumbar disk fragment with ring enhancement on MR. Am J Neuroradiol 1993; 14:401-4.
7. Birla R, Singh A, Kharat A, Phalke U. Role of contrast enhanced MR in diagnosis of a sequestered disc: A case report and review of literature. Indian J Radiol Imaging 2005; 15:4:489-91.
8. Dösoğlu M, Is M, Gezen F, Ziyal MI. Posterior epidural migration of a lumbar disc fragment causing cauda equina syndrome: case report and review of the relevant literature. Eur Spine J 2001; 10:348-51.
9. Neugroschl C, Kehrli P, Gigaud M, et al. Posterior extradural migration of extruded thoracic and lumbar disc fragments: role of MRI. Neuroradiology 1999; 41:630-5.

SINGAPORE MEDICAL COUNCIL CATEGORY 3B CME PROGRAMME
Multiple Choice Questions (Code SMJ 200908B)

	True	False
Question 1. Concerning disc disease:		
(a) About 90% of lumbar herniated discs occur at the L4–5 or L5–S1 levels.	☐	☐
(b) Herniated discs occur mostly in children, rather than adults.	☐	☐
(c) A sequestered disc is a free disc fragment that is no longer in continuity with the parent disc material.	☐	☐
(d) Magnetic resonance (MR) imaging is the imaging method of choice for the evaluation of disc disease.	☐	☐
Question 2. Concerning imaging of sequestered disc:		
(a) Free fragments tend to look like the parent disc on both computed tomography (CT) and T1-weighted MR imaging sequences.	☐	☐
(b) 10% of cases exhibit high signal intensity on T2-weighted images relative to the degenerated disc of origin.	☐	☐
(c) It is important to distinguish a sequestered disc from an epidural tumour.	☐	☐
(d) CT is the imaging method of choice to distinguish a sequestered disc from an epidural tumour.	☐	☐
Question 3. The following statements about sequestered disc are true:		
(a) Prompt surgery is the treatment of choice for a sequestered disc.	☐	☐
(b) A sequestered disc may mimic an epidural haematoma on MR imaging.	☐	☐
(c) After intravenous gadolinium contrast administration, the central portion of a free fragment of a sequestered disc maintains low signal intensity, whereas the periphery may enhance, producing a bull's eye sign on MR imaging.	☐	☐
(d) A spinal meningioma may resemble a sequestered disc on MR imaging.	☐	☐
Question 4. Concerning epidural abscesses:		
(a) On MR imaging, the lack of associated changes in the disc and adjacent endplates, and the lack of clinical findings of infection, should suggest a diagnosis other than infection.	☐	☐
(b) Epidural abscesses are frequently associated with disc space infection.	☐	☐
(c) Epidural abscesses do not show contrast enhancement.	☐	☐
(d) Epidural abscesses may mimic a sequestered disc on MR imaging.	☐	☐
Question 5. Which of the following statements is/are true:		
(a) An epidural haematoma is usually isointense or hyperintense on T1-weighted imaging, with no enhancement post-contrast, and an associated history of trauma.	☐	☐
(b) Findings that suggest vertebral metastases include discontinuous vertebral marrow infiltration without involvement of the pedicles and no enhancement.	☐	☐
(c) Intradural neurogenic tumours may occur in young adults.	☐	☐
(d) Sequestered discs may migrate cranially or caudally.	☐	☐

Doctor's particulars:

Name in full: _____

MCR number: _____ Specialty: _____

Email address: _____

SUBMISSION INSTRUCTIONS:
(1) Log on at the SMJ website: http://www.sma.org.sg/cme/smj and select the appropriate set of questions. (2) Select your answers and provide your name, email address and MCR number. Click on "Submit answers" to submit.

RESULTS:
(1) Answers will be published in the SMJ September 2009 issue. (2) The MCR numbers of successful candidates will be posted online at www.sma.org.sg/cme/smj by 15 October 2009. (3) All online submissions will receive an automatic email acknowledgment. (4) Passing mark is 60%. No mark will be deducted for incorrect answers. (5) The SMJ editorial office will submit the list of successful candidates to the Singapore Medical Council.

Deadline for submission: (August 2009 SMJ 3B CME programme): 12 noon, 7 October 2009.