

# *Osteoporotic insufficiency fractures of the pelvis*

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### Abstract

Insufficiency fractures are a subtype of stress fractures which occur when normal or physiological stresses are placed on weakened bone. The main predisposing cause is osteoporosis. The clinical and radiological features of two elderly women with pelvic insufficiency fractures are described. Isotope bone scan is the most sensitive imaging modality for the detection of these fractures. Computed tomography is useful for confirming these fractures and excluding malignancy. As pelvic insufficiency fractures are difficult to detect clinically, application of the appropriate radiological investigation is necessary for diagnosis. With early recognition of this entity, the patient could be managed appropriately, thus avoiding any unnecessary invasive investigations.

*Keywords:* Insufficiency fractures; Osteoporosis; Parasymphseal fractures; Pelvic fractures; Sacral fractures; Sacrum radionuclide studies; Stress fractures

Insufficiency fractures of the pelvis have become an increasingly recognized entity in the last decade.<sup>1-4</sup> It occurs mainly in post-menopausal women with osteoporosis, often without a significant history of preceding trauma.<sup>1,5-7</sup> Its incidence was noted in a recent study to be approximately five percent in females over 50 years of age.<sup>8</sup> Because of its rather non-specific signs and symptoms and the lack of general awareness of this condition, the diagnosis of this entity may be elusive. However, application of the appropriate radiological investigations should lead to the correct diagnosis. We present here the clinical and radiological features of pelvic insufficiency fractures via two illustrative cases.

### Illustrative Cases

#### Case 1

A 69-year-old Chinese female presented with severe low back pain for one month. There was no history of recent trauma. She was unable to walk because of severe pain. Total cystectomy and hysterectomy were performed for bladder carcinoma one and a half years ago. Nine months later, she developed vaginal vault recurrence and received a six-week course of external pelvic radiotherapy. On examination, the patient had localized tenderness over the right sacrum. There was no limitation of hip or lower limb movement, nor any neurological deficit.

Plain radiographs of the lumbo-sacral spine and pelvis showed moderate osteoporosis, but no fracture was demonstrated. Technetium (Tc)-99m methylene diphosphonate (MDP) bone scan showed intense uptake in the sacrum, in a butterfly or H-shaped pattern (Fig. 1). There was no other focal area of increased uptake elsewhere to suggest a metastatic lesion. Computed tomography (CT) scan demonstrated linear cortical breaks, with marginal sclerosis, extending vertically through both sacral ala, consistent with insufficiency fractures (Fig. 2). There was no soft tissue pelvic mass or bony osteolysis.

The patient had bed rest initially and was treated

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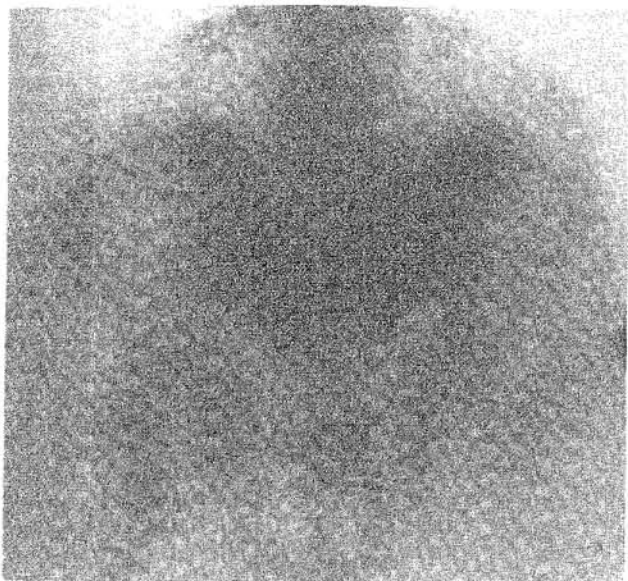
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**Fig. 1.** Case 1. Tc-99m MDP bone scan (posterior projection) at 3 hours shows intense increased sacral uptake in a butterfly shaped pattern.

with analgesics and physiotherapy. She recovered to the extent of being pain free and mobile after two months.

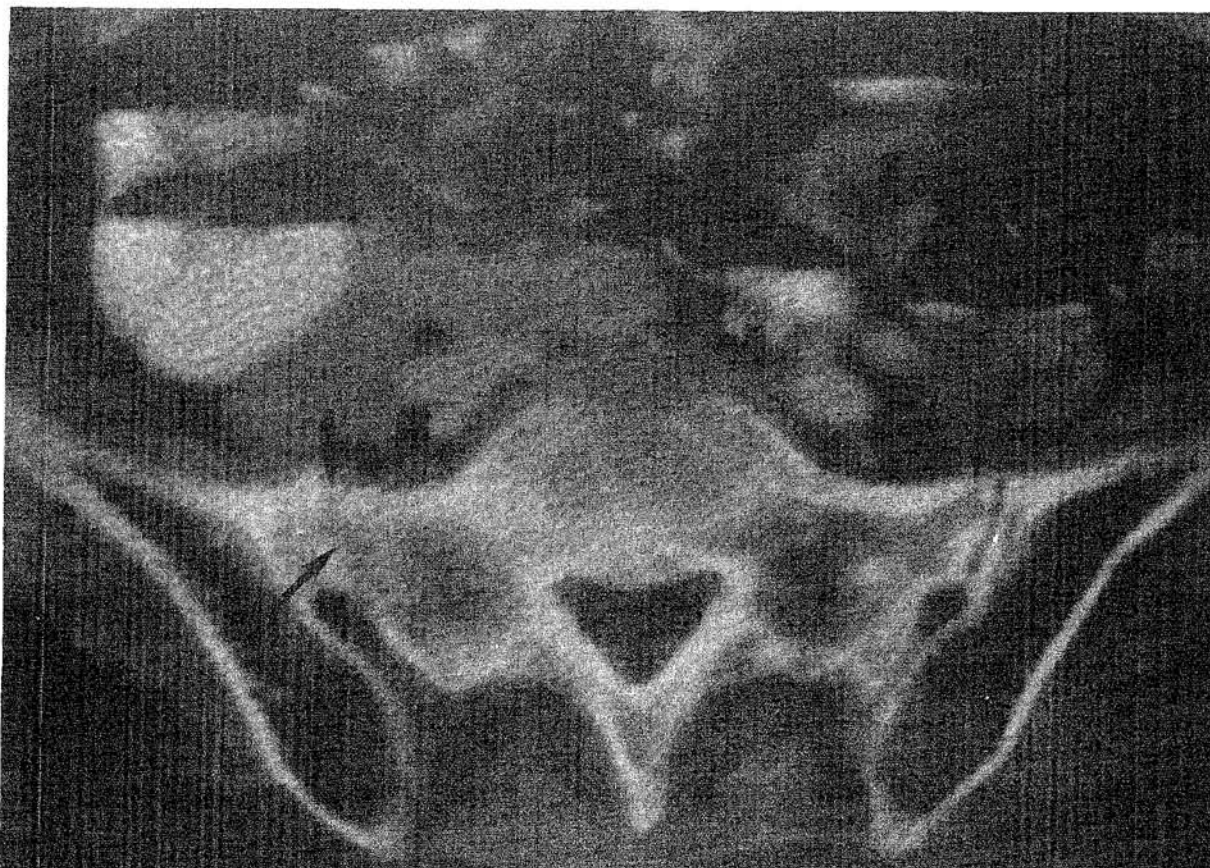
#### Case 2

A 62-year-old Chinese female presented with insidious onset of pain over the pubic symphysis for one and a half months. It was severe enough to affect her ability to walk. There was no recent trauma. Physical examination was negative.

Plain radiograph of the pelvis revealed generalized osteoporosis. There was an aggressive looking, sclerotic-lytic lesion in the right parasymphyseal area (Fig. 3). Tc-99m MDP isotope bone scan demonstrated a wedge-shaped area of uptake over the right sacrum with another area of focal uptake in the right parasymphyseal region, corresponding to the lesion seen on the plain radiograph (Fig. 4).

This combination of lesions was consistent with the diagnosis of concomitant sacral and parasymphyseal insufficiency fractures.

The patient was managed with bed rest, analgesics and physiotherapy. She recovered completely within one month.



**Fig. 2.** Case 1. CT of the sacrum shows anterior cortical breaks bilaterally (arrows), with the right ala fracture seen more clearly on this image.

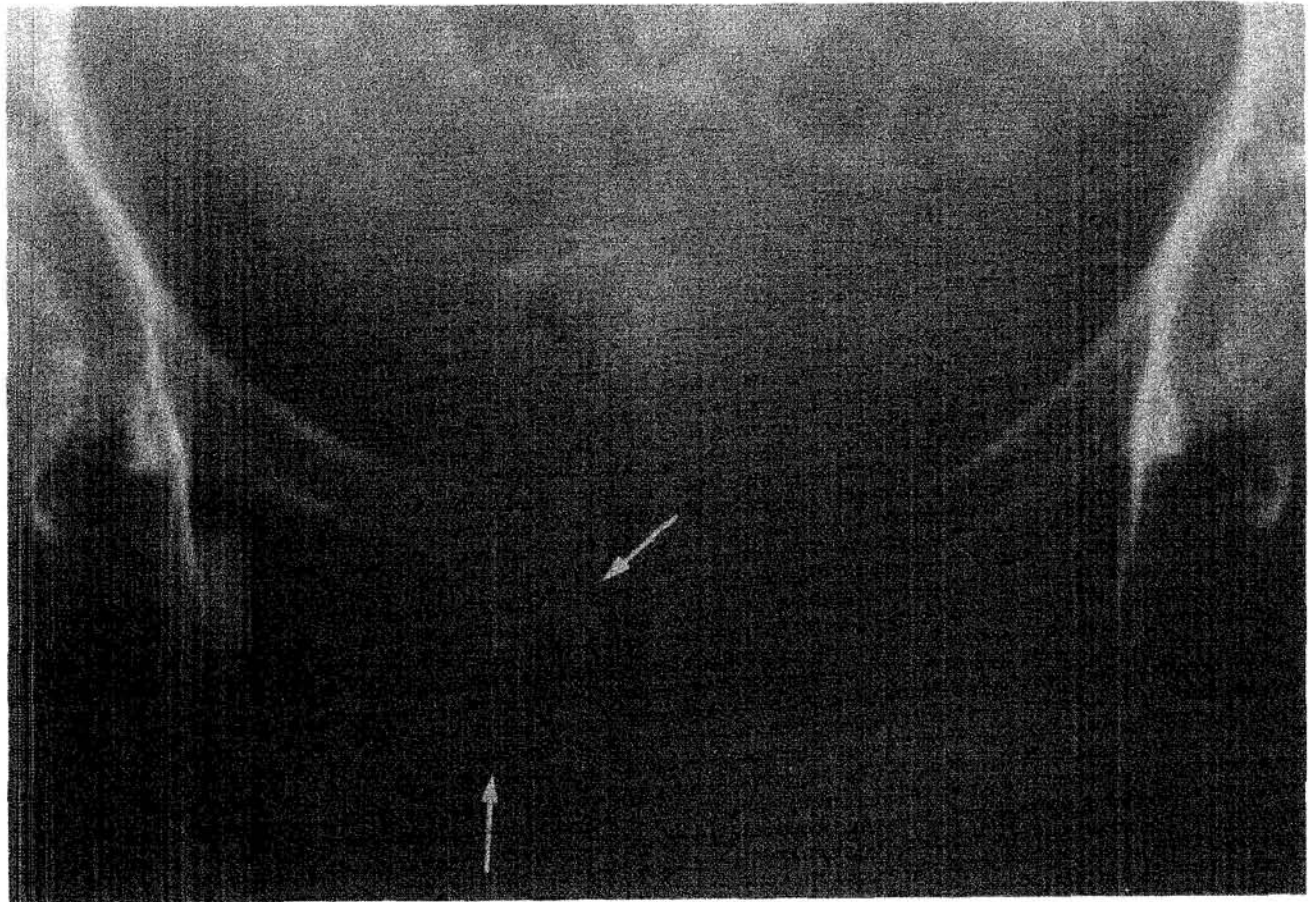


Fig. 3. Case 2. Plain radiograph shows a right parasymphyseal linear lytic lesion with surrounding sclerosis (arrows).

## Discussion

Insufficiency fracture is a subtype of stress fracture which occurs when normal or physiological stresses are placed on weakened bone.<sup>1</sup> The predisposing factors include post-menopausal osteoporosis, pelvic irradiation, previous hip replacement, long term cortico steroid therapy, rheumatoid arthritis and other metabolic bone diseases, with osteoporosis being the common denominator.<sup>9</sup> It has recently been suggested that large bony defects in the sacrum, such as Tarlov cysts, may be an additional predisposing factor.<sup>10</sup> In our patients, the risk factor in both cases was post-menopausal osteoporosis, with pelvic irradiation being an additional risk factor in Case 1. The typical sites for pelvic insufficiency fractures are the sacrum and parasymphyseal part of the pubis.<sup>6,7,11</sup> Other sites include the supra-acetabular region,<sup>6,12</sup> and in the blade of the iliac bone.<sup>6,15</sup>

Low back pain<sup>2,4,5,14</sup> is the most common presenting symptom. There is usually no history of significant trauma. The patient may also present with pain in the groin, buttock, hip, or perineum.<sup>5,7</sup> Less frequently, the patient may have radiculopathy.<sup>3,11</sup> As illustrated in our two cases, the pain is often so severe that the patient has difficulty in walking.<sup>1,11</sup> Physical exami-

nation is usually non-specific.<sup>5,7</sup> There may be some local tenderness or mild limitation of spinal or hip movement due to pain. Neurological examination is usually normal. At this stage of clinical assessment,

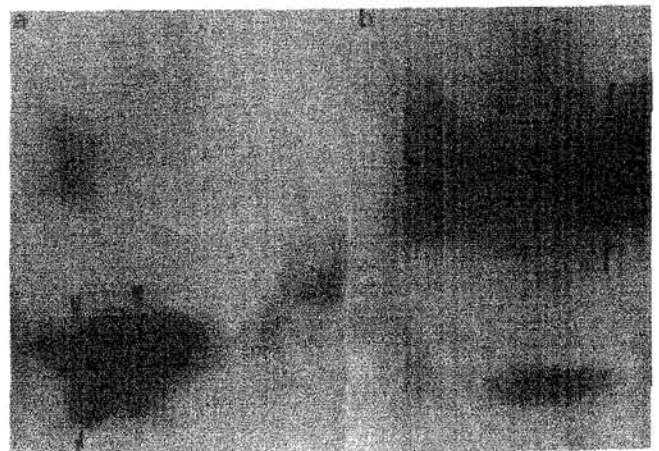


Fig. 4. Case 2. Tc-99m MDP bone scan (3 hours). (a) Anterior projection shows increased focal uptake at the site of the right para symphyseal lesion (arrows). Residual urine is present within the bladder (arrowheads). (b) Posterior projection shows a band-like area of increased uptake over the right sacral ala (arrows).

the clinician usually requires further imaging investigations.

Plain radiographs are usually unhelpful or even misleading.<sup>5,7,11</sup> Sacral fractures may occasionally be seen as broad and poorly defined vertical bands of sclerosis, cortical disruption or a vertical fracture line in the sacral ala.<sup>5,6</sup> The sacrum, however, usually appears normal, or is obscured by overlying bowel gas or vascular calcification. Parasymphyseal fractures, in contrast, have a varied and even aggressive appearance. Depending on the stage of its development or healing, the fracture may be seen as a poorly defined vertical linear area through the body of the pubis, a mixed lytic-sclerotic lesion or a combination together with florid callus formation. Not surprisingly, these lesions were mistaken for malignant tumours in the past and were often unnecessarily biopsied.<sup>1,6,7,15-17</sup>

Tc-99m MDP isotope bone scan is the most sensitive method for detecting occult pelvic insufficiency fractures and is the investigation of choice when this entity is suspected. The typical butterfly or H-shaped pattern, produced by areas of vertical uptake within the sacral alae with a transverse band-like component across the body of the sacrum, is considered diagnostic (Case 1). Other patterns include a partial butterfly pattern involving a single sacral ala with or without a central bar (Case 2),<sup>5,6</sup> bilateral vertical areas of uptake in the sacral alae without a central bar,<sup>6,7</sup> and the linear dot pattern seen as a series of focal areas of uptake across the inferior part of the body of the sacrum.<sup>14</sup> Parasymphyseal fractures are demonstrated as vertical areas of uptake in the body of the pubis adjacent to the symphysis.<sup>1,6</sup> Concurrent sacral and parasymphyseal fractures are a well recognized association.<sup>6,9,11,14,15</sup> Supra-acetabular and iliac fractures are much less common and are seen as areas of uptake in the supra-acetabular,<sup>12</sup> oblique and supero-medial iliac regions.<sup>13</sup>

CT should be reserved for confirming the diagnosis in doubtful cases,<sup>6,11</sup> where the isotope bone scan pattern is not typical. It is also useful in excluding malignant bony lesions,<sup>7,9,18</sup> and detecting large bony defects.<sup>10</sup> Axial CT scans demonstrate vertical fractures of the sacral ala well but not the horizontal component of the H-shaped fracture, which may be missed as it lies in the scan plane. Direct coronal CT will show the transverse sacral fracture optimally. Magnetic resonance imaging (MRI) is sensitive but not specific in the detection of pelvic insufficiency fractures.<sup>4,19</sup> On T1-weighted sequences, sacral insufficiency fractures appear as bands of decreased signal intensity. Its exact role in the investigation of pelvic insufficiency fractures is unclear at present.

Patients invariably recover with the appropriate conservative treatment which, in past studies, consisted of moderation of activity and bed rest.<sup>1,4,10,20</sup> As prolonged bed rest may lead to further bony

demineralization, management should be directed towards rapid pain relief and fracture healing, allowing early mobilization. Addition of subcutaneous calcitonin may be helpful.<sup>20</sup>

In our experience at Queen Mary Hospital, 21 patients with pelvic insufficiency fractures were diagnosed radiologically over a 36 month period from August 1990 to July 1993.<sup>21</sup> We suspect that the local prevalence may even be higher, especially with the increased awareness of this condition among clinicians. The diagnosis should be suspected in post-menopausal women presenting with severe low back or buttock pain, but having little or no positive physical signs. A characteristic scintigraphic appearance is diagnostic, with selective use of CT for confirming the diagnosis in equivocal scintigrams. Early diagnosis with the appropriate therapy will reduce patient morbidity, which may occur when this entity is not recognized. On the other hand, an erroneous diagnosis of malignancy may result in unnecessary and invasive investigations.

## References

1. Casey D, Mirra J, Staple TW. Parasymphyseal insufficiency fractures of the os pubis. *AJR* 1984; 142: 581-6.
2. Lourie H. Spontaneous osteoporotic fracture of the sacrum. An unrecognized syndrome of the elderly. *JAMA* 1982; 248: 715-7.
3. Ries T. Detection of osteoporotic sacral fractures with radionuclides. *Radiology* 1983; 146: 783-5.
4. Newhouse KE, El-Khoury GY, Buckwalter JA. Occult sacral fractures in osteopaenic patients. *J Bone Joint Surg* 1992; 74A: 1472-7.
5. Schneider R, Yacovone J, Ghelman B. Unsuspected sacral fractures: detection by radionuclide bone scanning. *AJR* 1985; 144: 337-41.
6. Davies AM, Evans NS, Struthers GR. Parasymphyseal and associated insufficiency fractures of the pelvis and sacrum. *Br J Radiol* 1988; 61: 103-8.
7. Hauge MD, Cooper KL, Litin SC. Insufficiency fractures of the pelvis that simulate metastatic disease. *Mayo Clin Proc* 1988; 63: 807-12.
8. Abe H, Nakamura M, Takahashi S, Maruoka S, Ogawa Y, Sakamoto K. Radiation induced insufficiency fractures of the pelvis. *AJR* 1992; 158: 599-602.
9. Davies AM. Stress lesions of bone. *Current Imaging* 1990; 2: 209-16.
10. Peh WCG, Evans NS. Tarlov cysts — another cause of sacral insufficiency fractures? *Clin Radiol* 1992; 46: 329-30.
11. Cooper KL, Beabout JW, Swee RG. Insufficiency fractures of the sacrum. *Radiology* 1985; 156: 15-20.
12. Cooper KL, Beabout JW, McLeod RA. Supra-acetabular insufficiency fractures. *Radiology* 1985; 157: 15-7.
13. Davies AM, Bradley SA. Iliac insufficiency fractures. *Br J Radiol* 1991; 64: 305-9.
14. Balseiro J, Brower AC, Ziessman HA. Scintigraphic diagnosis of sacral fractures. *AJR* 1987; 148: 111-3.
15. De Smet AA, Neff JR. Pubic and sacral insufficiency fractures: clinical course and radiologic findings. *AJR* 1985; 145: 601-6.

16. Goergen TG, Resnick D, Riley RR. Post-traumatic abnormalities of the pubic bone simulating malignancy. *Radiology* 1978; 126: 85-7.
17. Hall FM, Goldberg RP, Kasdon EJ, Glick H. Post-traumatic osteolysis of the pubic bone simulating a malignant lesion. *J Bone Joint Surg* 1984; 66A: 121-6.
18. Lundin S, Bjorkholm E, Lundell M, Jacobsson H. Insufficiency fractures of the sacrum after radiotherapy for gynaecological malignancy. *Acta Oncol* 1990; 29: 211-5.
19. Brahme SK, Cervilla V, Vint V, Cooper K, Kortman K, Resnick D. Magnetic resonance appearance of sacral insufficiency fractures. *Skel Radiol* 1990; 19: 489-93.
20. Peh WCG, Gough AKS, Sheeran T, Evans NS, Emery P. Pelvic insufficiency fractures in rheumatoid arthritis. *Br J Rheumatol* 1993; 32: 319-24.
21. Peh WCG, Khong PL, Ho WY, Yeung HWD, Luk KDK. Sacral insufficiency fractures. Spectrum of radiological features. *Clin Imaging* (in press).