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Fracture Originated at the Tip of Heterotopic Ossification of Femur by Minor External Force
: Report of Two Cases

Fracture of femur without evidence of severe osteoporosis rarely occurs as a result of minor external force such as a gentle passive or an active range of motion exercises. We report two cases of femoral shaft fracture occurred at the tip of heterotopic ossification of femur by a minor external force, in which the involved femur shows no evidence of remarkable osteoporosis. The possible mechanism inferred by authors is as follows: 1) heterotopic ossification limits range of motion of the hip joint; 2) a new lever arm is formed at the tip of heterotopic ossification where energy can be concentrated; 3) therefore, fractures develop even by a minor external force. Search for similar cases and further discussions on possible mechanisms and prevention of femoral fractures in patients with heterotopic ossification will be necessary.

Key Words : *Fractures; Ossification, heterotopic; Femur*

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INTRODUCTION

Heterotopic ossification (HO) occurs following head or spinal cord injuries, total hip arthroplasty, or internal fixation of acetabular fractures (1-4). Fracture of femur without evidence of severe osteoporosis rarely occurs by a minor external force such as a gentle passive or an active range of motion (ROM) exercises.

We experienced two cases of femoral shaft fracture occurred at the tip of HO of the femur as a result of minor external force. The involved femur shows no evidence of remarkable osteoporosis. Herewith, we report these two cases and present possible mechanisms inferred by authors.

CASE REPORT

Case 1

The patient was a 44 year-old male who had left hemiplegia with right intracranial hemorrhage due to Moyamoya disease of onset in February 1994. During the rehabilitational course, multiple heterotopic ossification developed at the left hip, left shoulder and both knees which was diagnosed by a simple radiography and three phase bone scan (Fig. 1A). Osteoporosis of the left femur was not remarkable on a simple radiography. The level of alkaline phosphatase was 140-150 U/L (normal<130 U/L) at the time of fracture. He was spastic and graded 2 by the modified Ashworth scale. The range of motion of left hip was 0°-90° for flexion, 0°-10° for extension, and 0°-30° for abduction. The patient had passive range of motion exercises for the major joints of hemiplegic side. He did not take any oral medications for the treatments of heterotopic ossifications. While sitting up from a mat with the help of a physical therapist in December 1996, spiral fracture occurred at the tip of heterotopic ossification of the left femur (Fig. 1B, C). The patient underwent an open reduction and internal fixation with intramedullary nail for the treatment of fracture.

Case 2

The second case was a 30 year-old male with T8 complete spinal cord injury due to fracture of 8^{th} and 9^{th} thoracic spine in a traffic accident in December 1996. Heterotopic ossifications occurred in both hips which was confirmed by a simple radiography and three phase bone

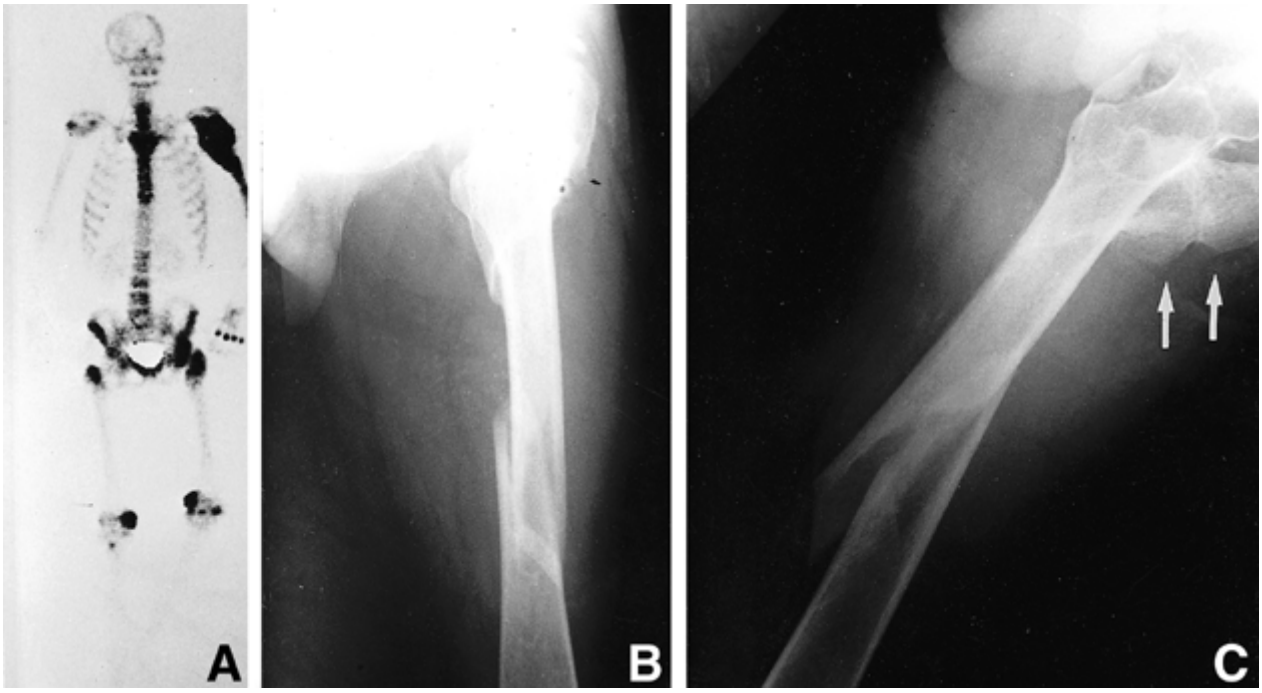

Fig. 1. (A) Pre-fracture whole body bone scan finding of case 1 shows multiple hot uptakes in the left side of body including left hip. (B, C) Simple radiographic finding of case 1 shows spiral fracture occurred at the tip of heterotopic ossification (arrows) of the left femur which shows relatively thick cortex.

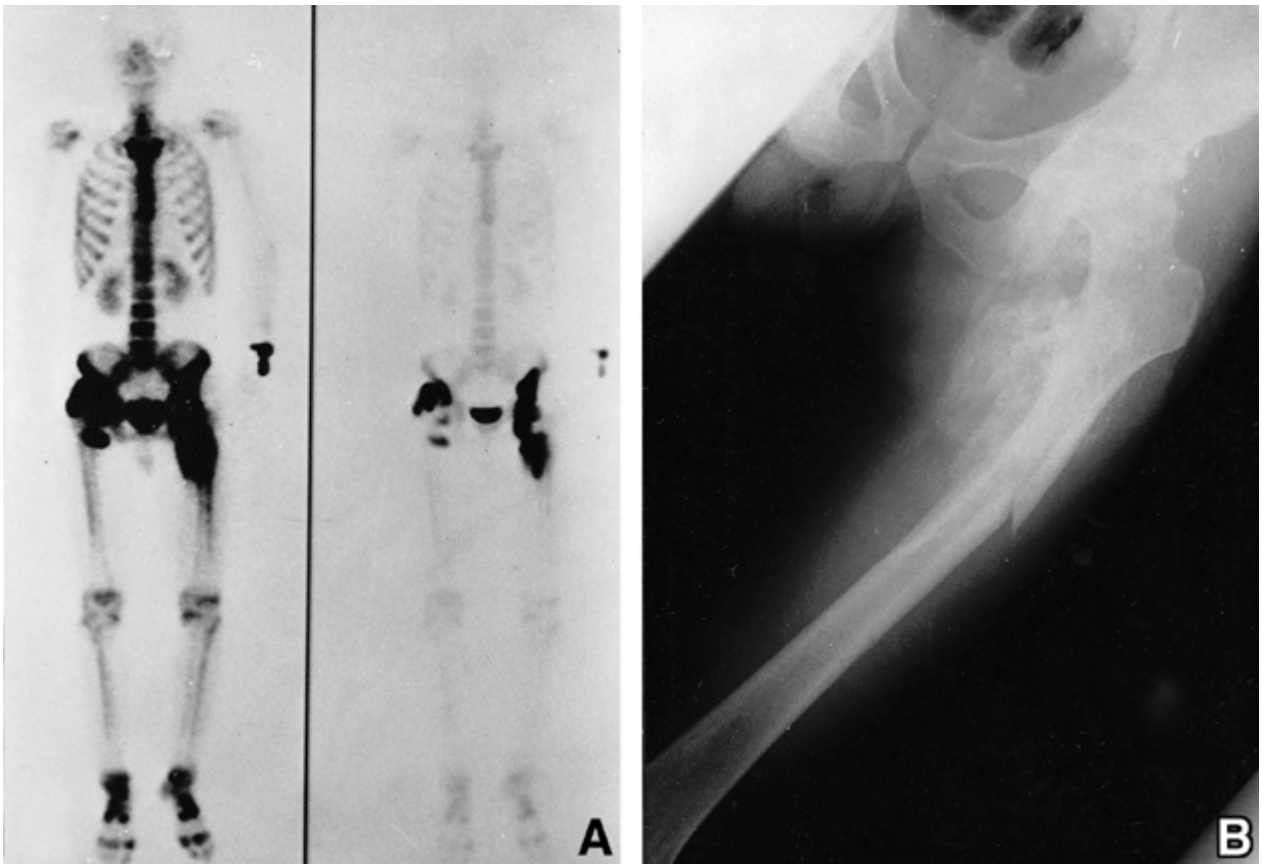

Fig. 2. (A) Pre-fracture whole body bone scan finding of case 2 shows hot uptakes in both hip. (B) Simple radiographic finding of case 2 shows fracture occurred at the tip of heterotopic ossification of the left femur which shows relatively thick cortex.

scan (Fig. 2A). Osteoporosis was not obvious in both femurs. He was spastic in both lower extremities and graded 2 by the modified Ashworth scale. The range of motion of both lower extremities was passively full except 0°-80° for the right hip flexion and 0°-70° for the left hip flexion. The level of alkaline phosphatase was high as 349 U/L and then declined to 174 U/L. He was not treated with oral medication for the heterotopic ossifications though he continued to receive passive range of motion exercises for both lower extremities. In April 1997, while stretching during his range of motion exercises for the hips in a long sitting posture, a fracture occurred at the tip of heterotopic ossification of left femur. He underwent open reduction and internal fixation with a plate for the fractured femur with a partial resection of heterotopic ossification.

DISCUSSION

According to our literature review, these seem to be the first report of femoral shaft fractures occurred at the tip of HO as a result of minor external force without evidence of obvious osteoporosis of the femur.

There have been arguments about exercise programs for HO. It has been accepted that HO requires aggressive passive ROM exercises for prevention of the ankylosis that severely limits activities of daily living; rest may well increase the joint motion limitations (5-10). On the other hand, there have been some reports indicative of a possible traumatic origin of heterotopic ossification such as forcible passive movement of paralytic legs (11, 12).

From these two case, we experienced that minor external force such as a gentle passive ROM exercise or a transfer activity could cause fracture at the end of HO, which needed surgery and prolonged hospital stay. Whether forceful passive ROM exercises are the cause of HO in some cases or not, we think that aggressive passive ROM exercise may not be the standard of exercises for HO.

In these two cases, fractured femurs were in the paralyzed legs and they could have mild osteoporosis when compared with non-paralyzed person. But, at least, simple radiograph showed thick cortex of the fractured femurs and did not show remarkable osteoporosis. Consequently, it was not likely that the fractures in these two cases were caused by minor external force due to osteoporosis.

The possible mechanism inferred by authors is as follows: 1) heterotopic ossification limits range of motion of the hip joint (1-6, 13, 14); 2) a new lever arm is formed at the tip of heterotopic ossification where energy can be concentrated; 3) therefore, fractures can develop even by a minor external force.

Search for similar cases and further discussions on possible mechanisms and a prevention of femoral fractures in patients with heterotopic ossifications will be necessary.

REFERENCES

1. Botte MJ, Keenan MA, Abrams RA, von Schroeder HP, Gellman H, Mooney V. *Heterotopic ossification in neuromuscular disorders. Orthopedics 1997; 20: 335-41.*
2. Bergman SB, Yarkony GM, Stiens SA. *Spinal cord injury rehabilitation. 2. Medical complications. Arch Phys Med Rehabil 1997; 78(3 Suppl): 53-8.*
3. Naraghi FF, DeCoster TA, Moneim MS, Miller RA, Rivero D. *Heterotopic ossification. Orthopedics 1996; 19: 145-51.*
4. Singer BR. *Heterotopic ossification. Br J Hosp Med 1993; 47: 247-51.*
5. Yarkony GM, Chen D. *Rehabilitation of patients with spinal cord injuries. In: Braddom RL, ed. Physical medicine & rehabilitation. Philadelphia: W.B. Saunders, 1996: 1149-79.*
6. Freed MM. *Traumatic and congenital lesions of the spinal cord. In: Kottke FJ, Lehmann JF, eds. Krusen's handbook of physical medicine and rehabilitation. Philadelphia: W.B. Saunders, 1990: 717-48.*
7. Subbarao JV. *Pseudoarthrosis in heterotopic ossification in spinal cord-injured patients. Am J Phys Med Rehabil 1990; 69: 88-90.*
8. An HS, Ebraheim N, Kim K, Jackson WT, Kane JT. *Heterotopic ossification and pseudoarthrosis in the shoulder following encephalitis: a case report and review of the literature. Clin Orthop 1987; 219: 291-8.*
9. Garland DE, Razza BE, Waters RL. *Forceful joint manipulation in head-injured adults with heterotopic ossification. Clin Orthop 1982; 169: 133-8.*
10. Stover SL, Hataway CJ, Zeiger HE. *Heterotopic ossification in spinal cord-injured patients. Arch Phys Med Rehabil 1975; 56: 199-204.*
11. Snoecx M, De Muynck M, Van Laere M. *Association between muscle trauma and heterotopic ossification in spinal cord injured patients: reflections on their causal relationship and the diagnostic value of ultrasonography. Paraplegia 1995; 33: 464-8.*
12. Izumi K. *Study of ectopic bone formation in experimental spinal cord injured rabbits. Paraplegia 1983; 21: 351-63.*
13. Nicholas JJ. *Ectopic bone formation in patients with spinal cord injury. Arch Phys Med Rehabil 1973; 54: 354-9.*
14. Wharton GW. *Heterotopic ossification. Clin Orthop 1975; 112: 142-9.*