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CASE REPORT

Effective treatment of delayed union of a lumbar vertebral fracture with daily administration of teriparatide in a patient with diffuse idiopathic skeletal hyperostosis

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Abstract
Introduction We herein describe a case of delayed union of a lumbar spine fracture in a 70-year-old patient with diffuse idiopathic skeletal hyperostosis (DISH).
Clinical Course and Result Because he decided not to undergo surgical treatment, we provided conservative treatment with teriparatide (TPTD). Union was obtained in 2 months, and no adverse events were observed during treatment. Six months after starting the TPTD, further bone formation was observed and the lumbar instability had resolved.
Conclusion This is the first report of successful use of TPTD to treat delayed union of a spine fracture in a patient with DISH without surgical intervention.

Keywords Diffuse idiopathic skeletal hyperostosis · Lumbar spine · Vertebral fracture · Delayed union · Teriparatide

Case report

A 70-year-old man arrived at the emergency room by ambulance with a 1-day history of lower back pain and fever. He had fallen several times during the past 3 weeks. His medical history included a complete thoracic spinal cord injury with associated complete paraplegia and left femoral neck fracture at the age of 50 years and myocardial infarction at the age of 68 years. On physical examination, his blood pressure was 136/80 mmHg, pulse was regular at 76/min, respiratory rate was 20 breaths/min, and temperature was 38.5 °C. The patient exhibited lower back pain. Spinal percussion pain was noted at the L2–3 level, and tenderness of the paravertebral muscles was present. Laboratory data indicated the presence of an inflammatory reaction (C-reactive protein level, 35.4 mg/dL; white blood cell count, 16,100/μL) and acute renal failure (blood urea nitrogen level, 51.6 mg/dL; creatinine level, 1.59 mg/dL). Plain X-rays and computed tomography images suggested a bone defect of the L2 vertebral body and diffuse idiopathic skeletal hyperostosis (DISH) from the thoracic to lumbar spine (Fig. 1). Magnetic resonance imaging showed high-intensity T1- and T2-weighted changes in the L2 vertebral body (Fig. 2). Based on these findings, we suspected pyogenic spondylitis, a metastatic spinal tumor, or delayed union of a spinal fracture.

Biopsy of the L2 vertebral body was performed on the second day of hospitalization, and neither infection nor neoplastic disease was detected. The patient was therefore diagnosed with delayed union of an L2 fracture with DISH. Bacteria were detected by urinalysis, and his high body temperature indicated a urinary tract infection. Medical treatment was started with antibiotics. Although operative treatment was considered because of his severe lower back pain, the patient had complete paraplegia, diabetes mellitus, and an old myocardial infarction; therefore, he and his family decided not to undergo surgical treatment. We thus performed conservative treatment using teriparatide (TPTD). The patient was equipped with a frame corset, and administration of daily TPTD was started 2 weeks after hospitalization. As shown in Fig. 3, callus formation was

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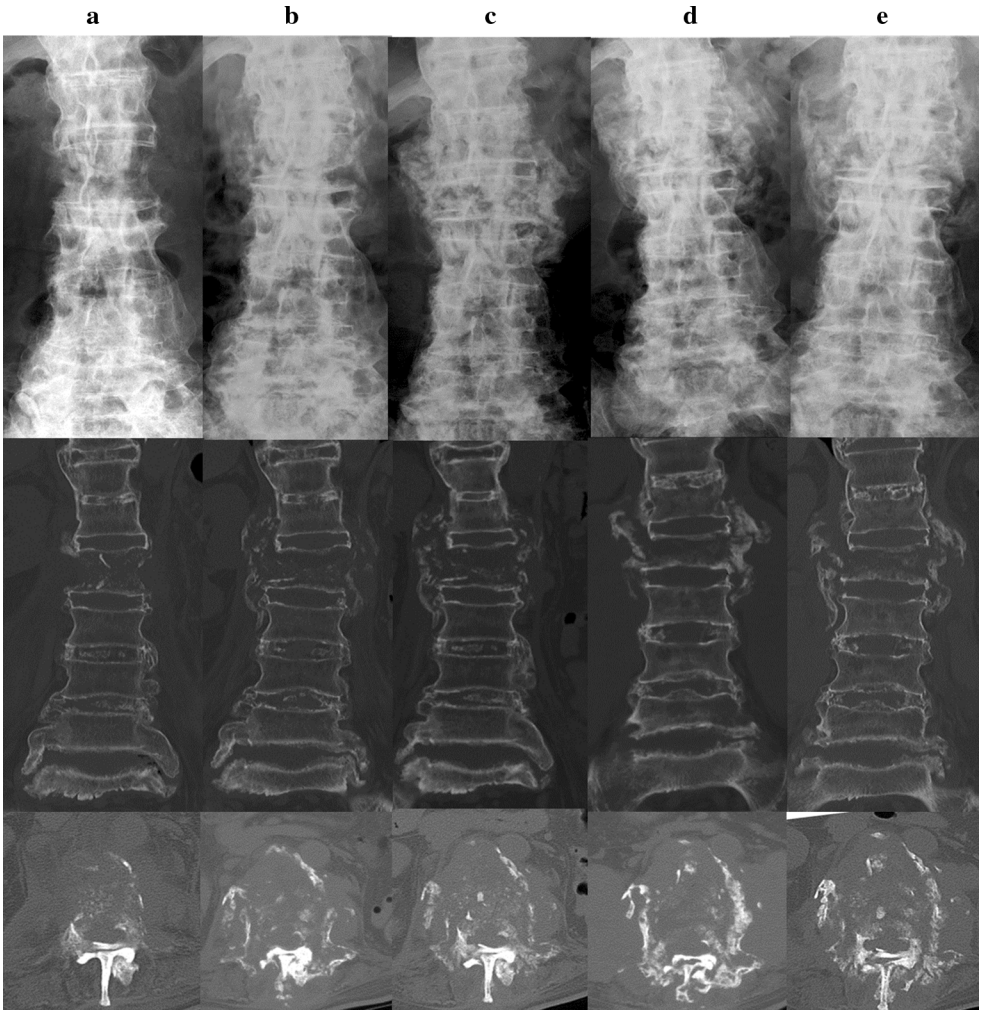

Fig. 1 Plain X-rays and computed tomography images **a** upon admission and after **b** 3 weeks, **c** 2 months, **d** 4 months, and **e** 6 months of daily administration of TPTD. Bone formation is evident after consecutive daily administration of TPTD

observed 3 weeks after starting treatment with TPTD, and the patient's lower back pain gradually disappeared. After 2 months, hyperplastic bone formation was observed involving the circumference of the L2 vertebral body (Fig. 1), and the patient regained a physical activity level close to that before hospitalization. Six months after beginning the TPTD treatment, further bone formation was observed (Figs. 1, 3), and his lumbar instability had resolved. He was finally able to return to his home life.

The visual analog pain [1] score and level of function (using the Barthel Index) [2] were assessed on admission, and after 3 weeks, 2 months, and 6 months of daily administration of TPTD. Pain decreased from 86 mm on admission to 30 mm after 3 weeks, 20 mm after 2 months, and 11 mm after 6 months. The Barthel Index increased from 10 on admission to 15 after 3 weeks and 20 after both 2 and 6 months. An 87 % reduction in the pain score and a 100 % improvement in the function score were noted after 6 months of daily administration of TPTD. This case indicates the efficacy of daily administration of TPTD to conservatively treat delayed union of a vertebral fracture in a patient with DISH. Surgical treatment was not performed because the patient had complete paraplegia and various medical complications.

Considerations

Resnick and Niwayama [3] coined the term "diffuse idiopathic skeletal hyperostosis" (DISH), which is currently widely used. DISH is a systemic noninflammatory disease characterized by ossification of the entheses, which are the bony attachment of tendons, ligaments, and joint capsules [3]. DISH is a systemic condition involving ossification and calcification of ligaments and entheses. This condition is observed on all continents and in all races, but most commonly affects men over 50 years of age [4].

Although DISH is asymptomatic in most individuals, it often indicates the presence of underlying metabolic

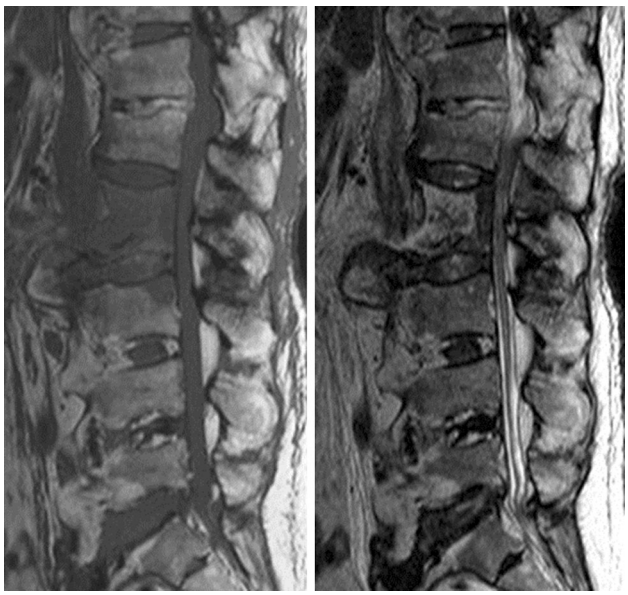

Fig. 2 Magnetic resonance imaging shows high-intensity T1- and T2-weighted changes in the L2 vertebral body

disease. Furthermore, spinal or extra-spinal ossification can sometimes lead to pain, stiffness, a reduced range of articular motion, and dysphagia and may increase the risk of unstable spinal fractures. Internal fixation of spinal fractures in patients with DISH should be performed in the early stage. Surgical rather than conservative treatment is recommended for thoracolumbar vertebral fractures in patients with DISH based on the incidence of complications and the prognosis of such fractures [5].

As previously reported, TPTD reduces the risk of fracture in postmenopausal women with osteoporosis [6–12]. Additionally, the efficacy of TPTD on human osteoporosis has been established, and several reports have suggested its preventive and analgesic effects for osteoporosis-derived spinal compression fractures [13–15]. TPTD is the only currently marketed agent indicated for use in postmenopausal women with osteoporosis who have a high risk or history of osteoporotic fracture, patients with multiple risk factors for fracture, and patients who have undergone failed treatment with or are intolerant to other available osteoporosis therapies. Much attention has been given to administration of TPTD for fracture repair, particularly to nonunion and delayed union. As previously reported, TPTD is useful for the treatment of delayed union of odontoid fractures [16], periprosthetic fractures [17], distal metaphysical femoral fractures [18], atypical subtrochanteric femur fractures [19], olecranon fractures [20], sternal fractures [21], and femoral neck fractures [22].

A recent report described TPTD treatment for spine fractures in patients with DISH [23]; however, it focused on fresh fractures, not delayed union. Surgical treatment is recommended for vertebral fractures in patients with DISH [5]. In the present study, we described the successful treatment of a lumbar spine fracture with delayed union in a patient with DISH using daily administration of TPTD.

Conclusions

This is the first report of the successful use of TPTD to treat delayed union of a spinal fracture in a patient with DISH without surgical intervention. Although we described only one patient, the present case may suggest an advantage of

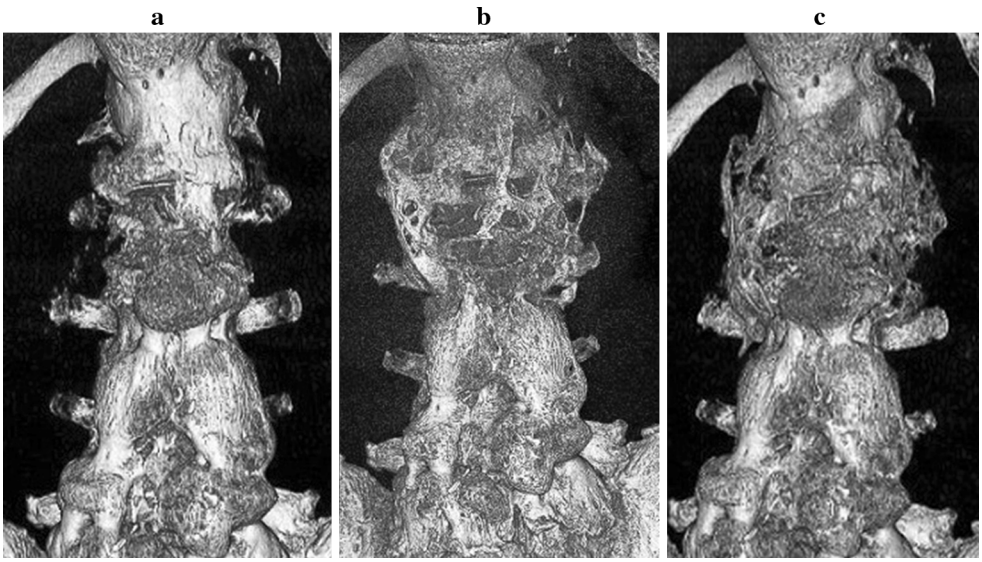

Fig. 3 Three-dimensional computed tomography shows bone formation around the vertebral body. **a** Upon admission and after **b** 3 weeks and **c** 6 months of daily administration of TPTD

administration of TPTD for treating delayed union of spinal fractures in patients with DISH.

Conflict of interest None.

Ethical statement This manuscript was approved by the ethics committee of our institution. The study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

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