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Case Report

# Bilateral Multiple Metacarpal Head Avascular Necrosis: A Case Report

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**Avascular necrosis of the metacarpal head is a rare disease. We herein report a case with varying degrees of lesions in the third and fourth metacarpal heads of the right hand and the third metacarpal head of the left hand. The patient was a 37-year-old male right-handed mechanical worker who presented with persistent dull pain in the right hand after labor work for more than a year. The 3 lesions in this patient were treated differently based on their clinical imaging manifestations. The neurologic function of the right hand recovered by the 18-month follow-up; only a slight limitation remained in the right middle finger. This is the first report of 1 patent who received 2 different treatment methods simultaneously and both provided a satisfactory clinical result.**

*Key words:* Avascular necrosis – Dietrich's disease – Metacarpal head

## Case Report

A 37-year-old male right-handed mechanical worker presented with persistent dull pain in the right hand after labor work for more than a year. The patient was an amateur boxer. A physical examination showed slight swelling and tenderness on the dorsal side of third and fourth metacarpophalangeal joints of the right hand. He had normal range of motion in the fourth metacarpophalangeal joint of the right hand, but it was limited in the third metacarpophalangeal joint; the maximum flexion angle was 60°, with full extension. The patient had no history of rheumatism, and erythrocyte sedimentation rate, C-reactive protein level, and blood coagulation parameters were within normal limits.

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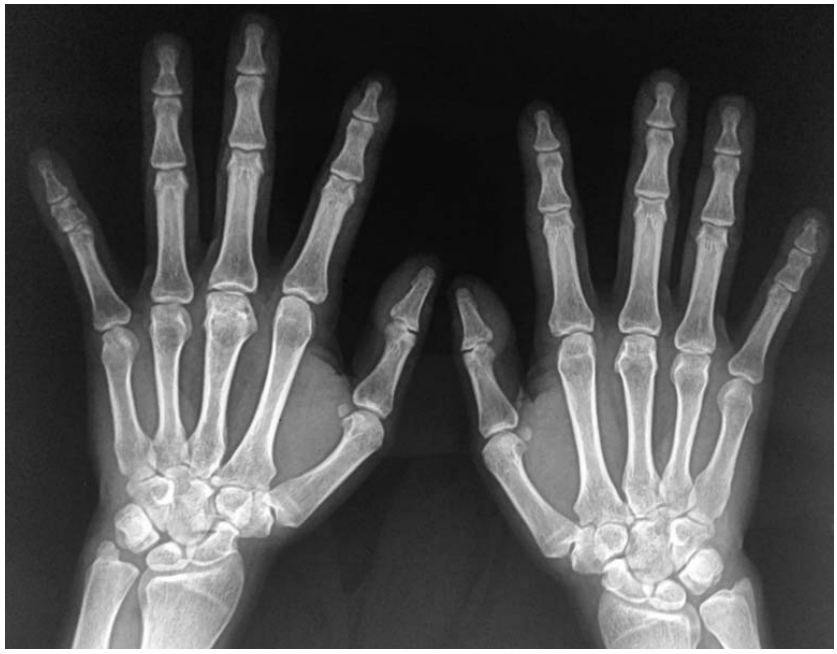

**Fig. 1** X-ray examination in 2011. Flattening of the left-hand third metacarpal head and the right-hand third and fourth metacarpal heads with focal bone sclerosis is present.

One year previously, radiographic examination revealed that the left-hand third metacarpal head was flattened and that the right-hand third and fourth metacarpal heads exhibited subchondral bone sclerosis (Fig. 1). Magnetic resonance imaging (MRI) showed that the right-hand fourth metacarpal head was flattened, and the third metacarpal head exhibited T1-low and T2-high areas (Fig. 2). The patient received no treatment for 1 year and visited our hospital because of pain aggravation.

After hospitalization, an initial X-ray examination revealed sacculiform bone destruction in the third metacarpal heads with adjacent bone sclerosis in both hands; these findings were more apparent in the right hand. The right-hand third metacarpal head was flattened (Fig. 3a). Subsequent computed tomography examination revealed a cystic low-density shadow with a clear boundary in the right-hand third metacarpal head, and the fourth metacarpal head was flattened and mildly osteosclerotic (Fig. 4). The above examinations yielded an initial diagnosis of avascular necrosis involving bilateral third metacarpal head and the right-hand fourth metacarpal head.

The right-hand third metacarpal head was treated with curettage and bone grafting. The patient was suggested to rest the affected hand postoperatively, avoiding mobilization. At the 6-month follow-up, the swelling in the metacarpophalangeal joint of the right ring finger was diminished, and the pain relief and tenderness were negative; additionally, the middle finger metacarpophalangeal joint exhibited a 75° flexion range. An X-ray showed that the right-hand third metacarpal head had developed bone sclerosis at the graft region, but the fourth metacarpal head showed no significant change (Fig. 3b). After 1 year of follow-up, no discomfort or tenderness was present in the right hand, and the middle finger metacarpophalangeal joint was restored to an 85° flexion range. X-ray findings during the follow-up period revealed improvement in the flattening of the third metacarpal heads, a cystic low-density area at the graft site, and no significant change in the fourth metacarpal head (Fig. 3c). At the 18-month follow-up evaluation, the patient had a painless full range of motion of the metacarpophalangeal joint.

## Discussion

Avascular osteonecrosis is a common clinical disease, but avascular necrosis of the metacarpal

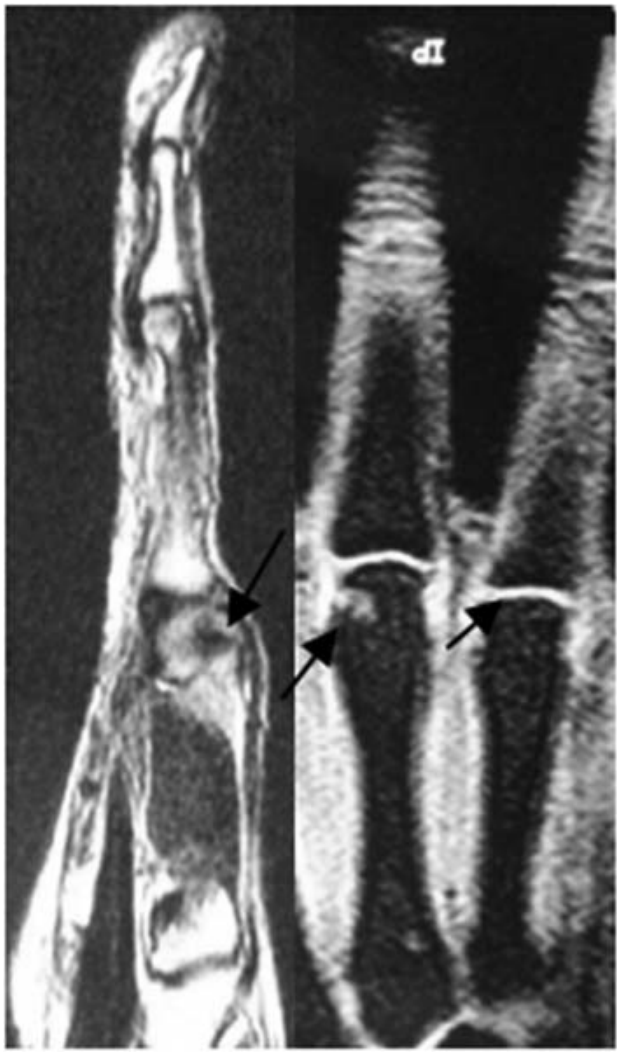

**Fig. 2** MRI examination. T1 low-signal and T2 high-signal areas at the third metacarpal head and flattening of the fourth metacarpal head are evident.

head is rarely reported. Avascular necrosis of the metacarpal head most commonly occurs in the third metacarpal head and is most rare in the first metacarpal head. Men are affected more commonly than women at a ratio of about 3:2.[1] Avascular necrosis often appears as a single lesion and occasionally coexists in several metacarpal heads.[2,3] The present patient had 3 metacarpal head lesions in both hands. The left hand only had an imaging finding but no clinical discomfort manifestations. The right-hand third and fourth metacarpal heads showed different disease conditions, and conservative and surgical treatments were adopted, respectively, in the same hand.

Previous studies have shown that the pathogenesis of avascular necrosis is highly associated with dermatomyositis,[3] trauma,[4] systemic lupus erythematosus,[5] steroid use,[3,5] and renal transplantation.[6] However, the underlying pathogenesis of Dietrich's disease is not clearly understood. Wright and Dell[7] found that vascular variations of the metacarpal head were correlated with vascular necrosis in an anatomical study of 50 cadavers with avascular necrosis of the metacarpal head. However, some patients had no clinical symptom, indicating possible spontaneity of this disorder. Bjorkman *et al*[8] found that in a 19-year-old female patient with avascular necrosis of the fourth metacarpal head, a heterozygous 20210A gene mutation induced a hypercoagulable state and increased the risk of microvascular thrombosis, leading to circulatory disorders. However, further studies are needed to explore whether it can trigger Dietrich's disease. In the present patient, an element of percussion labor work like boxing may possibly have contributed to developing Dietrich's disease.

Diagnosis of Dietrich's disease is mainly achieved by radiographic findings. Conventional X-ray examination plays a crucial role in the initial diagnosis and follow-up. Imaging findings may include trabecular interruption, bone destruction, articular facet flattening, joint space stenosis, metacarpal bone deformation, and even joint collapse or fractures. In the present case, X-ray radiography revealed obvious deformation, flattening of the articular facet, and local bone sclerosis in the left-hand third metacarpal head and right-hand third and fourth metacarpal heads, the latter also with cystic bone destruction in the third metacarpal head, and increased bone density. MRI has been widely used and plays a vital role in the diagnosis of avascular necrosis, showing T1 low signals and a T2 double-line sign.[9] However, X-ray and MRI findings are not absolutely specific, and a pathologic biopsy provides definitive evidence for a final diagnosis of ischemic necrosis.[9] The present patient exhibited clear positive symptoms and signs, and scraping of the subchondral necrotic bone tissue during surgery contributed to a definitive diagnosis of Dietrich's disease. Additionally, a bone scan[5] can detect focal lesions earlier than can conventional X-ray examination, and early treat-

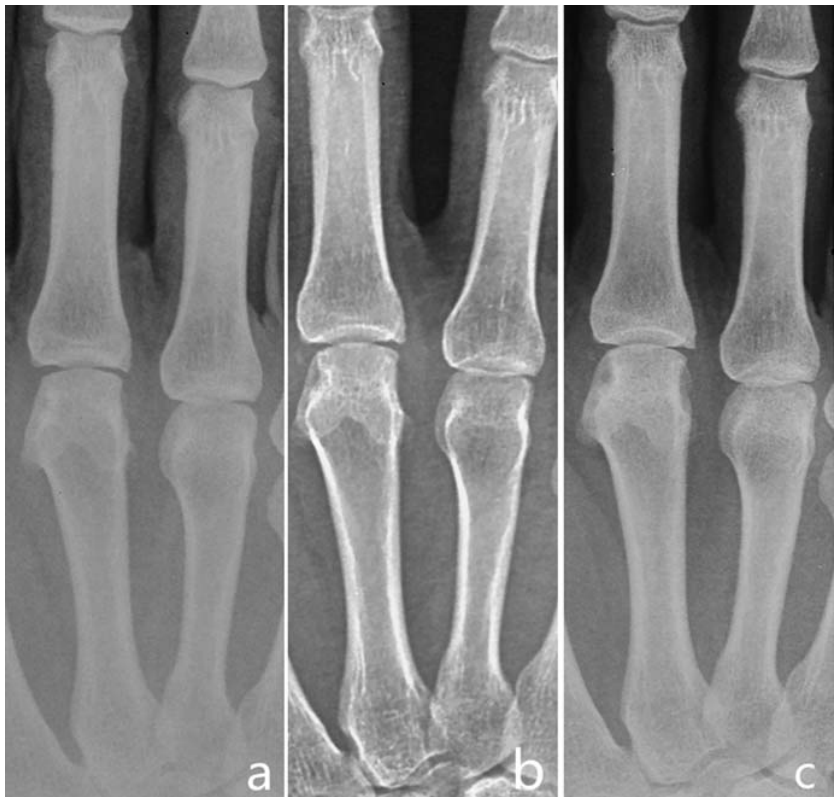


**Fig. 3** Preoperative and postoperative X-ray examinations. (a) Preoperative X-ray reveals flattening of the third and fourth metacarpal heads, joint space stenosis, cystic bone destruction at the third metacarpal head, and periosteal proliferation. (b) Six-month postoperative X-ray. The graft area in the right-hand third metacarpal head exhibited bone sclerosis, and the fourth metacarpal head showed no change. (c) Twelve-month postoperative X-ray. The flattening of the third metacarpal head had improved, a cystic low-signal area was found at the graft site, and the fourth metacarpal head showed no change.

ment may reduce joint damage. Bone scanning has high sensitivity but low specificity. Wada *et al*[2] performed arthroscopy to directly visualize the damage to the articular facet; such an examination can guide the choice of surgical approach.

Dietrich's disease is rarely seen, and the optimal treatment remains controversial. Hagino *et al*[10] recorded the entire radiographic course of a patient with metacarpal osteonecrosis by X-ray; the patient was asymptomatic and received no treatment, but the osteonecrosis finally healed. Wijeratna *et al*[4] found that pain and limited joint mobility diminished in a 14-year-old boy with Dietrich's disease after conservation treatment, and X-ray examination revealed improvement in the affected metacarpophalangeal joint. However, conservative treatment fails in most patients, who accordingly then undergo surgery. The common surgical approach is curettage and autologous bone grafting, and they obtained a satisfactory curative effect in most cases. Other proposed surgical approaches include flexion osteotomy of the metacarpal neck,[2] osteochondral mosaicplasty,[9] and arthroplasty,[11] In the present study, the patient's left hand had no symptoms, and the right hand was affected by varying degrees of necrosis in the third and fourth metacarpal heads; hence, it were treated with conservative and surgical treatment, respectively. During the follow-up, the pain and limited motion of the third and fourth metacarpophalangeal joints improved, and the bone destruction, flattening of the articular facets, and joint space stenosis did not worsen.

In conclusion, the treatment outcome of our reported patient indicates that both conservative and surgical therapy are effective in the treatment of avascular necrosis of the metacarpal head. However, the etiology, best diagnostic method, and optimal treatment of Dietrich's disease remain unknown. We report a typical case that will enlarge the existing sample size and provide further information for understanding Dietrich's disease.

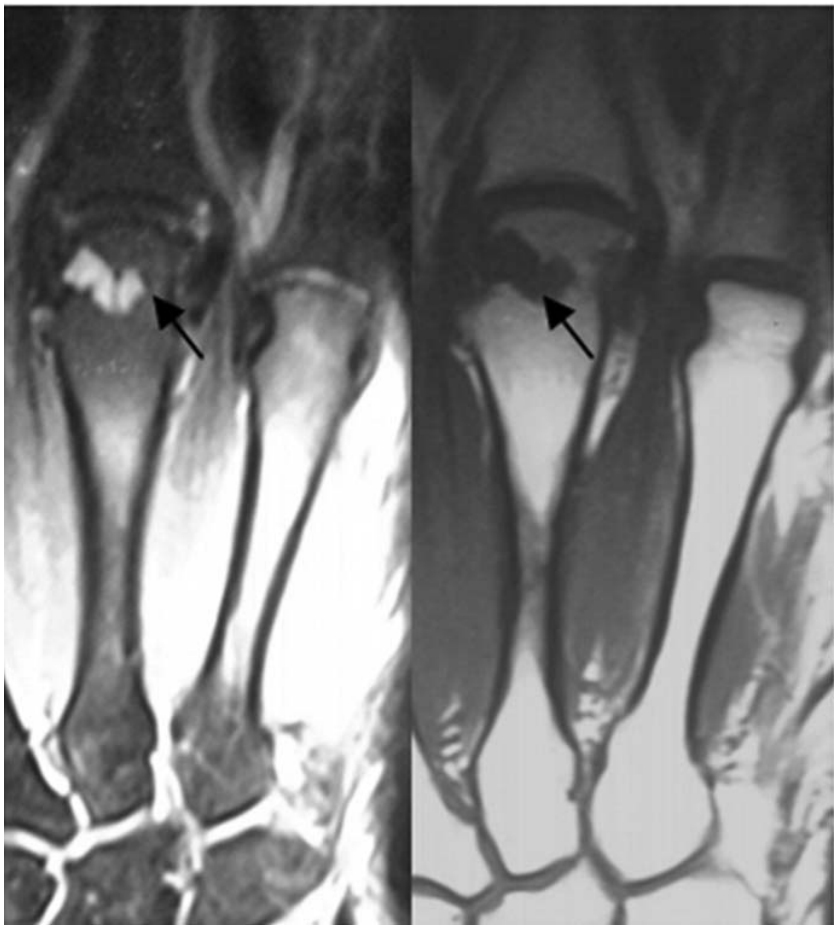

**Fig. 4** Computed tomography examination of right hand. Subcartilage bone destruction of the third metacarpal head and flattening of the fourth metacarpal head.

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