

Avascular Necrosis of the Head of the Third Metacarpal Bone

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Avascular necrosis of the metacarpal head named as 'Dieterich disease' is a very rare condition. Because of the lack of information about the natural course and treatment of this disease, the ideal treatment has not been established as yet. We report a case of avascular necrosis that occurred at the 3rd metacarpal head after fractures of the 4th and 5th metacarpal base; this was treated conservatively and obtained the spontaneous resolution.

Key words: Metacarpal bones, head, Avascular necrosis of bone

Avascular necrosis occurring in the metacarpal head, which was reported first by Dieterich¹⁾ in 1932, is a very rare disease. This disease occurs usually in one metacarpal head²⁻⁷⁾ but sometimes invades multiple metacarpal heads.⁸⁾ There is no ideal treatment for avascular necrosis in the metacarpal head, and various progresses and results after treatment have been reported according to cases.⁹⁾ The present authors experienced a case of avascular necrosis in the adjacent metacarpal head in 9 months after the fourth and fifth metacarpal base fracture and obtained satisfactory results from conservative treatment. As there is no report that avascular necrosis of metacarpal head occurred after the operation of the adjacent metacarpal bone fracture, here we report the case together with literature review.

CASE REPORT

An 18-year-old male patient visited the hospital for pain in the right hand for about two months. In the patient's past medical history, he had closed reduction and percutaneous K-wire fixation for the fourth and fifth metacarpal base fracture in the right hand,

which occurred after punching a sandbag around 11 months ago. At that time, the patient did not have pain in the third metacarpophalangeal joint and there had not been any notable symptom after the treatment of the fracture was completed. No abnormal finding was observed in the third metacarpal head in simple x-ray and computed tomography at the early stage of fracture and in simple x-ray in 2 months after the surgery (Fig. 1). The patient complained of pain in the third metacarpophalangeal joint, but no joint swelling or limitation of range of motion was observed. In physical findings, tenderness was observed in the third metacarpal head, and light pain on the passive hyperextension of the metacarpophalangeal joint. In simple anteroposterior x-ray of the hand, osteolysis was observed in the third metacarpal head and osteosclerosis was observed around the site, but joint space was maintained adequately (Fig. 2A). In magnetic resonance imaging findings, subchondral fracture and change in bone density were observed (Fig. 2B-D).

Conservative treatment was performed. In order to restrict the movement of the metacarpophalangeal joint, short arm splinting with intrinsic plus position was used for 4 weeks. And metacarpophalangeal joint is intrinsic plus position for preventing of limitation of motion. In physical findings after 4 weeks, tenderness and discomfort on hyperextension disappeared, and thus the splint was removed and daily activities were permitted. The patient did not complain of discomforts such as pain during 10 months' follow-up, and natural recovery from the lesion was observed in simple x-ray

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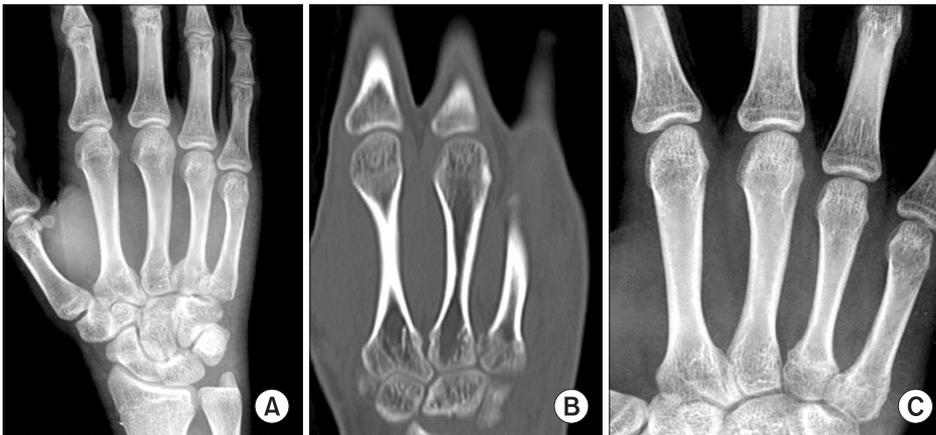


Figure 1. Images of fractures of 4th and 5th metacarpal base. Initial radiograph (A), computed tomography image (B) and image at postoperative 2 months (C) were showing no bony lesion of 3rd metacarpal head.



Figure 2. An 18-year-old boy complained of pain in right 3rd metacarpophalangeal joint. (A) Plain radiograph shows the osteolytic lesion with peripheral sclerotic change at distal epiphysis of right 3rd metacarpal bone. (B) Coronal T2-weighted image of the 3rd metacarpal head shows low-signal-intensity lesion. (C) Coronal T1-weighted image shows the fragmentation. (D) Sagittal T1-weighted image shows the 7.0×3.8×7.5 mm lesion in dorsal aspect of the 3rd metacarpal base.



Figure 3. Radiograph at 10 months follow-up. Avascular necrosis of 3rd metacarpal head was spontaneously regenerated.

(Fig. 3).

DISCUSSION

Avascular necrosis occurring in the metacarpal head is a very rare disease. It is more common in men than in women, and the cases are reported in various age groups from 6 to 54. Avascular necrosis in the metacarpal head occurs frequently in order of the third finger, the second finger, the fourth finger, the fifth finger, and the first finger, and the reason for high frequency in the third metacarpal head is probably because the finger protrudes more than the other ones and therefore has a higher risk of trauma.^{2,9,10}

The cause of avascular necrosis in the metacarpal head has not been explained clearly. According to existing literature, necrosis may happen without any particular cause,^{3,4} and it has been reported in patients with trauma,^{2,5,6} the use of adrenocortical hormone,⁸ dis-

eases accompanied by vasculitis such as systemic lupus erythematosus, organ transplant, jobs repeating motions using the fingers,⁷⁾ and osteonecrosis diseases such as Freiberg's disease. There are reports of necrosis occurring after the fracture of the metacarpal head,⁵⁾ the open reduction of metacarpo-phalangeal dislocation,⁶⁾ and boxer fracture or phalangeal fracture.²⁾ The authors' case is also believed to be related to trauma, but it is considered difficult to prove the accurate causal relation because the symptom appeared after 9 months from the injury. However, Sagar et al²⁾ reported avascular necrosis occurring after 5 months from fracture in their case. Thus, it may be necessary to consider the possibility of avascular necrosis if a patient complains of pain in the metacarpo-phalangeal joint even if it has passed a while after fracture.

Blood supply in the metacarpal bone consists of intraosseous blood supply and periosteal blood supply. While intraosseous blood supply maintains a relatively constant anatomical structure, periosteal blood supply does not. In cadaver research by Wright and Dell, major arterioles supplying distal epiphysis among blood vessels involved in periosteal blood supply to the metacarpal bone were not observed in around 35% of the sample, and blood was supplied from vessels around very small articular capsules.¹⁰⁾ Therefore, in case there is no arteriole supplying blood to the distal epiphysis of the metacarpal bone, if pericapsular arterioles are injured by trauma such as fracture/dislocation, vasculitis, or the use of adrenocortical hormone, the injury may cause avascular necrosis. However, this anatomical explanation is not applicable to every case. As in the authors' case, if there was fracture in the adjacent metacarpal bone but trauma was not observed in the metacarpal bone where avascular necrosis occurred, it is hardly possible that there was a vascular injury directly caused by trauma. Therefore, it is believed that even if there was no abnormal finding in early physical and radiographic examination, the shock on the injury might lead to the onset of the disease.

For avascular necrosis in the metacarpal head, its natural progress, results and prognosis have not been explained clearly, and various treatment methods and results have been reported.⁹⁾ There were satisfactory results from conservative treatment using splinting or non-steroidal anti-inflammatory agent,⁴⁾ but conservative treatment may be followed by the decreased range of motion, snapping in joint motion, deformed metacarpal head, traumatic arthritis in the metacarpo-phalangeal joint, etc.⁵⁾ If conservative treatment fails to improve the symptoms, surgical treatment is required,^{7,9)} and according to the authors, some perform surgical treatment directly without conservative treatment and follow-up.^{2,3)} The most com-

mon surgical treatment is autogenous bone graft on the distal radius after the curettage of the necrotized site in the metacarpal head, and sometimes arthroscopic debridement and metacarpal osteotomy are performed.⁹⁾ The outcomes of surgical treatment also vary from the recovery of normal functions and the complete regeneration of the metacarpal head in radiographic examination to continuous pain or functional restrictions. In the authors' case, the symptoms were improved and the lesion disappeared in radiographic examination only through restriction on activities using splinting for around 4 weeks until pain disappeared. Accordingly, it may be desirable to perform conservative treatment to the lesion at first rather than surgical treatment and to consider surgical treatment depending on the subsequent progress.

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제3 중수골 골두의 무혈성 괴사

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건양대학교 의과대학 건양대학교병원 정형외과학교실

'Dieterich disease'라 불리는 중수골 골두 무혈성 괴사는 매우 드문 질환이다. 이 병에 대한 경과 및 치료에 대한 정보가 부족하기 때문에 이상적인 치료에 대해서는 아직 확립되지 않았다. 저자는 제4 수지 및 제5 수지 중수골 기저부 골절 후에 제3 수지 중수골 골두에 일어나는 무혈성 괴사를 보존적으로 치료하여 자연적 해결을 얻을 수 있었다.

색인단어: 중수골, 골두, 무혈성 괴사

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