Osteochondral Autograft Used to Treat Avascular Necrosis of Metacarpal Head

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Case Report: Osteochondral Autograft Used to Treat Avascular Necrosis of the Metacarpal Head

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Abstract

Avascular necrosis of the metacarpal head is a rare condition, documented in less than 50 patients since 1932 when it was first described (2). The disease most commonly associated with steroid use, trauma, autoimmune disease, or idiopathic, which characterizes Dietrich’s disease (3). The patient generally presents with MCP joint stiffness and pain, with possible loss of active range of motion. As the disease advances, the subchondral bone can collapse causing joint incongruity. When non-operative treatment has failed, proposed treatment options include: simple debridement, curettage with cancellous bone grafting, osteochondral auto graft, arthroplasty, Bexion osteotomy, and arthrodesis (1). There has been no consensus on optimal treatment due to the rarity of the disease. This case presentation describes the treatment of chronic AVN of the metacarpal head in a 55 year old female using a previously documented osteochondral autograft transfer system (OATS) technique. An osteochondral autograft plug from the non-weight-bearing articular surface of the lateral femoral condyle was transferred and press-fit to the focal defect present in the ring metacarpal head, reinforcing the collapsed defect (1). The articular surface was restored which allowed for full range of motion of the metacarpal joint without crepitance or clicking. The patient is 8 months post op and has resumed all baseline activities without pain or functional deficit. This represents an exceedingly rare condition that has several surgical options, none of which have enough data to be recommended as the “gold standard” of care. We reproduced previously documented results that using an osteochondral autograft from the lateral femoral condyle provides an adequate match for the unique articular shape of the metacarpal head and provided full pain relief, full metacarpal joint range of motion, no loss of function, and no morbidity from the donor site.

Case Description

• CC: L 4th MCP pain
• HPI: 15 y/o female presented to the clinic with 7 months of left ring MCP joint pain. She injured her ring finger while playing volleyball and was told she had a “hairline fracture” by urgent care
• PMH: headaches PSN: None NKDA
• Social Hx: denies tobacco or ETOH

Post Operative Radiographs

Initial Tx: The patient was placed in an ulnar gauntlet short arm cast with MCP in 80° flexion for 3 months. At 4 months post operative the cast was removed, and the patient was given a range of motion splint for 5 weeks. At 8 months follow up patient had no pain of left knee or left hand. She is back to playing sports and running. Her QuickDash pre op was 81.25, sports module 25, which demonstrates significant hindrance of daily activities.

Operative Technique

Tourniquet was inflated to 250 mmHg. Dorsal incision over the MCP joint was made and the joint capsule exposed. A capsular flap was tunneled into subchondral bone, but there is no incongruity at the proximal phalanx. The smooth arc with range of motion supports the belief the articular cartilage lines up despite the depressed appearance on radiographs due to the thicker articular cartilage borrowed from the lateral femoral condyle of the knee. She was discharged from OT at this time.

Discussion

Although symptoms may resolve with nonoperative treatment, progressive collapse of the metacarpal head and subsequent degenerative arthritis is a possible long term outcome of avascular necrosis (6). Gold standard treatment for this condition has not been established and long-term prognosis is unknown, especially in the pediatric patient (5). This case represents a previously documented technique that osteochondral autograft from the lateral femoral condyle can be an option to help re-create the unique contour of the articular MCP joint. This can successfully reverse mechanical symptoms associated with joint collapse, providing full pain relief, full metacarpal joint range of motion, no loss of function, and no morbidity from the donor site.

References


Figure 2: CT showing 7mm x 3.7mm defect of 4th MC head

Figure 3 shows defect of the ring metacarpal head

Figure 4 demonstrates the graft fitting the defect appropriately

Response to Treatment

• 2 week follow up patient had mild pain of operative MCP joint. She was given prescription for custom brace to keep MCP in extension due to volar subluxation of joint during surgery.
• 6 week follow up patient had no pain of hand or knee. Hand exam revealed a full, tight fist, normal intrinsic set with mild swelling of MCP joint. Arc of MP is from 0 to 85 degrees with mild painless, palpable click. She expressed interest in playing volleyball again. Radiographs were obtained which demonstrated incorporation of an osteochondral autograft into the metacarpal head. There appeared to be displacement of the graft into subchondral bone, but there is no incongruity at the proximal phalanx.

Figure 5: AP, oblique, and lateral radiographs of left hand demonstrating incorporation of an osteochondral autograft into the metacarpal head and displacement of the graft into subchondral bone.

Significance of Case

Avascular necrosis is a disruption of the blood supply to bone, leading to destruction of the integrity of bony structure. AVN of the metacarpal head was first described by Maeclaire and later by Dietrich in 1932. Since its first description, there have been less than 50 patients documented with the disease in literature, which makes definitive treatment difficult due to limited results from different techniques. The vascular supply of the metacarpal heads has been studied, and it has been shown that in 35% of the 50 hand specimens, a main arteriole in the distal epiphysis of the metacarpal head is only involved in 5% of cases (4).

Operative Radiographs

Figure 1a and 1b: Initial AP and Lateral radiographs of left hand demonstrating fracture malunion of 4th MC head with flattening of articular surface