

TECHNIQUE

Radius Decompression for Treatment of Kienböck Disease

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ABSTRACT

The authors present a new concept in the treatment of Kienböck disease. They believe that the favorable outcome obtained with these different procedures (ie, either shortening of the radius or lengthening of the ulna) is due to the surgical decompression on the distal forearm. The procedure presented is called metaphyseal core decompression and it consists of curettage of the distal radius and ulna (the ulna has been excluded for the past 12 years) through a small cortical window. From 1976 to 2000, 48 patients were operated and retrospectively reviewed. Thirty-five were men and 13 were women, with an average age of 39 years (range, 18–64 years). The dominant limb was involved in 35 patients. All patients complained of pain and had decreased motion of the involved wrist. On radiographic examination, 4 had Lichtman stage 1, 17 had stage 2, and 25 had stage 3A. Patients who had stages 3B or 4 were excluded. Two patients had normal radiographic but MRI diagnostic for Kienböck disease, and were classified as stage 0. There were no postoperative complications reported and no patient had any additional procedure. The long-term follow-up reveals that metaphyseal core decompression produces results at least as good as other surgical procedures, with no postoperative complications.

Keywords: Kienböck disease, avascular necrosis, lunate, surgery osteotomy

HISTORICAL PERSPECTIVE

In 1944, Trueta[1] observed in children with tibia osteomyelitis that when there was an obstruction of the medullary channel and periosteal reaction, a lengthening of the limb occurred. He attributed this to an increase in the blood flow at the growth plate level. Napolitano[2] observed that wide curettage in the proximal metaphysis of the femur produced the same biologic reaction as a hip osteotomy, revascularizing necrotic areas of the femoral head. Gelberman and Gross[3] identified the vascularity of the wrist as a network of vascular anastomoses encircling the radius and extending across the carpus to the base of the metacarpal bones.

The technique of metaphyseal core decompression (MCD)[4] is based on these papers: periosteal elevation, window (partial osteotomy), and curettage of the distal radius. MCD represents a technically simple procedure that does not invade the wrist joint nor does it require any form of internal fixation. The absence of postoperative complications such as nonunion, distal radioulnar joint incongruence, or ulnocarpal impingement (which have been identified with previous treatment methods involving the forearm bones),[5–8] or problems such as limited wrist mobility, carpal malalignment, or complications from internal fixation (which have been noted following operative procedures for Kienböck disease performed on the wrist)[7,9,10] make MCD worthy of consideration.

Clinical results after MCD did not differ substantially from those reported for other osteotomies of the radius or ulna, even after a longer time of follow-up.

The almost immediate pain relief may be due to a change in intraosseous blood pressure as observed in other ischemic bone lesions by Arnoldi et al[11] and Astrom,[12]and the findings of Jensen,[13] who found elevated intraosseous venous pressure for avascular necrosis of the lunate, although postoperative changes were not confirmed.

Although a physiologic explanation for the good results of our procedure would be conjecture, there may

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well be some explanation found in the response of the local vascular environment to trauma.[1,2,11,12] This concept is contrasted to changes of the relationship of the end of the radius to the lunate, which has been suggested by many authors,[6–8,14] and has served as a basis for joint-leveling procedures.

We have identified increased radionuclide uptake extending across the carpus via scintigraphy carried out 3 months after the operation (Fig. 1). It might well be that the operative manipulation of the end of the radius alone or in combination with the distal ulna incite sufficient hyperemia to accelerate the revascularization of the lunate without the need for altering the relative length of the forearm bones.

■ INDICATIONS/CONTRAINDICATIONS

MCD is indicated in Kienböck disease with no collapse of the lunate, in stage 1 and 2 of the Lichtman classification,[15] and also in stage 0 when the X-ray is normal and the lesion is detected by MRI. In stages 3B and 4, MCD is contraindicated. The results were not as good in stage 3A cases.

■ OPERATIVE TECHNIQUE

The surgical procedure is performed under regional anesthesia with the patient in the supine position and the hand and arm resting on a hand table. A pneumatic tourniquet is used.

The radius is approached through a 3 to 4-cm longitudinal incision along the radial border of the distal metaphysis, beginning 1 cm proximal to the radial styloid. Care is taken to identify and protect the radial nerve branches (Fig. 2). The extensor tendons are separated with blunt dissection. The periosteum is incised and elevated widely to expose bone for decompression and to stimulate a reactive healing response.

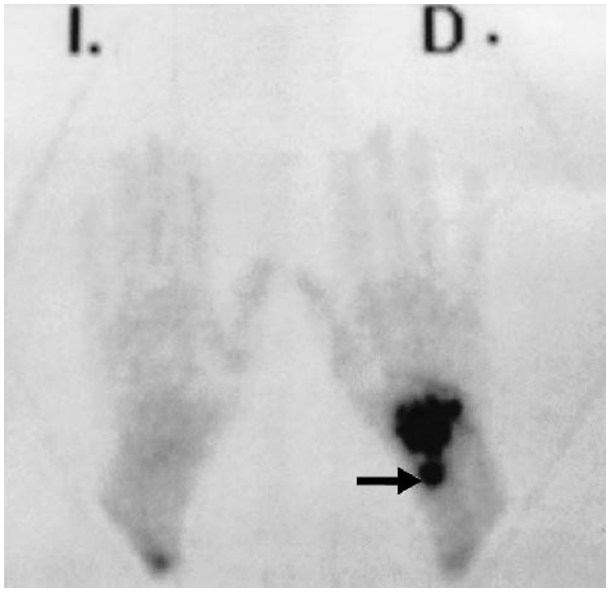

FIGURE 1. Three-month postoperative scintigram shows radionuclide uptake in the radius and extending across the carpus. The arrow shows MCD on the radius.

FIGURE 2. Surgical approach. Radial sensory branches are identified and retracted.

A window of approximately 2 × 0.5 cm is made either with osteotomes or a small bone saw (Fig. 3) beginning 2 cm proximal to the radial styloid. Through the window, the cancellous bone of the distal metaphysis is curetted and impacted without removing bone. The impacting of cancellous bone takes place only in the metaphysis, without compromising the bone cortex of the opposite side.

The bone cortex removed is either broken into 5-mm^2 fragments or is maintained in a single piece and left impacted in the metaphysis (Figs. 4 and 5).

The distal ulnar metaphysis is similarly approached through a longitudinal incision along the ulnar border of the distal forearm. Particular attention is paid to identi-

FIGURE 3. Radius osteotomy by making a cortical window.

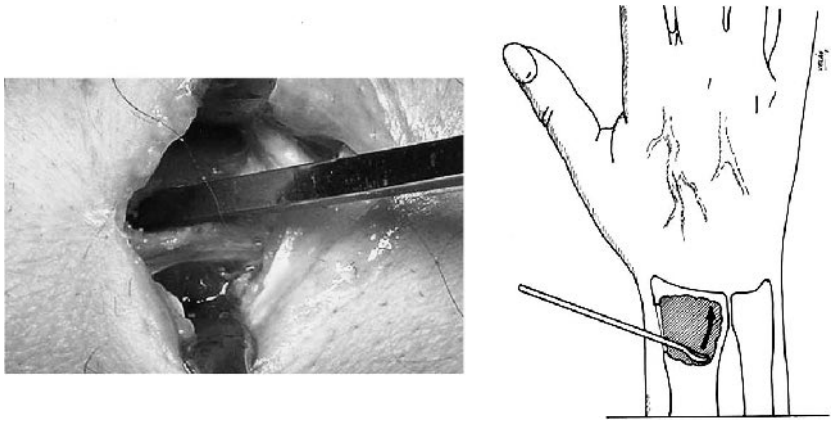

FIGURE 4. Cancellous bone impaction in the metaphysis with a curette or osteotome.

fying and protecting the dorsal sensory branch of the ulnar nerve if it is located in the surgical exposure. The same procedure is performed in the ulna by making a bone window 2 cm proximal to the ulnar styloid.

The ulnar portion of the procedure was not performed in 24 cases operated on since 1988, and final results were unchanged. The periosteum is left open and skin is closed. The procedure is performed in an ambulatory setting.

■ POSTOPERATIVE CARE/REHABILITATION

Postoperatively the limb is immobilized for 2 weeks in a below-elbow cast for bone protection. No intraoperative radiographs or images are necessary.

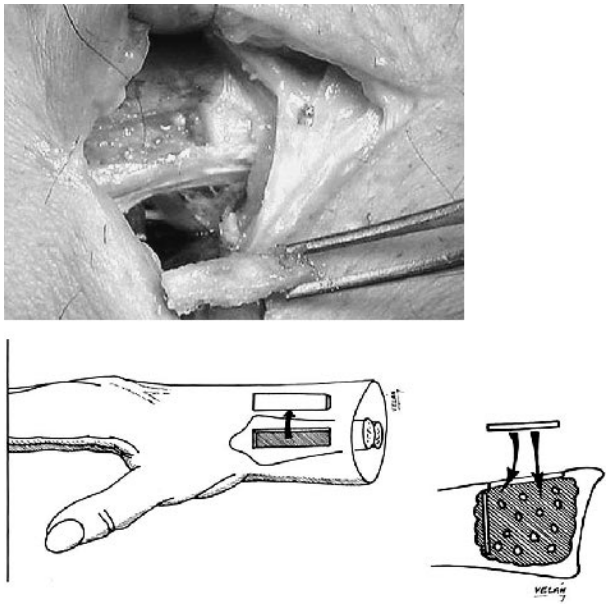

FIGURE 5. The cortical window is already made and the cortical bone is saved to be broken and impacted in the metaphysis.

By the third week, free active range of motion is encouraged. Strenuous activities are avoided for 3 months. A monthly follow-up is effected for the first 6 months and annual visits thereafter.

■ RESULTS

From 1976 to 2000, 48 patients with Kienböck disease were operated with this procedure and were retrospectively reviewed. Thirty-five were men and 13 were women, with an average age of 39 years (range, 18–64 years). The dominant limb was affected in 35 cases. All patients complained of pain and had less motion of the involved wrist. Following Lichtman's classification[15], 4 were stage 1, 17 were stage 2, and 25 were stage 3A. Patients at stages 3B and 4 were excluded. Two patients with normal radiographs and diagnostic MRI for Kienböck disease were classified as stage 0.

All patients were reviewed with an average follow-up of 9 years (range, 1–20 years). None had additional procedures. Thirty-four of 48 patients were pain free and 9 had mild pain occasionally. The range of flexion–extension at final follow-up was 56°/60° compared with 77°/78° on the nonaffected wrist. Grip strength was 75% of the contralateral side. The majority of patients had unchanged radiographs at the final follow-up (Fig. 6).

There were 5 patients with unsatisfactory results: 1 at stage 1, who had the same pain 2 years after operation; 3 patients with stage 3A had increasing pain, and 1 of them progressed to stage 4. All 3 patients had to change their job. The fifth patient seemed to have a Kienböck stage 2 on radiography and MRI. MCD was done, but the injury progressed to stage 4, with midcarpal and radiocarpal arthritic changes. Further studies revealed rheumatoid arthritis, with decreased range of motion and grip strength on her wrist. Forty-four of 48 patients were satisfied with the procedure and would elect it again.

FIGURE 6. A, Preoperative x-ray. B, Five years postoperative. C, Eighteen years postoperative without changes.

■ COMPLICATIONS

No complications due to the procedure were reported by the patients evaluated. The simple operative technique and no implant requirement avoided many complications of other operations.

However, theoretically, radius osteotomy may leave a weak zone in the metaphysis that could become complicated if a fracture occurred. We recommend protecting the bone with a cast to avoid this potential problem. Special care must be taken to identify and protect superficial nerves to avoid transient paresthesias or painful neuromas.

■ CONCLUSION

MCD is a technically easy surgical procedure: periosteum elevation, partial osteotomy (window), and curettage of the radial epiphysis. It produces a reactive hyperemia in the carpal bones and accelerates the vascularization of the lunate without the complications of the so-called "joint-leveling" procedures. The best results are obtained when there is no deformation of the lunate (ie, stages 0, 1, and 2 of Lichtman's classification[15]).

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