Fracture of the Metacarpal Shaft

A Method of Treatment

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• **Anatomically, metacarpal fractures, when reduced, are not spontaneously stable. They require maintenance of this reduction because of the forces acting on the fragments. Closed methods of maintaining this reduction are ideal, but in selected cases, intramedullary fixation of the fracture, using the Kirschner wire, gives excellent results. The method under consideration does not disturb the fracture site itself, the Kirschner wire being introduced "blind." Correct placement of the site of insertion of the wire, coupled with the rigid immobilization thus attained, gives excellent results in a high proportion of selected cases.**

FRACTURES OF THE METACARPAL SHAFT, although commonly regarded as of little importance, are actually serious injuries, frequently resulting in crippling deformities with considerable permanent disability.[11] The disability is due to inadequate reduction and lack of maintenance of proper position. This in turn leads to malunion and contractures at the distal joints, extension at the metacarpophalangeal joint and flexion of the proximal interphalangeal joint.

From a review of the frequent poor results of treatment, and taking into account the functional anatomy of the hand it appears that inadequate control of the ray (digit plus metacarpal) permits the muscle-tendon systems of the hand to distort the fracture fragments. Characteristic deformity which results, causes the metacarpal shaft to bow dorsally, the metacarpal head dropping into the palm. The collateral ligaments, which are short in extension and tend to tighten up the metacarpophalangeal joint during immobilization, tend to limit flexion later. Hence it is important to reduce the fracture and maintain the collateral ligaments and intrinsic muscles in a relaxed state to prevent traction that would displace the fragments during healing. Long dependency of the injured member, overtight dressings and prolonged immobilization must be avoided lest edema, swelling and fibrosis complicate healing. Some of the methods of immobilization may aggravate or prolong stiffness.

For fracture without displacement, minimal splinting of the hand and parts of the digit is the method of choice.

Historically, early methods of treatment included simple bandaging over roller bandage, with or without reduction, and immobilization in extension with use of straight dorsal splints or banjo splints. These older methods are to be condemned. They are no longer used by orthopedic or hand surgeons.

Later, Watson-Jones advocated flexion of the metacarpal joint to 90°, using the base of the proximal phalanx as a lever to reduce the fracture and then keeping this joint at right angles to maintain the reduction. Immobilization in this manner may result in contractures which require prolonged and intensive physiotherapy to overcome. Still later, many observers advocated open reduction and intramedullary fixation, using wires, screws, plates or intramedullary devices.[2]

To evaluate various methods of treatment in a critical manner, certain criteria must be established for reduction and immobilization to provide maximum eventual success. Burnhams'[3] criteria seem admirably inclusive:

- The method must provide complete control of the fractured bone during reduction and healing.
- The hand must be placed so that the muscle-tendon systems are at minimal tension.
- Immobilization must be adequate to prevent distraction by the muscle-tendon systems.
- There must be post-reduction compression to avoid edema.
- If possible, the method should be closed rather than open (for obvious reasons).

In an effort to correct the anatomic and functional deformity of these fractures, and also to prevent the restriction of finger motion which follows, many orthopedic and hand surgeons use a modified Jahss maneuver and then apply a light sugar-tong plaster or a Boehler frame splint. In selected cases, however, especially where the patient's livelihood depends on precision use of the hands, Kirschner wire internal fixation has been found to obviate many complications and their attendant problems. It should be used primarily where standard closed reduction methods or minimal splinting would not be adequate or satisfactory. The advantages are

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early correction of the deformity of the fracture and rigid internal fixation of the fragments. It is a most effective way of preserving function[1] and during the healing period the patient is able to continue at almost all jobs except those in which the hands must get wet. Closed anatomic reduction is not difficult for one experienced in the technique, but maintaining reduction occasionally presents problems.

In my experience, reduction of fractures of metacarpal bones and maintaining this reduction by either skeletal traction or casting require extremely close supervision and the results are uncertain. Breakdown of the skin due to pressure volarward on the metacarpal head and dorsalward on the base of the middle phalanx often prevents the patient's working for a considerable time postoperatively.

Open reduction entails additional trauma to the fracture site, the hematoma, the adjacent soft tissues and often includes enough periosteal stripping to delay bony union. Open reduction is best reserved for the rare case of compound fracture or of soft tissue interposition.

The method recommended consists of closed reduction, using the Watson-Jones[11] method or direct manipulation of the fragments (Jahss' maneuver).

Once the closed reduction is made and is confirmed by palpation of the fracture line, the metacarpal interphalangeal joint of the involved ray is flexed to at least 90°. With a No. 11 Bard-Parker blade a tiny puncture wound is made on the radial side of the dorsal surface of the metacarpal head, avoiding the greater part of the extensor hood mechanism.[12] A Kirschner wire of suitable diameter (usually 0.054 inch) is inserted in a hand chuck with about ¾-inch of the pointed tip protruding. Using a gentle rotary motion, the wire is passed into the metacarpal head and into its medullary canal. The hand chuck is then loosened enough to expose about 2½ to 3 inches of wire, after which the wire is inserted, using hand chuck pressure until resistance is met. Roentgenograms taken at this time will show the reduction of the fracture and also the depth of the intramedullary wire. In fractures near the metacarpal base, the wire should extend into the adjacent carpal bone. This will also prevent the wire from migrating.

This principle does not apply to all fractures at the base of the thumb metacarpal, since these fractures are often associated with subluxation at the carpo-metacarpal joint—the so-called Bennett's fracture. Fractures of that order are treated by complete abduction of the metacarpal, using skeletal traction or, in some cases, Kirschner wire fixation. After satisfactory roentgenograms are obtained, the wire is cut off just beneath the skin to allow for easy removal after bony union has occurred. This procedure is best done in the surgical suite of a modern hospital. The choice between general anesthesia and local nerve block will vary with the surgeon. Even if general anesthesia is used, the patient may safely return home six to eight hours after operation if he has recovered from the effects of the anesthetic.

Immediately after operation the ray is immobilized in a simple aluminum volar curved splint which is worn for three to five days. After this, a simple dressing over the wound is sufficient. The patient may safely move the finger during this time. Three to four weeks after operation a local anesthetic agent is injected and the pin is removed.

The advantages of this method of "blind nailing" combine many features of both closed and open reduction. There is no extraneous damage at the fracture site and fixation is adequately rigid, which encourages early mobilization of the uninjured parts. The maximum stability of the injured parts promotes soft tissue healing. Most important, the postoperative care of the hand is minimized for both the surgeon and the patient, permitting earlier return to full use of the member without loss of the desired end result. Thus, the patient has minimum economic loss and maximum functional recovery.

It should be stressed, however, that since the Kirschner wire makes the fracture a compound one, this treatment is the method of choice only in selected cases.

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