SCIENTIFIC ARTICLE

The Central Slip Fracture: Results of Operative Treatment of Volar Fracture Subluxations/ Dislocations of the Proximal Interphalangeal Joint

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Purpose Fractures of the base of the middle phalanx are particularly challenging. Dorsal fracture-subluxations/dislocations of the proximal interphalangeal (PIP) joint are relatively common, but the volar fracture-subluxation/dislocation, the so-called "central slip fracture," is quite rare. The current study presents our experience with surgically treated patients with central slip fracture subluxation/dislocation with a minimum of 1 year follow-up. We hypothesized that the majority of patients with a central slip fracture-subluxation/dislocation have poor outcomes.

Methods Thirteen patients with central slip fracture-subluxations/dislocation were identified from departmental billing records between 2003 and 2013. Nine patients completed the study follow-up examination and 8 were included in the final analysis. Clinical data assessed included age at injury, sex, mechanism of injury, injured digit, type of treatment, additional intervention(s), complications, length of follow-up, and range of motion follow-up. Fluoroscopic images and Quick Disabilities of the Arm, Shoulder, and Hand surveys were obtained at study follow-up.

Results All patients underwent at least 1 surgery and 7 of 8 underwent open reduction. The average age at the time of injury was 41 years (range, 25−60 years). All injuries were closed. The average follow-up was 43 months (range, 17−67 months). Average passive and active range of motion of the PIP joint at follow-up were 62° and 54°, respectively. Six of 8 patients developed radiographic evidence of arthritic change and 4 experienced an outcome that required additional interventions.

Conclusions Patients should be counseled about the outcomes following surgical treatment of this uncommon, difficult injury. *(J Hand Surg Am. 2017;■(■):1.e1-e6.*

Type of study/level of evidence Therapeutic V.

Key words Central slip fracture, proximal interphalangeal joint dislocation.

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Phalanx fractures are common injuries of the hand, accounting for 41% of hand fractures and up to 2.9% of emergency department visits.[1,2] Simple, nondisplaced phalanx fractures can be treated nonsurgically and typically have excellent outcomes. In contrast, articular fractures, especially those associated with joint subluxation or dislocation, are more difficult to treat and may require surgery in order to optimize outcome. Specifically, fractures of the base of the middle phalanx are particularly challenging and can lead to proximal interphalangeal (PIP) joint instability. Dorsal fracture-subluxations/dislocations of the PIP joint are relatively common, but the volar fracture-subluxation/dislocation, the so-called "central slip fracture,"[3] is quite rare (Fig. 1).

In contrast to volar dislocations of the PIPJ joint without an associated fracture of the dorsal base of the middle phalanx,[4–6] central slip fracture subluxations/dislocations and their outcomes have been rarely reported in the literature.[3,7–10] Imatami et al[3] recommended open reduction internal fixation (ORIF) with Kirshner-wires (K-wires) after reviewing their experience with 8 central slip fractures without an associated dislocation. Although none of their patients regained their preoperative range of motion, they reported satisfactory outcomes and none of their patients underwent additional procedures. Rosenstadt et al[9] reported good or excellent outcomes with closed reduction and transarticular K-wire fixation in 13 central slip fracture dislocations.

Our experience in the care of these injuries has been less successful and we hypothesized that the majority of patients with a central slip fracture subluxation/dislocation have poor outcomes. The current study presents our experience in the operative treatment of patients with a central slip fracture subluxation/dislocation at a minimum of 1 year follow-up.

METHODS

After institutional review board approval, we used departmental billing records to identify patients with a central slip fracture-subluxation/dislocation utilizing International Classification of Diseases, Ninth Revision, code 834.02 and Current Procedural Terminology codes 26746, 26776, and 26785. There were 562 patients identified between January 1, 2003, and December 31, 2013. All charts were reviewed and 13 patients met our inclusion criteria, which included a minimum follow-up of 1 year after surgery and complete medical and radiographic records. We excluded isolated volar dislocations of the PIP joint without fracture of the dorsal base of the middle phalanx and patients treated without surgery. Of the 13 patients identified, we excluded 4 patients who could not be located for follow-up and 1 patient who sustained an open central slip fracture.

We assessed the following clinical data: age, sex, mechanism of injury, injured digit, type of treatment, additional intervention(s), complications, length of follow-up, and range of motion at follow-up. We assessed fluoroscopic images for joint reduction and the presence of arthrosis, which was defined as joint space narrowing and/or osteophyte formation, at follow-up. At the follow-up evaluation, 1 member of the research team (Z.I.M.) performed a physical examination including active and passive range of motion of the PIP joint, pain assessment, and the Quick Disability of the Arm, Shoulder, and Hand (*Quick*DASH) questionnaire.[11] Frequency of pain was categorized as daily, weekly, monthly, or less than once per month. Pain severity was rated on a scale from 0 to 10 with 0 representing no pain and 10 representing severe pain.

In general, the postoperative protocol following ORIF with K-wires is to immobilize the affected finger in an orthosis with the K-wire in place for 4 to 8 weeks and monitor clinical and radiographic healing and joint congruity at office visits every 2 weeks. K-wires are removed once solid radiographic healing is evident. Once the K-wire is removed, the patient is slowly advanced from gentle active range of motion exercises (no passive range of motion) to full active and passage of range of motion. For patients treated with a dynamic external fixator, early range of motion exercises are initiated at 2 weeks and clinical and radiographic healing and joint congruity are monitored at office visits every 2 weeks, similar to the protocol outlined by Ruland et al.[12] The fixator is removed between 4 and 6 weeks. There was heterogeneity in the operative treatment of the 6 patients treated with ORIF (Table 1). The 5 patients who did not undergo salvage procedures completed a *Quick*-DASH at the time of their follow-up visit (patients 1, 2, 3, 4, and 5). Four patients returned for follow-up fluoroscopic evaluation (patients 1, 2, 4, and 5). There were 3 salvage procedures including 2 fusions (patients 7 and 8) and 1 revision amputation (patient 6). These patients did not return for repeat radiographs at greater than 1 year from treatment.

RESULTS

Six of the 8 patients sustained a fracture-subluxation of the middle phalanx and 2 sustained a fracture-dislocation. The central slip fragment was 1 large piece in 6 patients and comminuted in 2 patients. Six patients were initially treated with ORIF. One patient