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Symptomatic, Partial Union of the Hook of the Hamate Fracture in Athletes*

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Background: Many clinicians believe that after fracture of the hook of the hamate, nonunions are the rule rather than the exception.

Purpose: To describe a previously unreported condition in which the fractured hook of the hamate unites only along its ulnar column and causes pain similar to that in cases of nonunion.

Study Design: Retrospective review.

Methods: Eight patients who had sustained a hook of the hamate fracture were identified, on the basis of their persistent pain, as having achieved only partial union. This diagnosis was made despite evidence on computed tomography of healed bone across a significant portion of the fracture. All eight patients underwent subperiosteal excision of the hamulus because of persistent pain. At an average of 4 years after excision, each patient was evaluated by dynamometer grip strength testing and a subjective outcome assessment.

Results: All patients were able to return to their preinjury level of sports participation at an average 8 weeks after excision of the hook of the hamate. Grip strength was not adversely affected in any patient. Subjective evaluation of each patient revealed no residual pain.

Conclusions: Chronic or unresolved pain on the ulnar side of the wrist after hook of the hamate fracture can be due to partial union. This condition should be managed no differently from a symptomatic nonunion, with excision of the hook of the hamate and repair of the ligament attachments.

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Numerous reports have linked fractures of the hook of the hamate to participation in sports that require gripping a racquet, club, or bat.2,7,12,15,16 Although there are reported cases of successful healing of these fractures after cast immobilization, many clinicians believe that nonunions are the rule rather than the exception.2–6,12,14,17

Explanations for the development of hook of the hamate nonunion include delay in diagnosis, vascular injury, and biomechanical factors, such as ligament forces.3,6,12,15,18

Clinically, nonunions of the hook of the hamate manifest as unresolved pain in the hypothenar eminence, with symptoms aggravated by gripping.2–7,12,15

Excision of the hook of the hamate fragment in the athlete has been shown to lead to reliable resolution of symptoms and a successful return to previous levels of activity.1–7,12,14,16

We have seen similar symptoms of pain in athletes whose hook of the hamate fractures have united. Radiographic evaluation of these patients has revealed what we believe is a previously undescribed condition in which the fractured hook of the hamate unites only along its ulnar column and causes pain similar to that in cases of nonunion. We describe eight cases of patients who, after sustaining hook of the hamate fractures while participating in sports, subsequently achieved only partial union. Diagnosis was made on the basis of persistent symptoms of pain and CT findings; in all cases, patients were successfully treated with excision of the hamulus.

MATERIALS AND METHODS

From April 1991 through December 1998, 51 excisions of the hook of the hamate were performed by the senior author (NPZ) for persistent pain after fracture of the hamulus. In 43 of the 51 patients, nonunion or fibrous union of the hamulus had been diagnosed preoperatively. The preoperative diagnosis in the remaining eight patients was symptomatic partial union of the hook of the hamate frac-
Three inclusion criteria were used to make this diagnosis: 1) history of an injury to the wrist; 2) persistent, unalleviated pain during gripping activities, despite supportive treatment subsequent to injury; and 3) evidence on CT of a transverse lucent line along the hook of the hamate directly adjacent to trabecular architecture, consistent with healed bone across a significant portion of the cross-sectional area of the hook of the hamate (Fig. 1). These eight patients were the focus of this report.

The average age of the patients in this series was 34 years (range, 20 to 55). All of the patients were men and their nondominant hand was the injured hand in all cases (Table 1). Each patient recalled a specific, inciting event that led to the symptoms. All eight patients were playing either golf or baseball when their initial injury occurred. Of the five patients who were injured during golf, four were hitting the ball from the tee box and one patient struck the ground with a 5-iron club while swinging from the fairway. Three patients were baseball players (one collegiate, two professional), and all of them sustained their injuries at the time of bat-ball contact during batting practice. After the initial injury, all of the patients described a vague pain on the ulnar side of their wrist. The pain was not specifically associated with direct pressure on the hook of the hamate in any of these cases; rather, symptoms were aggravated exclusively by gripping activities related to sports participation. Dorsoulnar wrist deviation reproduced mild discomfort in two patients.

Of the eight patients in this study, only one received an initial diagnosis of fracture of the hook of the hamate. The diagnosis in this patient was made with the use of a CT scan that revealed a complete, nondisplaced fracture at the base of the hook of the hamate. This patient was advised to undergo immediate (during the acute phase) surgical excision of the fractured hamulus, but he chose cast immobilization for 6 weeks. After this immobilization period, the patient was asymptomatic and he returned to golf at 3 months after his injury. On attempting to return to golf, he experienced a return of his symptoms. A repeat CT scan performed at this time demonstrated, in consecutive axial (1.5 mm) cuts, normal hamulus bony architecture directly adjacent to a clearly separated fracture fragment (Fig. 2).

Four patients had an initial diagnosis of injury to the triangular fibrocartilaginous complex, and three patients had an initial diagnosis of inflammation of the flexor carpi...
ulnaris tendon at its insertion. Before the hook of the hamate injury was diagnosed, all seven of these patients attempted to return to sporting activities, each after various periods of activity modification. However, all seven described a return of continued ulnar-side wrist pain with gripping activities. The initial treatment of these patients included some combination of rest and ice or antiinflammatory medication, or both. One patient received a steroid injection for the diagnosis of tendinitis. The four patients who were initially thought to have injured the triangular fibrocartilaginous complex underwent wrist arthrography that revealed no abnormalities. One of the patients underwent MRI of the wrist and one underwent a triple-phase bone scan. In both of these cases these diagnostic measures were undertaken in an attempt to identify the source of the pain. It was only later that the diagnosis of hook of the hamate fracture was made.

Plain radiographs, including a carpal tunnel view (as described by Hart and Gaynor\(^8\)), were performed in the acute injury phase in all of the patients in this series, but they were useful in making the correct diagnosis in only one patient. Computed tomography was eventually performed in all eight patients at some point during the clinical course of their diagnostic tests for unresolved wrist pain. In the axial plane, 1.5-mm cuts with maximal bony windows were performed with the hands in the prayer position. Coronal and sagittal plane images were obtained as well. In each case, consecutive CT cuts demonstrated a column of bony union adjacent to a region of distinct fracture lucency (Fig. 3). The average duration of symptoms before the diagnosis of a partial union was 22 weeks (range, 11.3 to 35.7).

Excision of the hamulus was performed in all eight patients by the senior author (NPZ) through a curvilinear, volar incision. Tourniquet hemostasis was established and sharp subperiosteal dissection was used to expose the hook of the hamate and allow evaluation of the fracture site. Care was taken to prevent damage to the motor branch of the ulnar nerve. The flexor tendons were inspected for damage. In all cases, the hamulus was excised with a sharp osteotome. After the fragment was excised, the ligament attachments to the tip of the hook were repaired. The hand was immobilized in a short arm cast for 3 weeks. After immobilization was discontinued, rehabilitation was initiated to restore motion and grip strength.

All eight patients were available for follow-up by telephone or clinical examination, or both. The mean length of follow-up was 50 months (range, 24 to 96). Seven of the eight patients were evaluated at final follow-up with dynamometer strength testing (JAMAR dynamometer, Sammons Preston, Bolingbrook, Illinois) of both the involved and uninvolved hand and by a subjective outcome assessment. Grip strength data from both hands were analyzed by using the paired \(t\)-test.

**RESULTS**

At an average of 8 weeks (range, 4 to 12) after excision of the hook of the hamate, all eight patients were able to return to their preinjury level of sports participation. Seven of the patients (88%) in this series underwent excision of the hamulus without surgical complications. One patient developed first dorsal interosseous weakness and a postoperative claw deformity in the ring and little finger that was first noted at the time of cast removal. This was attributed to contusion or irritation of the motor branch of
the ulnar nerve. Resolution of the weakness and deformity was complete by 4 months postoperatively.

In seven of the patients, the grip strength in the involved hand after surgery was compared with the grip strength of the contralateral, uninvolved hand (Table 2). With the numbers available, no significant differences could be detected ($P = 0.85$).

**DISCUSSION**

Fractures involving the hook of the hamate are often the result of direct forces transmitted to the volar prominence of the hamate bone on the ulnar side of the wrist.2,5,6,14,16 In sports, the use of a golf club, baseball bat, and tennis racket have all been implicated in fractures of the hook of

**TABLE 2**

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<th>Patient</th>
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the hamate by means of this mechanism. The natural history of this fracture has classically been described as resulting in either asymptomatic bony union or some form of nonunion (bony or fibrous). We believe that between these two polarities exists a subset of patients who achieve bony union across only a limited cross-sectional area of the fractured surfaces of the hook of the hamate. This region of partial union is stable enough to prevent displacement of the hamulus and radiographically may appear to represent complete union; however, it does not provide a stable column through which muscle and ligament attachments may transmit forces and, therefore, prevents resolution of the patient’s painful symptoms. This poses a particular problem for the athlete who handles a bat, club, or racquet and generates repetitive forces across the hook of the hamate. It is our opinion that this clinical condition should be treated in the same manner as a nonunion; that is, with excision of the hamulus and repair of its ligament attachments.

We have considered the possibility that the condition described in this manuscript is a stress fracture of the hamate. Only two patients in this study had documentation of a complete fracture of the hook of the hamate before the diagnosis of a partial union was made; the remainder of the patients were presumed to have sustained a fracture at some point in time before our diagnosis of a partial union. However, stress fractures in bones are due to subthreshold forces that are chronic in nature. Symptoms of discomfort generally precede the development of bony injury. None of our patients described any precursory symptoms before the inciting event that led to their eventual complaints.

It is possible that this condition of partial union actually represents a point in time on the continuum of hamulus bone healing and that, with continued observation, this condition would have eventually been followed by a complete union. However, the diagnosis of partial union was made at an average of 5.5 months after the initial date of injury. In two of the cases, diagnosis was made more than 8 months after injury. We believe that sufficient time had passed to allow complete union. It is more likely that, for unclear reasons, the healing process had simply ceased at this incomplete stage of healing.

It could also be argued that this condition simply consists of a fibrous nonunion with calcification of the interposed tissues. This explanation could account for evidence of ap-
parent union on a plain radiograph but it inadequately explains the bony trabeculation seen adjacent to the lucent regions on CT. Furthermore, at the time of surgical excision, no gross motion was evident at the hook of the hamate in any of the patients in this series, and, in all cases, an osteotomy was necessary to complete the excision of the hook.

Finally, delayed diagnosis of chronic hook of the hamate nonunions has been associated with injury to the structures at the base of the hook. Unlar nerve paresthesia and flexor tendon injury have been reported in up to 38% of chronic hook of the hamate nonunions. None of the patients in our series had any of these associated conditions. Despite the small number of patients in this series, this would not be unreasonable to expect to see at least one of these complications of delayed diagnosis had nonunion been the cause of our patients’ discomfort.

At an average of 8 weeks (range, 4 to 12) after excision of the hamulus, all eight patients were able to return to their previous level of sports participation. This is consistent with the rate of return seen in other series involving athletes. Stark et al. reviewed the results of 59 patients who had undergone hook of the hamate excision for fracture nonunion. All 28 professional athletes were able to resume their former athletic pursuits at an average of 8 weeks. In a review of the results of primary excision of the fractured hook of the hamate in athletes, Parker et al. reported that all of their patients were able to resume physical activity involving their affected hand within 4 weeks of surgery, and all ultimately returned to their previous level of activity within 6 weeks of surgery. Futami et al. reported full recovery in eight athletes who had hook of the hamate fractures and subsequent excision.

Grip strength was not adversely affected by excision of the hook in this series. Other investigators have found a similar restoration of normal grip strength after excision of the hook of the hamate. Loss of grip strength in ulnar deviation after excision of the hook of the hamate has been reported, however, and is presumed to be due to the loss of the pulley effect of the hook on the flexor digitorum profundus to the ring and small finger.

Seven of the eight patients in this study had posteroanterior, lateral, oblique, and carpal tunnel view plain radiographs of their wrist obtained at the time of initial injury. Radiographic diagnosis of a hook of the hamate fracture was not made in any of these patients. In these seven cases, the hamulus was either poorly visualized or appeared normal. A considerable number of clinicians have found routine wrist radiographs to be unreliable in diagnosing an acute fracture of the hook of the hamate. The addition of the carpal tunnel view can be beneficial, but this view cannot always be obtained in the acute phase of injury because it requires hyperextension of the wrist, which can be limited by pain. One patient in this study had a second series of plain radiographs taken after 3 months of chronic symptoms. These films revealed evidence of a partial union of the hook of the hamate that was visible only on the carpal tunnel view (Fig. 4).

We prefer to use CT to assess the integrity of the hook of the hamate. By using 1.5-mm cuts through the hook itself, we were able to obtain excellent visualization of the bony architecture at the hook of the hamate. At our institutions, patients with suspected hook of the hamate fractures undergo CT scanning along three axes. Axial cuts through the wrist are obtained with the hands in the prayer position. This axis is parallel to the long axis of the hook of the hamate and demonstrates the fracture and its displacement clearly. The use of the prayer position allows for comparison with the normal side. Single wrist coronal and sagittal cuts are also obtained to assess the articulations of the hamate bone with the surrounding carpal bones.

In our patients, the average duration of symptoms before the diagnosis of a partial union of the hook of the hamate was 22 weeks. Others have recorded delays in the diagnosis of this injury. In a review of a recent large series of hook of the hamate fractures, there was an average 23-week interval from injury to diagnosis. The index of suspicion for hook of the hamate injuries should be high in any patient who sustains an injury to the ulnar side of the wrist while using a racquet, bat, or club. Chronic or unresolved pain after this type of injury can be due to a partial union of a fractured hook of the hamate. In these cases, excision of the partially united hook fragment can result in the relief of discomfort and the restoration of preinjury activity levels. Routine radiographs should not be relied on to rule out the diagnosis. Computed tomography is an excellent means of diagnosing an acute fracture, nonunion, or partial union of the hook of the hamate.

REFERENCES