

Second to fifth carpometacarpal fracture dislocation, a missed injury

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Abstract

Background

Injuries to the second to fifth carpometacarpal joints in the hand are uncommon. They comprise less than 1% of all hand and wrist injuries. This injury may be missed when associated with long bone injuries. Generalized swelling may obscure the characteristic deformity and routine radiographs may not show the displacement clearly.

Neglected injuries lead to muscle imbalance / weakness, articular incongruity and arthritis. Diagnosis of this unusual form of injury requires a high index of suspicion, careful examination and true lateral radiograph of the hand and wrist.

Patients and Methods

This study included 12 patients treated over 31 months at Zagazig University hospitals and Health insurance hospital. The mean age at time of injury was 29 years (range, 20 – 48 years). Nine patients were males and 3 patients were females. Six cases had motorcycle accident, 2 cases had motor vehicle accidents, 3 cases fell on the hand, and in one case the mechanism of injury was punching. The dominant hand was involved in 9 cases. Open reduction and internal fixation by K-wires was done in all 12 patients. The diagnosis had been missed in six patients when they first presented at an accident and emergency department; the delay in diagnosis was from three to eight days. Clinical and radiographic evaluation for all patients included postero-anterior, oblique and true lateral radiographs of wrist and hand.

Results

Mayo modified wrist score was used for clinical evaluation of all patients, which includes four domains: pain, job, range of motion and grip strength. The score is calculated from 0 to 100 points, with 91 to 100 points indicating an excellent outcome, 80 to 90 points a good outcome, 65 to 79 points a fair outcome, and < 64 points a poor outcome. According to Mayo modified wrist scoring system, eight patients (66.7%) showed excellent results, one patient (8.3%) presented with good result, and three (25 %) with fair results.

Conclusion

Carpometacarpal dislocation can be initially missed. Routine postero-anterior and oblique radiographs may not show the displacement clearly. A true lateral radiograph of the hand should be recommended for diagnosis of carpometacarpal dislocation. Open anatomical reduction and internal fixation with K-wires and early mobilization are required to achieve a good and early functional outcome.

Introduction

Carpometacarpal dislocations of the all four fingers of the ulnar side of the hand are seen following high-energy trauma commonly in boxers and motorcyclists.

Bony and soft tissue constraints provide stability to the carpometacarpal joint. Static stabilizers of the CMC joints include anatomic configuration of the joints, CMC joints are modified compound saddle joints. Dorsal and palmar intrinsic and extrinsic ligaments together with interosseous ligaments provide angular and translational stability.[1] The third meta-

carpocarpitate articulation is more proximal to the rest of the CMC joints thus forming a key stone in stability of the carpus and CMC joints. Extensor carpi radialis longus (ECRL) and flexor carpi radialis (FCR) inserts at the base of the 2nd metacarpal provide dynamic stabilization[1].

CMC joints of the ring and small fingers are more mobile compared to the index and middle finger due to the decreasing concavity of the saddle joints and therefore dislocation is much more common.[1,2]

The trapezoid is situated like a wedge between four bones, articulating with the scaphoid proximally, the

trapezium on its radial aspect, and the capitate on its ulnar aspect and the second metacarpal distally. The trapezoid is the keystone of the palmar arch and forms a stable articulation with the trapezium and the base of the 2nd metacarpal[2].

Carpometacarpal dislocations are often missed on initial presentation, diagnosis of this unusual form of injury requires high index of suspicion, careful examination and good radiography.[2]

Mechanism of injury including sudden violent impact, motor vehicle accidents and fighting must increase the index of suspicion for this injury Dislocation may be in the palmar or dorsal direction and there may be associated injury of the adjacent carpal or metacarpal bones. The mechanism of injury involves violent, forceful dorsiflexion of the wrist combined with longitudinal impact on the closed hand[1].

Considerable swelling on the back of the hand may mask the characteristic hump at the root of the hand the diagnosis can be easily missed due to other serious injuries and long bone fractures. Disability of the hand is severe in untreated or those where treatment is delayed [1, 2].

In many hospitals routine radiographs of an injured hand include only posteroanterior and oblique views. A postero anterior Radiograph of the normal hand should show a clear joint space between the bases of the metacarpals and the carpus with parallel joint surfaces (fig 1), after dislocation this parallelism is lost.[3]

The appearance of fractures of the base of the metacarpals or of hamate should arouse suspicion and the apparent shortening of a metacarpal, which is best seen at metacarpophalangeal joint level also indicated

possible dislocation. Only the true lateral view of the hand can reveal the dislocation[4].

Fisher et al described the importance of symmetry and parallelism of the normal CMC joints seen on the AP radiograph. The width of the index through little CMC joint spaces is a relative constant distance of 1 to 2 mm. if there is a change in this measurement, a high index of suspicion must exist for a CMC joint injury. Fisher et al also stressed the importance of parallel M lines on normal AP radiographs. The proximal line of the M is a zig-zag line drawn along the distal curvature of trapezoid, capitate and hamate fig (2)[5]. The distal line of the M is a symmetrical zigzag line running along the bases of the index through little metacarpals. A break in the parallelism of the M lines is suggestive of carpometacarpal dislocation[5].

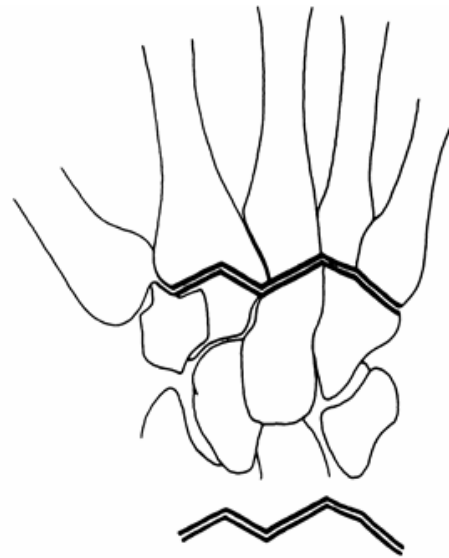


Fig 1: Sketch of parallel M lines formed by CMC joints [3]



Fig 2: A, PA view second through fifth CMC joints are well visualized without overlap B, PA view with hand dorsiflexed off cassette. Note loss of profile and parallelism at articular surfaces (arrow) C, Lateral view. In CMC dislocations, longitudinal axis of affected shaft no longer parallels axis of adjacent unaffected metacarpals. This view will demonstrate direction of dislocation and associated fractures, and permit detection of soft-tissue swelling. D, Internal oblique view, taken 30° from PA position and useful for analyzing fourth and fifth CMC joints. E, External oblique view, taken supinated 30° PA position and useful for analyzing first and second CMC joints.[3]

Computed tomography and tri-spiral tomography are useful diagnostic modalities, especially in cases with multiple CMC dislocations with associated fractures. These images aid in identifications of multiple fragments that may be difficult to discern on routine radiography. Computed tomography may also be used in preoperative planning for surgical intervention of these complex injuries[3].

Recent studies recommend open reduction and internal fixation as the primary method of approaching CMC dislocations, as these injuries commonly involve damage to intra-articular surfaces[6].

Complications are possible with an open approach as the deep (motor) branch of ulnar nerve lies immediately volar to the fifth CMC joint as it winds around the hook of hamate[1]

Aim of the study

This study performed to evaluate the outcome of patients with carpometacarpal fracture dislocation treated with open reduction and internal fixation (ORIF).

Patients and Methods

Multicenter prospective study analyzed the data of twelve patients who had suffered a carpometacarpal fracture dislocation with From October 2009 to May 2012, seen in the emergency department and outpatient clinic at Zigzag University hospitals and health insurance hospital were included. Age ranges from 20 to 48 years, mean was. Nine patients were males and 3 patients were females. Six cases had motorcycle accident, 2 cases had motor-vehicle accidents, 3 cases fall on the hand and in one case the mechanism of injury was punching. The dominant hand was involved in 9 cases and there were no bilateral injuries. All injuries were closed.

All patients had a dorsal dislocation, the diagnosis was sometimes delayed because the injury was initially missed or the patient had multiple injuries and attention was being focused on other injuries. The diagnosis had been missed in six patients when they first presented at an accident and emergency department; the delay in diagnosis was from three to eight days.

Four of the twelve patients had other serious injuries,

one patient had ipsilateral Galeazzi fracture dislocation and floating knee, another patient had transient ulnar nerve injury, one patient had tibial plateau fracture and one patient had femoral shaft fracture. All patients were treated by open reduction and internal fixation. In three patients, open reduction and fixation was performed on the day of the injury and the remaining patients had been operated between one and seventeen days after the injury.

The subluxation or dislocation did not recur in any patient after treatment with open reduction and internal fixation. No patient was treated with closed reduction and percutaneous fixation with wire. Table 1 contains detailed information about the patients.

Operative technique:

Open reduction was carried out through two separate longitudinal or single transverse dorsal incision,[1] with the extensor tendons reflected to either side to gain access to the dislocated joints. In patients who had dislocation of multiple carpometacarpal joints, it was not necessary to fix the site of every fracture and fracture dislocation with wire, since the strong intermetacarpal ligament was not disrupted. In these patients, reduction of the dislocation and fixation of one carpometacarpal joint provided sufficient stability to maintain the reduction.

Postoperative protocol:

Volar plaster splint for 4 to 6 weeks, active motion of the fingers (IP and MP joint ROM exercises) was begun in the immediate postoperative period with splint.

Wound check, repeat X-rays to ensure maintenance of reduction from 7 to 10 days. All casts and Kirschner wires were removed after six weeks, follow-up was 1 to 12 months after injury.

Follow up program: At 3 month: check for range of movement, 6 Months: Return to sport / unlimited activity, one year: outcome assessment

Mayo modified wrist score[7] (table 2), including pain, work status, range of motion and grip strength, was used to evaluate the clinical outcome of the patients after one year. Anatomic reduction of dislocation, consolidation and reduction of associated fractures were analyzed on the last follow-up x-rays (P/A, lateral and oblique views of the hand.)

Table 1: Data of the patients

case	sex	Age (yrs.)	Dominance Of injured Hand	Type of injury (metacarpals)	Mechanism Of injury	Associated Injuries	Type of treatment	Interval Between Injury And treatment (Days)	Duration of fixation with kw (wks.)
1	M	22	Dom	Dorsal	Motorcycle acc	-	ORIF	1	6
2	F	27	Dom	Volar	Motorcycle acc	-	ORIF	7	6
3	M	30	Dom	Dorsal	Motor-vehicle acc	Galeazzi fracture, Floating knee	ORIF	Same day	8
4	M	20	Non-dom	Dorsal	Falling down	-	ORIF	Same day	6
5	M	33	Dom	Dorsal	Motorcycle acc	Transient ulnar nerve injury	ORIF	3	6
6	F	48	Non-dom	Dorsal	Trivial falling down	-	ORIF	5	8
7	M	42	Non-dom	Dorsal	Falling down	-	ORIF	6	6
8	M	26	Dom	Dorsal	Punching	-	ORIF	7	6
9	M	20	Dom	Dorsal	Motorcycle acc	Tibial plateau fracture	ORIF	Same day	6
10	M	36	Dom	Dorsal	Motorcycle acc	-	ORIF	3	6
11	F	21	Dom	Dorsal	Motor-vehicle acc	Fracture shaft femur	ORIF	8	8
12	M	24	Dom	Dorsal	Motorcycle acc	-	ORIF	4	8

Table 2: Mayo modified wrist score

Pain	Points
No pain	25
Mild occasional	20
Moderate	15
Severe	0
Work status	Points
Regular job	25
Restricted job	20
Able to work but unemployed	15
Unable to work due to pain	0
Range of motion ((% of normal side)	Points
90 to 100	25
75 to 89	25
50 to 74	20
25 to 49	15
0 to 24	10
Grip strength (% of normal)	Points
90 to 100	25
75 to 89	15
50 to 74	10
25 to 49	5
0 to 24	0

* Total point scores: excellent (91 to 100), good (80 to 90), fair (65 to 79), and poor (<64).

Results

Mayo modified wrist score[7] was used for clinical evaluation of all patients, which consists of four domains: pain, job, range of motion and grip strength. The score which ranges from 0 to 100 points was calculated, with 91 to 100 points indicating an excellent outcome, 80 to 90 points a good outcome, 65 to 79 points a fair outcome, and < 64 points a poor outcome. There were 10 males and 2 females. The mean age at time of injury was 29 years old (range from 20 to 48 years).

There were six motorcycle injuries, two motor-vehicle injuries, three falling injuries and one punching injury.

Following Mayo modified wrist scoring system, presenting eight patients (66.7%) with excellent results, one patient (8.3%) with good result, three patients (25%) with fair results.

Eight patients (66.7%) without pain, four patients (33.3%) with mild occasional pain.

Twelve patients had been employed at time of injury nine of them (75%) returned to their previous type of employment, two patients (16.7%) had restricted job and only one patient (8.3) able to work but unemployed .

Seven patients (58.3%) had normal range of motion in comparison with the uninjured wrist, four patients (33.3%) had 80 % range of motion from normal side, one patient (8.3%) had 60 % range of motion from normal side and all patients could make fist. Regarding grip strength; eight patients (66.7%) had 90-100 % of normal side four patients (33.3%) had 75-89 % of normal side.

The complications encountered in our series were pin tract infection in four cases (33.3%) they were treated with antibiotics and daily dressing, one patient (8.3%) with wrist stiffness and transient ulnar nerve palsy had occurred due to primary trauma which was resolved after one month.

Radiologically all carpometacarpal dislocations had been anatomically reduced with consolidation and reduction of associated carpometacarpal fractures at the final follow up X-rays.

Discussion

There is relatively little information in the literature regarding carpometacarpal fracture dislocations. The early recognition of these injuries is vital for satisfactory outcomes. A late diagnosis occurs either in cases of multiple injuries or where a lateral radiograph of the wrist was not taken in suspicious cases of carpometacarpal injuries.[8]

It has been suggested that a carpometacarpal dislocation will be shown better in an oblique radiograph or one taken with the forearm pronated by 30 degree on the anteroposterior position, but both have suggested that a lateral radiograph is of more value.[9] In our cases, the postero-anterior radiograph appeared virtually normal, the oblique view was thought to show no major abnormality, and only the true lateral view of the hand revealed the dislocation.

In 6 cases (50%) with delayed diagnosis only postero-anterior and oblique radiographs of the hand were done at the initial presentation, while the rest of cases, without delay in diagnosis, presented with lateral radiographs of the hand.

In our study, twelve patients presented with carpometacarpal fracture dislocation. All were treated with open reduction and internal fixation and presenting eight patients (66.7%) with excellent results, one patient (8.3%) with good result, three patients (25%) with fair results.

We performed open reduction that allowed us accurate reduction and we used K-wire fixation to maintain reduction, soft tissue healing and early mobiliza-

tion. Most patients returned back to their regular job and regained full function of the hand without any pain. Open reduction and internal fixation of dislocations of the carpometacarpal joints ensure a more anatomical restoration of the joint and possibly prevents transfixion of the tendons, which often precludes early mobilization.

Lawlis JF et al, reported twenty patients who had a dislocation of one or all of the medial four carpometacarpal joints were followed for an average of 6.5 years (range, 1.5 to 20.5 years).

The results of treatment were evaluated mainly on the bases of the degree of functional use of the hand and the severity of pain. Sixteen patients had an excellent result (the result in Case 5 was upgraded to excellent after arthrodesis), and six of them felt that the hand was completely normal.

Of the fifteen patients who had been treated with open reduction and internal fixation, thirteen had an excellent result, one was deemed to have a satisfactory result, and one had an unsatisfactory result. Ten of these patients had a normal range of motion in comparison with the uninjured wrist, and all could make a fist. Twelve regained full grip strength.[10]

Henderson J. et al. reviewed 21 cases of dorsal dislocation of carpometacarpal joints. In 15 of them the diagnosis was missed when they were first seen in an accident and emergency department. General swelling may obscure the characteristic clinical deformity and routine radiographs may not show the displacement clearly. Of the 11 patients treated by closed reduction, four were held in a plaster cast alone, while seven had this supplemented by Kirschner wire fixation. All patients had regained full function of the hand within four months of reduction or operation. One patient with simple dislocation at the fourth and fifth joints, diagnosed four months after injury, failed to attend for treatment. They recommend that a lateral radiograph of the hand should be requested when a routine postero-anterior view of the injured hand shows loss of parallelism or of symmetry at the carpometacarpal joints, overlap of joint surfaces, or apparent shortening of the metacarpals.[3]

Roberth H. et al. reported four patients with carpometacarpal fracture-dislocations of the ulnar four joints and in all of them there was extensive additional trauma. Open reduction was necessary in three patients, and only one was treated successfully by a closed reduction. He then had persistent but painless subluxation of the metacarpal bases. On end-result evaluation, two of the other three patients had occa-

sional discomfort and diminished grip strength. One patient had a diminished range of motion of the wrist joint at one-year follow-up, and one patient had narrowing and sclerosis of the carpometacarpal joints.[11]

Prokuski LJ and Eglseder WA, reported an average follow up of 3 years in the literature of multiple CMC joint dislocations. They recommended an open reduction and internal fixation using k-wires and delay in reduction up to 4 weeks did not compromise results.[12]

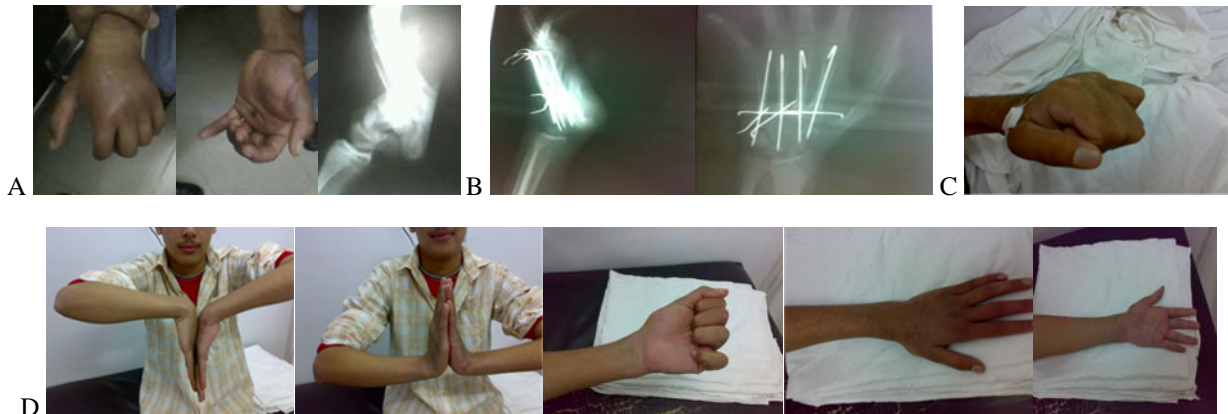
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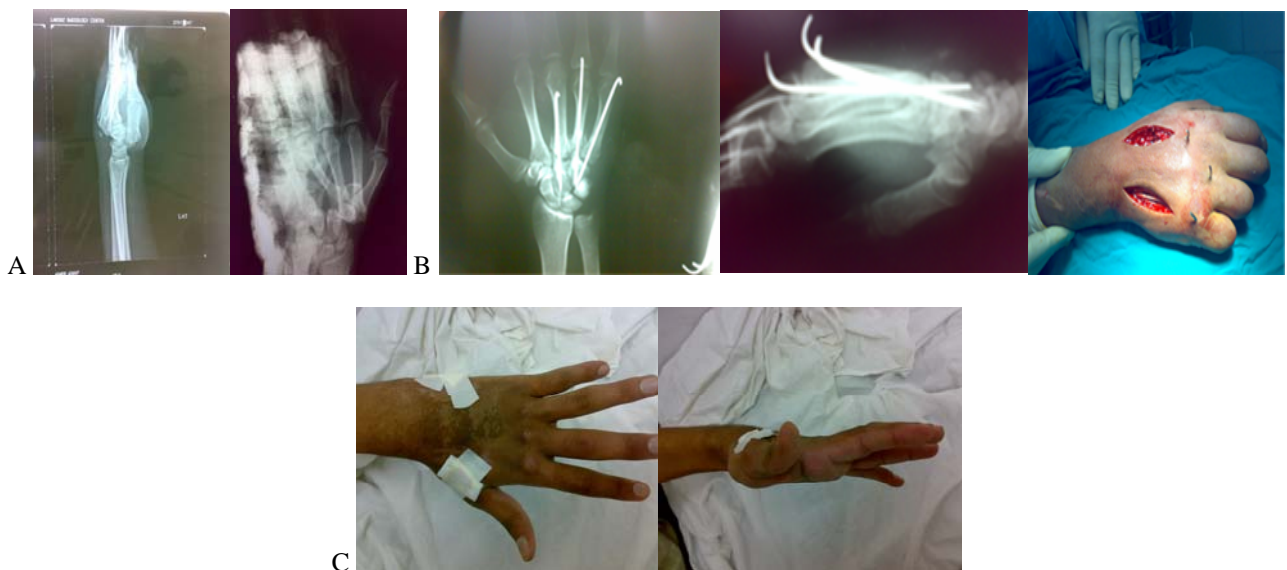
Limitations and strengths of the study

Conclusions

Open anatomical reduction and internal fixation of carpometacarpal dislocation with K-wires and early mobilization is recommended to achieve a good and early functional outcome. Carpometacarpal dislocation can be missed on initial assessment of the patient. Routine postero-anterior and oblique radiographs may not show the displacement clearly. A true lateral radiograph of the hand should be recommended for diagnosis of.



Case 1: Male patient 27years old with volar dislocation A: Preoperative. B: Post operative. C:6 weeks after wires removal. D: 6 month



Case 2: Male patient 22years old with volar dislocation A: Preoperative. B: Postoperative C:6 weeks

References

1. Frédéric Schuind, Wissam El Kazzi, Jörg Bahm, and Konstantinos Drosso M.Z. Siemionow and M. Eisenmann-Klein (eds.), *Hand Trauma, Dislocations and Fractures, Infections Plastic and Reconstructive Surgery*, 503 Springer Specialist Surgery Series, © Springer-Verlag London Limited 2010
2. Philip J. O'Connor Department of Musculoskeletal Radiology, Leeds Teaching Hospitals, Chapter 7 Hand and Wrist Injuries Philip J. O'Connor P. Robinson (ed.), *Essential Radiology for Sports Medicine*, DOI 10.1007/978-1-4419-5973-7_7, © Springer Science+Business
3. J. J. Henderson, FRCS Ed, M. A. M. Arafa, FRCS, FRCS Ed(Orth), Lecturer University of Manchester, Department of Orthopaedic Surgery, England.1987 British Editorial Society of Bone and Joint Surgery 0301-620X/87/2046
4. David H. Miller, M.D .,Theodore T. Miller, M.D ,Elizabeth Schultz, M.D., and Baruch Toledano, M.D.S Dislocation of the Second through Fifth Carpometacarpal Joints Department of Radiology and Department of Surgery., Division of Orthopedic Surgery, North Shore University Hospital, Manhasset, New York
5. Adeline R. Fisher1 Lee F. Rogers Ronald W. Hendrix Systematic Approach to Identifying Fourth and Fifth Carpometacarpal Joint Dislocations received June 8, 1 982; accepted after revision September 20, 1982. Presented at the annual meeting of the American Roentgen Ray Society, New Orleans, May 1982
6. Mezzadri G, Yzem I, Plotard F, Herzberg G. [Acute carpometacarpal joint dislocation of the long fingers: study of 100 cases].*Chir Main*. 2011 Oct;30(5):333-9. Elsevier Masson SAS
7. Amadio PC, Berquist TH, Smith DK, Ilstrup DM, Cooney WP 3rd, Linscheid RL. Scaphoid malunion. Mayo wrist score J Hand Surg [Am]. 1989 Jul;14(4):679-87
8. John D. HSU, M.D., C. M4, and Raymond M. Curtis, M.D. ,Baltimore, Maryland Carpometacarpal Dislocations on the Ulnar Side of the Hand From the Department of Surgery, Division of Orthopaedic Surgery and Plastic Surgery, Johns Hopkins University, School of Medicine and Hospital, Baltimore, the American Society for Surgery of the Hand, Chicago, Illinois, January 17, 1970
9. Sang-Uk Lee • Il-Jung Park • Hyoung-Min Kim • Changhoon Jeong • Jin-Rok Oh Fourth and fifth carpometacarpal fracture and dislocation of the hand: new classification and treatment Received: 20 July 2011/Accepted: 5 October 2011 Springer-Verlag 2011
10. JOHN F. LAWLIS, III, M.D.t, AND STEPHEN F. GUNTHER, M.D4, WASHINGTON, D.C. Carpo-metacarpal Dislocations Long-term follow up* BY From the Department of Orthopaedic Surgery, Washington Hospital Center and George Washington University, Washington, Copyright 1991 by The Journal of Bone and Joint Surgery.
11. ROBERT H. HARTWIG, M.D.*. AND DEAN S. LOUIS, M.D.t, ANN ARBOR, MICHIGAN Multiple Carpometacarpal Dislocations A REVIEW OF FOUR CASES BY From the Section of Orthopaedic Surgery. University of Michigan Medical Center, Ann Arbor Copyright 1 979 by The Journal of Bone and Joint Surgery. Incorporated
12. Laura J. Prokuski and *W. Andrew Eglseder, Jr. Concurrent Dorsal Dislocations and Fracture-Dislocations of the Index, Long, Ring, and Small (Second to Fifth) Carpometacarpal Joints Division of Orthopaedic Surgery, University of Wisconsin Hospital, Journal of Orthopaedic Trauma Vol. 15, No. 8, pp. 549-554 © 2001 Lippincott Williams & Wilkins, Inc., Philadelphia.