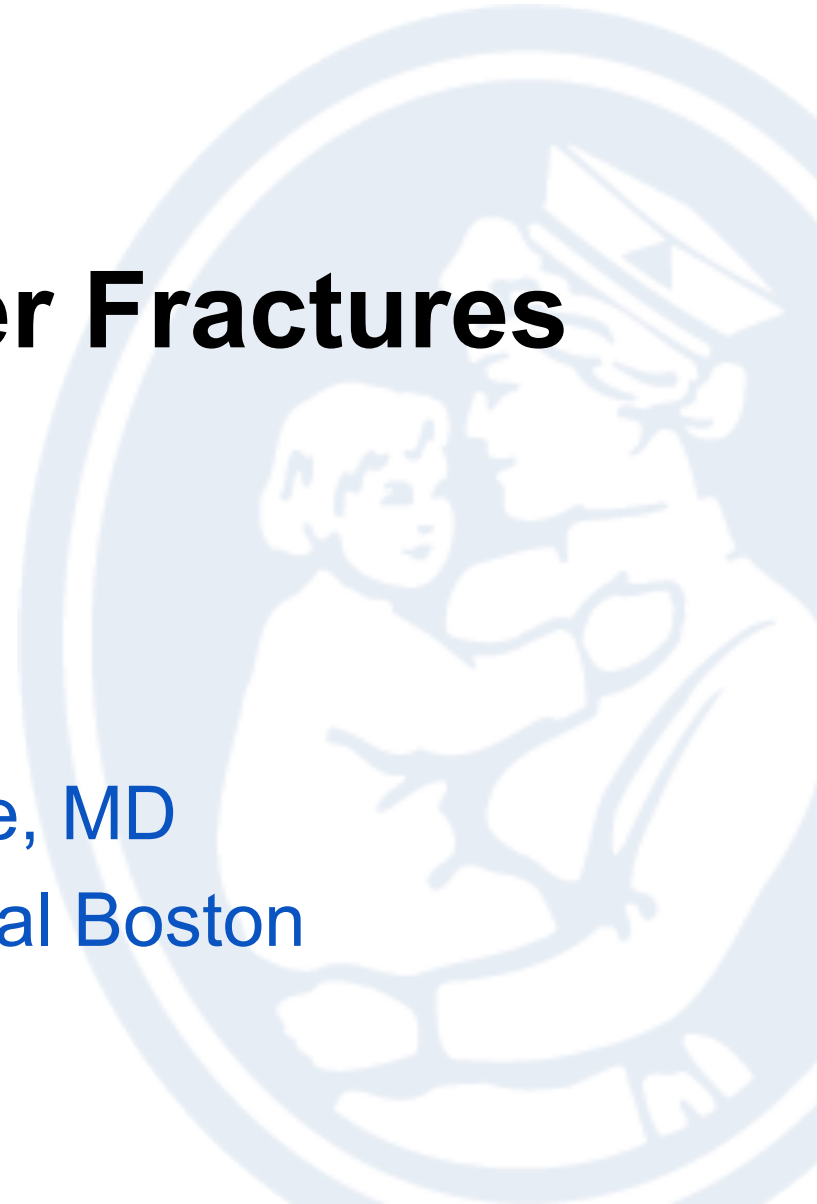

Carpal and Finger Fractures

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Objectives

Epidemiology of hand and wrist injuries

Discuss injuries requiring surgical care

Common complications & strategies for avoidance

Epidemiology

Hand fractures common

- Annual incidence 1 -2 : 1,000
- Bimodal distribution
 - Toddlers: fingertip crush
 - Adolescents: sports related
- Proximal phalanx of border digits most common
- 1/3 physeal fractures



Epidemiology

Hastings & Simmons, *Clin Orthop*, 1984

- 354 pediatric hand fractures, 2 year follow-up
- Small percentage of injuries -> large percentage of complications and poor outcomes
- Malunion risks
 - Failure to obtain adequate x-rays
 - False assumptions about remodeling

Epidemiology

Hastings & Simmons, *CORR*, 1984

- Problem fractures:
 - Open
 - Displaced articular
 - SH I of distal phalanx
 - Phalangeal neck
- Key: recognition of problematic injuries



1. Seymour's fracture



Physeal fracture with nailbed laceration

- High index of suspicion

Nail removal, I&D, nailbed repair, fracture reduction

Seymour's fracture

Complications

- Infection
- Physeal arrest
- Nail deformity



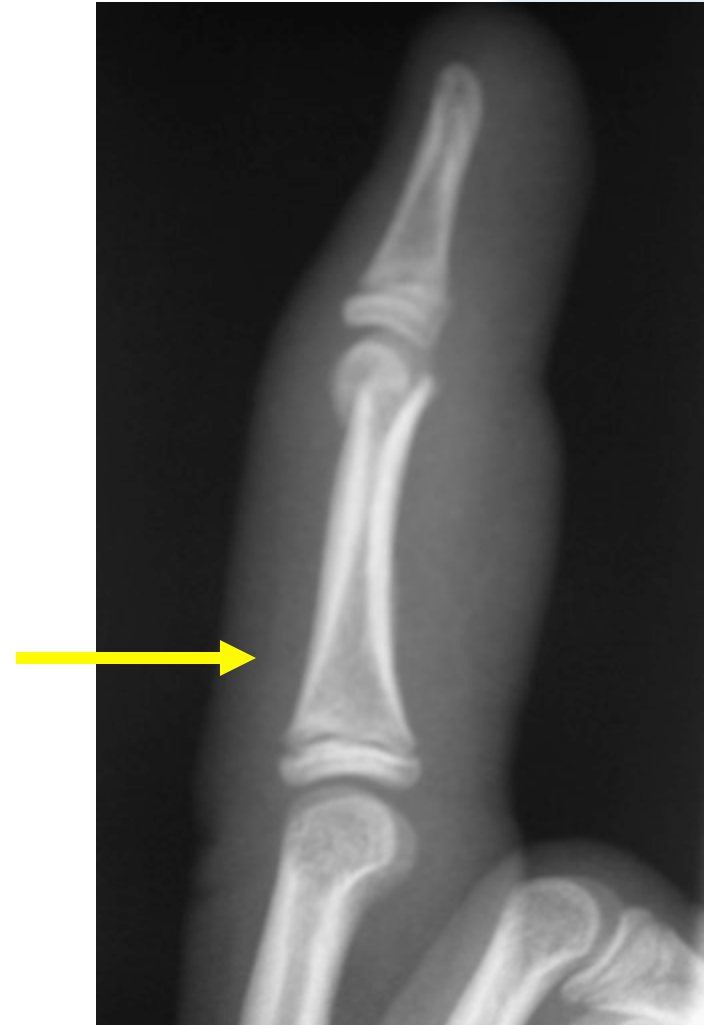
2. Phalangeal neck fractures

Sports or “doorjamb” injuries

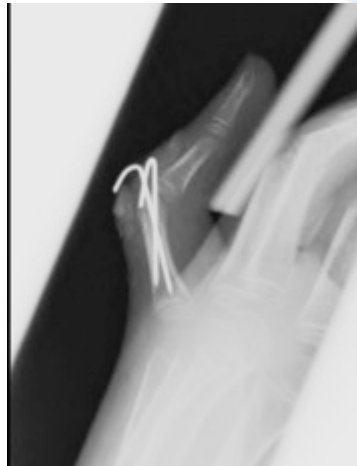
X-rays findings subtle

Closed treatment -> little remodeling, poor flexion

Surgery recommended for displaced fractures



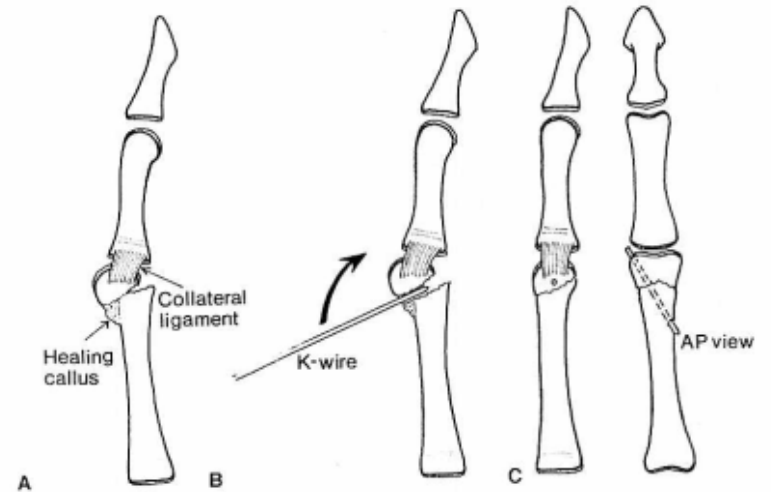
Phalangeal neck fractures



Phalangeal neck fractures

Percutaneous osteoclasis & pinning for late-presenting fractures

- Waters et al, JHS-A, 2004



Fossa reconstruction (“bumpectomy”) for established malunions

- Simmons & Peters, JHS, 1987.



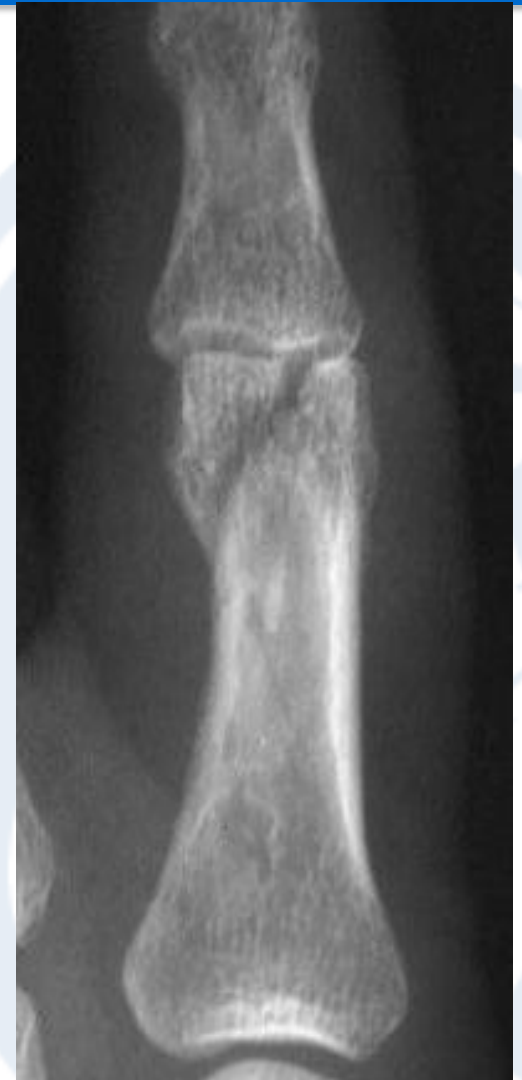
3. Intercondylar phalangeal fracture

Intra-articular fracture

Malunion → deformity, stiffness, arthrosis

Nondisplaced → high risk for late displacement

Displaced → ORIF



Intercondylar phalangeal fracture



4. Complex MCP dislocation

Simple → easily reducible

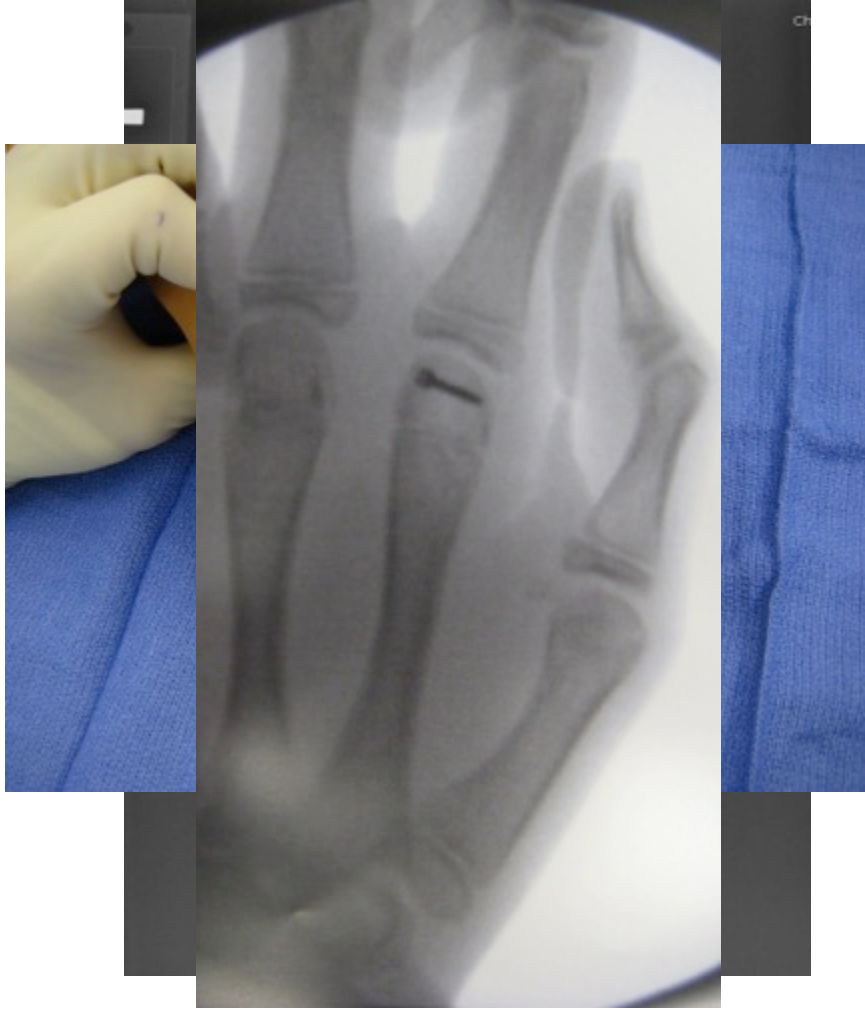
Complex → irreducible

Reduction maneuver

- Flex wrist to relax flexors
- Hyperextend MCP
- Volar pressure over P1
- Avoid direct longitudinal traction!



Complex MCP dislocation



5. Salter-Harris III fracture of thumb

Pediatric “gamekeeper’s”
thumb

UCL avulsion fracture

Surgery t for displaced fractures

- Restore articular congruity
- Restore stability



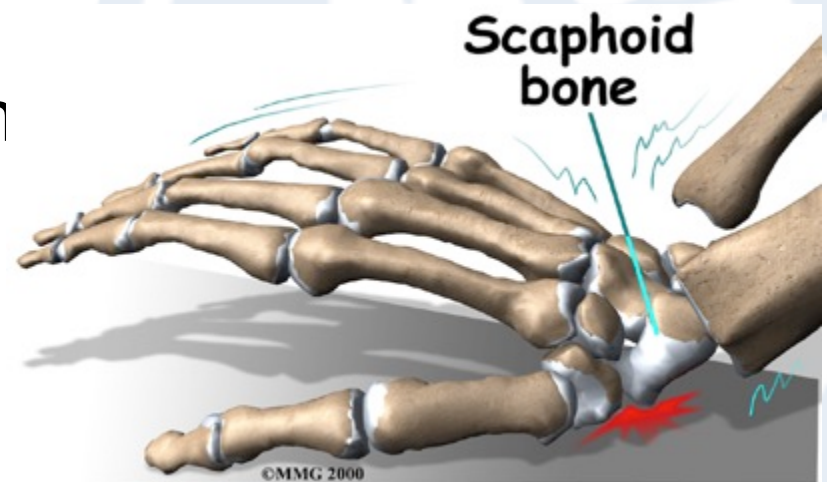
Salter-Harris III fractures of thumb



6. Scaphoid fractures

Most commonly fractured carpal bone

- 2nd & 3rd decade of life
- M > F
- Fall onto outstretched hand wrist extended
- Pain, swelling



Historical treatment

Historically:

- Distal pole fractures
- Non-operative care

Vanvanen et al, AOS, 1980

- 108 pediatric scaphoid fx
- 94 (87%) distal pole
- All healed with casting!

Christodoulou & Colton, JPO 1986



Contemporary perspective

Gholson et al, JBJS 2011

- 351 scaphoid fractures
- 342 patients
- 1995-2010

- 312 with complete f/u
- 14.6 years (7-18yrs)
- 26 week follow-up

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Scaphoid Fractures in Children and Adolescents: Contemporary Injury Patterns and Factors Influencing Time to Union

J. Joseph Gholson, BS, Donald S. Bae, MD, David Zurakowski, PhD, and Peter M. Waters, MD

Investigation performed at Children's Hospital Boston, Boston, Massachusetts

Background: Historically, scaphoid fractures in children and adolescents have predominantly involved the distal pole, requiring neither surgical care nor extended follow-up. Changing patient characteristics, however, appear to be altering fracture epidemiology and treatment. The purpose of this investigation was to characterize contemporary fracture patterns in children and adolescents and to identify factors influencing time to healing following both nonoperative and operative treatment.

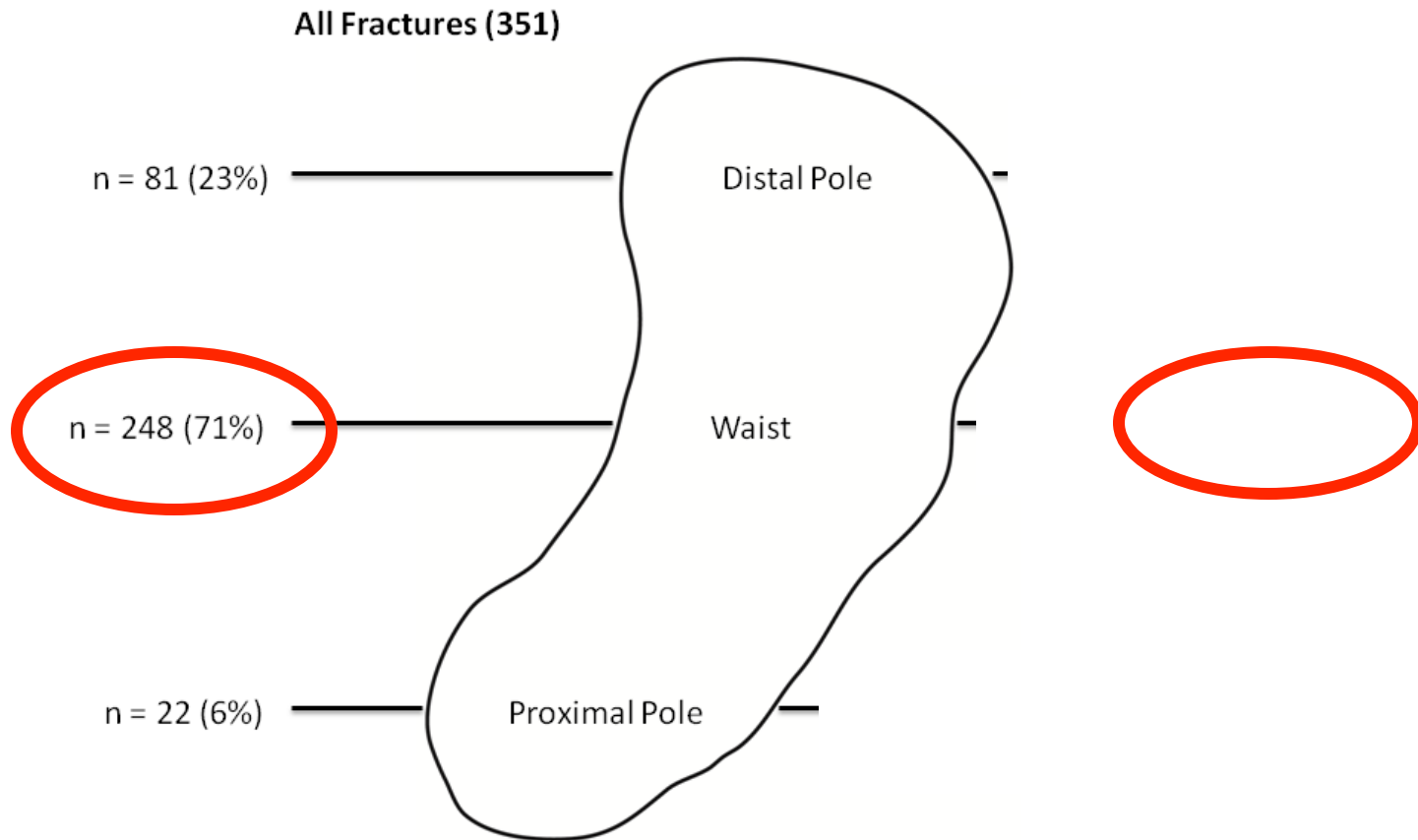
Methods: A retrospective analysis of 351 scaphoid fractures that had been treated from 1995 to 2010 was performed to characterize fracture patterns. The mean patient age was 14.6 years (range, seven to eighteen years). Complete clinical and radiographic follow-up data were available for 312 fractures (89%), with 222 fractures presenting acutely and ninety not acutely. Union rates following casting or surgical treatment were determined, and Cox regression analysis was utilized to identify factors influencing both the union rate and the time to union.

Results: Overall, 248 fractures (71%) occurred at the scaphoid waist, eighty-one (23%) occurred at the distal pole, and twenty-two (6%) occurred at the proximal pole. Male sex, high-energy mechanisms of injury, closed physes, and high body-mass index were associated with fractures of the waist or proximal pole. Treatment of acute fractures with casting alone resulted in a 90% union rate. Lower union rates were seen in association with the use of casting alone for the treatment of chronic fractures, displaced fractures, and proximal fractures. Longer time to union was seen in association with older fractures, displaced fractures, proximal fractures, and fractures in patients with osteonecrosis. The union rate following surgery was 96.5% (109 of 113). Increased time to union was seen in association with open physes, fracture displacement, proximal fracture, the type of screw used for surgical fixation, and the use of bone graft at the time of surgery.

Discussion: With changes in patient characteristics and activities, scaphoid fracture patterns in children and adolescents are now similar to the published patterns in adults. While 90% of acute nondisplaced fractures heal with nonoperative treatment, three months of cast immobilization or more may be required for more proximal injuries. Almost one-third of pediatric patients with scaphoid fractures will present late with chronic nonunions; in these instances, surgical reduction and internal fixation should be considered the primary treatment option.

Level of Evidence: Therapeutic Level III. See Instructions to Authors for a complete description of levels of evidence.

Contemporary injury patterns



Older age, higher energy injury --> more proximal fractures

Treatment: Acute

Non-displaced:

- Cast
- (Screw)

ORIF

- Displaced
- Proximal pole



Non-displaced fractures?

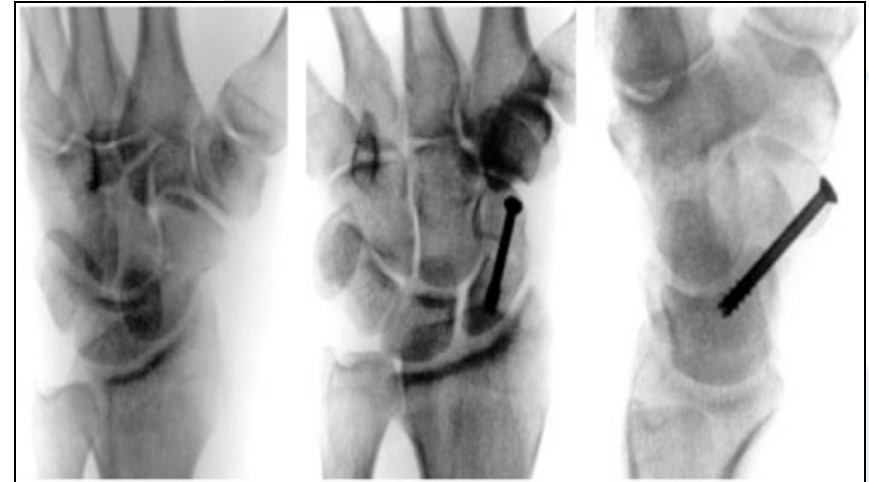
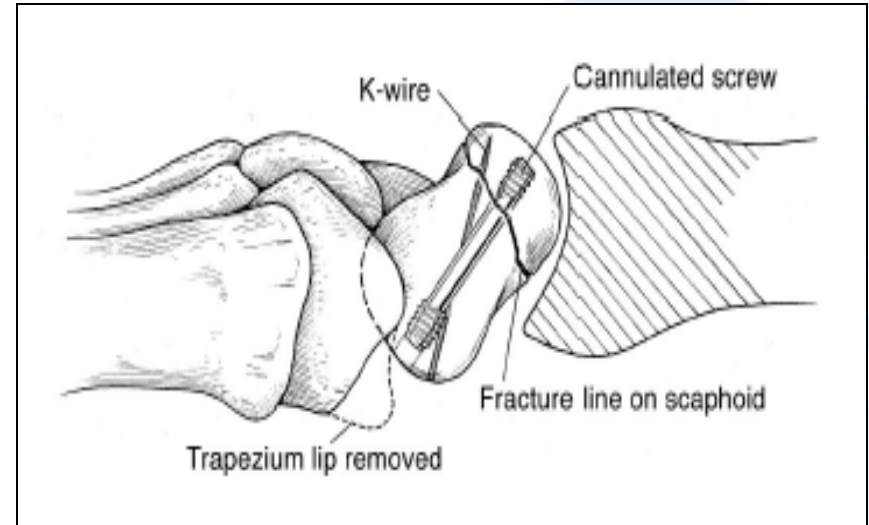
Percutaneous screw for non-displaced fractures

- Faster healing?

Bond et al., JBJS, 2001

Dias et al, JBJS 2005

McQueen et al, JBJSB 2008



Non-displaced fractures?



Proximal pole

ORIF for proximal pole fractures

- Limited vascularity
- High nonunion risk
- Challenging salvage



Outcomes

Bae et al, JPO 2015

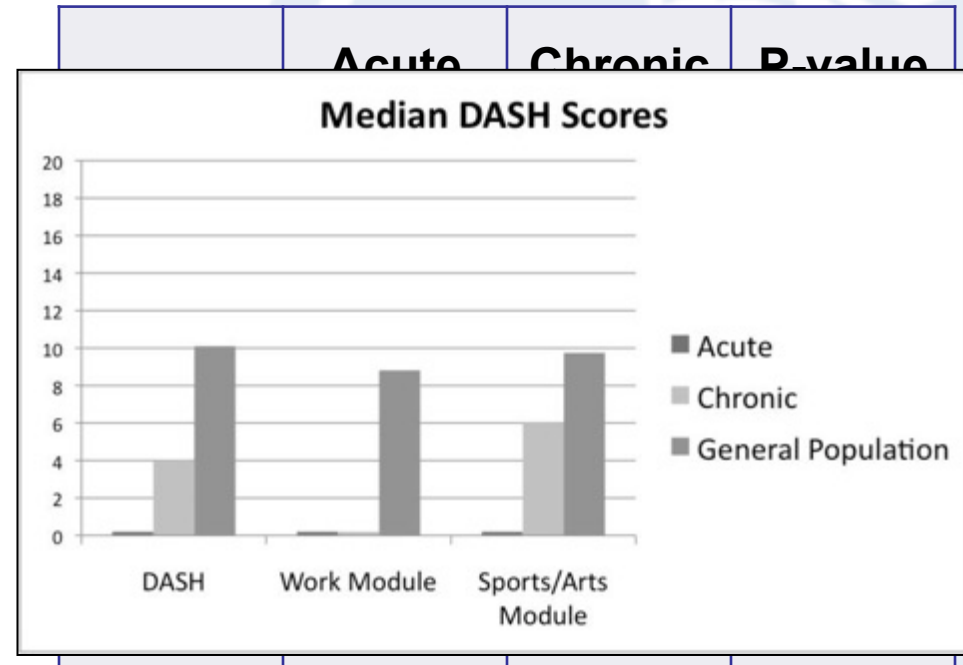
63 patients

- 39 acute fractures
- 24 non-unions
- Mean 7.3 yrs follow-up (range 2.6 – 17.7 yrs)

Overall, good outcomes with appropriate treatment

Functional Outcomes After Treatment of Scaphoid Fractures in Children and Adolescents

Donald S. Bae, MD, James J. Gholson, MD,† David Zurakowski, PhD,* and Peter M. Waters, MD**



Conclusions

Scaphoid fractures common in children

- Fracture patterns similar to adults

Acute non-displaced fractures: cast x 2-3 months

Surgical indications

- Displaced waist fractures
- Proximal pole fractures

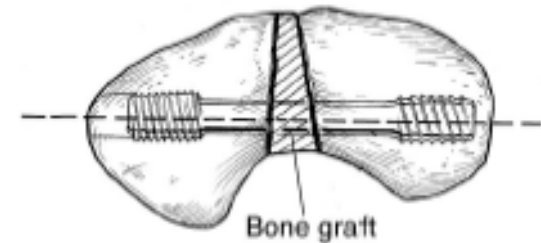
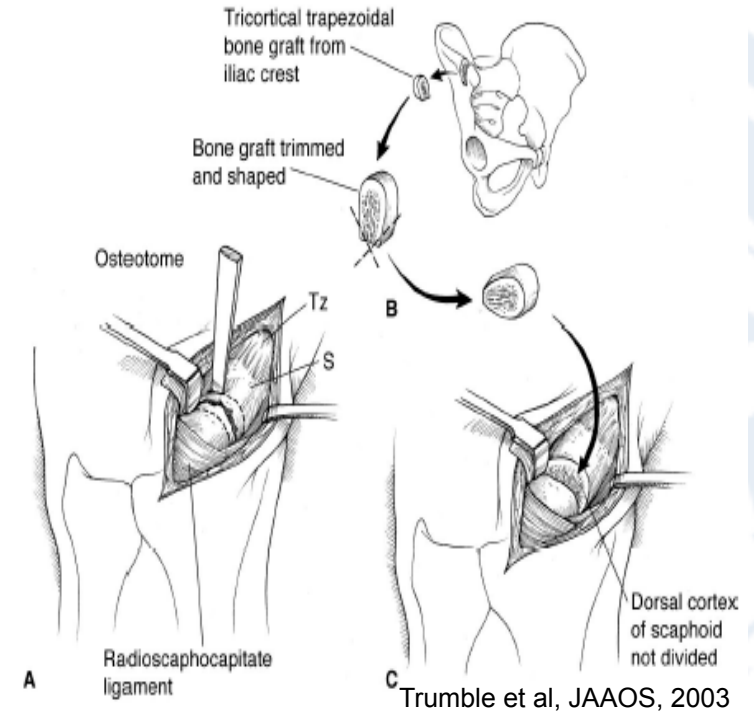
Scaphoid fractures

Displaced fractures

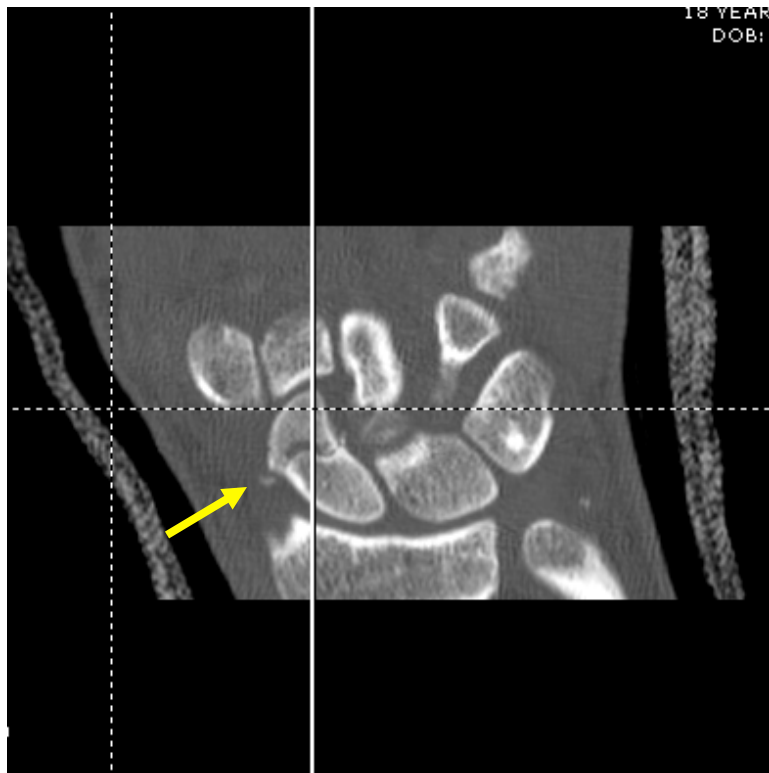
- Risk of nonunion
- Risk of arthrosis
- Treatment: ORIF!

Nonunion, osteonecrosis

- ORIF with bone graft
- Vascularized bone graft
- Salvage procedures



Scaphoid fractures



Summary

High index of suspicion and adequate radiographic evaluation is needed

Surgical treatment for:

- Seymour's fractures
- Displaced phalangeal neck fractures
- Unicondylar phalangeal fractures
- Displaced SH III fractures of the thumb proximal phalanx
- Complex MCP dislocations/ MC head fractures
- Scaphoid fractures