PAEDIATRIC HAND INJURIES

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Hand injuries in children

- Overview
- Flexor tendon
- Problem fractures

PAEDIATRIC HAND INJURY ASSESSMENT IN RVI

- OPEN ACCESS
- AGE 0 TO 16 YEARS
- DAILY TRAUMA CLINIC
- INJURIES TREATED AND FOLLOWED UP IN CLINIC
- OR ADMITTED FOR FURTHER TREATMENT

DATA ANALYSIS
3 YEAR PERIOD

- 2121 PATIENTS WITH HAND INJURIES REFERRED FOR TREATMENT
- THERMAL INJURIES EXCLUDED
- 1878 PATIENT RECORDS TRACED
- 93.6% RETRIEVAL
- 2201 INJURIES ANALYSED

MECHANISM OF INJURY

CRUSH	581
FALL	492
HYPEREXTENSION	317
PUNCH	277
DIRECT TRAUMA	205
OTHER	135
GLASS	114
KNIFE	25
UNKNOWN	24
BITES	17
CONGENITAL	14

TOTAL 2201

PATTERN OF INJURY (1)

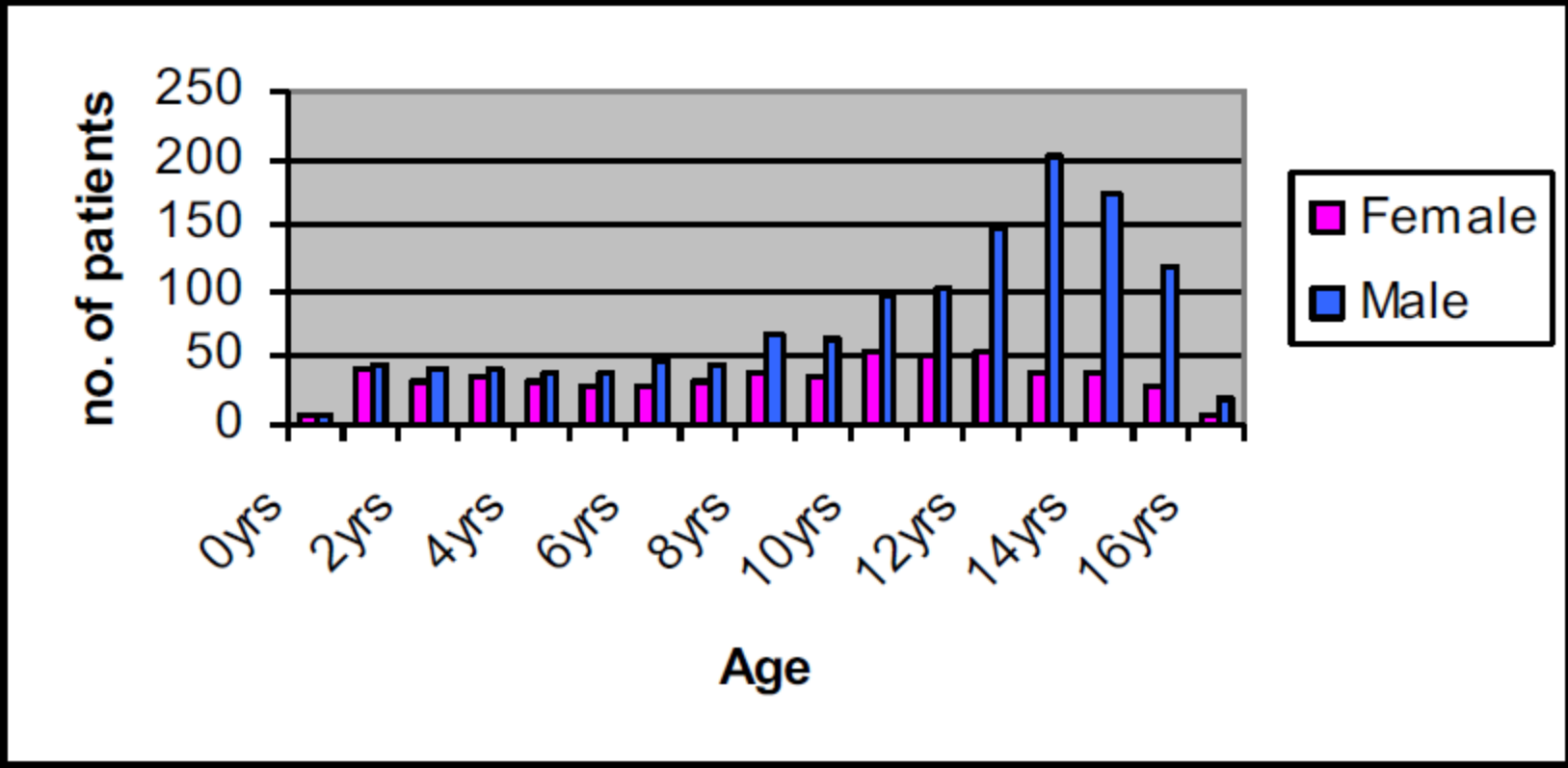
2201 injuries

- 617 phalangeal fractures
- 428 metacarpal fractures
- 249 nailbed injuries
- 186 simple wounds
- 177 digit tip amputations
- 157 sprains
- 75 palmar plate injuries

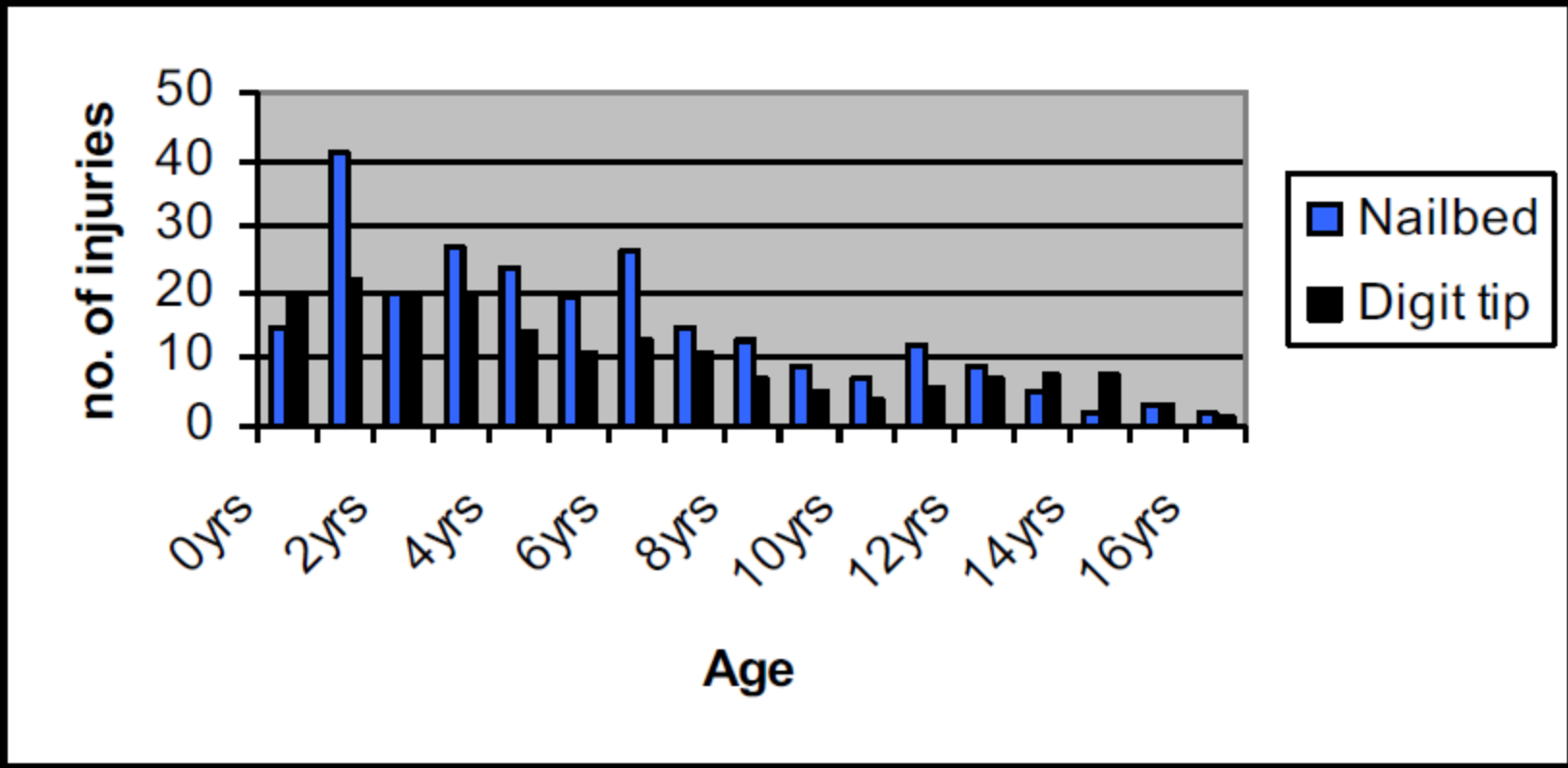
PATTERN OF INJURY (2)

- 65 infections
- 47 nerve injuries
- 36 foreign bodies
- 34 extensor tendon injuries
- 32 mallet injuries
- 31 flexor tendon injuries
- 26 dislocations
- 14 congenital abnormalities
- 4 vascular injuries
- 23 “other”

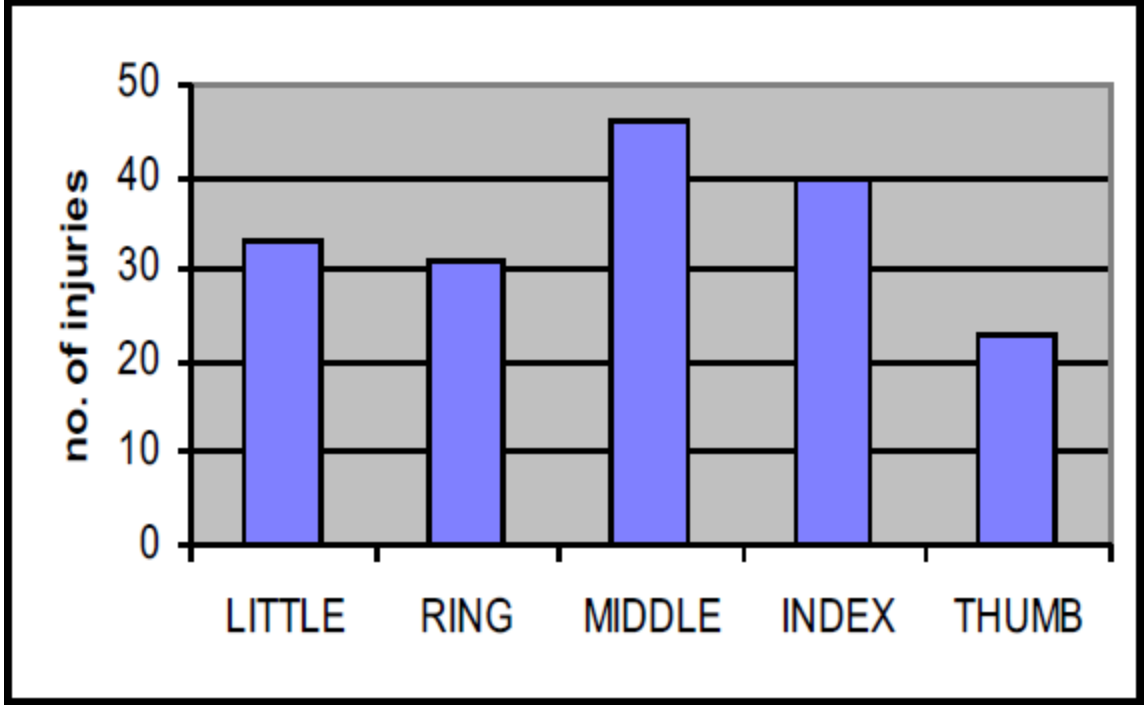
MALE : FEMALE RATIO



AGE DISTRIBUTION OF INJURIES



DIGIT TIP AMPUTATIONS



TREATMENT

177 INJURIES

-65 CONSERVATIVE

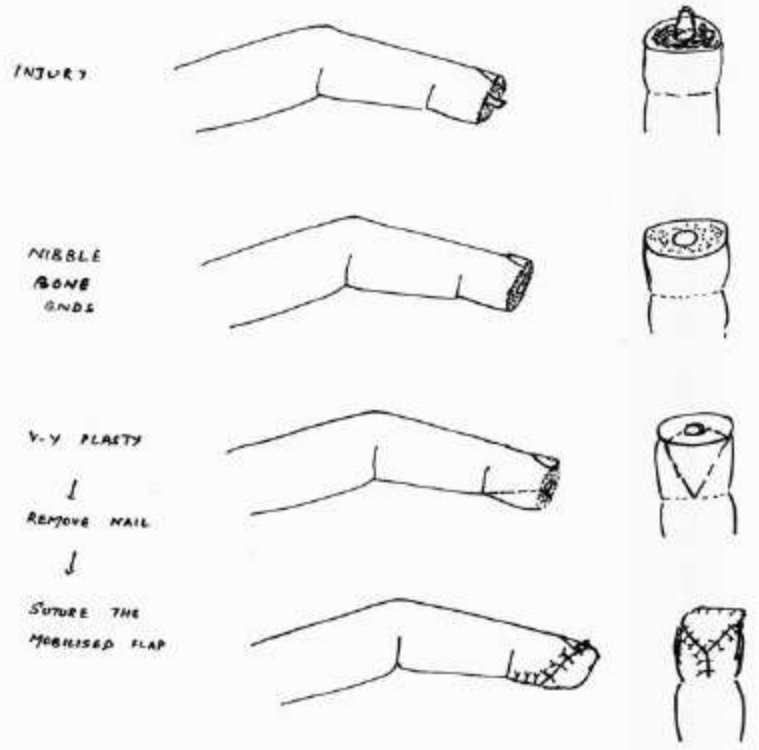
-112 SURGICAL

Geometry Of Fingertip Amputations

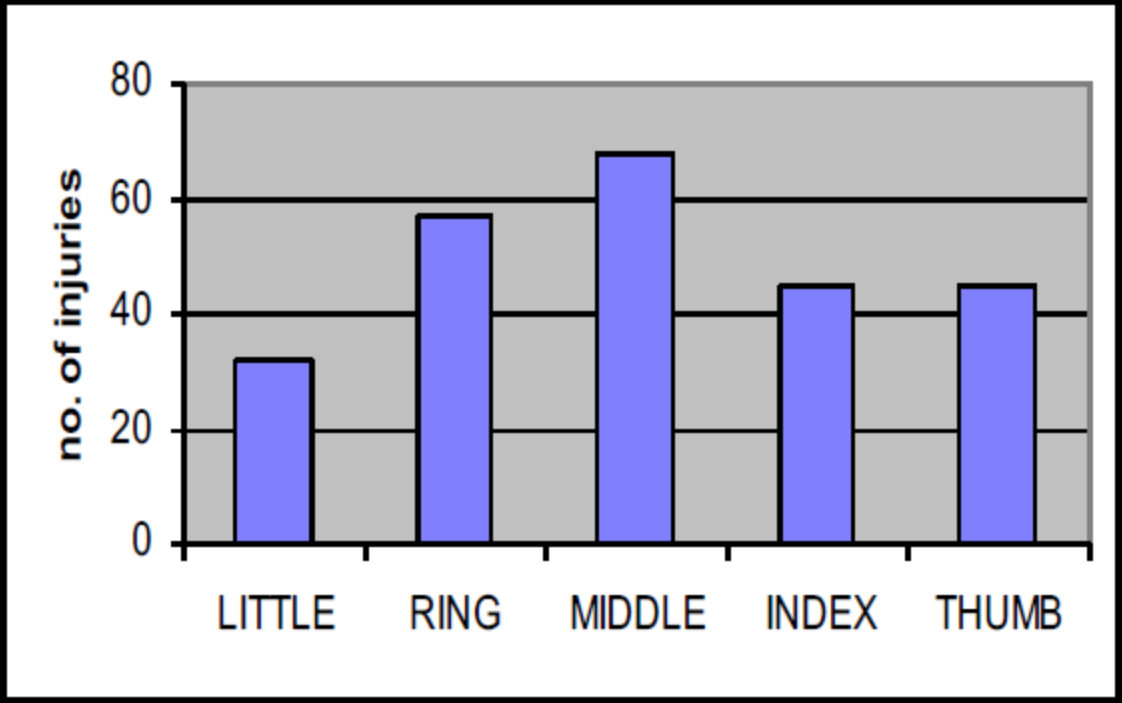
Transverse
- Involving soft tissue only (distal)
- Involving bone also

Dorsal oblique

Palmar oblique



NAILBED INJURIES



TREATMENT

249 INJURIES

-14 CONSERVATIVE

-235 SURGICAL

Fractures

TOPICS

- Special considerations in the child's hand
- Fractures specific to children
- Problem fractures
- Complications

SPECIAL CONSIDERATIONS IN THE CHILD'S HAND

- Anatomy and Biology
- Clinical and Diagnostic
- Therapeutic

ANATOMY AND BIOLOGY

- Plasticity of bones
  - influences fracture pattern
- Fast healing of fracture
- Less problems with stiffness

ANATOMY AND BIOLOGY

- Growing bones - physeal /periphyseal injuries
- Attachments of ligaments and tendons
- Blood supply/ ossification sequence

REMODELLING

ONLY in plane of motion of joint

Dorsal-palmar plane: *yes*

Radial-ulnar plane: *some*

Rotational: *no*

Less potential for remodelling

a) approaching skeletal maturity

b) with increasing distance from physis

c) with increasing angular deformity

CLINICAL AND DIAGNOSTIC CONSIDERATIONS

- History uncertain
- Small size of hand
- Oedema /fat may mask deformity
- Co-operation with examination/x-ray
- Inadequate x-rays - NB true lateral
- Non-ossified ‘bone’

CLINICAL AND DIAGNOSTIC CONSIDERATIONS

- **Non-accidental injury**
  - hand fractures in infants uncommon
  - multiple fractures
  - hyperextension mechanism
- **Pathological fracture**
- **Congenital anomalies**

eg trigger, camptodactyly, clinodactyly, brachydactyly, epiphyseal anomalies, Kirner's deformity, skeletal dysplasia

THERAPEUTIC CONSIDERATIONS

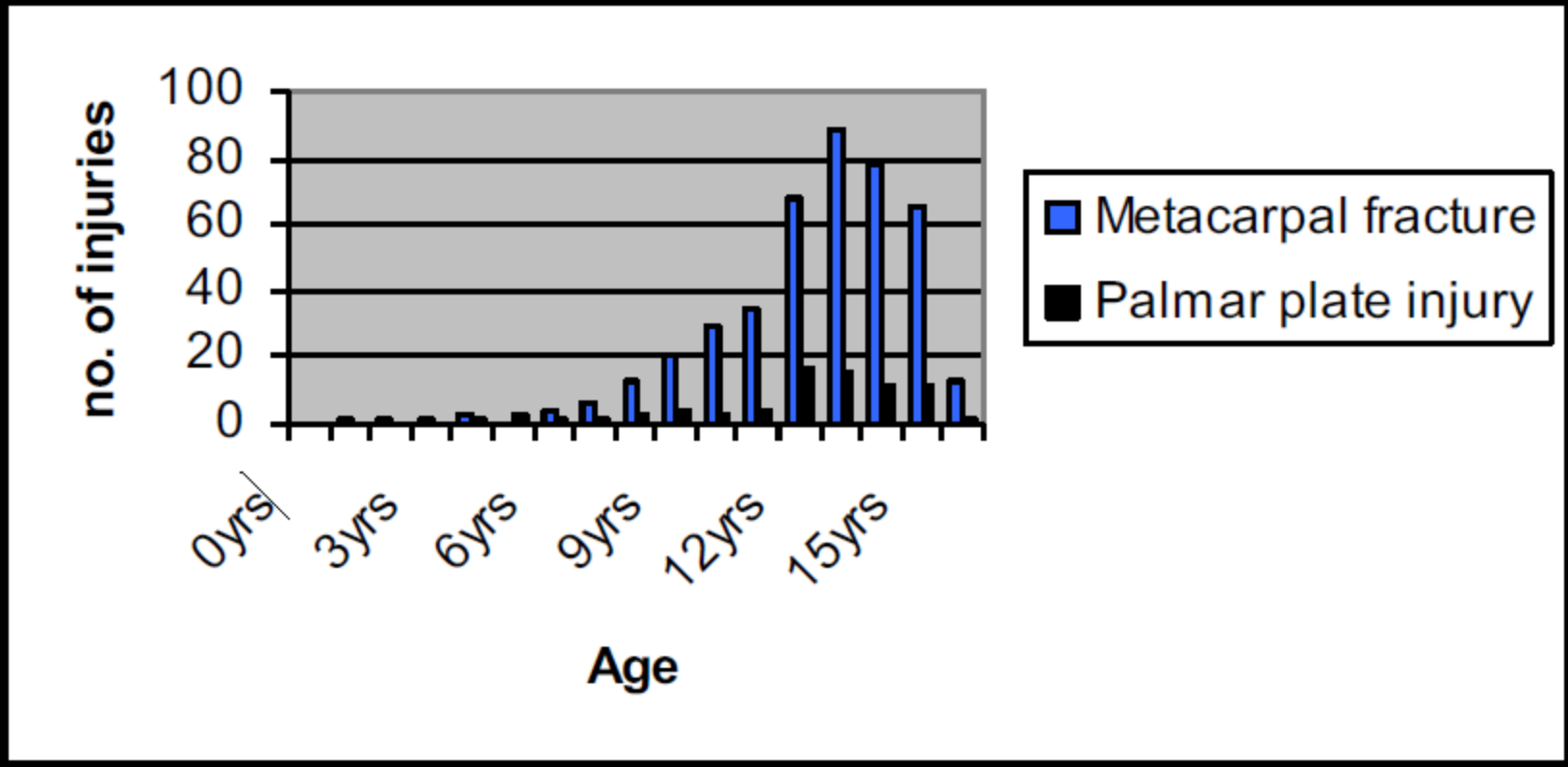
- Consent for treatment

- Immobilization of small bones in small hands
  - a challenge

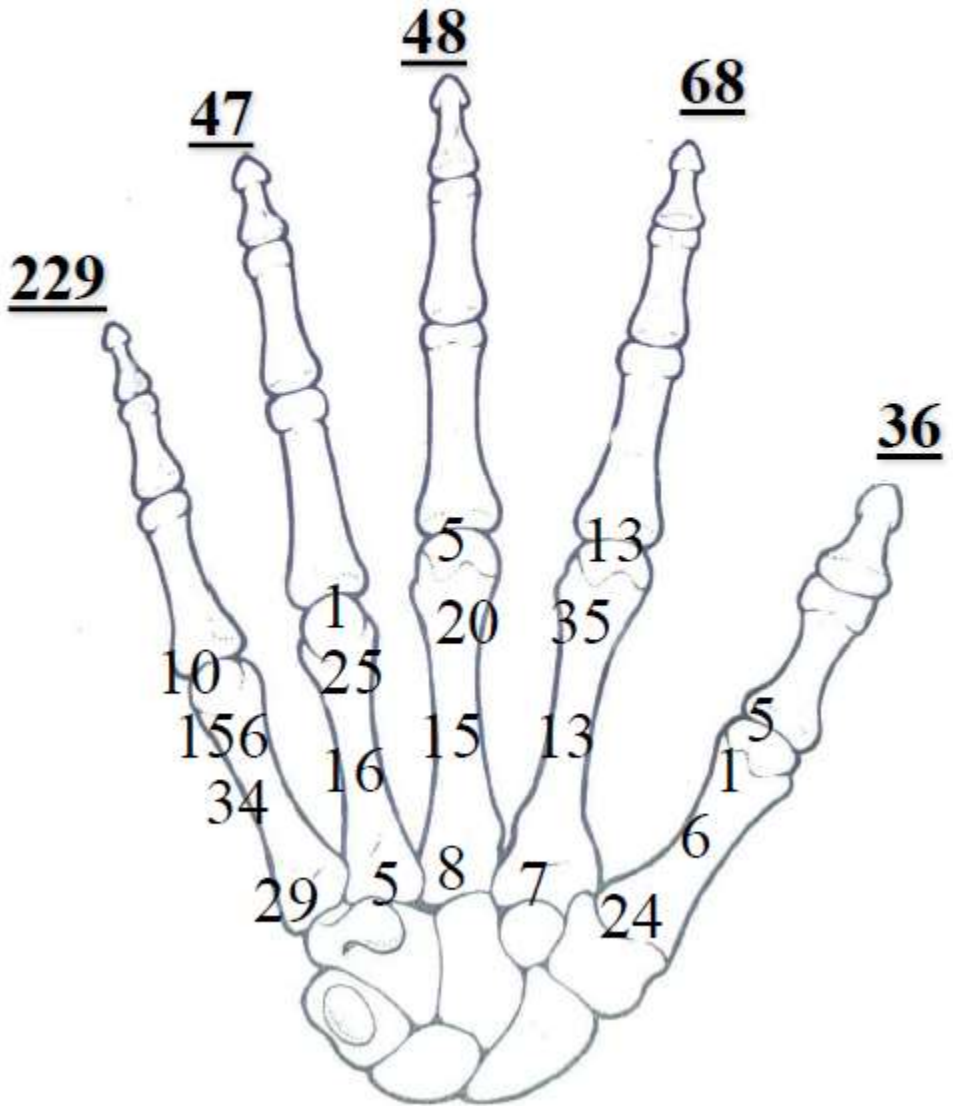
- Appropriate resources
  - skilled surgeon
  - paediatric anaesthesia
  - instrumentation
  - imaging

- Rehabilitation

AGE DISTRIBUTION OF INJURIES

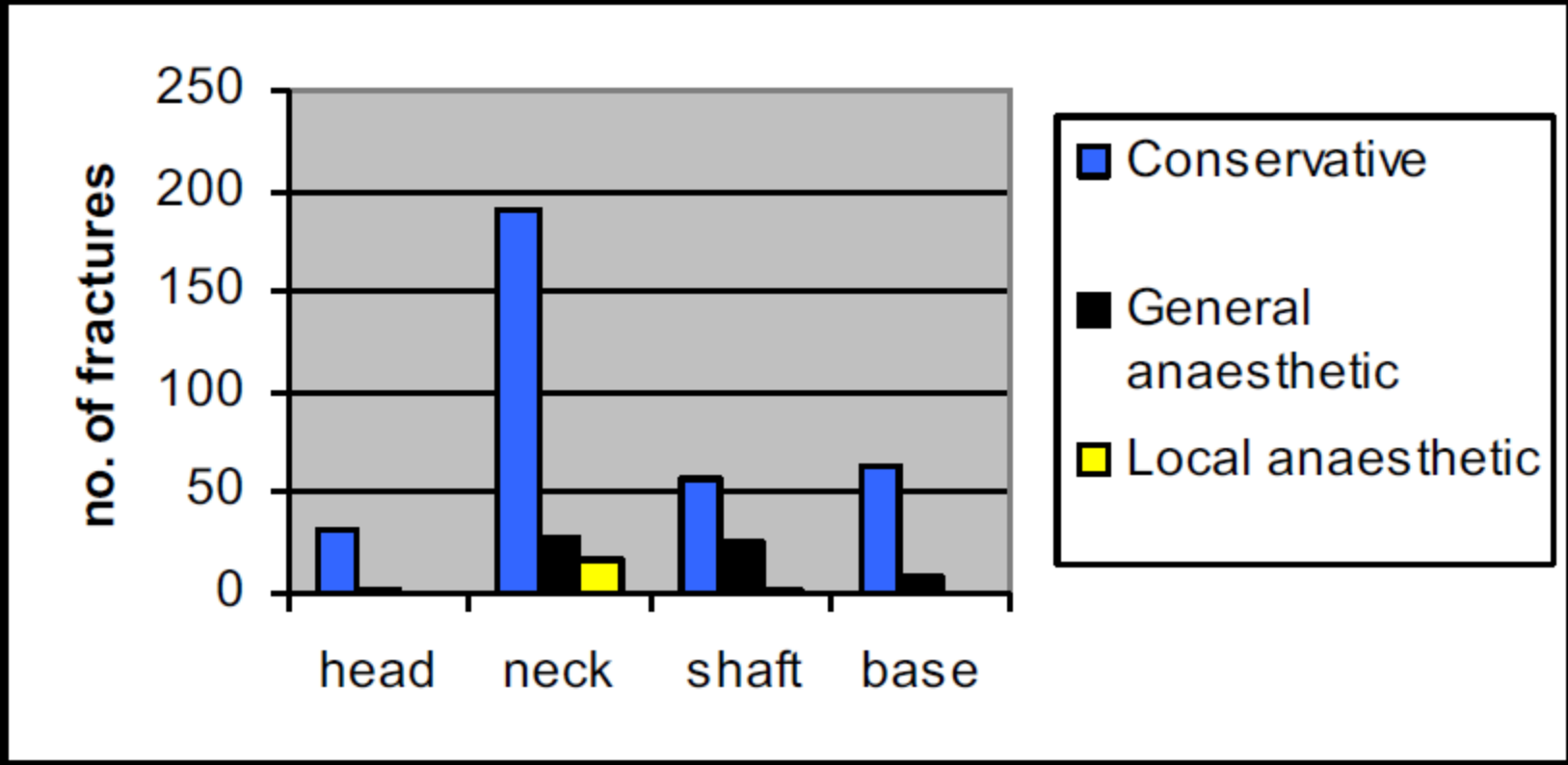


Metacarpal Fractures

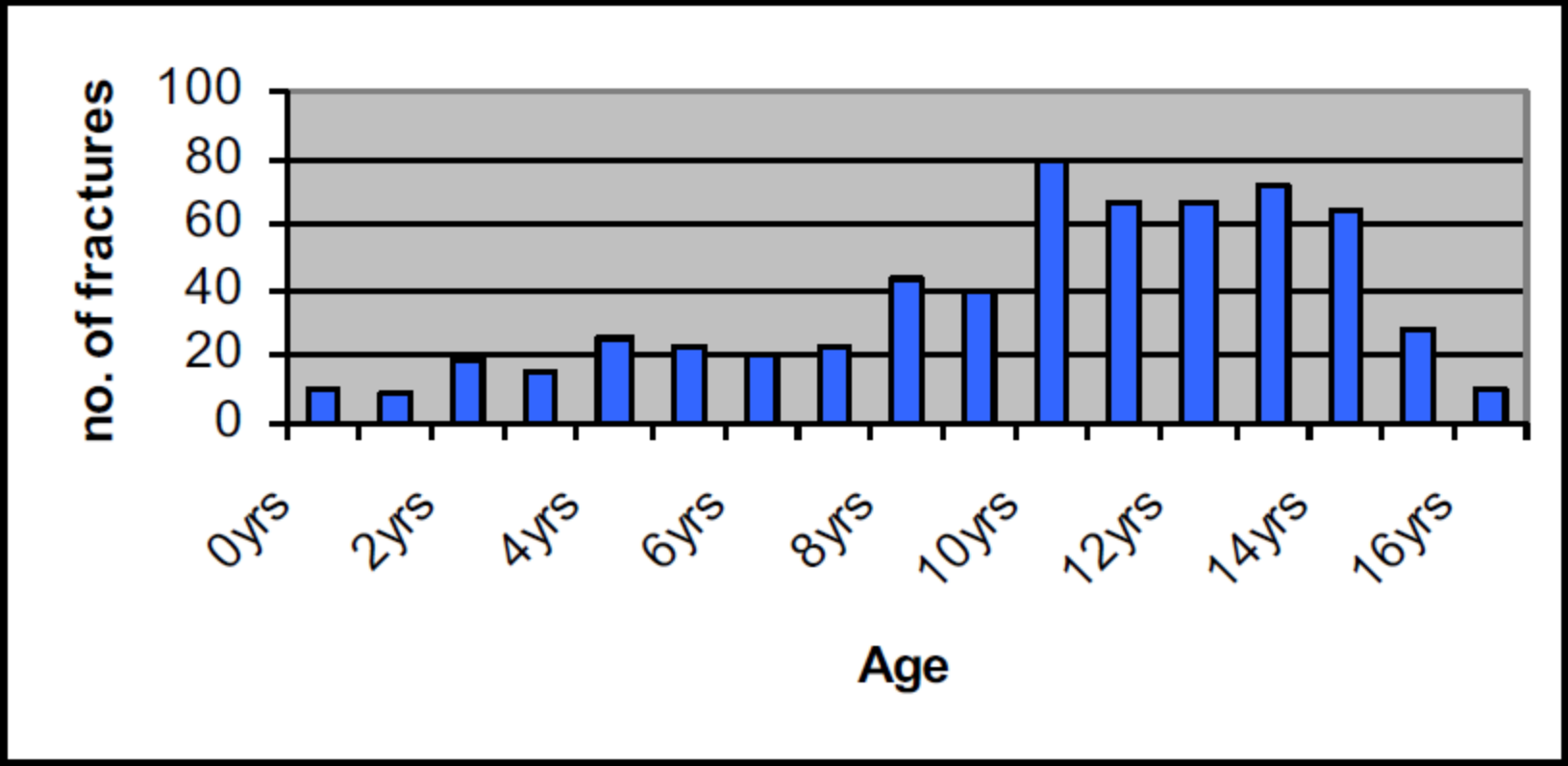


Total - 428

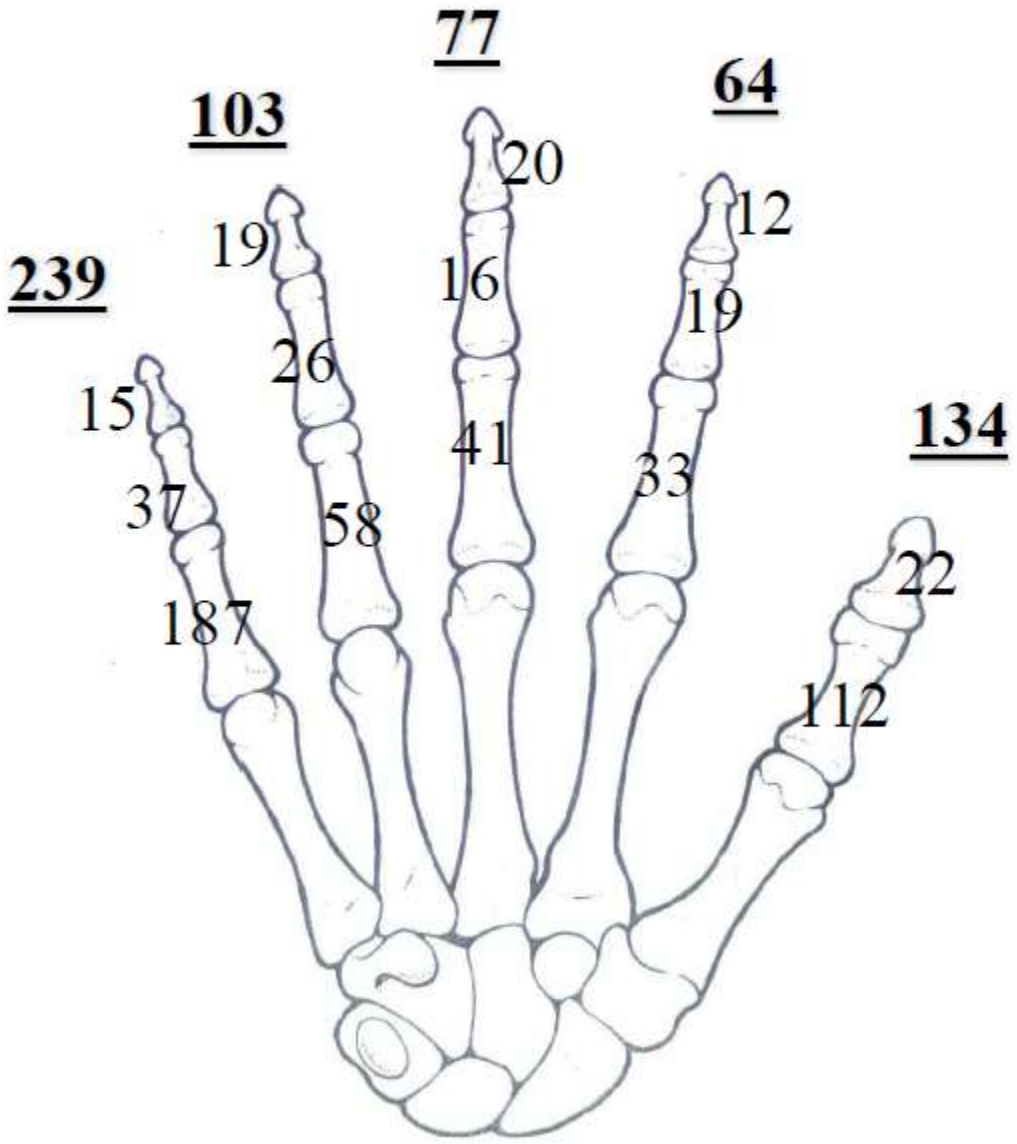
Management of Metacarpal Fractures



AGE DISTRIBUTION OF PHALANGEAL FRACTURES

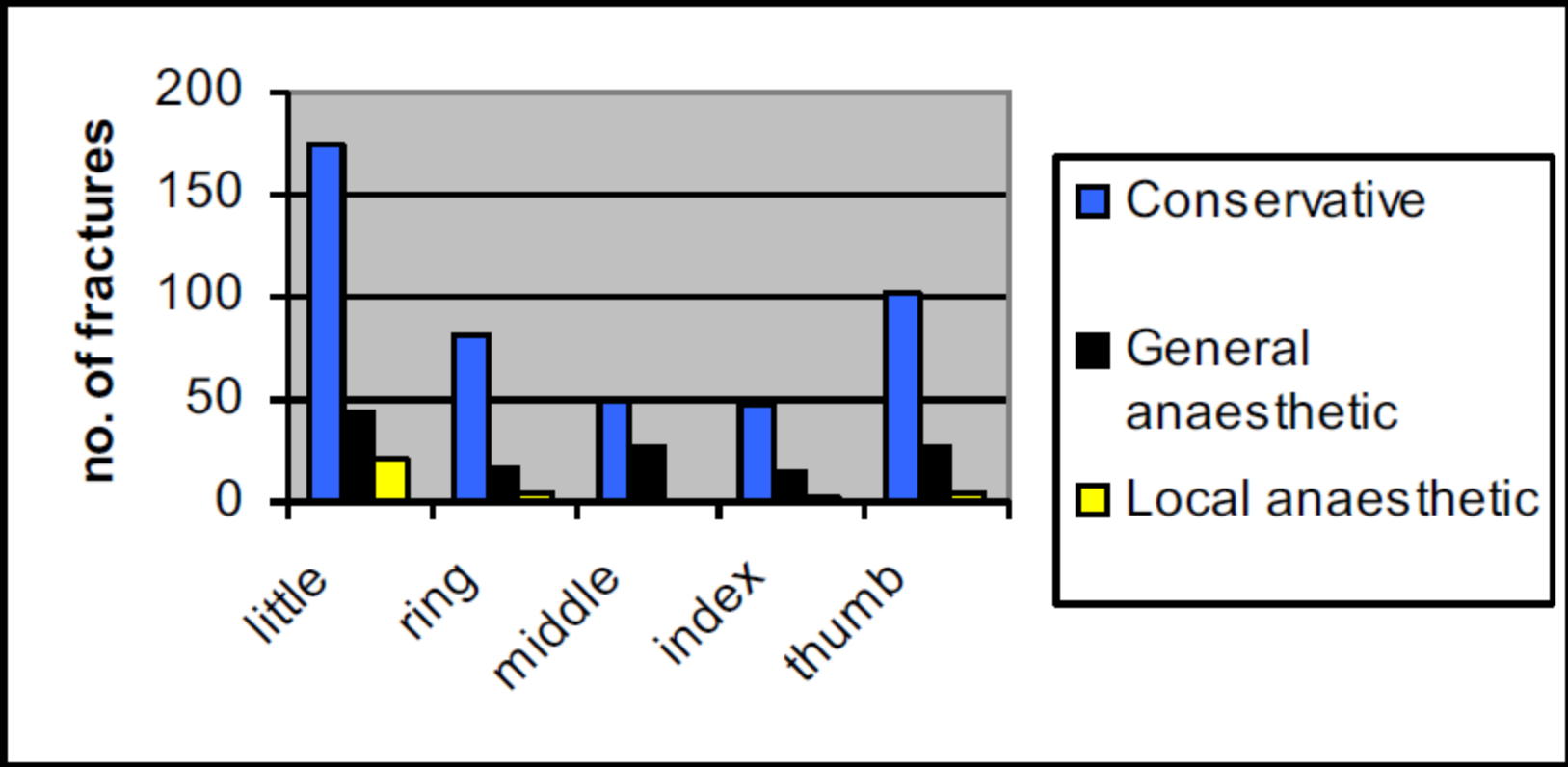


Phalangeal Fractures



Total - 617

Management of Phalangeal Fractures



EPIPHYSEAL FRACTURES

Injuries involving the Epiphyseal Plate

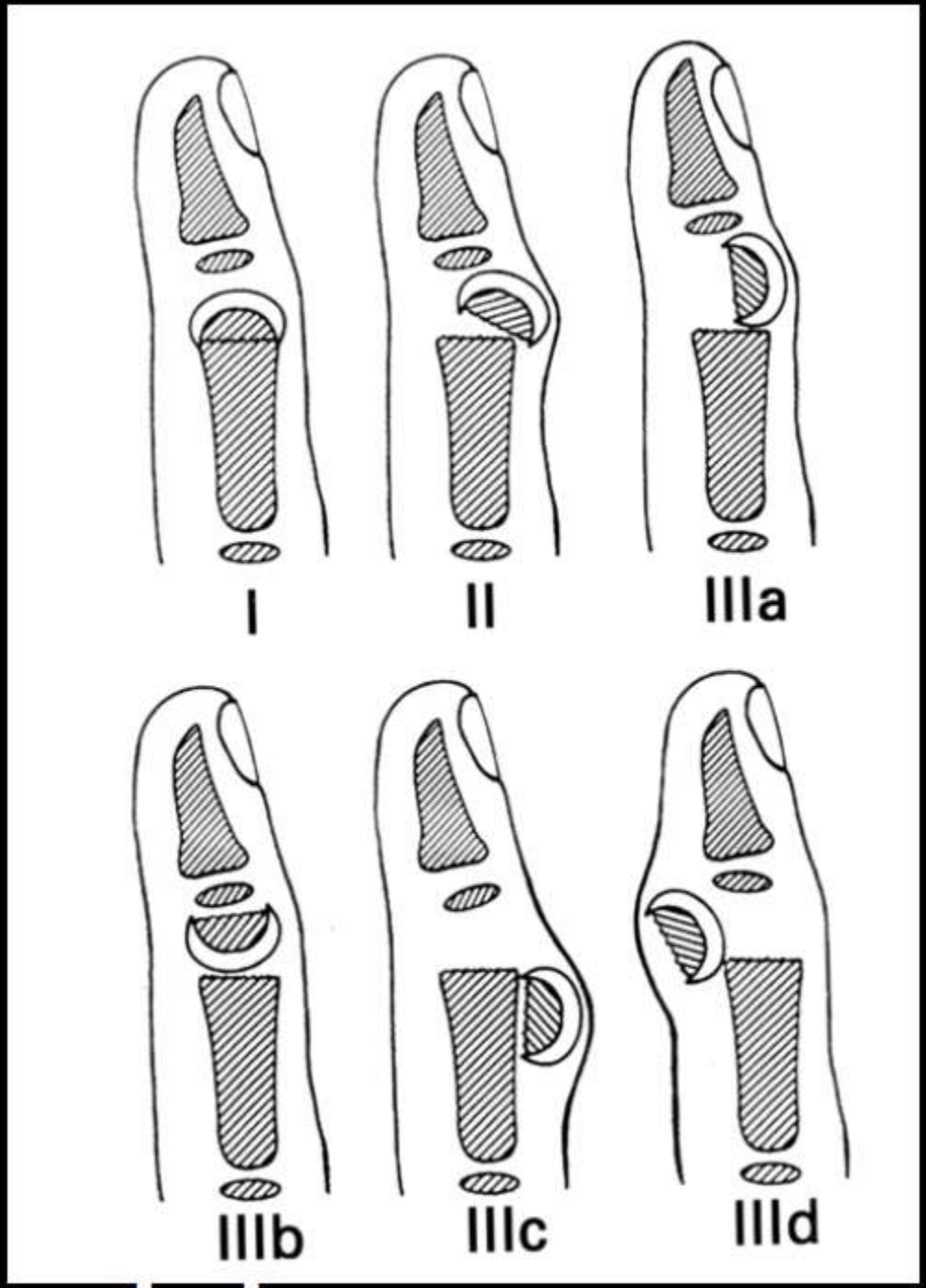
Salter and Harris, 1963

Salter-Harris II most common

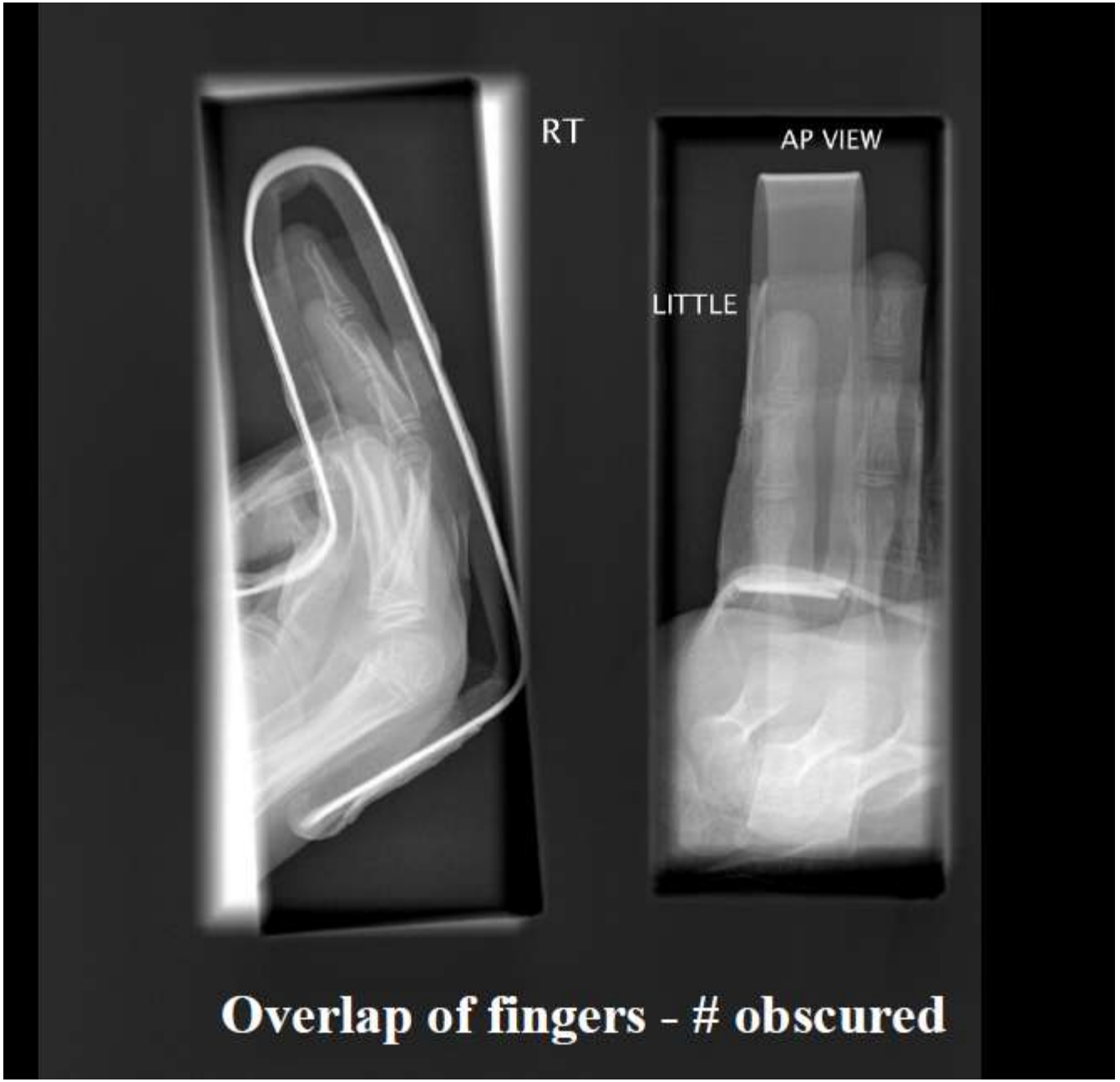
Salter- Harris II # base proximal phalanx ring finger

Phalangeal Neck Fractures

- Unstable
- Easily missed
- Adequate xrays: PA, oblique, true lateral
- Cartilaginous cap



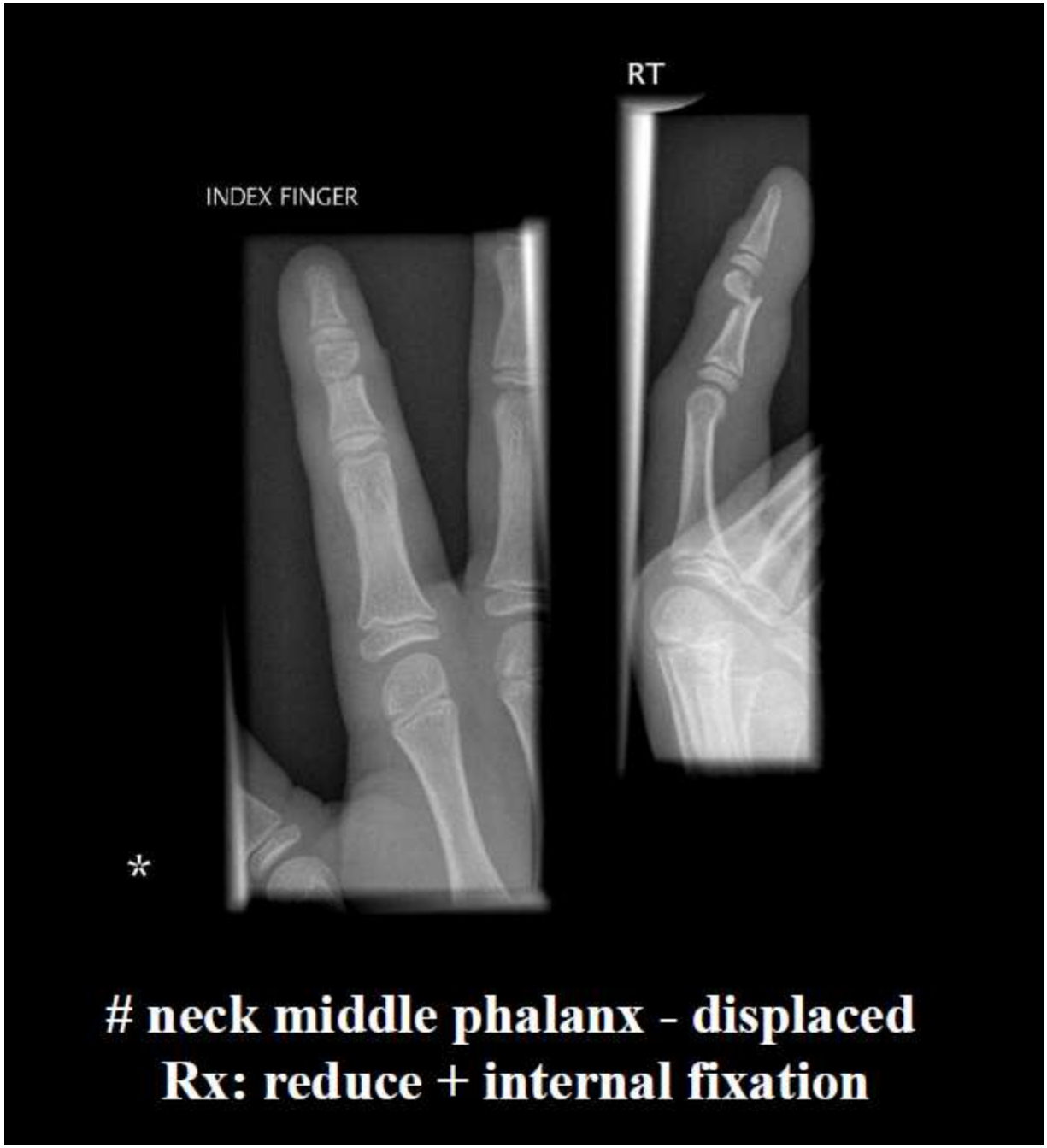
Al Qattan, 2001


RT
AP VIEW
LITTLE
Overlap of fingers - # obscured

Unstable phalangeal neck # - inadequate immobilization

Ring finger # neck middle phalanx remodelling potential


RING
R
RING
7 months post injury



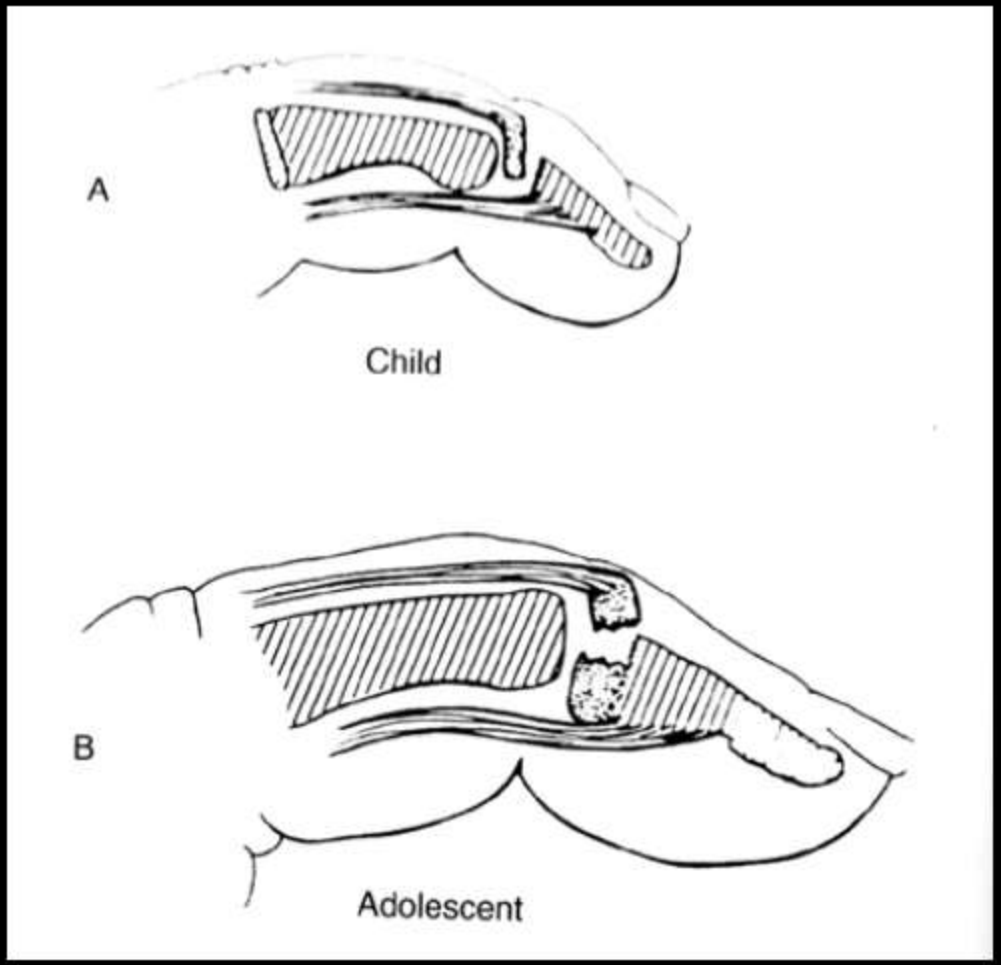
 # neck middle phalanx - displaced
Rx: reduce + internal fixation

FRACTURE-DISLOCATION PIP/DIP JOINT

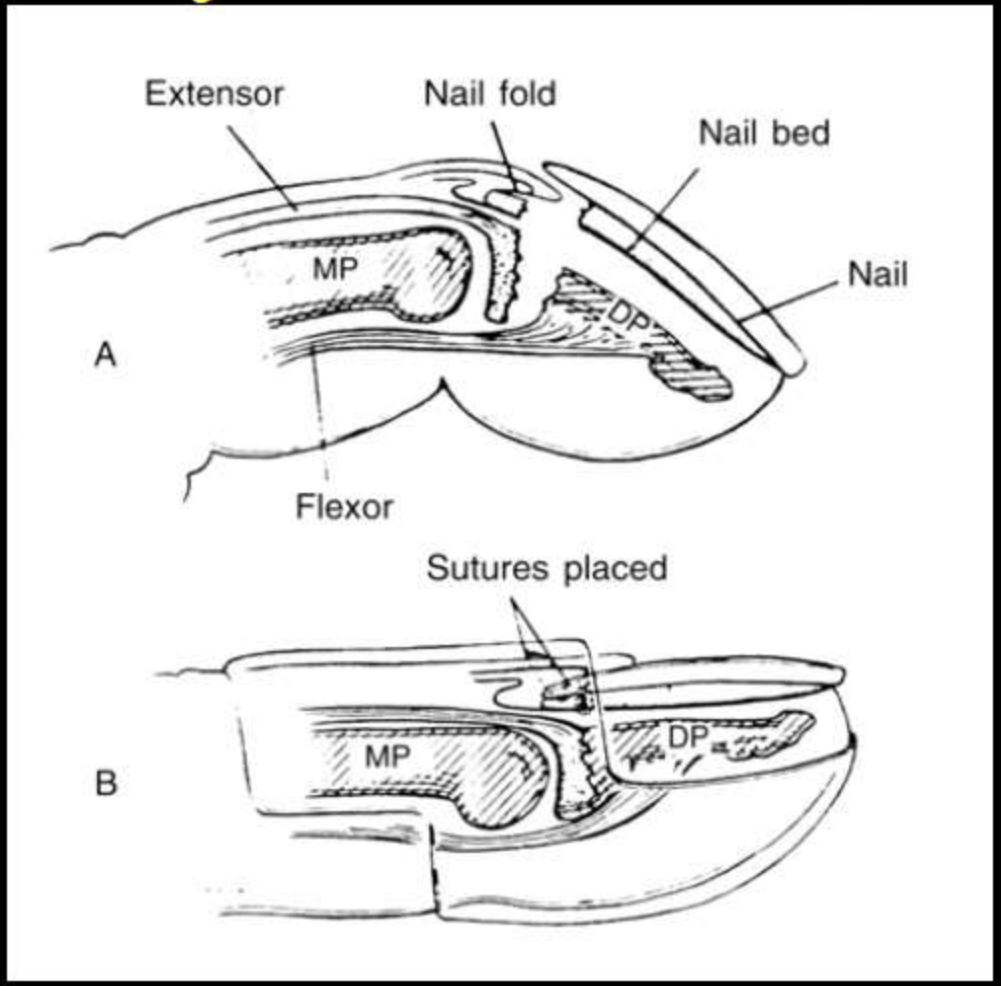
BEWARE!

Epiphysis may displace + become entrapped in joint

MALLET INJURY

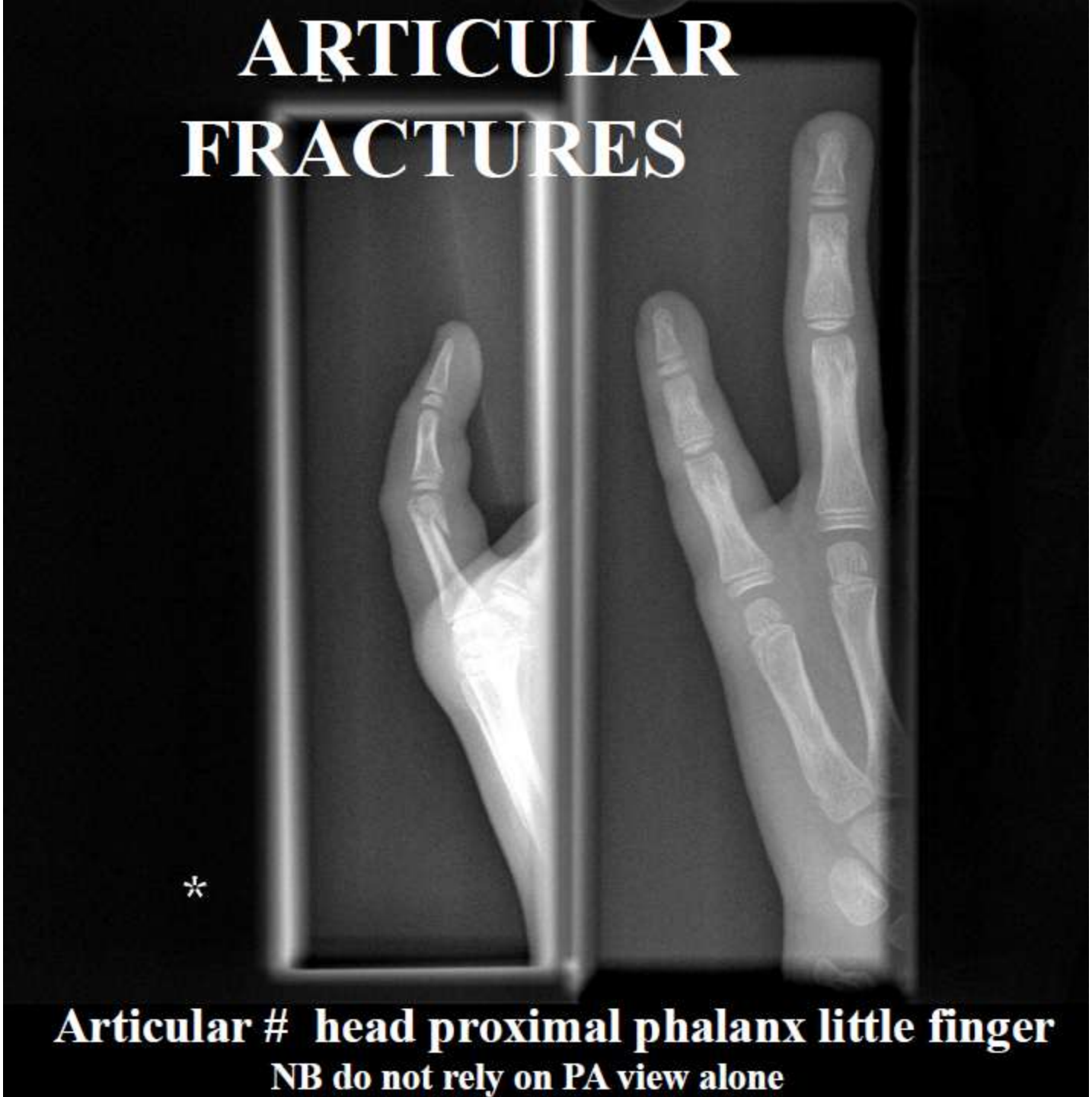


Seymour Fracture



Salter-Harris I # distal phalanx

ARTICULAR FRACTURES



Articular # head proximal phalanx little finger

NB do not rely on PA view alone

SCAPHOID FRACTURE

(OTHER CARPAL BONE # RARE IN CHILDREN)

Young child

- Immature carpus - ossifies distal to proximal
- X-ray diagnosis may be difficult
- Pseudo Terry-Thomas sign
- Pure chondral injury/distal pole #
- Large force to # - look for other injuries in upper limb
- Non-union rare in distal third #

Older child

- Adult variant as ossification completes

COMPLICATIONS

- Malunion
- Delayed union/ non union
- Growth arrest
- Osteomyelitis
- Avascular necrosis
- Stiffness

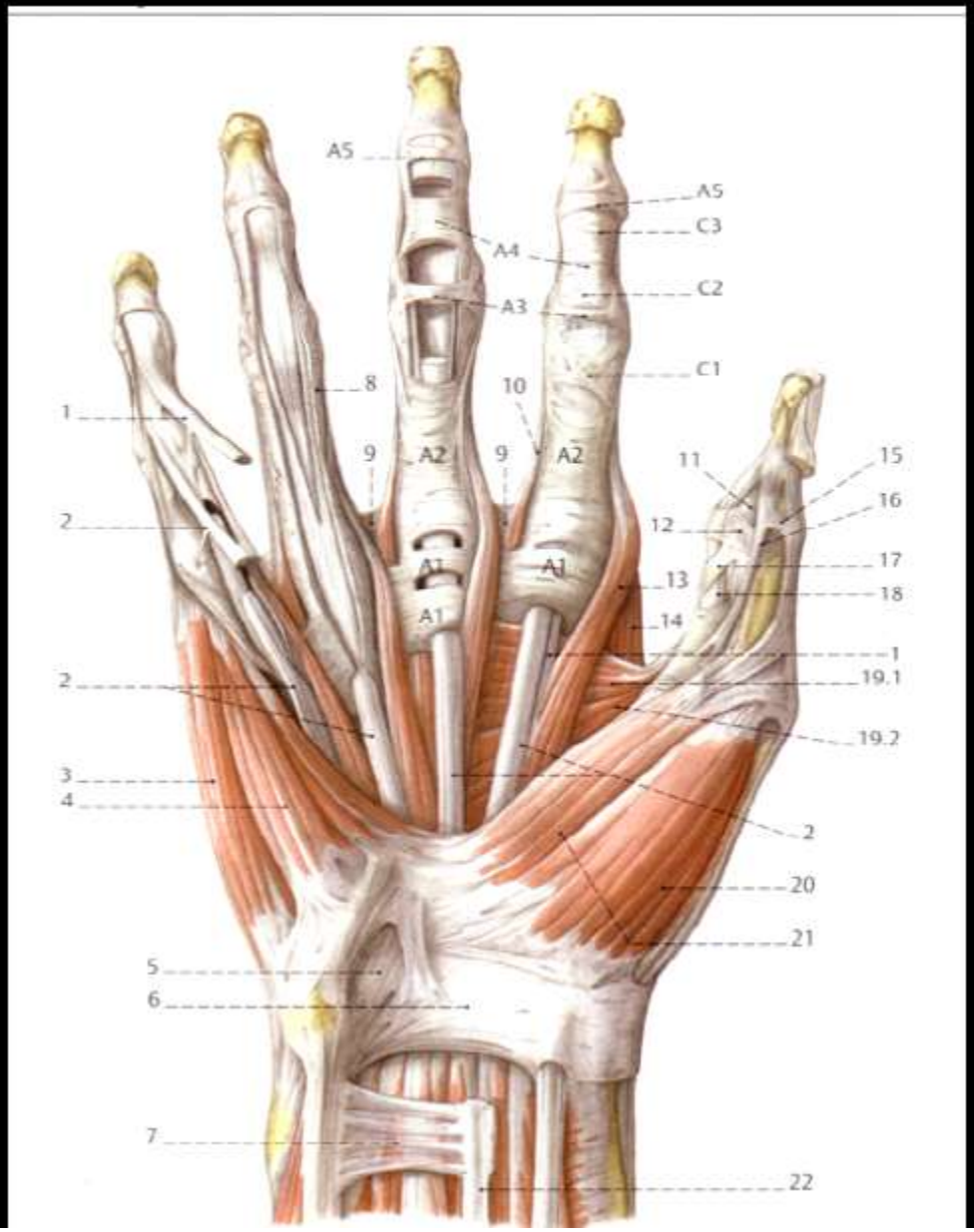
OSTEOMYELITIS

AVASCULAR NECROSIS

Condylar # - risk of avascular necrosis

AVASCULAR NECROSIS

The Hand - Flexor Tendons



NEWCASTLE UPON TYNE AUDIT

- 3 year period
- 2121 children's hand injuries
- 20 flexor tendon cases (35 tendons)
- <1% of total

Adults April '04-March '05: 156 cases

SPECIAL CONSIDERATIONS IN CHILDREN

Aetiology - glass, sharp object

Anatomical site - Zones I, II, III(Flexor)

SPECIAL CONSIDERATIONS IN CHILDREN

Blood supply :

Distance between vincula

Biology :

Adhesions more pliable

Less joint stiffness

Entin MA, Am J Surg 1965;109:287-93

SPECIAL CONSIDERATIONS IN CHILDREN

Comprehension

Co-operation

Carer

SPECIAL CONSIDERATIONS IN CHILDREN

Diagnostic difficulties :

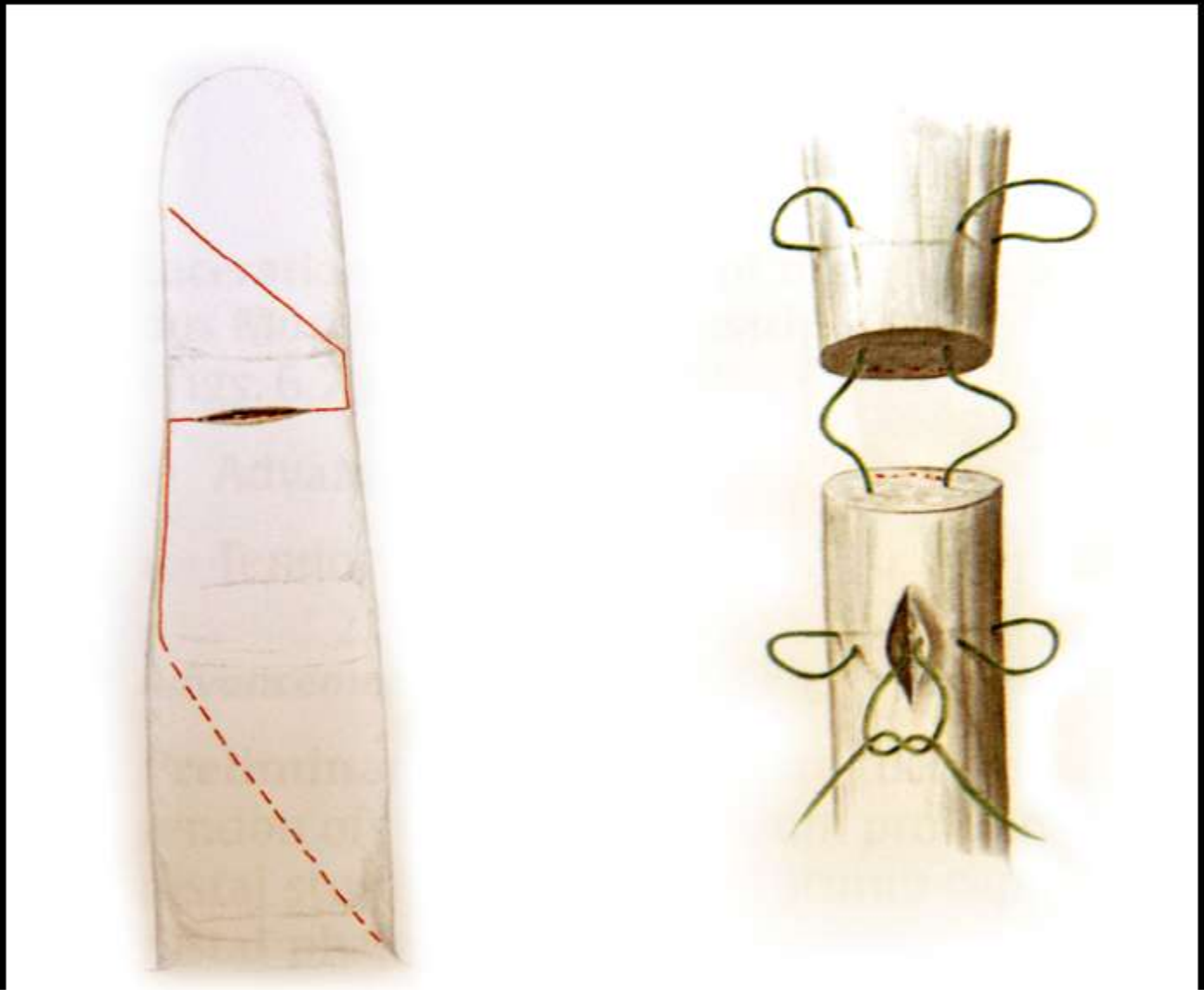
Injury

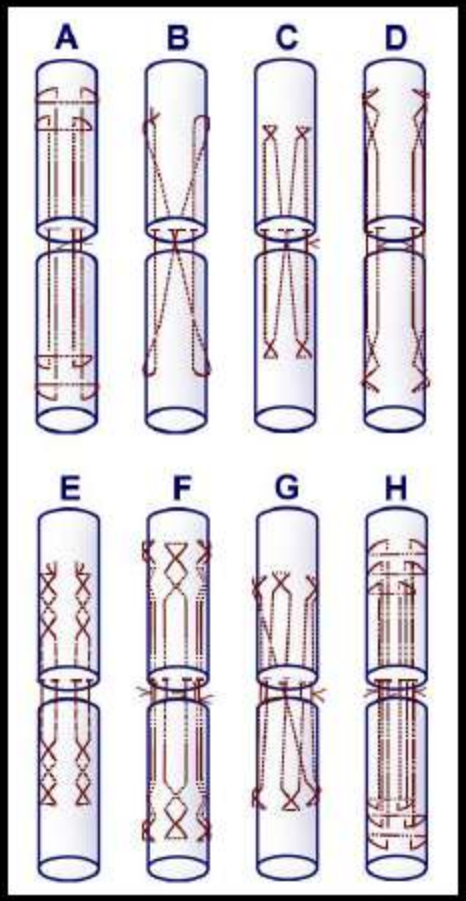
Complications

TENDON REPAIR

- Operating theatre
- Tourniquet control
- Experienced surgeon
- Fine instruments
- Magnification

TENDON REPAIR




A
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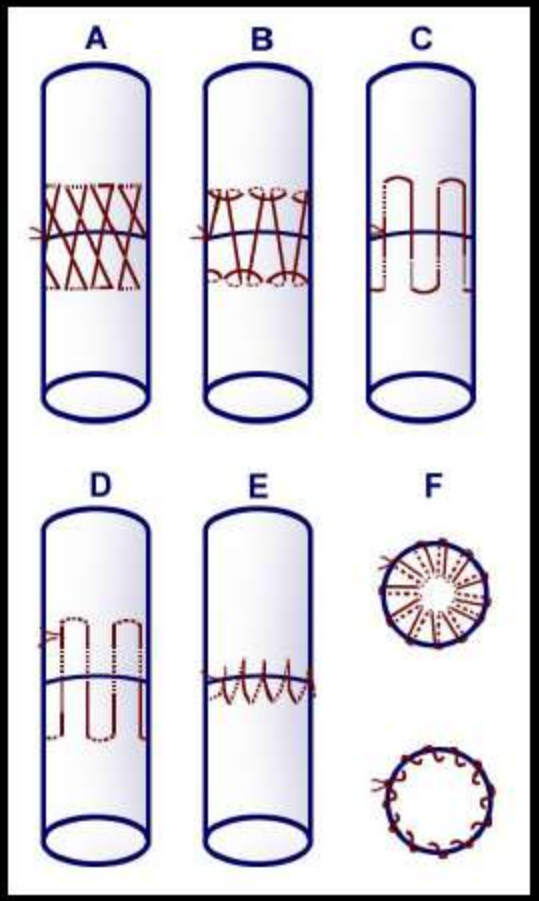
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AIMS OF REHABILITATION

- Minimise adhesions/joint stiffness
- Protect repair from rupture
- Provide favourable environment for healing
- Restore functional hand motion and strength

LITERATURE - Rehabilitation

Older co-operative child:

- Apply adult rehabilitation regimes
- Below elbow dorsal blocking splint as per regime

EARLY ACTIVE MOBILISATION

8-16 yrs - below elbow dorsal blocking splint

daytime: 4-6 wks **night/at risk:** 8 wks

Tendon glide

4-6 weeks

Splint by day - 4-6 weeks

Splint at night/ at risk - 8 weeks

Tendon glide - 4-6 weeks

Resisted flexion - 6-8 weeks

Static extension splint - > 6 weeks

+

Scar management/oedema control/ protected joint stretches

SCHOOL:

Leave class early or late to
avoid crowds

SPORT:

Avoid contact sport - 10 weeks at least

LITERATURE - Outcomes

- Most excellent or good
- Low rupture rate
- Low tenolysis rate
- Improve over time

COMPLICATIONS OF TENDON INJURY

- Rupture of repair
- Adhesions
- Stiffness
- Swelling
- Scars
- Pain

Associated injuries