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Supracondylar Humeral Fracture: How I deal with difficult case

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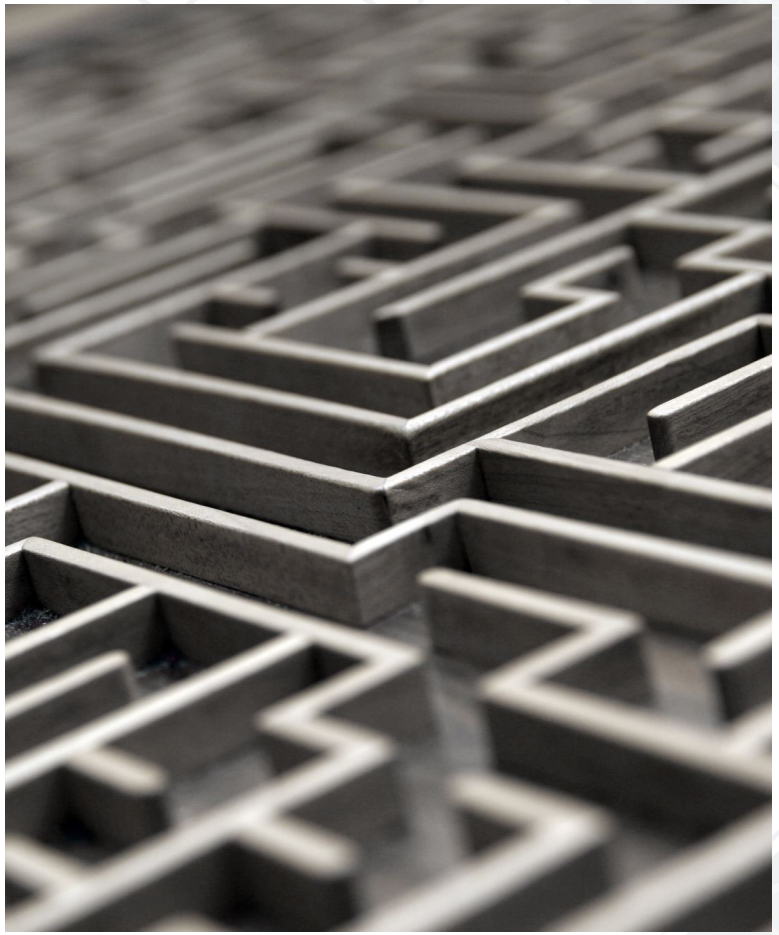
Outlines

- Type of difficult cases
- Factors associated with difficult case
- Surgical technique for difficult reduction and unstable fixations
- conclusions



Difficult Supracondylar humeral fracture

Difficult reduction

Unstable reduction

Wilkins modification of the Gartland classification

Type	Description[2]
I	**Non-displaced**
II	**Angulated with intact posterior cortex**
IIA	Angulation
IIB	Angulation with rotation
III	**Complete displacement but have perisosteal (medial/lateral) contact**
IIIA	Medial periosteal hinge intact. Distal fragment goes posteromedially
IIIB	Lateral periosteal hinge intact. Distal fragment goes posterolaterally
IV	**Periostial disruption with instability in both flexion and extension**

Difficult Reduction

Identify the potential difficult case

1. Obese patient

2. Soft tissue condition : Brachialis sign

3. Configuration of fracture

- Marked posterolateral displacement with medial spike

- Multidirectional instability: Gartland-Wilkin IV

- Flexion type

1. Obese patient (BMI >95th centile)

a/w more complex fracture

a/w pre op nerve injury and post op complication… *Seeley et al JBJS 2014*

More likely develop varus deformity and loss of stability post operatively

…*Chang et al. Injury 2015*

2. Soft tissue condition: Brachialis sign

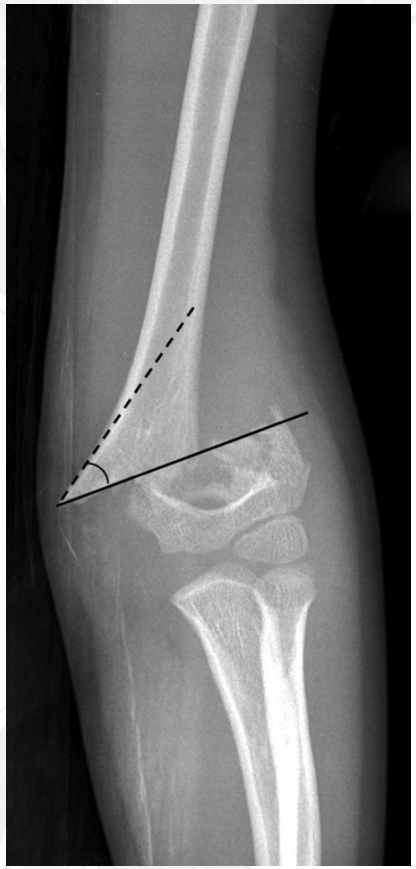
antecubital ecchymosis

- soft tissue interposition at the fracture
- a failure of standard closed reduction techniques

3. Configuration of fracture

Marked posterolateral displacement with medial spike

- Buttonholes in brachialis muscle
- Higher risk for ulnar nerve injury
- May considered open reduction after 2 attempt or >10 min



Medial spike angle

Fracture tip-skin distance

medial corner angle was < 45° and smaller fracture tip–skin distance

KBL Lim et al. Suprcondylar Humeral Fracture: Beware of Medial Spike , JBJS 2013

4. Configuration of fracture: Type IV (Multidirectional instability)

5. Flexion type

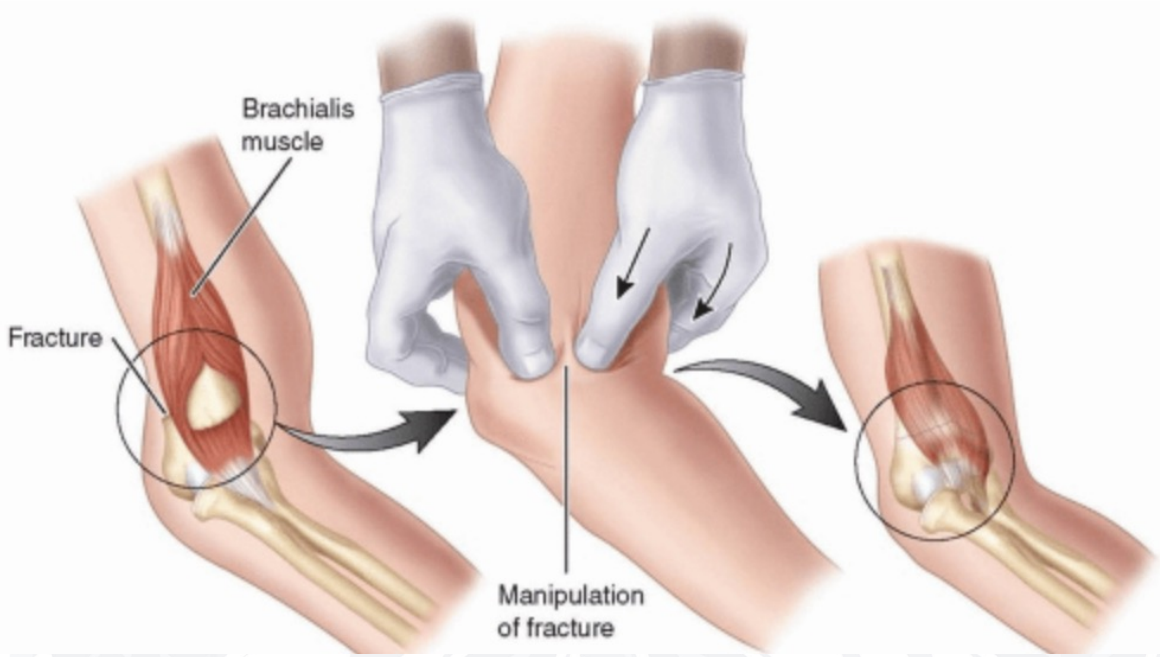
When to perform surgery?

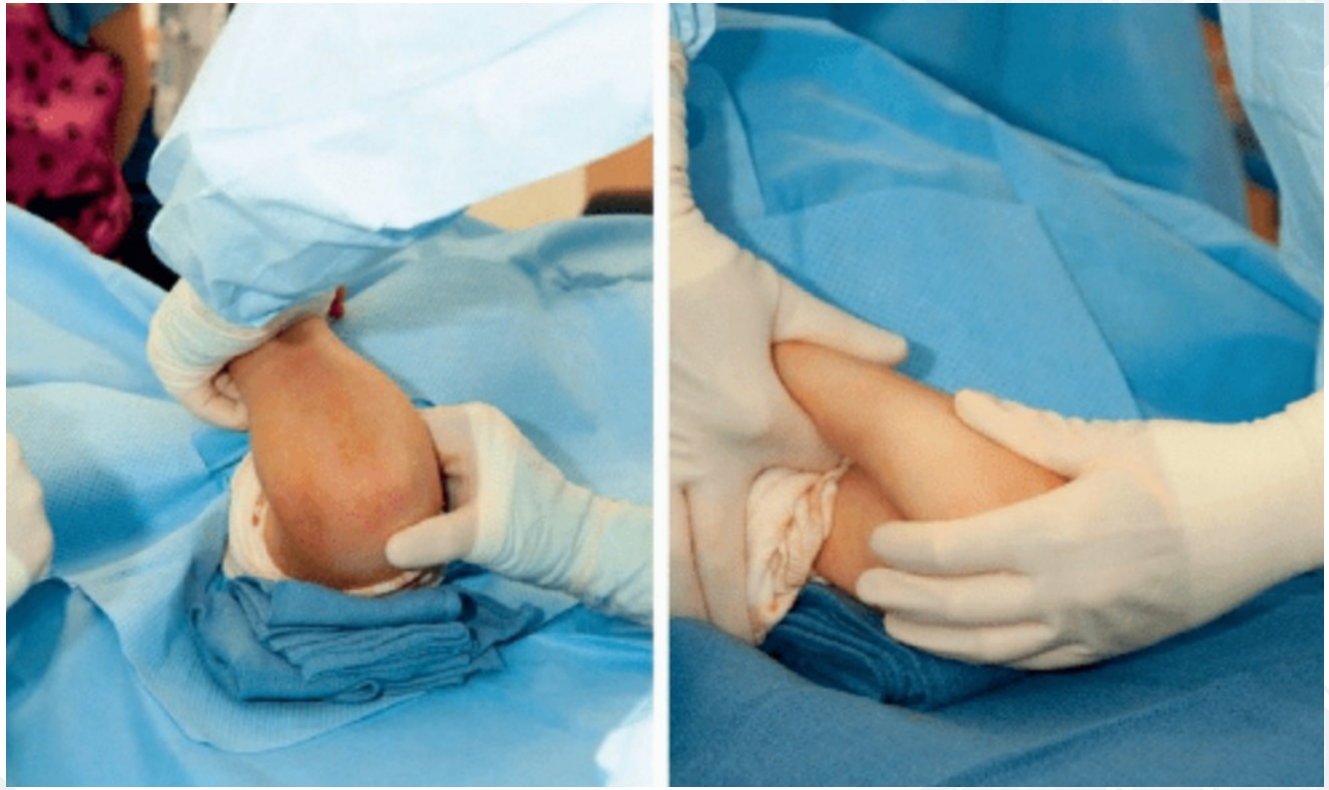
The AAOS guideline: No consensus

- Within 8-12 hr (next operating list)

Reduction Technique

- Standard method
- Milking method





Push olecranon from posterior and lock the reduction in pronation

Check the AP view

Check the lateral view in
external rotation of shoulder

What options to reduce the difficult fracture?

1. Joystick technique
2. leverage technique
3. “The Tansen Technique

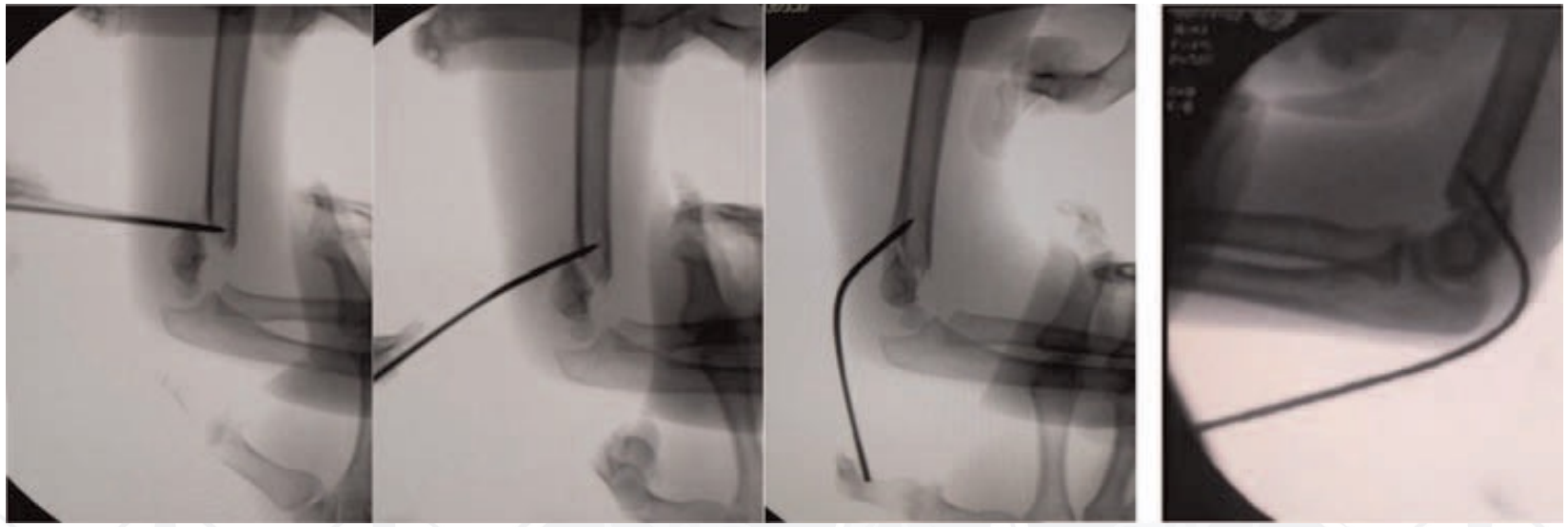
1. The Joystick technique: Posterior intra-focal pinning

Indications:

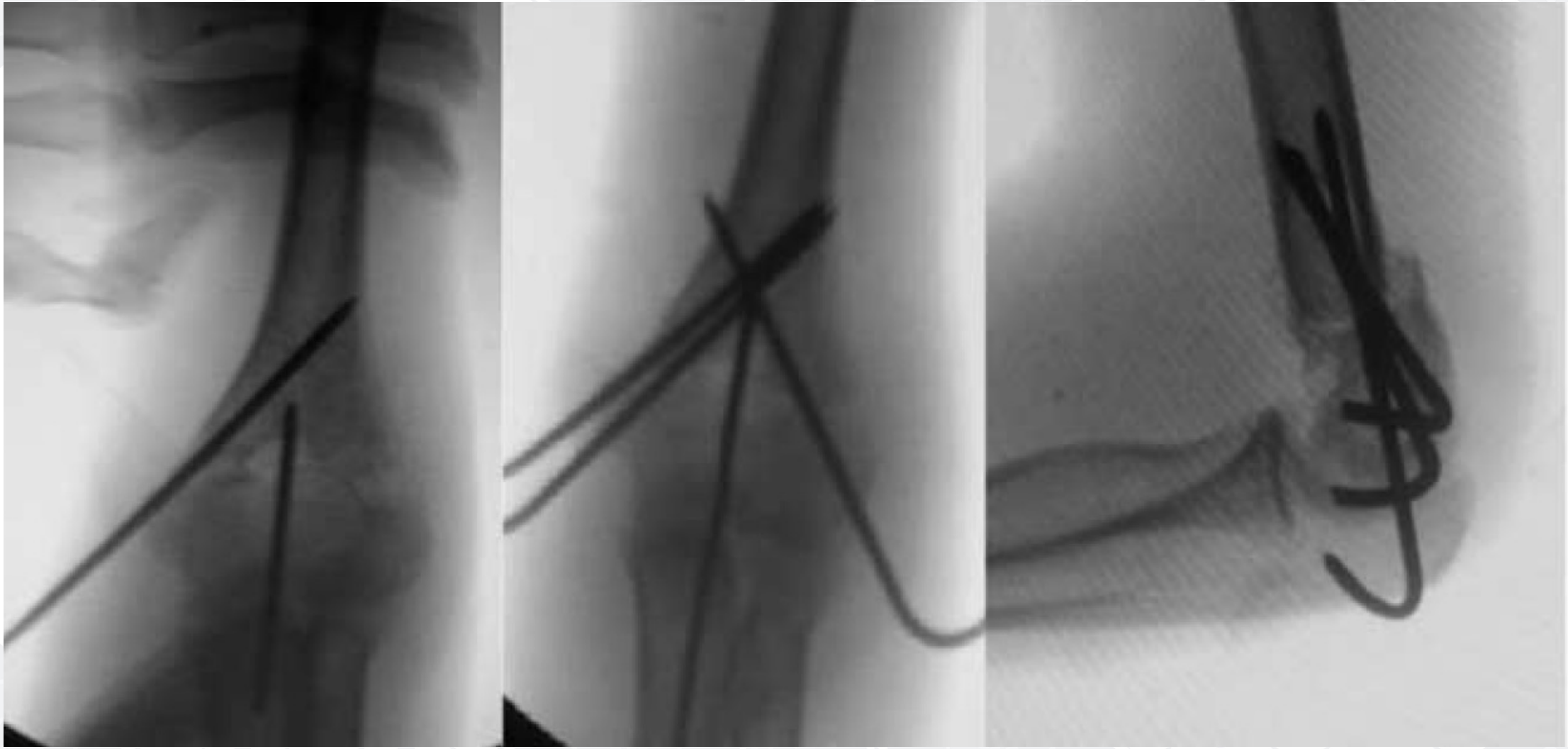
- Unstable extension type (oblique)
- Intact posterior cortex

Procedure:

- Kapandji procedure
- Intrafocal pin from posterior
- Do not pierce anterior cortex

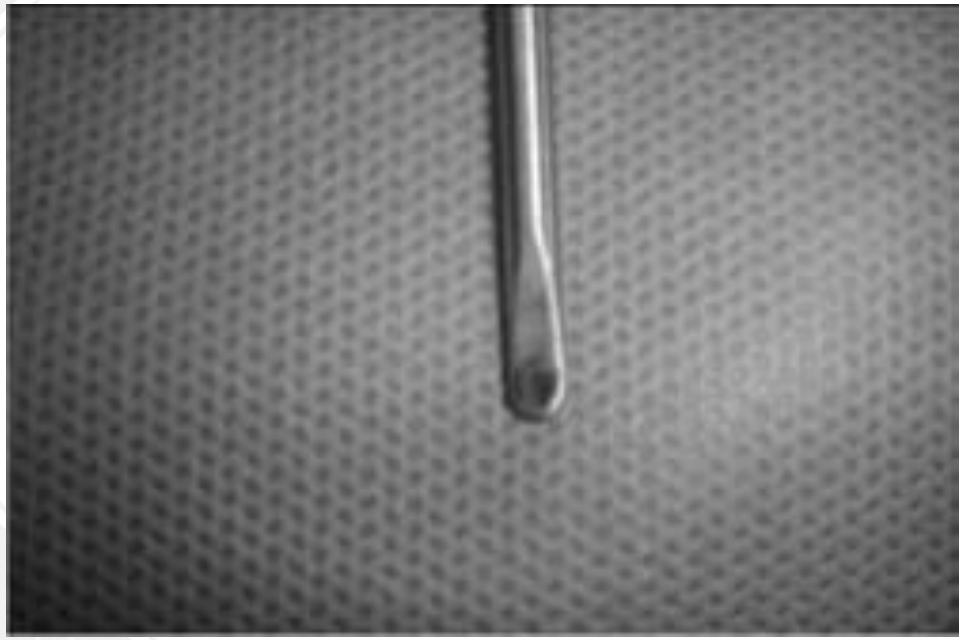


Intrafocal joystick technique for closed reduction and percutaneous fixation of late-presenting supracondylar fractures of the humerus: Ahmed Shawkat Current Orthopaedic Practice 2019



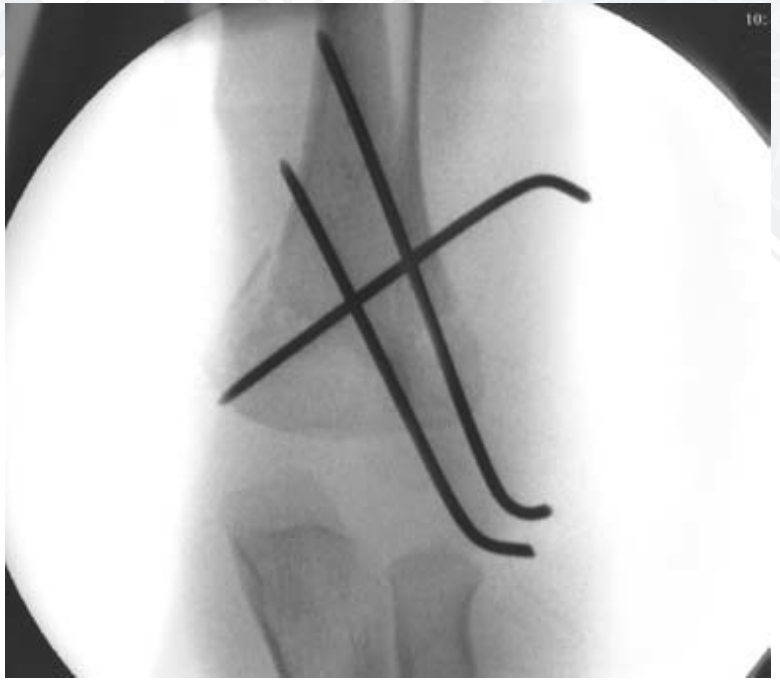
2. Pin leverage technique

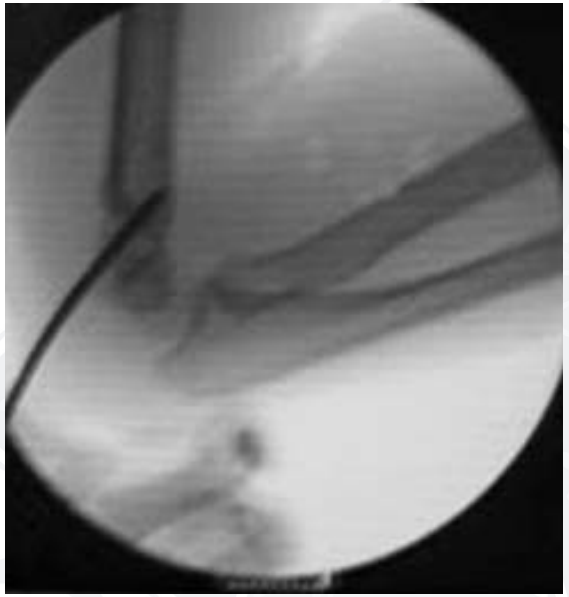
Steinmann pin and handle



Blunt end Steinmann pin

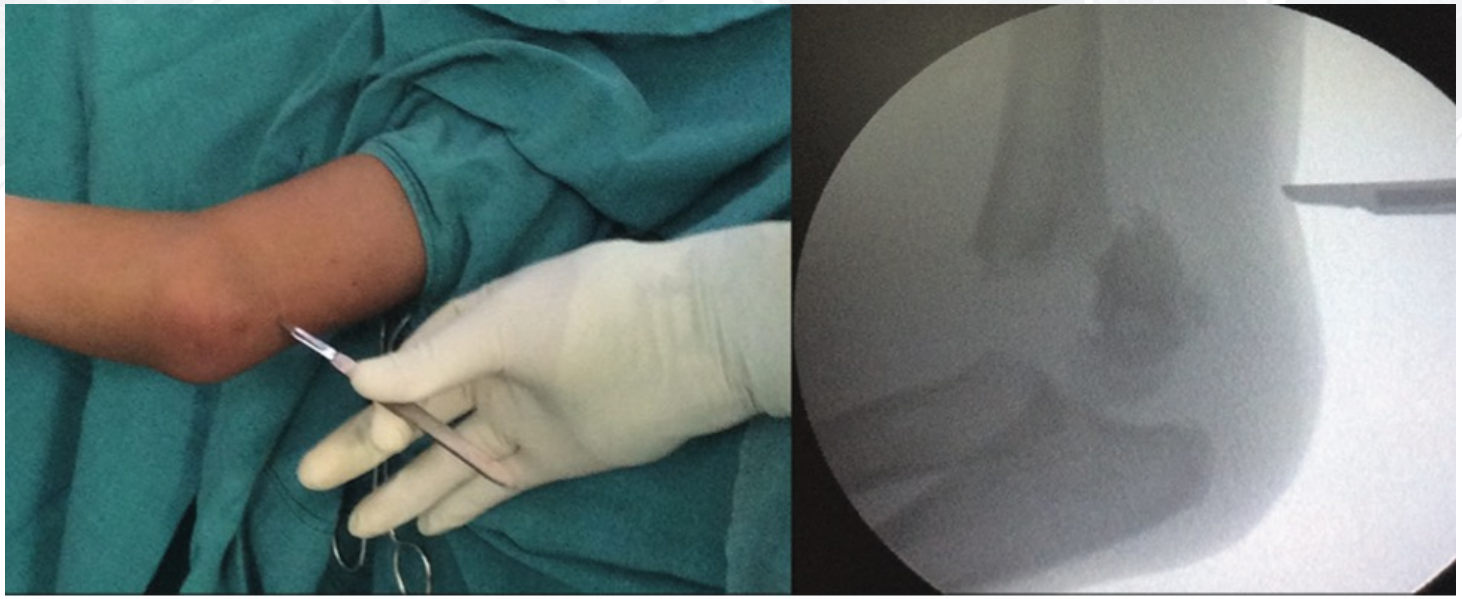
HY Lee, HJ Kim: Treatment of displaced supracondylar fractures of the humerus in children by a pin leverage technique. JBJ 2007

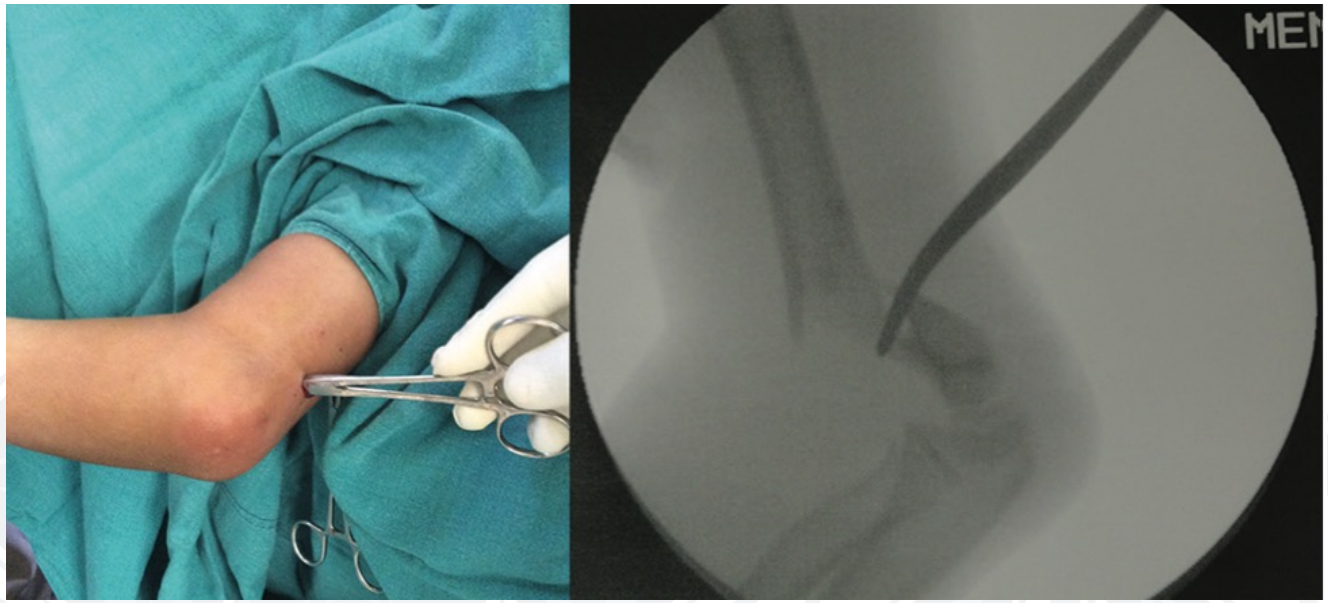




The Tansen Technique

Shreemal, *et al*.: Intrafocal closed reduction technique for difficult supracondylar fractures in children. CHRISMED Journal of Health and Research 2020

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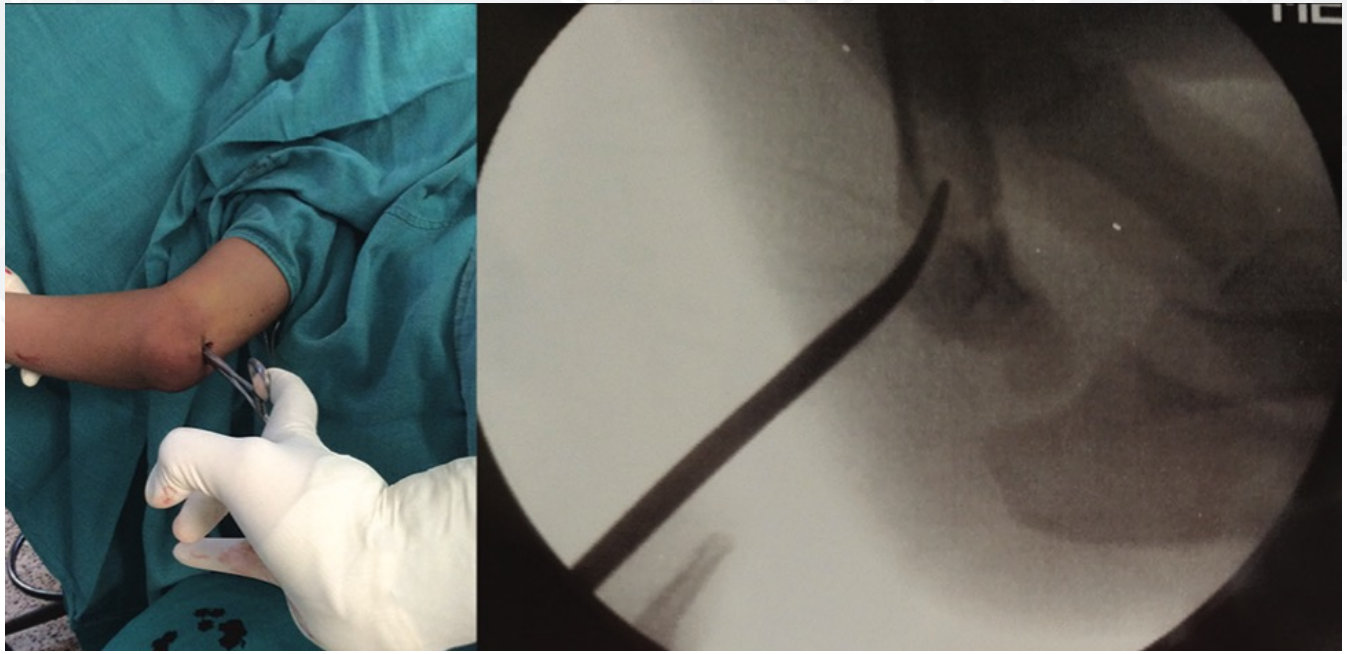
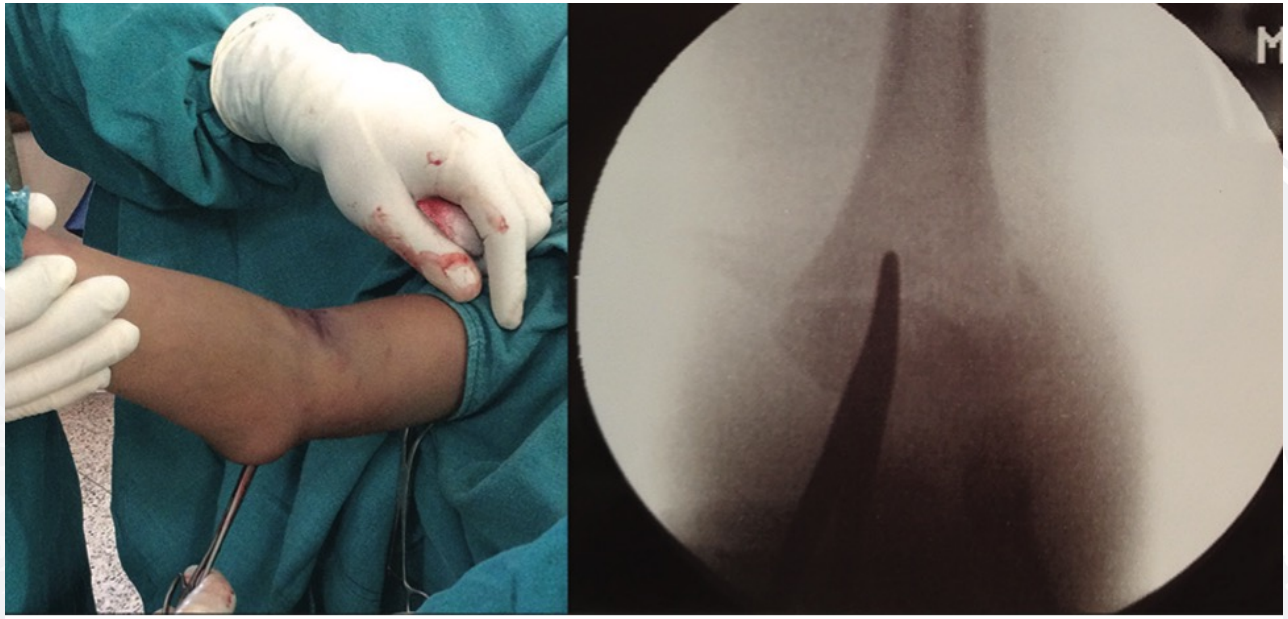
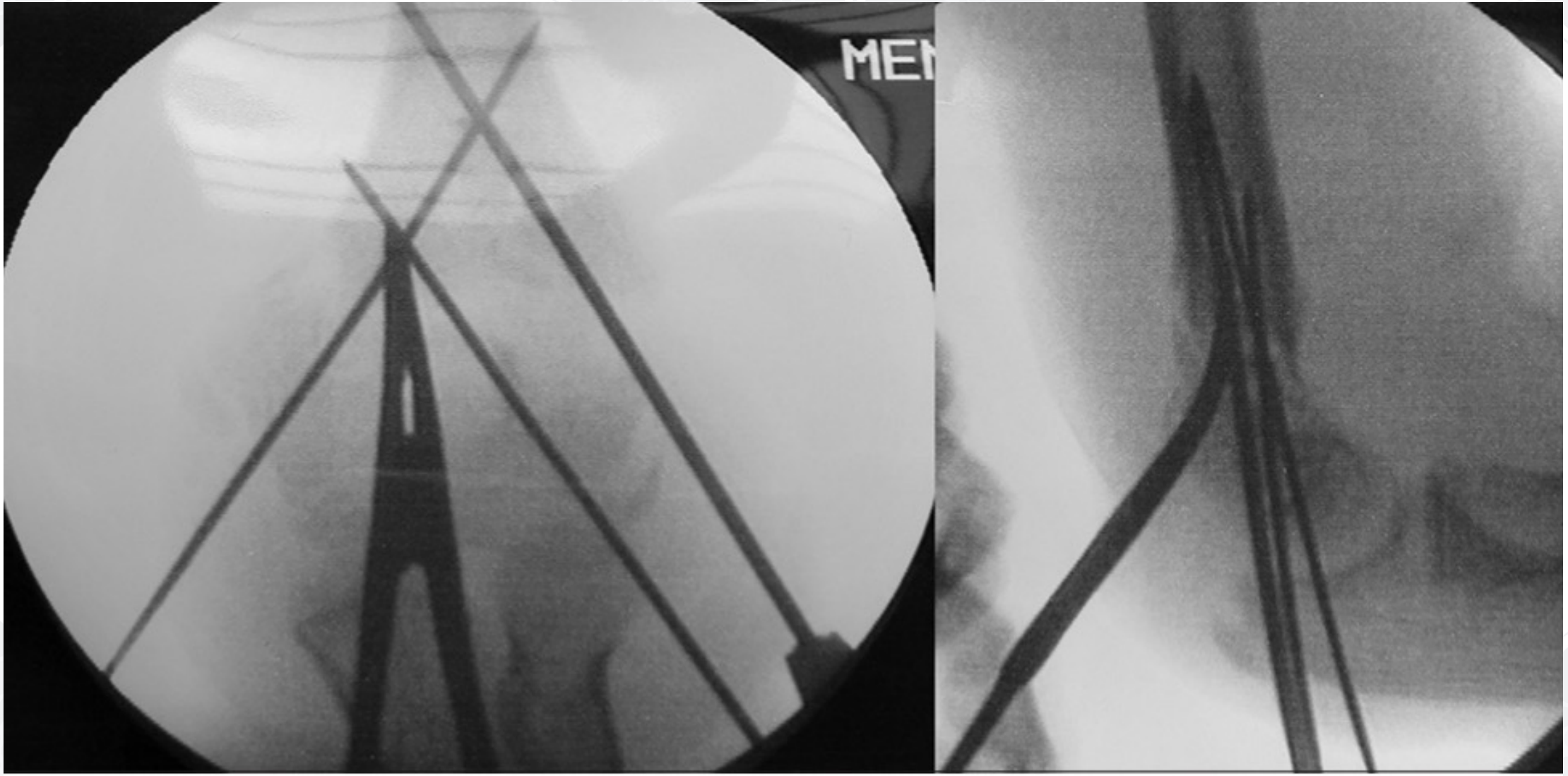




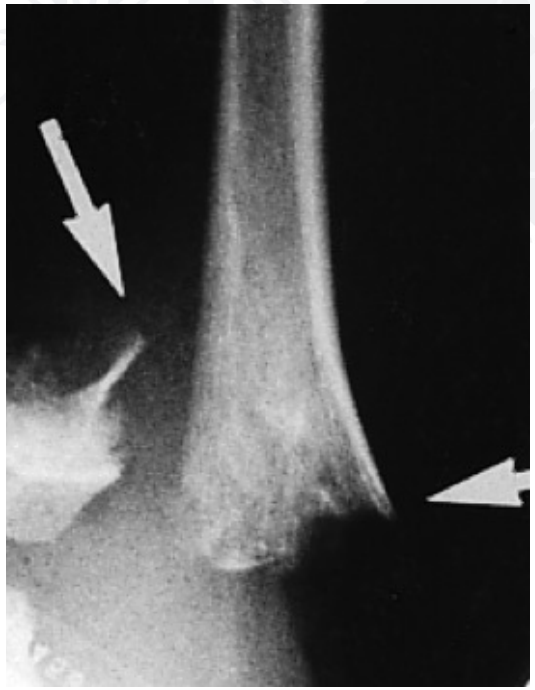


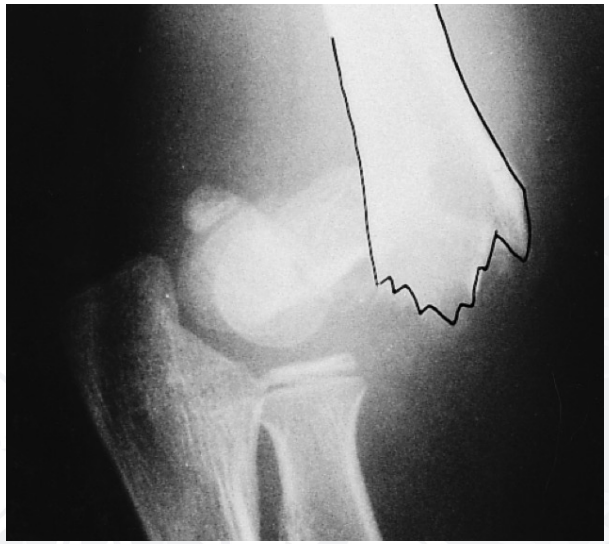
Open reduction

- a last resort, mainly because
  - ➢ fear of stiffness,
  - ➢ infection and
  - ➢ myositis ossificans.

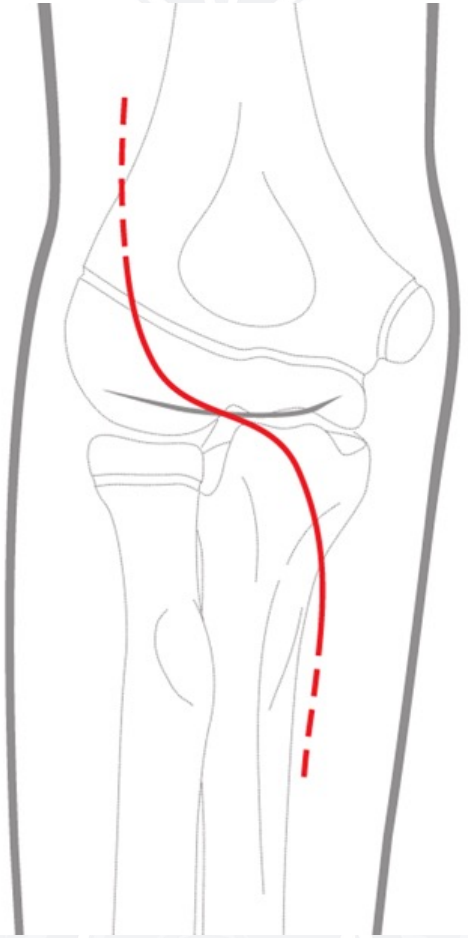
Open reduction: Indications

- Failed closed reduction
- skin puckering
- loss of pulse with manipulation
- a jagged fracture line and prominent metaphyseal or distal fragment spikes





Open reduction: Medial or anteromedial incision



Strat Traum Limb Recon (2010) 5:57–64
DOI 10.1007/s11751-010-0091-y

REVIEW

Does open reduction and pinning affect outcome in severely displaced supracondylar humeral fractures in children? A systematic review

Juan Pretell-Mazzini · Juan Rodriguez-Martin · Eva María Andres-Esteban

- Adequate anatomical reduction
- Excellent to good functional
- Better cosmetic outcomes
- Fewer complications

Unstable Fracture Reduction

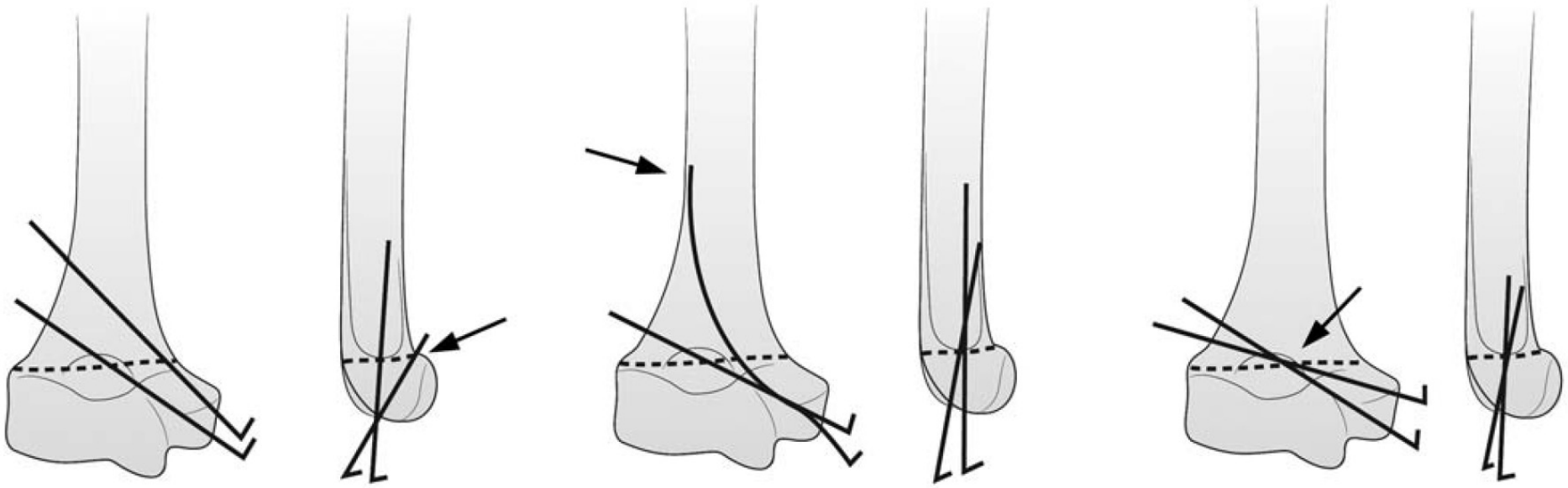
Risk of malunion: Why important to avoid?

- Posterolateral rotatory instability
- cosmetic
- Tardy ulna nerve palsy
- Poor function

Options of Fixation for unstable fracture: Which one more superior?

1. Lateral wire only: redisplacement and inability fully extend the elbow intra-operatively, preventing examination of the carrying angle at operation
2. Cross K-Wiring: Biomechanically more stable than lateral wire ..*Herzenberg JE; Orthop Trans 1988*
3. External Fixator and anti-rotational wire

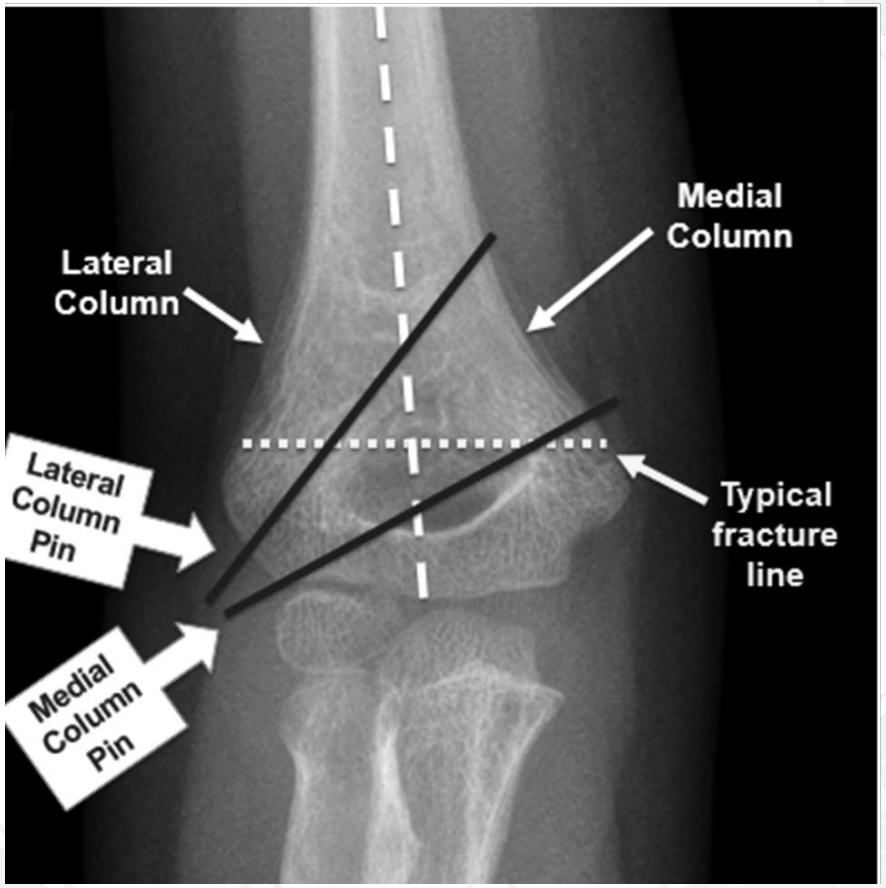
Loss of Reduction: Causes



- failure to achieve bicortical fixation with two or more pins
- failure to pass through both fragments with two or more pins
- failure to achieve adequate pin separation (>2 mm) at the fracture site

Sankar WN, Hebela NM, Skaggs DL, Flynn JM. Loss of pin fixation in displaced supracondylar humeral fractures in children: causes and prevention. J Bone Joint Surg Am 2007; 89:713–717.

Ideal Pin construct



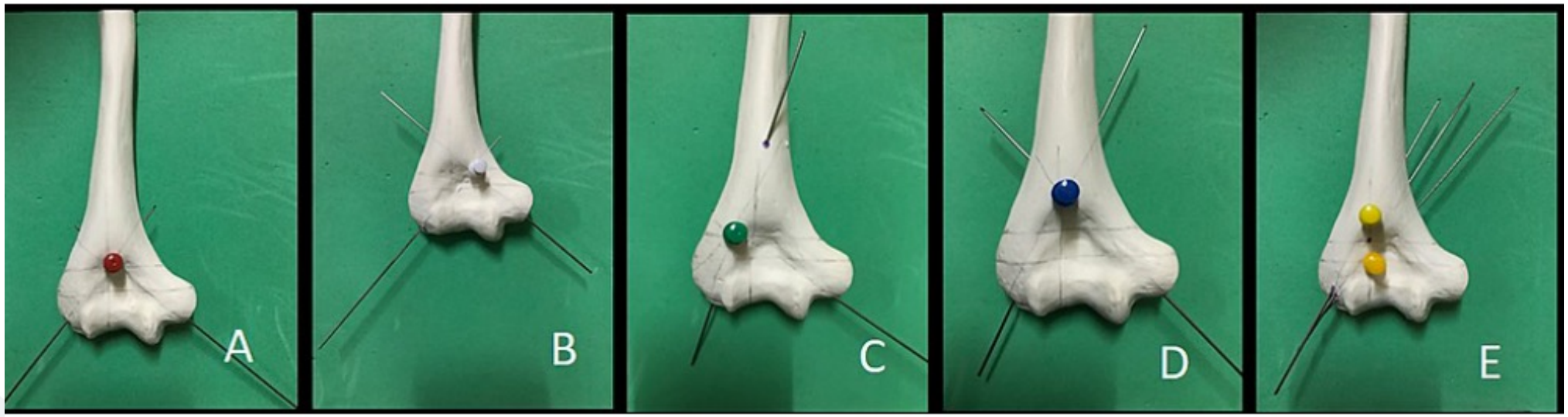
- maximal spread at the level of the fracture on the AP view
- should cross the fracture in the medial one-third and the lateral one-third of the distal humerus at the level of the fracture
- May add additional pin

SL Frick and CT Mehlman: The Community Orthopaedic Surgeon Taking Trauma Call: Pediatric Supracondylar Humeral Fracture Pearls and Pitfalls. J Orthop Trauma Volume 31, November 2017

Biomechanical Analysis of Crossed Pinning Construct in Supracondylar Fracture of Humerus: Does the Point of Crossing Matter?

Ardilla Hanim [1], Muhammad Wafiuddin [2, 1], Mohd Aizat Azfar [1], Mohd Shukrimi Awang [1], Nik Alyani Nik Abdul Adel [1]

2021 Hanim et al. Cureus 13(3): e14043



Center crossing point is the most stable construct.
lateral and superior crossing points have comparable stability

Multidirectionally Unstable Supracondylar Humeral:

- incompetent periosteal hinge

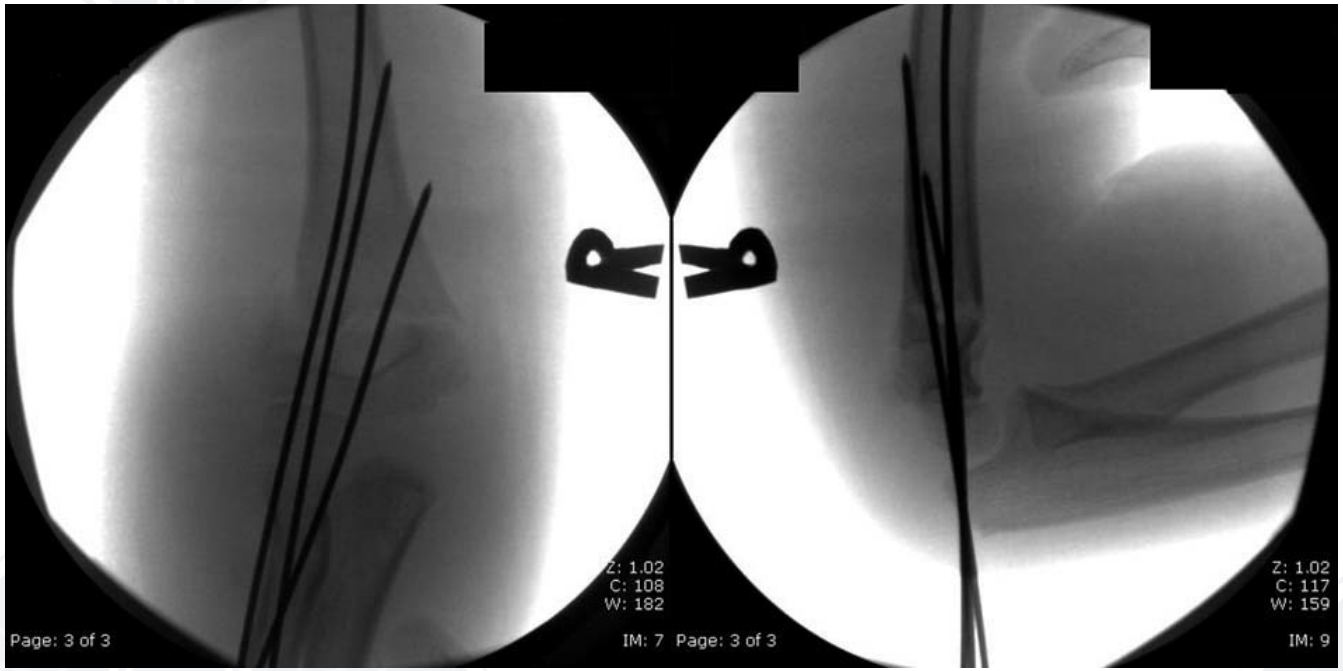
- with stress, may displace into either flexion or extension

KK Leitch et. Al JBJS may 2006

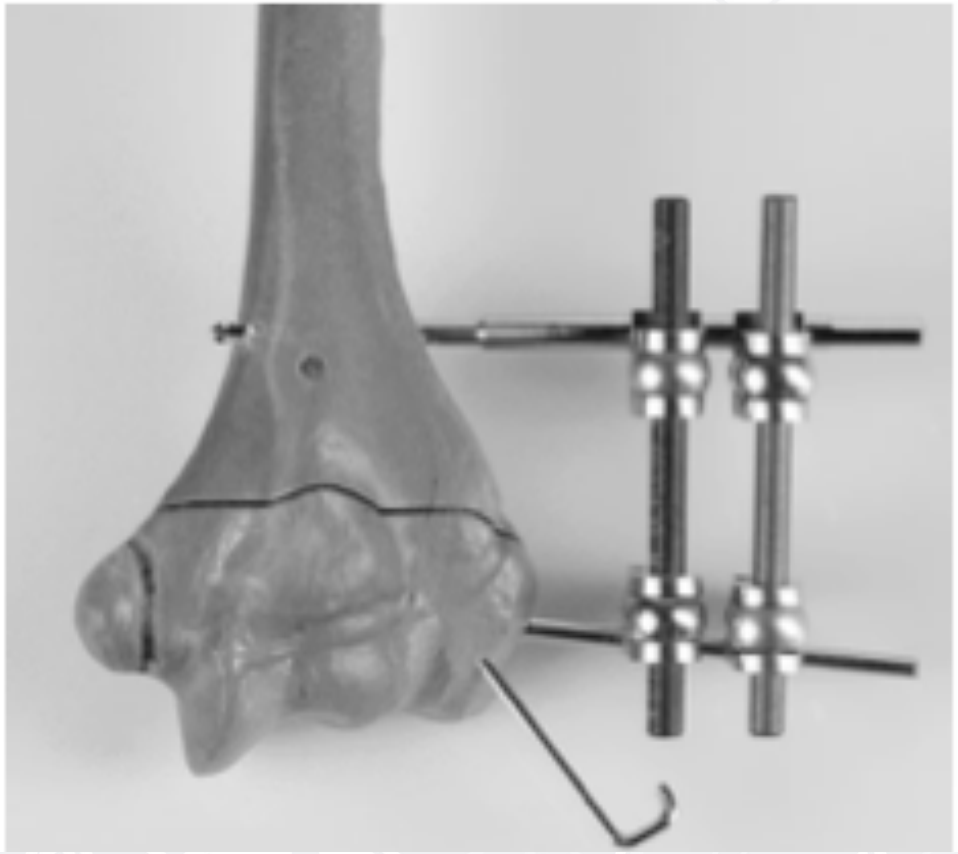
The Key factor in surgical technique

i. preplacement of Kirschner wires into the distal fracture fragment

ii. rotation of the fluoroscopic, not the child's arm, for lateral imaging.



Fixation with External Fixator

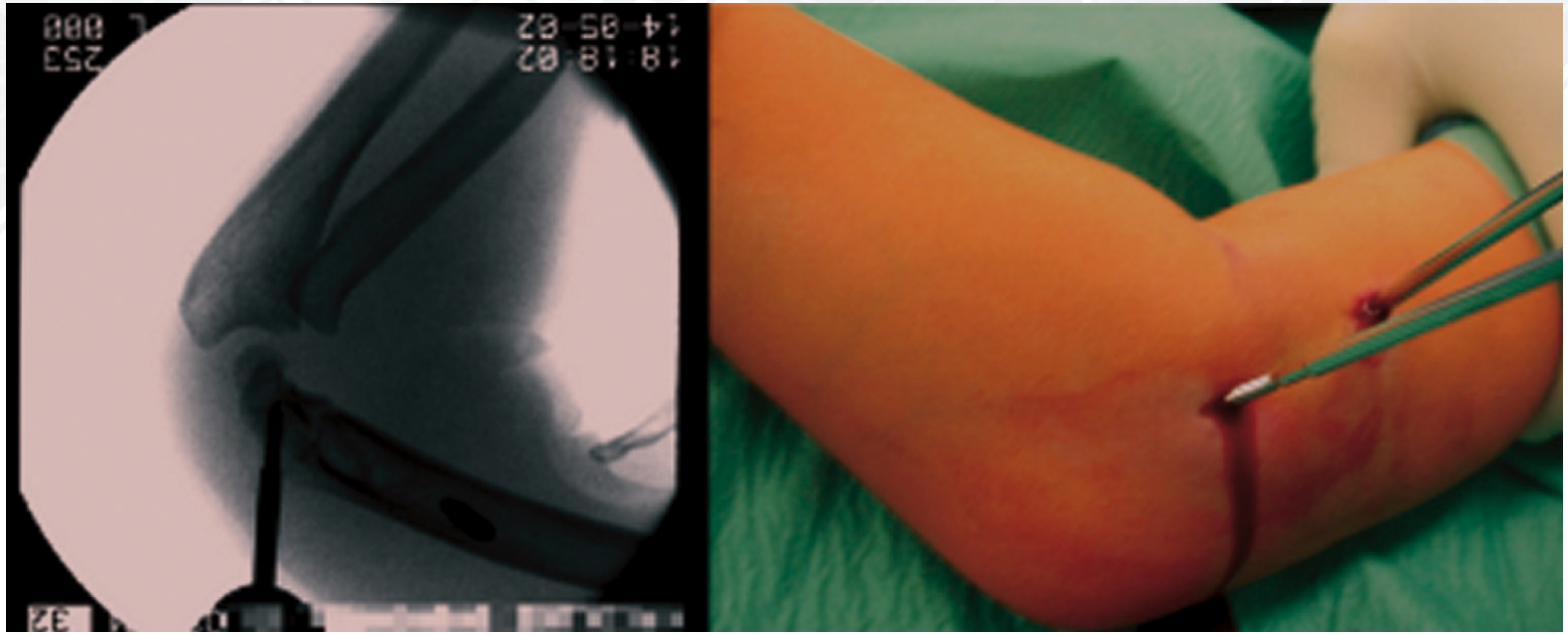


External Fixator: Indications

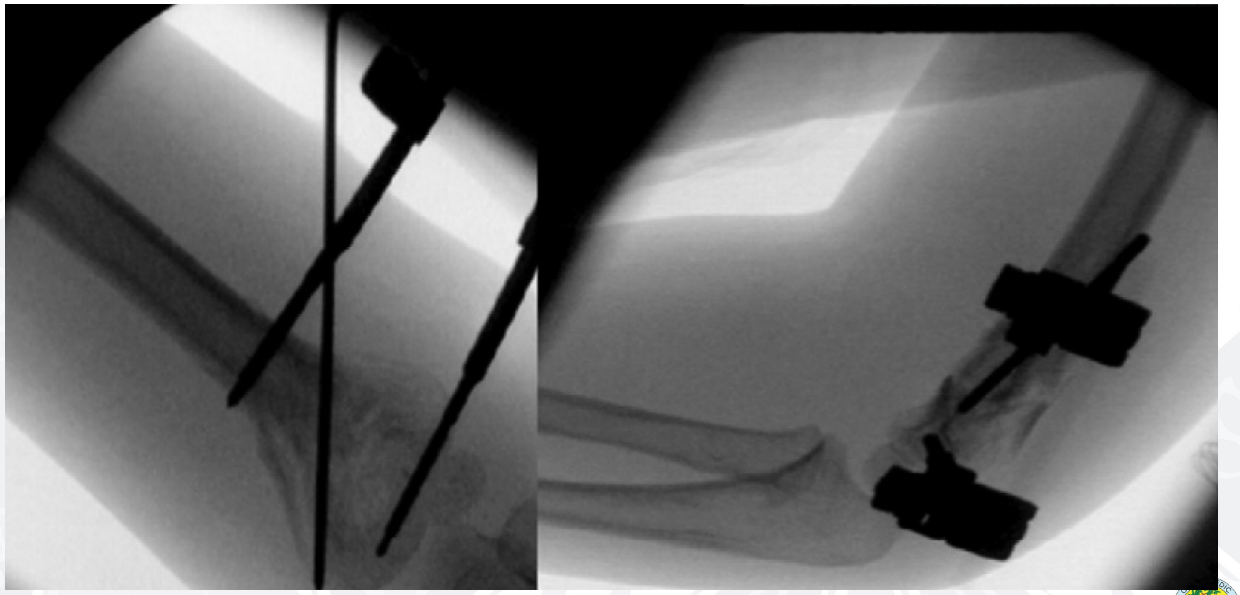
Unsatisfactory reduction

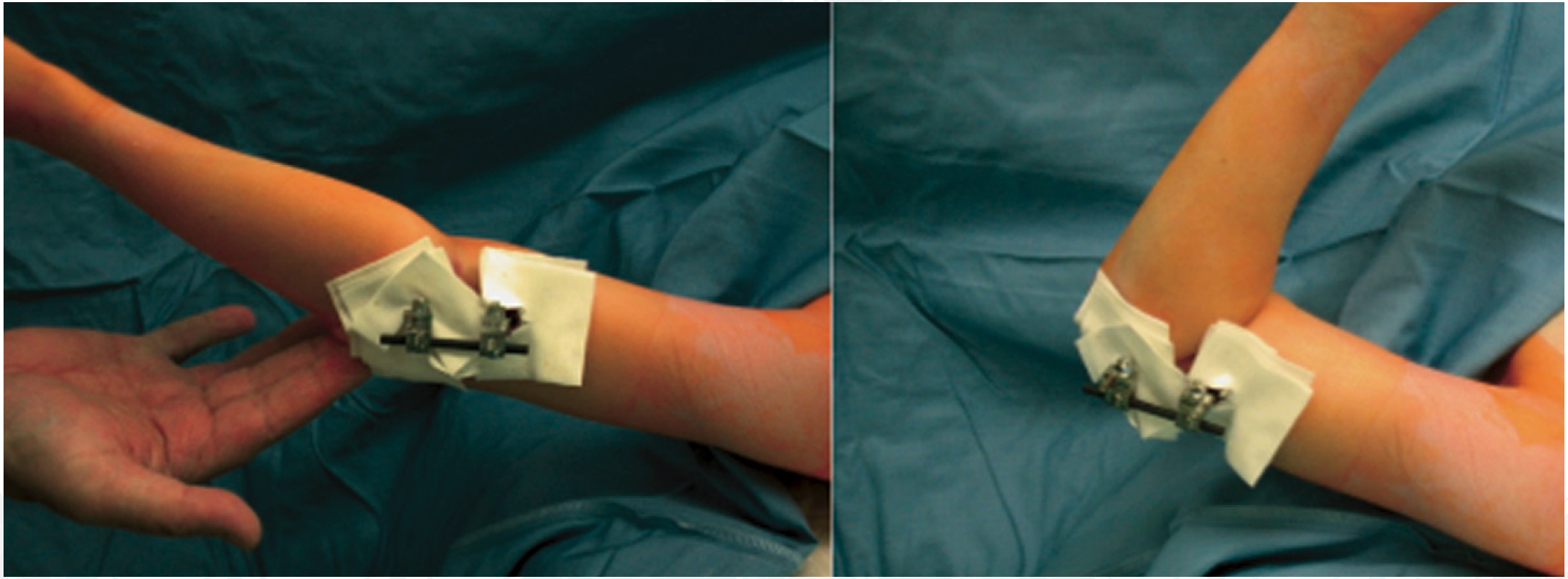
Unstable reduction.

T Slongo. T Schmid. K Wilkins.Lateral External Fixation—A New Surgical Technique for Displaced Unreducible Supracondylar Humeral Fractures in Children J Bone Joint Surg Am. 2008;90:1690-7



Fixation with External Fixator

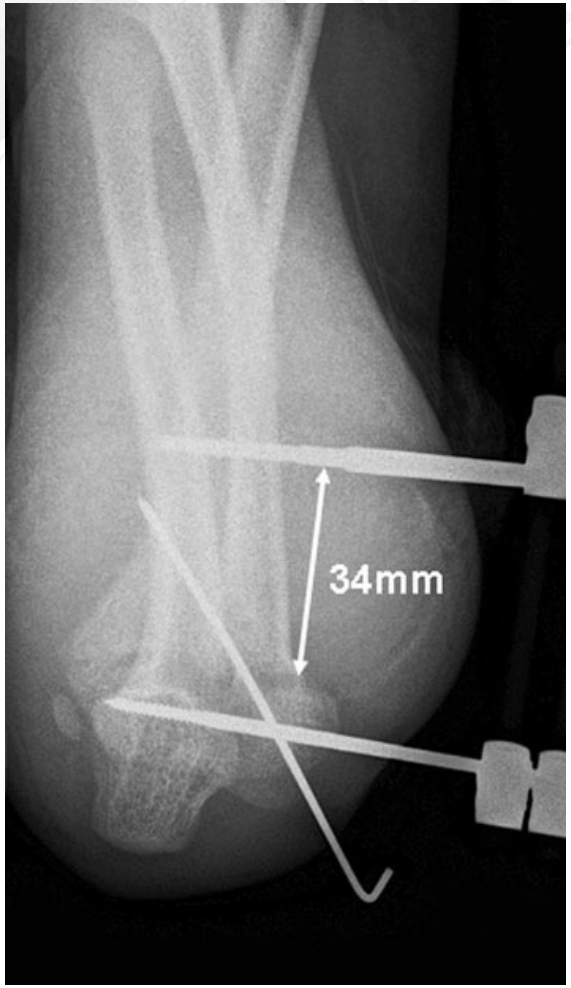




Complication

Iatrogenic radial nerve injury is a risk (proximal placement of the pin):

- inserting the proximal pin under direct vision within 2 cm from the fracture line using a drill sleeve.



M Horst. S Altermatt et. al. Pitfalls of lateral external fixation for supracondylar humeral fractures in children. Eur J Trauma Emerg Surg (2011) 37:405–410

Conclusions

Due to difficult reduction or unstable fixation

- Important to recognized the potential difficult case
- Reduction technique using intrafocal or leverage to reduce the fracture
- Technique of pin fixations
- The use of external fixator for unstable fracture

Thank you