

# Lateral Humeral Condyle Fractures in Children: The Potential Role of Initial Assessment in Decision-Making

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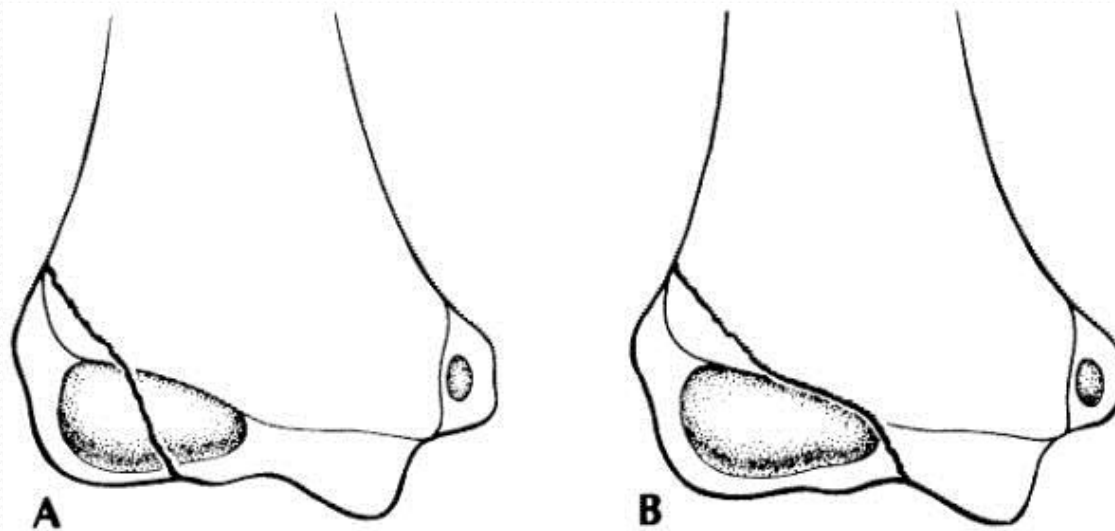
Riyadh, Saudi Arabia

- Accounts for 10-20% of all childhood elbow fractures
- The diagnosis and treatment remain challenging



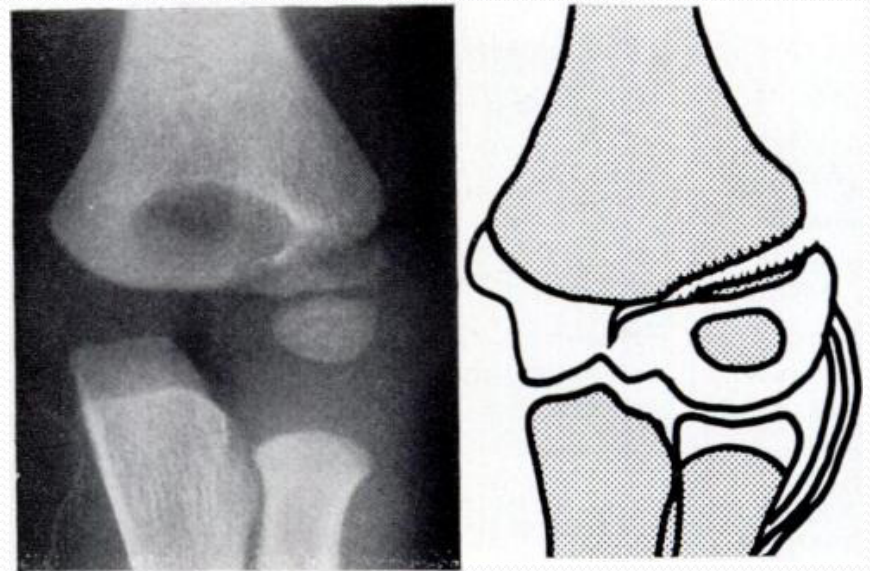
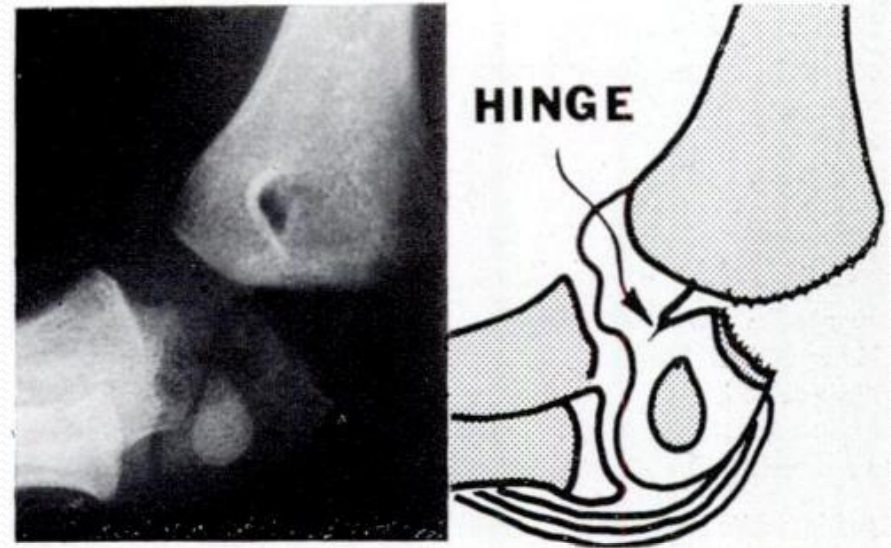
## Fracture Classification

- Milch classification (1964)
  - Based on fracture location through the epiphysis
  - The most commonly cited classification system,
  - Not predictive of outcome or suggestive for the treatment



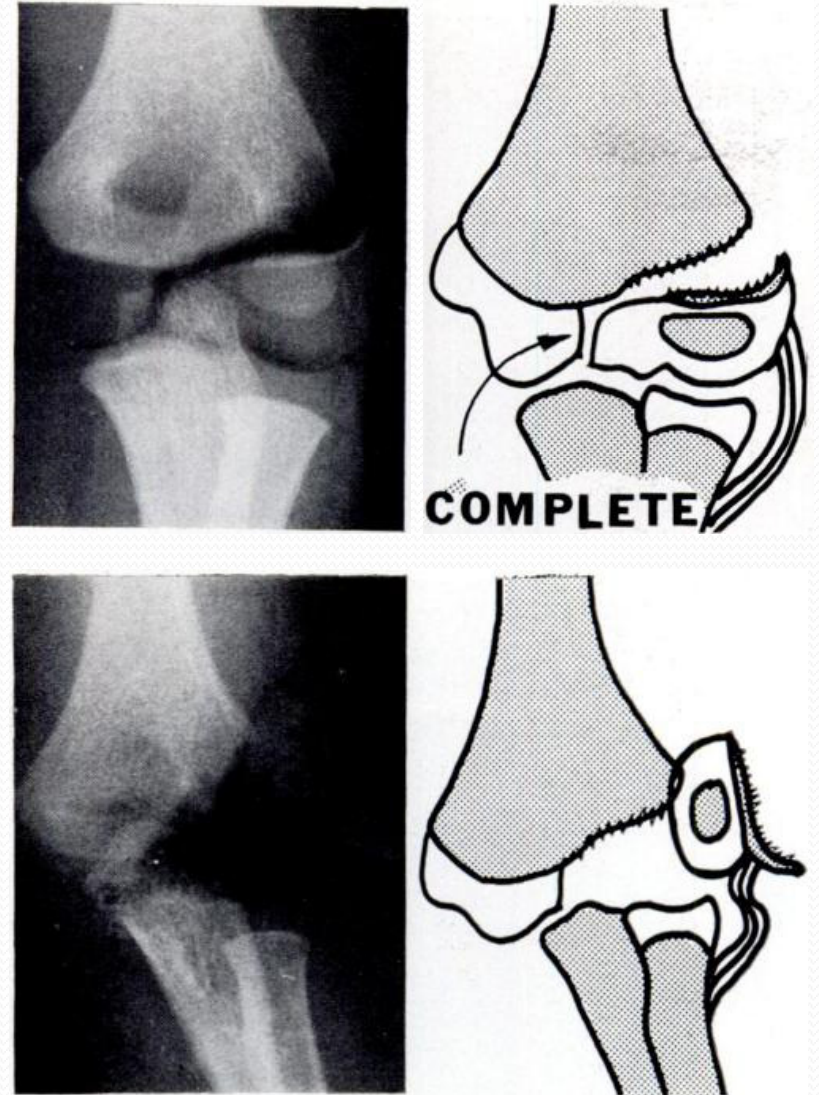
## Fracture Classification

- Jacob et al (1975) described two types of nondisplaced fractures
  - An incomplete fracture with a cartilaginous bridge that prevents subsequent displacement



## Fracture Classification

- A complete fracture with risk for further displacement



# Fracture Classification

- Song et al (2008) designed a comprehensive classification system that is linked to a treatment algorithm



**TABLE I Classifications According to Degree of Displacement and Fracture Pattern**

Stage	Degree of Displacement	Fracture Pattern	Radiograph Views Used as Basis	Stability
1	≤2 mm	Limited fracture line within the metaphysis	All 4 views	Stable
2	≤2 mm	Lateral gap	All 4 views	Indefinable
3	≤2 mm	Gap as wide laterally as medially	Any of 4 views	Unstable
4	>2 mm	Without rotation of fragment	Any of 4 views	Unstable
5	>2 mm	With rotation of fragment	Any of 4 views	Unstable

# Fracture Classification

- Degree of Displacement
  - Nondisplaced
  - Minimally displaced
  - Displaced





## Imaging

- All attempts for the differentiation are either invasive or expensive
  - Arthrography
  - MRI
  - Ultrasonographyare frequently used





## Treatment

- There is consensus that the treatment of displaced fractures is closed or open reduction and internal fixation
- The treatment of nondisplaced or minimally displaced fractures remains controversial



## Treatment

- The risk for subsequent displacement of these fractures has been reported as 11-42%
- Delayed surgery with attempts to mobilize the fragment by stripping soft tissues have often led to avascular necrosis
- Some investigators have recommended closed reduction with percutaneous pinning for minimally displaced fractures



## Purpose of the Study

Our aim was

- To recognize the impact of further displacement of nondisplaced and minimally displaced fractures on the outcome
- To define the fracture displacement that necessitates primary surgical intervention
- To ascertain which fractures need early follow up to avoid delayed surgery.



## Patients

### Inclusion Criteria

- From 2004 to 2010
- Complete information
- Full radiographic examination
- Follow up of at least four years



## Patients

### Exclusion Criteria

- Associated injury of the same limb
- Neuromuscular disorders



## Methodology

The collected Data Include

- Initial assessments
- Treatment method
- Operative data
- Cast immobilization
- Follow up
- Complications
- Healing



## Methodology

- The authors reviewed blindly all initial radiographs
- Clinical practice pathway for paediatric lateral humeral condyle fracture
  - Hairline fracture is considered nondisplaced
  - A fracture gap  $\leq 2$  mm is minimally displaced
  - A fracture gap  $> 2$  mm is a displaced fracture

## Methodology

- The outcome for each patient was graded according to the Cardona et al (4) modification of the Hardacre functional rating system

	Clinical and Radiological Assessment
<b>Excellent</b>	No loss of motion, normal carrying angle, the patient is asymptomatic, and radiographs revealed a healed fracture
<b>Good</b>	An extension loss of no more than 15°, mild alteration of the carrying angle, and radiographs revealed a healed fracture
<b>Poor</b>	Significant and disabling loss of motion, a conspicuous alteration of the carrying angle, ulnar neuritis, or radiographic findings of non-union or avascular necrosis.



## Results

- 98 children
- 67 boys (68.4%) and 31 girls
- Age range 3-10 years (average, 5.7)
- Right elbow in 38 patients (38.8%) and left in 60

## Results

- The initial assessment
  - 7 nondisplaced fractures (7.1%)
  - 29 minimally displaced fractures (29.6%)
  - 62 displaced fractures (63.3%)
- 63 were treated by surgical fixation within 24 hours
- 8 Redisplacement treated by delayed surgery
- 52 patients had internal oblique radiographic view
  - 49 displaced fracture
  - 3 minimally displaced

## Results

- The authors' assessments were compared with the initial assessments

Initial Assessment	Authors' Assessment		
	Nondisplaced	Minimally displaced	Displaced
Nondisplaced (7)	5	2	0
Minimally displaced (29)	1	21	7
Displaced (62)	0	0	62
Total (98)	6 (6.1%)	23 (23.5%)	69 (70.4%)

## Results

- Significant association of open reduction with both minimally displaced and displaced fractures

Initial Diagnosis	Surgical Procedure and Method of Fixation			Total
	Closed reduction 2 K-wires	Open reduction 2 K-wires	Open reduction 3 K-wires	
Minimally displaced	1	6	2	9
Displaced	10	41	11	62
Total	11	47	13	71



## Results

- The mean cast time was 5.1 weeks (range, 4-6)
- The average follow-up was 50.2 months (range, 48-61)
- 5 superficial infection at the site of wire entry
- 21 children underwent a rehabilitation program
- 5 required an extended period of intensive PT



## Results

- 4 poor results (minimally displaced fractures)
- 3 were proven to be displaced fractures
- Three variables, specifically the initial assessment, the time from injury to surgery, and the casting period were significantly associated with the final outcome by crude analysis

## Results

- Significant association of poor results with open reduction

Treatment Method	Final Results			
	Excellent	Good	Poor	Total
Closed Reduction	8	3	0	11
Open Reduction	46	10	4	60
Non-operative	27	0	0	27
Total	81 (82.7%)	13 (13.3%)	4 (4.1%)	98

## Lateral Humeral Condyle Fractures in Children

- The results highlighted the significance of the initial assessment in decision-making
- Most poor results were due to inaccurate initial evaluation and thus inadequate management





# Lateral Humeral Condyle Fractures in Children

- Standard classification system
- Standardization of displacement definitions improved the initial assessment by 75%
- Fracture with displacement  $\geq 2$  mm is considered displaced



# Lateral Humeral Condyle Fractures in Children

- AP and Lat. views
- Internal oblique view
- Stress radiography, MRI, arthrography, and US are additional tools
- Inherent drawbacks
- Certain situations



# Lateral Humeral Condyle Fractures in Children

- Most complications were associated with operative treatment
- Minor
- Major that led to substantial functional loss
- Delayed surgery and complications



# Lateral Humeral Condyle Fractures in Children

- Key to obtaining a satisfactory outcome
- Avoid delayed surgical intervention.
- Determine the proper time for the first follow-up radiograph
- No need to remove the cast to improve the x-ray quality



# Lateral Humeral Condyle Fractures in Children

- Closed or open reduction
- Anatomic reduction
- Two or three K-wires





## Conclusion

- Careful initial assessment using the IO view in addition to standard x-ray views is crucial for adequate treatment
- Fractures with  $\geq 2$  mm displacement should be primarily treated by surgical fixation
- Fractures with  $< 2$  mm displacement must be reviewed 4-6 days after cast application
- If the patient's compliance with early follow up is not guaranteed and the fracture is not hairline, then primary closed reduction and percutaneous fixation is indicated.