Pediatric Lateral Humeral Condyle Fractures: Reliability of a Modified Jakob Classification System and Its Impact on Treatment Planning With or Without Arthrography

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Disclosures

- I have no disclosures.
- Dr. Charles T. Mehlman has the following disclosures:
  - Financial Interest: Oakstone CME, DynaMD
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Background

- Lateral humeral condyle fractures are common in the pediatric population.
- Treatment options depend on fracture severity.
- This spectrum of injury demands a reliable fracture classification system to support clinical decision making
- Limited research exists on the reliability of currently available classification systems.
- **Purpose of current study**: We assess the reliability of a modified Jakob classification system and its value in guiding treatment with or without arthrography

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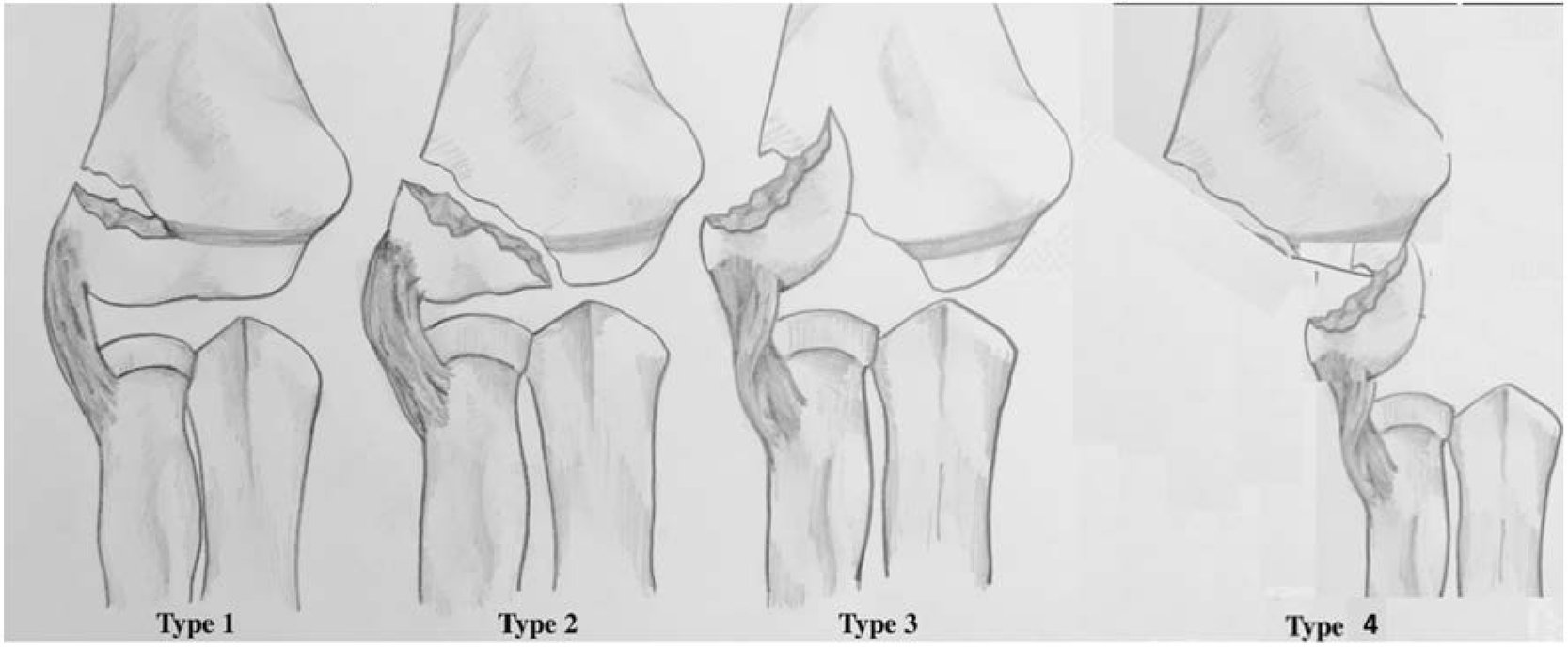
Methods

- Inter-rater and intra-rater reliability study using radiographs and arthrograms.
- 32 randomly selected lateral condyle fracture cases.
- Three pediatric orthopedic surgeons and six pediatric orthopedic surgery residents.
- Raters classified the fractures according to the modified Jakob system, described their intended treatment plan and if they would use arthrography
- Arthrograms were shown, if requested, and raters were asked if this changed their rating or treatment plan.
- Rating was repeated within a two-week interval to assess intra-rater reliability.
- Treatment plan with and without arthrography was compared at both rating points
- Reliability was used to assess the utility of arthrography in the classification schema

Modified Jakob Classification – Illustrative Demonstration

Modified Jakob Classification



Jakob Type 1: A non-displaced (<2 mm) fracture where the fracture line does not cross through the articular surface.

Jakob Type 2: Minimally displaced (≥2mm) fracture with lateral translation. The fracture extends to the articular surface. The fragment will **not** be significantly rotated.

Jakob Type 3: Completely displaced fracture extending to the articular surface. Fracture fragment **will** be significantly rotated.

Jakob Type 4: Completely displaced fracture extending to the articular surface with elbow components shifted greater than 50% either medially or laterally. The fragment **will** be significantly rotated.

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Image adapted from “Type 1, 2 and 3 lateral condyle fractures according to the Jakob Classification” by Zachary A. Winthrop

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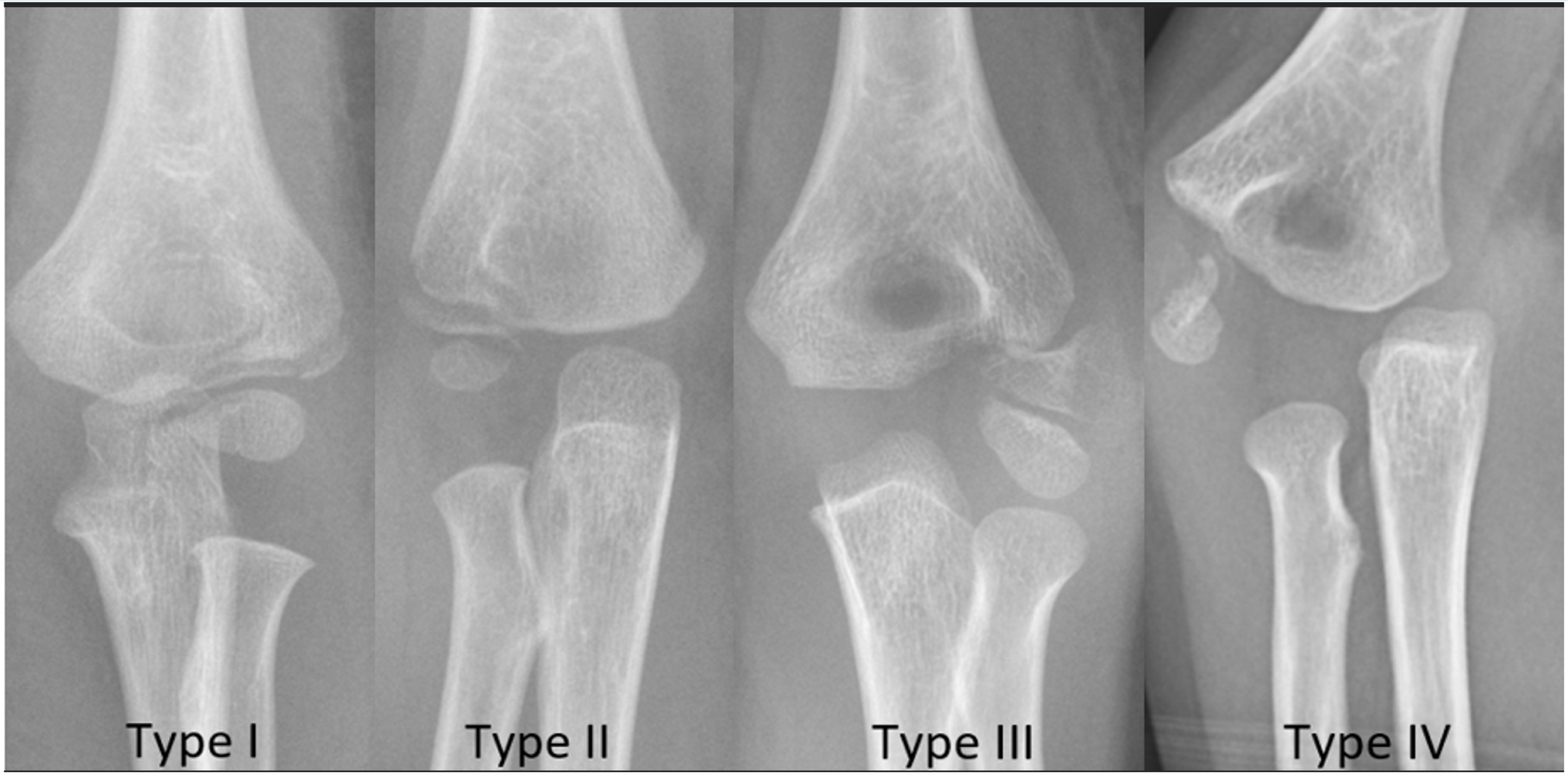
Modified Jakob Classification – Radiographic Demonstration



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Results

- The modified Jakob system had excellent average inter-rater reliability using only radiographs with a kappa of 0.82 and overall agreement of 86%.
- Average kappa for intra-rater reliability using only radiographs was 0.88 (range of 0.79 to 1.00) and average overall agreement of 91% (range of 84% to 100%).
- Inter-rater and intra-rater reliability was poorer when raters used both radiographs and arthrography.
- Arthrography changed the treatment plan in 8% of cases.

Inter-Rater Reliability

	Radiographs Only		Radiographs and Arthrogram	
	Inter-rater Kappa (95% CI)	Inter-rater Agreement (%)	Inter-rater Kappa (95% CI)	Inter-rater Agreement (%)
Rating 1	0.81 (0.73-0.89)	85.59	0.69 (0.61-0.78)	77.00
Rating 2	0.82 (0.72-0.91)	86.28	0.73 (0.63-0.83)	79.86
Overall	0.82 (0.73-0.91)	85.935	0.71 (0.62-0.81)	78.43

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Results Cont.

Intra-Rater Reliability

	Radiographs Only		Radiographs and Arthrogram	
	Intra-rater Kappa (95% CI)	Intra-rater Agreement (%)	Intra-rater Kappa (95% CI)	Intra-rater Agreement (%)
Surgeon 1	0.83 (0.68-0.99)	87.50	0.83 (0.68-0.99)	87.50
Surgeon 2	0.92 (0.80-1.00)	93.75	0.96 (.88-1.00)	96.88
Surgeon 3	0.88 (0.74-1.00)	90.63	0.83 (0.68-0.99)	87.50
Resident 1	0.88 (0.74-1.00)	90.63	0.83 (0.68-0.99)	87.50
Resident 2	0.79 (0.62-0.96)	84.38	0.67 (0.46-0.87)	75.00
Resident 3	1 (1.00-1.00)	100.00	0.92 (0.80-1.00)	93.75
Resident 4	0.83 (0.68-0.99)	87.50	0.75 (0.57-0.93)	81.25
Resident 5	1 (1.00-1.00)	100.00	1 (1.00-1.00)	100.00
Resident 6	0.83 (0.68-0.99)	87.5	0.71 (0.51-0.90)	78.13
Surgeon Group	0.88	90.63	0.87	90.63
Resident Group	0.89	91.67	0.81	85.94
Overall	0.88	91.32	0.83	87.50

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Conclusion

- The modified Jakob schema is a reliable classification system for pediatric lateral humeral condyle fractures, independent of arthrography, given the excellent kappa values.
- A standardized classification system facilitates treatment planning, allows for better communication, and guides research aimed at improving treatment.
- Importantly, the reliability of this system independent of arthrography limits radiation exposure, decreases treatment costs, and allows for better allocation of resources.

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