

Pediatric floating elbow injuries are not as problematic as they were once thought to be: a systematic review

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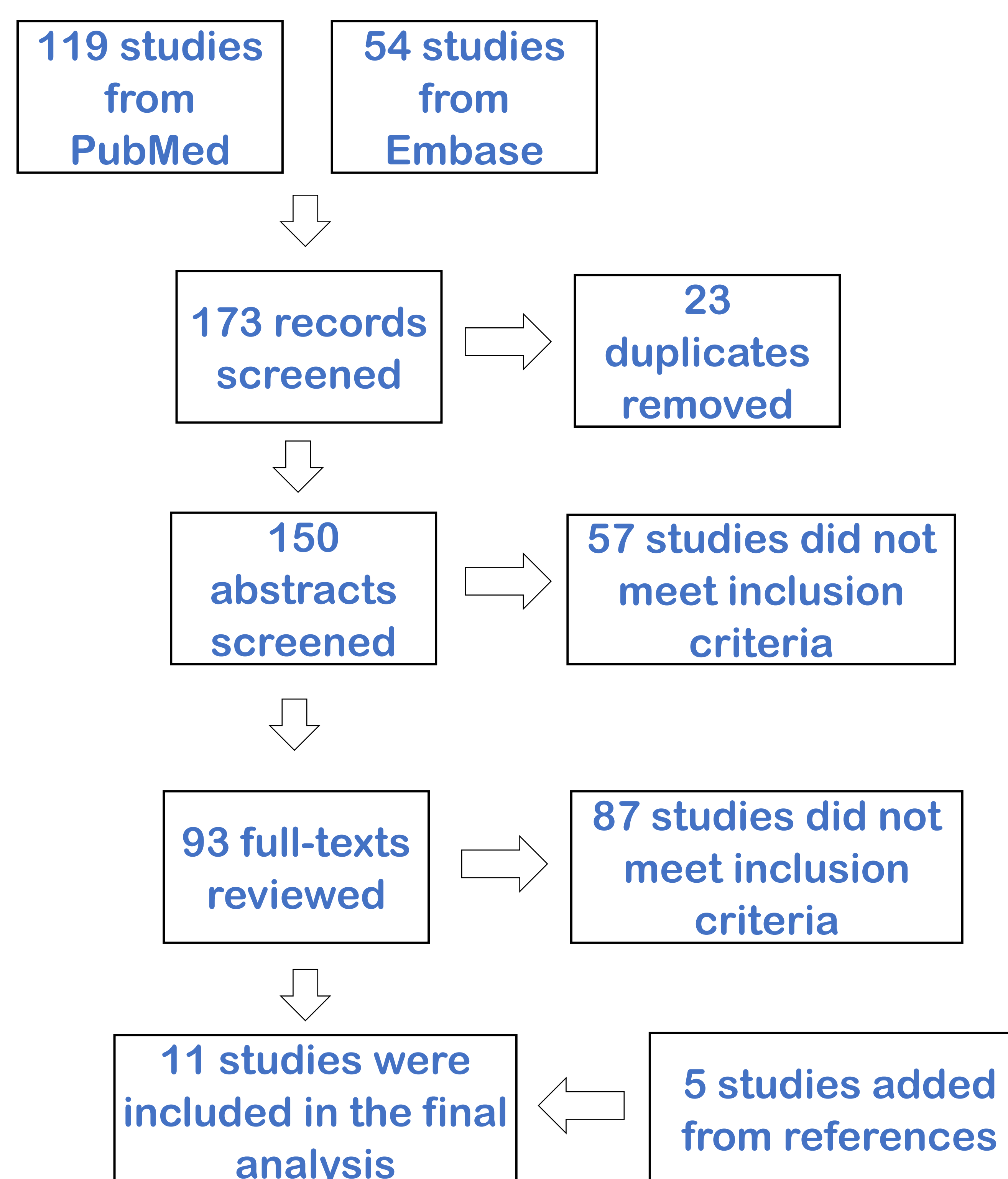
Background

- **Floating elbow** injuries, or ipsilateral injuries to the humerus and forearm are grievous injuries in adults, that result in a high complication rate and great disability even following highly skilled treatment
- In children, floating elbow injuries often consist of a supracondylar humerus fracture and an ipsilateral both bone forearm fracture or distal radius fracture.
- These injuries were **thought** to be associated with a **high rate** of pediatric acute compartment syndrome of the arm (**PACS**).
- Our multicenter group, the Children's Orthopedic Trauma and Infection Consortium for Evidence-based Study (CORTICES) is endeavoring to perform a multicenter study of this entity to determine the ideal management of this entity
- As a part of that we performed a systematic review of the literature to determine what the current state of the evidence is regarding pediatric floating elbows

Methods

- Data Sources
 - Pubmed, EMBASE
 - Search Terms: "pediatric AND ("floating elbow" OR ((elbow OR supracondylar OR "distal humerus") AND (forearm OR radius OR ulna)))"
 - January 1999- November 2019
- Study Selection-
 - PRISMA
 - Studies first identified by title, reviewed title abstract then full text
 - References searched for extra papers
- Data Extraction-
 - Each paper carefully reviewed
 - Fracture characteristics
 - Treatments
 - Compartment syndrome
 - Demographic factors

Flowchart for selection of studies



Results Summary

- Only 8/433 Patients developed PACS
- Most patients treated with **CRPP** for the **proximal** fracture and for the **distal** most fracture
- Pulseless limbs consisted of 4% of the fractures and all pulses returned following pinning
- There were 3 iatrogenic nerve injuries resultant from medial pin placement
- Good or Excellent results were the rule found in **over 80%** of cases

- **Unlike adult** floating elbow injuries, the available literature suggests that pediatric floating elbows may have a **more benign** course
- Early studies reporting a **high rate of PACS** in this injury have **not been observed** in the last 20 years of the reported literature with a reported rate of **2%**
- **Pinning benign fractures** present as a distal fracture in a floating elbow that would not otherwise have been pinned is probably **not necessary**

Results (papers)

Author (year)	Journal	Time period	n	Mean age (range) years	Sex (M/F)	Follow-up (months)
Blakemore ³ (2000)	Clin Orthop Relat Res	1984-1997	43	8 (2m – 15y)	NA	NA
Harrington ¹⁵ (2000)	Arch Orthop Trauma Surg	1989-1995	12	8.2 (5 – 12)	8:4	>18
Ring ¹ (2001)	J Pediatr Orthop	1987-1996	16	7.6 (1.5 – 13.8)	10:6	15 (mean)
Roposch ¹² (2001)	J Pediatr Orthop B	1984-1991	47	6.3 (2 – 13)	40:7	NA
Tabak ¹¹ (2003)	J Child Orthop	1996-1999	22	7.3 (3 – 12)	17:5	38.6 (mean)
Dhoju ¹⁶ (2011)	Kathmandu Univ Med J (KUMJ)	2005-2011	31	8.9 (2 – 14)	25:6	NA
Malheiros ⁹ (2011)	Rev Bras Ortop	1994-2009	31	8.5 (1 – 14)	24:7	NA
Muchow ² (2015)	J Pediatr Orthop	2001-2012	150	6.8 (NA)	NA	>3
Joshi ⁸ (2016)	Journal of Lumbini Medical College	2013-2016	17	8.5 (6 – 11)	12:5	12.9 (mean)
Blumberg ¹³ (2018)	J Pediatr Orthop	2007-2014	47	6.6 (2.6 – 10.1)	22:25	NA
Mishra ¹⁰ (2019)	J Clin Diagn Res	2013-2017	17	9.5 (6 – 15)	11:6	20 (mean)

Results (PACS)

Study	Patient characteristics	Fracture type	Initial treatment	Time to diagnosis of ACS	Secondary treatment	Final prognosis	comments
1	6Y male, falling, no palpable pulses at presentation	Displaced SCH and BBFF	CRPP of SCH fracture, CR of BBFF, pulse returned	18h after initial surgery	Fasciotomy, pinning of the BBFF	Excellent. Full ROM and no sequela	Falling from a 1.8m high treehouse
2	11Y female, falling	Displaced open SCH and displaced open distal radial and ulnar fractures	CRPP of SCH fracture, CR of forearm fractures	24h after initial surgery	Fasciotomy, carpal tunnel release	Excellent. Full ROM at 6 months	Falling from 1.5m high monkey bars
3	9Y female, falling	Displaced SCH and displaced open BBFF	CRPP of SCH fracture, ORIF of radius with plate	Diagnosed at initial surgery by measuring compartment pressure	Fasciotomy at initial surgery	Excellent. No sequela	Falling from monkey bars
4	Initially treated at another institution	Displaced SCH and DRF	CRPP of SCH and DRF, fasciotomy. All at another institution	Persistent symptoms at arrival	Extensive fasciotomy	No sequela.	Incomplete fasciotomy was performed at the first institution
5	NA	Displaced SCH and DRF	CRPP of SCH, CR of DRF	Brachial artery thrombosis diagnosed 48h later. No early surgery performed	Saphenous vein grafting, extensive debridement, flexor slide, plating of DRF non-inion, free gracilis transfer	Poor result after multiple reconstructive procedures	Missed brachial artery thrombosis at initial procedure
6	Initially manipulated by a bone-setter	Displaced SCH and BBFF	NA	NA	NA	NA	No details on the treatment of ACS
7	NA	Displaced SCH, no details on the distal fracture	CRPP of SCH, no details on the distal fracture	NA	Fasciotomy	NA	-
8	10M, falling	Displaced SCH and forearm fractures	Late presentation	2 days	CRPP and fasciotomy	Fair result	The patient presented 2 days after the injury