

# Close Reduction Percutaneous Pinning (CRPP) versus Open Reduction Internal Fixation (ORIF) for Pediatric Supracondylar Humerus Fractures Gartland Type II and III: A Systematic Review and Meta-analysis

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## **Abstract**

**Introduction:** Displaced supracondylar fracture in children is a challenging injury that may result in impaired functional and cosmetic outcome if not well-treated. Utilization of Closed Reduction and Percutaneous Pinning (CRPP) increased for this pathology, some authors believe ORIF results better anatomical reduction and lower rate of loss of reduction. Study aims to compare CRPP and ORIF for pediatric supracondylar humerus fracture.

**Method:** Systematic review was conducted based on PRISMA guideline. Inclusion criteria were age <18 years old, comparing CRPP and ORIF for Supracondylar Humerus Fractures Gartland Type II, III. Studies of one surgical technique, Gartland type I, case reports were excluded. For meta-analysis, 6 studies were included and fixed effect model used to pool the result. In each study, mean difference (MD) with 95% confidence interval (CI) was calculated for dichotomous outcomes using Review Manager.

**Result:** Total of 252 patients aged 0-15 years old were included. CRPP more often performed than ORIF. Satisfactory outcomes measured by Flynn's criteria were achieved in 87.74% in CRPP and 86.73% in ORIF patient group, indicating significant difference (Heterogeneity,  $I^2 = 23\%$ ; WMD, 1.26; 0.58 to 2.73;  $P = 0.56$ ).

**Conclusion:** Current systematic review and meta-analysis suggest that for displaced supracondylar humerus fractures, ORIF offers a comparable functional and cosmetic outcome compared to CRPP.

**Keywords:** CRPP, ORIF, Supracondylar Humerus Fracture.

**Close Reduction Percutaneous Pinning (CRPP) versus Open Reduction Internal Fixation (ORIF) pada Fraktur Supracondylar Humerus Gartland Tipe II dan III pada Pasien Pediatri: Tinjauan Sistematis dan Meta-analisis**

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**Abstrak**

**Pendahuluan:** Fraktur supracondylar humerus yang displaced pada anak merupakan cedera yang rumit karena dapat berakibat pada gangguan fungsi dan kosmetik jika tidak ditangani dengan baik. Walaupun penggunaan Closed Reduction and Percutaneous Pinning (CRPP) meningkat pada patologi ini, beberapa peneliti meyakini bahwa kendati lebih invasif, ORIF masih memberikan reduksi anatomis yang lebih baik dan tingkat loss of reduction yang lebih rendah. Dengan demikian, studi ini bertujuan untuk membandingkan CRPP dan ORIF pada pasien dengan fraktur supracondylar humerus tipe Gartland II, III pada populasi pediatrik.

**Metode:** Tinjauan sistematis dilakukan berdasarkan panduan PRISMA. Kriteria inklusi adalah usia <18 tahun, membandingkan antara CRPP dengan ORIF untuk fraktur supracondylar humerus Gartland II dan III menggunakan kriteria Flynn untuk penilaian keluaran fungsional. Penelitian non-komparatif dengan hanya satu modalitas teknik operasi, Gartland tipe I, dan laporan kasus dieksklusikan. Untuk Meta-analisis, 6 penelitian diikutsertakan dan model fixed effect digunakan untuk pengumpulan hasil. Pada setiap penelitian, perbedaan mean dengan interval kepercayaan 95% dihitung untuk hasil dikotomis menggunakan Review Manager.

**Hasil:** Sejumlah 252 pasien dengan usia 0-15 tahun diikutsertakan dalam analisis, di mana CRPP lebih sering dilakukan daripada ORIF. Tingkat kepuasan diukur menggunakan kriteria Flynn, dengan hasil 87,74% pada kelompok CRPP dan 86,73% pada kelompok ORIF, mengindikasikan adanya perbedaan signifikan (Heterogeneity, I<sup>2</sup> = 23%; WMD, 1.26; 0.58 to 2.73; P = 0.56).

**Kesimpulan:** Tinjauan sistematis dan meta-analisis saat ini menunjukkan bahwa ORIF menawarkan keluaran fungsional dan kosmetik yang sebanding dengan CRPP untuk fraktur supracondylar humerus displaced.

**Kata kunci:** CRPP, ORIF, Fraktur supracondylar humerus

## Introduction

Supracondylar fracture of the humerus is the second most frequent types of bone injury in children.<sup>1</sup> The occurrence of supracondylar fracture of the humerus accounts for 55 to 75% of patients with elbow fractures and represents approximately 3% of all fractures in pediatric population, especially those aged 5-7 years old.<sup>2</sup> Ligamentous laxity commonly found in the growing skeleton is also associated with hyperextension of the elbow, focusing a bending force on the susceptible supracondylar area. In these cases, the achievement of accurate anatomical reduction in the coronal plane plays an important role, as residual deformity in this region is less likely to remodel.<sup>3</sup> Therefore, as a challenging injury, displaced supracondylar fracture may result in complications, undesirable cosmetic results, and impaired functional outcome if not

well-treated.

Effective treatment for this pathology is necessary in order to avoid serious complications, such as cubitus varus, malunion, limitation of movement due to pain or stiffness, and any nerve injuries.<sup>4</sup> Undisplaced supracondylar humerus fracture usually requires only simple immobilization for comfort and protection. On the other hand, displaced supracondylar humerus fracture in children presents a challenge for surgeons, as the treatment of choice is still controversial, considering the functional and cosmetic outcome, as well as the surgical risks it might carry. Some of the most common surgical procedures performed for this condition are open reduction internal fixation (ORIF) and close reduction with percutaneous pinning (CRPP).<sup>2,5</sup>

The ideal treatment for supracondylar humerus fractures is, according to many authors, closed reduction and percutaneous pin-

ning. As the increasing use of CRPP for this pathology, it has also been considered to be the best approach due to avoidance of high expense during the hospital stay, delayed bone union, and some complications caused by the open reduction. However, some other authors believe that even though more invasive, open reduction and internal fixation method still results in more sufficient anatomical reduction and lower rate of loss of reduction, especially for patients with displaced supracondylar humerus fracture. Furthermore, the only reliable method for restoring the normal alignment and contour of the distal humerus is operative exposure and direct manipulation of fracture fragments. In this case, ORIF also offers stable fixation to allow motion while ensuring union.<sup>6</sup> Nevertheless, many issues are still open to discussion for a number of reasons, including the effect of delaying operative treatment, the pinning technique used for fixation (number and configuration of pins) in CRPP, etc.<sup>7</sup>

There have not been a lot of studies comparing the outcome of CRPP and ORIF in displaced supracondylar fractures, which includes Gartland type II and III fractures. Therefore, this study aims to compare both treatments for displaced supracondylar humerus fracture, through systematic review and meta-analysis. Criteria taken into consideration were baseline characteristics, final (functional and cosmetic) outcomes, complications, and follow-up period.

## Materials and Methods

A systematic review using PubMed and Google Scholar was conducted based on PRISMA guideline to identify relevant articles, which was searched up through June

2019 using the keywords “CRPP” AND “ORIF” AND “Supracondylar Humerus Fracture”. Those data were then manually scanned and reviewed by author. Inclusion criteria were studies with samples aged <18 years old, comparing CRPP and ORIF procedure for Supracondylar Humerus Fractures Gartland Type II and III, with Flynn criteria as the main outcome. Studies of only one surgical technique modality, Gartland type I, and case reports were excluded. Studies with samples older than 18 years old were excluded from the analysis, considering that World Health Organization (WHO) criteria for pediatric population comprises individuals below 18 years old. Gartland type I fracture was excluded because of minimal degree of displacement, and case reports were excluded because the sample size is insignificant to draw conclusion from.

For the meta-analysis, a total of 6 studies were included and fixed effect model was used to pool the result. The quality of the three articles was evaluated using The Joanna Briggs Institute (JBI) Critical Appraisal Tools. The results are shown in Tables 2. Six studies provide clear research purpose, coherent patients, objective results clear methods of data collection, and adequate follow-up time. Two studies stated unclear confounding factors and strategies to deal with them. Eventually six studies with a JBI score of more than 8 were included in this meta-analysis.

The data extraction was collected under basic characteristics and outcomes, mainly Flynn criteria. In each study, mean difference (MD) with a 95% confidence interval (CI) was calculated for dichotomous outcomes using Review Manager 5.3.

**Table 1. PICO Table Describing Inclusion and Exclusion Criteria**

Study Component	Inclusion	Exclusion
Population	<ul style="list-style-type: none"> <li>• Aged &lt;18 years old</li> <li>• Patients with supracondylar fracture</li> </ul>	<ul style="list-style-type: none"> <li>• Aged 18 years old or older</li> <li>• Animal studies</li> <li>• Other fracture regions</li> </ul>
Intervention	<ul style="list-style-type: none"> <li>• ORIF</li> <li>• CRPP</li> </ul>	<ul style="list-style-type: none"> <li>• Other methods of treatment</li> <li>• Studies with only one method of treatment</li> </ul>
Outcome	Flynn's criteria, complications	No outcome mentioned or different outcome
Publication	<ul style="list-style-type: none"> <li>• Studies published in English in peer-reviewed journals</li> <li>• All year publication studies</li> </ul>	<ul style="list-style-type: none"> <li>• Abstracts, editorials, letters</li> <li>• Duplicate publications of the same study that do not report on different outcomes</li> <li>• Meeting presentations or proceedings</li> </ul>
Study Design	All study design except case reports and review articles	Case reports, review articles.

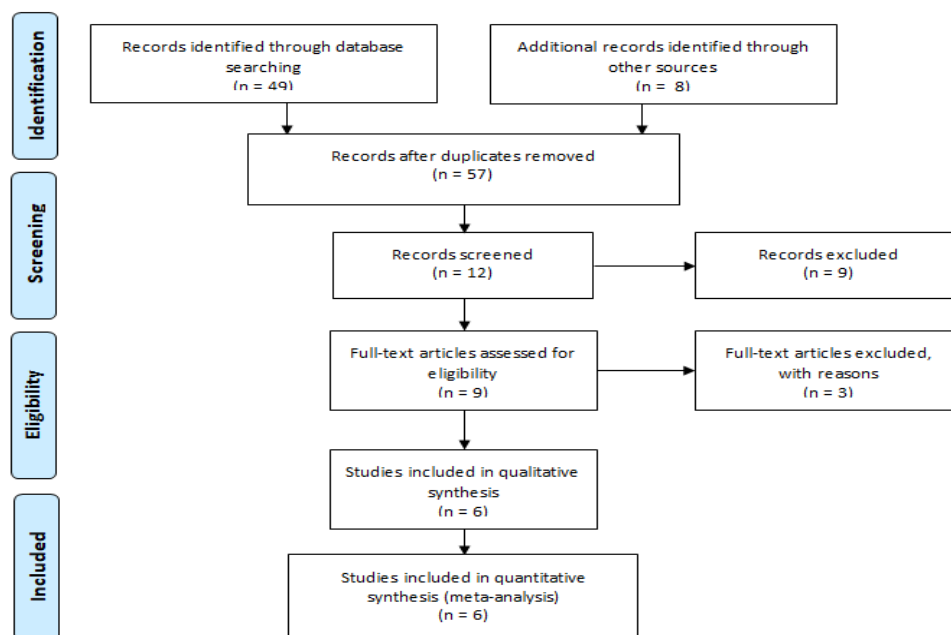


Figure 1. Flow chart Showing Article Selection Based on PRISMA Guideline

Table 2. JBI Critical Appraisal Tools Result

Study	1	2	3	4	5	6	7	8	9	10	11	JBI Scores
Turgut 2015 <sup>8</sup>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11
Bahadur 2018 <sup>9</sup>	Yes	Yes	Yes	Unclear	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	9
Cramer 1992 <sup>10</sup>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11
Algawy 2018 <sup>4</sup>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11
Sinikumpu 2016 <sup>3</sup>	Yes	Yes	Yes	Unclear	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	9
Joshi 2016 <sup>5</sup>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11

Results

Two hundred seventy-four patients aged 0-15 years old were included in the analysis. Male and female were equally affected, and CRPP procedure was done more often than ORIF. Study designs were all cohort retrospective (Level II-III) except for one study that was cohort prospective. One study was done in 1992 and the others were done between 2015 and 2018 (Table 3). From 274 patients aged 0-15 years old, 65% patients were treated with CRPP and 35% with ORIF (Table 4).

Patients were assessed functionally using Flynn’s criteria. Flynn’s criteria include two factors, which are ‘cosmetic factor’ (loss of carrying angle) and ‘functional factor’ (motion loss in degrees). In this study, The Flynn’s criteria were

grouped into satisfactory and unsatisfactory results. Satisfactory consists of excellent and good results, while fair and poor results were considered unsatisfactory. Meta-analysis based on Flynn’s criteria proved that satisfactory outcomes (excellent or good) were achieved in 76,4% of patients in CRPP group and 88,5% in ORIF group, indicating no significant difference (Heterogeneity, I<sup>2</sup> = 43%; P=0.45). Considering the low heterogeneity of the studies involved, fixed effect model was used for the analysis (Figure 3).

Other outcomes measured were Baumann angle, range of motion (ROM), carrying angle, Mayo Elbow Performance Score, and radiographic union. Not all studies mentioned about other outcomes so author could not undergo the quantitative systematic review beside the Flynn’s Criteria.

Table 3. References and Study design

No	Reference	Journal	Study Design	Level of Evidence
1	Turgut 2015 <sup>8</sup>	Joint Diseases and Related Surgery	Cohort Retrospective	Level III
2	Bahadur 2018 <sup>9</sup>	Medical Journal of Pokhara Academy of Health Sciences	Cohort Retrospective comparative	Level III
3	Cramer 1992 <sup>10</sup>	Journal of Orthopaedic Trauma	Cohort Cohort Retrospective	Level III
4	Algawy 2018 <sup>4</sup>	European Journal of Orthopaedic Surgery & Traumatology	Cohort Retrospective comparative	Level III
5	Sinikumpu 2016 <sup>3</sup>	The Bone And Joint Journal	Cohort Prospective comparative	Level II
6	Joshi 2016 <sup>5</sup>	Journal of Lumbini Medical College	Cohort Retrospective	Level III

	Yes	No	Unclear	Not applicable
1. Were the two groups similar and recruited from the same population?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Were the exposures measured similarly to assign people to both exposed and unexposed groups?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Was the exposure measured in a valid and reliable way?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Were confounding factors identified?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Were strategies to deal with confounding factors stated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Were the outcomes measured in a valid and reliable way?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Was the follow up time reported and sufficient to be long enough for outcomes to occur?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Was follow up complete, and if not, were the reasons to loss to follow up described and explored?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Were strategies to address incomplete follow up utilized?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Was appropriate statistical analysis used?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Overall appraisal:    Include     Exclude     Seek further info

Figure 2. JBI critical appraisal tools form for cohort studies

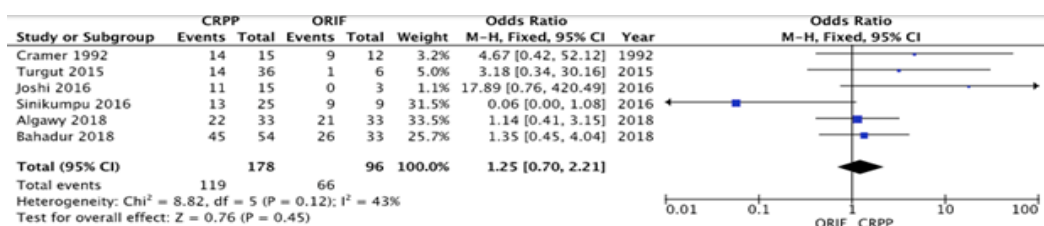


Figure 3. Analysis of Flynn’s criteria between CRPP and ORIF

Though differs from one study to another, CRPP and ORIF seem to offer comparable outcome measures as well as complication rate. Some of the complications mentioned in the literatures are nerve injuries (ulnar, median, and radial nerve), infection, deformity, and implant loosening. The follow up time in all literatures varies from 1 to 144 months (Table 5).

**Discussion**

Supracondylar fracture of the humerus is the second most frequent type of bone injury in children.<sup>1</sup> Supracondylar humerus fracture ac-

counts for 55 to 75% of patients with elbow fractures and represents approximately 3% of all fractures in pediatric population, especially those aged 5-7 years old.<sup>2</sup> Closed reduction and percutaneous pinning and open reduction and internal fixation are two common managements for supracondylar fracture of the humerus, though the choice between the two is still controversial.<sup>11</sup>

The ideal treatment for supracondylar humerus fractures is, according to many authors, closed reduction and percutaneous pinning. Nevertheless, many issues are still open to discussion for a number of reasons, including the pinning technique used for fixation (number and configu-

Table 4. Patient Characteristics and Treatment Procedure

No	Reference	Characteristics					Procedure	
		Sample Size	Age (years)	Sex		Grade	CRPP	ORIF
				Male	Female			
1	Turgut 2015 <sup>8</sup>	42	8.6 (4-15)	55.3%	44.7%	Gartland Type III	36 (85.7%)	6 (14.3%)
2	Bahadur 2018 <sup>9</sup>	89	4-14	60 (67.8%)	29 (32.2%)	Gartland Type III	54 (60.7%)	33 (39.3%)
3	Cramer 1992 <sup>10</sup>	27	0-13	8 (31.0%)	19 (69.0%)	Gartland Type II & III	15 (55.5%)	12 (45.5%)
4	Algawy 2018 <sup>4</sup>	66	7 (3-11)	41 (62.1%)	25 (37.9%)	Gartland Type III	33 (50.0%)	33 (50.0%)
5	Sinikumpu 2016 <sup>5</sup>	34	6.3 (1.2 -14.6)	2 (6.2%)	32 (93.8%)	Gartland Type II & III	25 (73.5%)	9 (26.5%)
6	Joshi 2016 <sup>5</sup>	18	9.5 (6-14)	13 (70.6%)	5 (29.4%)	Gartland Type III	15 (83.3%)	3 (16.7%)

Table 5. Outcomes and Complications

Reference	Outcome				Complications		Follow Up Time (Month)	
	Functional (Flynn)		Other Outcome		CRPP	ORIF		
	CRPP	ORIF	CRPP	ORIF				
Turgut 2015 <sup>8</sup>	<ul style="list-style-type: none"> <li>Excellent: 14 (93.3%)</li> <li>Good: 1 (6.7%)</li> <li>Fair: 0 (0%)</li> <li>Poor: 0 (0%)</li> </ul>	<ul style="list-style-type: none"> <li>Excellent: 1 (16.7%)</li> <li>Good: 4 (66.7%)</li> <li>Fair: 1 (16.7%)</li> <li>Poor: 0 (0%)</li> </ul>	<ul style="list-style-type: none"> <li>Baumann angle &gt;5°: 13.89%</li> <li>Baumann angle &lt;5°: 86.11%</li> </ul>	<ul style="list-style-type: none"> <li>Baumann angle &gt;5°: 16.67%</li> <li>Baumann angle &lt;5°: 83.33%</li> </ul>	<ul style="list-style-type: none"> <li>Ulnar nerve palsy (4.2-6.4%)</li> <li>Others: infection</li> </ul>	NA	>12	
Bahadur 2018 <sup>9</sup>	<ul style="list-style-type: none"> <li>Excellent: (45) 83.3%</li> <li>Good: (6) 11.1%</li> <li>Fair: (3) 5.6%</li> <li>Poor: (0) 0%</li> </ul>	<ul style="list-style-type: none"> <li>Excellent: (26) 78.8%</li> <li>Good: (4) 12.1%</li> <li>Fair: (2) 6.1%</li> <li>Poor: (1) 3%</li> </ul>	<ul style="list-style-type: none"> <li>Normal range of motion: 45 (83.3%)</li> </ul>	<ul style="list-style-type: none"> <li>Normal of range motion: 26 (78.8%)</li> </ul>	<ul style="list-style-type: none"> <li>Median nerve injury: 6 (11.1%)</li> <li>Radial nerve injury: 2 (3.7%)</li> <li>Ulnar nerve injury: 3 (5.6%)</li> <li>Pin tract infection: 6 (11.1%)</li> </ul>	<ul style="list-style-type: none"> <li>Radial nerve injury: 2 (6.1%)</li> <li>Pin tract infection: 3 (9.1%)</li> </ul>		1
Cramer 1992 <sup>10</sup>	<ul style="list-style-type: none"> <li>Excellent: 14 (93.3 %)</li> <li>Good: 0 (0%)</li> <li>Fair: 1 (6.7%)</li> <li>Poor: 0 (0%)</li> </ul>	<ul style="list-style-type: none"> <li>Excellent: 9 (64.3%)</li> <li>Good: 3 (21.4%)</li> <li>Fair: 2 (14.3%)</li> <li>Poor: 0 (0%)</li> </ul>	<ul style="list-style-type: none"> <li>Carrying angle ≤ 5°: 14 (93.3%)</li> <li>12° difference in carrying angle: 14 (93.3%)</li> </ul>	<ul style="list-style-type: none"> <li>Carrying angle ≤ 5°: 10 (71.4%)</li> <li>15° difference in carrying angle: 2 (14.3%)</li> <li>&lt;5° loss of motion flexion and extension: 12 (85.7%)</li> </ul>	NA	NA	NA	NA
Algaway 2018 <sup>4</sup>	<ul style="list-style-type: none"> <li>Excellent: (22) 66.66%</li> <li>Good: (8) 24.24%</li> <li>Fair: (2) 6%</li> <li>Poor: (1) 3%</li> </ul>	<ul style="list-style-type: none"> <li>Excellent: (21) 63.6%</li> <li>Good: (7) 21.2%</li> <li>Fair: (3) 9.1%</li> <li>Poor: (1) 3%</li> </ul>	Perfect ROM	NA	<ul style="list-style-type: none"> <li>pin tract infection: 3 (9.1%)</li> <li>neural nerve neurapraxia: 1(3.0%)</li> <li>20° varus</li> </ul>	<ul style="list-style-type: none"> <li>Pin tract infection: 3 (9.1%)</li> <li>Others: Decreased ROM, 20° varus deformity</li> </ul>		24
Sinikumpu 2016 <sup>6</sup>	<ul style="list-style-type: none"> <li>Satisfactory: 13 (56.52%)</li> <li>Unsatisfactory: 10 (43.48%)</li> </ul>	<ul style="list-style-type: none"> <li>Satisfactory: 9 (90%)</li> <li>Unsatisfactory: 1 (10%)</li> </ul>	Mayo Performance Score and ROM are all satisfactory, 60.8% normal radiograph at long term follow up		30% long term complications (subluxation of ulnar nerve, local deformity), ORIF <<			144
Joshi 2016 <sup>5</sup>	<ul style="list-style-type: none"> <li>Excellent: 11 (73.3%)</li> <li>Good: 2 (13.3%)</li> <li>Fair: 1 (6.7%)</li> <li>Poor: 0 (0%)</li> </ul>	<ul style="list-style-type: none"> <li>Excellent: 0 (0%)</li> <li>Good: 1 (50%)</li> <li>Fair: 1 (50%)</li> <li>Poor: 0 (0%)</li> </ul>	<ul style="list-style-type: none"> <li>No change more than 8° of carrying angle</li> <li>Good radiographic union</li> </ul>		<ul style="list-style-type: none"> <li>Pin tract infection: 3 (20%)</li> <li>Distal radius pin loosening: 2 (13.3%)</li> </ul>	NA		3-6

ration of pins), time to surgery, et cetera.<sup>7</sup> A large number of studies initially chose closed reduction combined with percutaneous pinning as the mainstay of treatment. However, if closed reduction failed or complications occurred, open reduction became the next step in management. Therefore, some studies concluded that patients receiving open reduction method generally have more complicated pathology and the clinical outcomes were mostly worse than closed reduction group.<sup>12</sup> However, the result of our current systematic review and meta-analysis is in accordance with a study Kazimoglu, et al. of 80 patients, revealing that CRPP and ORIF produced comparable functional outcome as measured by Flynn's criteria.<sup>13</sup>

In CRPP, the advantages of crossed-pin fixation are based on the fact that this method ensures good biomechanical stabilization, while unilateral fixation brings weaker biomechanical stability.<sup>14</sup> The usage of two lateral pins was an effective and relatively stable method to avoid iatrogenic ulnar nerve injury. Though cross-pinning was associated with more occurrence of ulnar nerve injury, long-term follow-up revealed that ulnar nerve injury generally recovered spontaneously without complication.<sup>15</sup> Furthermore, authors who advocate the use of crossed wires defend the high rate of satisfaction, as a consequence of the

greater stability with restored anatomy, due to the strength applied medially through elastic deformation of the wire, known as the "spring effect". However, despite anatomical reduction, rotational deformity of the distal fragment may still occur when the wires are not positioned in the same plane, more commonly when one of the wires is located anterior to the other.<sup>16</sup>

Although CRPP has proven to be a success, sometimes ORIF is still indicated when adequate closed reduction is difficult to obtain, the limb is dysvascular, or in open fractures. In cases such as blocked reduction due to brachialis muscle entrapment at the fracture site, ORIF should also be considered, as the closed reduction would be time-consuming. The comparable outcome they provide leads to the belief that optimal result is not related to the method, but to the stability of fixation and the quality of reduction. Though displaced extension fractures (Gartland type II and type III) were associated with numerous complications and impaired functional final outcome regardless of the treatment of choice, the post-procedural complication rate has been dramatically decreased with the advances in modern operative pinning techniques, imaging modalities, and the increase in surgical experience. Furthermore, close perioperative monitoring for each individual

patient will be beneficial in preventing complications such as neurovascular injuries, infection, and deformities.<sup>17,18</sup>

## Conclusion

Current systematic review and meta-analysis suggest that for displaced supracondylar humerus fractures, ORIF offers similar functional and cosmetic outcome compared to CRPP.

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