Clinical Outcomes after Fixation, Arthroplasty and Resection for Treatment of Comminuted Fracture Radial Head: A Systematic Review and Network Meta-Analysis

Kornkit Chaijenkij, MD\(^1\), Alisara Arirachakaran, MD\(^2\) and Jatupon Kongtharvonskul, MD, PhD\(^3\)*

\(^1\)Orthopedic Department, College of Sports Science and Technology, Mahidol University, Bangkok, Thailand
\(^2\)Orthopedics Department, Bumrungrad International Hospital, Bangkok, Thailand
\(^3\)Sports and Orthopedic Center, Samitivej Hospital and Section for Clinical Epidemiology and Biostatistics, Faculty of Medicine Ramathibodi Hospital, Bangkok, Thailand

*Corresponding author: Jatupon Kongtharvonskul, MD, PhD, Sports and Orthopedic Center, Samitivej Hospital and Section for Clinical Epidemiology and Biostatistics, Faculty of Medicine Ramathibodi Hospital, Bangkok, Thailand

Abstract

**Background:** Radial head fractures make up approximately 3% of all fractures and they are the most common elbow fracture in adults. The treatment for comminuted radial head fracture remains controversial. This systematic review was conducted with the aim to compare the post-operative outcomes among surgical treatment and identify which method is the best for comminuted radial head fractures.

**Methods:** Relevant studies were identified from Medline and Scopus from inception to August 18th, 2018 that reported Mayo elbow performance score (MEPI) and postoperative complications of either treatment. A network meta-analysis was applied to assess treatment outcomes. Probability of being best-treatment was estimated using surface under the cumulative ranking curves (SUCRA).

**Results:** Twelve comparative studies and one RCT (N = 526 patients) met the inclusion criteria. Intervention included ORIF (N = 210 patients), RHA (N = 227 patients) and RHR (N = 152 patients). A network-meta-analysis showed that MEPI of RHA was significantly higher when compared to ORIF and RHR, with the pooled mean MEPI of 7.28 (1.69, 12.86) and -7.32 (-13.21, -1.43) respectively. In terms of complications, RHA and RHR had lower risk with RRs of 0.61 (0.29, 1.31) and 0.54 (0.24, 1.25) when compared to ORIF. The SUCRA probabilities of RHA and RHR were in the first rank with 99.2% in MEPI and 60.6% in complications, respectively.

**Conclusions:** This study suggests RHA is the best treatment of choice for efficacy and safety for comminuted radial head fracture while RHR is the safest choice for postoperative complication and patients being able to perform all daily life activities.

Keywords

- Systematic review
- Fixation
- Arthroplasty
- Comminuted radial head fracture
- MEPI
- Complications

List of Abbreviations

- RHF: Radial Head Fracture
- ORIF: Open Reduction-Internal Fixation
- RHR: Radial Head Resection
- RHA: Radial Head Arthroplasty
- PROSPERO: Prospective Register of Systematic Review
- MEPI: Mayo Elbow Performance Index
- SD: Standard Deviation
- UMD: Unstandardized Mean Difference
- RR: Relative Risk
- SUCRA: Surface Under the Cumulative Ranking Curves
- RCT: Randomized Controlled Trial

Background

Fractures of the radial head (RHF) account for 4% of all fractures and 33% of all elbow fractures [1,2]. The simple classification system that useful for the preoperative planning and as a prognostic tool was introduced by Mason in 1954 [3] and later modified by Johnston in 1962 [4]. The surgical treatment of comminuted radial head fractures (modified Mason Type III and IV) is challenging and controversial. Surgical treatment options include open reduction-internal fixation (ORIF) [5-7], radial head resection (RHR) [8-10] and radial head arthroplasty (RHA) [11-13] with no clear advantage of one over the other. Previous systematic reviews and meta-analyses [14-19] that reported the treatment outcome of ORIF and RHA. First meta-analysis was re-
ported that surgical treatment of radial head and neck fractures according to the Mason classification (ORIF in type II and RHA in type III-IV) [14]. Most meta-analyses were report that RHA had better elbow function and fewer adverse events than ORIF for Mason type III RHF in the short-term outcomes [15-19]. However, these evidences are of low quality and there did not compare ORIF or RHA with RHR. Therefore, we have conducted a systematic review and network meta-analysis of comparative studies (case control, cohort and RCTs designs) that compared post-operative outcomes (MEPI and total complications (abnormal ossification, fracture hardware removal, nerve palsy and revision)) of ORIF, RHA and RHR for comminuted radial head fractures.

Methods

This systematic review and network meta-analysis were conducted following guidelines in the preferred reporting items for systematic reviews and meta-analyses (PRISMA), extension of network meta-analyses [20]. The review protocol has been registered at the international prospective register of systematic review (PROSPERO CRD42017077779).

Search strategies and study selection

An electronic literature search was conducted using two databases (PubMed and Scopus databases) to identify previous meta-analysis studies and comparative studies of surgical treatment (ORIF, RHA and RHR) for comminuted radial head fractures up to August 18, 2018. The search terms and strategies were constructed as following: “(comminuted radial head fracture) AND (treatment)” [21]. The reference lists of included studies identified through the search were also reviewed.

Selection of studies

Identified studies were selected by one author (K.C.) and randomly checked by (J.K.). Their titles and abstracts were initially screened, and full papers were retrieved if a decision could not be made from the abstracts. The reasons for ineligibility or exclusion of studies were recorded (Figure 1).

Inclusion criteria

Comparative studies (case control, cohort and RCT designs) that compared post-operative outcomes (Mayo Elbow Performance Index (MEPI) scores and total complications abnormal ossification, fracture hardware removal, nerve palsy and revision)) of open reduction and internal fixation (ORIF), radial head arthroplasty (RHA) and radial head resection (RHR) for comminuted radial head fractures were eligible. All

Figure 1: Flow of selection of studies.
the studies had sufficient data to extract and pool, i.e. the reported mean, standard deviation (SD), the number of subjects according to treatments for continuous outcomes, and the number of patients according to treatment for dichotomous outcomes. If eligible papers had insufficient information, we contacted authors by email (up to 3 times) for additional information. If author did not provide additional data, that study was excluded from the review. Exclusion criteria were as follows: Case reports, abstracts, reviews, letters to authors or editors and animal studies.

Data extraction

Two reviewers (A.A. and K.C.) independently performed data extraction using standardized data extraction forms. General characteristics of the study (e.g., mean age, gender, fracture type and mean follow-up time at baseline) were extracted. The number of subjects, mean, and SD of continuous outcomes (i.e., MEPI score) between groups were extracted. Cross-tabulated frequencies between treatment and all dichotomous outcomes (abnormal ossification, fracture hardware removal, nerve palsy and revision) were also extracted. Any disagreements were resolved by discussion and consensus with a third party (J.K.).

Risk of bias assessment

To assess the study quality, the modified Newcastle Ottawa scale [21] was employed to assess the methodological quality of each study included in this review. Five domains were assessed, i.e., representativeness of cohorts, ascertainment of exposure and outcome, adjustment for confounders, and duration of follow-up. This process of quality assessment was completed by two independent reviewers (A.A., K.C.) for each study included in the review. Disagreements between the two authors were resolved by consensus and discussion with a third party (J.K.).

Outcomes

The outcomes of interest were Mayo Elbow Performance Index and post-operative total complications after surgery. Methods of measure for these outcomes were used according to the original studies. Briefly, this includes the Mayo Elbow Performance Index from 0-100 (higher values are equivalent to better outcomes) and Postoperative total complications (abnormal ossification, fracture hardware removal, nerve palsy and revision) were considered.

Statistical analysis

The efficacies of each surgical treatment options (ORIF, RHA and RHR) were directly compared. The continuous outcomes measured at the end of each study between surgical approaches were pooled using an unstandardized mean difference (UMD). Heterogeneity of the mean difference across studies was checked using the Q-statistic and the degree of heterogeneity was quantified using the I² statistic. If heterogeneity was present as determined by a statistically significant Q-statistic or by I² > 25%, the UMD was estimated using a random effects model; otherwise a fixed effects model was applied.

For dichotomous outcomes, a relative risk (RR) of postoperative total complication of treatment comparisons at the end of each study was estimated and pooled. Heterogeneity was assessed using the previous method. If heterogeneity was present, the Dersimonian and Laird method [22] was applied for pooling. If not, the fixed effects model by inverse variance method was applied. Meta-regression was applied to explore the source of heterogeneity (e.g., mean age, percentage of females, fracture type and follow-up time) if data was available. Publication bias was assessed using contour-enhanced funnel plots [23,24] and Egger tests [25]. Publication bias was assessed using funnel plots and the Egger test. If one of this indicated asymmetry, a contour enhanced funnel plot was constructed to distinguish whether the cause of asymmetry is due to publication bias or heterogeneity.

Network meta-analysis

A network meta-analysis was applied to assess treatment effects between different treatment options. Indirect comparisons between two surgical options were performed by borrowing information from common comparator. A network of all fixations was mapped. Nodes and edges were respectively weighted by number of subjects and numbers of included studies for that comparison. Contribution plot was performed to display contribution of each direct comparison in network meta-analysis estimates. A two-stage meta-analysis was applied to estimate relative effects of surgical options in comminuted radial head fractures follows. A relative treatment effect (i.e., coefficient and lnRR) and its variance-covariance were estimated for each study using in a binary regression with log-link function in dichotomous outcome. Pairwise differences treatment effect (i.e., coefficient and MD) between means were further assessed using results of the regression model in continuous outcome. These relative treatment effects were then pooled across studies using a multivariate meta-analysis with maximum likelihood function [26,27]. Relative treatment effects between fixation methods were then compared using a linear combination of the multivariate meta-analysis model [26]. Treatment efficacy was then ranked by estimate probability of being best treatment using surface under the cumulative ranking curves (SUCRA) method. Predictive interval was estimated and plotted to see whether relative treatment effects will work in other populations. Finally, inconsistency assumption, i.e., agreement between direct and indirect treatment effects was assessed using a design-treatment interac-
tion model. All analyses were performed using STATA software version 14.0 [28]. P-values < 0.05 were considered as statistically significant unless otherwise specified.

**Results**

Two hundred and thirteen and 964 studies from Medline and Scopus were identified, respectively; 190 studies were duplicates, leaving 987 studies for review of titles and abstracts. Of these, 13 studies [5,29-40] were review and extracted. Characteristics of the 13 studies are described in Table 1. Twelve studies were comparative cohort studies only one study was RCTs. Among 8 ORIF studies, the comparator included RHA in 5 studies and RHR in 3 studies. Comparing to RHR, the comparator is RHA in 4 studies. One study compared ORIF, RHA and RHR. Seven studies were treated in comminuted radial fracture Mason type III. Five studies were type III or IV and one study was type II. Mean age, sex and follow-up time after surgery varied from 32.7 to 67.1 years, 18-76% and 12.7 to 157 months respectively. Various outcomes were compared between treatment groups (Figure 1).

Risk of bias in included studies.

Risk of bias assessment is described in Table 2.

**Direct meta-analysis**

Data for direct comparisons of all treatments and outcomes measured at the end of each study are described in Supplement Table 1. Pooling according to outcomes was performed if there were at least two studies for each comparison. Treatment effects for MEPI was moderately to highly heterogeneity, in which RHA reached statistically significance with the pooled UMD of MEPI of 10.21 (4.11, 16.32) higher when compared to ORIF and insignificant higher with 3.08 (-2.55, 8.69) when compared to RHR. While ORIF have higher MEPI score with pooled UMD of 3.87 (-0.88, 8.62) when compared to RHR but without statistically significant. This suggested that treatment of comminuted radial head fracture with RHA could be approximately 10 score and 3 score higher functions when compared to ORIF and RHR, respectively. The effect for complications was homogenous heterogeneity, in which ORIF reached statistically significance with the pooled RR of 3.87 (-0.88, 8.62) when compared to RHR but without statistically significant. This suggested that treatment of comminuted radial head fracture with RHA could be approximately 10 score and 3 score higher functions when compared to ORIF and RHR, respectively. The effect for complications was homogenous heterogeneity, in which ORIF reached statistically significance with the pooled RR of 2.75 (1.29, 5.85) when compared to RHA. This suggested that ORIF could be approximately 2.75 time higher risk of complications when compared with RHA in comminuted radial head fracture. In contrast, there were no significant treatment effects on complications of RHA and ORIF when compared to RHR.

**Network meta-analysis**

All 13 comparative studies of comminuted radial head fracture with different fixation techniques (n = 526 patients) were included in a network meta-analysis for
comminuted radial head fracture of MEPI score when compared with RHR, follow by ORIF (Table 3). Multi-
ple comparisons between different treatment method were further performed (see Table 3 above diagonal
cells), however; RHA were statistically significant different higher MEPI score of 7.28 (1.69, 12.86) and 7.32
(1.43, 13.21) when compared to ORIF and RHR. Being best treatment ranking was next assessed, which sug-
gested that RHA was the first treatment of choice with a SUCRA of 99.5, and probability of being best treatment
of 99.2% (Figure 4 and Table 3). We checked inconsis-
tency assumption by applying a design-by-treatment in-
teraction model, which indicated no evidence of incon-
sistency effects. In addition, predictive intervals were
also estimated and plotted, see Figure 5.

<table>
<thead>
<tr>
<th>Author</th>
<th>Representativeness of cohort</th>
<th>Ascertainment of exposure</th>
<th>Ascertainment of outcome</th>
<th>Adjustment for confounder</th>
<th>Duration of follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akman YE</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Wu PH</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Iopiz Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Pogliacomi F</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Liu R</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Al-burdeni S</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Yu SY (stiffness)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Zarattini G</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Lindenhovius ALC</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>RCTs</td>
<td>randomization</td>
<td>Allocation concealment</td>
<td>Blinding</td>
<td>Incomplete outcome report</td>
<td>Selective outcome report</td>
</tr>
<tr>
<td>Chen X</td>
<td>U</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Ruan HJ</td>
<td>U</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

Nodes are weighted by number of studies; edges are weighted by numbers of included subjects. Values in diagonal cells
were mean difference MEPI and relative risk of complication of that the RHA and RHR compared with ORIF along with
95%CI in round parenthesis. Values in square parenthesis were surface cumulative ranking curve area and probability of
being best treatment, respectively. *: statistically significant different. Abbreviation: MEPI: mayo elbow performance score;
ORIF: open reduction and internal fixation; RHA: radial head arthroplasty; RHR: radial head resection.

**Figure 2:** A network plots of MEPI score and complications after uses of different treatment methods for comminuted radial head fracture.
### Table 3: Comparisons of surgical techniques for comminuted radial head fracture.

<table>
<thead>
<tr>
<th>Surgical treatment</th>
<th>ORIF</th>
<th>RHA</th>
<th>RHR</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEPI</td>
<td>[25.3, 0.3]</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>RHA</td>
<td>7.28 (1.69, 12.86) [99.5, 99.2]</td>
<td>-7.32 (-13.21, -1.43)’</td>
<td></td>
</tr>
<tr>
<td>RHR</td>
<td>-</td>
<td>-</td>
<td>-0.05 (-5.89, 5.81) [25.1, 0.5]</td>
</tr>
</tbody>
</table>

**Complications**

<table>
<thead>
<tr>
<th>Surgical treatment</th>
<th>ORIF</th>
<th>RHA</th>
<th>RHR</th>
</tr>
</thead>
<tbody>
<tr>
<td>[8.8, 2.9]</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>RHA</td>
<td>0.61 (0.29, 1.31) [63.2, 36.5]</td>
<td>0.89 (0.39, 2.05)</td>
<td></td>
</tr>
<tr>
<td>RHR</td>
<td>1.12 (0.49, 2.58)</td>
<td>0.54 (0.24, 1.25) [78.0, 60.6]</td>
<td></td>
</tr>
</tbody>
</table>

**Abbreviations:** ORIF: Open Reduction and Internal Fixation; RHA: Radial Head Arthroplasty; RHR: Radial Head Resection; MEPI: Mayo Elbow Performance Index; ‘: p-value < 0.05 statistically significant different.

Values in diagonal cells were mean difference MYPS and complication of that the RHA and RHR compared with ORIF along with 95% CI in round parenthesis. Values in square parenthesis were surface cumulative ranking curve area and probability of being best treatment, respectively.

Values above or below diagonal cells were the mean difference (95% CI) of MYPS for the column surgical technique compared the row surgical technique (reference). Values < 0 show worsen effect of column technique than reference technique in row. Values < 0 show benefit effects of the column technique than the reference technique in row.

Values above or below diagonal cells were the RR (95% CI) of complications for the column surgical technique compared the row surgical technique (reference). Values > 1 show complication risk effect of column technique than technique in row. Values < 1 show benefit effects (complication) of the column technique than the technique in row.

---

**Figure 3:** Forest plot of comparison of MEPI score and complications after uses of different treatment methods effects: A network meta-analysis.
Complications

The results indicated that RHR was the least complications for treatment of comminuted radial head fracture follow by RHA and ORIF respectively (Supplementary Table 2). Multiple comparisons between different treatment methods were further performed (see Table 3 above diagonal cells). RHR and RHA were lower risk of complications with RR of 0.54 (0.24, 1.25) and 0.61 (0.29, 1.31) when compared to ORIF. RHR had a risk of...
having complications with RR of 0.89 (0.39, 2.05) lower when compared to RHA. Being best treatment ranking was next assessed, which suggested that RHR was the first rank with a SUCRA of 78.0, and probability of being best treatment of 60.6%, see rankogram in Figure 4 and Table 3. We checked inconsistency assumption of all outcomes by applying a design-by-treatment interaction model, which indicated no evidence of inconsistency effects. In addition, predictive intervals were also estimated and plotted, see Figure 5. Network funnel graph did not suggest any evidence of publication bias.

**Discussion**

We had done the network meta-analysis of treatment method in comminuted radial head fracture patients. Three treatment methods had been used and studied that were ORIF, RHA and RHR. The most effective treatment in elbow performance (MEPI) was RHA. In term of complications (abnormal ossification, fracture hardware removal, nerve palsy and revision), RHR was the lowest risk out of 3 treatment methods. A total of 14 and 12 patients are needed to be treated with RHA and RHR to prevent one complications case.

The treatment outcomes and complication after surgical treatment with ORIF, RHA and RHR in comminuted radial head fracture still controversy might be probably related to the fact that radial head fractures can be classified to isolated radial head fracture or accompanying with soft tissue injury (humeroradial joint and distal ulnar radiolal joint) [29,41,42] or fractures of elbow joint with related elbow instability. Moreover, poor bone quality, impaired vascularity of the fragments and severe comminution fracture might be lead to poor post-operative results after ORIF. ORIF with reconstruction of the native radial head is being widely used and conclusive [37,43-48], However, in case of unreconstructed comminuted radial head fracture by ORIF then the management with RHA or RHR should be the better choice. From the result of this study ORIF have the second rank in term of elbow function while the highest risk of complications. RHA have the highest function without significant risk of complication while RHR have the lowest risk of complication with the lowest function. Therefore, we recommend RHA is the best treatment of choice for efficacy and safety for comminuted radial head fracture while RHR is the safest choice for postoperative complication and patients being able to perform all daily life activities. Further research with an increased sample size and a prospective randomized controlled trial study design are required to determine as to which surgical treatment options be the best should be done in the future.

**Conclusions**

This study suggest RHA is the best treatment of choice for efficacy and safety for comminuted radial head fracture while RHR is the safest choice for postoperative complication and patients being able to perform all daily life activities. Further research with an increased sample size and a prospective randomized controlled trial study design are required to determine as to which surgical treatment options be the best should be done in the future.

**Declarations**

Ethical approval and consent to participate: This article does not contain any studies with human participants performed by any of the authors.

**Consent for Publication**

Not applicable.

**Availability of Data and Materials**

Not applicable.

**Competing Interests**

All authors declare that they have no conflicts of interests.

**Funding**

This study has no funding support.

**Authors’ Contributions**

KC: Was responsible for the conception and design, collection and assembly of data, analysis and interpretation of the data, drafting of the manuscript, final ap-
approval of the article. AA: conception and design, drafting of the article, critical revision of the article for important intellectual content, final approval of the article. JK was responsible for the conception and design, collection and assembly of data, supervise in analysis and interpretation of the data, writing the manuscript, critical revision of the manuscript for important intellectual contents, final approval of the article, statistical expertise.

Acknowledgements

All authors declare no sponsor involvement in the study design, collection, analysis and interpretation of the data, in writing the manuscript, and in submission of the manuscript for publication.

References

Open reduction and internal fixation versus radial head arthroplasty in the treatment of adult closed comminuted radial head fractures (modified Mason type III and IV). Int Orthop 39: 1659-1664.


### Supplement Table 1: Continuous outcomes for comminute by surgical techniques from direct meta-analysis.

<table>
<thead>
<tr>
<th>Authors, Year</th>
<th>N</th>
<th>mean</th>
<th>SD</th>
<th>N</th>
<th>mean</th>
<th>SD</th>
<th>UMD (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wu PH, 2016</td>
<td>12</td>
<td>81.9</td>
<td>10.11</td>
<td>13</td>
<td>87</td>
<td>10.19</td>
<td>-5.10 (-13.06, 2.86)</td>
</tr>
<tr>
<td>Pogliacomi F, 2015</td>
<td>34</td>
<td>88.2</td>
<td>12.5</td>
<td>20</td>
<td>90.5</td>
<td>5.1</td>
<td>-2.30 (-7.06, 2.46)</td>
</tr>
<tr>
<td>Liu R, 2015</td>
<td>35</td>
<td>81.3</td>
<td>1.25</td>
<td>37</td>
<td>93.24</td>
<td>1.38</td>
<td>-11.94 (-12.55, -11.33)</td>
</tr>
<tr>
<td>Chen X, 2011</td>
<td>23</td>
<td>72.4</td>
<td>7.1</td>
<td>22</td>
<td>92.1</td>
<td>6.8</td>
<td>-19.70 (-23.76, -15.64)</td>
</tr>
<tr>
<td><strong>Pooled UMD</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>( \chi^2 = 32.62, d.f. = 3, p = 0.001, I^2 = 90.8 )</td>
</tr>
</tbody>
</table>

\( \bar{R}^2 = 0.21 \) \( \chi^2 = 10.21 (-16.32, -4.11) \)

*\( p < 0.05 \), statistically significant difference.

### Supplement Table 2: Complications for comminuted radial head fracture by surgical treatments from direct meta-analysis.

<table>
<thead>
<tr>
<th>Authors, Year</th>
<th>N</th>
<th>N of Patient</th>
<th>No of complications</th>
<th>N of patient</th>
<th>No of complications</th>
<th>RR (95% CI)</th>
<th>% Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wu PH</td>
<td>25</td>
<td>4</td>
<td>8</td>
<td>0</td>
<td>13</td>
<td>8.67 (0.51, 147.35)</td>
<td>7.11</td>
</tr>
<tr>
<td>Pogliacomi F</td>
<td>63</td>
<td>2</td>
<td>32</td>
<td>0</td>
<td>20</td>
<td>2.35 (0.11, 49.65)</td>
<td>6.14</td>
</tr>
<tr>
<td>Liu R</td>
<td>72</td>
<td>0</td>
<td>35</td>
<td>0</td>
<td>37</td>
<td>1.06 (0.02, 51.84)</td>
<td>3.77</td>
</tr>
<tr>
<td>Al-burdeni S</td>
<td>36</td>
<td>4</td>
<td>15</td>
<td>3</td>
<td>14</td>
<td>1.19 (0.31, 4.59)</td>
<td>31.47</td>
</tr>
<tr>
<td>Chen X</td>
<td>45</td>
<td>11</td>
<td>12</td>
<td>3</td>
<td>19</td>
<td>3.51 (1.13, 10.91)</td>
<td>44.29</td>
</tr>
<tr>
<td>Ruan HJ</td>
<td>22</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>14</td>
<td>14.00 (0.84, 232.23)</td>
<td>7.23</td>
</tr>
<tr>
<td><strong>Pooled RR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>( \chi^2 = 3.82, d.f. = 3, p = 0.576, I^2 = 0 )</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RHA</td>
<td>RHR</td>
<td>RHA</td>
<td>RHR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wu PH</td>
<td>25</td>
<td>9</td>
<td>5</td>
<td>1</td>
<td>10</td>
<td>7.70 (1.05, 47.71)</td>
<td>21.65</td>
</tr>
<tr>
<td>Pogliacomi F</td>
<td>63</td>
<td>0</td>
<td>20</td>
<td>0</td>
<td>9</td>
<td>0.45 (0.01, 20.94)</td>
<td>5.36</td>
</tr>
<tr>
<td>Liu R</td>
<td>34</td>
<td>6</td>
<td>13</td>
<td>3</td>
<td>12</td>
<td>1.58 (0.47, 5.29)</td>
<td>53.82</td>
</tr>
<tr>
<td>Zarattini G</td>
<td>59</td>
<td>1</td>
<td>34</td>
<td>1</td>
<td>23</td>
<td>0.69 (0.05, 10.44)</td>
<td>10.65</td>
</tr>
<tr>
<td>Stoffelen DV</td>
<td>55</td>
<td>2</td>
<td>14</td>
<td>0</td>
<td>39</td>
<td>9.75 (0.47, 204.61)</td>
<td>8.52</td>
</tr>
<tr>
<td><strong>Pooled RR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>( \chi^2 = 4.00, d.f. = 4, p = 0.405, I^2 = 0.1 )</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RHA</td>
<td>RHR</td>
<td>RHA</td>
<td>RHR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wu PH</td>
<td>25</td>
<td>5</td>
<td>14</td>
<td>3</td>
<td>12</td>
<td>1.32 (0.37, 4.64)</td>
<td>40.91</td>
</tr>
<tr>
<td>Pogliacomi F</td>
<td>63</td>
<td>2</td>
<td>32</td>
<td>0</td>
<td>9</td>
<td>1.06 (0.05, 21.49)</td>
<td>7.18</td>
</tr>
<tr>
<td>Liu R</td>
<td>28</td>
<td>3</td>
<td>10</td>
<td>6</td>
<td>9</td>
<td>0.58 (0.18, 1.86)</td>
<td>47.52</td>
</tr>
<tr>
<td>Ikeda M</td>
<td>28</td>
<td>0</td>
<td>13</td>
<td>0</td>
<td>15</td>
<td>1.15 (0.03, 54.17)</td>
<td>4.39</td>
</tr>
<tr>
<td><strong>Pooled RR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>( \chi^2 = 0.92, d.f. = 3, p = 0.820, I^2 = 0 )</td>
<td></td>
</tr>
</tbody>
</table>

\( *: p < 0.05 \), statistically significant difference.