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REVIEW ARTICLES

Interventions for displaced radial head fractures: network meta-analysis of randomized trials

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Background: The purpose of this study was to conduct a systematic review of studies comparing treatments for displaced radial head fractures (RHFs) and perform a network meta-analysis of randomized controlled trials (RCTs).
Methods: We searched electronic databases and reviewed the reference lists of included studies and prior systematic reviews. We included RCTs and cohort studies that (1) compared treatments for displaced RHFs in adults and (2) reported a functional outcome or postoperative complications. Data from RCTs were synthesized using a Bayesian network meta-analysis. We compared the proportion of patients categorized as "excellent" or "good" according to the Broberg and Morrey scale and the rate of postoperative complications using odds ratios (OR) with 95% credible intervals (CrI).
Results: We included 20 studies (4 RCTs). The evidence from RCTs examined radial head arthroplasty (RHA), open reduction and internal fixation (ORIF) with metal implants (ORIF-M), and ORIF with biodegradable implants (ORIF-B). The network meta-analysis demonstrated that patients treated with an RHA had greater odds of achieving an "excellent" or "good" score compared with ORIF-M (OR, 22.5; 95% CrI, 2.73-299.58) and ORIF-B (OR, 11.83; 95% CrI, 0.58-324.57). For postoperative complications, RHA patients had a lower odds of experiencing a complication than ORIF-M (OR, 0.15; 95% CrI, 0.01-1.81) and ORIF-B (OR, 0.16; 95% CrI, 0.01-3.06) patients.
Conclusion: The network meta-analysis of RCTs indicated that RHA results in better function and reduced postoperative complications than ORIF-M and ORIF-B over 2 years in the treatment of displaced RHFs.
Level of evidence: Level III Systematic Review; Level II Meta-analysis

Keywords: Radial head fracture; arthroplasty; prosthesis; open reduction and internal fixation; ORIF; systematic review; meta-analysis

Radial head fractures account for approximately one-third of all adult elbow fractures.[22,39] The Mason classification system is the most widely used measure to grade the severity of radial head fractures. Nondisplaced fractures fall under the category of Mason type I fractures, and displaced

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fractures range from Mason-Johnson type II to IV.[45] Nonoperative measures are typically used when the fracture is nondisplaced, but because conservative management may result in loss of function or malunion, controversy exists surrounding the appropriate treatment of displaced fractures, although the current trend for Mason-Johnson type II fractures is nonoperative management.[4,35,45]

A variety of surgical approaches have been investigated for the treatment of displaced radial head fractures.[4,35,45] These include, broadly, open reduction and internal fixation (ORIF), radial head excision, Silastic (Dow Corning, Midland, MI, USA) replacement, and radial head arthroplasty (RHA).[22,39] Case series have shown satisfactory outcomes with ORIF.[35] Many fixation methods and devices are available, which can include metal (screws, plates, or Kirschner wires) or biodegradable implants (pins or screws), and have not yet demonstrated any superiority over another.[35,45]

Radial head excision has typically been indicated for displaced fractures that are too comminuted for internal fixation and is performed without the addition of arthroplasty, although some biomechanical data suggest an alteration in joint kinematics, load transfer, and elbow stability.[35] RHA and Silastic replacement have typically been indicated for displaced fractures deemed unreconstructible with elbow dislocation or disruption of the surrounding ligaments, although the latter is no longer used due to its associated complications. Available designs and the types of material vary widely. The resected radial head is used as template for sizing the implant in an attempt to replicate, as close as possible, the anatomy of the native radial head.[27,35]

The purpose of this study was to conduct a systematic review of comparative studies assessing treatments for displaced radial head fractures and perform a network meta-analysis of the randomized controlled trial (RCT) evidence evaluating the efficacy and safety of these interventions.

Materials and methods

Search strategy

We conducted literature searches in the MEDLINE, Embase, and Cochrane Library databases (Appendix SA, Search strategy). We also reviewed the reference lists of included studies and previously published systematic reviews for potentially relevant trials.[22,29,33]

Inclusion criteria and study selection

We included RCTs and comparative cohorts that (1) evaluated treatments for displaced radial head fractures in adults and (2) reported a functional outcome or postoperative complication rates. We excluded trials that did not include a comparison group and conference abstracts that did not provide sufficient information. Title, abstract, and full-text screening was done in duplicate. Any discrepancies were resolved via consensus.

Data extraction and outcomes

We extracted data related to the study design, participant demographics, fracture characteristics, treatment details, and measures on function and safety.

Quality assessment

The methodological quality of included RCTs was graded according to the Cochrane Risk of Bias tool.[17] The quality evidence of the network meta-analysis was assessed using the Grading of Recommendations Assessment, Development and Evaluation approach.[37]

Data analysis

Results from cohort studies were summarized and described qualitatively.

Data from randomized trials were synthesized using a Bayesian network meta-analysis using the methods provided by Brown et al[7] and the Canadian Agency for Drugs and Technologies in Health.[9] The analysis was completed using the NetMetaXL Excel-based tool (Microsoft, Redmond, WA, USA) and WinBUGS software (Imperial College and MRC Biostatistics Unit, Cambridge, UK).[7] The WinBUGS code is based on the National Institute for Health and Care Excellence Decision Support Unit Series.[7,12,13] We synthesized the proportion of patients in each group categorized as "excellent" or "good" according to the Broberg and Morrey functional score and the rate of overall postoperative complications. The Broberg and Morrey score ranges from 0 to 100 points, and these scores may be categorized as excellent (95 to 100 points), good (80 to 94 points), fair (60 to 79 points), or poor (0 to 59 points).[6,11]

We calculated odds ratios (ORs) with 95% credible intervals (CrIs) using a fixed-effects and random-effects model with vague priors.[7] Heterogeneity between studies was measured using the tau-square (τ^2) statistic. We generated the corresponding network diagrams and forest plots displaying all pairwise comparisons. Also presented were surface under the cumulative ranking curve (SUCRA) values, which provide a numeric representation of the overall ranking of a given treatment relative to all other treatments included in the network (ie, the higher the value, the greater the likelihood that the treatment is top ranked).[28]

Results

Search results

The electronic literature search yielded 1224 citations. An additional search for duplicates left 1186 references for title and abstract screening. We reviewed 34 full texts for final eligibility, and 20 were included.[1,3,5,11,16,18,20,21,23-26,30,32,36,38,40,42-44] Sixteen cohort studies were described qualitatively, and 4 RCTs were used in the quantitative synthesis (Fig. 1).

Description of included studies

Cohort studies evaluated open reduction and internal fixation (ORIF) vs. RHA, ORIF vs. radial head excision, ORIF vs. nonoperative treatment, RHA vs. excision, excision vs.

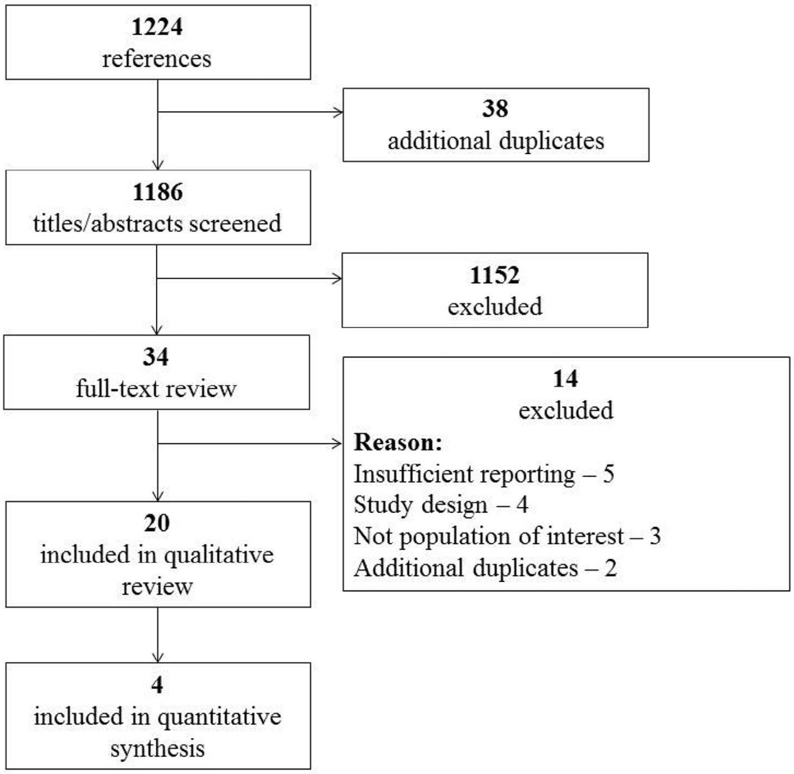

Figure 1 Flow diagram of included studies.

Table I Cochrane risk of bias of the included randomized controlled trials

First author, yr	Adequate randomization?	Adequate allocation concealment?	Physician blinding?	Assessor blinding?	Patient blinding?	Selective outcome reporting?	Incomplete data?	Other bias?
Chen, 2011	Unclear	Yes	No	Yes	No	No	No	No
Helling, 2006	Yes	Unclear	No	Unclear	No	No	No	No
Ruan, 2009	Unclear	Unclear	No	Unclear	No	Unclear	Unclear	No
Wang, 2014	Not completed for this study as this was a non-English publication							

nonoperative treatment, excision vs. Silastic replacement, smooth vs. porous stem RHA, monopolar vs. bipolar RHA, and 1 study compared ORIF vs. excision vs. Silastic replacement vs. nonoperative treatment (Supplementary Table S1). One of the cohort studies was conducted prospectively with patients monitored for 24 weeks, whereas the rest were retrospective.

The most commonly reported outcomes were the Broberg-Morrey, Disabilities of the Arm, Shoulder and Hand (DASH), Mayo Elbow Performance Score (MEPS), visual analog scale (VAS) for pain, and postoperative complications. Two studies reported receiving funding from industry, 8 were not industry-funded, and funding sources were unclear in the remaining studies.

The evidence from RCTs examined RHA, ORIF with metal implants (ORIF-M), and ORIF with biodegradable implants (ORIF-B; Supplementary Table S1). Three of the RCTs were conducted in China, and 1 was performed in Germany. One RCT did not report postoperative complications and was not included in that analysis.[36] Outcomes were typically assessed up to 2 years after surgery. We were unable to assess the risk of bias in 1 trial because it was a non-English publication and only outcome data were extracted.[42] Of the remaining 3 trials, 1 reported adequate randomization, and another reported adequate allocation concealment and assessor blinding (Table I). One RCT was not industry funded, and funding information could not be determined in the other 3 trials.

Patient demographics are summarized in Supplementary Table S2. Total sample sizes ranged from 25 to 165 patients. The highest reported mean age was 69 years and the lowest was 31 years. The most commonly used fracture classification system was the Mason-Johnson classification (grade I to IV), and the AO (Arbeitsgemeinschaft für Osteosynthesefragen) classification was reported in 1 study.

Cohort studies

Nonoperative vs. excision

After an average follow-up of 10 years, Miller et al[34] found more favorable results with nonoperative cases (33 patients with 34 fractures) compared with those who had excision (6 patients with 6 fractures) in a cohort of patients with Mason-Johnson type II fractures. According to the Radin and Riseborough criteria, "good" results were seen in 26 fractures (76%) managed nonoperatively and in 1 of 6 (17%) in the excision group. The authors of this study concluded that type II fractures should be treated nonoperatively unless a loose fragment is present in the joint.[30]

Nonoperative vs. ORIF vs. excision vs. Silastic replacement

Boulas et al[5] compared nonoperative management (Mason-Johnson type I or II) to ORIF (Mason-Johnson type II or III), excision (Mason-Johnson type I-IV), and Silastic replacement (Mason-Johnson type not reported). Patients managed nonoperatively (8 patients; average follow-up, 3 years) and with ORIF (7 patients; average follow-up, 3 years) showed the greatest absolute scores on the MEPS, with values of 99 and 98 points, respectively, relative to those treated with excision (13 patients; average follow-up, 20 years; 95 points) and Silastic replacement (8 patients; average follow-up, 7 years; 94 points; P value not reported). All 8 patients in the nonoperative group and 86% of ORIF patients achieved an "excellent" result (ie, ≥90 points) compared with 77% and 63% in the excision and Silastic replacement groups, respectively.[5]

Nonoperative vs. ORIF

In a sample of patients with Mason-Johnson type II fractures monitored for average of 18 months, Khalfayan et al[20] found significantly greater Broberg-Morrey functional scores in 10 patients treated with ORIF relative to 16 managed nonoperatively (92 vs. 77 points, respectively; $P < .01$). On one hand, 9ORIF patients (90%) had an "excellent or good" result compared with 7 nonoperative patients (44%).[20] On the other hand, Yoon et al[43] found a significant outcome ($P = .012$) on the MEPS in favor of nonoperative treatment (30 patients, 93 points) vs. ORIF (30 patients, 86 points) after an average of 3 and 4.5 years, respectively; however, no significant differences were seen on the DASH, Patient-Rated Elbow Evaluation, or 12-Item Short-Form Health Survey scores. Complications occurred in 33% in patients treated with ORIF compared with 7% in the nonoperative group.[43]

Silastic replacement vs. excision

Stoffelen et al[40] evaluated 14 patients who received Silastic replacement (Mason-Johnson type III or IV; average follow-up: 6 years) and 39 patients whose radial head was excised (Mason-Johnson type II-IV; average follow-up, 6 years). They found that, using the Radin and Riseborough criteria, 14% in the Silastic replacement group showed a "good" result compared with 55% in the excision group (P value not reported). A greater proportion of Silastic replacement patients also demonstrated degenerative changes on radiographs (36% vs. 18% in the excision group).[40]

ORIF vs. excision

In a 2005 retrospective cohort, Ikeda et al[18] reviewed data between 13 ORIF patients (average follow-up, 3 years) and 15 excision patients (average follow-up, 10 years) with Mason-Johnson type III or IV fractures. Differences in the American Shoulder and Elbow Surgeons and Broberg-Morrey scores between groups were statistically significant ($P = .0031$ and $P = .0034$, respectively) in favor of ORIF. Based on the Broberg-Morrey criteria, "excellent" or "good" results were seen in 92% of ORIF patients compared with 60% of those in the excision group.[18]

Zarattini et al[44] also concluded that ORIF (35 patients; average follow-up, 125 months) resulted in better outcomes relative to excision (24 patients; average follow-up, 157 months), for Mason-Johnson type II fractures, because the ORIF group had significantly more favorable Broberg-Morrey, DASH, and VAS pain scores (all $P < .01$) and a lower incidence of post-traumatic arthritis.

Lindenhovius et al[23] performed a similar comparison with an average of 17 years of follow-up in 13 patients treated with ORIF and 15 patients treated with excision; however, this cohort comprised Mason-Johnson type II or III fractures. The authors found no significant differences in the American Shoulder and Elbow Surgeons (ORIF: 91 points, excision: 89 points), Broberg-Morrey (ORIF: 91 points, excision: 88 points), MEPS (ORIF: 92 points, excision: 86 points), or patient satisfaction scores (ORIF: 86 points, excision: 80 points); however, they also suggested that ORIF might protect against long-term arthrosis. According to the MEPS classification, 88% of ORIF patients had an "excellent" or "good" outcome compared with 90% in the excision group. Using the Broberg-Morrey scores, this was 75% for ORIF and 80% for excision.[23]

In a prospective evaluation of ORIF vs. excision over 24 weeks of 40 patients with Mason-Johnson type II or III fractures, Shetty et al[38] found significantly more favorable DASH scores with ORIF (4.8 points) vs. excision (14.2 points). There were also more complications in the excision group (55%) compared with ORIF (5%), which included secondary osteoarthritis, periarticular ossification, and proximal radial migration.[38]

RHA vs. excision

Lopiz et al[26] assessed the use of an RHA device vs. excision in a cohort of Mason-Johnson type III fractures after average follow-ups of 42 and 60 months, respectively. The 14 individuals treated with RHA demonstrated no significant difference on DASH scores ($P = .13$) and a greater complication rate (43% vs. 9% with excision) relative to the 11 managed with excision. An "excellent" or "good" outcome on the MEPS was seen in 64% of RHA patients and in 82% of excision patients.[26]

Nestorson et al[32] also conducted this type of investigation with 18 RHA patients (median follow-up, 58 months) and 14 excision patients (median follow-up, 108 months) with Mason-Johnson type IV fractures. They also recorded no significant findings in functional scores on the MEPS and DASH. An “excellent” or “good” outcome, according to the MEPS, was seen in 83% of RHA patients and in 79% of excision patients. In addition, all but 1 patient in the excision group (93%) experienced secondary arthritis whereas this occurred in 28% of RHA patients.[32]

RHA vs. ORIF

Al-Burdeni et al[1] retrospectively reviewed 17 RHA and 19 ORIF patients with Mason-Johnson type III or IV fractures and an average follow-up of 15 months. There were no significant differences in DASH scores (RHA: 12 points, ORIF: 14 points; $P = .58$) or postoperative complications (RHA: 18%, ORIF: 21%; $P = .57$), but the study investigators noted a significant reduction in surgical time with RHA ($P < .0001$).[1]

In the 2010 study by Liu et al,[24] these 2 treatments were evaluated in 65 patients with Mason-Johnson type III fractures with an average follow-up of 3 years. They found a statistically significant improvement on the Broberg-Morrey scores in the RHA group (82 points) relative to the ORIF group (70 points). An “excellent” or “good” result was demonstrated in 73% of RHA patients compared with 57% of ORIF cases.[24] A separate investigation by Liu et al[25] in 2015 in 72 patients with Mason-Johnson type III fractures, monitored for an average of 14 months for RHA and 15 months for ORIF, also revealed a significantly more favorable functional result with RHA based on the Broberg-Morrey scores (93 points) compared with ORIF (81 points; $P = .0079$), with a higher rate of an “excellent” or “good” outcome (97%) vs. the ORIF group (94%).

RHA vs. RHA

Berschback et al[3] compared 2 different types of radial head prostheses: a monopolar device (Anatomic Radial Head System; Acumed, Hillsboro, OR, USA) and a bipolar device (Katalyst; Integra Life Sciences, Plainsboro, NJ, USA). They retrospectively assessed 27 patients after an average of 33 months, and no significant differences were seen in the MEPS (92 points in both groups), DASH (monopolar: 13 points, bipolar: 15 points), and VAS for pain (monopolar: 1.7 points, bipolar: 1.9 points). The proportions of “excellent” or “good” results were 85% and 86% in the monopolar and bipolar groups, respectively.[3]

A porous stem RHA (ExploR; Biomet, Warsaw, IN, USA; average follow-up, 4 years) was evaluated against a smooth stem implant (EVOLVE; Wright Medical, Memphis, TN, USA; average follow-up, 10.4 years) in 57 patients with Mason-Johnson type III or IV fractures in the study by Laflamme et al.[21] These treatments resulted in insignificantly different MEPS (porous stem: 96 points, smooth stem: 97 points), DASH (porous stem: 9 points, smooth stem: 6 points), and VAS pain scores (porous stem: 1.4 points, smooth stem: 0.7 points).[21]

Network meta-analysis of RCTs

Two RCTs examined ORIF-M vs. ORIF-B, and 2 other RCTs compared RHA vs. ORIF-M.[11,16,36,42] The corresponding network meta-analysis is seen in Fig. 2.

Broberg-Morrey (excellent or good)

The network meta-analysis on Broberg-Morrey scores included all 4 RCTs, totaling 281 patients. The results of the random-effects model showed that patients treated with RHA had greater odds of achieving an “excellent” or “good” result on the Broberg-Morrey scale compared with ORIF-M (OR, 22.5; 95% CrI, 2.73-299.58) and ORIF-B (OR, 11.83; 95% CrI, 0.58-324.57; Fig. 3). ORIF-B demonstrated a more favorable outcome relative to ORIF-M (OR, 1.89; 95% CrI, 0.24-16.27). The τ^2 value was 0.965. The corresponding SUCRA values were 98% for RHA, 40% for ORIF-B, and 12% for ORIF-M.

Postoperative complications

The network meta-analysis on postoperative complications included 3 of the 4 RCTs and 288 patients. The results of the random-effects model showed that patients managed with an RHA had lower odds of experiencing a complication compared with ORIF-M (OR, 0.15; 95% CrI, 0.01-1.81) and

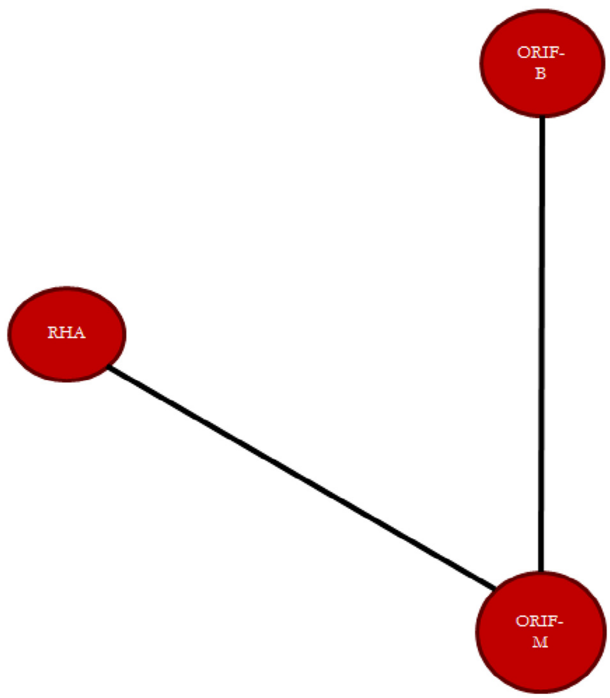

Figure 2 Network diagram of randomized controlled trial evidence. *ORIF-B*, open reduction and internal fixation with biodegradable implants; *ORIF-M*, open reduction and internal fixation with metal implants; *RHA*, radial head arthroplasty.

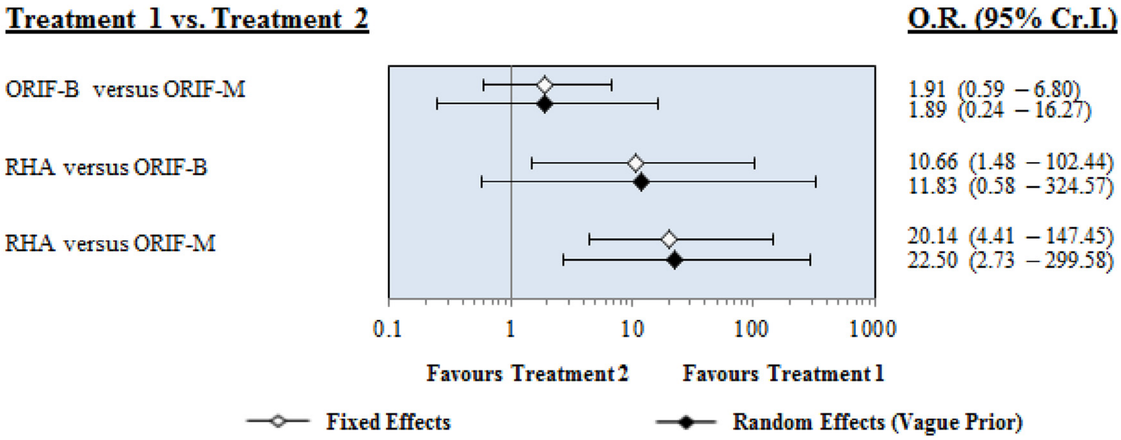

Figure 3 Network meta-analysis forest plot of an "excellent" or "good" outcome on the Broberg-Morrey scale. Results from fixed-effects and random-effects (vague prior) models. The *white and black* ◊ indicate the odds ratio (*O.R.*), and the *horizontal lines* show the 95% credible interval (*CrI*). *ORIF-B*, open reduction and internal fixation with biodegradable implants; *ORIF-M*, open reduction and internal fixation with metal implants; *RHA*, radial head arthroplasty.

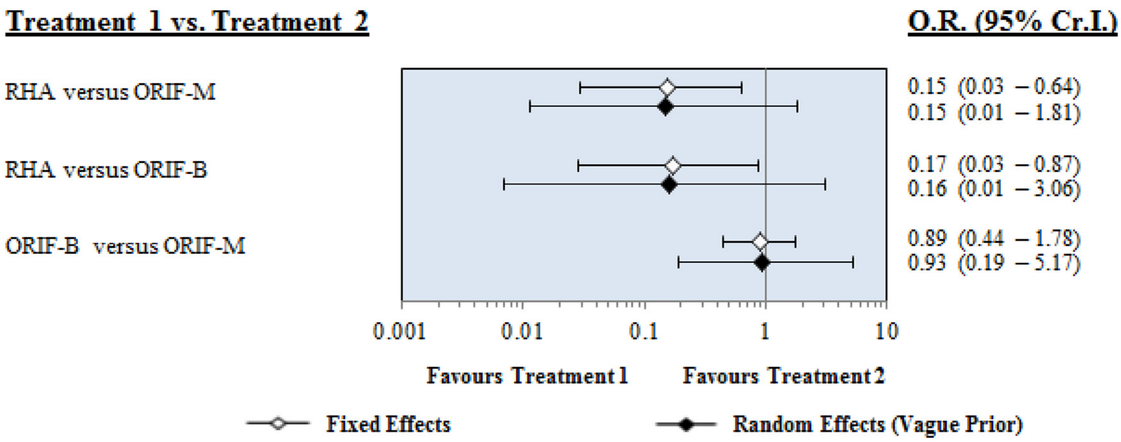

Figure 4 Network meta-analysis forest plot of postoperative complications. Results from fixed-effects and random-effects (vague prior) models. The *white and black* ◊ indicate the odds ratio (*O.R.*), and the *horizontal lines* show the 95% credible interval (*CrI*). *ORIF-B*, open reduction and internal fixation with biodegradable implants; *ORIF-M*, open reduction and internal fixation with metal implants; *RHA*, radial head arthroplasty.

ORIF-B (OR, 0.16; 95% CrI, 0.01-3.06; Fig. 4). ORIF-B demonstrated a more favorable outcome relative to ORIF-M (OR, 0.93; 95% CrI, 0.19-5.17). The τ^2 value was 0.681. The corresponding SUCRA values were 93% for RHA, 31% for ORIF-B, and 26% for ORIF-M.

Quality of evidence

The quality of evidence of outcomes for each comparison is summarized in Supplementary Tables S3 to S5. The certainty in the effect estimates ranged from very low to moderate for the Broberg-Morrey outcomes and from very low to low for postoperative complications. Major concerns included the lack of reporting on randomization and allocation concealment methods, lack of assessor blinding, small sample sizes, wide precision intervals, and that certain comparisons (ie, RHA vs. ORIF-B) only included indirect evidence.

Discussion

Main findings

A network meta-analysis of randomized trials suggests that RHA, compared with ORIF-M implants and ORIF-B implants, results in more favorable functional outcomes (according to the Broberg-Morrey scale) and fewer postoperative complications in patients with displaced radial head fractures. Our results may be limited by the lack of RCT evidence (4 trials), low sample size, and wide precision intervals surrounding the effect estimates. In addition, other treatment options have been used in the past to manage this injury, such as nonoperative methods, radial head excision, and Silastic replacement, although, to our knowledge, these particular interventions have only been investigated in the observational literature. We identified 1 ongoing randomized trial (the Radial Head – Amsterdam – Amphia – Boston – Others [RAMBO] trial) being conducted to compare nonoperative treatment vs. ORIF in patients with Mason-Johnson type II fractures.[8]

Radial head excision may have fallen out of favor due to high complication rates, and data from the included observational studies indicated that these patients may be at an increased risk of long-term joint degeneration, although improved symptoms after this procedure have still been demonstrated at long-term follow-up (ie, ≥15 years).[2,4,14,23,32,38,44] Cohort studies have demonstrated that nonoperative intervention, ORIF, and excision may result in better outcomes than Silastic replacement.[5,40] Silicone implants have also shown an increase in complications relative to metal implants, such as synovitis and fractures of the implant, and provide little axial or valgus stability to the elbow.[15,35,45]

RHA implants vary by material, shape, surface type, and fixation type, or may be monopolar or bipolar, and were designed to provide the mechanical stability of the native radial head.[4,15,27] Several RHA devices have been manufactured (Supplementary Table S6). No clear differences in functional outcomes exist between these different products, and complication rates are difficult to compare due to small sample sizes from, predominantly, case series and, because many of these studies are retrospective, the variation in lengths of follow-up. These observational studies may also be confounded by the inclusion of patients with an associated injury or a previously failed treatment. Any trials directly evaluating different RHA devices to each other are currently limited to retrospective cohorts, which have yet to demonstrate any significant findings.

The systematic review by Heijink et al[15] also suggested that, after examining revision rates, complications, and functional scores, there is no clear evidence to support one type of prosthesis over another. Chen et al[10] conducted a meta-analysis comparing monopolar vs. bipolar implants and found no significant difference in clinical outcomes (DASH and MEPS) between these devices. Until these different devices are compared in prospective, head-to-head clinical trials, other considerations need to be made by the surgeon.

The design of these implants has evolved over the years, with a focus on finding the best conformity between the patient's anatomy and the prosthesis. More specifically, the shape and surface of the radial head implant has changed to improve its relationship with the capitellum. Monopolar and bipolar heads have been the mainstay. More recently, anatomic radial heads have been developed to replicate, as closely as possible, the actual shape of a native radial head to reproduce the kinematics of the radiocapitellar joint; the Acumed Anatomic Radial Head is currently the only such device.[27] Moro et al[31] found that capitellar osteopenia was present in 18 of 23 (78%) of their RHA patients, suggesting that changes in the load transfer across the elbow can occur after surgery. Inserting an implant that more closely resembles a native radial head and, thus, the normal biomechanics and load absorption of the joint, may reduce such a complication from occurring, especially when these implants are left in situ long-term. Future investigations should evaluate both the short-term and long-term safety of these devices.

In a systematic review of Mason-Johnson type III fractures, Li and Chen[22] also determined that RHA may result in fewer complications and greater satisfaction compared with ORIF, although these conclusions were based on the same 2 RCTs of RHA vs. ORIF included in our study. In contrast, Miller et al[29] concluded that RHA, ORIF, and excision all provide satisfactory outcomes for Mason-Johnson type III fractures and could not distinguish between the treatments due to the limited evidence. Zwingmann et al[45] suggested ORIF, both with biodegradable and metal implants, might be best for Mason types II and III fractures, with less certainty in their conclusions for Mason-Johnson type IV fractures. Most of the studies included in their quantitative synthesis were observational and retrospective. All prior reviews related to this topic tended to agree that additional high-quality, randomized trials are needed to make more definitive conclusions on how to manage radial head fractures.[10,19,22,29,41]

Strengths and limitations

The strengths of our study were a comprehensive and systematic search strategy, independent and duplicate screening for eligible studies, and use of a network meta-analysis to clearly differentiate the comparative effects of RHA, ORIF-M implants, and ORIF-B implants. RHA vs. ORIF-B implants has not yet been evaluated in a randomized trial.

Limitations of our analysis include the lack of randomized trials and, thus, a low number of patients in the network meta-analysis. The corresponding precision intervals around the effect estimates were large, and the inclusion of trials with larger sample sizes may change these results. The τ^2 values were considerable, representing the existence of between-study heterogeneity. Also, when data are sparse, Bayesian methodology with vague priors may have a greater influence on the analysis.[7]

Another consideration is that postoperative complications may occur in any form. A specific complication may occur more often with one treatment than with another, and grouping all of them as one outcome makes it difficult to ascertain the actual severity of these events. We were also unable to compare the effects of RHA and ORIF against nonoperative treatment, excision, and Silastic replacement in the network because these interventions have not been investigated in prospective, randomized trials.

Conclusions

A network meta-analysis of randomized trials suggests that RHA, compared with both ORIF-M implants and ORIF-B implants, results in better functional and fewer postoperative complications in patients with displaced radial head fractures. These results are limited by the lack of RCT evidence, and additional trials are needed to determine whether and, possibly, in what subgroups (such as fracture severity) one treatment should be preferred over another. It is also important to note that many different manufacturers develop products with varying characteristics; however, there is no clear evidence that suggests whether a particular brand or device feature is superior to another.

Disclaimer

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Supplementary data

Supplementary data to this article can be found online at http://doi.org/10.1016/j.jse.2018.10.019

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