International Journal of Research and Review
[Indexed, Peer-Reviewed Journal]
Volume 12; Issue: 4; April 2025
Website: www.ijrrjournal.com
Review Paper *E-ISSN: 2349-9788; P-ISSN: 2454-2237*

Comparison of Clinical Outcomes after Open Reduction and Internal Fixation and Radial Head Arthroplasty for Treatment of Radial Head Fractures: A Systematic Review and Meta-Analysis

Andini Febriana[1], Made Bramantya Karna[2], AA. Gde Yuda Asmara[3], Stedi Adnyana Christian[4], I Gusti Ngurah Paramartha Wijaya Putra[5]

[1]Resident of Orthopaedics and Traumatology Department, Faculty of Medicine Udayana University, Prof. Dr. I.G.N.G Ngoerah Hospital
[2]Consultant of Orthopaedics and Traumatology Department, Faculty of Medicine Udayana University, Prof. Dr. I.G.N.G Ngoerah Hospital

Corresponding Author: Andini Febriana

DOI: https://doi.org/10.52403/ijrr.20250411

ABSTRACT

Introduction: Radial head fractures (RHF) constitute 33% of all elbow fractures. The Mason classification system, introduced in 1954 and modified in 1962, remains pivotal for prognostic and preoperative planning. Comminuted radial fractures (modified Mason type III and IV) provide difficult and contentious treatment issues. Numerous studies have been conducted on surgical procedures like radial head arthroplasty (RHA) and open reduction and internal fixation (ORIF). Previous meta-analyses suggest RHA may offer slightly superior elbow function and fewer unfavorable occurrences in the short term compared to ORIF for Mason type III RHF although the evidence quality is low. This study systematically reviews and compares the outcomes of ORIF versus RHA using the Mayo Elbow Performance Score (MEPS) and range of motion (ROM) evaluations.

Method: PRISMA guidelines were used in conducting the systematic review. We searched Cochrane Library, PubMed, and Google Scholar for comprehensive, peer-reviewed English studies. that compared the results of ORIF plate screw and RHA in RHF. The inclusion criteria were studies comparing clinical outcomes of these operative treatments, with outcomes assessed including DASH score, quick DASH score, MEPS, and ROM. AHRQ, GRADE Working Group, and Oxford Center for Evidence-based Medicine criteria were used to evaluate the study's quality and bias risk.

Results: The initial search yielded 158 studies. After excluding duplicates and screening titles and abstracts, five studies met the inclusion criteria. All included studies were randomized controlled trials. The mean age of participants was over 35 years, with more males than females. The sample sizes varied, with most studies including over 30 patients. Subgroup analyses revealed significant differences between ORIF and RHA groups. In terms of the Mayo Elbow Performance Score (MEPS), plating was found to be more favorable, with a mean difference of 4.05 (95% CI, 0.11 to 8.00). For flexion range of motion (ROM), arthroplasty was superior, showing a mean difference of -1.88 (95% CI, -2.53 to -1.24). Pronation ROM favored plating with a mean difference of 2.63 (95% CI, 2.09 to 3.18), and supination ROM also

favored plating, with a mean difference of 8.22 (95% CI, 7.50 to 8.95).

Conclusion: Based on the included studies, both ORIF and RHA are viable surgical options for RHF Mason type II and III fractures. Plating was more favorable for MEPS and supination/pronation ROM, while RHA was better for flexion ROM. More extensive studies are required to draw definitive conclusions and guide treatment strategies for RHF.

Keywords: Arthroplasty, ORIF, Radial head fracture

INTRODUCTION

In 33 percent of cases, radial head fractures result in an elbow fracture (RHF).[1,2] Mason's 1954 classification system was improved by Johnston in 1962 for preoperative prognostication.[3,4] Treatment for comminuted radial fracture fragments (modified Mason types III and IV) is still controversial and challenging.[5]

Surgical options including radial head arthroplasty (RHA) and open reduction and internal fixation (ORIF) have been documented by systematic reviews and meta-analyses.[6–8]

Regarding immediate results, most meta-analyses concluded that for Mason type III RHF, radial head arthroplasty (RHA) results in fewer adverse events and somewhat better elbow function than ORIF. Low evidence quality was present in the study when comparing ORIF with RHA, nevertheless.[8,9]

Therefore, the goal of this study was to perform a systematic review on the topic of comparing the measurement of range of motion (ROM) after surgery using ORIF and RHA with the major outcomes of the Mayo Elbow Performance Score (MEPS).

MATERIALS AND METHOD

Search Strategy

A systematic review was conducted in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria (Figure 1). To find a full-length, peer reviewed in English publication comparing the results of ORIF plate screw and RHA in radial head fractures, a thorough literature search was conducted. We looked through the Cochrane Library, PubMed, and Google Scholar. This systematic study compares the outcome measures the surgery treatment of radial head fractures. The following keywords matched the MeSH rule and phrase used in the search: "Radial Head Fracture,"

AND (“ORIF Plate Screw”), AND (“Radial Head Arthroplasty”)).

Inclusion Criteria

The inclusion criteria were any studies comparing clinical outcome between operative treatment in the management of Radial Head Fracture. DASH score, fast DASH score, and Mayo Elbow performance score are among the outcomes evaluated. (MEPS), and ROM. There were no restrictions on the demographics of the patients due to the small number of studies; nevertheless, non-English literatures were disregarded.

Quality Evaluation

The definition of perspicacity by the Grades of Recommendation Assessment, Development and Evaluation (GRADE) Working Group and the standards set forth by the Oxford Center for Evidence-based Medicine, and the Agency for Healthcare Research and Quality's (AHRQ) approval are used to evaluate the quality and risk of bias in studies. While the evidence class is divided into "class I" for high-quality RCTs, "class II" for good-quality cohorts and moderate-to-poor RCTs, "class III" for case-control studies and moderate-to-poor cohorts, and "class IV" for case series.

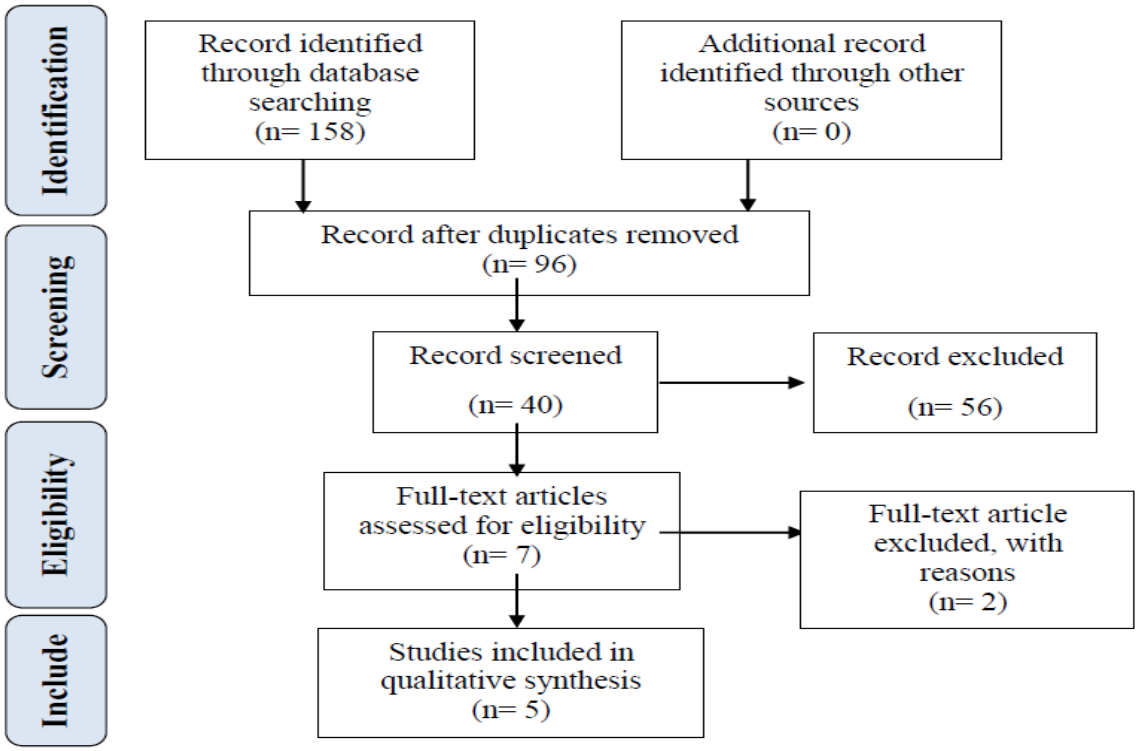

Figure 1. Flow diagram describing the strategy for conducting this study based on PRISMA guideline.

RESULTS

Literature Search, Study Selection and Study Characteristics

A total of 158 studies were obtained upon executing the search strategy in PubMed, Google Scholar, Clinical Key and Cochrane Library databases. Of these, 40 were eliminated due to title screening and 96 were eliminated due to duplication. 56 further articles were eliminated subsequent to perusing the abstract. The final seven items were examined in their entirety. Two of these were eliminated after a full-text review. Five studies were ultimately included in this systematic review.

Table 1 and 2 presents the key characteristic of the included studies along with the level of evidence. All of the studies included are randomized controlled study. In all the included studies, males were greater than females in number. The mean age of study participants was about >35 years in every intervention in all studies. The total sample size for each study is variable, most of the study included has more than 30 patients. Table 3 presents the outcome assessed and the complication among 5 studies. The DASH score, fast DASH score, Mayo Elbow performance score (MEPS), and ROM were used to evaluate the functional result.

Table 1 List of studies included

No	Reference	Journal	Study Design	Level of Evidence
1	Wu *et al*, 2016	Journal of Orthopaedic Surgery	Retrospective Cohort	III
2	Yan *et al*, 2015	The Orthopaedic Journal	Randomized Controlled Trial	III
3	Al-Burdeni *et al*, 2015	International Orthopaedic Journal	Retrospective Cohort	III
4	Liu *et al*, 2015	International Medical Journal of Experimental and Clinical Research	Retrospective Cohort	III
5	Pogliacomi *et al*, 2015	Acta Biomed Journal	Retrospective Cohort	III

Table 2 Characteristic of Patients

No	Reference	Total Sample Size	Treatment Protocol		Mason Type	Mean Age (SD)	Gender (M/F)	
			Arthroplasty	Plate			Arthroplasty	Plate
1	Wu *et al*, 2016	25 patients	13	12	III-IV	ORIF: 45 (21-59) Arthroplasty: 46 (27-80)	10/3	6/6
2	Yan *et al*, 2015	39 patients	20	19	III-IV	ORIF: 35.5 (SD 6.28) Arthroplasty: 36.5 (SD 6.58)	11/9	7/12
3	Al-Burdeni *et al*, 2015	36 patients	17	19	III-IV	ORIF: 34.1 (SD 1.6) Arthroplasty: 38.1 (SD 2.6)	15/2	17/2
4	Liu *et al*, 2015	72 patients	37	35	III	ORIF: 65.5 (SD 1.61) Arthroplasty: 68.7 (SD 2.22)	19/18	19/16
5	Pogliacomi *et al*, 2015	54 patients	20	34	III-IV	ORIF: 41.2 (SD 8.7) Arthroplasty: 58.4 (SD 5.9)	17/3	25/9

Table 3. Characteristic of Outcome of studies

No	Reference	Outcome Measure					
		Mayo elbow performance score		ROM		DASH Score	Quick DASH score
		Arthroplasty	ORIF	Arthroplasty	ORIF		
1	Wu *et al*, 2016	87.0 (65-100)	81.9 (65–100)	Flexion/extension: 115±25.8 Pronation: 68±12 Supination: 68±12	Flexion/extension: 110±24 Pronation: 60.5±17 Supination: 59±19	N/A	N/A
2	Yan, et al, 2015	85.8±7.51	77.9±13.86	Flexion/extension: 101.40 ± 11.35 Pronation: 63.00 ± 9.98 Supination: 51.10 ± 5.48	Flexion/extension: 92.42 ± 9.06 Pronation: 56.74 ± 13.74 Supination: 49.53 ± 9.58	N/A	N/A
3	Al-Burdeni *et al*, 2015	N/A	N/A	N/A	N/A	12±2.6	14.1±2.6
4	Liu *et al*, 2015	N/A	N/A	Flexion: 133±1.27 extension: –10.5±2.1 Pronation: 73.9±1.12 Supination: 79.8±1.72	Flexion: 135±1.51 extension: –12.3±1.91 Pronation: 71.3±1.24 Supination: 81.3±1.13	N/A	N/A
5	Pogliacomi *et al*, 2015	90.5±5.1	88.2±12.5	N/A	N/A	N/A	N/A

STATISTICAL ANALYSIS

All statistical analyses were performed using Review Manager software (RevMan; The Cochrane collaboration Oxford, England) version 5.4. Considering the heterogeneity of the current investigation, we evaluated the overall results by a sensitivity analysis.

The fixed-effect models were utilized to compute the overall MDs/ORs in cases when studies showed minimal heterogeneity. We applied the random effects concept in different scenarios. Studies were deemed to be statistically significant if their P values were less than.05. Plots of forests displayed the results of our meta-analysis.

Mayo Elbow Performance Score outcome

In radial head fracture cases, we performed a subgroup analysis to compare the Mayo Elbow Performance Score outcomes of plating versus arthroplasty.

We found that the plating outcome is superior and that there is a statistically significant difference in the Mayo Elbow Performance Score between these two groups. (mean difference 4.05; 95% CI, 0.11 to 8.00).

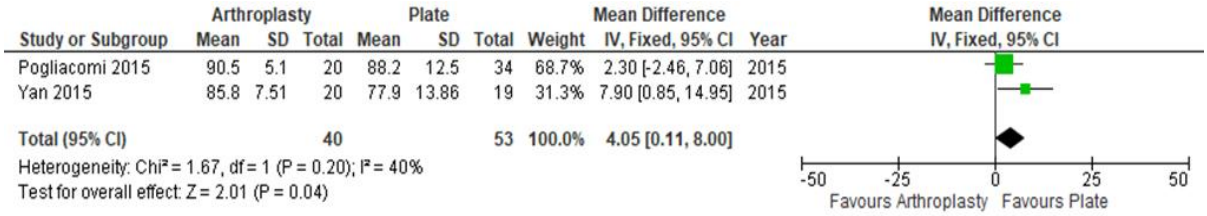

Figure 1. Comparison between Arthroplasty versus Plate According to Mayo Elbow Performance Score.

Flexion Range of Motion outcome

We performed a subgroup analysis to evaluate flexion range of motion outcome between Plating versus Arthroplasty in Radial Head Fracture. We discovered that there is significant difference of statistic between these two groups. in flexion range of motion, an arthroplasty yields a more favorable result.

(mean difference -1.88; 95% CI, -2.53 to -1.24).

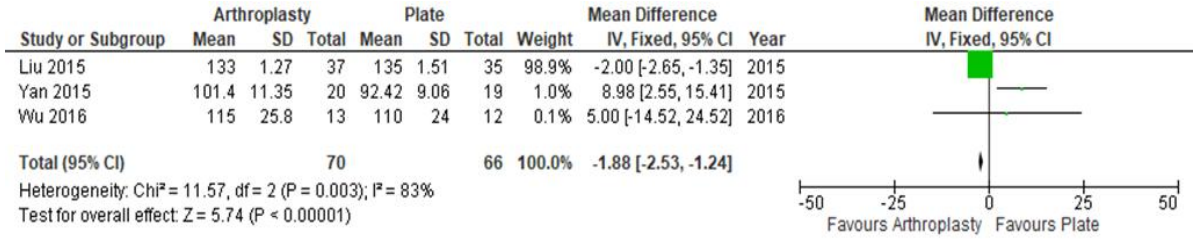

Figure 2. Comparison between Arthroplasty versus Plate According to Range of Motion of Flexion Movement.

Pronation Range of Motion outcome

We performed a subgroup analysis to evaluate pronation range of motion outcome between Plating versus Arthroplasty in Radial Head Fracture. We discovered that there is a statistically significant difference between these two groups in the pronation range of motion outcome, which is better with plating.

(mean difference 2.63; 95% CI, 2.09 to 3.18).

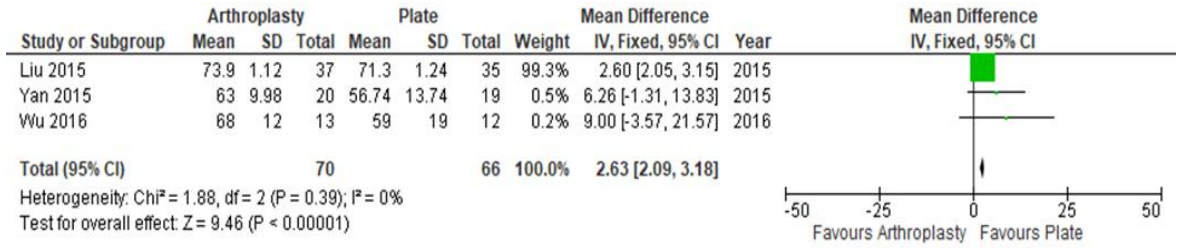

Figure 3. Comparison between Arthroplasty versus Plate According to Ranga of Motion of Pronation Movement

Supination Range of Motion outcome

We process subgroup analysis to evaluate supination range of motion outcome between Plating versus Arthroplasty in Radial Head Fracture. We discovered that there is a statistically significant difference between these two groups in the supination range of motion outcome, which is better when plating is present.
(mean difference 8.22; 95% CI, 7.50 to 8.95).

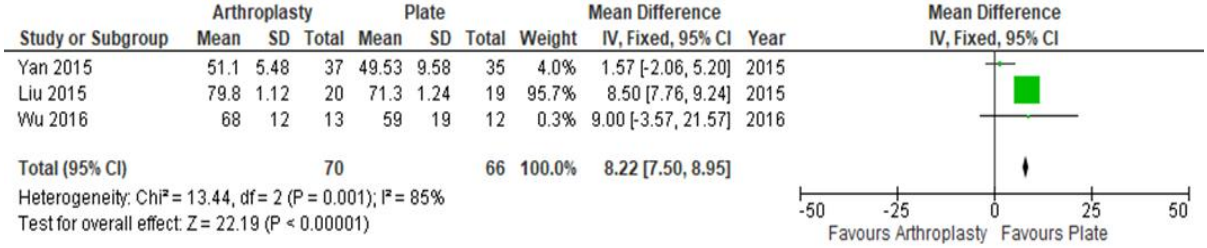

Figure 4. Comparison between Arthroplasty versus Plate According to Range of Motion of Supination Movement

DISCUSSION

There are different outcomes in surgical treatment on patient with RHF. The treatment of this topic should always aim to achieve achieve best functional outcome and least complication. We reviewed some studies using several surgical treatments on radial head fracture patient and assessed functional outcome by Mayo Elbow performance score (MEPS), and ROM.
Burdeni *et al*[10] reported 36 patients, 26 had a modified Mason type III and ten type IV fracture. Nineteen patients (52.8 %) were treated with ORIF and 17 (47.2 %) with RHA. Mean surgery duration was 128.2 minutes (SD 16.2) for group of ORIF and for group of RHA was 96.8 minutes (SD 7.8), had statistically significant results with time difference was thirthy three minutes. Mean Quick DASH score was 14.1 (SD 2.6) for the ORIF group and 12.0 (SD 2.6) for RHA group, there was no statistically significant regain in functional ROM of the elbow between. For an average of 12.7±1.28 months (range, 10–15.6 months), For an average of 12.7±1.28 months (range, 10–15.6 months), all patients were monitored. The replacement group, which comprised seven patients who had undergone radial head replacement surgery, was monitored for 13.8±1.92 months on average.
Another often used scoring tool was the Visual Analog scale, which is a line of ten centimeters with an anchor at each end to indicate no discomfort (0 to 10) and is subjectively recorded from the viewpoint of the patient.
Liu *et al*[12] (Liu et al., 2015)reported 72 patients with Mason type III fracture, which 37 of them undergone radial head replacemet treatment and 35 patient with ORIF. Report calculated using VAS score, 2.25±0.16 for replacement treatment group and 1.67±0.21 for ORIF group which significantly differences (P<0.05).
Mayo Elbow Performance Score or MEPS also used to evaluated clinical outcomes in radial head fractures. Pogliacomi *et al*[13]

reported of 63 patients which 38 of them had modified Mason type III and 25 patient had type-IV fracture. 34 patients were treated with ORIF and 20 with radial head arthroplasty. The average MEPS at follow up in 63 patients was 89.5 (range 57-98, SD 23.4), excellent in 50 patients (79.4%), good in 6 (9.5%), fair in 4 (6.3%) and poor in 3 (4.8%). Mean MEPS was 88.2 (range 57-98, SD 12.5) for ORIF group, 90.5 (range 82-98, SD 5.1) for RHA group and 88.7 (57-94, SD 18.4) for RHR group. Wu *et al*[11] also reported 41 patients with Mason type III or IV whom underwent fixation compression screw (n=16), radial head arthroplasty (n=13) and fixation with Shyntes plate (n=12). Three groups were compared in terms of Mean MEPS (p=0.56) and mean range of motion (p=0.45). Also reported complication rate was higher after plate fixation, followed by screw fixation and arthroplasty (50% [6/12] vs 18.8% [3/16] vs 15.4%[2/13].

Yan *et al*[14] also reported comparison of MEPS between radial head replacement and radial head repair. Which concluded on 39 patients which had Mason type III or IV fracture, showed that radial head replacement had higher average MEPS than the radial head repair group (*P*=0.009). The same result showed in case of elbow movement range which radial head replacement group had better extension than those in radial head repair group (*P<0.001)*

The only few study that discuss about clinical outcomes comparing the plate fixation versus radial head arthroplasty, more study needed to explore about these two surgical options. Further study needed to be included in the upcoming systematic review and Meta-analysis.

CONCLUSION

Based on the 5 studies included in this systematic review, all surgical treatment may become a choice for RHF Mason type II and III fracture, but in our study we can conclude that Plating was more favourable when evaluation with MEPS, and also when evaluation of the Range of Motion especially in Supine and Pronation. Another result, Radial Head Arthroplasty was more favourable when evaluation of Flexion Range of Motion. Hence, more studies needed to conclude a better conclusion since there was limitation of the study regarding this topic.

Declaration by Authors

Ethical Approval: Not Required
Acknowledgement: None
Source of Funding: None
Conflict of Interest: No conflicts of interest declared.

REFERENCES

1. Kovar FM, Jaindl M, Thalhammer G, et al. Incidence and analysis of radial head and neck fractures. *World Journal of Orthopedics* 2013; 4: 80–84.
2. Duckworth AD, Clement ND, Jenkins PJ, et al. The epidemiology of radial head and neck fractures. *Journal of Hand Surgery* 2012; 37: 112–119.
3. Mason ML. Some Observations On Fractures Of The Head Of The Radius With A Review Of One Hundred Cases Slnior Orthopedic Registrar South-East Kent, Canterbury, And Isle Of Thanet Groups Or Hospitals.
4. Yu W, Hu J, Zhang X, et al. Acute unstable complex radial head and neck fractures fixed with a mini T-shaped plate in a 20-year-old man: A case report. *Therapeutics and Clinical Risk Management* 2016; 12: 825–830.
5. Heijink A, Kodde IF, Mulder PGH, et al. Radial head arthroplasty: A systematic review. *JBJS Reviews*; 4. Epub ahead of print 2016. DOI: 10.2106/JBJS.RVW.15.00095.
6. Zwingmann J, Welzel M, Dovi-Akue D, et al. Clinical results after different operative treatment methods of radial head and neck fractures: A systematic review and meta-analysis of clinical outcome. *Injury* 2013; 44: 1540–1550.
7. Li N, Chen S. Open reduction and internal-fixation versus radial head replacement in treatment of Mason type III radial head fractures. *European Journal of Orthopaedic Surgery and Traumatology* 2014; 24: 851–855.

8. Sun H, Duan J, Li F. Comparison between radial head arthroplasty and open reduction and internal fixation in patients with radial head fractures (modified Mason type III and IV): a meta-analysis. *European Journal of Orthopaedic Surgery and Traumatology* 2016; 26: 283–291.
9. Dou Q, Yin Z, Sun L, et al. Prosthesis replacement in Mason III radial head fractures: A meta-analysis. *Orthopaedics and Traumatology: Surgery and Research* 2015; 101: 729–734.
10. Al-Burdeni, S., Abuodeh, Y., Ibrahim, T. et al. 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). International Orthopaedics (SICOT) 39, 1659–1664 (2015). https://doi.org/10.1007/s00264-015-2755-1
11. Wu PH, Shen L, Chee YH. Screw fixation versus arthroplasty versus plate fixation for 3-part radial head fractures. *Journal of Orthopaedic Surgery* 2016; 24: 57–61.
12. Liu R, Liu P, Shu H, et al. (2015) Comparison of primary radial head replacement and orif (open reduction and internal fixation) in mason type iii fractures: A retrospective evaluation in 72 elderly patients. *Medical Science Monitor* 21(January): 90–93. DOI: 10.12659/MSM.893048.
13. Pogliacomi F, Schiavi P, Pedrazzini A, et al. (2015) Modified Mason type III and IV radial head fractures: Results of different surgical treatments. *Acta Biomedica* 86(3): 242–250.
14. Yan M, Ni J, Song D, et al. (2015) Radial head replacement or repair for the terrible triad of the elbow: which procedure is better? *ANZ Journal of Surgery* 85(9): 644–648. DOI: 10.1111/ans.13060.

How to cite this article: Andini Febriana, Made Bramantya Karna, AA. Gde Yuda Asmara, Stedi Adnyana Christian, I Gusti Ngurah Paramartha Wijaya Putra. Comparison of clinical outcomes after open reduction and internal fixation and radial head arthroplasty for treatment of radial head fractures: a systematic review and meta-analysis. *International Journal of Research and Review*. 2025; 12(4): 93-100. DOI: *https://doi.org/10.52403/ijrr.20250411*

******