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Postoperative Radial Nerve Palsy After Surgical Fixation of Humeral Shaft Fractures: A Systematic Review of Management and Functional Outcomes

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Abstract

Radial nerve palsy (RNP) is a clinically important complication of surgical fixation of humeral shaft fractures and may result in wrist drop, impaired hand function, and prolonged disability. This systematic review evaluated the incidence, risk factors, management, neurological recovery, and functional outcomes of postoperative RNP. PubMed/MEDLINE, Embase, Scopus, and the Cochrane Library were searched from inception to September 2026. Primary clinical studies evaluating postoperative RNP following surgical fixation of humeral shaft fractures were included. Data regarding fracture characteristics, fixation technique, neurological findings, management, recovery, and functional outcomes were extracted, and methodological quality was assessed using appropriate risk of bias tools. Ten primary studies were included. Postoperative RNP was reported across the included studies, with neurological recovery generally favorable, although recovery frequently required several months. Reported incidence estimates varied across studies and depended on the population at risk and the definition of postoperative palsy. Postoperative RNP remains an important complication of humeral shaft fracture fixation. Standardized neurological assessment and prospective multicenter studies are required to better define risk factors and optimize management and recovery.

Categories: Trauma, Orthopedics
Keywords: functional outcomes, humeral shaft fracture, open reduction and internal fixation, radial nerve palsy, wrist drop

Introduction And Background

Humeral shaft fractures represent approximately 1%-3% of all fractures and occur across a broad spectrum of mechanisms, from low-energy falls to high-energy trauma. Their clinical significance extends beyond fracture alignment and union because of the close anatomical relationship between the radial nerve and the humeral diaphysis, particularly through the spiral groove and the middle to distal third of the humerus. Radial nerve palsy (RNP) is consequently the most frequently reported neurological complication of humeral shaft fracture, with reported incidence generally ranging from 8% to 16%. Large systematic reviews have estimated an overall incidence of approximately 10%-12%, although this varies according to fracture location, pattern, mechanism of injury, and study population [1]. Transverse, spiral, middle-third, and distal fractures have been particularly associated with radial nerve dysfunction, reflecting the vulnerability of the nerve to traction, compression, displacement, and direct injury at the fracture site [2].

RNP associated with humeral shaft fracture has two clinically distinct forms. Primary RNP is present at the time of injury or before definitive fracture manipulation and may result from nerve contusion, traction, compression, entrapment between fracture fragments, or, less commonly, laceration or transection. In contrast, secondary or postoperative RNP develops after reduction, fixation, or subsequent surgical intervention and therefore represents a potentially preventable iatrogenic complication. This distinction is critical because the natural history and clinical decision-making differ between the two entities. Contemporary systematic evidence suggests that primary RNP in closed humeral shaft fractures occurs in approximately 10% of patients and has a high probability of spontaneous neurological recovery; one systematic review reported recovery in approximately 94% of affected patients, with no significant difference between early operative exploration and non-operative management (98% versus 91%, $p = 0.29$). Conversely, secondary RNP appears substantially more associated with operative treatment, with a reported incidence of approximately 4% following operative management compared with 0.4% following non-operative treatment ($p < 0.01$). These findings underscore why postoperative nerve dysfunction should not simply be combined with pre-existing palsy when assessing surgical risk [3].

The increasing use of operative fixation for humeral shaft fractures has therefore intensified interest in the prevention, recognition, and management of postoperative radial nerve injury. Plate fixation, minimally invasive techniques, and intramedullary nailing each expose the nerve to different anatomical and technical

hazards, including excessive retraction, direct manipulation, entrapment beneath the plate, screw-related injury, traction during reduction, fracture fragments, and unrecognized nerve laceration. A contemporary systematic review of humeral shaft fracture treatment demonstrated that secondary RNP rates differ according to fixation strategy, with pooled rates of approximately 3% following intramedullary nailing, 4% following minimally invasive plating, and 7% following open reduction and plate fixation [4]. Importantly, the clinical manifestation of radial nerve dysfunction is not limited to a generic nerve palsy, in which patients may develop loss of wrist and finger extension, impaired thumb extension or abduction, and sensory disturbance over the dorsoradial hand, producing clinically significant wrist drop and limitations in activities of daily living, work, and upper-limb function. Recovery may occur through spontaneous axonal regeneration, but persistent motor deficit can require nerve exploration, neurolysis, nerve repair or grafting, and, in selected patients, tendon transfer [5]. Despite the substantial literature surrounding RNP after humeral shaft fracture, considerable heterogeneity remains regarding definitions of postoperative palsy, fracture characteristics, operative technique, timing of neurological assessment, indications for exploration, electrophysiological evaluation, and reporting of functional recovery.

The primary aim of this systematic review is to determine the incidence of new postoperative RNP or wrist drop following surgical fixation of humeral shaft fractures and to evaluate clinically and statistically relevant patient-, fracture-, and treatment-related factors associated with its occurrence. Secondary aims are to characterize the clinical and neurological phenotype of postoperative palsy; identify reported mechanisms and intraoperative causes of nerve injury; evaluate the diagnostic role and timing of electromyography or nerve conduction studies and other imaging modalities; compare management strategies, including observation, splinting, physiotherapy, nerve exploration, decompression, neurolysis, repair, grafting, hardware revision, and tendon transfer; determine the timing, completeness, and durability of neurological recovery; and assess patient-centered functional outcomes.

Review

Materials and methods

Search Strategy

A comprehensive systematic literature search was conducted in accordance with the PRISMA 2020 guidelines to identify primary studies evaluating postoperative RNP and wrist drop following surgical fixation of humeral shaft fractures [6]. PubMed/MEDLINE, Embase, Scopus, and the Cochrane Library were searched from June 4, 2026, to September 1, 2026, with no lower date restriction. The search combined controlled vocabulary and free-text terms related to humeral shaft fractures, radial nerve injury, postoperative palsy, wrist drop, and surgical fixation. Key terms included "humeral shaft fracture", "humeral diaphyseal fracture", "radial nerve palsy", "radial nerve injury", "radial neuropathy", "iatrogenic radial nerve palsy", "wrist drop", "open reduction and internal fixation", "ORIF", "plate fixation", and "intramedullary nail". Synonymous terms were combined using OR, while the major concepts were combined using AND. The search strategy was adapted for the indexing requirements of each database. Reference lists of eligible studies and relevant reviews were also screened, with forward citation searching performed where available. Duplicate records were removed before title/abstract screening, followed by full-text assessment according to predefined eligibility criteria. Primary and postoperative RNP were extracted separately to ensure accurate estimation of new postoperative/iatrogenic neurological injury. The complete search strategy is presented in Table *1*.

Database	Search strategy and dates
PubMed/MEDLINE	(("Humeral Fractures"[Mesh] OR humeral shaft fracture*[tiab] OR humeral diaphyseal fracture*[tiab]) AND ("Radial Neuropathy"[Mesh] OR radial nerve palsy[tiab] OR radial nerve injury[tiab] OR radial neuropathy[tiab] OR wrist drop[tiab]) AND ("Fracture Fixation, Internal"[Mesh] OR surgical fixation[tiab] OR "open reduction internal fixation"[tiab] OR ORIF[tiab] OR plate fixation[tiab] OR intramedullary nail*[tiab] OR "minimally invasive plate osteosynthesis"[tiab])) Search dates: June 4, 2026, to September 1, 2026.
Embase	Search terms covering humeral shaft fractures, radial nerve palsy or injury, wrist drop, and surgical fixation, using Emtree terms and free-text terms. Search dates: June 4, 2026, to September 1, 2026.
Scopus	Search terms covering humeral shaft fractures, radial nerve palsy or injury, wrist drop, and surgical fixation, using TITLE-ABS-KEY fields. Search dates: June 4, 2026, to September 1, 2026.
Cochrane Library	Search terms covering humeral shaft fractures, radial nerve palsy or injury, wrist drop, and surgical fixation. Search dates: 04 June 2026 to 01 September 2026.

TABLE 1: Database search strategies

Eligibility Criteria

Eligibility criteria were predefined according to the PICO framework [7]: Population (individuals of any age with acute humeral shaft/diaphyseal fractures, including closed or open fractures, undergoing surgical fixation); Intervention/Exposure (ORIF, plate osteosynthesis, minimally invasive plate osteosynthesis (MIPO), or intramedullary nailing, with assessment of postoperative or iatrogenic RNP/wrist drop; Comparator (different fixation methods, surgical approaches, fracture patterns or locations, and, where available, operative versus non-operative or early exploration versus expectant management); and Outcomes (incidence of new postoperative RNP as the primary outcome, with secondary outcomes including clinical motor and sensory deficits, Medical Research Council (MRC) strength grading, findings of electromyography (EMG)/nerve conduction studies (NCS), nerve injury mechanism, management, time and completeness of neurological recovery, persistent deficit, and functional outcomes, including range of motion, grip strength, and return to work). Systematic reviews, meta-analyses, editorials, conference abstracts, animal/cadaveric studies, isolated technical studies, single case reports, pathological fractures, and periprosthetic fracture studies were excluded.

Study Selection

Study selection was conducted according to the predefined eligibility criteria. Titles and abstracts were screened for relevance, followed by full-text assessment of potentially eligible reports. The number of reviewers involved in screening, whether screening was performed independently, and the procedure used to resolve disagreements are reported transparently. Reasons for excluding full-text reports were recorded and summarized in the PRISMA 2020 flow diagram.

Data Extraction

Data were collected using a structured data-extraction form. The form captured study design, sample size, fracture characteristics, preoperative radial nerve status, fixation method, new postoperative RNP events, management, neurological recovery, follow-up duration, and functional outcomes. The number of extractors, whether duplicate independent extraction was undertaken, whether the form was pilot-tested, and the process for checking and resolving discrepancies are reported according to the procedures actually performed. Numerical outcomes were checked against the original publications wherever verification was possible, with particular attention to event counts, denominators, and the distinction between primary and postoperative RNP.

Risk of Bias Assessment

The risk of bias of the included studies was assessed using tools selected according to study design and research question. ROBINS-I was considered for non-randomized studies evaluating interventions, while an appropriate prognostic study assessment tool was considered for studies primarily investigating predictors or the time course of neurological recovery [8]. The JBI critical appraisal tools were considered for relevant cohort and case series designs, where appropriate [9]. The assessment considered participant selection, confounding, outcome measurement, missing data, and selective reporting, as applicable to each tool. The number of assessors, procedures for resolving disagreements, domain-level judgments, and the rationale for overall assessments are reported transparently. Each judgment was based on the relevant study report rather than the study design alone.

Data Synthesis

Data synthesis was performed because substantial clinical and methodological heterogeneity was anticipated across the included primary studies. Studies were grouped according to fracture characteristics, fixation technique, surgical approach, primary versus postoperative RNP, mechanism of nerve injury, management strategy, and neurological recovery. The incidence of new postoperative RNP was reported separately from pre-existing traumatic palsy to avoid misclassification of iatrogenic events. Where available, proportions, risk estimates, p-values, confidence intervals, recovery times, and functional scores were summarized. Quantitative pooling was considered only where studies were sufficiently homogeneous in population, exposure, outcome definition, and follow-up; otherwise, findings were synthesized narratively and comparatively. Emphasis was placed on clinically meaningful neurological recovery and validated functional outcomes.

Results

Study Selection Process

Figure *1* shows the study selection process conducted in accordance with the PRISMA 2020 guidelines. A total of 147 records were identified through database searching, including PubMed/MEDLINE (n = 52), Embase (n = 38), Scopus (n = 45), and the Cochrane Library (n = 12). After removal of duplicate records (n = 32), 115 records remained for title and abstract screening. Following screening, 88 records were excluded

because they were unrelated to humeral shaft fractures or RNP, involved non-human or cadaveric studies, or did not evaluate surgical fixation or relevant neurological outcomes. The remaining 27 reports were sought for retrieval, of which 2 reports were not retrieved, leaving 25 full-text articles for eligibility assessment. Following full-text review, 15 studies were excluded because they were systematic reviews or meta-analyses (n = 3), case reports or very small, isolated case series (n = 4), conference abstracts without sufficient primary data (n = 3), studies involving pathological or periprosthetic fractures without a separately extractable eligible population (n = 2), or studies that did not report relevant radial nerve or functional outcomes following surgical fixation (n = 3). Ultimately, 10 primary clinical studies met the predefined eligibility criteria and were included in the final systematic review and qualitative synthesis.

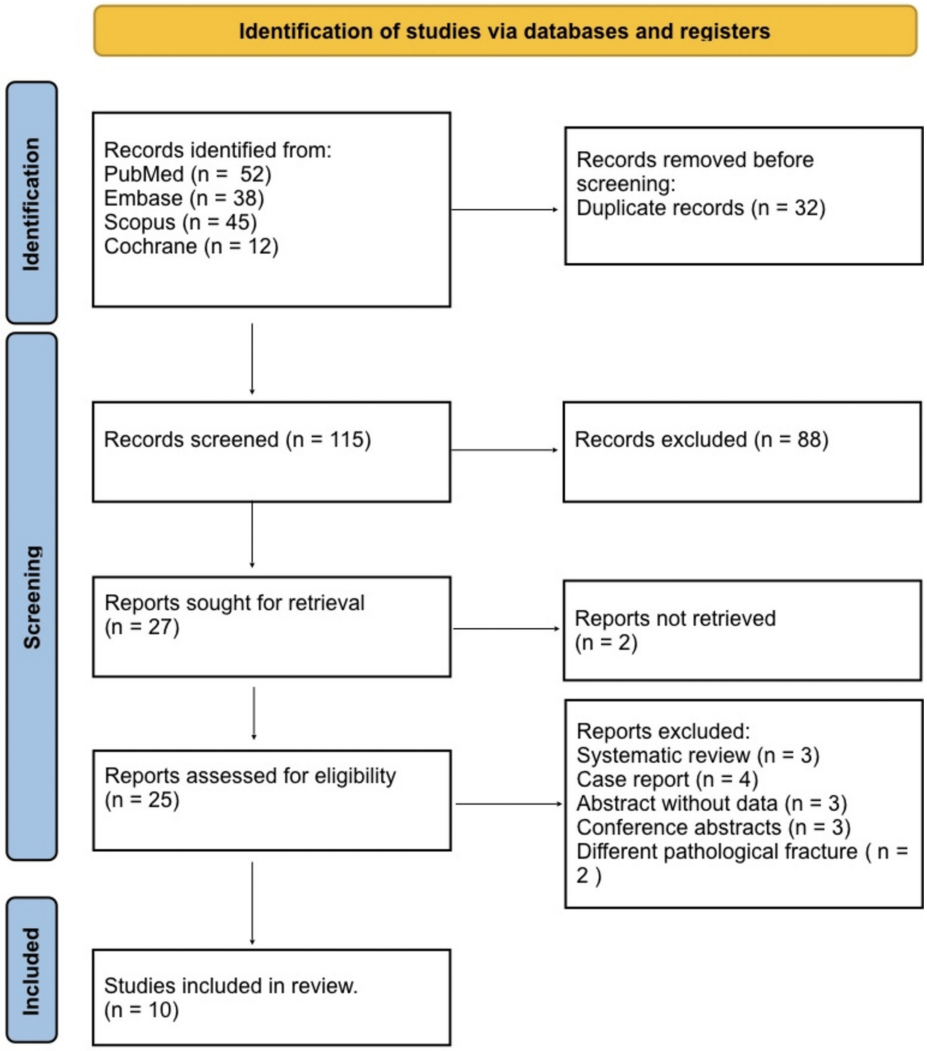


FIGURE 1: PRISMA 2020 flow diagram

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

Characteristics of the Selected Studies

Table 2 shows the characteristics and clinical outcomes of the 10 included primary studies evaluating RNP following surgical fixation of humeral shaft fractures. The studies comprised predominantly retrospective cohorts, two prospective multicenter studies, and one prospective multicenter case series, and included populations ranging from 31 to 469 patients, with postoperative RNP rates ranging from 0.6% to 10.5% where directly reported. Clinical assessment primarily included motor and sensory examination, MRC grading, wrist and finger extension, and, in selected studies, EMG/NCS evaluation. Surgical management included plate fixation, minimally invasive or open approaches, and intramedullary nailing, while treatment of postoperative palsy ranged from observation and splinting to nerve exploration, decompression, repair, and reconstruction. Neurological recovery was generally favorable, although recovery time varied substantially, with reported complete or substantial recovery rates ranging from 75.9% to 94% in selected cohorts. Functional outcomes were assessed using Disabilities of the Arm, Shoulder and Hand (DASH) or QuickDASH, Constant-Murley score, Mayo Elbow Performance Score (MEPS), range of motion, grip strength,

and return to activity, with several studies demonstrating clinically meaningful functional recovery following neurological improvement.

Study	Study design and population	Fracture/ NP characteristics	Surgical treatment and nerve findings	Management and neurological recovery	Functional outcomes/key statistics
Wang et al. (2014) [10]	Retrospective cohort; n = 125 surgically treated humeral shaft fractures	Postoperative RNP 6/125 (4.8%); motor and sensory deficits assessed clinically; EMG/NCS used during follow-up	Internal fixation; no definite intraoperative nerve transection reported	Initial observation; exploration in persistent cases; recovery generally occurred within 12 months	Clinical wrist/finger extension recovery; mean follow-up 28 months
Schwab et al. (2018) [11]	Retrospective cohort; n = 151 surgically treated fractures	Preoperative RNP 20/151 (13%); new postoperative RNP 9/151 (6%); complete/partial motor and sensory deficits recorded	Plate fixation or IM nail; secondary palsy associated with contusion, compression, entrapment or iatrogenic injury	Observation or exploration; decompression/repair when indicated; most secondary palsies recovered	Clinical neurological recovery; postoperative RNP 6%; follow-up approximately 13-14 months
Claessen et al. (2015) [12]	Retrospective comparative cohort; n = 325 adult patients	Preoperative RNP 17/77 (22.1%) operative patients; complete vs incomplete palsy assessed	ORIF using anterolateral/posterior approaches; fracture location analyzed	Operative/non-operative treatment according to clinical indication; neurological resolution monitored	Clinical neurological recovery; middle-third location associated with RNP (p = 0.02)
Van Bergen et al. (2023) [13]	Prospective multicenter case series; n = 390, 245 operative	Preoperative RNP in 13/245 operative patients; new postoperative RNP 9/232 (3.9%)	8/9 postoperative cases treated with plates and 1/9 with IM nail; one nerve entrapment identified	Mainly observation/brace; nerve release and repair for entrapment; 8/9 (89%) recovered	DASH, Constant-Murley, SF-36, EQ-5D-3L, pain, ROM, and activity resumption; 12-month follow-up
Den Hartog et al. (2023) [14]	Prospective multicenter comparative cohort; n = 245 operative	Postoperative temporary RNP: plate 8/76 (10.5%) vs IMN 1/156 (0.6%)	Plate fixation vs intramedullary nailing; postoperative nerve dysfunction clinically assessed	Standard observation/treatment; deficits predominantly temporary	Functional outcomes assessed within HUMMER cohort; p < 0.001 for difference between fixation groups
Gunsoy et al. (2024) [15]	Retrospective cohort; n = 31 patients with humeral fracture + RNP	RNP cohort; motor recovery evaluated using MRC	Plate fixation with different plate positions; plate location examined as potential determinant of recovery	Operative fixation with neurological follow-up; anteromedial plating associated with faster recovery	MRC, DASH, and MEPS; some functional differences were not statistically significant
Gómez et al. (2025) [16]	Retrospective prognostic cohort; n = 471 surgically treated fractures; 32 complete RNP	17/32 primary and 15/32 postoperative palsies; complete motor deficit assessed serially using MRC	Internal fixation; prognostic analysis of neurological recovery	Standard treatment with observation of nerve recovery; 30/32 regained full motor function	Median M5 recovery 36 weeks; first recovery in 90.6% within 6 months; full hand/wrist function 84.3% at 12 months and 94% at 18 months
Cruz et al. (2025) [17]	Retrospective cohort of surgically treated 164 humeral shaft fractures	Middle- vs distal-third fractures; postoperative RNP analyzed according to fracture location	Surgical fixation; fracture location and morphology evaluated as potential risk factors	Standard postoperative neurological surveillance and management	Clinical neurological recovery; study focused on association between distal-third location and RNP
Krijnen et al. (2026) [18]	Retrospective prognostic cohort; n = 53 patients with radial nerve motor injury after fixation	44/53 (83%) presented with preoperative palsy; 9 postoperative; recovery defined as wrist extension against gravity, MRC ≥3	Surgical fixation; fixation type, fracture location, and vascular injury assessed	Observation with consideration of reconstruction according to recovery trajectory	If no recovery by 7 months, predicted recovery by 18 months 56%; if no recovery by 12 months, 17%; no clear association with fixation type
				Observation, identifies	

Acar et al. (2026) [19]	Retrospective observational cohort; 469 fractures, 77 RNP	Primary and secondary RNP separately evaluated; 29 postoperative cases analyzed	Predominantly plate fixation; fracture pattern/location and nerve exploration assessed	29/129 as the new-onset postoperative palsy count and denominator, with 7/129 having persistent deficits	QuickDASH; mean recovery time ~121 days among recovered postoperative cases

TABLE 2: Characteristics of the selected studies

RNP: radial nerve palsy, IMN: intramedullary nail, ORIF: open reduction and internal fixation, MRC: Medical Research Council, DASH: Disabilities of the Arm, Shoulder and Hand, MEPS: Mayo Elbow Performance Score, ROM: range of motion.

Note: Van Bergen et al. [13] and Den Hartog et al. [14] are linked publications arising from the HUMMER research cohort. The specific outcomes extracted from each report were considered separately, and overlapping participants were not treated as independent observations when interpreting the evidence.

Incidence of New Postoperative RNP

Incidence was assessed using studies that reported new postoperative RNP among patients undergoing surgical fixation. For each estimate, the number of new postoperative events was recorded alongside the number of patients at risk. Where the original study excluded patients with pre-existing traumatic RNP, this restricted denominator was reported explicitly. Studies primarily investigating neurological recovery or functional prognosis among patients with established radial nerve injury were considered separately and were not treated as independent estimates of postoperative incidence.

Neurological Recovery and Functional Outcomes

Studies evaluating recovery were synthesized separately from studies estimating incidence. Extracted outcomes included the first documented evidence of neurological improvement, motor recovery according to the MRC scale, recovery of wrist and finger extension, complete motor recovery, persistent deficit, and patient-reported functional outcomes. Recovery proportions were interpreted in relation to each study's definition, baseline neurological status, and follow-up duration.

Risk of Bias Assessment

Table *3* shows that the included studies demonstrated predominantly moderate risk of bias, with concerns mainly related to retrospective design, small numbers of postoperative RNP cases, and heterogeneous surgical techniques. Potential confounding arose from differences in fracture location, severity, fixation method, and pre-existing RNP. Prospective multicenter studies showed comparatively lower methodological concerns because of structured follow-up and predefined neurological and functional assessments. Outcome assessment was generally appropriate, although variability in MRC grading, EMG/NCS use, functional scores, and follow-up duration limited direct comparison. Overall, the evidence was considered clinically useful but should be interpreted cautiously because residual confounding and heterogeneity may influence reported incidence and recovery outcomes.

Study	Study design and assessment tool	Selection and confounding	Outcome measurement and reporting	Overall risk of bias
Wang et al. (2014) [10]	Retrospective cohort; ROBINS-I	Moderate concern due to retrospective selection and limited postoperative RNP events	Neurological outcomes clinically assessed; EMG/NCS supported assessment; some reporting limitations	Moderate
Schwab et al. (2018) [11]	Retrospective cohort; ROBINS-I	Moderate concern from fracture severity, location, and fixation-related confounding	Motor/sensory outcomes clearly assessed; recovery reported, but heterogeneous clinical presentation	Moderate
Claessen et al. (2015) [12]	Retrospective comparative cohort; ROBINS-I	Serious concern due to heterogeneous population and non-randomized treatment allocation	Neurological recovery assessed clinically; potential variability in outcome ascertainment	Moderate-serious
Van Bergen et al. (2023) [13]	Prospective multicenter cohort; JBI	Low-moderate concern; prospective recruitment reduced selection bias, although postoperative RNP numbers were small	Standardized clinical and functional assessments including DASH and Constant score; prospective follow-up	Moderate
Den Hartog et al. (20230 [14]	Prospective non-randomized comparative cohort; ROBINS-I	Low-moderate concern; residual confounding from selection of plate versus IMN	Clearly defined postoperative RNP and functional outcomes; prospective assessment	Low-moderate
Gunsoy et al. (2024) [15]	Retrospective cohort; ROBINS-I	Moderate-serious concern due to small, selected RNP population and treatment heterogeneity	MRC, DASH, and MEPS provided clinically relevant outcomes; limited sample size	Moderate-serious
Gómez et al. (2025) [16]	Retrospective prognostic cohort; ROBINS-I	Moderate concern related to retrospective design and limited number of complete RNP cases	Serial MRC assessment and long-term functional recovery were reported; relatively comprehensive follow-up	Moderate
Cruz et al. (2025) [17]	Retrospective cohort; ROBINS-I	Moderate concern from confounding by fracture location, morphology, and operative factors	Clinical neurological outcomes assessed; reporting of functional measures was limited	Moderate
Krijnen et al. (2026) [18]	Retrospective prognostic cohort; ROBINS-I	Moderate concern due to selected RNP cohort and retrospective treatment allocation	Recovery defined objectively using MRC criteria with longitudinal follow-up; prognostic outcomes clearly reported	Moderate
Acar et al. (2026) [19]	Retrospective observational cohort; ROBINS-I	Moderate-serious concern from treatment heterogeneity and selection for nerve exploration/reconstruction	Neurological recovery and QuickDASH were reported; retrospective outcome assessment may introduce measurement bias	Moderate-serious

TABLE 3: Risk of bias assessment of included studies

RNP: radial nerve palsy, ROBINS-I: risk of bias in non-randomized studies of interventions, JBI: Joanna Briggs Institute, MRC: Medical Research Council, EMG: electromyography, NCS: nerve conduction study, DASH: Disabilities of the Arm, Shoulder and hand, MEPS: Mayo Elbow Performance Score, IMN: intramedullary nail.

Discussion

The systematic review demonstrates that postoperative RNP remains an important complication of surgical fixation of humeral shaft fractures, although most patients demonstrate neurological recovery. Reported postoperative RNP rates varied from 0.6% to 10.5%, reflecting differences in fracture characteristics and surgical techniques. Wang et al. reported a rate of 4.8%, Schwab et al. 6%, while the prospective HUMMER cohort reported 10.5% after plating versus 0.6% after intramedullary nailing ($p < 0.001$) [10,11,14]. Claessen et al. reported 18 cases of iatrogenic RNP among 259 patients without pre-existing traumatic RNP,

corresponding to an incidence of approximately 6.9% in the population at risk [12]. Fracture location and nerve status also influenced postoperative outcomes. Although distal and middle-distal fractures demonstrated numerically higher RNP rates in the study by Cruz et al., the difference was not statistically significant (p = 0.18) [17]. Van Bergen et al. reported postoperative RNP in 9 of 232 patients, with 8 recovering, while 1 required nerve release and repair for nerve entrapment [13]. These findings indicate that postoperative palsy may result from potentially reversible mechanisms such as traction, compression, or entrapment, emphasizing the importance of early and accurate postoperative neurological assessment. Differences in the definitions of neurological recovery and duration of follow-up limit direct comparison between studies. Early evidence of nerve regeneration does not necessarily indicate restoration of useful wrist and finger extension, and functional improvement does not always imply complete motor recovery. Recovery percentages should therefore be interpreted according to each study's outcome definition, baseline neurological status, and follow-up duration.

Neurological recovery was generally favorable but often prolonged. Gómez et al. reported complete motor recovery in 30/32 patients, with a median M5 recovery time of 36 weeks [16]. Krijnen et al. demonstrated that meaningful recovery may continue beyond 12 months, although the probability decreases with prolonged absence of recovery [18]. Functional improvement was also reported using DASH, Constant-Murley, and QuickDASH measures, supporting the importance of combining objective neurological assessment with patient-reported functional outcomes [13,19]. The limitations were the predominance of retrospective studies, small numbers of postoperative RNP events, heterogeneous surgical techniques, inconsistent neurological definitions, and variable follow-up. These factors limited direct comparison and prevented reliable pooled estimation of several outcomes. Future prospective multicenter studies should use standardized definitions of postoperative RNP, serial MRC assessment, consistent EMG/NCS protocols, validated functional scores, and multivariable analysis of fracture and surgical risk factors. Larger collaborative datasets may improve prediction of neurological recovery and help define appropriate timing for nerve exploration or reconstruction.

Conclusions

Postoperative RNP remains a clinically relevant complication of surgical fixation of humeral shaft fractures. Reported incidence varies across studies and depends on the definition of new postoperative palsy, the population at risk, and the fixation technique. Most patients appear to experience neurological improvement, although recovery may take several months and requires appropriate follow-up.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Disclosures

Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

References

1. Hendrickx LA, Hilgersom NF, Alkaduhimi H, Doornberg JN, van den Bekerom MP: Radial nerve palsy associated with closed humeral shaft fractures: a systematic review of 1758 patients. Arch Orthop Trauma Surg. 2021, 141:561-8. 10.1007/s00402-020-03446-y
2. Shao YC, Harwood P, Grotz MR, Limb D, Giannoudis PV: Radial nerve palsy associated with fractures of the shaft of the humerus: a systematic review. J Bone Joint Surg Br. 2005, 87:1647-52. 10.1302/0301-620X.87B12.16132

3. Hegeman EM, Polmear M, Scanaliato JP, Nesti L, Dunn JC: Incidence and management of radial nerve palsies in humeral shaft fractures: a systematic review. Cureus. 2020, 12:e11490. 10.7759/cureus.11490
4. Van Bergen SH, Mahabier KC, Van Lieshout EM, et al.: Humeral shaft fracture: systematic review of non-operative and operative treatment. Arch Orthop Trauma Surg. 2023, 143:5035-54. 10.1007/s00402-023-04836-8
5. Smolle MA, Bösmüller S, Puchwein P, Ornig M, Leithner A, Seibert FJ: Complications in humeral shaft fractures - non-union, iatrogenic radial nerve palsy, and postoperative infection: a systematic review and meta-analysis. EFORT Open Rev. 2022, 7:95-108. 10.1530/EOR-21-0097
6. Page MJ, McKenzie JE, Bossuyt PM, et al.: The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021, 372:n71. 10.1136/bmj.n71
7. Eriksen MB, Frandsen TF: The impact of patient, intervention, comparison, outcome (PICO) as a search strategy tool on literature search quality: a systematic review. J Med Libr Assoc. 2018, 106:420-31. 10.5195/jmla.2018.345
8. Sterne JA, Hernán MA, Reeves BC, et al.: ROBINS-I: a tool for assessing risk of bias in non-randomised studies of interventions. BMJ. 2016, 355:i4919. 10.1136/bmj.i4919
9. Aromataris E, Fernandez R, Godfrey C: Summarizing systematic reviews: methodological development, conduct and reporting of an Umbrella review approach. Int J Evid Based Healthc. 2015, 13:132-40.
10. Wang X, Zhang P, Zhou Y, Zhu C: Secondary radial nerve palsy after internal fixation of humeral shaft fractures. Eur J Orthop Surg Traumatol. 2014, 24:331-3. 10.1007/s00590-013-1197-y
11. Schwab TR, Stillhard PF, Schibli S, Furrer M, Sommer C: Radial nerve palsy in humeral shaft fractures with internal fixation: analysis of management and outcome. Eur J Trauma Emerg Surg. 2018, 44:235-43. 10.1007/s00068-017-0775-9
12. Claessen FM, Peters RM, Verbeek DO, Helfet DL, Ring D: Factors associated with radial nerve palsy after operative treatment of diaphyseal humeral shaft fractures. J Shoulder Elbow Surg. 2015, 24:e307-11. 10.1016/j.jse.2015.07.012
13. Van Bergen SH, Van Lieshout EM, Verhofstad MH, Den Hartog D: Recovery and functional outcome after radial nerve palsy in adults with a humeral shaft fracture: a multicenter prospective case series. JSES Int. 2023, 7:516-22. 10.1016/j.jseint.2023.02.003
14. Den Hartog D, Mahabier KC, Van Bergen SH, Verhofstad MH, Van Lieshout EM: Functional and clinical outcomes after plate osteosynthesis versus intramedullary nailing of a humeral shaft fracture: the results of the HUMMER multicenter, prospective cohort study. J Bone Joint Surg Am. 2023, 105:1101-11. 10.2106/JBJS.22.00647
15. Gunsoy Z, Sayer G, Dinc M, Soydemir OC, Oguzkaya S: The effect of plate location on radial nerve palsy recovery time associated with humeral shaft fractures. Eur J Trauma Emerg Surg. 2024, 50:2855-60. 10.1007/s00068-024-02524-9
16. Gomez C, Perez A, Breyer JM, Vergara P: Time to recovery of radial nerve palsy after surgically treated humeral shaft fractures. J Hand Surg Am. 2025, 50:1081-7. 10.1016/j.jhsa.2024.11.024
17. Cruz JP, Durtschi M, Chalmers C, et al.: Incidence and outcomes of radial nerve palsy in distal third diaphyseal humerus fractures after surgical fixation. Eur J Orthop Surg Traumatol. 2025, 35:330. 10.1007/s00590-025-04462-7
18. Krijnen NA, Comerci AJ, Head LK, Legerstee IW, de Klerk HH, Chen N, Teunis T: What is the probability of radial nerve recovery after surgical repair of humerus fractures accounting for time since injury?. Clin Orthop Relat Res. 2026, 484:844-53. 10.1097/CORR.0000000000003733
19. Acar A, Girgin AB, Acar AB, Özcan MF, Torun Ö: Radial nerve palsy associated with humeral shaft fractures: incidence, recovery patterns, and functional outcomes in surgically treated patients. Medicina (Kaunas). 2026, 62:1427. 10.3390/medicina62071427