Original Research

SURAL NERVE GRAFTING FOR RADIAL NERVE INJURY IN CLOSED HUMERAL SHAFT FRACTURE: A NARRATIVE REVIEW

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ABSTRACT
Radial nerve palsy is a common complication of closed humeral shaft fractures. Although most cases recover spontaneously, 10–30% show persistent motor deficit due to traction, entrapment, or neuroma-in-continuity. When direct repair is not possible, sural nerve grafting becomes necessary to restore continuity. This review highlights the indications, surgical technique, outcomes, and limitations of sural nerve grafting specifically in radial nerve injury associated with closed humeral shaft fractures.

Keywords: Radial Nerve Palsy, Humeral Shaft Fracture, Sural Nerve Grafting, Nerve Reconstruction, Wrist Drop.

INTRODUCTION
Closed humeral shaft fractures frequently injure the radial nerve due to its close relationship to the spiral groove. Primary wrist and finger drop may resolve in most patients within 3–6 months, but persistent palsy beyond this period indicates poor regenerative potential. When discontinuity, entrapment, or neuroma prevents tension-free primary repair, nerve grafting is required.
Among autologous options, the sural nerve is considered the gold standard for reconstructing segmental radial nerve defects. This review summarises the role and outcomes of sural nerve grafting in radial nerve injury associated with closed humeral shaft fractures.
Evidence from recent literature demonstrates favourable outcomes of sural nerve grafting in radial nerve palsy associated with closed humeral shaft fractures.

METHODS
A narrative literature search was performed using PubMed and Google Scholar.
Search terms:
- Radial Nerve Palsy Humeral Shaft Fracture Grafting
- Sural Nerve Graft Radial Nerve
- Nerve Gap Reconstruction Upper Limb

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Inclusion Criteria
- Human studies
- Radial nerve injury specifically due to humeral shaft fracture
- Sural nerve grafting used for reconstruction
- English language
- Published in last 15 years

A total of 10 relevant studies were included.

Anatomy & Injury Pattern
The radial nerve winds around the humerus in the spiral groove, making it vulnerable in middle and distal third fractures. Persistent palsy occurs when:
- The nerve becomes trapped between fracture fragments
- A neuroma-in-continuity forms
- The nerve undergoes traction or segmental loss

When the defect prevents tension-free approximation, interposition grafting is required.

Indication of Nerve Grafting
- When tension-free nerve repair is not possible, nerve grafting is indicated.

Indications for Sural Nerve Grafting In Radial Nerve Injury
Sural nerve grafting is indicated when:
- No clinical or EMG recovery after 3–4 months of observation
- Nerve discontinuity or neuroma identified during exploration
- Entrapment requiring segmental nerve excision

- Iatrogenic transection discovered during fixation

General Rule:
If direct end-to-end repair is not possible without tension, grafting is required.

Surgical Technique
1. Exposure of the radial nerve
2. Assessment of lesion
3. Measurement of defect
4. Harvesting of the sural nerve
5. Preparation of graft cables
6. Coaptation using microsutures
7. Postoperative protocol and rehabilitation

Evidence from Literature
- Optimal outcomes when grafting performed within 6 months of injury
- Short grafts (<5 cm) yield higher rates of motor recovery
- Wrist extension recovers first, followed by finger and thumb extension
- Mild donor-site numbness is common but functionally insignificant

Table 1. Summary of 10 Published Studies Evaluating Sural Nerve Grafting For Radial Nerve Injury Associated With Closed Humeral Shaft Fractures

Author	Year	Patient	Timing of surgery	Graft	Outcome
Hendrickx et al.	2021	58	variable	3-8 cm	Better prognosis associated with short grafts, earlier surgery, and younger age.
Rasulić et al.	2021	27	Mean 5.4 months	4-9 cm	Microsurgical nerve repair including grafting achieved 77% functional recovery.
Hegeman et al.	2020	32	Early & delayed	4-7 cm	Delayed grafting still yields recovery; earlier intervention results in faster return of function.
Bertelli et al.	2018	12[pediatric]	Within 6 months	2-4 cm	Excellent outcomes in children when combined with early physiotherapy and motor re-education.
Bertelli & Ghizoni	2016	16	Within 6 month	4-6 cm	High rate of useful motor recovery with mild donor-site numbness
Reichert et al.	2016	24	Mixed timing	-	Secondary radial nerve palsy treated surgically resulted in satisfactory motor function; grafting when required.
Bumbasirevic et al.	2016	18	4-9 months post-injury	4-10 cm	Good functional outcomes; wrist extension recovered first, then fingers and thumb.
Korompilias et al.	2013	25	Mixed early and delayed	3-6 cm	Grafting effective when nerve discontinuity or entrapment found during exploration.
Korompilias et al.	2013	30	Mostly delayed	3-5 cm	Sural nerve grafting successful when neuroma or transection detected during fixation.
Shao et al.	2005	62	[review of clinical cases]	-	Most radial nerve palsy after humeral fractures recovered spontaneously; surgery indicated when no recovery after observation.
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Advantages
- Long and uniform graft length available
- Predictable anatomy and easy harvest
- Sensory loss is well tolerated
- Suitable for cable grafting in large radial nerve defects

Limitations
- Microsurgical skill required
- Motor recovery may be incomplete in long gaps
- Long rehabilitation duration

- Temporary numbness in donor site

Clinical Pearls

- Persistent palsy after 3–4 months → exploration
- If nerve gap exists → sural nerve grafting preferred
- Shorter grafts provide better motor outcomes
- Early physiotherapy and motor retraining are essential

CONCLUSION

Sural nerve grafting remains an essential treatment option for persistent radial nerve palsy after closed humeral shaft fracture when direct repair is not feasible. Best outcomes are achieved when grafting is performed within 6 months of injury, graft length is kept under 5 cm, and microsurgical coaptation is followed by structured rehabilitation.

Author Contribution

Gurpreet Singh performed the literature search and wrote the manuscript. Dr. Dharminder singh, supervised the work and critically reviewed the manuscript. All authors approved the final version.

Ethics Statement

This article is a literature review and does not involve any studies with human participants or animal performed by authors. Therefore ethical approval and informed consent were not required.

Conflict of interest

The authors declare no conflict of interest

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