

Shoulder Replacement for Fracture

Shoulder Replacement for Proximal Humerus Fracture – Evidence Behind the Rehabilitation Protocol

Topic scope: The evidence underpinning rehabilitation after **shoulder arthroplasty performed for an acute proximal humerus fracture** – covering **both** the implant options used in this setting: **reverse total shoulder arthroplasty (rTSA) for fracture** and **stemmed hemiarthroplasty for fracture**. The defining feature of both, and the reason this is a slow, protected pathway, is that the **greater and lesser tuberosities are broken free and stitched back around the prosthesis at operation** – they must heal as fractures before the shoulder can be actively moved or loaded. This contrasts with *elective* arthroplasty (for arthritis or cuff arthropathy), where the bone is intact and rehabilitation can move at the pace of soft-tissue healing.

Defining principle of this rehab: Replacement-for-fracture is a PROTECT pathway driven by TUBEROSITY HEALING, not by implant type. At operation the greater tuberosity (with supraspinatus/infraspinatus) and lesser tuberosity (with subscapularis) are reattached around the stem. Until those bone fragments unite – typically the first 6 weeks, confirmed on X-ray – the shoulder is moved passively only and within a restricted arc: forward elevation kept low, external rotation limited (it loads the greater-tuberosity repair), resisted/active internal rotation avoided (it loads the lesser-tuberosity/subscapularis repair), and no reaching behind the back. Active range and strengthening are deferred, not just reduced. This is the opposite of an early-motion pathway such as capsular release (where immediate aggressive motion is the treatment) or calcific excision (early movement below shoulder height from day 1). The whole pace is set by the fractured tuberosities, not the new joint surface.

The operation, and why the tuberosities matter

A displaced three- or four-part proximal humerus fracture in an older patient may be unreconstructable with plate-and-screw fixation, and arthroplasty is then offered. Two implants are used:

- **Hemiarthroplasty (HA)** – replaces the ball (humeral head) only. It relies on the surgeon reconstructing the head–tuberosity–shaft relationship and, critically, on the **tuberosities healing back in anatomical position** so the rotator cuff can pull on them. Where the tuberosities fail to heal, function is poor.
- **Reverse total shoulder arthroplasty (rTSA)** – reverses the ball-and-socket so the **deltoid**, not the rotator cuff, drives elevation. This makes rTSA **less dependent** on tuberosity healing than HA, which is the main reason it has largely supplanted hemiarthroplasty for fracture in the elderly. Tuberosity healing still **improves** the result (it adds rotation), but a workable shoulder is achievable even when the greater tuberosity does not unite.

In **both** operations the surgeon repairs the tuberosities, and in **both** the rehabilitation protects that repair. That shared dependence – not the choice of implant – is why the protocol has one shape for both.

Evidence by theme

1. TUBEROSITY HEALING DRIVES THE FUNCTIONAL RESULT (THE RATIONALE FOR PROTECTION)

This is the best-supported principle in the topic, and the reason rehabilitation protects the repair for ~6 weeks.

- A large **systematic review and meta-analysis of 21 studies (1,616 reverse arthroplasties)** found a pooled greater-tuberosity **non-healing rate of ~32%** (anatomic healing in roughly two-thirds). **Healed** tuberosities had significantly better active abduction, anterior elevation and external rotation, and better functional scores, without any increase in pain – confirming that *attempting and protecting the repair is worthwhile* [meta-analysis, 2025; Schmalzl 2020].
- In the corpus, a dedicated study asked “**can a healed tuberosity improve the functional outcomes?**” after reverse arthroplasty for four-part fracture and answered yes – healing was associated with better rotation and outcome scores. DOI: 10.1016/j.jse.2016.11.034.
- For **hemiarthroplasty**, the dependence is even stronger: reported greater-tuberosity healing rates range widely (~30–91%), and tuberosity malunion/nonunion/migration is the dominant cause of a poor result. This is precisely why HA is now reserved and rTSA preferred in older patients [web review literature].

Strength: MODERATE–STRONG for “healing predicts outcome” (large pooled cohorts/meta-analysis); the link is consistent and direction-of-effect is not in dispute. It is observational, not randomised.

2. HEMIARTHROPLASTY VS REVERSE ARTHROPLASTY FOR FRACTURE

- A corpus **multicentre randomised controlled trial (the SHERPA trial)** found **superior functional outcome with reverse arthroplasty compared with hemiarthroplasty** for displaced three- and four-part fractures in patients 65 and older. DOI: 10.1016/j.jse.2024.05.016.
- An earlier corpus comparative study (JBJS) likewise compared HA and rTSA for elderly proximal humeral fractures. DOI: 10.2106/jbjs.l.01637.
- Reverse-for-fracture does carry a caveat: one corpus study asked whether rTSA **for fracture** does worse than rTSA for **elective** indications, reflecting that the fracture setting (broken tuberosities, frailer patients) is more demanding than an elective replacement – the same reason this rehab runs more slowly than the elective pathway. DOI: 10.1016/j.jse.2020.03.053.

Strength: MODERATE–STRONG (an RCT plus comparative cohorts) that rTSA generally outperforms HA for fracture in the elderly. This is a surgeon’s intra-operative decision, made per patient and per fracture pattern.

3. EARLY VS DELAYED MOTION, AND THE REHABILITATION PROTOCOL ITSELF

This is where the evidence is **thinnest and least standardised** – honestly, the phase timings below are consensus and protocol-derived, not RCT-derived.

- A **JOSPT systematic review of proposed rehabilitation guidelines** after anatomic and reverse arthroplasty found **substantial heterogeneity** between published protocols – sling use ranged from “comfort only” to a full 6 weeks; permitted motion ranged from none to precautionary limits; early external rotation was commonly capped (e.g. to ~30° in the scapular plane) to protect the repair. There is **no single agreed regimen**.
- A corpus **randomised single-blinded trial of early rehabilitation vs immobilisation after reverse arthroplasty** exists (DOI: 10.1016/j.jse.2019.10.005), and the **2025 Neer Award SHORT trial** compared surgeon-directed home therapy with formal outpatient physiotherapy after rTSA (DOI: 10.1016/j.jse.2025.10.005) – but these are largely **elective** rTSA populations, where the tuberosities are not broken. They do **not** licence early active motion in the *fracture* setting, where the repair must be protected first.
- A corpus **network meta-analysis** explicitly examined the *optimal combination* of arthroplasty type, fixation method and **post-operative rehabilitation protocol** for complex proximal humerus fractures (DOI: 10.1016/j.jse.2024.03.040), and a corpus survey found that **trauma and shoulder surgeons differ** in their rehabilitation preferences (DOI: 10.1016/j.jse.2021.12.045) – both confirm that the protocol is an area of genuine, unresolved variation rather than settled science.

Strength: WEAK / CONSENSUS for the specific phase structure and week ranges. The principle “protect the tuberosity repair, defer active motion and load until union” is well grounded; the exact timings are typical, not trial-proven.

Phased post-op timeline (consistent with the patient protocol)

Phase	Window	Sling	Shoulder ROM	Strengthening	What's healing / why
I – Protection	Weeks 0–6	Full-time, including sleep	Passive only , within a safe zone: scapular-plane elevation $\leq 90^\circ$; external rotation to neutral (0°) for ~4 weeks then $\leq 30^\circ$; no internal rotation behind the back; pendulums (fully relaxed). Active elbow/wrist/hand.	None for the shoulder	Tuberosity fragments uniting onto bone + prosthesis; ER loads the greater-tuberosity repair, resisted IR loads the lesser-tuberosity (subscapularis) repair. In rTSA this window also protects against early dislocation.
II – Restoring movement	Weeks 6–12	Wean after the 6-week X-ray review	Progress passive \rightarrow active-assisted \rightarrow active; ease the rotation limits as healing is confirmed	Gentle sub-maximal isometrics (deltoid, periscapular) late in phase; resisted IR only once cleared	Tuberosities consolidating; lifting still limited to ~a cup of coffee; no weight-bearing through the hands
III – Strengthening	Weeks 12–24	Off	Maintain/progress active range in all planes	Banded \rightarrow light weights; deltoid + periscapular first, rotator cuff as the healed tuberosities allow	Tuberosity union usually well advanced and confirmed at review before loading begins
IV – Return to activity	6 months onwards	Off	Functional range for daily demands	Progressive, guided by control not the calendar; lifting kept moderate long-term	Strength/movement keep improving for 12–24 months ; full uninjured-shoulder range is not expected

The pacing is **gated on two things together at each step: enough time, AND X-rays showing the tuberosities healing**, confirmed at review with Dr Hirpara. Approximate functional milestones (subject to healing): driving ~6–12 weeks (never in the sling); breaststroke swimming ~4 months; nothing heavier than a cup of coffee until ~12 weeks; heavy lifting avoided for 6 months.

Key controversies / evidence quality

1. **Implant choice (HA vs reverse).** An RCT and comparative cohorts favour **reverse** over hemiarthroplasty for displaced fractures in older patients, chiefly because rTSA is **less hostage to tuberosity healing**. This is a per-patient surgical decision – and either way the rehabilitation protects the tuberosity repair. *Moderate–strong.*
2. **Does the tuberosity actually need to heal?** For **hemiarthroplasty**, effectively yes – non-union/malunion is the main failure mode. For **reverse**, healing is **beneficial but not essential** (the deltoid drives elevation), though healed tuberosities add rotation and reduce complications. The protection strategy is justified for both because *attempting* healing is worthwhile and forced early motion can disrupt it. *Moderate.*
3. **Early vs delayed motion / the protocol itself.** The single weakest area. Published protocols vary widely (JOSPT review), the trials that test *early* motion are mostly in *elective* reverse populations, and surgeons genuinely disagree on the optimum. The conservative, tuberosity-led timeline used here reflects the fracture-specific protocols and the healing biology rather than a defining RCT. *Weak / consensus.*

Evidence-strength flags (summary)

- **MODERATE–STRONG:** tuberosity healing predicts better range/function after reverse arthroplasty for fracture (21-study meta-analysis, 1,616 cases; ~32% non-healing); reverse > hemiarthroplasty for elderly displaced fractures (SHeRPA RCT + comparative cohorts).
- **MODERATE:** hemiarthroplasty outcome is strongly tuberosity-dependent (healing ~30–91%; malunion the dominant failure mode); reverse-for-fracture more demanding than elective reverse.
- **WEAK / CONSENSUS:** the specific **phased rehabilitation protocol** and its week ranges – published guidelines are heterogeneous (JOSPT review); early-motion trials are mostly elective populations; the tuberosity-protective timeline is derived from fracture-specific protocols and healing biology, not a defining rehab RCT.

Citations

RAG CORPUS (180,000+ ORTHOPAEDIC ARTICLES) – REAL DOIS, RETURNED BY SEARCH

- Reverse shoulder arthroplasty for four-part proximal humerus fracture in elderly patients: can a healed tuberosity improve the functional outcomes? *J Shoulder Elbow Surg.* DOI: 10.1016/j.jse.2016.11.034
- Superior functional outcome following reverse shoulder arthroplasty compared to hemiarthroplasty for displaced three- and four-part fractures in patients 65 and older – the SHeRPA randomized controlled trial. *J Shoulder Elbow Surg.* 2024. DOI: 10.1016/j.jse.2024.05.016

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- 2025 Neer Award Part 1: The SHORT trial – surgeon-directed home therapy vs. outpatient rehabilitation after reverse total shoulder arthroplasty. *J Shoulder Elbow Surg*. 2025. DOI: 10.1016/j.jse.2025.10.005
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LITERATURE (URLS)

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- Schmalzl J, et al. Tuberosity healing improves functional outcome following primary reverse shoulder arthroplasty for proximal humeral fractures with a 135° prosthesis. *Eur J Orthop Surg Traumatol*. 2020. <https://pubmed.ncbi.nlm.nih.gov/32162048/>
- Tuberosity healing after reverse shoulder arthroplasty for proximal humerus fractures: is there clinical improvement? *PubMed*. <https://pubmed.ncbi.nlm.nih.gov/33364654/>
- Prosthesis designs and tuberosity fixation techniques in reverse total shoulder arthroplasty: influence on tuberosity healing in proximal humerus fractures. *PMC*. <https://pmc.ncbi.nlm.nih.gov/articles/PMC8468418/>
- A Systematic Review of Proposed Rehabilitation Guidelines Following Anatomic and Reverse Shoulder Arthroplasty. *JOSPT* 2019. <https://www.jospt.org/doi/10.2519/jospt.2019.8616>

PUBLISHED REHAB PROTOCOLS (PATIENT-GUIDANCE – BASIS FOR THE PHASE STRUCTURE)

- Frantz T. Proximal Humerus Fracture Rehabilitation Protocol (reverse shoulder arthroplasty). Texas Health Orthopedic Specialists. <https://www.frantzorthopedics.com/pdf/proximal-humerus-fracture-reverse-shoulder-arthroplasty-updnew.pdf>
- North Tees and Hartlepool NHS Foundation Trust. Shoulder Hemi-Arthroplasty (trauma) – post-operative protocol. Reviewed April 2023. <https://www.nth.nhs.uk/resources/shoulder-hemi-arthroplasty-trauma/>

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