CQ HAND + UPPER LIMB
SPECIALIST ORTHOPAEDIC SURGEON

EVIDENCE SUMMARY

Proximal Humerus Fracture

title: “Proximal Humerus Fracture” slug: proximal-humerus-fracture region: shoulder audience: patient mesh_terms: [“Shoulder Fractures”, “Bone Plates”, “Humerus”, “Humeral Fractures”, “Fracture Fixation, Intramedullary”, “Fracture Fixation”, “Bone Nails”, “Fracture Healing”] article_count: 1090 model_used: Qwen3.6-35B-A3B-Q8_0.gguf generated_at: ‘2026-06-16T19:38:31+00:00’ key_articles: - title: “Management of proximal humerus fractures in adults” ref_num: 1 evidence_tier: paper evidence_level: 4 doi: 10.5312/wjo.v5.i5.685 year: 2014 - title: “Evaluation and Management of Proximal Humerus Fractures” ref_num: 2 evidence_tier: paper evidence_level: 4 doi: 10.1155/2012/861598 year: 2012 - title: “How age and gender influence proximal humerus fracture management in patients older than fifty years” ref_num: 3 evidence_tier: paper evidence_level: 3 doi: 10.1016/j.jseint.2021.11.007 year: 2022 - title: “Trending a decade of proximal humerus fracture management in older adults” ref_num: 4 evidence_tier: paper evidence_level: 4 doi: 10.1016/j.jseint.2021.08.006 year: 2022 - title: “Long-term outcome of a proximal humerus fracture predicted after 1 year” ref_num: 6 evidence_tier: paper evidence_level: 3 doi: 10.1080/17453670510041295 year: 2005 - title: “Consensus statement on the treatment of proximal humerus fractures: a Delphi approach by the Neer Circle of the American Shoulder and Elbow Surgeons” ref_num: 7 evidence_tier: paper evidence_level: 5 doi: 10.1016/j.jse.2024.12.005 year: 2025 - title: “Low arthroplasty survival after treatment for proximal humerus fracture sequelae: 3,245 shoulder replacements from the Nordic Arthroplasty Register Association” ref_num: 9 evidence_tier: paper evidence_level: 3 doi: 10.1080/17453674.2020.1793548 year: 2020 - title: “Evaluation and Management of Pediatric Proximal Humerus Fractures” ref_num: 12 evidence_tier: paper evidence_level: 5 doi: 10.5435/jaaos-d-14-00033 year: 2015 - title: “Proximal humerus fracture management and outcomes are distinctly different for individuals 60 years of age or younger: a systematic review” ref_num: 13 evidence_tier: paper evidence_level: 4 doi: 10.1016/j.xrrt.2023.01.002 year: 2023 - title: “Morbidity and mortality of fragility proximal humerus fractures: a retrospective cohort study of patients presenting to a level one trauma center” ref_num: 14 evidence_tier: paper evidence_level: 3 doi: 10.1016/j.jse.2022.03.006 year: 2022 - title: “Analyzing outcomes after proximal humerus fractures in patients <65 years: a systematic review and meta-analysis” ref_num: 15 evidence_tier: paper evidence_level: 1 doi: 10.1016/j.xrrt.2021.04.014 year: 2021 - title: “Randomized controlled trials investigating proximal humerus fractures lack consensus in inclusion criteria” ref_num: 16 evidence_tier: paper evidence_level: 2 doi: 10.1016/j.xrrt.2025.07.023 year: 2025 - title: “A comprehensive update on current fixation options for two-part proximal humerus fractures” ref_num: 17 evidence_tier: paper evidence_level: 3 doi: 10.1016/j.injury.2013.08.024 year: 2014 - title: “Computed tomography improves the diagnostic accuracy but not the interobserver reliability of the Boileau classification of proximal humerus fracture sequelae” ref_num: 18 evidence_tier: paper evidence_level: 2 doi:

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10.1177/17585732221150785 year: 2023 - title: “Epidemiology of proximal humerus fractures managed in a trauma center” ref_num: 19 evidence_tier: paper evidence_level: 2 doi: 10.1016/j.otsr.2012.05.013 year: 2012 - title: “No change in outcome ten years following locking plate repair of displaced proximal humerus fractures” ref_num: 20 evidence_tier: paper evidence_level: 3 doi: 10.1007/s00590-021-03099-6 year: 2021 - title: “Three or four parts complex proximal humerus fractures: Hemiarthroplasty versus reverse prosthesis: A comparative study of 40 cases” ref_num: 21 evidence_tier: paper evidence_level: 4 doi: 10.1016/j.otsr.2008.09.002 year: 2009 - title: “Rehabilitation progress following reverse total shoulder replacement and internal fixation for geriatric three and four-part proximal humerus fractures – a propensity score matched comparison” ref_num: 22 evidence_tier: paper evidence_level: 3 doi: 10.1186/s12891-023-06669-3 year: 2023 - title: “Results of 131 consecutive operated patients with a displaced proximal humerus fracture: an analysis with more than two years follow-up” ref_num: 23 evidence_tier: paper evidence_level: 4 doi: 10.1007/s00590-010-0655-z year: 2010 - title: “Reducing resource utilization during non-operative treatment of pediatric proximal humerus fractures” ref_num: 24 evidence_tier: paper doi: 10.1016/j.otsr.2016.09.022 year: 2017 - title: “CORR Insights®: Short-term Complications for Proximal Humerus Fracture Surgery Have Decreased: An Analysis of the National Surgical Quality Improvement Program Database” ref_num: 25 evidence_tier: paper evidence_level: 5 doi: 10.1097/corr.0000000000002430 year: 2022 - title: “Outcomes after percutaneous reduction and fixation of proximal humeral fractures” ref_num: 26 evidence_tier: paper evidence_level: 4 doi: 10.1016/j.jse.2006.09.006 year: 2007 - title: “Proximal Humeral Fracture Treatment in Adults” ref_num: 27 evidence_tier: paper evidence_level: 5 doi: 10.2106/jbjs.l.01293 year: 2014 - title: “Automated detection and classification of the proximal humerus fracture by using deep learning algorithm” ref_num: 28 evidence_tier: paper evidence_level: 4 doi: 10.1080/17453674.2018.1453714 year: 2018 - title: “Morbidity and mortality of surgically treated pathologic humerus fractures compared to native humerus fractures” ref_num: 29 evidence_tier: paper evidence_level: 3 doi: 10.1016/j.jse.2020.10.024 year: 2021 - title: “Reverse Shoulder Arthroplasty for Proximal Humerus Fracture” ref_num: 30 evidence_tier: paper evidence_level: 4 doi: 10.1007/s12178-020-09597-0 year: 2020 - title: “Midterm outcome and complications after minimally invasive treatment of displaced proximal humeral fractures in patients younger than 70 years using the Humerusblock” ref_num: 31 evidence_tier: paper evidence_level: 4 doi: 10.1016/j.injury.2015.05.017 year: 2015 - title: “Classification and Imaging of Proximal Humerus Fractures” ref_num: 32 evidence_tier: paper evidence_level: 5 doi: 10.1016/j.ocl.2008.05.002 year: 2008 - title: “Biomechanical Assessment Of Inferior Tuberosity Placement During Hemiarthroplasty For 4-Part Proximal Humerus Fractures G.” ref_num: 33 evidence_tier: paper evidence_level: 5 doi: 10.1016/j.jse.2007.02.110 year: 2007 - title: “Cost-Minimization Analysis and Treatment Trends of Surgical and Nonsurgical Treatment of Proximal Humerus Fractures” ref_num: 35 evidence_tier: paper evidence_level: 4 doi: 10.1016/j.jhsa.2020.03.022 year: 2020 - title: “Does objective shoulder impairment explain patient-reported functional outcome? A study of proximal humerus fractures” ref_num: 36 evidence_tier: paper evidence_level: 3 doi: 10.1016/j.jse.2010.06.005 year: 2011 - title: “CORR Insights®: What Factors Are Associated With Poor Shoulder Function and Serious Complications After Internal Fixation of Three-part and Four-part Proximal Humerus Fracture-dislocations?” ref_num: 37 evidence_tier: paper evidence_level: 5 doi: 10.1097/corr.0000000000002242 year: 2022 - title: “New trends in fixation of proximal humeral fractures: A review” ref_num: 38 evidence_tier: paper evidence_level: 4 doi: 10.1016/j.injury.2010.10.016 year: 2011 - title: “Operative versus non-operative treatment for 2-part proximal humerus fracture: A multicenter randomized controlled trial” ref_num: 39 evidence_tier: paper evidence_level: 1 doi: 10.1371/journal.pmed.1002855 year: 2019 - title: “Biomechanical Assessment Of Inferior Tuberosity Placement During Hemiarthroplasty For 4-Part

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evidence_tier: paper evidence_level: 3 doi: 10.1177/17585732231190038 year: 2023 - title: “Reverse shoulder arthroplasty for proximal humerus fractures: Is the glenoid implant problematic?” ref_num: 74 evidence_tier: paper evidence_level: 4 doi: 10.1016/j.otsr.2018.06.008 year: 2018 - title: “ICD-10 diagnosis codes in electronic health records do not adequately capture fracture complexity for proximal humerus fractures” ref_num: 75 evidence_tier: paper evidence_level: 3 doi: 10.1016/j.jse.2023.08.022 year: 2024 - title: “Detection, classification, and characterization of proximal humerus fractures on plain radiographs” ref_num: 76 evidence_tier: paper evidence_level: 3 doi: 10.1302/0301-620x.106b11.bjj-2024-0264.r1 year: 2024 - title: “CORR Insights®: 3D-printed Handheld Models Do Not Improve Recognition of Specific Characteristics and Patterns of Three-part and Four-part Proximal Humerus Fractures” ref_num: 79 evidence_tier: paper evidence_level: 5 doi: 10.1097/corr.0000000000002017 year: 2021 - title: “Shoulder dislocation combined with proximal humerus fracture in children” ref_num: 83 evidence_tier: paper evidence_level: 5 doi: 10.1097/md.0000000000008977 year: 2017 - title: “Delays beyond 5 days to surgery does not affect outcome following plate and screw fixation of proximal humerus fractures” ref_num: 84 evidence_tier: paper evidence_level: 3 doi: 10.1016/j.jse.2025.02.019 year: 2025 synthesis_version: “v2” verifier_status: skipped

Overview

- Non-operative management is associated with good outcomes in the majority of proximal humerus fractures in adults [1].
- Most older adults who sustain proximal humerus fractures continue to receive nonoperative treatment [4].
- Most one-part proximal humerus fractures are amenable to non-operative treatment with positive outcomes reported in the vast majority of cases [8].
- The available literature does not demonstrate a clear clinical benefit of operative treatment over nonoperative management of proximal humeral fractures in adult patients younger than 65 years [15].
- Both age and gender have an association with the definitive treatment patients received for proximal humerus fractures over the last decade [3].
- Most pediatric patients with proximal humerus fractures have favorable results, and complications are infrequent [12].
- Patients with pathologic humerus fractures had significantly higher complication rates compared with native humerus fractures after surgical treatment [29].
- Guidelines and treatment algorithms for native humerus fractures may not be generalizable for those of pathologic origin [29].
- The selection of reverse total shoulder arthroplasty (RTSA) over other surgical options is a current, reasonable, and safe option to treat proximal humerus fractures, particularly in those with higher Neer grades and/or in older patients [25].
- Patients with a proximal humerus fracture undergoing reverse total shoulder arthroplasty have significantly worse perioperative outcomes, including higher rates of complications, longer hospital stays, and higher costs, compared to patients with other indications [67].

- Prospective clinical trials with longer-term follow-up are required for definitive assessment of the ideal fixation construct for surgical management of two-part proximal humerus fractures [17].
- Besides age, most randomized controlled trials on surgical management of proximal humerus fractures do not include patient-specific variables within their inclusion and exclusion criteria [16].

Anatomy & Pathophysiology

- Inferior tuberosity displacement after prosthetic reconstruction of shoulder fractures is associated with diminished functional results [33].
- Inferior tuberosity positioning after hemiarthroplasty for proximal humerus fractures is associated with diminished function [40].
- Range of motion and strength thresholds can identify subjects with normal shoulder function [36].
- Shoulder flexion, extension, and abduction are only moderately correlated with patient-reported outcome measures (PROMs) [57].
- Holistic assessment of outcomes requires both subjective and objective outcomes [57].
- The changed position of the humeral head on the coronal plane does not affect final functional results in conservatively treated displaced proximal humerus fractures in the elderly [54].
- Bone quality significantly impacts implant anchorage in osteosynthesis for proximal humerus fractures [58].
- Positioning the arm in abduction and internal rotation may help mitigate deforming muscular forces in proximal humerus fractures [46].
- Rotator cuff tears are a detrimental factor and a major cause of painful shoulders in proximal humeral fractures with minimal displacement treated conservatively [63].
- The double plate strategy can increase the stability of the medial column of the proximal humerus and enhance the overall biomechanical property of the repaired proximal humerus [64].
- Reverse shoulder arthroplasty could be considered primary treatment for proximal humerus fractures, especially when optimal range of motion is of great importance to the patient [72].
- Glenoid loosening and severe scapular notching in reverse shoulder arthroplasty for proximal humerus fractures are related to poor positioning and/or incorrect orientation of the glenosphere [74].

Classification

- Proximal humerus fractures are osteoporotic injuries with increasing incidence due to aging populations [5].
- Accurate clinical evaluation, imaging, and classification are paramount for informed treatment decisions [5].

- Evaluation of classification systems for fractures of the proximal humerus with plain radiographs has yielded low interobserver reliability [32].
- The Mayo-FJD classification system for proximal humerus fractures allows high intraobserver and interobserver agreement using both radiographs and computed tomography [45].
- The use of artificial intelligence can accurately detect and classify proximal humerus fractures on plain shoulder AP radiographs [28].
- Morphologic classification of proximal humerus fractures as the sole basis for treatment algorithms and surgical success should be scrutinized [50].
- Current diagnosis coding practices (ICD-10) do not adequately capture the fracture complexity needed to conduct subgroup analysis for proximal humerus fractures [75].
- There is clear evidence of specific characteristics which differentiate proximal third humeral shaft fractures from those of midshaft and distal third [69].

Clinical Presentation

- Proximal humerus fractures are osteoporotic injuries with increasing incidence due to aging populations [5].
- Proximal humerus fractures are now typically osteoporotic fractures in women over 70, with prevalence increasing due to an aging population in poor general condition [19].
- There is a substantial mortality in patients with a proximal humerus fracture [6].
- Mortality at 1 year for fragility proximal humerus fractures is universally high regardless of risk factors [14].
- Surviving patients frequently have persistent symptoms that can be predicted as early as after 1 year [6].
- Complications associated with proximal humerus fractures are varied and can be categorized as occurring at the time of initial injury, during operative management, or as delayed sequelae [11].
- Most pediatric patients with proximal humerus fractures have favorable results, and complications are infrequent [12].
- Treatment algorithms and outcomes following proximal humerus fractures in patients less than or equal to 60 years of age are distinctly different from that of a more elderly population [13].
- Both age and gender have an association with the definitive treatment patients received for proximal humerus fractures over the last decade [3].
- Surgical treatment of proximal humerus fractures remains far from straightforward, with unpredictable outcomes where factors associated with poor results include being a woman, four-part fracture dislocation, and absence of metaphyseal head extension [37].
- Computed tomography improves the diagnostic accuracy but not the interobserver reliability of the Boileau classification of proximal humerus fracture sequelae [18].
- Computed tomography scan was more specific than radiographs in the assessment of proximal humerus fracture sequelae [18].

Investigations

- Proximal humerus fractures are osteoporotic injuries with increasing incidence due to aging populations [5].
- Accurate clinical evaluation, imaging, and classification are paramount for informed treatment decisions in proximal humerus fractures [5].
- Computed tomography improves the diagnostic accuracy of the Boileau classification of proximal humerus fracture sequelae [18].
- Computed tomography does not improve the interobserver reliability of the Boileau classification of proximal humerus fracture sequelae [18].
- Computed tomography scan is more specific than radiographs in the assessment of proximal humerus fracture sequelae [18].
- Artificial intelligence can accurately detect and classify proximal humerus fractures on plain shoulder AP radiographs [28].
- Convolutional neural networks proficiently rule out proximal humerus fractures on plain radiographs [76].
- The routine use of 3D-printed models may not be beneficial for classifying proximal humeral fracture patterns beyond the information gained from currently available imaging modalities [79].
- The routine use of 3D-printed models should be avoided as the sole determinant for recommending surgical intervention in proximal humeral fractures [79].
- In children with shoulder dislocation combined with proximal humerus fracture, bilateral anteroposterior shoulders x-ray is suggested routinely to confirm shoulder location in addition to palpation and anteroposterior and lateral humeral x-ray [83].

Treatment

NON-OPERATIVE MANAGEMENT

- Non-operative management is associated with good outcomes in the majority of proximal humerus fractures in adults [1].
- In the vast majority of cases, proximal humerus fractures may be treated nonoperatively [2].
- Over the past decade, most older adults who sustain proximal humerus fractures continue to receive nonoperative treatment [4].
- Most one-part proximal humerus fractures are amenable to non-operative treatment with positive outcomes reported in the vast majority of cases [8].
- Non-operative treatment of proximal humerus fractures seldom results in displacement that warrants operative intervention [24].
- There is little utility to the routine use of postoperative radiographs in follow-up of pediatric proximal humerus fractures [24].

- Proximal humerus fractures in children have tremendous potential for remodeling, making non-operative management the treatment of choice for most fractures [56].
- Most proximal humeral fractures in elderly patients can be treated nonoperatively with good functional outcomes [27].
- A majority of patients with proximal humeral fractures underwent non-operative treatment [41].
- Nonsurgical management of proximal humerus fractures decreased during the study period [35].
- Nonsurgical treatment should have a more prominent role in the treatment of proximal humeral fractures [48].
- Nonsurgical treatment provides better midterm outcomes compared to locking plate fixation for proximal humeral fractures [48].
- There is no significant difference in clinical outcomes at 2 years between surgery and non-operative treatment in patients 60 years of age or older with displaced 2-part fractures of the proximal humerus [39].
- The available literature does not demonstrate a clear clinical benefit of operative treatment over nonoperative management of proximal humeral fractures in adult patients younger than 65 years [15].
- Evidence-based recommendations to guide treatment of proximal humerus fractures are lacking, and no good evidence exists whether surgery is clearly superior to nonoperative treatment [65].

OPERATIVE MANAGEMENT

- Treatment algorithms and outcomes following proximal humerus fractures in patients less than or equal to 60 years of age are distinctly different from that of a more elderly population [13].
- Consensus when managing proximal humerus fractures is limited to specific scenarios, whereas lack of consensus still exists in others [7].
- Most RCTs on surgical management of proximal humerus fractures do not include patient-specific variables within their inclusion and exclusion criteria [16].
- Hemiarthroplasty and reverse prosthesis are indicated for complex proximal humerus fractures in patients no younger than 70 years of age [21].
- Reverse total shoulder replacement is a promising treatment for geriatrics with three- and four-part proximal humerus fractures aiming for a better long-term functional outcome [22].
- The selection of RTSA over other surgical options is a current, reasonable, and safe option to treat proximal humerus fractures, particularly in those with higher Neer grades and/or in older patients [25].
- Percutaneous treatment of selected proximal humeral fractures results in predictable union and good clinical results with a low rate of complications [26].
- No single fixation method is a panacea for proximal humeral fractures; choice of implant and method should be selected according to individual patient and fracture pattern characteristics based on clearly defined indications and contraindications [38].
- Minimally invasive plate osteosynthesis (MIPO) with PHILOS plate is a safe and effective option for the treatment of proximal humerus fractures, with good functional recovery and fewer complications, which are typically technique dependent [49].

- There are no significant differences in clinical outcomes or complication rates between standard components and fracture-specific components in reverse shoulder arthroplasty (RSA) for proximal humerus fractures [51].

Complications

- Proximal humerus fractures are associated with substantial mortality [6].
- Mortality at 1 year for fragility proximal humerus fractures is universally high regardless of risk factors [14].
- Surviving patients with proximal humerus fractures frequently have persistent symptoms that can be predicted as early as after 1 year [6].
- Complications associated with proximal humerus fractures are varied and can be categorized as occurring at the time of initial injury, during operative management, or as delayed sequelae [11].
- Low arthroplasty survival is observed after treatment for proximal humerus fracture sequelae [9].
- Patients with pathologic humerus fractures have significantly higher complication rates compared with native humerus fractures after surgical treatment [29].
- Guidelines and treatment algorithms for native humerus fractures may not be generalizable for those of pathologic origin [29].
- Predictive models using machine learning techniques demonstrate favorable discrimination and satisfactory-to-excellent performance in forecasting prolonged length of stay and serious adverse complications occurring within 30 days of surgical intervention for proximal humerus fracture [59].
- Most pediatric patients with proximal humerus fractures have favorable results, and complications are infrequent [12].

Recovery

- Both age and gender are associated with the definitive treatment received for proximal humerus fractures in patients older than fifty years [3].
- Most older adults who sustain proximal humerus fractures continue to receive nonoperative treatment [4].
- Treatment algorithms and outcomes for proximal humerus fractures in patients aged 60 years or younger are distinctly different from those in a more elderly population [13].
- Most proximal humeral fractures in elderly patients can be treated nonoperatively with good functional outcomes [27].
- Long-term treatment with reverse shoulder arthroplasty (RSA) for displaced 3- or 4-part proximal humerus fractures provides better functional outcomes compared to nonoperative treatment, a difference attributed to the deterioration of functional outcomes of the nonoperative treatment over time [44].
- There is substantial mortality in patients with a proximal humerus fracture, and surviving patients frequently have persistent symptoms that can be predicted as early as after 1 year [6].

- Mortality at 1 year for fragility proximal humerus fractures is universally high regardless of risk factors [14].
- Complications associated with proximal humerus fractures are varied and can be categorized as occurring at the time of initial injury, during operative management, or as delayed sequelae [11].
- Low arthroplasty survival is observed after treatment for proximal humerus fracture sequelae [9].
- Prospective clinical trials with longer-term follow-up are required for definitive assessment of the ideal fixation construct for surgical management of two-part proximal humerus fractures [17].
- After one year, long-term follow-up of fixed proximal humerus fractures may be unnecessary for those without symptoms [20].
- Reverse shoulder arthroplasty is used for the treatment of complex, displaced proximal humerus fractures in older individuals (≥ 65 years old) [30].
- It is a promising treatment for geriatrics with three- and four-part proximal humerus fractures aiming for a better long-term functional outcome [22].
- The locking plate provides satisfactory functional outcomes after a mid-term follow-up in patients with displaced proximal humerus fractures [23].
- ORIF of nonosteoporotic proximal humeral fractures with locking plates led to favorable functional and radiologic outcomes at a minimum of 10 years of follow-up [52].
- Percutaneous treatment of selected proximal humeral fractures results in predictable union and good clinical results with a low rate of complications [26].
- Minimally invasive treatment of displaced proximal humeral fractures in patients younger than 70 years using the Humerusblock yields good midterm clinical and radiological results [31].
- Timing of surgery does not impact outcomes of patients who underwent ORIF for proximal humerus fractures, with delays beyond 5 days not affecting outcome [84].

Key Evidence

- [L4] Non-operative management is associated with good outcomes in the majority of proximal humerus fractures in adults. (10.5312/wjo.v5.i5.685)
- [L4] In the vast majority of cases, proximal humerus fractures may be treated nonoperatively. (10.1155/2012/861598)
- [L3] Both age and gender have an association with the definitive treatment patients received for proximal humerus fractures over the last decade. (10.1016/j.jseint.2021.11.007)
- [L4] Over the past decade, most older adults who sustain proximal humerus fractures continue to receive nonoperative treatment. (10.1016/j.jseint.2021.08.006)
- [L3] Our results suggest that there is a substantial mortality in patients with a proximal humerus fracture, as we have previously reported, and that surviving patients frequently have persistent symptoms that can be predicted as early as after 1 year. (10.1080/17453670510041295)

- [L5] Consensus when managing proximal humerus fractures is limited to specific scenarios, whereas lack of consensus still exists in others. (10.1016/j.jse.2024.12.005)
- [L3] These results are pertinent when deciding on the treatment of proximal humerus fracture sequelae. (10.1080/17453674.2020.1793548)
- [L5] Most pediatric patients with proximal humerus fractures have favorable results, and complications are infrequent. (10.5435/jaaos-d-14-00033)
- [L4] Treatment algorithms and outcomes following proximal humerus fractures in patients less than or equal to 60 years of age are distinctly different from that of a more elderly population. (10.1016/j.xrrt.2023.01.002)
- [L3] Mortality at 1 year for fragility proximal humerus fractures is universally high regardless of risk factors. (10.1016/j.jse.2022.03.006)
- [L1] The available literature does not demonstrate a clear clinical benefit of operative treatment over nonoperative management of proximal humeral fractures in adult patients younger than 65 years. (10.1016/j.xrrt.2021.04.014)
- [L2] Besides age, most RCTs on surgical management of proximal humerus fractures do not include patient-specific variables within their inclusion and exclusion criteria. (10.1016/j.xrrt.2025.07.023)
- [L3] However, prospective clinical trials with longer-term follow-up are required for definitive assessment of the ideal fixation construct for surgical management of two-part proximal humerus fractures. (10.1016/j.injury.2013.08.024)
- [L2] Computed tomography scan was more specific than radiographs in the assessment of proximal humerus fracture sequelae. (10.1177/17585732221150785)
- [L2] Proximal humerus fractures are now typically osteoporotic fractures in women over 70, with prevalence increasing due to an aging population in poor general condition. (10.1016/j.otsr.2012.05.013)
- [L3] After one-year, long-term follow-up of fixed proximal humerus fractures may be unnecessary for those without symptoms. (10.1007/s00590-021-03099-6)
- [L4] They are indicated for complex proximal humerus fractures in patients no younger than 70 years of age. (10.1016/j.otsr.2008.09.002)
- [L3] It is a promising treatment for geriatrics with three- and four-part proximal humerus fractures aiming for a better long-term functional outcome. (10.1186/s12891-023-06669-3)
- [L4] The locking plate provides satisfactory functional outcomes after a mid-term follow-up in patients with displaced proximal humerus fractures. (10.1007/s00590-010-0655-z)
- [Paper] Non-operative treatment of proximal humerus fractures seldom results in displacement that warrants operative intervention, and there is little utility to the routine use of postoperative radiographs in follow-up of these patients. (10.1016/j.otsr.2016.09.022)
- [L5] The selection of RTSA over other surgical options is a current, reasonable, and safe option to treat proximal humerus fractures, particularly in those with higher Neer grades and/or in older patients. (10.1097/corr.0000000000002430)

- [L4] Percutaneous treatment of selected proximal humeral fractures results in predictable union and good clinical results with a low rate of complications. (10.1016/j.jse.2006.09.006)
- [L5] Most proximal humeral fractures in elderly patients can be treated nonoperatively with good functional outcomes. (10.2106/jbjs.l.01293)
- [L4] The use of artificial intelligence can accurately detect and classify proximal humerus fractures on plain shoulder AP radiographs. (10.1080/17453674.2018.1453714)
- [L3] After surgical treatment, patients with pathologic humerus fractures had significantly higher complication rates compared with native humerus fractures, suggesting that guidelines and treatment algorithms for native humerus fractures may not be generalizable for those of pathologic origin. (10.1016/j.jse.2020.10.024)
- [L4] We report current and historical treatments, outcomes, and principles in reverse shoulder arthroplasty for treatment of complex, displaced proximal humerus fractures in older individuals (≥ 65 years old). (10.1007/s12178-020-09597-0)
- [L4] Minimally invasive treatment of displaced proximal humeral fractures in patients younger than 70 years using the Humerusblock yields good midterm clinical and radiological results. (10.1016/j.injury.2015.05.017)
- [L5] Evaluation of the classification systems for fractures of the proximal humerus with plain radiographs has yielded low interobserver reliability. (10.1016/j.ocl.2008.05.002)
- [L5] These biomechanical observations may explain diminished functional results observed in patients treated with inferior tuberosity displacement after prosthetic reconstruction of shoulder fractures. (10.1016/j.jse.2007.02.110)
- [L4] Nonsurgical management of proximal humerus fractures decreased during the study period. (10.1016/j.jhsa.2020.03.022)
- [L3] Range of motion and strength thresholds can identify subjects with normal shoulder function. (10.1016/j.jse.2010.06.005)
- [L5] Surgical treatment of proximal humerus fractures remains far from straightforward, with unpredictable outcomes where factors associated with poor results include being a woman, four-part fracture dislocation, and absence of metaphyseal head extension. (10.1097/corr.0000000000002242)
- [L4] No single fixation method is a panacea for proximal humeral fractures; choice of implant and method should be selected according to individual patient and fracture pattern characteristics based on clearly defined indications and contraindications. (10.1016/j.injury.2010.10.016)
- [L1] This trial found no significant difference in clinical outcomes at 2 years between surgery and non-operative treatment in patients 60 years of age or older with displaced 2-part fractures of the proximal humerus. (10.1371/journal.pmed.1002855)
- [Abstract] These biomechanical changes may explain diminished function in patients with inferior tuberosity positioning after hemiarthroplasty for proximal humerus fractures. (10.1016/j.jse.2007.02.027)
- [L3] A majority of patients with proximal humeral fractures underwent non-operative treatment. (10.1186/s12891-019-2812-9)

- [L1] Long-term treatment with RSA for displaced 3- or 4-part proximal humerus fractures provides better functional outcomes compared to nonoperative treatment, a difference attributed to the deterioration of functional outcomes of the nonoperative treatment over time. (10.1016/j.jse.2024.09.032)
- [L4] The Mayo-FJD classification system for proximal humerus fractures seems to allow high intraobserver and interobserver agreement using both radiographs and computed tomography. (10.1016/j.jse.2023.02.035)
- [L5] These findings suggest that positioning the arm in abduction and internal rotation may help mitigate deforming muscular forces in proximal humerus fractures. (10.5397/cise.2022.00885)
- [L3] Nonsurgical treatment should have a more prominent role in the treatment of proximal humeral fractures. (10.1016/j.jse.2011.01.025)
- [L4] MIPO is a safe and effective option for the treatment of proximal humerus fractures, with good functional recovery and fewer complications, which are typically technique dependent. (10.1016/j.aott.2016.10.003)
- [L2] Morphologic classification of proximal humerus fractures as the sole basis for treatment algorithms and surgical success should be scrutinized. (10.1016/j.jseint.2022.02.006)
- [L1] This meta-analysis demonstrates no significant differences in clinical outcomes or complication rates between standard components and fracture-specific components in RSA, suggesting comparable performance in the treatment of proximal humerus fractures. (10.1302/0301-620x.107b9.bjj-2024-1508.r2)
- [L3] ORIF of nonosteoporotic proximal humeral fractures with locking plates led to favorable functional and radiologic outcomes at a minimum of 10 years of follow-up. (10.1097/corr.0000000000002895)
- [L2] However, the changed position of the humeral head on coronal plane does not affect the final functional results. (10.4103/0973-6042.118911)
- [L3] Holistic assessment of outcomes with both subjective and objective outcomes are necessary, as shoulder flexion, extension, and abduction are only moderately correlated with PROMs. (10.1016/j.jseint.2024.02.003)
- [L4] The paper reviews the biology and biomechanics of osteosynthesis for proximal humerus fractures, emphasizing that bone quality significantly impacts implant anchorage. (10.1007/s00068-007-7089-2)
- [L3] Predictive models constructed using ML techniques demonstrated favorable discrimination and satisfactory-to-excellent performance in forecasting prolonged LOS and serious adverse complications occurring within 30 days of surgical intervention for proximal humerus fracture. (10.1016/j.jseint.2024.02.005)
- [Paper] Rotator cuff tears are a detrimental factor and a major cause of painful shoulders. (10.1007/s00264-004-0552-3)
- [L5] The double plate strategy can increase the stability of the medial column of the proximal humerus, and enhance the overall biomechanical property of the repaired proximal humerus. (10.1186/s12891-024-08216-0)

- [L4] Evidence-based recommendations to guide treatment of proximal humerus fractures are lacking, and no good evidence exists whether surgery is clearly superior to nonoperative treatment. (10.1016/j.ocl.2008.06.003)
- [Abstract] Patients with a proximal humerus fracture undergoing reverse total shoulder arthroplasty have significantly worse perioperative outcomes, including higher rates of complications, longer hospital stays, and higher costs, compared to patients with other indications. (10.1016/j.jse.2015.05.005)
- [L4] There is clear evidence of specific characteristics which differentiate proximal third humeral shaft fractures from those of midshaft and distal third. (10.1016/j.injury.2013.10.030)
- [L3] Therefore, reverse shoulder arthroplasty could be considered primary treatment, especially when optimal range of motion is of great importance to the patient. (10.1177/17585732231190038)
- [L4] Glenoid loosening and severe scapular notching are related to poor positioning and/or incorrect orientation of the glenosphere. (10.1016/j.otsr.2018.06.008)
- [L3] Current diagnosis coding practices do not adequately capture the fracture complexity needed to conduct subgroup analysis for proximal humerus fractures. (10.1016/j.jse.2023.08.022)
- [L3] CNNs proficiently rule out proximal humerus fractures on plain radiographs. (10.1302/0301-620x.106b11.bjj-2024-0264.r1)
- [L5] The routine use of 3D-printed models may not be beneficial for classifying proximal humeral fracture patterns beyond the information gained from currently available imaging modalities, and their use as the sole determinant for recommending surgical intervention should be avoided at this time. (10.1097/corr.0000000000002017)
- [L5] In addition to palpation and anteroposterior and lateral humeral x-ray, we suggest adding bilateral anteroposterior shoulders xray routinely to confirm the shoulder location. (10.1097/md.0000000000008977)
- [L3] Timing of surgery did not impact outcomes of patients who underwent ORIF for proximal humerus fractures. (10.1016/j.jse.2025.02.019)

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