

Golfer's Elbow

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Overview

- Percutaneous common flexor origin release of the medial humeral epicondyle is a safe and effective treatment for golfer's elbow, providing significant and sustainable improvements in pain and function during a 1-year follow-up period [2].
- Elbow arthroscopy is a safe modality of treatment for a variety of pathologies when performed by experienced surgeons [3].
- In patients with surviving implants, 57% achieved good to excellent Mayo Elbow Performance Scores following hemiarthroplasty of the elbow for posttraumatic arthritis, with predictable improvement in range of motion [5].
- Survival rates for the Latitude primary total elbow arthroplasty remain low and complication rates remain high, yet are comparable to those of other elbow arthroplasties [7].
- Both hemiarthroplasty and total elbow arthroplasty provide acceptable elbow function for the management of irreparable distal humeral fractures [10].
- Operative repair is indicated for most elbow fracture-dislocations to restore sufficient osseoligamentous support, allowing safe, early motion and providing a stable functional elbow in the long term [13].
- Use of a standard surgical protocol for treating elbow dislocations with radial head and coronoid fractures restores sufficient elbow stability to allow early motion postoperatively, enhancing functional outcome [15].
- The majority of elbows treated for trans-ulnar basal coronoid fracture-dislocations achieve union, a functional range of motion, and reasonable patient-reported outcome measures [16].
- Surgery is indicated for acute elbow dislocations involving unstable elbows requiring flexion beyond 50 to 60 degrees to remain reduced or for unstable periarticular fractures [25].
- A staged protocol utilizing arthroscopic assessment refines the approach to painful total elbow arthroplasty by directly influencing definitive surgical management [30].
- The Van Gorder approach is the surgical approach for primary total elbow arthroplasty evaluated in the largest study with an average follow-up of 32 months [31].
- Various approaches to total elbow arthroplasty, including triceps-on approaches, have reported outcomes that assist surgeons in making an informed choice [62].

Anatomy & Pathophysiology

- The ulnar collateral ligament (UCL) is a key structure in the elbow, with its functional anatomy and biomechanics reviewed in the context of overhead athletes [4].
- UCL injuries in overhead athletes result from repetitive valgus forces during throwing [46].
- Understanding normal elbow anatomy and etiological factors is required to develop effective strategies for treating soft tissue contracture [6].
- The primary goal of treating nonacute elbow fracture with persistent ulnohumeral dislocation or subluxation is stable reduction of the ulnohumeral joint and functional elbow motion [11].

- Musculoskeletal ultrasonography allows for dynamic, functional assessment of elbow structures, including visualization of pathology under stress and motion [17].
- An understanding of relevant anatomy and factors associated with elbow stability allows for the application of a systematic treatment algorithm for terrible triad injuries to ensure sufficient stability for early motion [18].
- Understanding elbow biomechanics and injury mechanisms provides insight into variations of pathology observed in complex elbow dislocations [35].
- Elbow joint loads vary in different directions during simulated activities of daily living, which has implications for post-total elbow arthroplasty recommendations [36].
- Combining an understanding of anatomy and biomechanics with surgical technique can reconstruct chronically dislocated joints to achieve functional and painless elbows [37].
- Increasing pitch count is associated with increasing elbow flexion angle at ball release in youth baseball pitchers [39].
- Pitching with fatigue may cause biomechanical changes associated with increased rates of elbow injury in the adult throwing population [39].
- The External Joint Stabilizer – Elbow (EJS-E) via the posterior approach can restore mobility and stability in patients with persistent elbow instability [40].
- Varus loads simulating everyday activities produce changes in varus joint angulation that are linearly dependent on the applied moment and persist after release of lateral stabilizing structures [41].
- Overhead elbow extension results in similar kinematics between an intact elbow and an elbow with medial collateral ligament (MCL) and lateral collateral ligament (LCL) tears [42].
- Normalized elbow varus torque is associated with ball velocity and other kinematic parameters in elite adult baseball pitchers [43].
- Monopolar radial head prostheses provide superior enhancement of elbow stability compared to bipolar designs from a biomechanical perspective [44].
- Changes in pitching distance are associated with slight increases in shoulder kinetics and kinematic differences in youth baseball pitchers [45].
- Revision UCL reconstruction using a suspension button fixation technique reliably restores elbow kinematics to the intact state [47].
- Increased medial elbow torque is associated with greater ball velocity regardless of the history of medial elbow injuries in youth baseball pitchers [48].
- Limiting the number of innings pitched is likely the best way to reduce elbow injury in youth pitchers because biomechanical variables correlated with peak valgus torque are not easily modifiable [50].
- Elbow valgus torque is poorly suited as a standalone metric for predicting injury risk due to narrow data ranges, modeling noise, and crude assumptions [51].

Classification

- Complex elbow injuries are classified as complex elbow instability [1].
- Thrower's elbow is a distinct pathophysiology affecting the ulnar collateral ligament in overhead athletes [4].
- Elbow injuries in young athletes require classification based on immature developing anatomy and specific injury pathophysiology [8].
- Elbow instability in children includes both traumatic and nontraumatic causes [14].
- Terrible triad injury is a specific classification of elbow instability requiring a systematic treatment algorithm [18].
- Traumatic elbow instability has distinct patterns that guide surgical management [27].
- Complex fracture-dislocations of the proximal ulna and radius in adults have a comprehensive classification system [38].
- Persistent symptomatic olecranon physis in adolescent throwing athletes is classified using radiographic criteria [71].

Clinical Presentation

- Golfer's elbow (medial epicondylitis) is a common problem that resolves by 6 months in most cases regardless of treatment [29].
- For the small percentage of patients who do not respond to nonoperative approaches, surgery provides near 90% satisfaction rates [29].
- Isolated elbow injuries are rare, and fractures should be interpreted as proxies for associated soft tissue injuries [21].
- Adequate elbow assessment is essential for accurate diagnosis and initiating proper treatment [21].
- A comprehensive approach to the physical examination of the elbow, including special tests, may facilitate improved diagnosis of elbow pathology [19].
- Post-traumatic osteoarthritis of the elbow is an uncommon condition where clinical manifestations often vary from radiological findings [22].
- Incarceration of the medial epicondyle in the joint often occurs in association with an elbow dislocation and is important to consider to avoid diagnostic mistakes [53].
- Dominant elbow MRI abnormalities are common in asymptomatic Little League baseball players and commonly progress over three years, especially amongst players who continue to play baseball [23].
- Baseball and softball players frequently present with elbow, wrist, and hand complaints [52].

Investigations

- Elbow arthroscopy is a safe modality of treatment for a variety of pathologies in experienced hands [3].
- Elbow arthroscopy has become a safer and more effective treatment modality for several elbow pathologies due to advances in equipment and surgical technique [9].
- Musculoskeletal ultrasonography provides a dynamic, functional assessment of elbow structures, allowing visualization of pathology under stress and motion [17].
- Adequate elbow assessment is essential for accurate diagnosis and initiating proper treatment [21].
- Isolated elbow injuries are rare [21].
- Fractures should be interpreted as proxies for associated soft tissue injuries [21].
- Post-traumatic osteoarthritis of the elbow is an uncommon condition [22].
- Clinical manifestations of post-traumatic osteoarthritis of the elbow often vary from radiological findings [22].
- Dominant elbow MRI abnormalities are common in asymptomatic Little League baseball players [23].
- Dominant elbow MRI abnormalities commonly progress over three years in Little League baseball players, especially amongst those who continue to play baseball [23].
- Lower MRI grade is objectively associated with higher return to throw in non-operatively treated elbow ulnar collateral ligament injuries in professional baseball players [33].
- Humeral location of elbow ulnar collateral ligament tears is objectively associated with higher return to throw in non-operatively treated injuries in professional baseball players [33].
- Lower MRI grade is objectively associated with higher return to play in non-operatively treated elbow ulnar collateral ligament injuries in professional baseball players [33].
- Humeral location of elbow ulnar collateral ligament tears is objectively associated with higher return to play in non-operatively treated injuries in professional baseball players [33].
- Lower MRI grade is objectively associated with lower ulnar collateral ligament reconstruction (UCLR) rates in non-operatively treated elbow ulnar collateral ligament injuries in professional baseball players [33].
- Humeral location of elbow ulnar collateral ligament tears is objectively associated with lower UCLR rates in non-operatively treated injuries in professional baseball players [33].
- Lower MRI grade is objectively associated with higher survival in non-operatively treated elbow ulnar collateral ligament injuries in professional baseball players [33].
- Humeral location of elbow ulnar collateral ligament tears is objectively associated with higher survival in non-operatively treated injuries in professional baseball players [33].
- Higher grade and ulnar or both-sided tears are objectively associated with lower return to throw, lower return to play, higher UCLR, and lower survival compared to lower grade and humeral location tears in non-operatively treated elbow ulnar collateral ligament injuries in professional baseball players [33].
- A 69-year clinical and radiologic follow-up of a previously unknown radial head prosthesis has been reported [34].

- Dominant elbow MRI abnormalities are common in asymptomatic youth baseball players [59].
- MRI abnormalities involving the medial aspect of the elbow are common in year-round Little League baseball players [61].
- Medial elbow MRI abnormalities in Little League baseball players are especially common in those with internal rotation deficits and private coaches [61].
- Increased MRI signal in the extensor carpi radialis brevis (ECRB) origin is common in symptomatic elbows [64].
- Increased MRI signal in the ECRB origin is common in asymptomatic elbows [64].
- Increased MRI signal in the ECRB origin is more common with age [64].
- Interobserver reliability for reading predraft elbow MRI on Major League Baseball prospects was acceptable following the definition of pathology [65].
- The coronoid opening angle is a novel radiographic technique to assess bone loss in coronoid trauma [66].
- The coronoid opening angle can be of value alongside 3-dimensional imaging in evaluating elbow injuries [66].
- The coronoid opening angle can be used as an adjunct in clinical decision making [66].
- There is a high rate of abnormal magnetic resonance imaging findings in asymptomatic throwers' elbows [67].
- Most young patients with elbow dislocations are successfully treated without ligament repair [69].
- There should be an emphasis on not overanalyzing and treating based on MRI findings alone for young patients with elbow dislocations [69].
- Changes in the ulnar collateral ligament (UCL) detectable on ultrasound may help distinguish elbows at risk for later clinical UCL insufficiency [76].
- Preseason and post-season MRI abnormalities of the medial elbow are common in Little League baseball players [78].
- Interobserver and intraobserver agreement of ligamentous injuries on conventional MRI after simple elbow dislocation should be the basis to develop new MRI quality standards with special focus on coronal oblique reconstructions to improve the evaluation of ligament injuries [83].
- The diagnostic and prognostic value of MRI imaging in lateral epicondylar tendinopathy is drawn into question, especially in older patients [86].
- Ultrasound assessment of traumatic elbow lesions could be performed by an orthopedic surgeon on a well-defined protocol [87].
- Lesions on ultrasound matched clinical symptomatology in the assessment of traumatic elbow lesions [87].

Treatment

NON-OPERATIVE MANAGEMENT

- Conservative management is the gold standard for most simple elbow dislocations [77].
- Patients after conservatively treated simple elbow dislocations show good clinical and functional results [85].
- Elbow valgus instability in the throwing athlete may be managed nonsurgically [84].
- The Elbow UCL Injury Prognosis Score was created to predict which patients would succeed with nonoperative management and avoid unnecessary surgery [72].
- Tennis elbow resolves by 6 months in most cases no matter what treatment is used [29].
- For the small percentage of tennis elbow patients who do not respond to nonoperative approaches, surgery provides near 90% satisfaction rates [29].

OPERATIVE MANAGEMENT: SOFT TISSUE AND INSTABILITY

- Percutaneous common flexor origin release of medial humeral epicondyle in golfer's elbow appears to be a safe and effective treatment option [2].
- Percutaneous common flexor origin release provides significant and sustainable improvements in pain and function during a 1-year follow-up period [2].
- In experienced hands, elbow arthroscopy is a safe modality of treatment for a variety of pathologies [3].
- Use of the standard surgical protocol to treat elbow dislocations with radial head and coronoid fractures restored sufficient elbow stability to allow early motion postoperatively [15].
- The standard surgical protocol for elbow dislocations with radial head and coronoid fractures enhances the functional outcome [15].
- The majority of elbows treated surgically for trans-ulnar basal coronoid fracture-dislocations achieve union, a functional range of motion, and reasonable patient reported outcome measures [16].
- Surgery is indicated for unstable elbows requiring flexion beyond 50 to 60 degrees to remain reduced [25].
- Surgery is indicated for unstable periarticular fractures [25].
- Operative repair is indicated for most elbow fracture-dislocations to restore sufficient osseoligamentous support to allow safe, early motion [13].
- Operative repair provides a stable functional elbow in the long term for most elbow fracture-dislocations [13].
- The primary goal of treatment for nonacute elbow fracture with persistent ulnohumeral dislocation or subluxation is stable reduction of the ulnohumeral joint and functional elbow motion [11].
- Hinged external fixation is indicated for acute or chronic instability of the elbow after trauma [60].
- Hinged external fixation is indicated for distraction interposition arthroplasty [60].
- Hinged external fixation is indicated for use after contracture release or excision of heterotopic ossification [60].

- Graft reconstructions may not be necessary to obtain favorable outcomes and rapid return to sports in nonprofessional athletes who require surgical intervention for medial elbow instability [80].
- Lower MRI grade and humeral location of UCL injuries are objectively associated with higher return to throw, higher return to play, lower UCLR, and higher survival compared to higher grade and ulnar or both-sided tears [33].

OPERATIVE MANAGEMENT: ARTHROPLASTY

- In patients with surviving implants, 57% of those undergoing hemiarthroplasty for posttraumatic arthritis achieved good to excellent Mayo Elbow Performance Scores [5].
- Hemiarthroplasty for posttraumatic arthritis provides predictable improvement in range of motion [5].
- Survival rates for the Latitude primary total elbow arthroplasty remain low [7].
- Complication rates for the Latitude primary total elbow arthroplasty remain high [7].
- Complication rates for the Latitude primary total elbow arthroplasty are comparable to those of other elbow arthroplasties [7].
- Both hemiarthroplasty and total elbow arthroplasty provided acceptable elbow function for irreparable distal humeral fractures [10].
- The age at surgery is a risk factor for complications in total elbow arthroplasty [63].
- The indication for total elbow arthroplasty in patients under 60 should be carefully considered [63].
- The Van Gorder approach is the largest study evaluating the surgical approach to the elbow for primary TEA with an average follow-up of 32 months [31].

OPERATIVE MANAGEMENT: PROSTHETICS AND STIFFNESS

- There are no contraindications to bipolar radial head prostheses in elbow dislocation with associated injuries [58].
- Treatment choices for elbow stiffness must consider non-surgical management [74].
- Surgical options for elbow stiffness include arthroscopic or open capsular release [74].
- Surgical options for elbow stiffness include arthroplasty [74].
- Surgical options for elbow stiffness include elbow replacement [74].

REHABILITATION

- Rehabilitation programs are used to treat individuals with elbow injury and return them to high-level overhead activity [26].

Complications

- Long-term outcomes with surgical management of complex elbow injuries are unknown [1].

- Percutaneous common flexor origin release for golfer's elbow provides significant and sustainable improvements in pain and function during a 1-year follow-up period [2].
- Elbow arthroscopy is a safe modality of treatment for a variety of pathologies in experienced hands [3].
- In patients with surviving implants, 57% achieved good to excellent Mayo Elbow Performance Scores with predictable improvement in range of motion after hemiarthroplasty for posttraumatic arthritis [5].
- Survival rates for the Latitude primary total elbow arthroplasty remain low and complication rates remain high, yet are comparable to those of other elbow arthroplasties [7].
- The GSBIII elbow replacement provides good long-term function with a low revision rate and few complications [20].
- The terrible triad of the elbow is surgically treatable to allow a high functional standard in the short-term and long term [24].
- Open arthrolysis combined with radial head arthroplasty yielded satisfactory short-term outcomes for post-traumatic elbow stiffness at 3 years, with substantial improvements in elbow mobility and function, and results were durable over the long term (8 years) [28].
- Long-term survival of semiconstrained elbow arthroplasties is favorable, but wear of the hinge mechanism is a risk during follow-up [54].
- Achieving full stability of the elbow and avoiding overstuffing are necessary to prevent acute disassembly of a bipolar radial head arthroplasty [56].
- Few patients with simple elbow dislocations develop complications requiring surgery, but those that do most commonly undergo soft-tissue stabilisation or contracture release within 4 years of the injury [75].
- Factors clinically associated with an increased risk of deep infection with hinged external fixators of the elbow include a history of prior procedures in the post-traumatic elbow and the complexity of the operative technique [79].
- Postoperative complications including synostosis and elbow instability may not be as common as previously understood with the Boyd approach for treating simple to complex elbow fractures and dislocations [81].

Recovery

- Percutaneous common flexor origin release for golfer's elbow provides significant and sustainable improvements in pain and function during a 1-year follow-up period [2].
- In patients with surviving implants, 57% achieved good to excellent Mayo Elbow Performance Scores with predictable improvement in range of motion after hemiarthroplasty for posttraumatic arthritis [5].
- Both elbow hemiarthroplasty and total elbow arthroplasty provided acceptable elbow function for irreparable distal humeral fractures [10].
- The GSBIII elbow replacement provides good long-term function with a low revision rate and few complications [20].
- Surgically treated acute isolated terrible triad injuries of the elbow allow a high functional standard in both the short-term and long term [24].

- Open arthrolysis combined with radial head arthroplasty yielded satisfactory short-term outcomes for post-traumatic elbow stiffness at 3 years, with substantial improvements in elbow mobility and function that were durable over 8 years [28].
- A 69-year clinical and radiologic follow-up was reported for a McKee radial head arthroplasty [34].
- Following complex elbow instability surgical treatment, a rehabilitation programme needs to be started promptly and continued for at least 6 months because a significant improvement of range of motion occurs prevalently in this period [89].
- Following ulnar collateral ligament repairs and reconstructions, elbow range of motion is reliably preserved or improved with a predictable trajectory of rapid improvement within the first 2 to 4 months [91].
- An off-season of at least 1 month is a minimal requirement for the prevention of elbow pain and morphologic abnormalities of the medial epicondyle in elementary school-aged baseball players [92].

Key Evidence

- [L5] Long-term outcome with surgical management of complex elbow injuries is unknown. ([10.5435/00124635-200605000-00003](#))
- [L4] Percutaneous common flexor origin release of medial humeral epicondyle in golfer's elbow appears to be a safe and effective treatment option and provides significant and sustainable improvements in pain and function during a 1-year follow-up period. ([10.1016/j.rboe.2016.06.007](#))
- [L4] In experienced hands, elbow arthroscopy is a safe modality of treatment for a variety of pathologies. ([10.1016/j.arthro.2007.03.081](#))
- [Paper] This article reviews the functional anatomy and biomechanics of the ulnar collateral ligament, the pathophysiology of the thrower's elbow, and its history, physical examination, imaging modalities, and treatment options. ([10.1016/j.csm.2010.06.007](#))
- [L4] In patients with surviving implants, 57% achieved good to excellent Mayo Elbow Performance Scores with predictable improvement in range of motion. ([10.5435/jaaos-d-18-00055](#))
- [L5] Treatment of the stiff elbow requires a thorough understanding of normal anatomy and etiological factors to develop effective strategies. ([10.1016/j.jisako.2023.10.006](#))
- [L4] Survival rates nonetheless remain low and complication rates remain high yet are comparable to those of other elbow arthroplasties. ([10.1016/j.jse.2021.08.028](#))
- [L5] Evaluation and management of elbow injuries in young athletes requires knowledge of the immature developing anatomy, injury pathophysiology, and established treatment algorithms for each diagnosis. ([10.1016/j.csm.2010.06.010](#))
- [L5] Elbow arthroscopy has become a safer and more effective treatment modality for several elbow pathologies due to advances in equipment and surgical technique. ([10.5435/00124635-200810000-00003](#))
- [L1] Both treatments provided acceptable elbow function. ([10.1016/j.jse.2022.01.016](#))

- [L5] The primary goal of treatment is stable reduction of the ulnohumeral joint and functional elbow motion. ([10.2106/jbjs.m.00817](#))
- [L5] Operative repair is indicated for most of these injuries to restore sufficient osseoligamentous support to allow safe, early motion and provide a stable functional elbow in the long term. ([10.1016/j.hcl.2004.06.005](#))
- [L5] The article reviews current concepts of injuries leading to elbow instability in children, discusses recognition and treatment of instability, and addresses nontraumatic causes. ([10.1016/j.hcl.2007.11.007](#))
- [L4] Use of the surgical protocol restored sufficient elbow stability to allow early motion postoperatively, enhancing the functional outcome. ([10.2106/jbjs.d.02933](#))
- [L4] However, the majority of elbows achieve union, a functional range of motion, and reasonable patient reported outcome measures. ([10.1016/j.jse.2024.05.024](#))
- [L5] Musculoskeletal ultrasonography provides a dynamic, functional assessment of elbow structures, allowing visualization of pathology under stress and motion. ([10.5435/jaaos-d-20-00935](#))
- [L5] Despite the complexities of this injury, an understanding of the relevant anatomy and the factors associated with elbow stability allows the application of a systematic algorithm for treatment that can help ensure sufficient elbow stability to allow early motion, thereby leading to improved outcomes in most patients. ([10.5435/00124635-200903000-00003](#))
- [L5] A comprehensive approach to the physical examination of the elbow, including special tests, may facilitate improved diagnosis of elbow pathology. ([10.5435/jaaos-d-16-00622](#))
- [L4] The GSBIII elbow replacement provides good long-term function with a low revision rate and few complications. ([10.1016/j.jse.2015.10.013](#))
- [L5] Adequate elbow assessment is essential for accurate diagnosis and initiating proper treatment, as isolated elbow injuries are rare and fractures should be interpreted as proxies for associated soft tissue injuries. ([10.1016/j.jhsa.2014.04.028](#))
- [L4] Post-traumatic osteoarthritis of the elbow is an uncommon condition where clinical manifestations often vary from radiological findings. ([10.1016/j.otsr.2013.11.004](#))
- [L3] Dominant elbow MRI abnormalities are common in asymptomatic Little League baseball players and commonly progress over three years, especially amongst players who continue to play baseball. ([10.1177/2325967119s00060](#))
- [L4] This study adds to the evidence that the terrible triad of the elbow is surgically treatable to allow a high functional standard not only in the short-term but also in the long term. ([10.1016/j.jse.2024.06.023](#))
- [L5] Surgery is indicated for unstable elbows requiring flexion beyond 50 to 60 degrees to remain reduced or for unstable periarticular fractures. ([10.5435/00124635-199801000-00002](#))
- [Paper] The purpose of this article is to review the common elbow injuries in the overhead athlete and clinical tests used to confirm them, in addition to providing key concepts in the rehabilitation programs used to treat individuals with elbow injury and return them to high-level overhead activity. ([10.1016/j.csm.2009.09.013](#))
- [L5] Understanding the patterns of traumatic elbow instability helps the surgeon counsel and manage patients with these injuries. ([10.1016/j.jhsa.2010.05.002](#))

- [L4] OEA with RHA yielded satisfactory short-term outcomes for PTES at 3 years, with substantial improvements in elbow mobility and function, and the results were durable over the long term (8 years). ([10.1016/j.jse.2021.10.028](#))
- [L5] Tennis elbow is a common problem that resolves by 6 months in most cases no matter what treatment is used, but for the small percentage of patients who do not respond to nonoperative approaches, surgery provides near 90% satisfaction rates. ([10.1016/j.arthro.2017.02.020](#))
- [L4] The staged protocol described in the present study, utilizing arthroscopic assessment, has refined the approach to the painful total elbow arthroplasty because it directly influences the definitive surgical management of the patient. ([10.1177/1758573215591946](#))
- [L4] This is the largest study evaluating the Van Gorder surgical approach to the elbow for primary TEA with an average follow-up of 32 months. ([10.1016/j.jse.2021.09.005](#))
- [L3] Lower MRI grade and humeral location were objectively associated with higher return to throw, higher return to play, lower UCLR, and higher survival compared to higher grade and ulnar or both-sided tears. ([10.1177/2325967119s00311](#))
- [L4] We have reported a 69-year clinical and radiologic follow-up of a previously unknown radial head prosthesis. ([10.1016/j.jse.2014.09.030](#))
- [L4] Understanding elbow biomechanics and the injury mechanism provides valuable insight into the variations of pathology that may be observed. ([10.5435/jaaos-d-14-00023](#))
- [L5] This study analyzed elbow joint moments in different directions during daily tasks. ([10.1016/j.jse.2023.07.042](#))
- [L4] By combining an understanding of anatomy and biomechanics with surgical technique, the authors could reconstruct chronically dislocated joints to achieve functional and painless elbows. ([10.1016/j.jse.2006.09.003](#))
- [L3] The authors created a comprehensive classification of complex fracture-dislocations of the elbow that appeared to be reproducible and may represent a useful tool for the management of such difficult injuries. ([10.1016/j.jse.2011.06.003](#))
- [L5] These findings demonstrate that pitching with fatigue may cause biomechanical changes that have been associated with increased rates of elbow injury in the adult throwing population. ([10.1016/j.jse.2024.05.050](#))
- [L4] Biomechanical and clinical outcomes show that EJS-E via the posterior approach can restore mobility and stability in all patients, thus serving as a valuable alternative option for the treatment of persistent instability of the elbow. ([10.1186/s12891-022-06103-0](#))
- [L5] Varus loads simulating everyday activities produce changes in the varus joint angulation of the elbow that are linearly dependent on the applied moment and persist after release of the lateral stabilizing structures. ([10.1177/03635465211018208](#))
- [L5] Overhead elbow extension results in similar kinematics between an intact elbow and an elbow with MCL and LCL tears. ([10.1016/j.jht.2022.01.008](#))
- [L4] Normalized elbow varus torque was associated with ball velocity and 10 other kinematic parameters. ([10.1177/23259671241300560](#))

- [L5] From a biomechanical perspective, the enhancement of elbow stability with a monopolar radial head prosthesis is superior to that with a bipolar design. ([10.1016/j.jse.2010.10.033](#))
- [L5] Change in pitching distance was associated with a slight increase in shoulder kinetics as well as a few kinematic differences. ([10.1177/0363546518795890](#))
- [L5] This article reviews the anatomy, biomechanics, pathophysiology, diagnosis, and treatment options for ulnar collateral ligament injuries in overhead athletes, emphasizing that the injury is not uncommon and results from repetitive valgus forces during throwing. ([10.1016/j.csm.2004.05.002](#))
- [L5] Ulnar collateral ligament reconstruction using a suspension button fixation technique reliably restored elbow kinematics to the intact state. ([10.1177/0363546509350109](#))
- [L2] Increased medial elbow torque was associated with greater ball velocity regardless of the history of medial elbow injuries. ([10.1016/j.arthro.2022.07.016](#))
- [L5] Given that the biomechanical variables correlated with peak valgus torque are not easily modifiable, limiting the number of innings pitched is likely the best way to reduce elbow injury in youth pitchers. ([10.1016/j.jse.2004.01.013](#))
- [L5] Elbow valgus torque is poorly suited as a standalone metric for predicting injury risk due to narrow data ranges, modeling noise, and crude assumptions; future efforts should focus on integrated, longitudinal metrics rather than single-session proxies. ([10.1002/arj.70098](#))
- [L5] Baseball and softball players frequently present with elbow, wrist, and hand complaints; familiarity with these conditions and player-specific treatment algorithms is essential for managing these patients and preventing future injury. ([10.1016/j.jhsa.2014.11.024](#))
- [Case_report] Incarceration of the medial epicondyle in the joint often occurs in association with an elbow dislocation and is important to consider to avoid diagnostic mistakes. ([10.1016/j.jse.2011.09.030](#))
- [Case_report] Long-term survival of semiconstrained elbow arthroplasties is favorable, but wear of the hinge mechanism is a risk during follow-up. ([10.1016/j.otsr.2014.07.013](#))
- [L4] Achieving full stability of the elbow and avoiding overstuffing are necessary to prevent this complication. ([10.1016/j.otsr.2010.02.015](#))
- [L3] The authors see no contraindications to bipolar radial head prostheses in elbow dislocation with associated injuries. ([10.1016/j.otsr.2019.10.027](#))
- [L2] Dominant elbow MRI abnormalities are common in asymptomatic youth baseball players. ([10.1177/0363546519888647](#))
- [L5] The most common indications are acute or chronic instability of the elbow after trauma, distraction interposition arthroplasty, or use after contracture release or excision of heterotopic ossification. ([10.1016/j.hcl.2010.04.004](#))
- [L3] MRI abnormalities involving the medial aspect of the elbow are common in year-round Little League baseball players, especially those with internal rotation deficits and private coaches. ([10.2106/jbjs.15.01017](#))
- [L4] The review discusses various approaches to total elbow arthroplasty and their reported outcomes to assist surgeons in making an informed choice. ([10.1177/1758573216682479](#))

- [L4] The age at surgery is a risk factor for complications, and the indication for total elbow arthroplasty in patients under 60 should be carefully considered. ([10.1016/j.otsr.2013.10.012](#))
- [L4] Increased MRI signal in the ECRB origin is common in symptomatic and in asymptomatic elbows. ([10.1016/j.jse.2016.01.033](#))
- [L4] Interobserver reliability was acceptable following the definition of pathology when reading predraft elbow MRI on MLB prospects. ([10.1016/j.jse.2024.05.021](#))
- [L4] It can be of value alongside 3-dimensional imaging in evaluating elbow injuries and used as an adjunct in clinical decision making. ([10.1016/j.jse.2021.12.039](#))
- [L4] This study demonstrates a high rate of abnormal magnetic resonance imaging findings in asymptomatic throwers' elbows. ([10.1177/0363546503262646](#))
- [L4] Given that most young patients with elbow dislocations are successfully treated without ligament repair, there should be an emphasis on not overanalyzing and treating based on MRI findings alone. ([10.1177/1558944720949961](#))
- [L3] The radiographic classification of persistent olecranon physis is useful for treatment decision making. ([10.1177/0363546509342677](#))
- [L3] The Elbow UCL Injury Prognosis Score was created to predict which patients would succeed with nonoperative management and avoid unnecessary surgery while simultaneously identifying patients for whom nonoperative management would delay the inevitable need for a surgical intervention. ([10.1177/03635465251366318](#))
- [L5] Treatment choices must consider non-surgical management and various surgical options including arthroscopic or open capsular release, arthroplasty, and elbow replacement. ([10.1016/j.jisako.2023.10.009](#))
- [Paper] Few patients with simple elbow dislocations develop complications requiring surgery, but those that do most commonly undergo soft-tissue stabilisation or contracture release within 4 years of the injury. ([10.1016/j.injury.2015.02.009](#))
- [L2] Our data suggests that changes present in the UCL and detectable on ultrasound may help distinguish elbows at risk for later clinical UCL insufficiency. ([10.1177/2325967115s00162](#))
- [L4] Conservative management remains the gold standard for most simple elbow dislocations. ([10.1016/j.arthro.2014.02.037](#))
- [L3] Pre-season and post-season MRI abnormalities of the medial elbow are common in Little League baseball players. ([10.1177/2325967116s00141](#))
- [L4] Factors clinically associated with an increased risk of deep infection include a history of prior procedures in the post-traumatic elbow and the complexity of the operative technique. ([10.1016/j.jse.2007.10.006](#))
- [L4] Graft reconstructions may not be necessary to obtain favorable outcomes and rapid return to sports in nonprofessional athletes who require surgical intervention for medial elbow instability. ([10.1177/0363546508315201](#))
- [L4] Postoperative complications including synostosis and elbow instability may not be as common as previously understood. ([10.1016/j.jse.2023.06.005](#))

- [L4] This should be the basis to develop new MRI quality standards with special focus on coronal oblique reconstructions to improve the evaluation of ligament injuries after simple elbow dislocations. ([10.1186/s12891-017-1451-2](#))
- [L5] Elbow valgus instability in the throwing athlete may be managed either nonsurgically or surgically. ([10.5435/00124635-200611000-00014](#))
- [L4] Patients after conservatively treated simple elbow dislocations show good clinical and functional results. ([10.1007/s00167-016-4176-0](#))
- [L4] This draws into question the diagnostic and prognostic value of MRI imaging in lateral epicondylar tendinopathy, especially in older patients. ([10.1177/17585732221146731](#))
- [L4] Ultrasound assessment of traumatic elbow lesions could be performed by an orthopedic surgeon on a well-defined protocol, and lesions on ultrasound matched clinical symptomatology. ([10.1016/j.otsr.2021.102836](#))
- [L3] Following CEI surgical treatment, a rehabilitation programme needs to be started promptly and continued for at least 6 months because a significant improvement of ROM occurs prevalently in this period, which should be considered the critical time period to obtain a functional elbow in a majority of patients. ([10.1016/j.injury.2013.11.033](#))
- [L4] Following UCL repairs and reconstructions, elbow ROM is reliably preserved or improved with a predictable trajectory of rapid improvement within the first 2 to four months. ([10.1016/j.jse.2025.10.002](#))
- [L3] An off-season of at least 1 month is a minimal requirement for the prevention of elbow pain and morphologic abnormalities of the medial epicondyle. ([10.1016/j.jse.2019.02.005](#))

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