Review Article

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Recent Nonoperative Treatment of Elbow Pain

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Pain originating from the elbow can be due to issues affecting the joint itself or the structures surrounding it. These structures include the medial and lateral epicondyles, associated ligaments, the origins of wrist flexor and extensor muscles, the olecranon bursa, the distal biceps tendon, and the radial and ulnar nerves. Pain that appears to originate from a different location may actually be referred pain, potentially stemming from the neck (cervical radiculopathy) or the shoulder. Among complaints related to the elbow, lateral elbow pain is the most frequently reported. This pain could originate from the lateral epicondyle, the radiohumeral joint, or it could be referred pain from other areas. Medial elbow pain is the second most common complaint, often resulting from issues with the medial epicondyle or the ulnar nerve as it travels through the cubital tunnel. The biceps tendon is frequently the cause of anterior elbow pain. Patients who report swelling in the elbow are often experiencing olecranon bursitis. These conditions can often be effectively managed through conservative treatment. The aim of this article is to provide a structured approach to addressing patients with elbow pain, by detailing the common causes of such discomfort and exploring effective nonsurgical treatment options.

Introduction

Elbow pain can originate from various conditions that affect the joint itself, the surrounding soft tissues, or even from a different part of the body such as the neck, shoulder, or wrist [1]. Frequent culprits of pain include the joint and soft tissue structures like the attachment points of the epicondyles (both medial and lateral), the olecranon bursa, and the nearby radial, median, and ulnar nerves. The complex anatomy of the elbow joint, coupled with the wide array of potential causes, makes identifying the precise cause of elbow pain a challenging task [2–4]. Similar to addressing other musculoskeletal issues, the crucial steps in diagnosing elbow pain involve delving into the patient's history to understand the injury's mechanism and movements that worsen the pain, along with a focused physical examination. The patient's occupation and leisure activities can also provide valuable insights for the diagnosis. This article provides a systematic guide for approaching patients with elbow pain, by outlining the most typical sources of discomfort and exploring effective nonsurgical treatment options.

Main Text

1. Anatomy

The elbow joint is formed where the lower part of the humerus connects with the radial head

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and ulna bones. Flexion and extension occur at the ulnohumeral joint and are driven by the biceps and triceps muscles, respectively. The normal range of motion is 0° (full extension) to 135° (full flexion).

Despite primarily being a hinge joint, the elbow possesses a unique capability to rotate the lower arm in pronation and supination. These distinct movements, combined with a wide array of dynamic forces during physical exertion, make the elbow and its structures susceptible to significant injuries, especially from repetitive actions. Rotation in pronation and supination takes place at the radiohumeral and proximal radioulnar connections within the elbow joint. The biceps muscle handles supination, while the pronator teres muscle is responsible for pronation. This enables the elbow to rotate between 0° and 180°. The elbow bears the weight generated by both gravity and muscle contractions during the dynamic motion of swinging the arm [5]. Understanding the anatomy and the forces involved in movement can assist in making diagnoses [6].

Several ligaments provide support to the elbow joint, with the ulnar collateral or medial group of ligaments being of particular clinical significance due to their contribution to valgus stability [7]. The anterior bundle of ulna collateral ligament, which runs from the medial humeral condyle to the coronoid process of the ulna, serves as the primary resistance against valgus stress. Another significant structure is the annular ligament, which is part of the lateral collateral ligament complex and plays a key role in stabilizing the proximal radioulnar joint. Due to its complex and exposed nature, the elbow can suffer severe fractures resulting from high-energy traumatic events, with disruptions to the joint's surface, damage to soft tissues, and injuries to nerves and blood vessels [8].

There are three main nerves around the elbow joint: the ulnar nerve, the median nerve, and the radial nerve. The ulnar nerve traverses a narrow space called the cubital tunnel, which is formed by the medial epicondyle, the olecranon, and a retinaculum (Osborne fascia) continuing distally with the arcuate ligament. The radial nerve does not pass through a specific tunnel or canal like the ulnar nerve. Instead, it courses through a groove in the humerus, which provides some protection to the nerve as it runs behind the humerus. The median nerve runs between the pronator teres and brachialis muscles, and it is sometimes difficult to distinguish from the muscles because of the compactness of the muscles and the minimal amount of fat [6].

The biceps brachii attaches to the radial tuberosity through a tendon that passes over the anterior aspect of the elbow joint and is mainly considered a strong elbow flexor muscle. The biceps tendon is a narrow tendon made up of the long and short bicipital heads, and it attaches to the posterior part of the radial tuberosity. Rotation of the radius along its longitudinal axis at the radiocapitellar joint can result in forearm supination [9].

The olecranon bursa is a subcutaneous sac sparsely lined by synovial cells, and normally no detectable fluid is present. It lies between the skin and a firm base that includes the triceps tendon and the back of the olecranon process. Due to its proximity to the skin and the support it receives from a firm base, it is susceptible to traumatic bursitis resulting from repetitive trauma, and septic bursitis, which is caused by skin bacterial infections. These conditions are relatively common [9].

2. Imaging

The initial evaluation of acute injuries often relies on plain radiography, which is particularly effective in revealing bone injuries, soft tissue swelling, and fluid accumulation within joints. Plain radiography also plays a role in assessing chronic conditions like enthesopathy, bone spurs, and osteochondral diseases [10]. Many chronic elbow issues are diagnosed based on a clinical evaluation, and imaging can be employed to confirm the diagnosis before considering further steps or referrals. MRI is the favored imaging modality for patients with chronic elbow pain [11,12]. MRI excels at detecting abnormal conditions such as bone marrow edema, tendinopathy, nerve entrapment, and joint effusions. In instances where there is no effusion, magnetic resonance arthrography may be performed to identify ligament tears, osteochondral defects, or loose bodies [10,12].

Unlike MRI, CT plays a limited role in evaluating chronic elbow pain. However, it may outperform MRI in identifying soft tissue calcifications, such as myositis ossificans or intra-articular bodies. Musculoskeletal ultrasonography relies more on the operator's skill than MRI, yet it offers a cost-effective and dynamic assessment of commonly injured structures. The elbow is well suited for ultrasonographic evaluation because the majority of structures are superficial and it is possible to obtain long- and short-axis images of almost every anatomic structure [13]. When performing an ultrasonographic evaluation of the elbow joint, a careful investigation is required depending on the area. The distal biceps tendon, brachialis tendon, median nerve and anterior interosseous nerve should be evaluated anteriorly; the common extensor tendon origin, lateral collateral ligament, radial nerve and posterior interosseous nerve laterally; the common flexor tendon origin and medial collateral ligament medially; and the triceps tendon and ulnar nerve posteriorly [13]. Ultrasonography is less expensive than MRI and, when performed skillfully, exhibits a sensitivity of 64% to 82% in diagnosing medial and lateral elbow tendinopathy, in contrast to MRI's sensitivity of 90% to 100% [12].

Electrodiagnostic studies, including nerve conduction studies and electromyography, are beneficial for confirming the diagnosis of peripheral compressive neuropathy and ruling out conditions such as plexopathies and cervical radiculopathies. However, because it takes time for compressive or traction neuropathy to produce positive results in electrodiagnostic studies, there is a risk of false-negative results if testing is performed before symptoms have persisted for 6 to 8 weeks [10,14].

3. Etiology

Numerous common causes of elbow pain are related to the surrounding structures, such as epicondylitis (inflammation or degeneration of underlying tendons), olecranon bursitis, nerve entrapment, and referred pain. Conditions that affect the entire body (like rheumatoid arthritis) usually affect multiple joints and can be identified through a thorough assessment of a musculoskeletal history and physical examination. However, oligoarticular involvement can occur, as in seronegative spondyloarthritis.

Individuals with issues specifically related to the elbow typically present with complaints of pain (like in cases of epicondylitis or tendinopathy), swelling (as seen in olecranon bursitis), or a restriction in motion (such as after a joint injury).

4. Lateral elbow pain

Lateral elbow pain is a primary reason for medical consultations concerning non-traumatic elbow conditions. The most prevalent diagnosis is a tendon-related ailment known as lateral epicondylitis, commonly referred to as “tennis elbow.” Nonetheless, several pathological issues can resemble lateral epicondylitis, such as intra-articular plica, osteochondritis dissecans, radiocapitellar arthritis, or posterolateral rotatory instability. To differentiate these diseases, certain symptoms and diagnostic tests can be considered. For instance, patients with intra-

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articular plica may report clicking sensations within the elbow joint, and imaging tests can confirm the presence of the plica. In cases of osteochondritis dissecans, imaging tests can identify loose fragments of bone or cartilage within the joint. For radiocapitellar arthritis, X-ray images may reveal arthritic changes such as joint space narrowing. Finally, patients with posterolateral rotatory instability may experience a sense of joint instability, and a stress test can be useful in these cases [15].

Each year, approximately 1% to 3% of the population experiences lateral epicondylitis, and despite its association with tennis, only a small fraction (5% to 10%) of tennis players actually develop this condition [16]. Most patients with lateral epicondylitis are in their 30s and 40s, and they typically develop lateral epicondylitis due to occupational factors rather than recreational pursuits [17]. The lateral side of the elbow is affected four to ten times more frequently than the medial side of the elbow [18]. The lateral epicondyle of the humerus serves as the shared origin for the active supinators of the forearm, including the extensor carpi radialis brevis. A physical examination reveals the most pronounced tenderness approximately 1 cm below the epicondyle, where the extensor carpi radialis brevis originates. Patients often experience pain and reduced strength when gripping against resistance, as well as during wrist supination and extension [18].

Nonoperative treatment is the primary approach for medial and lateral epicondylitis [2]. It has been suggested that a significant majority, ranging from 85% to 90%, of patients show a positive response to nonsurgical interventions [19]. However, some series have presented more modest outcomes, indicating that around 40% of patients with lateral epicondylitis still experience some lingering discomfort [20]. Moreover, there is a viewpoint suggesting that no treatment beyond addressing symptoms is necessary, given that this condition is typically benign and self-limiting, frequently accompanying middle age. A recent analysis of data from randomized controlled trials did not show any superiority of nonsurgical treatments over placebo. These studies investigated a variety of interventions, including injections of corticosteroids, platelet-rich plasma (PRP), autologous blood, hyaluronic acid, or glycosaminoglycan, as well as different therapies such as shock wave therapy, laser, ultrasound, iontophoresis, topical agents, and oral naproxen [21].

Physical therapy is classically the first-line treatment for lateral epicondylitis. Stretching exercises are among the most widely used, despite sparse published data on their efficacy [22]. A meta-analysis did not provide definitive conclusions about the use of stretching exercises [23]. Conversely, mobilization involving joint movements, Mill's manipulation, or regional mobilization may be beneficial [24].

For symptom relief, a fundamentally important approach is modifying one's activities to avoid activities that trigger symptoms. Studies have observed that tennis players who employ a two-handed backstroke have a lower likelihood of developing tennis elbow, likely due to altered biomechanics that dissipate forces upon ball contact [25]. Similarly, other equipment and technique adjustments can contribute to resolving symptoms.

A three-phase treatment approach has been proposed for epicondylitis. The initial phase involves modifying activities to prevent triggers and applying ice multiple times daily. NSAIDs might be used to alleviate any accompanying elbow synovitis. Nighttime splints and corticosteroid injections could be considered [26], and counterforce bracing can be employed during this phase to restrict muscle contractions. However, the effectiveness of these treatment options, including injections, bracing, therapy, and oral/topical medications, has been debated, and their efficacy remains uncertain [26,27].

The second phase entails commencing a rehabilitation regimen once acute symptoms have subsided, and painless motion in the wrist and elbow has been restored. This involves initiating a

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program of isometric exercises and stretching, followed by the integration of resistive exercises and activities aimed at enhancing performance for sports or work-related tasks [26]. The third phase constitutes a maintenance period, encompassing adjustments to equipment and techniques for sports or work, along with ongoing conditioning to prevent symptom recurrence [26].

Various substances have been proposed as injections to treat lateral and medial epicondylitis. However, the evidence published to date is inconsistent and inconclusive, making it challenging to provide clear recommendations for injections as a treatment for lateral epicondylitis [21,28].

Botulinum toxin injections have been suggested for lateral epicondylitis, with some series demonstrating benefits, though not consistently across all cases. Muscle weakness is a possible side effect [29]. Autologous blood injections have also been proposed as potentially beneficial for treating epicondylitis [30]. PRP injections have been used, yielding mixed results—promising according to some studies, but less so in others [25–27]. Additionally, polydeoxyribonucleotide injections are a consideration, particularly since a combination of polydeoxyribonucleotide injections and exercises to strengthen the extensor muscles showed superior improvement in functional scores when compared to exercises alone or exercises combined with extracorporeal shock wave therapy (ESWT) [31].

A study focusing on tendinopathy cases found that both PRP and corticosteroid injections led to improvements in patient symptoms. The study concluded that PRP could serve as a safe and effective alternative to corticosteroids, even over extended periods, to lessen both local and systemic effects associated with corticosteroid injections [32,33]. This treatment strategy could be especially advantageous for patients with diabetes, as PRP injections have been shown to be well-tolerated and safe [34]. A recent case-control study also demonstrated that the combination of pie crusting and corticosteroid injections for lateral epicondylitis yielded superior results compared to corticosteroid injections alone [35].

5. Medial elbow pain

Medial elbow pain is the second most commonly reported elbow-related issue. It often originates from either the region near the medial epicondyle or the ulnar nerve as it passes through the cubital tunnel. Similar to lateral epicondylitis, pain associated with medial epicondylitis is highly localized and intensifies during activities that engage the wrist flexors and pronators, such as lifting or repetitive forearm and wrist movements. Pain originating from the ulnar nerve is indicated by sensations radiating into the ulnar side of the hand and accompanying sensory symptoms (and occasionally motor symptoms) in the fourth and fifth fingers.

Medial epicondylitis is notably less frequent than lateral epicondylitis and typically occurs in athletes or individuals who engage in activities requiring repetitive valgus stress, elbow flexion, and repetitive wrist flexion and pronation. It involves tendinopathy of the common flexor tendon, usually affecting the flexor carpi radialis and pronator teres tendons [1]. Patients often describe a gradual onset of pain at the medial elbow, sometimes accompanied by grip-strength weakness. The point of most intense tenderness typically is the insertion of the flexor-pronator mass, situated 5 to 10 mm distal and anterior to the medial epicondyle. The most sensitive sign during a physical examination is pain experienced when resisting pronation. It is also usually possible to replicate the pain with resisted wrist flexion [36].

The core approach to managing medial epicondylitis centers around conservative treatment. This involves using anti-inflammatory medications, splinting, and occasionally steroid injections to provide sustained relief for the majority of patients. Of note, steroid injections can be precisely administered under ultrasound guidance.

ESWT may offer pain relief for certain patients. Stimulating the affected tendon with electrical impulses can promote angiogenesis, tendon healing, and provide short-term analgesia [37]. Lee et al. compared the outcome of ESWT or steroid injections in patients with medial or lateral epicondylitis. They reported worse clinical pain scores at 1 and 2 weeks with ESWT, but better patient satisfaction at 8 weeks [38]. However, another study reported favorable clinical results with ESWT in only 7 of 30 patients at 1-year follow-up, which was notably worse than the results from patients diagnosed with lateral epicondylitis who underwent similar treatment [39]. At this point, definitive recommendations exist for the use of ESWT for medial epicondylitis, including the treatment duration and stimulation protocol [40].

When noninvasive modalities achieve unsatisfactory results, a corticosteroid injection is often effective in reducing medial elbow pain. The corticosteroid is injected into the peritendinous and synovial tissues, rather than into the tendon itself [41]. Similar to oral anti-inflammatory medications, corticosteroids can reduce the surrounding synovitis and resultant pain [40]. A prospective study of steroid injections in 60 elbows diagnosed with medial epicondylitis reported an acute improvement in pain for 6 weeks after the injection but no difference at 3 months [42].

In the study examining the efficacy of PRP injections for lateral and medial epicondylitis, the treatment was found to be significantly effective, suggesting it could be a viable alternative to surgical intervention. Beyond its clinical efficacy in promoting structural healing, PRP has been associated with decreased narcotic usage, improved sleep, and a reduction in pain perception [43]. Consequently, it can be inferred that PRP injections are not only effective in restoring the structure and function of the lateral or medial epicondyles, but also in enhancing quality of life [44].

If nonoperative treatments do not yield satisfactory results, excising the affected tendon origin and reattaching it typically results in successful outcomes.

Cubital tunnel syndrome is a condition characterized by compression or traction of the ulnar nerve as it passes through the cubital tunnel in the inner elbow. It is the second most common compressive neuropathy affecting the upper limbs, following carpal tunnel syndrome [10]. Approximately 60% of patients with medial epicondylitis also experience compressive ulnar neuropathy [3]. These patients typically have recurrent pain in the medial elbow, often accompanied by numbness and tingling sensations along the ulnar side of the forearm and hand, extending to the ring and little fingers. If not addressed over an extended period, this condition can result in weakness in the hand's intrinsic muscles [3]. To rule out other compressive neuropathies, a comprehensive assessment of the upper limbs and cervical spine is necessary [17].

Conservative treatment should be the first approach when dealing with this syndrome, before considering surgical intervention. The severity of cubital tunnel syndrome can be categorized into three levels [45]. Mild dysfunction involves occasional paresthesia and subjective weakness. Moderate dysfunction presents with intermittent paresthesia and quantifiable weakness, while severe dysfunction is characterized by persistent paresthesia and measurable weakness. For patients with mild to moderate cubital tunnel syndrome, it is recommended to avoid prolonged elbow flexion during work and to use elbow extension splints during sleep. When applying the splint, care should be taken to prevent the forearm from being positioned in pronation, as this could potentially worsen the symptoms. To effectively limit elbow flexion while sleeping, towels or cushions can be secured around the elbow. The use of local steroid injections into the cubital tunnel is not widely supported due to their less favorable response [46,47]. A study examined

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the effectiveness of steroid injections on 12 ulnar nerves by dividing patients into two groups: one that received treatment involving nighttime and occasional daytime splinting, and another that received the same splinting along with a local steroid injection. Mild symptoms were adequately addressed with splinting alone, and the inclusion of the steroid injection did not lead to any additional improvement [48]. Typically, conservative measures are pursued for a period of 3 months before surgical intervention is contemplated.

6. Anterior elbow pain

Pain in the anterior elbow often originates from the biceps tendon. Although distal biceps tendon ruptures are uncommon and make up only 3% of all tendon ruptures, distal biceps tendinopathy is more frequently encountered [49]. This condition follows a gradual pattern of anterior elbow pain, particularly during resisted flexion and supination movements of the forearm. Individuals with biceps tendinopathy may experience vague discomfort in the elbow's anterior region. Their medical history often includes repetitive elbow flexion coupled with forearm supination or pronation, as seen in activities like dumbbell curls. During a physical examination, a healthy biceps muscle belly should display a piston-like movement during passive supination and pronation of the forearm when the elbow is flexed at a 90° angle. The lack of this movement suggests a complete tear. Pain in the antecubital fossa is often recreated by resisted supination. To evaluate the tendon's continuity and changes in size, MRI or musculoskeletal ultrasonography can be utilized [50].

Surgery can sometimes be avoided by conservative management of partial or complete biceps ruptures; however, untreated complete distal biceps ruptures can result in an estimated loss of 40% to 60% of supination power and 30% of flexion power. Nevertheless, some patients may adapt well and even regain substantial strength during supination over time [51]. While functional challenges might endure, a study has reported that there could be a notable prevalence of lingering pain and weakness even after 4.5 years of follow-up after nonoperative treatment [52]. Conversely, other studies have shown that many patients adjust well, resulting in high rates of satisfactory outcomes and only a slight decrease in supination strength, as observed over a median follow-up period of 38 months [4]. Injection therapy around the distal biceps tendon can be considered. However, performing injection therapy with PRP or glucocorticoids around the distal biceps tendon and bicipitoradial bursa is complicated due to the lack of clear palpable markers, the complex anatomy of the distal biceps, and the close proximity of critical structures such as the brachial artery, median nerve, and posterior interosseous nerve [53].

7. Posterior elbow pain

Olecranon bursitis, the most common type of superficial bursitis, often results in posterior elbow pain and swelling [54]. This condition can present in two forms: septic or aseptic. Those suffering from septic olecranon bursitis typically experience pain, swelling, warmth, and redness over the olecranon, with approximately half also displaying symptoms of fever. Diagnosis is confirmed through an examination of the fluid within the bursa [55]. In contrast, aseptic olecranon bursitis may be associated with a history of minor elbow trauma, a non-tender mass over the olecranon without redness or warmth, limited range of motion, or absence of other infection-related symptoms [56]. Given the potential complications associated with bursal fluid aspiration, such as infection, this procedure should be reserved for instances when the diagnosis remains uncertain or when symptom relief is sought for persistent cases [54].

Aseptic olecranon bursitis may primarily concern the patient from a cosmetic perspective,

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causing minimal to no discomfort, and it often resolves on its own. When the bursal swelling is neither tender nor excessively tense, management is symptomatic, involving the use of NSAIDs, compression, and precautions to prevent further injury. For acute hemorrhagic bursitis, aspirating the bursa, applying a compression dressing, and using ice can decrease the likelihood of developing chronic bursitis. In cases of aseptic olecranon bursitis with a significant, tense, and inflamed bursa, aspiration along with a steroid injection (after ruling out infection) has been shown to speed up symptom resolution. An alternative method involves aspirating the olecranon bursa and then injecting corticosteroids into the elbow joint, which has demonstrated favorable results with fewer complications [57]. After aspiration and steroid injection, employing a compression dressing and a brief period of limited movement could be beneficial. However, repeated steroid injections for aseptic olecranon bursitis have been linked to triceps rupture and should be avoided.

Managing septic bursitis involves the use of antibiotics targeted at penicillinase-producing *Staphylococcus* bacteria, along with splinting, warm soaks, and bursa drainage. The drainage can be accomplished via daily needle aspiration until the fluid is sterile [58]. Nevertheless, some cases might require an open incision and drainage, especially if the infection persists or becomes refractory [59].

Conclusion

Since conservative treatment is effective for numerous causes of elbow pain, it is crucial to administer adequate nonoperative treatment before contemplating surgical intervention.

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Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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