

## Elbow injuries in golf

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**Golf is not a sport known for its high injury level; however, injuries do occur. Such mishaps usually involve overuse-type injuries that are more common among amateur golfers than among professional golfers. This article attempts to provide an overview of golf injuries to the elbow, with a concentration on incidence, proper diagnosis, adequate treatment (including rehabilitation), and prevention strategies. After reading this article, primary care physicians should be able to manage most golfing injuries to the elbow.**

**(Key words: primary care, sports medicine, elbow, golf)**

Golf is generally considered to be a noncontact sport with minimal aerobic benefit that requires a great deal of practice to achieve proficiency. What makes golf truly distinct from so many other sports, however, is that it is played by young and old, male and female, and those with modest incomes as well as great wealth.

Golf injuries in professional and amateur golfers tend to be similar, though the frequency of specific injuries differs between pros and amateurs—and between men and women. In professional golfing, men tend to have back injuries most frequently, with wrist and shoulder problems being the next most common maladies. Among female professionals, the left wrist is injured most commonly, followed by the low back (*Table 1*).<sup>1</sup> Mallon<sup>2</sup> reports that among male amateur golfers, the low back is injured most commonly, followed by the elbow, and then the hand, wrist, and shoulder. The

elbow is the most commonly injured body part among female amateurs, with the back a close second and the shoulder, hand, and wrist following that (*Table 2*).<sup>3</sup> This may be due to the greater carrying angle of the elbow (cubitus valgus).<sup>4</sup> Batt<sup>4</sup> found that professional golfers' injuries occurred primarily from overuse during practice (68%), with only 7% of their injuries occurring during competition. Overuse in either practice or golf rounds is the leading cause of injury among professionals and amateurs (*Table 3*), with poor swing mechanics being an exclusive cause of injury in amateurs.<sup>1,5</sup> Most other injuries occur as the golf club hits the ground (divot)—this injury is approximately four times more common in amateur golfers and is due to improper swing mechanics and other deviations from a fundamentally sound golf swing (*Figure 1*).

Kohn<sup>6</sup> found that elbow problems in golfers occurred in 24% of amateurs and approximately 4% of professionals, with two to three rounds of golf per week appearing to be "the threshold after which complaints of elbow pain began to rise" in golfers aged 35 to 55 years. Overall, the factors contributing to elbow injuries are overuse, poor swing mechanics, conditioning, warm-up, age, equipment, and preexisting pathologic mechanisms.<sup>6</sup>

Although the term *golfer's elbow* has historically described medial epicondylitis, the more common problem is actually lateral epicondylitis. McCarroll and colleagues<sup>5</sup> found lateral elbow pain to be more common than medial pain by a 5:1 ratio in amateur golfers. Other investigators have found the incidence to be approximately equal. Lateral epicondylitis occurs on the left elbow of a right-handed golfer. Medial epicondylitis affecting the right elbow is most likely caused by sudden impact loading, such as can occur by striking the ground, encountering unexpected obstacles, or taking repetitive strokes that leave large divots (*Figure 2*).<sup>4</sup>

Lateral epicondylitis among golfers is caused by the same mechanisms as with nongolfing activities. Specifically, this condition is caused by repetitive forceful extension of the forearm accompanied by a twisting motion, especially if associated with excessive gripping of the golf club. Other elbow injuries occurring in golf include extensor overload injuries, lateral compression injuries, and (conceivably) avulsion fractures of the medial epicondyle in adolescents, though the literature is sparse concerning these conditions. Radial tunnel syndromes are rare in golfers. Ulnar neuritis is associated with medial epicondylitis in as much as 20% of cases.<sup>6</sup> If golfers have symptoms of catching and locking, degenerative spurs and loose bodies may be the cause.<sup>6</sup> Another golf malady worth noting is flexor carpi ulnaris tenosynovitis.<sup>7</sup>

### History

As with any athletic injury, taking the patient's history is the critical part of the diagnosis. History is key, for example, in differentiating between overuse and acute injuries, as most elbow injuries follow well-known patterns. Approximately 75% of elbow injuries can be diagnosed by history and physical examination alone.<sup>8</sup>

The demands of golf, the age of musculoskeletal development, and the extent of injury should all be considered.<sup>7</sup> Always obtain a detailed description of the exact movements that exacerbate the patient's injury and find out if any activ-

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**Table 1**  
**Professional Golf Injuries\***

| Injury         | Men<br>No. (%) | Women<br>No. (%) | Total<br>No. (%) |
|----------------|----------------|------------------|------------------|
| Left wrist     | 31 (16.1)      | 63 (31.3)        | 94 (23.9)        |
| Lower back     | 48 (25)        | 45 (22.4)        | 93 (23.7)        |
| Left hand      | 13 (6.8)       | 15 (7.5)         | 28 (7.1)         |
| Left shoulder  | 21 (10.9)      | 6 (3)            | 27 (6.9)         |
| Left knee      | 14 (7.3)       | 12 (6)           | 26 (6.6)         |
| Left elbow     | 6 (3.1)        | 9 (4.5)          | 15 (3.8)         |
| Left thumb     | 10 (5.2)       | 3 (1.5)          | 13 (3.3)         |
| Foot           | 4 (2.1)        | 9 (4.5)          | 13 (3.3)         |
| Cervical spine | 9 (4.7)        | 3 (1.5)          | 12 (3.1)         |
| Right wrist    | 3 (1.6)        | 9 (4.5)          | 12 (3.1)         |
| Ribs           | 6 (3.1)        | 6 (3)            | 12 (3.1)         |
| Right elbow    | 8 (4.2)        | 3 (1.5)          | 11 (2.8)         |
| Right shoulder | 1 (0.5)        | 9 (4.5)          | 10 (2.5)         |
| Thoracic spine | 8 (4.2)        | 0 (0)            | 8 (2)            |
| Ankles         | 2 (1)          | 6 (3)            | 8 (2)            |
| Groin          | 2 (1)          | 3 (1.5)          | 5 (1.3)          |
| Left hip       | 4 (2.1)        | 0 (0)            | 4 (1)            |
| Head           | 2 (1)          | 0 (0)            | 2 (0.5)          |
| <b>Total</b>   | <b>92</b>      | <b>201</b>       | <b>393</b>       |

\*Percentages have been rounded.

ities of daily living or occupational activities increase the pain. If the golfer states that the pain only occurs during or immediately after playing golf, ask the question, "At what point in your golf swing do you notice the pain, or is the pain only present toward the end of a round or later that evening?" Other basic questions should be asked, including the following:

- "How and when did the symptoms first appear?"
- "Was the elbow twisted, struck, or subjected to shearing forces?"
- "Did you fall on your elbow or your outstretched hand?"
- "What position was your elbow in when the injury occurred? Was it flexed

or extended? Pronated or supinated?"

- "How long have you noticed the symptoms? Have you had any other injuries or disorders affecting this elbow?"

■ "What is the range of motion that you can achieve without producing pain?"

- "Is your pain sharp or dull? Constant or intermittent? Throughout your golf game or only afterward?"<sup>8</sup>

■ "If your injury is believed to be acute, exactly what was occurring when you first felt the pain?"

- "What treatment have you attempted?"

■ "Has your pain caused you to alter your swing or stop playing altogether?"

If your patient describes numbness or tingling along with the pain, suspect some sort of neuropathy due to stretching, compression, or osteophytes around the elbow. Cervical radiculopathy must be ruled out.<sup>8</sup> If a golfer complains of pain on attempting to grip a club—especially when pronating and supinating the wrist—and has pain at the elbow along with resisted extension, the physician should consider a diagnosis of lateral epicondylitis until proved otherwise.<sup>9</sup>

Chronic repetitive microtrauma can cause lateral or medial epicondylitis, and direct trauma or a particular bout of strenuous activity can bring on a subclinical overuse disorder. It would appear that subclinical injury and dysfunction typically precede an episode of conscious injury. Symptoms begin gradually and become noticeable when a patient's activity level increases. Clancy and Hagen<sup>10</sup> have suggested that a preexisting pathologic mechanism must be present for a tendon to rupture during a mechanical load.

Several terms are worth defining at this point: *paratenonitis*, *tendonitis*, and *tendinosis*. *Paratenonitis* describes an inflammation of the outer layer (paratenon) of the tendon alone. *Tendinitis* describes the injury that produces inflammatory repair response within the tendon. Secondary reactive paratenonitis can be present along with an inflammatory response within the tendon. *Tendinosis* describes intratendinous degeneration. Often tendinosis is asymptomatic, with clinically palpable nodules. This condition is not associated with an inflammatory response.<sup>9</sup> This is a tendon that is ripe for rupture.

## Physical examination

Just as when examining many other parts of the musculoskeletal system, it is wise to first observe the elbow for any swelling, ecchymosis, deformity, warmth, or any other visible abnormality. Next, palpate the elbow to identify tenderness, beginning palpation away from the site of the patient's complaint of pain, and gradually working toward the region in question. This region should be palpated last, with gentle palpation that pro-

gresses gradually to more vigorous palpation. In my practice, I find it useful to grade the degree of palpable tenderness on a scale of 0 to 4, with 0 being no palpable tenderness and 4 being extreme pain on light palpation only. This gives a frame of reference when the patient returns for subsequent visits. Compare any findings of swelling, deformity, and palpable tenderness with findings from the uninvolved elbow. Make sure to evaluate the shoulder and wrist of the involved arm as well, because some pathologic mechanisms can be overlooked by dwelling only on the elbow.

Bulging at the soft spot below the lateral epicondyle is a useful sign of a swollen joint. Obvious swelling in an elbow is most often caused by posttraumatic olecranon bursitis rather than by other types of inflammation.<sup>8</sup>

Proceed to a range of motion assessment by comparing the injured arm with the uninjured arm to determine the normal range of motion for that patient. Normally, elbows have a valgus angle of about 5° to 10°. If the difference between the two arms is 5° (particularly in children), one should consider a growth disturbance caused by a previous injury.<sup>8</sup>

In children, look for a loose body if the arm lacks full extension. Rare conditions that impair extension include humeral hypertrophy (blocking the olecranon from entering the trochlear groove) and contracture of the forearm muscles.<sup>8</sup> Far and away the most common cause of lack of full elbow extension, however, is contracture of the elbow due to prolonged immobility. Most often, lack of full flexion of the elbow is caused by pain or extreme swelling in the olecranon region.

Ulnar neuropathy is commonly overlooked, but a history of tingling sensations in the fourth and fifth fingers in conjunction with pain in the medial elbow (the funny bone region) should raise suspicions that this condition may be present. Palpate the ulnar groove and percuss the ulnar nerve in this region to check for Tinel's sign (tingling at the fingertips with percussion). As Bogard noted, "Weakness of finger extension or

| Table 2<br>Amateur Golf Injuries* |                |                  |                  |
|-----------------------------------|----------------|------------------|------------------|
| Injury                            | Men<br>No. (%) | Women<br>No. (%) | Total<br>No. (%) |
| Lower back                        | 210 (35.9)     | 34 (27.4)        | 244 (34.5)       |
| Elbow                             | 190 (32.5)     | 44 (35.5)        | 234 (33.1)       |
| Lateral                           | 160 (27.4)     | 34 (27.4)        | 194 (27.4)       |
| Medial                            | 30 (5.1)       | 1 (8.1)          | 40 (5.6)         |
| Hand and wrist                    | 124 (21.2)     | 18 (14.5)        | 142 (20)         |
| Shoulder                          | 64 (11)        | 20 (16.1)        | 84 (11.9)        |
| Knee                              | 52 (8.9)       | 14 (11.3)        | 66 (9.3)         |
| Neck                              | 26 (4.5)       | 2 (1.6)          | 28 (4)           |
| Hip                               | 18 (3.1)       | 4 (3.2)          | 22 (3.1)         |
| Ribs                              | 16 (2.7)       | 6 (4.8)          | 22 (3.1)         |
| Ankle                             | 8 (1.4)        | 10 (8.1)         | 18 (2.5)         |
| Foot                              | 12 (2.1)       | 0 (0)            | 12 (1.7)         |
| Head                              | 12 (2.1)       | 0 (0)            | 12 (1.7)         |
| Thigh                             | 8 (1.4)        | 0 (0)            | 8 (1.1)          |
| Face                              | 6 (1)          | 0 (0)            | 6 (0.8)          |
| Abdomen                           | 4 (0.7)        | 0 (0)            | 4 (0.6)          |
| Calf                              | 4 (0.7)        | 0 (0)            | 4 (0.6)          |
| Forearm                           | 0 (0)          | 2 (1.6)          | 2 (0.3)          |
| <b>Total</b>                      | <b>584</b>     | <b>124</b>       | <b>708</b>       |
| *Percentages have been rounded    |                |                  |                  |

sensory abnormality of the thumb web space suggests injury to the radial nerve; abnormal sensation to the distal thumb, index finger, and long finger (which is common in golfers who repetitively grip points to the median nerve."<sup>8</sup>

Next, perform varus and valgus stressing of the elbow—with the elbow at approximately 30° to 40° of flexion—to determine stability. Gapping of the medial elbow suggests significant injury to the ulnar collateral ligament, avulsion fracture of the medial epicondyle, or both. This is not an uncommon injury. However, gapping on the lateral side of the elbow is rare. If range of motion tests prove extremely painful for the patient, obtain plain radiographs. If negative, pal-

pate the radial head and olecranon in flexion/extension as well as supination/pronation. Check for crepitance as well as bony end points.

### Diagnosis and diagnostic studies

Plain film radiographs of the elbow should be obtained if there is extreme point tenderness over a bony prominence, if the elbow is unable to achieve full range of motion, if there is gapping of the medial joint line, if there is obvious deformity or severe swelling, or if the elbow is too painful for the patient to move—even for a very limited range of motion.

The most common golf-related fracture of the elbow in children and adolescents is the medial epicondyle frac-

**Table 3**  
**Mechanisms of Injury**

|                           | Professional | Amateur |
|---------------------------|--------------|---------|
| Too much play or practice | 270          | 204     |
| Poor swing mechanics      | 0            | 150     |
| Hit ground (divot)        | 40           | 171     |
| Overswing                 | 0            | 85      |
| Poor warm-up              | 0            | 60      |
| Twist during swing        | 18           | 22      |
| Grip or swing change      | 0            | 26      |
| Fall                      | 2            | 24      |
| Bending over putt         | 5            | 8       |
| Injury secondary to cart  | 0            | 18      |
| Hit by ball               | 3            | 36      |

ture. Such fractures are usually considered to be epiphyseal avulsion injuries. Curl<sup>9</sup> states that displacement between 0.5 and 1.0 cm is acceptable if the elbow is otherwise stable. It is generally believed that any displacement over 1.0 cm is significant and that surgical intervention should be considered in such cases.<sup>9</sup> Radial head fractures are considered a rare golf injury.

Recent advances in magnetic resonance imaging provide for excellent methods of evaluating the elbow. Subtle changes can be detected, as can certain soft tissue injuries. A good magnetic resonance imaging study will often preclude the need for surgery if no fracture, soft tissue disruption, spurs, or loose bodies are identified. Technetium bone scans and arthrography have been used to evaluate elbows; however, magnetic resonance imaging has made these studies practically obsolete. Bogard and others<sup>8</sup> believe that computed tomographic arthrograms are best if you are looking for loose bodies not seen on plain films. Magnetic resonance imaging arthrograms may also be useful.

When ordering plain films, be sure to order lateral views with the elbow both flexed and extended, as well as antero-

posterior films with the forearm pronated and supinated. Of course, patients with open growth plates should routinely get bilateral films. Significant fractures, loose bodies (or other mechanical problems), neurologic injuries, severe intra-articular swelling, signs of infection, or grade III tendon or ligament tears all warrant orthopedic consultation.<sup>8</sup>

If the elbow joint is hot, swollen, and red—especially in the presence of nearby abrasions, small lacerations, or puncture wounds—assume infection until you prove otherwise. The best way to rule out infection is to aspirate fluid from the joint for Gram stain and culture and sensitivity. When aspirating, be careful not to leave a large tract, especially on the tip of the olecranon bursa. Otherwise, you may create a pathway for secondary infection. In the elbow, infected fluid is usually clear and low in viscosity, rather than yellowish.<sup>8</sup> If infection is suspected, strongly consider broad-spectrum antibiotics (with indications for skin and soft tissue infection), such as cefadroxil monohydrate or azithromycin, until the culture is obtained. Obviously, a sterile dressing should be applied after aspiration, along with a compression dressing that does not restrict blood flow.

## Treatment and rehabilitation

As previously discussed, lateral epicondylitis is far and away the most common elbow injury among amateur golfers. Treatment includes rest, ice, compression, and elevation; nonsteroidal anti-inflammatory drugs (NSAIDs); muscle-tendon strengthening within the limits of pain; tennis elbow strap to allow decreased pain if activities must continue; physical therapy; corticosteroid injections; and measures to prevent recurrence.

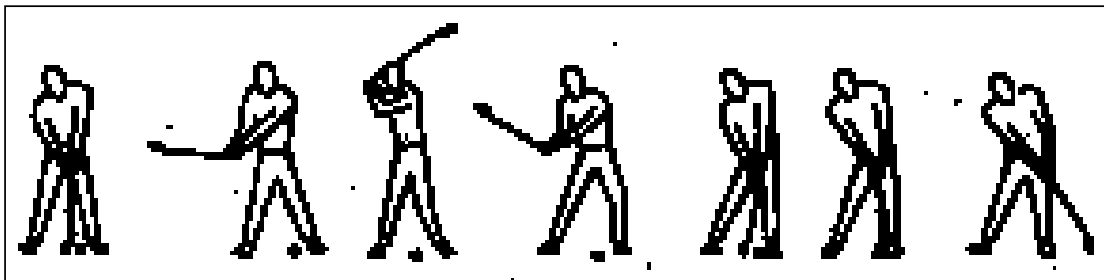
Ice should be applied two or three times daily during the acute phase of the injury. Rest includes the avoidance of all activities that significantly increase the pain in the injured region, including excessive wrist motion and hard gripping of any kind. Compression is not usually necessary in cases of lateral epicondylitis because of the lack of edema. As soon as lateral epicondylitis is diagnosed, NSAIDs should be prescribed to be taken regularly by the patient. This will help to decrease inflammation and offer a certain amount of analgesia. As with most medications for athletes, the NSAID should be taken once or twice daily to increase patient compliance.

Ideally, physical therapy should begin immediately. Such problems as muscular atrophy, neurologic discoordination, and altered muscle function typically can be avoided with a good and regular physical therapy program.<sup>10</sup> Some authors advocate immobilization by splinting for severe lateral epicondylitis.<sup>8</sup>

However, these same authors contradict themselves by stating that one should “place less emphasis on rest for the elbow than for other joints. Specialists agree that an injured elbow should begin moving as soon as possible the next day, ideally.” They further state that “casting is almost never used for fractures or dislocations in elbows.”<sup>8</sup> I have yet to encounter a patient with lateral epicondylitis so severe that it required splinting. Range of motion within the limits of pain is a basic tenet of sports medicine.

Cryotherapy should be continued as long as inflammation is suspected. After the acute phase has ended, application of

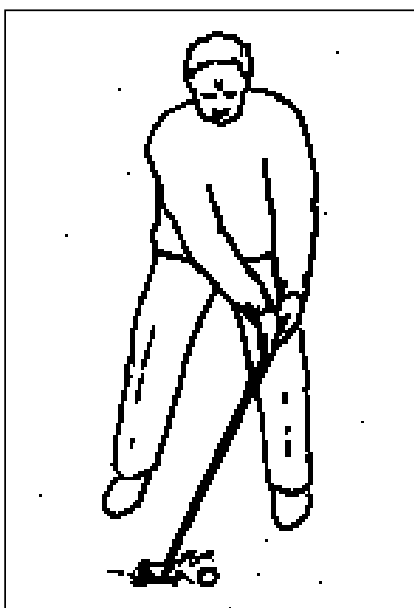
**Figure 1.** A fundamentally sound golf swing.



heat can help to increase blood flow and decrease muscle spasm and stiffness. Ultrasound therapy also is useful because it increases the blood flow and extensibility of tissue while also decreasing pain and spasm.<sup>10</sup> In my practice, iontophoresis is by far the most useful modality.

Exercise is generally aimed at increasing grip strength but also includes stretching exercises for the extensor flexor muscles of the forearm and strengthening exercises for the wrist in flexion and extension. Therapy also must include strengthening of the supinators and pronators to prevent reinjury. The program should follow the usual progressive, resistive exercise model to diminish the inflammatory response.<sup>6</sup> Common exercises for this purpose are shown in Figure 3. Physical therapy should be pursued at 6- to 8-week trial before more aggressive treatment is considered. The patient also should perform wrist and shoulder exercises to keep the entire upper extremity strong.

A "tennis elbow" strap can be used if the athlete or worker needs to continue certain activities that cannot be discontinued or modified. Use of the strap allows activity to a certain level and can help maintain strength and endurance, as well as promote healing.<sup>11</sup> The mechanism of the tennis elbow strap is to cinch down the proximal forearm musculature to a point that the forced contraction is decreased—by effectively shortening the length of the muscles. Harding<sup>11</sup> found that force to the forearm extensors decreases in lateral tennis elbow and force to the forearm flexors decreases in medial tennis elbow. The most effective strap in my experience has been the Aircast Pneumatic Armband (Aircast Inc., Summit, NJ), which has an inflatable air sack that is placed 1.5 inches distal to the lat-



**Figure 2.** Medial epicondylitis affecting the right elbow is most likely caused by sudden impact loading, such as can occur by taking repetitive strokes that leave large divots.

eral epicondyle on the belly of the extensor carpi radialis brevis (Figure 4).

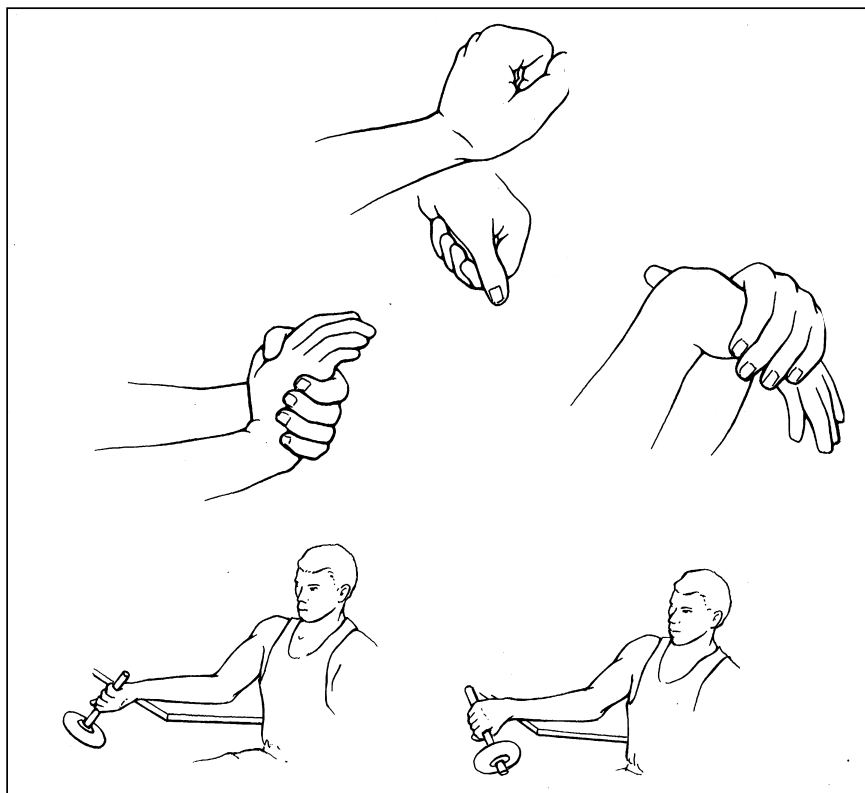
Theoretically, all of these braces create a new "origin" of the muscle that shortens the length of the overall muscle's pull, slightly changes the direction of force, and bypasses the inflamed and injured portion of the muscle.<sup>4</sup> Studies performed by Groppe and Nirschl<sup>12,13</sup> found that the elbow braces decrease muscle forearm activity. The wrist brace used in the studies, however, effectively decreased force around the wrist, therefore increasing force at the elbow,<sup>11</sup> making wrist braces counterproductive in the treatment of lateral epicondylitis.

One word of caution about tennis elbow straps: They should be used carefully and judiciously in children, as the

straps do not offer protection against growth plate pathology and "by giving a false sense of comfort and security, it can lead to overuse and conditions such as osteochondritis dissecans, loose bodies in the joint, or medial epicondylar apophysitis."<sup>11</sup> Avulsion of the medial epicondylar apophysis can occur as well.<sup>11</sup> Therefore, the best method of treatment for adolescents is rest, ice, and tincture of time.

If the conservative treatments described so far fail to relieve pain, particularly if there is point tenderness directly on the lateral epicondyle, corticosteroids may be helpful. Some physicians prefer to use an oral corticosteroid dose pack before injections. In my experience, however, dose packs have less of a chance of achieving a "cure" than do properly paced steroid injections. Each clinician has his or her favorite corticosteroid preparation—my preference is Celestone Soluspan (Schering Corp, Kenilworth, NJ) because it is easily injected through a small-bore (25-gauge) needle and mixes well with all local anesthetics. I mix 1 mL (6 mg) betamethasone sodium phosphate/ betamethasone acetate with 1 mL bupivacaine hydrochloride 0.25%, and I have never had a patient complain of the "steroid flare" when using this combination. As many as three steroid injections can be performed, spaced 2 to 6 weeks apart within a given calendar year. Of course, all athletes are cautioned not to return to any golf activities or other vigorous activities involving the elbow for at least 2 weeks after an injection.

The injection technique itself varies somewhat from clinician to clinician, but the technique I have found to be most effective is to have the patient sit with his or her elbow flexed to 90°, palm



**Figure 3.** Common exercises for diminishing the inflammatory response.

down, resting on the examination table. The approach involves finding the landmarks of the lateral epicondyle of the humerus and the proximal olecranon process of the ulna (*Figure 5*). Using a 0.5" to 1" needle, insert perpendicular to the skin, directed medially and slightly toward the hand. I prefer to use Fluorimethane spray (Gebauer Co, Cleveland,

Ohio) to numb the skin before injection—after I have noted my injection site with an indentation of my fingernail. On inserting the needle, there should be no resistance; after aspiration is negative for blood return, the injection should be effortless—again with no resistance.

There is significant controversy regarding the injection of tendons themselves.

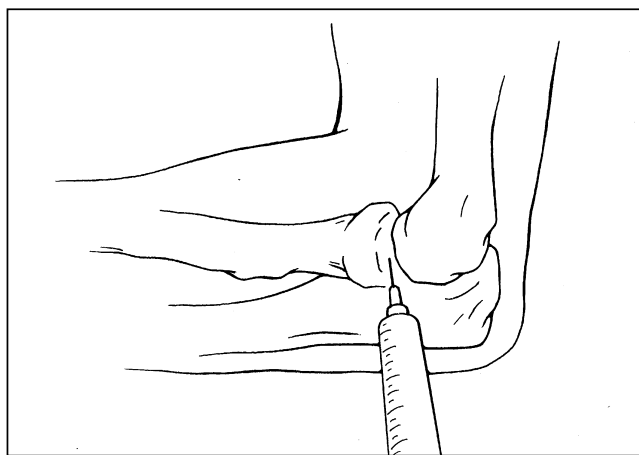
Clancy and Hagan<sup>10</sup> believe there is no good evidence that injection adjacent to tendons, into the surrounding sheath and paratenon, causes injuries to the tendon. It is unclear if steroid injections cause abnormal healing effects with regard to tendons; however, they may block a "protective" inflammatory response, making the patient more susceptible to a spontaneous tendon rupture.<sup>10</sup> I do not believe that it is ever a good policy to inject a tendon or the area immediately around a tendon unless all else fails—and never in a weight-bearing joint.

Osteopathic manipulative treatment has been effective in some cases of lateral epicondylitis. The manipulation, according to Steiner, consists of "softening the muscles of the forearm and then locating proximal lesions such as the deltoid, trapezius, and cervical musculature which may have contracted, splinting the articulations in the process of protecting the inflamed joints. Manipulation releases the splinted joints and contributes to normalization of function."<sup>14</sup> I am aware of some high-velocity, low-amplitude techniques performed by some osteopathic physicians for lateral epicondylitis, but I do not believe that this type of manipulation is effective for this specific condition. It may be effective for radial head subluxation, or "nursemaid's elbow."

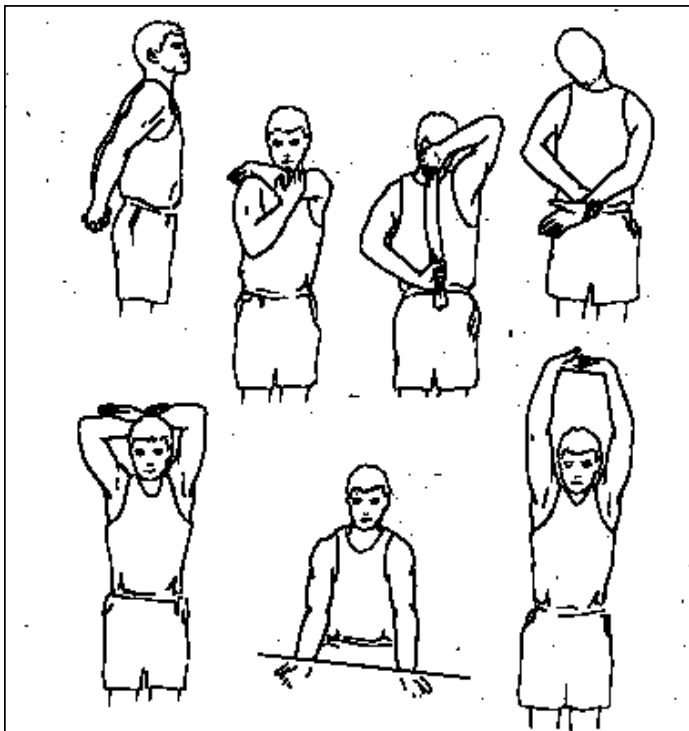
Surgery is rarely indicated for lateral epicondylitis unless conservative treat-



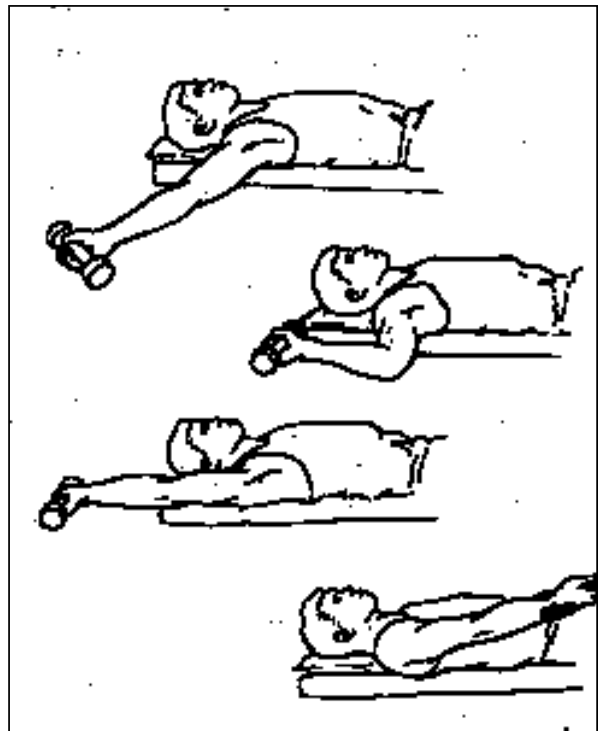
**Figure 4.** Proper placement of tennis elbow support. The inflatable air sack is placed 1.5 inches distal to the lateral epicondyle on the belly of the extensor carpi radialis brevis.



**Figure 5.** Site of steroid injection for lateral epicondylitis.



**Figure 6.** *Shoulder and elbow exercises.*



**Figure 7.** *Shoulder and elbow stretches with weights or assistance.*

ment has failed to be helpful for at least 6 months, even in conjunction with forearm bracing and at least three corticosteroid injections. Obviously, surgery might be considered sooner than this if loose bodies, avulsion fracture, or other degenerative processes are revealed on plain films or magnetic resonance imaging.

Medial epicondylitis, the so-called "golfer's elbow," is usually treated conservatively, as in lateral epicondylitis. The chief difference in treatments between the two conditions is that the medial portion of the elbow should probably never be injected with corticosteroids. Such injections run the risk of causing valgus stresses that can lead to rupture of the ulna collateral ligament. Prevention of medial epicondylitis requires altering the golf swing (the patient should seek the assistance of a golf professional in this regard), and, obviously, not making large divots when attempting to hit the ball. As with lateral epicondylitis, surgical intervention is rare but, when performed, is aimed at releasing the tendon and scraping the tendon insertion on the epicondyle.<sup>9</sup>

Nondisplaced medial epicondyle fractures, as well as grade I or II ulnar collateral ligament sprains, can be treated in the office with initial immobilization in a sling and then relative immobilization (range of motion within the limits of pain only), followed by progressive rehabilitation exercises over several weeks. As stated before, lateral compression injuries of the elbow can occur during the acceleration phase of the golf swing.<sup>9</sup> However, these are infrequent and usually can be treated conservatively. Extensor overload injury to the elbow can occur, but is much more frequent in baseball pitchers. This repetitive overload can cause osteophytes to form in the olecranon fossa. This is also generally treated conservatively, but surgical intervention is often necessary to restore full range of motion.<sup>9</sup> Flexor carpi ulnaris tenosynovitis is usually treated conservatively, like lateral epicondylitis, except that injections are extremely rare.

With any of these injuries, full return to play should not occur until the elbow is free of pain, full range of motion has been achieved, strength is bilaterally

equal, and corrections have been made in the golf swing mechanics to prevent recurrence of the injury in the future.

## Prevention

Most golf injuries can be prevented by the player developing proper swing mechanics, which makes it less likely that he or she will develop overuse injuries. Proper swing mechanics are best taught by a golf professional, during multiple lessons, until the swing has become "grooved." However, even with good swing mechanics, hitting 250 golf balls in an afternoon can still produce repetitive microtrauma-type injuries.

Kohn<sup>6</sup> has discovered that if the golf club deviates from the proper plane on the backswing, compensatory movements to bring it back on plane can lead to elbow injuries. Proper conditioning before repetitively swinging a golf club involves developing adequate warm-up, good stretching techniques, strengthening aimed at improving muscular endurance, and even cardiovascular conditioning.<sup>15</sup> Warm-up involves warming up all of the body tissues, not just the elbow. One

suggestion would be approximately 5 minutes of general stretches, a few jumping jacks, or running in place.<sup>14</sup> More vigorous stretching should occur at this point, which should be static and involve all the joints of the body.

For the elbow specifically, the golfer should hyperextend the elbows and hold them in that position for approximately 10 seconds, performing three to five repetitions. The golfer also could place his or her hands under an object, such as a desk or table, with the elbows extended and hands palms up, then push gently upward to hyperextend the elbows more fully. This exercise produces a proprioceptive neuromuscular facilitation-type stretch. The forearm should be fully pronated and held in that position for approximately 10 seconds, with three to five repetitions, and the forearm should be supinated and held in that position for 10 seconds, with three to five repetitions. Wrist and shoulder stretches should also be performed to loosen up the entire upper extremity (Figure 6).

If lack of flexibility is a recurring problem, stretches should be performed daily, possibly using weights or proprioceptive neuromuscular facilitation-type stretches (Figure 7). Kohn<sup>6</sup> recommends a short period of upper body stretching performed with golf clubs. Golfers should then gradually increase the arc of their swings from short irons to drivers. He believes that this best acclimates forearm muscles to the forces necessary to swing longer and heavier clubs, while also invoking muscle memory of the previously learned "grooved swing." Probably a combination of these two types of stretching/warm-up would be ideal.

The proper equipment in golf cannot be overemphasized. A golf pro should help each golfer assess his or her grip size as well as length of clubs. New golf technology has developed cavity-backed irons that lessen the vibration of off-center hits. Also available are oversized irons and woods that give a greater "sweet spot" or hitting area. Graphite shafts fitted to the individual golfer's size and swing speed offer a truer flight of the ball with diminishment of vibrations, thus reducing the possibility of overuse injuries.<sup>6</sup>

## Comments

Elbow injuries in golf, while not as prevalent in general as lower back or wrist injuries, do occur and can usually be treated by the primary care physician. Most such injuries respond to conservative treatment, particularly if formal physical therapy is instituted by a physical therapist or an athletic trainer. Because most golf-related elbow problems are due to overuse rather than to direct trauma, the general principles of overuse injury treatment tend to be effective. As with any type of overuse injury, prevention is the best treatment. Therefore, all golfers should attempt to get themselves into some sort of reasonable physical condition. Certainly, they also should take golf lessons if they are in any way serious about playing golf for years to come.

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