

## **TANK CARRIER'S LATERAL EPICONDYLITIS: CASE REPORTS AND A NEW CAUSE FOR AN OLD ENTITY**

Lori L. Barr and Larry R. Martin

### **Introduction**

Lateral epicondylitis is a common injury which may be difficult to treat. While the injury is classically associated with tennis playing, a number of other causes have been reported.<sup>1,2</sup> However, the entity has not previously been associated with the carrying of compressed air tanks. We report five cases of lateral epicondylitis related to the carrying of compressed air tanks during dive-related activities.

### **Methods**

After an episode of acute elbow pain was noted in a research diver during intensive periods of lifting and carrying compressed air tanks, the authors performed a retrospective literature search to review the causes of lateral epicondylitis and to evaluate the likelihood of cause and effect between the association. During the year between presentation of the first case and the present time, four other cases of tank carrier's lateral epicondylitis were discovered. We present five cases for consideration.

### **Case 1**

This 46 year old male has a twelve year history of intermittent pain localized to the lateral aspect of the right elbow. While the majority of his year is spent in a supervisory position, two months per year involve intensive research diving trips. These activities require lifting and carrying of equipment (A180 compressed air tanks) over rough terrain for at least fifty yards twice a day. He has no history of other predisposing factors for lateral epicondylitis. The pain typically occurs during his research dive trips and lasts one to nine months after returning to his sedentary lifestyle. The pain occurs during rest and is not associated with grip weakness. He experienced a three year pain free interval approximately eight years ago. Since the last episode, he has been pain free for eleven months.

Over the course of the illness, he has consulted several physicians. He has tried the entire spectrum of non-steroidal anti-inflammatory agents with variable success. During medical therapy, he experiences a decrease in rest pain but suffers from gastrointestinal side effects. He feels that after his last trial with Feldene (piroxicam), 20 mg daily for one month, his return to a pain free state was more rapid.

Physical examination was significant for point tenderness over the lateral epicondyle aggravated with resistive wrist dorsiflexion. No clinically apparent evidence of swell-

ing or discoloration was present. No grip weakness was elicited. Radiographic examination was negative. Ultrasound examination was positive for thickening of the right common extensor tendon.

### **Case 2**

This 34 year old male dive instructor complained of pain the day after he was required to carry ten to twenty compressed air tanks (A180, A150) from the dive shop to the local college pool used for certification classes via a station wagon. He typically teaches large classes of five weeks duration four times per year. The onset of pain occurs the day after the first pool session and lasts from days to weeks. He has experienced no grip weakness. Although he has tried taking aspirin for his pain, no objective relief has been noted. He feels he has modified his lifting technique to compensate for the pain. Physical examination was positive for point tenderness over the lateral epicondyle without grip weakness. No radiographic examination was performed.

### **Case 3**

This 33 year old male had a one and a half year history of fencing when he began working for a local marine park. His job consisted of extensive scrubbing of sides of aquariums and carrying 11 tanks to be filled each week. He would carry the tanks from a dive locker to a pick-up truck, load them and drive to the local dive shop where he would unload them, wait while they were filled, carry them to the pick-up truck, load them and then unload at the other end and carry them to the storage. This involved lifting each tank eight times. After nine months, he developed right lateral elbow pain. He did not seek medical attention. Instead, his pain was relieved by cradling the tanks instead of carrying them by the valve stems and stopping the scrubbing motion he was using. The pain lasted for less than one year and did not interfere with fencing. He has since changed jobs and is not required to clean aquariums or lift tanks. He has been pain free for one year.

### **Case 4**

This 40 year old female was in her normal state of health until she played tennis for the first time three years ago. She is 155 cm tall and right handed. After playing tennis for one afternoon with her brother, she noticed that her right elbow was occasionally painful. Aside from this isolated attempt at tennis, her history was negative for other racquet sports, golf or occupational predisposition to elbow injury. Three months later, she began taking a scuba diving class for open water certification. At the pool sessions, each diver was required to participate in the loading and unloading of the forty tanks (A180) used for class. Specifically, the tanks were passed from one diver to the next while the divers

stood in a line between the two points where the tanks were being transported.

Three weeks into the class, the patient awoke with a sharp pain in her right elbow joint which felt like a hot poker. The following day she sought medical attention. Physical examination revealed exacerbation of lateral pain and grip weakness with right wrist dorsiflexion. She was started on passive therapy including anti-inflammatory agents and splinting. However, her pain and grip weakness continued to increase and by the time of her check out dives, the pain was incapacitating. Her doctor injected the area with a steroid/lignocaine mixture which temporarily provided relief.

After the course, the patient chose to purchase A150 and A160 tanks for her personal use. She continued to lift the tanks by the valve stem and began using her left hand more than her right due to her disability. Consequently, her left elbow became symptomatic within nine months of the start of her right elbow pain. Radiographic examination was negative. Her orthopaedic surgeon operated on the right elbow one year ago. She has been pain free on the right since that time. Her left elbow was operated on six months ago. She still experiences some pain on the left as she is well within the expected time frame for post operative recuperation.

### Case 5

This 48 year old research diver averages approximately fifty dives per year but otherwise lives a sedentary lifestyle. His job also requires that he drive long distances and much of his time is spent working at a computer. His history was significant for playing golf as a hobby.

Four years ago, he developed agonizing dull pain in the left elbow. For one year he endured the pain which occurred even with simple activities such as lifting a coffee cup. When his grip weakness became severe enough that he feared a diving mishap might occur, he sought medical attention. Physical exam was positive for limited range of motion of the left shoulder, grip weakness and left lateral epicondylar pain. His diagnosis of lateral epicondylitis was followed by a six month trial of various anti-inflammatory agents which gave him no relief. He endured a total of five cortisone shots in the left elbow which were effective for approximately three days after injection. Passive splinting of the elbow did not decrease the pain.

MRI examination of the left shoulder revealed nerve impingement and surgery was recommended. He decided to have the left elbow operated on at the same time. Surgery occurred approximately eighteen months ago and he has been pain free since. The patient also has a history of right medial epicondylitis which has been present for four years but which has gradually worsened since his left arm pain

became disabling. He plans to undergo surgical therapy for his right medial epicondylitis during the coming year.

### Discussion

Lateral epicondylitis is a common injury which in the chronic state, can be difficult to treat. The injury usually presents in the fourth decade of life.<sup>3</sup> The patient may have a history of racquet sports, golf, throwing sports or an occupation which requires lifting such as baggage handling.<sup>4</sup>

Patients complain of pain along the lateral aspect of the elbow which extends inferiorly.<sup>5</sup> They may experience grip weakness or aggravation of the condition with a gripping activity. In acute epicondylitis, the patient is usually able to identify the motion with which the injury was associated. However, since the damage is cumulative, patients presenting in the chronic state may not be able to relate the pain to a specific activity. Patients often do not seek medical attention until the pain has affected their lifestyle for several months.

On physical examination point tenderness along the lateral epicondyle is elicited with resistive wrist dorsiflexion.<sup>6</sup> Radiological examination of the elbow is usually negative. Occasionally, a bone spur is noted along the lateral epicondyle in chronic cases (less than 10%). In Case 1, elbow ultrasound revealed thickening of the symptomatic common extensor tendon with certainty. Increased use of ultrasound may aid in a more rapid diagnosis of musculoskeletal injury in the future.

Pathologically, there is inflammation of the common extensor tendon as it inserts along the lateral epicondyle.<sup>7</sup> Often, a tear is identified through the extensor carpi radialis brevis portion of the common extensor tendon. Granulation tissue and fibrosis are often identified. There is an increase in the number of subtendonous free nerve endings in symptomatic patients.

Treatment of acute lateral epicondylitis centres around cessation of the offending activity and the use of non-steroidal anti-inflammatory agents.

The majority of patients with acute epicondylitis respond to conservative management and return to a normal lifestyle. However, some patients develop chronic epicondylitis since damage to the common extensor tendon is cumulative. When symptoms are persistent and debilitating, subtendonous injection of a combination of steroids with lignocaine into the area of tenderness may provide relief. While some authors feel that steroid injection contributes to injury, a large series has not shown any significant increase in morbidity after repeated steroid injections.<sup>3</sup> Most patients require more than one injection to achieve relief. Other non-invasive measures include plaster splint immobilization of the involved wrist in dorsiflexion and limitation of hand

activity.

A small percentage of patients will require surgical treatment. Indications for surgery vary but if the patient has had symptoms for over one year or has failed conservative treatment and has sufficient discomfort to cause incapacity then he is usually considered a candidate. While some surgeons advocate radical resection of the synovium or complete exploration of the elbow joint, a more conservative approach includes excision of the tear which is identifiable in the majority of cases or resection of the area of obvious degeneration. One group performed all surgery under local anaesthesia so the site of tenderness could be better localized. Surgery is highly successful for relief of symptoms. Patients usually resume normal activity within a year of operation.

Since injury to the common extensor tendon of the forearm is a cumulative phenomenon, it is important to identify all factors contributing to the development of the condition. The medical literature has not previously noted that the carrying of compressed air tanks associated with scuba diving activities may predispose patients to the development of both acute and chronic lateral epicondylitis. This is not surprising when one considers that the mechanism of injury (a weight load on the forearm with wrist pronation and dorsiflexion) is the exact mechanism required for tank handling.

### Conclusion

Although a number of factors have been previously implicated in the formation of lateral epicondylitis, the carrying of compressed air tanks has not been associated with this entity. The authors report five cases of lateral epicondylitis where periods of intensive tank carrying either caused or contributed to the disease. Both research and recreational divers are at risk for the development of the condition.

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### TANK CARRIER'S LATERAL EPICONDYLITIS: A BIOMECHANICAL RATIONALE FOR INJURY AND PREVENTION

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### Introduction

Five cases of lateral epicondylitis, in which the carrying and lifting of compressed air tanks led to injury of the common tendon affixing the extensor muscles of the forearm to the lateral epicondyle, have been reported.<sup>1</sup> The following experiment was performed to investigate the biomechanical effects of tank lifting on the forearm and to determine whether hand position could be altered to reduce the amount of muscle activity during lifting.

### Materials and Methods

Four subjects ranging in ages from twenty-eight to forty-five years were asked to lift an A180 compressed air tank filled to capacity (3,000 PSI). Three of the subjects were healthy volunteers with no arm symptoms (subjects 1 - 3). One subject was symptomatic for chronic lateral epicondylitis and will be referred to as Subject S. Subject 1 was 152.5 cm in height, subject 2 167.5 cm, subject 3 170 cm and subject S 167.5 cm.

Surface electrodes were applied unilaterally to the skin overlying the common extensor muscle group of the forearm and the ipsilateral biceps brachii muscle. Each recording electrode consisted of two silver-silver chloride one centimetre diameter electrodes embedded in an epoxy-mounted pre-amplifier system. The electromyographic signal was high pass filtered (40 Hz), further amplified, RMS processed and low passed filtered (400 Hz). Processed signals were sampled on-line at a rate of 1000 Hz for one second.

The experiment was started with the compressed air tank lying on its side on the floor. Subjects were asked to begin the experiment with bent knees, without raising the heels from the floor, and to pull the tank into a neutral