# Tennis Elbow and the Cervical Spine

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The exact cause of tennis elbow, a common condition, is still obscure. While the condition may well be entirely due to a local disorder at the elbow, the results of a study of 50 patients whose condition was resistant to 4 weeks of treatment directed to the elbow suggest that the underlying condition may have been (at least in these patients) a reflex localization of pain from radiculopathy at the cervical spine. Clinical, radiologic and electromyographic findings supported this suggestion. The pain was demonstrated to be muscular tenderness, which was maximal and specific at motor points. Treatment directed to the cervical spine appeared to give relief in the majority of patients. The more resistant the condition, the more severe were the radiologic and electromyographic findings in the cervical spine.

Tennis elbow, a common affliction, the exact cause of which is unknown, has been considered to be a self-limiting condition, seldom persisting for longer than 12 months, yet symptoms may continue longer despite all types of conservative treatment or even surgery.

This paper reports a new approach: in a series of 50 patients treatment was directed to the cervical spine after at least 4 weeks of treatment of the elbow had failed, and it was successful in most.

**Patients and symptoms**

The 50 patients with tennis elbow, 37 men and 13 women, were referred by attending physicians to the rehabilitation clinic of the Workers' Compensation Board of British Columbia for management. In many the condition had not responded to the usual conservative office measures, such as injections of steroids and local anesthetics, manipulation, ultrasound, friction massage and immobilization. Their age distribution was as follows: 21 to 30 years, 8 patients; 31 to 40 years, 10; 41 to 50 years, 13; 51 to 60 years, 15; and over 60 years, 4.

All were right-side-dominant, but three had only left-side complaints. Eleven had bilateral lateral epicondylar symptoms, 12 had concurrent medical epicondylar symptoms and 7 had bilateral medical and lateral epicondylar symptoms. The time lapse between onset of symptoms and referral to the clinic was 8 weeks or less in 24, 8 to 12 weeks in 11 and more than 12 weeks in 15.

The clinical types of tennis elbow, classified by onset and injury, were the following:

1. Acute type, precipitated by indirect trauma (Cyriax's typeI) - - for example, probable avulsion due to acute pull of forearm extensor muscles at their origin (four patients).
2. Subacute type, following indirect trauma (Cyriax's type II), from repeated and forcible extension movements at the wrist (six patients).
3. Insidious onset (Cyriax's type III), with no specific single incident (11 patients).
4. Acute onset following blunt trauma (Cyriax's type IV) (six patients).
5. Associated with cervical "strain", with history of phyerextension or flexion injury to cervical spine or neck "strain" (13 patients).
6. Associated with jolt or traction to shoulder (three patients).
7. Not classified elsewhere - - for example, as part of multiple injuries, when exact mechanism is not determined (seven patients).

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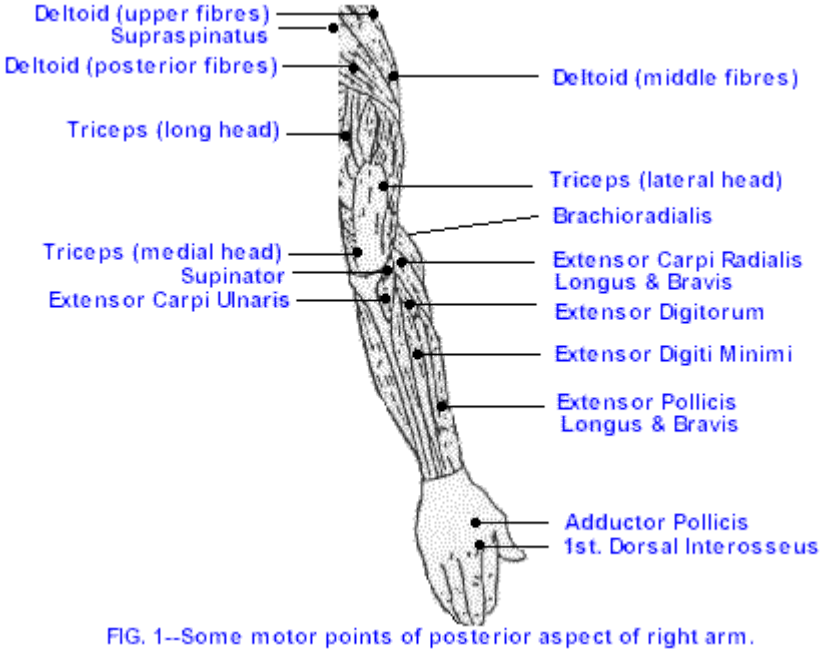


FIG. 1--Some motor points of posterior aspect of right arm.

**Examination**

In addition to eliciting the classic signs, the examiner palpated carefully the entire elbow region with a blunt point or the tip of a finger. Points of maximal tenderness found (usually four) were accurately determined and marked. These points seemed to correspond to the sites of muscle motor points in the region and were confirmed as such by electric stimulation. A motor point is defined as the site where a muscle twitch may be evoked in response to minimal electric stimulation. This point, a fixed anatomic site, lies close to where the motor nerve enters the muscle. Many of the motor points of the wrist extensor lie around the lateral epicondyle of the humerus, where there is also a rich supply of sensory nerve fibre endings (Fig I). Other upper-limb motor points where tenderness might be found were likewise examined (Figs. 2, 3 and 4). Since the tender muscles have common root derivations of their motor nerves (Table I), the cervical spine was also examined.

Electromyographic examination was performed in 42 patients, and in all patients with a history of acroparesthesia or in whom carpal tunnel syndrome or ulnar nerve tardiness was suspected, motor nerve conduction velocity tests were done to exclude such conditions.

***Physical findings***

The wrist extensor motor points generally found to be tender were those of the brachioradialis, extensor carpi radialis, supinator, extensor digitorum and extensor carpi ulnaris; these points are closely situated in an area of about 5 cm in diameter. Tenderness in other areas was of similar quality and often equal intensity; frequently both sides were involved. The frequency of tenderness at the various motor points is shown in Table II.

Eighteen patients showed slight limitation of lateral rotation or lateral tilting of the cervical spine to the affected side. On that side, in all patients, the apophyseal joints of involved levels were tender to digital pressure (commonly C5 and C6) when carefully examined showed resistance to passive motion.

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**Table I - Spinal cord root derivations of motor nerves supplying arm and shoulder muscles.**

| Muscle | Motor nerve root derivation |
|---|---|

| | |
|---|---|
| **Infraspinatus, supraspinatus** | **C5,6** |
| **Deltoid** | **C5,6** |
| **Biceps** | **C5,6** |
| **Brachioradialis** | **C5,6** |
| **Pectoralis major** | **C5-8, T1** |
| **Triceps** | **C6-8, T1** |
| **Extensor carpi radialis** | **C6-8** |
| **Flexor carpi radialis** | **C6-8** |
| **Pronator quadratius** | **C8, T1** |
| **Flexor carpi ulnaris** | **C7,8, T1** |
| **Dorsal interossei** | **C8, T1** |

**Table II - - Frequency of tenderness at various motor points.**

| Muscle of tender motor point | Frequency* of tenderness |
|---|---|
| **Trapezius** | **36** |
| **Supraspinatus** | **39** |
| **Infraspinatus** | **12** |
| **Deltoid (any of three points)** | **28** |
| **Pectoralis major** | **13** |
| **Biceps branchialis** | **15** |
| **Extensor carpi radialis** | **57** |
| **Extensor carpi ulnaris** | **57** |
| **Extensor digitorum** | **50** |
| **Branchirradialis** | **12** |
| **Triceps (any of three points)** | **6** |
| **Adductor pollicis brevis** | **13** |
| **Flexor carpi ulnaris** | **16** |

***Out of a possible 100 -- that is, 50 X patients X 2 sides.**

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Muscle atrophy, especially of the trapezius, supraspinatus, triceps and deltoid, was noted in 15 patients, and partial loss of sensation to pinprick over the associated dermatome was detected in 1 patient.

In 10 patients an autonomic (pilomotor and sudomotor) reflex was elicited when the patient was exposed to cold air: the skin over the dermatome involved - generally C5,6 - showed "goose pimples" or an erector pili effect (cutis anserina). This reflex (sometimes accompanied by excessive perspiration in the axillae) could also be induced by digital frictional pressure over many of the tender motor points. Deep reflexes were always normal.

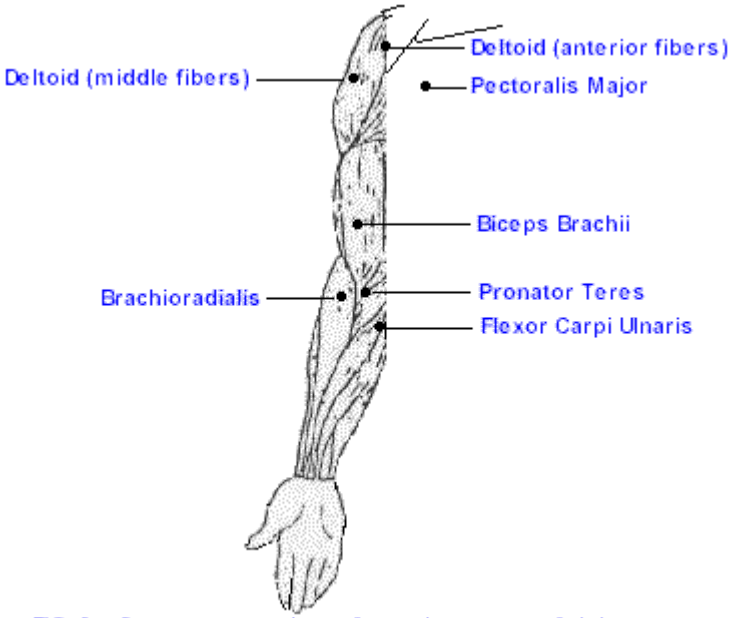

FIG. 2 -- Some motor points of anterior aspect of right arm

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***Radiologic findings***

Radiographs of the elbow invariably showed no significant findings, but radiographs of the cervical spine in 34 patients (average age, 47 years) showed changes commensurate with age.

***Electromyographic findings***

All 42 patients showed some abnormal electromyographic findings of early neuropathy or radiculopathy in affected myotomes. Discharge of action potentials due to mechanical excitation was often increased, and with voluntary activity the mean duration of the action potentials appeared prolonged, but the amplitude was normal or reduced. Typically, polyphasic potentials appeared in abnormal numbers. The interference pattern was reduced and in severe cases lost altogether. In some patients, action potentials of individual units could be identified even during maximum contraction.

**Treatment**

When first assessed, the condition of 23 of the 50 patients had not improved with at least 4 weeks of standard treatment measures. Two had had bilateral surgical procedures but pain had persisted. In view of the apparent relation of elbow symptoms to disorders of the cervical spine, our approach to relieving the symptoms in this group (group A) was directed immediately to the neck.

The other 27 patients (group B), who had not previously received local treatment of the elbow, were first given ultrasound, friction massage, ice and other therapy, and when symptoms persisted after 4 weeks, treatment was directed instead to the neck.

Treatment of the cervical spine included one or more of the following:

1. Mobilization (Maitland's grades I to IV).
2. Cervical traction.
3. Isometric cervical exercises.
4. Heat or ultrasound, or both, applied to apophyseal joints if excessive tenderness was spresent.

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*Response to cervical treatment*

Of the patients in group A the average duration of cervical treatment in the 22 who responded was 4.7 weeks; 1 patient still had symptoms on discharge after 9 weeks. Of the patients in group B the average total duration of treatment (elbow and neck) at the clinic in the 25 who responded was 11.1 weeks, and the average duration of neck treatment was 5.8 weeks; 2 patients still had symptoms on discharge after 18 to 20 weeks. The time lapse between onset of symptoms and beginning of treatment did not appear to influence duration or outcome of treatment.

*Relation to electromyographic findings:* Of the 42 patients who had an electromyographic examination the average duration of treatment in the 39 who responded was 5.3 weeks (4.7 weeks in the 20 with mild electromyographic abnormalities and 7.2 weeks in the 19 with moderate to severe abnormalities); 3 patients with moderate to severe abnormalities continued to have symptoms.

*Relation to radiologic findings:* The average duration of treatment was as follows: in the 16 patients with normal radiologic findings, 4.8 weeks; in the 19 patients with minor radiologic abnormalities (restricted motion, early degenerative changes), 4.7 weeks; and in the 12 patients with moderated to severe radiologic abnormalities (severe osteoarthrosis, narrowing of disc space, foramina encroachment), 7.31 weeks. The tree patients who continued to have symptoms had moderate to severe radiologic abnormalities.

*Results on discharge from the clinic*

- *Good:* These 29 patients were able to resume their previous occupation.
- *Satisfactory:* These 14 patients returned to light duties or changed to a suitable, nonaggravating occupation.
- *Fair:* Four patients were discharged with residual discomfort. Some relief was obtained with a cervical traction apparatus used at home. All returned to a suitable, nonaggravating occupation.
- *Poor:* Three patients, with severe radiologic and electromyographic abnormalities, continued to complain of symptoms on discharge.

*Follow-up*

Of the 47 patients who responded to treatment 44 were assessed at 3 and 6 months (time of writing) after discharge. They had had no further symptoms and had not sought further medical attention. Of the three who had symptoms on discharge, two were asymptomatic within 3 months and one, with severe cervical spondylosis, continued to have symptoms, even at a 1-year follow-up.

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**Discussion**

It is obviously not possible to draw definite conclusions from this small series because the condition of tennis elbow is often self-limiting, yet the findings challenge some current concepts.

For instance, women in this series were proportionately affected more than twice as often as men. Although the proportion of women affected was only 26% (13 patients), this is more than twice the usual proportion of women attending the clinic for other injuries - - 12% (598 of 4990 patients in 1974).

Bilateral and medial epicondylar symptoms are said to be unusual, yet 22% (11 patients) in this series had bilateral lateral epicondylar symptoms and 24 % (12 patients) had concurrent medial epicondylar symptoms; 14% (7 patients) had bilateral lateral and medial epicondylar symptoms.

In this study a force overload to the extensor muscles, direct or indirect, was found to be not the only precipitating factor; in 26% (13 patients) cervical "strain" was associated, and 84% (42 patients) showed some

electromyographic evidence of cervical radiculopathy as well as physical signs in muscles of the myotomes involved.

While the pain may have presented at the bony epicondyle, maximum tenderness was more commonly found in the muscles at the several motor points that are close together and situated over bony prominences, where they are subjected to tension or pressure.

Other physical signs found, related to the cervical spine, were selective atrophy of muscles, especially the triceps and supraspinatus (15 patients), altered dermatomal sensation (1 patient) and presence of an autonomic reflex (10 patients).

These findings led us to conclude that, at least in this group of selected patients, the condition of tennis elbow was related to disorders of the cervical spine; therefore, when treatment to the elbow failed, neck treatment was tired - - with good results. It is probable that in many patients some degree of cervical degeneration preceded the elbow condition.

In this series, treatment of the cervical spine was followed by good or satisfactory relief of elbow symptoms in 86% (43 patients) in an average of 5.25 weeks. In four patients the continual use of a cervical traction apparatus at home provided relief. Tow of the three patients who had symptoms at the time of discharge subsequently improved within 12 weeks. Recovery time may be related to the degree of trauma sustained. Denny-Brown and Brenner have shown that mild percussive trauma to a nerve leads to swelling and local edema of the nerve, together with dissolution of the myelin, and recovery takes at least 4 to 5 weeks; however, if the trauma is sufficiently severe to lead to Wallerian degeneration, recovery takes at least 12 weeks. In the one patient in this series with persistent pain, treatment probably failed to relieve the causative factor (severe cervical spondylosis). The time lapse between onset of symptoms and beginning of treatment bore no relation to the outcome of treatment.

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