Editorial

The epidemiology and health care burden of tennis elbow: a population-based study

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What we have learned

Epidemiology is not an easy discipline to assess a large patient population. In their epidemiology article, Dr. Sanders and his associates have taken a manageable approach using a relatively homogeneous and small community (Olmstead County Minnesota) (1). This community is the home of the Mayo Clinic, and as such, adds the Mayo resources to a highly efficient county government. Mayo Clinic's Dr. Morrey, one of the authors, is, as well, a world expert in the diagnosis and treatment of elbow disorders.

Up to this point in history, the epidemiological data concerning tennis elbow has been based primarily on the written articles from tertiary care centers reflecting their emphasis on diagnosis and treatment and empirical observations regarding epidemiology. As an example in our center, we did a limited study of five very active tennis clubs and found that 50% of 194 tennis players, average age 43, who played 4 times a week for at least 1 year, or more, had a tennis elbow incidence of 50% over their tennis playing years. This limited study was, of course, a small sample and a very specific patient sports population.

In contrast, Dr. Sanders' study was of a general population of 144,000. Over a period of 13 years, 5,867 persons were identified with tennis elbow, an overall incidence rate of 4.5 per 1,000 in the year 2000 reducing to 2.4 per 1,000 in the year 2012. Of the 5,867, a 10% random group of 576 patients were chosen for closer evaluation. Out of the group of 5,867, 1.6% or 89 patients came to lateral elbow surgery. Fifty five of the 89 (61.8%) had open, and 34 (38.2%) had an arthroscopic technique.

A main stated goal of the study was to determine the natural history of the lateral tennis elbow and identify, if possible, a clear indicator to proceed to surgery. In this regard, the study suggested that patients with symptoms persisting for over six months were more likely to come to surgery.

Nirschl Orthopaedic Center experience

This author has operated on approximately 1,500 patients with lateral tennis elbow over a period of 40 years. As our expertise and experience expanded, many patients presented to our center requesting surgery, having failed both non-operative and operative treatment at other institutions. In our 1979 original clinical series of 1,213 patients, 88 elbows came to surgery (0.73%). There were 38 women, average age 41.5 and 44 men, average age 45. The average time from symptom onset to surgery was 51 months for the women and 21.6 months for the men. The dominant arm was involved in 75 patients and 13 non-dominant (16%). Three of these patients had bilateral surgery (2). The thousands of patients that followed did not substantially deviate statistically from the 1979 group with one exception, our surgical incidence. Over the years, as our confidence increased and the sophistication of our technique progressed to a mini-open incision, our percentage of surgical cases increased to approximately 25%. This occurred because our center became a tertiary center for failed cases by both operative and non-operative approaches. Many of these patients had multiple cortisone injections with decreasing

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Table 1 Nirschl pain phase scale for athletic overuse injuries
Phase 1: stiffness or mild soreness after activity, usually gone within 24 hours
Phase 2: stiffness or mild soreness before activity that is relieved by warm-up. Symptoms are not present during activity but return after, lasting up to 48 hours
Phase 3: stiffness or mild soreness before specific sport or occupational activity. Pain is partially relieved by warm-up. It is minimally present during activity but does not cause athlete to alter activity
Phase 4: pain is similar to but more intense than phase 3 pain. Phase 4 pain causes athlete to alter performance of the activity. Mild pain may also be noticed with activities of daily living
Phase 5: significant (moderate or greater) pain before, during, and after activity, causing alteration of activity. Pain occurs with activities of daily living but does not cause a major change in them
Phase 6: phase 5 pain that persists even with complete rest. Phase 6 pain disrupts simple activities of daily living and prohibits doing household chores
Phase 7: phase 6 pain that also disrupts sleep consistently. Pain is aching in nature and intensifies with activity

effectiveness of pain control.

The Sanders' study noted that patients with symptoms greater than 6 months were more likely to come to surgery but did not comment further on other potential surgical indicators (1). Our experience is similar regarding symptoms over 6 months but we noted other indicators. As noted above, our first series time to surgery was 21.6 to 51 months (male to female). As our surgical technique (Nirschl open resection and repair) was first developed in 1975, we were initially quite careful not to move to surgery too quickly. As the experience and sophistication (mini-open) with the new technique grew, we were much more confident to recommend surgery earlier (now approximately 15 months). It would be rare for us to proceed to surgery in less than 1 year. Besides the 6-month time frame noted, we have found that 2 or more failed cortisone injections and the patient suffering Nirschl pain scale phases 6 and 7, are also strong indicators for surgery (*Table 1*).

The Sanders' study noted the preponderance of persons getting tennis elbow were office workers and nurses and that the dominant arm was more likely. Our experience is similar that these groups are involved (e.g., much computer work or lifting in patient care). Our experience also noted an even higher incidence of upper extremity sport and blue collar groups (e.g., carpentry, plumbing, tennis, golf, racquet ball, baseball, and squash). To understand the high incidence of the malady in these groups, one must understand the histopathology of tendinopathy.

In our 1979 report (2), we not only reported a new surgical technique, but what the technique was predicated upon. For the first time we clearly identified that the full body of the extensor carpi radialis brevis (ECRB), and the anterior medial edge of extensor digitorum communis (EDC) tendons were grossly abnormal (gray, friable, edematous) in comparison to normal surrounding tendon (firm and shiny). Microscopic evaluation of this tissue, also revealed very abnormal findings (e.g., dysfunctional vascular and immature fibroblastic elements with disruption of collagen). These anatomical regions also have minimal blood supply (3). There were also no inflammatory cells. Since there are no inflammatory cells the common term tendinitis is a misnomer and we called the tissue angio-fibroblastic hyperplasia. In 1976, Paddu, in Italy, noted a similar histological pattern in achilles tendons and he named this achilles tissue tendinosis (4). The subsequent terminology we now use is angio-fibroblastic tendinosis and the term has been widely accepted. It should be noted that this same histological appearance is similar in all tendinopathies (e.g., rotator cuff, elbow tendons lateral, medial, and triceps, quadriceps, patellar, Achilles and planta fascia).

With understanding the histopathology, we now had a clearer picture of the causation of the tendon failure. The history is almost always the same (e.g., repetitive overuse). In a few cases, a direct blow to the epicondyle adds another dimension to pathological findings (namely the formation of a bony exostosis at the tip of the epicondyle). Bony exostosis has also been caused by an ill-placed injection needle against the epicondyle. In the huge majority, however, high repetitive activity is the key factor in tendon failure.

In 1969, we noted another important factor, a subset of patients had not only unilateral tennis elbow but bilateral, and also had associated symptoms in the medial elbow, rotator cuff, the cubital and carpal tunnels and hip bursitis. It was clear that this subset of patients added another dimension to causation (namely a generalized tendon

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durability deficiency). We theorize this deficiency as a collagen defect and have named this malady "mesenchymal syndrome" (5,6). We note that Dr. Sanders' study noted, of the 576 patients, 67 had bilateral symptoms (a 11.29% incidence). Presence of medial elbow, and carpal or cubital tunnel symptoms was not cited in the Sander study, but I suspect their subgroup of bilateral lateral symptoms also included some of these symptoms but were not recognized or discussed. The 11.29% incidence of bilateral lateral elbow symptoms is consistent with our observation of "The Mesenchymal Syndrome".

The Sanders' study included review of the 576 patients for non-operative and operative treatments. The study concluded there were no standard non-operative treatment protocols in the patient's studied. This noted lack of treatment consistency suggests that multiple prescribers with a relative small amount of cases had limited experience. Patients referred into our center also often had wide variation of treatments, in large part ineffective. In contrast to this wide variation of non-operative protocol, we developed a consistent protocol with the following concepts (7,8):

(I) Enhance collateral vascular infiltration and collagen production with controlled eccentric rehabilitation exercise associated with the modalities of physical therapy (heat, cold, and high voltage electrical stimulation).

(II) Control repetitive overuse by counter force bracing, proper technique modification of high demand activity, proper equipment, and control of frequency intensity and duration of activity. The concept and term counter force bracing was initially introduced in our clinic in 1976, with the function of diffusing excess concentration of forces (9).

(III) Pain control is not curative but important to allow efficient rehab exercise. Pain control can include anti-inflammatory medication including cortisone injections to control inflammatory chemical mediators which are adjacent to but not in the pathological angio-fibroblastic tissue.

Surgical concepts

If the above three non-operative approaches prove ineffective, surgical intervention is considered. The Nirschl mini-open surgical technique like non-operative treatment is as also precise. To be successful, the technique must accurately identify the painful pathological tissue in the ECRB and EDC tendons and cleanly remove it (6,10). On occasion (5%), an intra-articular synovial plica or an epicondyler spur is present and these additional elements are addressed when present. The success of the Nirschl mini-open technique with total pain relief for activities of daily living is 97%. About 93% of patients have returned to the sport level (tennis, golf, etc.) that they enjoyed prior to surgery (2). A long range review of our patients at 10 to 14 years post-op revealed the above noted success rate was maintained (11).

There are also many surgical candidates who have not only lateral elbow but medial elbow and cubital tunnel symptoms concomitantly. We reviewed a group of these patients in 2011 and found the success rate of all three areas was 95% (12). We note the Sanders' study did not report surgicalS success rates from their patient population but did report success of a literature report comparing arthroscopy versus open techniques. The reported success rate was 78% for arthroscopic and 67% for the open technique utilized by these surgeons (13). Such success would not be acceptable by our standard of 97% success. Our center has, as well, had the opportunity to do salvage procedures from prior failed open and arthroscopic surgery at other institutions. The reason for failure is almost always the same (namely failure to clearly identify and remove the ECRB and EDC pathological tissue (14). This is especially true of arthroscopic procedures, and by our observation of a high failure rate arthroscopy is not recommended. It is also necessary to do the open procedure correctly. In this regard, it needs to be emphasized that the Nirschl procedure is not a release operation but is dedicated to clear identification and removal of the pathological tissue which is extra-articular (6,10).

There are a few cases (5%) which have an additional intra-articular component (namely synovial plica) and in these cases a small intra-articular incision is made and the plica removed.

Summation

The Sanders' study confirms what we have known empirically, but it is always helpful to have confirmation. Lateral tennis elbow does not threaten quantity of life, but is a major impediment to quality of life. As noted in the Sanders' report, the malady is also statistically significant and I agree with the Sanders' estimation of approximately 1,000,000 cases per year in America. Dr. Sanders and his colleagues are to be congratulated for a job well done. I

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trust my editorial comments will add deeper understanding to a very bothersome malady.

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