Clinical Pathological Correlation: Wrist Pain

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Musculoskeletal injury due to repetitive movement at specific joints, particularly those of the upper extremity, is now appreciated as a major health hazard (1). Although the specific etiology is uncertain, it appears that specific types of repetitive motion can cause damage to the microvascular supply of bone, ligament or tendon that result in the production of pain and limitation of function (2–5). The symptoms are often sufficiently severe or disabling that the patient seeks medical attention.

The work these patients perform often involves a repetitive movement, such as the activities of a cashier, a worker on a production line or a typist. Often, patients have few if any specific objective indications of inflammation on physical examination. The range of motion at the affected joint(s) may be limited and pain can usually be elicited as the patient reproduces the specific movements. Laboratory evidence of damage is difficult to obtain since radiographs are usually normal. Although bone scans have not been widely used yet, they may have a role to play in the objective documentation of the specific site and extent of injury. The following cases illustrate that three-phase bone scanning may play an important role in evaluating patients afflicted with wrist pain.

CLINICAL PRESENTATIONS

Patient 1 is a 39-yr-old female typist who complained of having diffuse right wrist for the past 3 mo. The patient stated that her wrist pain occurred when she would type at her computer keyboard. She indicated that her keyboard was at the recommended height of 30” from the floor and that her chair and table provided appropriate back and wrist support. On physical examination, she had good pulses in both wrists, her hands were warm, her skin was of good turgor and she had normal sensation, range of motion and strength in both wrists. Tapping her flexor retinaculum did not elicit a Tinel’s sign. Her wrist pain did not improve despite rest, nonsteroidal anti-inflammatory medication and job modification. Further evaluation with plain films of the hands and wrists were normal. To obtain objective evidence of disease, a three-phase bone scan was performed.

Dynamic images of the forearms, wrists and hands in the palmer views were acquired for 3 sec each for a total of 60 sec using a large field of view camera after intravenous injection of 20 mCi 99mTc-methylene diphosphonate. Anterior and posterior views of the extracellular space of these areas were obtained for the next 5 min and 2 hr later spot views of the hands and wrists were recorded for 15 min each using a converging collimator in a small field of view camera (Fig. 1).

There is normal perfusion to both hands and wrists on the flow images (not shown). There is a subtle asymmetry with increased activity in the region of the lunate of the right wrist on the immediate static images. The delayed images show increased uptake in the triquetral and lunate bones on the right wrist, corresponding to her area of pain. In addition, increased uptake is seen in the lunate on the left, suggesting a metabolic response to injury in these regions.

Patient 2 is a 28-yr-old left-handed male airplane mechanic who sustained a hyperextension injury to his left wrist while playing softball approximately 1 yr ago. He developed increasing pain in the left wrist that was aggravated by specific activity, such as using a large wrench. He was initially treated with a wrist brace for 6 wk without relief. Approximately 10 days prior to his bone scan, he was seen by an orthopedic surgeon and was given a cortisone injection with some relief of symptoms. His physical examination was remarkable for focal tenderness in the region of the triquetrum of the left wrist. Plain films of the hands and wrists were normal. An MRI of the left wrist showed slight signal abnormality suggestive of edema. A triple-phase bone scan was performed to rule out piso-triquetral arthritis (Fig. 2).

The delayed images demonstrate markedly increased activity at the ulnar aspect of the proximal carpal row, which appears to involve both the triquetral and pisiform bones. These findings, together with the focal tenderness, suggest fracture with non-union. Although the findings could be seen with arthritis, it is less likely to cause this degree of focal metabolic activity.

Patient 3 is a 20-yr-old female athlete (triple jumper and weight lifter) who developed right mid-ulnar pain radiating to the wrist. When the pain persisted for 4 mo, she sought medical attention. She did not recall any trauma. Examination of her upper extremities was remarkable for tenderness along the midshaft of the right distal ulnar. An MRI of the mid-ulnar was performed to evaluate her pain. The perfusion and immediate static images (not shown) demonstrate increased perfusion and blood-pool activity in the mid-ulnar. The images recorded at 2 hr (Fig. 3) reveal marked uptake in the middle third of the right ulnar diaphysis. An MRI of the upper extremities obtained 3 wk after the bone scan showed increased T2 signal within the bone marrow of the right ulna corresponding to the area of increased
upake on the bone scan. The bone scan findings are consistent with stress fracture of the ulnar diaphysis.

**DISCUSSION**

Repetitive stress injuries account for more than 50% of all occupational illnesses in the U.S. (6). This illness has attracted media attention due to the recent out-of-court settlement of a case between a clerical worker and a computer manufacturer. The plaintiff alleged that the poor design of a computer keyboard was the cause of repetitive stress injury. The pain resulting from this injury did not allow the plaintiff to continue working as a secretary. As a result, suit was brought against two prominent computer manufacturers for damages and suffering. One of the manufacturers settled out-of-court, while the other persevered and won the case in court.

Repetitive stress injuries (RSIs) of the hands and wrists may be seen in association with other soft-tissue or bony disorders (Table 1). Repetitive microtrauma is thought to be the underlying cause of the injury. Force, repetition and vibration have been associated as risk factors in the etiology of occupational upper extremity musculoskeletal disorders (7).

A detailed occupational history and physical examination should be conducted to distinguish RSIs from other rheumatologic diseases, psychologic disorders, acute joint or tendon inflammation from other causes and single-event traumatic sprains and strains (8). Common occupations associated with RSIs of the wrist include: meat processing, fruit packing, upholstering, knitting, painting, weight lifting, cashier, typing when the keyboard is too high, use of vibrating tools and other activities that require the wrist to be held in unusual positions (9). Plain radiography of the hands and wrists should be obtained to help diagnose any obvious anatomical derangement. A major differential point in the evaluation of these patients is the exclusion of an entrapment neuropathy, such as carpal tunnel syndrome. The major signs of this entrapment neuropathy include sensory loss (especially to vibration, temperature and pain). Carpal tunnel syndrome, however, may be induced by repetitive stress, since this may cause swelling of structures contained in the transverse carpal ligament. A battery of tests may be useful to measure the functional impairment of the hands and wrists, such as grip strength, pinch strength, sensory response to touch, two-point discrimination and vibration. Specific diagnostic tests such as MRI, CT and triple-phase bone scanning are increasingly used. Levinsohn suggests that a combination of the clinical and appropriate imaging modalities will offer the referring clinician an adequate assessment of the bones and soft tissues of the hands and wrists (10). The three-phase bone scan is particularly useful to assess the chronicity of the abnormality. To optimize the value of bone scans of the wrist, the images should be recorded for an extended interval of time. The low concentration of $^{99m}$Tc-MDP in the wrists of adults, coupled with the complex anatomy, requires high-resolution data for definitive diagnosis. To minimize patient motion, it is helpful to have the patient rest their palms on the collimator, with the fingers slightly flexed in a comfortable position. Collecting data as sequential 3-min images allows cinematic review to check for motion, prior to summing the data for interpretation. When possible, a converging collimator should be used because it increases sensitivity and resolution compared to a parallel-hole collimator. Interpretation of the images is simplified if a skeletal model is available for direct comparison to the scans.

**CONCLUSION**

Conservative treatment, such as rest, application of ice or heat and anti-inflammatory drugs, is usually helpful in most patients; infrequently, patients have persistent pain for a few weeks to a few months. Early identification of workplace ergonomic problems and modifications in the workplace should help prevent reinjury after the patient’s return to work and may be the most cost-effective way to control this increasingly expensive occupational injury.

**REFERENCES**