An Introduction to Imaging for Athletic Trainers and Therapists

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Imaging of the human body is a vital tool in the process of evaluating disease and injury. The variety of tests that can be conducted is often overwhelming to athletic trainers and therapists, athletes, their families, and even other medical professionals. Many exams that were standard care only a few years ago are now rarely performed. They have been replaced by less invasive, and often less complicated, tests.

Athletes sometimes do not understand why a particular test has been ordered (“Can’t we just get an MRI?”). It is important for us to have a basic understanding of the most common radiologic exams ordered today so we can clearly explain to our athletes and their families what to expect.

Radiographs
X-ray radiation was described in 1895 by Prof. Roentgen, who received the first Nobel prize in physics for the discovery. With or without various forms of contrasts that can be injected, swallowed, or introduced into the body by other means, radiographs are still the basic and most common study performed.

"Plain films" are the studies with which we are most familiar. In the realm of musculoskeletal injury, extremity films for bony abnormalities are the most common reason for ordering them (Figure 1). Chest x-rays show ribs, clavicles, sternum, lungs, thoracic and cervical vertebrae, upper arms, shoulders, scapula, and heart. Abdominal films help visualize the large and small intestines, diaphragms, stomach, vertebrae, pelvis, and upper femurs. Mammograms (Figure 2) help reveal early breast cancer in both women and men.

Various techniques of manipulating the body part, film plate, and machinery allow for changes in angles to visualize within joints and around curves, eliminating shadows caused by overlapping organs or bones. Magnification of images to create greater detail is also possible.

Fluoroscopy is continuous real-time radiography during which motion can be observed. Videotape can be done or single images can be taken and developed as plain radiographs. Orthopedists use this to observe manipulation of bones or fragments during surgery and check the placement of hardware. Many surgical specialties use fluoroscopy to evaluate placement of devices, or the patency of blood vessels and ureters after injecting dye. The portable x-ray machines currently available are fluoroscopes that are able to generate routine x-ray images.
ics of swallowing (videotape), emptying of the stomach, peristalsis of the small and large bowel, ulcers, growths, and disease processes.

**Arteriogram**, coronary angiogram (see Figure 3), venogram, arthrogram, myelogram, and intravenous pyelogram (IVP) involve injection of dyes to opacify arteries and veins, joints, the spinal canal, and the kidneys, ureter, and bladder. They delineate anatomy, blockages, leaks, tears, and function. Ultrasound evaluations have replaced venograms in most settings. MRI has replaced arthograms in a majority of cases. These dyes can cause allergic reaction and kidney failure in diabetics. Again, single films, real-time fluoroscopy, and video to see the dye actively flowing are routine procedures.

**Nuclear scans** (Figure 4) refer to the use of low level, very short lived, radioactive isotopes to delineate disease or infection, assess early injury, and evaluate function. These have been part of the diagnostic menu since the 1960s. Technetium, thallium, and iodine are some of the most common substances.

In active populations you will be seeing bone scans, stress thallium scans of the heart, HIDA scans of the gallbladder, and thyroid scans. White cells can even be tagged with radioactive agents and reinjected to find where the cells pool as a locus of infection. And, no, the patient won’t glow in the dark.

Bone scans are vital tools in detecting occult bony injury. Plain x-ray film findings often lag significantly behind nuclear scans in revealing abnormalities.

**Ultrasound** is a rapidly expanding modality for noninvasive evaluation. The same physical principles as therapeutic ultrasound apply except that the transducer detects the reflected sound waves and a computer digitizes the rela-