STANFORD
SCHOOL OF MEDICINE
Stanford University Medical Center

DEPARTMENT OF ORTHOPEDIC SURGERY
SPORTS MEDICINE
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IMAGING STUDIES

ARTHROGRAPHY

Arthrography is used to evaluate the soft tissue structures within joints, joint surfaces and occasionally structures that surround the joint (such as the rotator cuff tendon, cartilage, ligaments and sometimes loose bodies). With an arthrogram, dye (and sometimes air) is injected into a joint then an imaging study is obtained. This may be a plain radiograph, though a CT scan or MRI may be done with injection of material into joint to assess the injured joint. Risks of arthrography include allergic reaction to the dye or other contrast material, infection or becoming faint.

BONE SCAN / SPECT

Bone scan is a highly sensitive tool looking for bone trauma or increased bone activity (healing or stress to the bone). An injection of a short acting radioactive tracer (very low dose radiation is given through the veins. A machine later counts the activity of the bones by the amount of tracer they pick up. This test looks at the activity of the bone, not the anatomy (shape or structure). The problem is the bone scan is not very specific. Increased uptake or activity in the bone can mean many things (including infection, fracture, stress fracture, arthritis, bone bruise or just increased stress to an area). Increased activity of the bone scan reflects increased blood flow to the area and/or increased activity of the cells that make bone. Soft tissue injury (tendon, cartilage or ligament injuries) may often show indirect evidence on a bone scan. Bone scanning is particularly helpful when there is bone or joint pain and plain radiographs are normal or inconclusive.

SPECT scan is a bone scan that looks at different areas of the body in slices (like slicing a loaf of bread). It is like a CT scan of a bone scan. It allows for more detail of the area.

COMPUTED TOMOGRAPHY (CT) SCAN

CT scans look at bone, and to some degree soft tissues, in many planes, as opposed to plain radiographs. It allows evaluation of bone and joints looking in more than one plane. In other words, without moving the patient or area being studied, the area can be looked at side-to-side, top-to-bottom or front-to-back. Even more impressive is that one can see structures in segments, like slices of bread. Thus the CT scan allows visualization of each slice of bread. CT scans show soft issue structures better than plain radiographs, but not as well as MRI. These studies may be performed with the use of dye in the joint. CT Scans can also be reformatted in 3 dimensions for a more real appearance to study bony structure.

MRI

MRI is a non-irradiating tool that allows for evaluation of soft tissues as well as bone. It is essentially a large magnet that looks at cellular structure and to date is the most impressive tool available to evaluate the soft tissues including looking at swelling, inflammation and injury of the soft tissues (like cartilage, tendon and muscle). Another benefit of the MRI is that it allows evaluation of the structure being studied in more than one plane. In other words, without moving the patient or area being studied, the area can be looked at side-to-side, top-to-bottom or front-to-back. Even more impressive is that one can see structures in segments, like slices of bread, evaluating each slice of bread.

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MRI's have the disadvantage of often taking a long time (1 hour) to obtain images of a particular area, and often having to be done in a closed, confined space. It is particularly difficult for most patients with claustrophobia (afraid of enclosed spaces). However, newer technology is currently being developed to overcome this. Open-air MRI's and in office MRI's are being used with some success, however, often the sharpness of the picture is not as good as the enclosed models. MRI cannot be performed on people with pacemakers, aneurysm clips in the brain, some artificial eye implants, and some bullet fragments within the body. Orthopaedic implants (such as plates, screws and wires) do not preclude the patient from having an MRI but may affect the quality of the study.

MRI may be done with injection of a dye like material to help evaluate structures within the joint (MR Arthrography).

MYELOGRAPHY

This is where contrast material or dye is injected around the spinal cord and an imaging study (usually plain radiography or CT scan) to look for herniated disc, nerve compression or compression on the spinal cord. Myelography complications include headache, nausea, vomiting and leg pain.

RADIOGRAPHS (X-RAYS)

Plain radiographs, often known as X-Rays, are simple tests that allow evaluation of bone, joints and occasionally the soft tissues around the bone. They are the first line of supplemental studies when evaluating a patient since they are simple, readily available and cost-effective. The radiographs show shadows of bone, though sometimes the soft tissues of different densities will also appear, particularly when swelling is present in an area, including joints. Usually, however, non-bony structures, including cartilage, muscle, ligaments, tendons, and joint fluid all appear to have the same density on radiographs, making evaluation of abnormalities of these tissues difficult unless fat or calcification is present. Thus, radiographs will show bone and calcifications most easily and is best at detecting fractures, dislocations, bone tumors and infections of bone.

Since these are shadows of bone, usually more than 1 x-ray needs to be taken of a particular bone to look at it from different angles.

TOMOGRAPHY

This is a technique of plain radiographs that blurs out area above and below the area of interest, essentially like looking at different areas in slices (like slicing a loaf of bread and looking at the area between each slice). Though still of some use, it is has been replaced by computed tomography (CT) and MRI.

ULTRASOUND

Ultrasound is a portable machine that uses radiowaves to look at soft tissues, particularly tendon and cysts. It requires no injection or radiation and allows evaluation of tissues while moving. This device, however, is somewhat difficult to use and the images can be difficult to interpret. It is being increasingly used in sports medicine as other specialties. Radiowaves are reflected by bone and thus not as useful in orthopaedic surgery for bone or for internal bony structures.

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