A Litigation Primer
On Diagnostic Imaging

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There are different diagnostic tools for
different purposes—and different ways of interpreting them.

AN EMERGENCY ROOM DOCTOR rushes
a head trauma patient to the hospital radiology
department to determine the extent of injury. An orthopedist refers a patient for an MRI to
try to find out what has been causing the pa-
tient’s nagging back pain. A family doctor sug-
gests to a patient that she have a bone density
test. An obstetrician recommends an ultra-

sound for a pregnant patient. What do all of
these scenarios have in common? The physi-
cians will rely heavily on diagnostic imaging to
find out what’s going on—and safeguard the
patients’ health.

Diagnostic imaging gives healthcare provid-
ers the ability to assess the internal structures of
the body. Ever since Hippocrates painted a pa-
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DIAGNOSTIC RADIOLOGY • Diagnostic medicine involves the use of radiation to image a structure within the body. Procedures range from the plain film x-ray to the more sophisticated techniques which create three-dimensional pictures of the body. Dye is also used to visualize the soft tissue structures which are not normally visible on plain film x-rays.

Plain Film X-Rays
X-rays account for more than 75 percent of all imaging procedures. Beams passed through the body will cause a film plate to lighten or darken based upon the density of the body part through which the beam has passed. Solid bone is dense since it contains calcium phosphate and absorbs the radiation causing the film to be less exposed or whiter. X-rays, therefore, provide graphic evidence of a fracture or misaligned bone as well as degenerative changes such as bone spurs and loss of intervertebral disk height. Soft tissues, such as the brain, muscles, disks, and organs, have a very high water content and offer little resistance to x-ray beams. This causes the film to darken, so little detail is available for diagnostic interpretation. Although x-rays can provide graphic illustrations of anatomical abnormalities, the images must be taken in a variety of views and angles not to miss an elusive problem. Traditionally, the images have been stored on x-ray film but there is now an increased use of digitized images. Contraindications for the test are pregnancy, and a severe allergic reaction to the contrast dye.

Does The Test Aggravate The Complaints?
Physicians frequently order x-rays following an automobile accident but the utility of this practice must be questioned. It has been found
that radiography of the lumbar spine in patients with low back pain of at least six weeks duration does not correlate with improved patient function, severity of pain, or overall health status. In fact, having an x-ray performed results in a greater proportion of patients reporting low back pain at the three-month interval, a longer duration of pain complaints, and reduction in functioning. One possible explanation for this phenomenon is that the taking of an x-ray encourages the patient’s belief that he or she is not well. Denise Kendrick et al., Radiography of the Lumbar Spine in Primary Care Patients with Low Back Pain: Randomized Controlled Trial, 322 Brit. Med. J. 400 (February 17, 2001).

Can X-Rays Support An Inference Of Soft Tissue Injury?

It is common for a radiology report following a car accident to note, “The cervical spine is negative for fracture but there is a straightening of the lordotic curve suggestive of muscle spasm.” If an x-ray cannot visualize the soft tissues, how can it demonstrate spasms in the neck?

A soft tissue injury to the spine may occasionally be inferred from x-ray findings. The long muscles of the back run parallel to the spinal column and respond to injury with spasm. Since the muscles are attached to the various bony structures of the back, muscle spasm may be indicated by a change in the configuration of the spine. For example, there may be a straightening or reversal of the normal curvature of the back due to a pulling of the muscles. Samuel D. Hodge. ed., Thermography and Personal Injury Litigation, 10 (Wiley Law Publications, 1987). On the other hand, this type of abnormal finding is just as consistent with improper patient positioning or a pre-existing asymptomatic condition.

Are All Abnormal Findings Clinically Significant?

A number of investigative studies have demonstrated that a sizeable portion of the asymptomatic population have abnormal findings on x-ray imaging including spur formations, spondylosis, and disk space narrowing. These abnormalities are unrelated to trauma and the statistics should prove beneficial to the defense when attempting to discredit a physician’s opinion causally relating the abnormality to the accident. For instance, a study of the lumbar spine of healthy people between 16 and 34 years of age found abnormalities in 58 percent of those x-rayed. J. Korber & B. Bloch, The Normal Spine, 140 Med. J. of Austl. 70 (Jan. 21, 1984). Other researchers have reported abnormal findings in 46 percent of the lumbar spines of patients which abnormalities had a very low correlation to their actual complaints and physical findings. Campbell’s Operative Orthopaedics, 3020 (S. Terry Canale, ed., Mosby Publishers, 9th ed., 1998). A study performed in England specifically examined the loss of cervical lordosis in the x-rays of patients presenting with neck pain and muscle spasm. The authors concluded that 42 percent of the normal population showed x-ray evidence of a straightening of the spine and women are more likely to have this abnormal finding. This led to the conclusion that their research failed to support the hypothesis that a loss of cervical lordosis reflects muscle spasm caused by pain in the neck. P.S. Helliwell and V. Wright, The Straight Cervical Spine: Does It Indicate Muscle Spasm? 76 J. Bone & Joint Surg. 103 (Jan. 1994).

If the average rate of clinically insignificant findings on plain film x-rays are between 40 percent and 58 percent, how may a physician state with a reasonable degree of medical certainty that an abnormality found on x-ray examination following trauma is causally related to the accident?
**What Can X-Rays Tell The Defense?**

From a defense perspective, x-rays taken shortly after the accident should be reviewed by a radiologist or physician performing the independent medical examination. Statistically, the chances of finding a pre-existing abnormality or obtaining a different diagnosis are high. Whether the pre-existing condition is the cause of the plaintiff’s complaints and not the trauma of the accident creates a factual dispute to be decided at trial.

**Venography**

Venography is the x-ray examination of the veins after a contrast dye has been injected to make them visible. Venography is useful in locating blood clots, or suitable veins to use in coronary bypass surgery. Venography is also beneficial in distinguishing blood clots from obstructions in the veins, to ascertain how the deep leg vein valves are working, and in evaluating congenital vein problems. Although the test is very accurate in detecting deep vein thrombosis, venography is painful and exposes patients to high doses of radiation. Side effects include phlebitis, tissue damage, a severe allergic reaction to the dye, and the formation of deep vein thrombosis in a healthy leg. See: [www.healthatoz.com/healthatoz/Atoz/ency/venography.jsp](http://www.healthatoz.com/healthatoz/Atoz/ency/venography.jsp).

**Bone Densitometry**

Osteoporosis is a common disease process in which the body’s bones become brittle making them susceptible to fracture. This condition occurs as a natural part of the aging process as bone loses its density and strength. Porous bones may occur anywhere in the body but a fracture is mostly likely to happen in the spine, hip, or wrist. Post-menopausal women are particularly susceptible to this problem but osteoporosis affects both sexes especially over the age of 50.

**The Inadequacy Of X-Rays In Detecting Osteoporosis**

Plain film x-rays are inadequate in detecting osteoporosis until a significant amount of bone density has been lost. This radiological shortcoming has been solved with the dual energy x-ray absorptiometry or “DEXA” test. This enhanced x-ray technique accurately measures bone mass density (“BMD”) by sending a very low dose of radiation through the body via two energy streams. The first beam is absorbed by the soft tissues and the second by bone. The soft tissue amount is then subtracted from the total amount of absorbed energy and what remains is the person’s bone mineral density. The test results are provided in the form of a T-score and Z-score. The T-score identifies the amount of bone the patient has as compared to a young adult of the same gender who enjoys peak bone mass. A score above -1 is considered normal but a finding between -1 and -2.5 is classified as osteopenia, the first stage of bone loss. The diagnosis of osteoporosis is made if the T-score is lower than -2.5. On the other hand, a Z-score reflects the amount of bone a person has as compared to other people of the same age group, size, and sex. If the score is unusually high or low, additional testing may be recommended. See: [www.radiologyinfo.org/content/dexa.htm](http://www.radiologyinfo.org/content/dexa.htm). Also, a patient’s exposure to radiation is lower than that from the plain film x-ray.

**Angiogram**

An angiogram is an x-ray procedure that allows for the visualization of the heart and blood vessels. This invasive test requires the insertion of a catheter into an arm or leg through which a radio-opaque dye is injected. This contrast medium illuminates the area under study and shows a narrowing or blockage of a blood vessel, a pulmonary emboli, or an aneurism.

The test takes about one hour to complete and has the advantage of allowing corrective