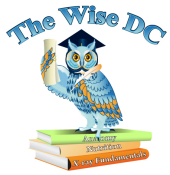

Section 11

Diagnostic Testing Procedures For Pain

There is no way to tell how much pain a person has. No test can measure the intensity of pain, no imaging device can show pain, and no instrument can locate pain precisely. Sometimes, as in the case of headaches, physicians find that the best aid to diagnosis is the patient's own description of the type, duration, and location of pain. Defining pain as sharp or dull, constant or intermittent, burning or aching may give the best clues to the cause of pain. These descriptions are part of what is called the pain history, taken by the physician during the preliminary examination of a patient with pain. However, as Doctors of Chiropractic we do have a number of diagnostic testing procedures at our disposal to include:

- Plain film radiographs
- Full spine, plain film radiographs
- Plain film radiographs: Stress films
- Videofluoroscopy / Cineradiography
- Plain film radiographs with contrast: myelography and discography
- Tomography
- Computerized tomography
- Magnetic resonance imaging
- Ultrasound/sonograms/echography
- Radionuclide scanning: bone scan
- Thermography
- Electrocardiogram
- Angiography
- Current Perception Threshold (CPT)
- Electroencephalography (EEG)
- Surface Electromyography (SEMG)
- Electromyography (EMG)
- Nerve Conduction Velocity (NCV)
- Somatosensory Evoked Potentials (SSEP)
- Brain Stem Auditory Evoked Potential
- Visual Evoked Potential

Overview of Frequently Utilized Diagnostic Procedures

Plain Film Radiographs

- Provide information regarding skeletal integrity, misalignment, components of vertebral subluxation and the dynamics of spinal motion.
- Conventional plain film radiography is the most widely utilized skeletal imaging method.
- X-ray image contrast is derived from the five radiographic densities - air, fat, water, bone, and metal.
- There is an absolute necessity of having a minimum of two views perpendicular to each other. These should be supplemented with additional projections, such as oblique, angulated, or stress studies, as clinically indicated.
- A routine cervical series of X-rays involves three views: A-P lower cervical, A-P open mouth cervical, and lateral cervical. A Davis series also includes obliques, flexion, and extension views and is considered the gold standard in cases of cervical whiplash.
- A routine thoracic series of X-rays involves two views: A-P thoracic and lateral thoracic.
- A routine lumbar or lumbosacral series of X-rays involves two to three views: A-P lumbar and lateral lumbar. A lateral L5-S1 spot shot is often elected.

Applications:

- Useful in the detection of skeletal abnormalities such as neoplasms, traumatic injury, infection, and anomalies.
- Provides information as to what additional imaging modality may be indicated or contraindicated.
- Allows for comparison of changes of a disease process over time.

Advantages:

- Inexpensive and accessible.
- Provides excellent anatomical detail.

Disadvantages:

- Exposure of radiosensitive tissues such as the thyroid gland and gonads to ionizing radiation.
- Diagnostic sensitivity is limited.
- 30% to 50% loss of bone density and a lesion size of 1 to 5 cm is often necessary before a lesion is visible on X-ray. A patient may have extensive histologic disease and have a normal appearing radiograph. The time interval from when a disease process manifests clinically until it becomes visible radiographically is the radiographic latent period. This period can be quite long.
- Soft tissue depiction is limited.

Magnetic Resonance Imaging

Magnetic resonance imaging provides clear images of disc deterioration, pathologies of the spinal cord, spinal stenosis, herniated discs, spinal tumors, and abnormalities in nerves and ligaments. Contrast dye may be injected to highlight problematic areas.

Applications:

- Widely utilized for the differential diagnosis of both pathological and acute lesions.
- In recent times, MRI has replaced CT as the gold standard in the evaluation of cervical, thoracic, and lumbar disc disease.
- No other imaging modality defines the anatomical relationship of the intervertebral disc and the content of the spinal canal as accurately MRI.
- Unparalleled evaluation of spinal cord injury has been obtained with MRI.
- Only imaging modality which can visualize ligamentous tears, bone contusions, spinal hematomas, and spinal contusions.
- Used to detect vertebral fractures; however, CT is considered better at identifying neural arch fracture and the presence of bone fragments within the spinal canal.
- Spinal cord or nerve root injury because of its superior spatial and contrast resolution.
- Evaluation of bone hemorrhage and bone marrow edema.
- Infection of soft tissue and bone.
- MRI provides the most sensitive imaging modality in the detection of osseous metastatic disease in the spine. The initial MRI findings of vertebral metastasis usually affect the marrow adjacent to the posterior cortical margin. The remaining portion of the vertebral body, pedicles, and the rest of the neural arch may be involved secondarily as the neoplastic process spreads throughout the intravertebral venous system. The replacement of normal fatty marrow within the vertebral body is often seen with MRI in the absence of gross morphological alterations.
- Definitive diagnosis of multiple sclerosis. MRI is the first and only imaging modality that allows direct visualization of the central nervous system plaques that characterize MS. Recently, the use of contrast has made it possible to distinguish between acute inflammation and fresh plaques in areas of chronic involvement.
- Soft tissue injury to virtually every joint of the body.

Computerized Tomography

Computerized tomography is an x-ray that utilizes computer technology and can be enhanced with contrast dye. It is used to show abnormalities in bones and soft tissue. CT scan can be used for patients who are unable to tolerate MRI.

Applications:

- Most commonly used in conjunction with plain film X-ray findings.
- Traumatic lesions of the musculoskeletal system, particularly of complex anatomical structures, flat bones, vertebrae, pelvis, ankle, wrist, and shoulder.
- The use of CT is indicated when radiographs are equivocal or when suspected clinical findings are not substantiated by the present plain film study.
- In instances of comminuted fractures, CT provides information concerning the location of bony fragments.
- CT is the imaging modality of choice for visualization of calcified lesions of periosteum or soft tissues.
- Infection of discitis and osteomyelitis, are well visualized.
- In the evaluation of soft tissue neoplasm, CT best evaluates the osseous characteristics and calcified regions of a neoplasm. Able to detect bony changes of neoplasm earlier than X-ray; however, nuclear medicine scans are far more superior concerning early detection.
- Best suited for detailed assessment of bony cortex, bony expansion, periosteal reaction, or subtle fracture.

- Used in the assessment of congenital malformations of neural arch and facet asymmetry.
- Accurate assessment of the extent of degenerative joint disease, particularly in cases of spinal canal and lateral recess stenosis secondary to degenerative bony hypertrophy of endplates and facets and ligamentous hypertrophy of the posterior longitudinal ligament and ligamentum flavum.
- Evaluation for disc herniation or injury in communities where MRI is not available or when a patient is not candidate for MRI evaluation.
- MRI has replaced CT scanning as the imaging modality of choice for disc herniations in any region of the spine

Comparison of CT Scanning and MRI

	CT	MRI
1.	Accurate for evaluation of bone cortex, bony expansion, periosteal reaction, fractures, and subtle bone fractures particularly of the neural arch.	Accurate for evaluation of soft tissue injury, spinal cord injury, trauma of bone marrow, and bone fractures.
2.	Used to evaluate neoplasms of bone. Best demonstrates the osseous characteristics and calcified regions of soft tissue neoplastic processes.	Used to evaluate neoplasms of soft tissue, spinal cord, bone marrow, and bone. Provides early detection of vertebral metastatic disease.
3.	Accurate in determining spinal canal and lateral recess stenosis as a result of degenerative hypertrophy of vertebral endplates and facets and congenitally short pedicles.	The gold standard in the evaluation of intervertebral disc disease. No other imaging modality defines the anatomical relationship of the intervertebral disc and the content of the spinal canal as accurately.
4.	Utilized to evaluate osseous infections.	Utilized to evaluate soft tissue and osseous infections. Provides early detection of osseous infections.
5.	Does not adequately visualize the spinal cord for assessment of pathology.	Visualizes plaques and demyelination of the central nervous system.
6.	Uses ionizing radiation.	Does not use ionizing radiation.

Electrodiagnostic Tests

Electrodiagnostic procedures include electromyography (EMG), nerve conduction studies, and evoked potential (EP) studies. Information from EMG can help physicians tell precisely which muscles or nerves are

affected by weakness or pain. Thin needles are inserted in muscles and a physician can see or listen to electrical signals displayed on an EMG machine. With nerve conduction studies the doctor uses two sets of electrodes (similar to those used during an electrocardiogram) that are placed on the skin over the muscles. The first set gives the patient a mild shock that stimulates the nerve that runs to that muscle. The second set of electrodes is used to make a recording of the nerve's electrical signals, and from this information the doctor can determine if there is nerve damage.

Myelography

Myelography is used to examine the spinal canal and cord. Contrast dye is injected into the cerebrospinal fluid to outline the spinal cord and nerve roots, thus allowing abnormal disc conditions or bone spurs to be visualized with x-ray or CT scan.
Spinal tap involves drawing a sample of cerebrospinal fluid and analyzing it for elevated pressure, infection, bleeding, or tumor.

Bone Scan

Bone scan locates problems (e.g., fracture, osteoporosis) in the vertebrae. A radioactive tracer is injected into the patient and after several hours, x-ray will reveal bone undergoing rapid changes where large amounts of tracer accumulate.