

tion tests for the diagnosis of cervical radiculopathy. They further stated that when consistent with patient history, clinicians may use a combination of Spurling's, axial traction, and an arm squeeze test to increase the likelihood of a cervical radiculopathy, whereas as a combined result of 4 negative neurodynamic tests (upper limb, neurodynamic test, arm squeeze test, shoulder abduction (relief) test, and traction-distraction test) and an arm squeeze test could be used to rule out the disorder.

7.2.2 Imaging

In reference to imaging, Rubinstein and van Tulder (703), in a best evidence review of diagnostic procedures for neck and low back pain, concluded that in patients 50 years of age or older, plain spinal radiography together with standard laboratory tests are highly accurate in identifying the underlying systemic disease; however, plain radiography is not a valuable tool for nonspecific neck pain. They also showed that no systematic reviews were identified which examined the diagnostic accuracy of diagnostic imaging in those with neck pain.

When applicable, the American College of Radiology recommends a cervical spine series of x-rays as an initial study including lateral, anteroposterior, and oblique views. Disc-space narrowing, subchondral sclerosis, and osteophyte formation can be evaluated on lateral views. Attention to comparing disc height at one level to adjacent levels as well as foraminal stenosis can be pertinent in some cases (725,726). CT imaging may be required to visualize C7 adequately. Flexion and extension and lateral bending films can be used to diagnose instability.

Based on the above discussion, plain radiography is not of much significant use in neck pain or radiculopathy. Myelography is an invasive and stressful investigation. This can show the deformations produced by intradural, dural, and some extradural lesions of the cervical vertebral canal. However, it does not demonstrate a lesion directly, and it demonstrates those affecting the lateral reaches of the cervical spine nerves poorly, if at all (727). Conventional CT scan provides axial images, in which the lateral reaches of the intervertebral foramina can be seen. CT myelography is considered to be an accurate and reliable test and has proven to be superior to myelography in the diagnosis of cervical disc protrusions; however, it is an expensive and invasive test. MRI is the choice of imaging in the modern era, replacing myelography, CT scan, and CT myelography. MRI is considered to be as accurate as CT myelography for detecting cervical nerve root com-

pression, even though it may be slightly inferior for detecting bony impingement of nerve roots (545,728). As observed with MRI, the prevalence of numerous abnormalities of the cervical spine in asymptomatic individuals is a concern (546,728,729). Boden et al (526) demonstrated in a study of asymptomatic subjects, 10% of patients under age 40 had disc herniations, and in patients over 40, 20% have foraminal stenosis and 8% had disc herniations. Hence, a diagnosis of cervical radicular pain is considered definite only after careful evaluation and corroboration of history, physical examination, imaging, electrodiagnostic and in some cases, diagnostic injectational studies.

7.2.3 Neurophysiologic Testing

Neurophysiologic testing with electromyography and nerve conduction studies offers no advantage in radiculopathy. However, they are of significant value in the identification and differentiation of cervical radiculopathy with a peripheral lesion (549,730,731). According to Narayanaswami et al (730), the specificity of EMG for diagnosing radiculopathy has been reported to be 77%, while average sensitivity is 73%. This review further noted the sensitivity lower, 40% for mild to moderate radiculopathy and higher, 80% moderate to severe radiculopathy. The diagnosis changed in only 2/60 cases with the addition of clinical information. Intra-rater reproducibility was 80%, 87% for radiculopathy and 73% for normal studies. Inter-rater agreement was 63%, 70% for radiculopathy and 53% for normal studies. Inter-rater agreement for denervation was 90% and re-innervation was only 60%. They further noted the 2 to 3-week delay in the onset of the positive sharp waves and fibrillation potentials could yield falsely negative results done at onset of radiculopathy. In their 2011 clinical guidelines, the North American Spine Society notes insufficient evidence to make a recommendation for or against the use of electromyography for patients in whom the diagnosis of cervical radiculopathy is unclear after clinical examination and MRI (540).

The most common causes of cervical nerve root compression are cervical spondylosis, disc degeneration, disc herniation, and spinal stenosis. However, numerous other causes exist. Radiculopathy is a shooting, radiating pain that extends into the hand, or with paresthesia in forearm and hand, accompanied by objective neurologic signs with sensory loss, objective motor weakness, or hyporeflexia. In difficult cases, without radicular symptoms, diagnostic interventions applied include very rarely selective nerve root blocks, associated with high