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Neck Pain Neck pain is a highly prevalent global problem. In the United States, it is the fourth leading cause of disability and can affect people of all ages, genders, and professions. The lifetime prevalence is nearly 50%, women appear to be at a higher risk than men, and the incidence increases with age, peaking in late middle life. It is associated with sport- and work-related injuries, with low job satisfaction and poor work support having been found to play a role in work-related neck pain. Other risk factors include genetics, headaches, sleep disorders, smoking, obesity, sedentary lifestyle, secondary gain, history of neck pain, trauma, back pain, and poor overall physical or mental health. Neck pain usually arises from diseases of the cervical spine and soft tissues of the neck, is typically precipitated by movement, and may be accompanied by focal tenderness and limitation of motion. Pain arising from the brachial plexus, shoulder, or peripheral nerves can sometimes be confused with cervical spine disease, but the history and examina tion usually identify a more distal origin for the pain (discussed later). The underlying causes of neck pain are diverse, and patients often present with nonspecific and vague symptoms; occipital headache is a common complaint. It is especially important to develop a system atic approach to evaluation and management, as well as to recognize dangerous etiologies including infection, malignancy, or spinal cord involvement from any cause. When a patient presents with neck pain, the clinician should iden tify if the pain has a neuropathic component, indicating that the pain originates from identifiable nerves producing cervical radiculopathy. Causes of neuropathic neck pain include compression or irritation of cervical spinal nerves secondary to disk herniation, ligamentous hyper trophy, or facet overgrowth, among other etiologies, discussed below. APPROACH TO THE PATIENT Neck Pain A complete clinical history is essential to gain an appreciation of the patient’s chief complaints and to look for red flags. A patient’s TABLE 19-1 Cervical Radiculopathy: Neurologic Features EXAMINATION FINDINGS CERVICAL NERVE ROOT PAIN DISTRIBUTION REFLEX SENSORY MOTOR C5 Biceps Lateral deltoid Rhomboidsa (elbow extends backward with hand on hip) Lateral arm, medial scapula Infraspinatusa (arm rotates externally with elbow flexed at the side) Deltoida (arm raised laterally 30°–45° from the side) C6 Biceps Palmar thumb/index finger Bicepsa (arm flexed at the elbow in supination) Lateral forearm, thumb/index fingers Dorsal hand/lateral forearm Pronator teres (forearm pronated) C7 Triceps Middle finger Tricepsa (forearm extension, flexed at elbow) Posterior arm, dorsal forearm, dorsal hand Dorsal forearm Wrist/finger extensorsa C8 Finger flexors Palmar surface of little finger Abductor pollicis brevis (abduction of thumb) Fourth and fifth fingers, medial hand and forearm Medial hand and forearm First dorsal interosseous (abduction of index finger) Abductor digiti minimi

(abduction of little finger) T1 Finger flexors Axilla, medial arm, anteromedial forearm Abductor pollicis brevis (abduction of thumb) Medial arm, axilla First dorsal interosseous (abduction of index finger) Abductor digiti minimi (abduction of little finger) aThese muscles receive the majority of innervation from this root. Source: From JW Engstrom: Back and neck pain, in Harrison's Principles of Internal Medicine, 21st ed. New York, NY: McGraw Hill; 2022, Table 17-4, p. 127.

occupation, general health, and past medical history are impor tant to identify likely pain generators and risk factors. A history of cancer, fever, and weight loss should prompt investigations to rule out malignancy and infectious etiologies. Characteristics of the pain (dull, sharp, electric, stabbing, spasms) and aggravating and alleviating factors should be determined. Any radiating pain into the occiput, arms, or hands can raise concern for radiculopa thy. Patients should be specifically asked if they have experienced numbness or tingling in extremities; clumsiness in hands; change in handwriting; difficulty with buttons; unsteady gait; saddle pares thesia; and bladder or bowel incontinence. Neck Pain CHAPTER 19 Physical examination of the patient begins with observation. The head, neck, and shoulder should be examined for any deformity, mass, skin changes, or signs of trauma. Determining the location of the pain is imperative, as well as the quantity of pain and whether it is interfering with daily function and activities. The range of motion of the neck and shoulder should be assessed, and any restriction or guarding against movement noted. Fifty percent of cervical motion (flexion, extension, and rotation) originates from the atlantoaxial joint (C1-C2) and 50% from the subaxial (C3-C7); in general, any motion restriction needs to be further investigated to rule out underlying pathologies. Radicular pain in the arms typically follows dermatomal distribu tions (Table 19-1). Obtaining a precise description of the pain pattern can assist in determining if the pain is neuropathic and where the problem might originate. If a patient describes radiculopathy-like or other neuropathic pain, a complete neurologic examination is required, including assessment of the cranial nerves, motor strength, sensation, coordination, reflexes, and gait (Chaps. 433, V6, and V7). A few bedside tests are of particular value when assessing for radiculopathy or possible spinal cord involvement in patients present ing with neck pain. Spurling's maneuver is a test for radiculopathy originating from the cervical spine. It is performed by passively rotat ing and flexing a patient's neck laterally and performing axial compres sion to the top of the head. A test is considered positive if it triggers or worsens symptoms of upper extremity radiculopathy. Lhermitte's sign is elicited by gently flexing a patient's neck. It is considered posi tive and signifies underlying cervical spinal pathology if the maneuver reproduces electric pain down the spine or extremities. Also useful is Hoffmann's test, which should be performed whenever there is any suspicion of cervical spinal cord pathology. It is a sign of hyperreflexia

whereby a patient involuntarily flexes and adducts the thumb and index finger while the examiner snaps the distal phalanx of the middle finger. Similarly, the presence of more than three beats of ankle clonus when the ankle is briskly dorsiflexed and held under pressure by the examiner is an upper motor neuron sign signifying underlying spinal cord pathology. Patients should also be observed for tandem or heel-totoe gait, the integrity of which is dependent on proprioception, as well as coordination and strength. Patients are asked to walk in a straight line with one foot in front of the other. If there are any signs of imbal ance (i.e., the patient is not able to complete this task), the possibility of spinal cord compression should be considered.

Imaging and additional tests are often necessary to finalize the diagnosis and should be guided by the patient's history and physical examination findings. Cervical spine x-rays are simple diagnostic tools that are readily accessible and can provide an excellent initial assessment for spinal column pathologies. Performed in the anteriorposterior, lateral, and flexion-extension views, these radiographs are useful tools to screen for fractures, instability, and osteoarthritis, and can often prompt further investigations. Computed tomography (CT) scan is usually indicated if there are any concerns for fractures in the spinal column or if there have been previous surgical instrumentations to assess for any hardware complications. However, due to the poor visualization of soft tissues, CT is not very helpful when evaluating the spinal cord or ruling out intervertebral disk pathologies. Magnetic resonance imaging (MRI) is the gold standard for assessing these soft tissue structures. MRI is indicated for patients presenting with radicu lopathy symptoms or signs of myelopathy or other neurologic deficits. PART 2 Cardinal Manifestations and Presentation of Diseases MRI is also the imaging modality of choice when ruling out malig nancy or infectious causes of neck pain. However, given the high rate of abnormal findings on MRI in asymptomatic individuals, and degenerative changes in particular, it should be performed with caution and only in subjects with strong indications based on history, physi cal exam, and other screening radiographs. Finally, for individuals in whom MRI is contraindicated (Chap. 434), CT myelography, whereby contrast is injected into the spinal canal prior to the CT scan, can be used to assess the spinal cord and surrounding structures. Electromyography (EMG) and nerve conduction studies (NCS) are diagnostic studies often utilized in evaluating a patient with neck pain and associated neuropathic symptoms. While these electrodiagnostic studies are typically unnecessary when the diagnosis is clear, they can be helpful when a patient's symptoms do not correlate with the MRI findings. By measuring the electrical response to nerve stimulation in the muscles and the speed by which an electrical impulse travels, the combination of EMG and NCS can distinguish radiculopathy arising from the spine from peripheral neuropathy and brachial plexopathy (Chap. 457). Referral to a neurologist is recommended in the setting of high clinical suspicion and negative electrodiagnostic findings. Routine laboratory tests have limited value in assessment of most patients with neck pain. However, if there is clinical suspicion of an underlying infection, malignancy, inflammatory arthritis, or neuro muscular disorder, appropriate blood panels should be obtained. While the differential diagnosis of neck pain is very broad, the most important goal of the clinical evaluation is recognizing nonmuscular causes of pain and identifying clinically dangerous underlying pathol ogy. Table 19-2 summarizes clinical findings that should prompt a clinician to conduct further investigations to rule out dangerous under lying etiologies. The following section will provide an overview and discussion of various causes of clinically important neck pain. CAUSES OF NECK PAIN ■ ■DEGENERATIVE Cervical radiculopathy occurs when a cervical spinal nerve root is compressed. Herniated cervical disks cause about 25% of cervical radiculopathy, whereas protruding cervical disks and the narrowing intervertebral foramen due to osteophytic spurs, hypertrophic facet joints, and uncovertebral joints can be solely or jointly responsible for ~70% of cervical radiculopathy. Although the mechanisms underly ing radiculopathy are not fully understood, ischemia and hypoxia of

TABLE 19-2 Clinical Features Suggesting a Need for Further Investigation in Patients With Neck Pain HISTORY PHYSICAL EXAM History of congenital disorders Fever History of cancer Neck stiffness History of substance abuse Severe neck pain and tenderness History of inflammatory arthritis Torticollis Recent trauma to the head and neck Motor weakness in upper or lower extremities Signs or symptoms of infection Sensory changes in upper or lower extremities Family history of spinal

conditions Upper motor neuron signs: Hoffman, clonus, Babinski Unexplained weight loss Hyperreflexia Progressive neurologic deficits Unsteady gait Saddle anesthesia Difficulty with tandem or heel-to-toe walk Bladder or bowel incontinence the affected nerve root appear to contribute to injury and subsequent symptoms. The nerve root most frequently affected is C7, followed by C6. Besides neck pain, cervical radiculopathy is commonly accom panied by symptoms such as pain, sensory disturbance, and motor weakness in the shoulder, interscapular, or upper limb, depending on the affected nerve root; however, neck pain can be the only symptom, especially when arising from nerve roots at C4 or higher. Degenerative cervical disk disease is a relatively common pathology. Degenerative disks contain inflammatory mediators, including proin flammatory cytokines, that can lead to stimulation of inflammation-

responsive sensory nerve fibers, which innervate intervertebral disks, resulting in nociceptive or “discogenic” pain. When cervical disks are her niated, they can cause radiculopathy and myelopathy (Fig. 19-1 A, B). Neck pain in patients with cervical disk herniation is often caused by a combination of the mechanisms mentioned above—ischemia of the compressed root and/or spinal cord and inflammation arising from degenerative disks. Degenerative cervical myelopathy, which is the comprehensive term used to describe the various degenerative diseases causing symptom atic cervical spine narrowing such as cervical spondylosis, ossification of the posterior longitudinal ligament, degenerative disk disease, and ossification of the ligamentum flavum, is also a common cause of neck pain. In degenerative cervical myelopathy, the conditions listed above can compress the cervical spinal cord and lead to spinal cord injury (Fig. 19-1 C, D). Clinicians need to understand this condition well, given that the initial presenting symptoms can often be vague and misleading. It has been reported that the delay in obtaining a diagnosis of degenerative cervical myelopathy can be up to 2 years after the onset of symptoms. Given the shifting demographics of an aging society, this will become more and more relevant at the primary care level, where these patients are typically first encountered. The early signs of cervical myelopathy can be extremely mild, such as paresthesia, minor loss of hand dexterity, or feelings of “clumsiness.” These can easily be overlooked during the initial clinical encounter, especially when the chief presenting complaint is neck pain. Severe dysfunction, including gait disturbance, quadriparesis, and bowel or bladder incontinence, often presents at a later stage. However, prompt diagnosis and timely surgical intervention at the initial phase of the disease often result in better clinical outcomes in these individuals, hence the importance of early recognition and prompt referral for definitive treatment. Fortunately, the deterioration in degenerative cer vical myelopathy is typically slow and occurs in a stepwise progressive fashion. Spinal cord disorders are discussed in Chap. 454. ■ ■NEOPLASTIC Spinal tumors can cause neck pain when they occur in the cervical spine. Metastases are the most common extradural spinal tumors. Although the cervical spine is involved in <20% of patients with spinal

A B C D FIGURE 19-1 Cases of degenerative cervical disk disease and degenerative cervical myelopathy. Cervical x-ray shows a disk height reduction at the C5/C6 level (arrowhead) (A), and cervical magnetic resonance imaging (MRI) shows a herniated disk compressing the spinal cord (arrow) (B) in a case of degenerative cervical disk disease. Cervical x-ray shows osteophytic spurs at C5/C6 and C6/C7 levels (dotted arrow) (C), and cervical MRI shows a protruded disk (asterisk) and thickened ligamentum flavum (double arrows) (D) in a case of degenerative cervical myelopathy. metastatic tumors, neck pain is the most common symptom in such patients. This pain tends to be unrelieved by rest and worse at night. Metastases sometimes cause pathological

fractures, which can also be responsible for neck pain (Fig. 19-2 A, B). Primary spinal cord tumors including schwannomas, meningiomas, and intramedullary tumors can induce neuropathic neck pain, whereas primary spinal bone tumors, such as hemangiomas or chordomas, typically cause nociceptive neck pain. Systemic tumors such as multiple myeloma or lymphoma may also be responsible for neck pain when the cervical spine is involved. ■ ■INFECTIOUS Cervical vertebral osteomyelitis and diskitis, which is less common com pared with thoracic or lumbar regions, can cause constant neck pain (Chap. 136). Although fever is present in some patients, it is absent in many others, which can lead to a delay in diagnosis. Whenever patients present with neck pain and unidentified fever, physicians should always consider these etiologies, especially in patients with a history A B C D FIGURE 19-2 Cases of cervical metastasis and cervical epidural abscess. Cervical computed tomography shows osteolytic lesions at C6 and C7 that protrude into the spinal canal (arrow) (A, B) in a case of cervical metastasis. Sagittal (C) and axial (D) views of cervical fat-suppressed contrast-enhanced magnetic resonance imaging show enhanced epidural lesions at C2/3–C4/5, which compress the spinal cord drastically (dotted arrows) in this case of cervical epidural abscess.

 of intravenous drug abuse, immunocompromised status, diabetes mel litus, or other disorders that predispose to infection. Cervical epidural abscess (Chap. 145) can cause severe neck pain and progressive neurologic deterioration due to cord compression (Fig. 19-2 C, D), often requiring urgent surgical intervention. Meningitis (Chap. 143) is another important cause of neck pain, usually accompanied by fever and headache. ■ ■VASCULAR Neck pain associated with vascular pathologies often occurs suddenly. Vertebral and carotid artery dissections can cause sudden neck pain as well as headache. Acute coronary syndromes may present as a referred neck pain. Cervical arteriovenous malformations and other vascular pathologies can cause acute neck pain when they bleed. Cervical epi dural hematomas typically present with sudden neck pain and neuro logic deficits. They can be misdiagnosed as stroke; however, the neck pain aggravated by palpation of the spinous process can be a helpful distinguishing sign.

■ ■CONGENITAL Chiari type 1 malformations (Chap. 453) can cause headache and neck pain aggravated by cough. The pathophysiology remains unclear, but dissociation between intracranial and intraspinal pressures or traction on pain-sensitive nerves of the dura mater may be responsible.

■ ■AUTOIMMUNE/INFLAMMATORY Rheumatoid arthritis (Chap. 370) commonly affects the cervical spine and produces neck pain most often due to cervical instability. Approxi mately 50% of patients with rheumatoid arthritis have atlantoaxial subluxation, which may lead to neurologic deterioration. Polymyalgia rheumatica (Chap. 375) presents with pain and stiffness in the neck, shoulder, and pelvic girdle and is accompanied by other systemic symptoms. Ankylosing spondylitis (Chap. 374) also causes neck pain, though chronic back pain is more common, and these pains typically worsen with rest or inactivity. Crowned dens syndrome, also known as periodontoid calcium pyrophosphate dihydrate crystal deposition disease, is another cause of severe neck pain and neck stiffness. ■ ■ENDOCRINE/METABOLIC Paget’s disease (Chap. 424) is a bone disorder characterized by an imbalance in bone modeling and remodeling. Paget’s disease in the cer vical spine is less common compared with the thoracolumbar regions but can cause neck pain that tends to be worse at rest. Osteoporosis (Chap. 423), which is sometimes induced by hyperparathyroidism and glucocorticoid therapy, and

osteomalacia due to abnormal vitamin D metabolism (Chap. 421), can produce pathological bone fractures. Although these disorders usually affect lumbar or lower thoracic verte brae, neck pain can occur when the cervical spine is affected. ■ ■TRAUMATIC Traumatic fracture and dislocation of the cervical spine are lifethreatening conditions when accompanied by injury to the cervical spinal cord. Nociceptive and neuropathic neck pains can be combined, and immobilization of the neck is essential to reduce neck pain and prevent further cervical cord injury due to spinal instability. Whiplash injury is also responsible for neck pain. It is usually caused by motor vehicle collisions, and injury to the facet joints is believed to underlie this pain syndrome. Approximately 50% of patients with whiplash injury will have had persistent neck pain for 1 year. ■ ■OTHER CAUSES Cervical myofascial pain is a very common clinical condition that can involve diffuse areas around the neck and shoulder. Restriction of motions of the cervical spine can cause this nonspecific neck pain. Myofascial trigger points, which are palpable nodules housed inside taut muscle bands, are regarded as a hallmark of myofascial pain. TREATMENT Neck Pain Given the broad differential diagnosis of neck pain, the manage ment and treatment should be tailored toward the underlying condition. Most important is to recognize red flags that indicate the possible presence of myelopathy, malignancy, infection, or a severe spinal column injury; in such cases, urgent assessment is required. The discussion below will focus on the management of the common causes of neck pain seen in general medical practice. In general, the evidence regarding treatment for neck pain is less comprehensive than that for low back pain (Chap. 18), but the approach is similar in many respects. NECK PAIN WITHOUT RADICULOPATHY OR OTHER NEUROLOGIC FINDINGS For many patients with acute neck pain, spontaneous improvement is the norm, and the usual goals of therapy are to promote a rapid return to normal function and provide pain relief while healing proceeds. Acute neck pain is often treated with nonsteroidal antiinflammatory drugs (NSAIDs), acetaminophen, cold packs, or heat,

alone or in combination while awaiting recovery. Patients should be specifically educated regarding the favorable natural history of acute neck pain to avoid unrealistic fear and inappropriate requests for imaging and other tests. For patients kept awake by symptoms, cyclobenzaprine (5–10 mg) at night can help relieve muscle spasm and promote drowsiness. A trial of physiotherapy such as super vised exercise with or without mobilization appears to be effective. Exercises often include shoulder rolls and neck stretches. The McKenzie method of physical therapy is one option in widespread use. Some patients obtain modest pain relief using a soft neck col lar; there is little risk or cost. Massage can produce temporary pain relief. For patients with chronic neck pain, supervised exercise pro grams can provide symptom relief and improve function. Acupunc ture provided short-term benefit for some patients when compared to a sham procedure and is an option. Spinal manipulation alone has not been shown to be effective and carries a risk for injury. Surgery plays a very limited role in patients with acute and chronic neck pain without neurologic findings, spine instability, or fractures. For individuals with pain refractory to conservative man agement, referral to a pain specialist can be of benefit. The literature shows that neck pain originating from cervical facet joints can be effectively treated with fluoroscopically guided radiofrequency ablation. However, careful patient selection is essential to ensure optimal outcomes, and the procedure is not available in many cen ters. Referral to a specialist for diagnostic and treatment guidance is highly recommended for any patient in whom such procedures are considered. NECK PAIN WITH RADICULOPATHY OR OTHER NEUROLOGIC FINDINGS The natural history of acute neck pain with radiculopathy due to disk disease is also favorable, and many patients will improve without specific therapy. Although there are no randomized trials of NSAIDs for neck pain, a course of NSAIDs,

acetaminophen, or both, with or without muscle relaxants, and avoidance of activi ties that trigger symptoms are reasonable as initial therapy. Gentle supervised exercise and avoidance of inactivity are reasonable as well. A short course of high-dose oral glucocorticoids with a rapid taper or epidural steroids administered under imaging guid ance can be effective for acute or subacute disk-related cervical radicular pain but have not been subjected to rigorous trials. The risk of injection-related complications is higher in the neck than the low back; vertebral artery dissection, dural puncture, spinal cord injury, and embolism in the vertebral arteries have all been reported. Opioid analgesics can be used in the emergency depart ment and for short courses as an outpatient. Soft cervical collars can be modestly helpful by limiting spontaneous and reflex neck movements that exacerbate pain; hard collars are in general poorly tolerated. If cervical radiculopathy is due to bony compression from cervi cal spondylosis with foraminal narrowing, periodic follow-up to assess for progression is indicated and consideration of surgical decompression is reasonable. Surgical treatment can produce rapid pain relief, although it is unclear if long-term functional outcomes are improved over nonsurgical therapy. Indications for cervical disk surgery include a progressive motor deficit due to nerve root compression, functionally limiting pain that fails to respond to conservative management, or spinal cord compression. In other circumstances, clinical improvement over time regardless of thera peutic intervention is common. Surgical treatments include anterior cervical diskectomy/

corpectomy and fusion, posterior cervical laminectomy, laminoplasty or laminectomy with fusion. The risk of subsequent radiculopathy or myelopathy at cervical segments adjacent to a fusion is ~3% per year and 26% per decade. Although this risk is sometimes portrayed as a late complication of surgery, it may also reflect the natural his tory of degenerative cervical disk disease.

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