SEMPI Priority clinical area: Cervical or Neck pain AUCs

INTRODUCTION

Importance of Neck Pain

Neck pain is common with an annual prevalence rate of more than 30% and represents the sixth leading cause of disability (Cohen, 2015; Mokdad et al., 2018). Prevalence of neck pain disorders peak at middle age, supporting a multimodal etiology of repetitive stress and strain and may or may not be associated with extremity symptoms such as radiculopathy (numbness or pain from nerve root injury). Neck pain overlaps with other musculoskeletal and rheumatologic conditions regarding number of variables including genetics, psychopathology (e.g. depression, anxiety, poor coping skills, and somatization), sleep disorders, smoking, and sedentary lifestyle (Cohen, 2015). Unique risk factors for neck pain include trauma (e.g. concussion, other traumatic brain and whiplash injuries) and certain sports injuries (e.g., wrestling, ice hockey, football).

Classification of Neck Pain

Neck pain is most commonly classified by duration, severity, type of mechanism and the etiology or structure (Cohen, 2015). A 2019 systematic review recommends grading neck pain severity from I-IV as follows: no signs, little disability; no signs but impact of function; neck pain with neurological arm symptoms/signs; neck pain with major pathology (Lin et al., 2019). Type of mechanism is most commonly either musculoskeletal/mechanical, neuropathic, mixed or referred. Common examples of pain of musculoskeletal or mechanical origin include arthritis (facet joint), discogenic, and myofascial disorders. Common examples of pain of neuropathic origin include radiculopathy (peripheral cause) and myelopathy/spinal cord pathology (central cause).

History, Red Flags, Physical Examination

A comprehensive history is imperative in order to obtain important differentiating characteristics between primary neck and other upper body pain, and to determine if neck pain stems from an acute traumatic injury requiring emergency intervention or from, a chronic problem that can be assessed over time. In addition, identification of "red flag" signs and symptoms are key. Red flags include various types/mechanisms of trauma, constitutional or infectious symptoms, upper motor neuron signs, age >50 years, concurrent chest pain/diaphoresis, and rheumatoid arthritis (Cohen, 2015). The physical examination is rarely diagnostic of a specific disease although an exam is often used to confirm historical findings, screen patients for serious or treatable pathology, and guide advanced imaging or other diagnostic evaluations. Pain-induced weakness must be differentiated from genuine neurogenic weakness while upper motor neuron signs must be investigated promptly. Range of motion may be limited in all types of neck pain but exacerbation by specific positions/movements can be very informative; hence the plethora of available "diagnostic signs" (such as Spurling's, Adson's, Lhermitte's to name a few).

RADIOLOGICAL EVALUATION OF NECK PAIN

Radiological imaging is discouraged in patients with neck pain unless serious pathology is suspected, or there has been an unsatisfactory response to conservative care or progression of signs and symptoms has occurred, or imaging is likely to change management (Lin et al., 2019). Specifically, the approach to blunt traumatic neck injury involves both non-radiologic as well as radiographic assessment as follows:

Clinical Diagnostic Rules

Two algorithms, the National Emergency X-Radiography Utilization Study (**NEXUS**) and the Canadian C-spine Rule (**CCR**) incorporate several clinical findings that categorize patients as "low" (versus "high") risk for clinically significant cervical spine injury, thus safely obviating the need for imaging.

The five NEXUS "low risk" criteria must **ALL** be met to "clear" the cervical spine without imaging and include (Hoffman et al., 2000):

1) No posterior midline cervical spine tenderness
2) No intoxication
3) No focal neurologic deficit
4) No distracting injuries
5) Normal alertness--Glasgow Coma Scale $\geq$ 15

Alternatively, the CCR identifies "**high risk**" patients in whom imaging is mandatory as those who meet **any** of 3 criteria (Stiell et al., 2009):

1) Age > 65 years, or
2) Paresthesia in extremities, or
3) Dangerous mechanism of injury

CCR also identifies "**low risk**" patients as those who meet **any** of the following 5 criteria (Stiell et al., 2009):

1) Ability to sit in Emergency Dept
2) Ambulate following injury
3) Delayed onset of pain
4) Absence of posterior midline c-spine tenderness, or
5) Simple rear-end motor vehicle collision.

Low risk patients do not warrant imaging if they have active neck rotation of 45 degrees; however, inability to actively rotate neck warrants imaging in low risk patients (Stiell et al., 2009). Historically, both NEXUS and CCR tools have demonstrated adequate sensitivity and negative predictive value rates, but recent reports suggest that these algorithms are not diagnostically adequate in older patient (> 65 years) and pediatric populations.

Plain Radiography (XR)

Currently, a very poor relationship exists between symptoms and imaging abnormalities in whiplash-injured patients who continue to experience neck pain (Matsumoto et al., 2010). In patients with suspected structural abnormalities (e.g. scoliosis, spondylolisthesis, bone erosions or expansion, non-acute fractures), plain radiographs (XR) are generally sufficient (Cohen, 2015). Anterior-posterior (AP) and lateral views are of reasonable cost, readily available, and pose limited radiation exposure.

Magnetic Resonance Imaging (MR)

MR imaging has been the "gold standard" of radiographic diagnostics for spinal imaging for several decades (Matar et al., 2013). MR imaging most reliably detects soft-tissue abnormalities (e.g. disk, nerve root, spinal cord, vasculature). It can be used to evaluate transverse atlanto-axial ligament integrity in a Jefferson fracture of the atlas (C1) as well as the intervertebral disc in an axis "ring" fracture at C2-C3 (Chang et al., 2017; Schleicher et al., 2018). Another indication for MR imaging in cervical/neck trauma is the assessment of radiculopathy/myelopathy symptoms in a patient with a negative CT scan (Inaba, 2016). In children/adolescent and pregnant patients, MR imaging offers radiation-free imaging. Of note, MR demonstrates high rates of degenerative changes in asymptomatic individuals over a wide age bracket, the most common being disk protrusions (Nakashima et al., 2015). As such, a high false-positive rate can be minimized by ordering MR imaging only when clinical findings support its use. MR imaging is recommended to exclude red flag conditions in patients with serious or progressive neurologic deficits and when referring patients for procedural interventions (e.g. surgery).

Computed Tomography (CT) and CT Myelography (CT-M)

CT imaging is preferred compared to XR for "high risk" blunt cervical spine trauma and concerns for vertebral fracture/displacement or ligamentous calcification exist (Abiola et al., 2016; Bailitz et al., 2009). CT provides superior bony detail which can be useful when cervical spine anatomy is critical, as in surgical planning. CT myelography, the addition of intrathecal contrast material to CT, provides accuracy that is comparable to MR imaging in distinguishing osseous from soft tissue etiologies of nerve root impingement, identifying foraminal stenosis, and CSF leaks (Akbar et al., 2012; Sasaki et al., 2013; Waly et al., 2017).

Pain Management—Epidural Steroid Injection (ESI)

Epidural steroid injection (ESI) is performed for chronic cervical spine pain management (Manchikanti et al., 2013). ESI is primarily performed under **fluoroscopic** and/or **computed tomographic (CT)** guidance and requires a small volume of contrast injection to confirm needle placement (Rathmell et al., 2015; Van Boxem et al., 2019). Of note, **MR** imaging is not routinely used for imaging guidance in ESI but can identify rare contraindications such as spinal metastases and infection that would preclude the procedure.

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