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Cervical (Whiplash) Sprain

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Introduction

The term "whiplash" injury was first coined by Harold Crowe in 1928 to define acceleration-deceleration injuries occurring to the cervical spine or neck region.[1] Later modified to an all-encompassing term known as whiplash-associated disorders (WAD), these clinical entities have been refined to describe any collection of neck-related symptoms following a motor vehicle accident (MVA).[2][3] The elusive difficulty that remains in describing these injuries is secondary to the fact that there is, by definition, no structural pathology identified following a comprehensive diagnostic workup.[4] Therefore, WADs remain a diagnosis of exclusion.[5][6] Treatments include rest, analgesia, soft braces, and early physical therapy.[7] The injury may be acute with full recovery or may be chronic with residual long term pain, disability, and health care resource utilization.[8]

Etiology

Whiplash-associated disorders describe a constellation of neck-related clinical symptoms manifesting after an MVA or car crash-related mechanism. The pathophysiologic cascade remains poorly understood and ultimately elusive. Previous speculated underlying mechanisms had attributed multifactorial elements including vertebral distraction to the facet joint capsule region of the cervical spine causing pain. Other plausible explanations can include any combination of minor (i.e., clinically irrelevant) injuries to either the facet joint(s), spinal ligaments, dorsal root ganglia/nerve roots, intervertebral discs, cartilage, and paraspinal muscle spasms or contusions of the intraarticular meniscus hemarthrosis may cause symptoms consistent with WADs or "whiplash" injuries.[9][4]

Epidemiology

As of 2018, whiplash injuries are estimated to affect 0.3% of people a year in the US sustained during sporting injuries, falls, and most commonly motor vehicle accidents.[8] Approximately 1 million people suffer from a whiplash-associated disorder from a motorcycle accident each year.[4] Before the introduction of seatbelts in 1990 in the UK, the rate was 42.5% of patients seen for automobile collisions with neck injuries[4] British Columbia reported that 61% of claimants to insurance companies were for neck claims in 1995.[4] The incidence is higher in women with females representing almost two-thirds of the population.[4] There is little consistency in the literature regarding epidemiology partially because of poor quality studies compounded by the complex interconnection of other factors including individual, legal, and socioeconomic factors that may influence outcomes.[10]

Pathophysiology

The injury occurs in three stages with a rapid loss of lordosis. Both the upper and lower spines experience flexion in stage one. In stage two the spine assumes an S-shape while it begins to extend and eventually straighten to make the neck lordotic again. The final phase shows the entire spine in extension with an intense sheering force that causes compression of the facet joint capsules.[4] Studies with cadavers have shown the whiplash injury is the formation of the S-shaped curvature of the cervical spine which induced hyperextension on the lower end of the spine and flexion

of the upper levels, which exceeds the physiologic limits of spinal mobility.[4] The Quebec task force proposed a classification system to define the severity of the whiplash injury. Stage In Grade 1 the patient complains of neck pain, stiffness, or tenderness with no positive findings on physical exam. In Grade 2 the patient exhibits musculoskeletal signs including decreased range of motion and point tenderness. In Grade 3 the patient also shows neurologic signs that may include sensory deficits, decreased deep tendon reflexes, muscle weakness. Grade 4 the patient shows a fracture.[11] Most WADs are considered to be minor soft tissue-based injuries without evidence of fracture.

History and Physical

The mechanism of injury is essential in the diagnosis of a whiplash-associated disorder. Typically the patient will report a history of an injury that shows rapid acceleration and deceleration forces such as an MVC, or a sports injury with a collision similarly affecting the neck.[8] The patient may present immobilized with a hard-cervical collar by EMS rescue personnel or the triage provider to prevent further injury until seen and cleared by the appropriate healthcare provider.

A comprehensive examination and trauma evaluation are necessary with the cervical spine in a neutral position and while the provider palpates the spine and the paraspinal muscles. Any midline tenderness or step off dictates further imaging and that the collar remains in place. Distracting injuries or intoxication are prohibiting factors that serve as absolute contraindications to c-spine clearance in the acute traumatic setting. Serial and follow-up examinations are warranted once the patient is appropriately alert and oriented to participate in a comprehensive physical examination.

In otherwise normal patients presenting with a low clinical suspicion of injury with no midline tenderness and unremarkable physical examination allows for clearance of the c-spine precautions without additional imaging. Neurological exam of the upper extremities including strength and sensation is necessary to rule out any deficits. NEXUS [Neuro Emergency X-ray Utilization Study], validated cervical spine criteria or Canadian Cervical Spine Rule are used to help rule in and rule out the need for additional imaging.[7]

Evaluation

The Canadian cervical spine rules or NEXUS criteria are useful for the evaluation of cervical spine injuries in the emergency department.[12] These criteria determine the need for imaging based on the mechanism of injury, physical presentation at the time of the accident, symptomatic presentation in the emergency department, as well as the physical exam.[13] The NEXUS c-spine criteria recommend imaging if there is posterior midline cervical-spine tenderness, focal deficits, altered mental status, intoxication or distracting injuries. The Canadian c-spine rules define the need for imaging with patients greater than 65 years of age, dangerous mechanism of injury, paresthesia, midline tenderness, immediate onset of neck pain and impaired range of motion.[14] Additional imaging such as MRI may be necessary for abnormal findings on CT to evaluate for cord injury. Flexion and extension films can help rule out ligamentous injury.[15]

Treatment / Management

Immobilization with a soft cervical collar, resumption of normal activity, and mobilization exercises are generally the treatment of choice. Immobilization has shown the least improvement[11][16] Ultrasound has also been shown to relieve muscle pain for whiplash-associated disorders.[17] First-line treatments include analgesics, nonsteroidal anti-inflammatories, ice, and heat.[18] Other controversial analgesic measures include muscle relaxants, which have been shown to have some therapeutic effect in limited studies.[19] Biofeedback has also demonstrated effectiveness when used in conjunction with other modalities in acute WAD.[20] Injection of lidocaine intramuscularly was also found to relieve pain symptoms.[21] Most treatments alone appeared to have moderate effectiveness with combinations of treatment measures improving efficacy and early mobilization consistently most effective.[19]

Differential Diagnosis

The differential diagnosis for cervical spine injuries includes cervical spine fracture, carotid artery dissection, herniated disc, spinal cord injury, subluxation of the cervical spine, muscle strain, facet injury, ligamentous injury. Whiplash is an injury associated with trauma; remote trauma should dictate evaluation for other causes, such as mass, tumor, infection, etc.

Prognosis

Prognosis varies secondary to comorbidities prior to the injury, severity of WAD, age and socioeconomic environment. Full recovery has been shown to occur in a few days to several weeks.[10] However, disability can be permanent and range from chronic pain to impaired physical function.[10] There have been inadequate studies that incorporate mitigating factors, such as socioeconomic and legal, which can impact an accurate assessment of recovery. In regions where there is little or no litigation, the prognosis is more favorable lending that economic gain for disability may play a role in determining the patient's reports of full recovery.[10]

Complications

Though cervical pain is the most common symptom, dizziness and/or headaches can be chronic, persistently reported symptoms.[8] Chronic pain, subsequent interference with work, and physical function can cause loss of income and lifestyle.[22]

Deterrence and Patient Education

In a retrospective analysis, seatbelt restraints have been shown to reduce the incidence of WAD.[4] Low-velocity MVAs remain one of the leading causes of cervical strain or WAD.[4] Safe, alert driving practices, as well as the avoidance of distraction activities (such as text messaging), can help reduce the incidence of MVAs and WADs occurring due to reckless driving practices. Early mobilization is most effective when other more serious clinical pathologies noted on examination and imaging diagnostics have been ruled out.[19]

Enhancing Healthcare Team Outcomes

Diagnosis and treatment of WAD are complex and associated with many complex issues. Legal environment, prior injury, comorbidity, age, and defensive medicine all play roles in the management and outcomes.[10] There is a large variation in diagnosis and persistence of symptoms depends largely on legal culture or the ability to seek compensation for WAD. The nexus c-spine criteria, as well as the Canadian C-spine rules, are widely accepted as guidelines for imaging in the evaluation of cervical spine injury associated with acceleration/deceleration injury.[12] [14] A recent study by Parikh et al. showed that more guidelines aim at treatment recommendations as opposed to diagnosis, prognosis, and outcomes.[14] Additional studies are needed to fully understand the etiology, pathophysiology, and prognosis of patients with WAD, taking into accounts, pre-existing conditions, age-related degeneration of the spine can influence of compensation laws on outcomes.[10] Primary care providers and nurse practitioners should educate the public on the use of seatbelts and avoiding distractions during driving to help lower the frequency of WAD. Many of these patients need long term followup with enrollment in a physical therapy program.

Questions

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