Spinal cord injuries in Emergency Medicine

Abstract: Spinal cord injury is a serious medical disorder that frequently leads in significant morbidity and permanent impairment. Direct damage to the spinal cord or compression owing to broken vertebrae or masses such as epidural hematomas or abscesses are the most common causes of spinal cord injury. When examining a blunt trauma victim, medical professionals are taught to presume the patient has a spinal column damage unless it is proven otherwise. The early examination of a patient with a suspected cervical spinal injury in the emergency department (ED) is no different than that of any other trauma patient. The ABCs, or airway, breathing, and circulation, procedures are being taken into consideration. Surgical removal of bone fragments, foreign objects, herniated discs, or broken vertebrae that appear to be compressing the spine is frequently required. In order to avoid future discomfort or deformity, surgery may be required to stabilize the spine. In this review we'll be looking at spinal cord injury, it's diagnosis and treatment.

Introduction:

Spinal cord injury is a serious medical disorder that frequently leads in significant morbidity and permanent impairment. When the axons of neurons that go through the spinal cord are damaged, motor and sensory function is lost below the degree of lesion. Injury is frequently the outcome of substantial trauma, and initial injury is often irreparable. [1] These injuries are very costly and harmful because they disproportionately impact patients under the age of 30, cause considerable functional impairment for the rest of the person's life, and put the person at risk for a variety of consequences that raise morbidity and mortality. SCI is expected to have a 2-to-4-billion-dollar economic impact. [2,3,4]

Major trauma is the leading cause of death in people under the age of 50 in the United Kingdom, and survivors often have severe disability. In the United Kingdom, an estimated 1200 traumatic spinal cord injuries occur each year, and over 40000 individuals live with long-term disability as a result of SCI, however other organisations believe the number is greater. Around 14% of spinal fractures cause injury to the spinal cord, with 50% of those fractures being incomplete. Half of patients will walk on discharge if properly handled. As a result, proper early

care is critical, with the goal of preserving cord function while preventing subsequent difficulties. [5-10]

The yearly incidence of traumatic spinal injury (TSI) in the United States is believed to be around 40 per million people. Over half of the patients have isolated spine injuries, whereas roughly a quarter have concurrent brain, chest, and/or significant extremities injuries. Though once assumed to be a condition only affecting young men, new epidemiological research on TSI patients show a bimodal distribution. As predicted, the initial peak comes in teens and young adults. The second peak, on the other hand, occurs in the senior population (those over 65 years old). Injury to the spine is more likely to happen in locations with the most movement. Cervical TSIs account for more than half of all traumatic TSIs, and they're linked to significantly higher short- and long-term morbidity than injuries to the cord at the thoracic or lumbar levels. Incomplete tetraplegia is the most common injury (31 percent), followed by total paraplegia (25 percent), complete tetraplegia (20 percent), and incomplete paraplegia (10 percent) (19 percent) [11]

Traumatic spinal cord injury (TSCI) is a relatively uncommon yet life-threatening illness with significant rates of morbidity and death. Global incidence rates have been reported to range from 10 to 83 incidences per million. In comparison to these global rates, the Dutch incidence rate is modest, with 14.0 cases per million in 2010. TSCI-related mortality rates in the Netherlands are 3.4 per million, which is lower than the European average of 6.7 per million. Global TSCI investigations have revealed a bimodal age distribution, with trends between 15 and 30, and over 65. The major TSCI mechanism in Europe differs per nation. In the Netherlands, the most common causes of TSCI are falls followed by motor accidents. [12]

Etiology & Pathophysiology:

Motor vehicle crashes are the main cause of spinal cord injury in the United States, accounting for 38 percent of new SCI each year. Thirty percent are caused by falls, thirteen percent by violence, nine percent by sports injuries, and five percent by medical and surgical causes. [1,2]

Direct damage to the spinal cord or compression owing to broken vertebrae or masses such as epidural hematomas or abscesses are the most common causes of

spinal cord injury. Compromise of blood flow, inflammatory processes, metabolic derangements, or exposure to toxins are all less prevalent causes of spinal cord injury. [1]

A abrupt, severe impact on the spine that fractures or dislocates vertebrae is the most prevalent cause of SCI. Primary damage occurs when "displaced bone fragments, disc materials, and/or ligaments bruise or rip into the spinal cord tissue" during the first mechanical pressures imparted to the spinal cord at the time of injury. Notably, most spinal cord injuries do not result in the full amputation of the spinal cord (10). The following are the four main mechanisms of initial damage that have been identified: (1) Consistent compression plus impact; (2) Transient compression plus impact; (3) Distraction; (4) Laceration/transection. Impact with persistent compression is the most frequent type of primary injury, which usually happens as a result of burst fractures with bone fragments compressing the spinal cord or fracture-dislocation injuries. Impact alone with temporary compression is seen less frequently, although hyperextension injuries are the most prevalent. [13-18]

Secondary injury is a set of biological events that start within minutes and progress to self-immolation weeks or months after the main injury. Vascular damage, ionic imbalances, free-radical production, the early inflammatory response, and neurotransmitter buildup are all part of the acute phase of secondary injury following SCI (excitotoxicity). The subacute phase follows, which involves surviving axon demyelination, Wallerian degeneration, matrix remodelling, and glial scar development. [1]

In addition, the results of SCI in military and civilian instances varies significantly. Blast damage, which frequently affects numerous segments of the spinal cord, is the most prevalent cause of SCI in the battlefield as compared to civilian SCI. Blast SCI is also connected with greater severity ratings and longer hospital stays. A study of American military veterans who had SCI in a conflict zone between 2001 and 2009 found that their injuries were more severe and had a worse neurological recovery than civilian SCI. Furthermore, in combat injuries, lower lumbar burst fractures and lumbosacral dissociation are more common. [13]

Following SCI, neuroinflammation can be useful or harmful depending on the time-point and the condition of immune cells. Inflammatory processes during the

first three days after SCI include the recruitment of blood-borne neutrophils, resident microglia, and astrocytes to the injury site. The second phase, which begins three days after the injury, involves the recruitment of macrophages, B-, and T-lymphocytes to the injury site. Antigen-presenting cells activate CD4+ helper T cells, which produce cytokines that drive B cells to make and release antibodies, exacerbating neuroinflammation and tissue death. In the acute phase of SCI, neuroinflammation is more active. [1]

Evaluation:

When examining a blunt trauma victim, medical professionals are taught to presume the patient has a spinal column damage unless it is proven otherwise. A number of organisations have recently proposed that the term "spinal immobilisation" be replaced with "spinal motion restriction," and that spinal motion restriction, which includes the use of cervical collars and backboards, should not be used in patients who are at low risk of spinal column injury. [11]

These criteria should be considered when evaluating a person with a suspected thoracic or lumbosacral spine injury: [19]

- 65 years of age or older, with thoracic or lumbosacral spine discomfort
- axial load to the head or base of the spine – for example, falls landing on feet or buttocks, high-speed motor vehicle collisions, rollover motor vehicle accidents, lap belt restraint only, ejection from a motor vehicle, accident involving motorised recreational vehicles, bicycle collisions, horse riding accidents)
- pre-existing spinal disease, or osteoporosis, whether recognised or at risk — for example, steroid usage
- There is a possibility of a spinal fracture in another part of the spine.
- On examination, aberrant neurological symptoms (paraesthesia, weakness, or numbness):
    - unusual neurological symptoms (motor or sensory deficit)
    - a new deformity or soreness in the bony midline (on palpation)
    - discomfort in the bony midline (on percussion)
    - discomfort in the midline or in the spine (on coughing)

The early examination of a patient with a suspected cervical spinal injury in the emergency department (ED) is no different than that of any other trauma patient. The ABCs, or airway, breathing, and circulation, take precedence. As long as spinal protection is maintained, the majority of spine injuries may be postponed while other life-threatening injuries, such as bleeding or traumatic brain damage, are addressed. Clinicians should do their primary survey, which includes determining the patient's ABCs and level of impairment. Finally, the physician should expose the patient completely to search for symptoms of damage. [11]

The American Spinal Injury Association (ASIA) Impairment Scale is used to grade SCI. From A through E, the grading system is based on the severity of the injury.

- ASIA A: Total paralysis with loss of motor and sensory functions.
- ASIA B: Incomplete damage with sensory function retained but total motor function lost.
- ASIA C: Incomplete damage with retained motor function below the degree of injury; fewer than half of these muscles exhibit MRC grade 3 strength.
- . ASIA D: Incomplete damage with retained motor function below the injury level. At least half of these muscles have MRC (Medical Research Council) grade 3 strength
- ASIA E: A normal motor and sensory. [1]

Historically, the typical first examination for cervical spine injury was a 3-view cervical spine radiograph series. The Eastern Association for Trauma Surgery (EAST) and the American College of Radiology, however, advocate computed tomography (CT) with multi-planar reconstruction as the first imaging modality if imaging is judged acceptable by the physician. If plain radiographs are still utilised in the case of suspected cervical spine injuries, they should only be used in individuals with a low pre-test likelihood. [11]

Management:

Trauma care begins before you arrive at the hospital. Up to 25% of traumatic spinal cord injuries happen after the main injury, such as during extraction, transportation, or handling. Spinal immobilisation is a priority in patients with a mechanism of damage consistent with spinal trauma, and it leads to improved results. The gold standard in spinal protection is three-point immobilisation of the cervical spine with blocks, collars, and tape, as well as a hard spinal board to keep

the majority of the spine aligned. Although these procedures are necessary to prevent future spinal damage, they come with their own set of problems, including pressure sores, aspiration, and increased intracranial pressure, as well as the potential to obstruct early examination. Immobilizing devices should be removed as soon as it is safe to do so. [5]

Examine the person for a spinal injury, first considering the factors given below. Check to see if the person has any distracting injuries.

- is inebriated or under the influence of drugs
- has a decreased degree of consciousness is confused or uncooperative
- suffers any kind of back pain
- Is there any weakness in his hands or feet? (motor assessment)
- Sensation in the hands and feet is altered or nonexistent (sensory assessment)
- Priapism is a kind of priapism that occurs when (unconscious or exposed male)
- has a history of previous spinal issues, such as previous spinal surgery or disorders that predispose to spine instability [19]

When establishing a secure airway or treating hypotension compounded by neurogenic shock, treating additional life-threatening injuries in the face of suspected SCI might be difficult. Hypoxia and hypotension can also be caused by other traumas, causing subsequent injury to the spinal cord. To guarantee that life-threatening injuries and other spinal cord injuries are not missed, all trauma patients must be examined and treated according to an Advanced Trauma and Life Support (ATLS) protocol. Priority should be given to life-threatening injuries, but spinal alignment must always be preserved. [5]

In contrast to individuals with hypovolemic shock caused by bleeding, people with neurogenic shock are usually hypotensive and have warm, dry skin. This is due to a decrease of sympathetic tone, which prevents blood flow from the periphery from being redirected to the core circulation. Other causes of hypotension, such as hemorrhagic shock or tension pneumothorax, may be present in a patient with numerous traumas. These factors must be recognised and treated as soon as possible. Bradycardia is a common symptom of neurogenic shock and can help distinguish it from other types of shock. Because there is no tachycardia, it is

important not to assume that a patient has neurogenic shock. In the case of bleeding, young healthy people, the elderly, and patients on pre-injury beta-blockers are unlikely to experience tachycardia. [11]

In the past, methylprednisolone (Solu-Medrol) administered through an arm vein (IV) has been used to treat acute spinal cord injuries. However, new study has found that the risks of using this medicine, such as blood clots and pneumonia, exceed the benefits. As a result, methylprednisolone is no longer indicated as a first-line treatment following a spinal cord injury.

Surgical removal of bone fragments, foreign objects, herniated discs, or broken vertebrae that appear to be compressing the spine is frequently required. In order to avoid future discomfort or deformity, surgery may be required to stabilise the spine.

Rehabilitation is an important component of the healing process, and these patients benefit from intensive rehabilitation under the supervision of physiatrists, physical therapists, and occupational therapists. Once the patient is ready to be discharged from the inpatient rehabilitation unit, rehabilitation will be maintained on an outpatient basis. [1]

Conclusion:

Spinal cord injury is serious condition, management of such cases begins before arriving at emergency department by immobilizing the spine to prevent any serious damage to the spinal cord, ABCs and other trauma/emergency procedures should be done as with any emergency case, assessment of the spinal injury is done first then treatment is done based on the assessment, surgery is needed In many cases to remove any bodies that may by compressing the spine followed by immobilization.

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