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FOR PRIMARY HEALTH CARE

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Non-Emergency and Non-Trauma Pathology

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Spinal trauma

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Learning objectives

- Identify clinical features.
- Analyse imaging studies.
- Perform a comprehensive examination.
- Formulate differential diagnoses.
- Understand the importance of urgency.
- Comprehend multi-disciplinary management.
- Evaluate surgical and non-surgical options.
- Recognise rehabilitation needs.
- Appreciate prevention and precautions.
- Critically analyse clinical references.

Case presentation

A 32-year-old female patient arrives at the emergency department after a high-speed motor vehicle accident (MVA). She was the driver involved in a head-on collision. The patient is conscious but complains of severe pain in her neck and back. On further inquiry, she mentions numbness and tingling in both arms and legs. The medical history reveals no previous spinal problems or significant medical conditions.

A lateral x-ray of the cervical spine indicated a C5/6 facet dislocation, a serious injury, which can result in spinal cord compression.

***Figure 1**: A clinical photograph depicting the patient's position upon arrival at the emergency department. The cervical collar and backboard are in place and the patient is being carefully stabilised. (Source: Koroushtaherian, CC BY-SA)*

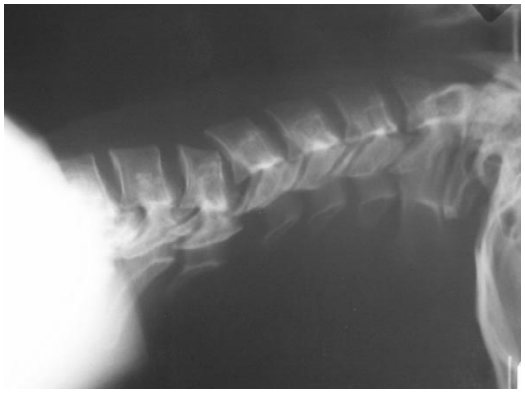

***Figure 2:** Lateral x-ray of the cervical spine indicating a C5/6 facet dislocation*

History

When dealing with potential spinal trauma, gathering a comprehensive history is vital for diagnosis and management. The most common causes of traumatic spinal cord injury worldwide are falls and road traffic injuries (RTIs). In South Africa, penetrating injuries from gunshot wounds and stabs are also common.

Mechanism of injury: How did the trauma occur? Was it a car accident, fall, sport-related incident or another cause?

Duration of symptoms: When did the patient start experiencing pain, numbness or other symptoms?

Neurological changes: Are there any changes in sensation or strength in the arms and legs?

Previous spinal conditions: Has the patient had any previous spinal issues or surgeries?

Medical history: Are there any underlying medical conditions that might affect the treatment plan?

Examination

Perform a thorough physical examination to assess the patient's spinal stability and neurological status. Perform a log-roll to assess the spine thoroughly.

Inspection: Look for signs of deformity, bruising or swelling around the spinal region.

Palpation: Gently feel for tenderness, abnormalities or instability along the spine. Crepitus or a gap on palpation of spinous processes are indicative of instability.

Movement: Assess the range of motion and the patient's ability to move their limbs. Be cautious not to exacerbate any potential injuries.

Undertake neurovascular examination. Evaluate peripheral pulses and sensory function in all extremities. Assess motor strength in the arms and legs.

Digital rectal examination is performed to assess pin-prick sensation and voluntary anal pinch. Absence of the bulbo-cavernosus reflex indicates the patient is in spinal shock.

Special investigations

In cases of suspected spinal trauma, the following investigations are crucial:

X-rays: Obtain anterior-posterior (AP) and lateral views of the affected region to identify fractures, dislocations or misalignments. Also, see the related chapter: "Approach to orthopaedic x-rays".

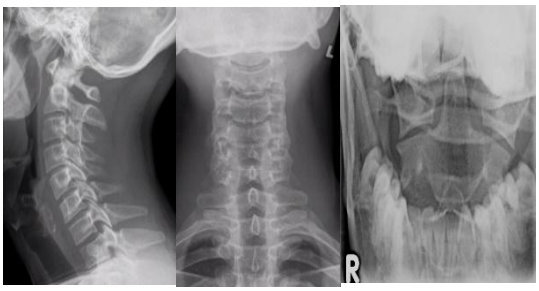

Figure 3: *Cervical spine trauma series showing (left to right) lateral, AP and open-mouth views to assess the C1/2 level*

Magnetic resonance imaging (MRI) or computed tomography (CT) scan: These imaging techniques provide detailed information about spinal cord injuries, nerve compression and soft tissue involvement.

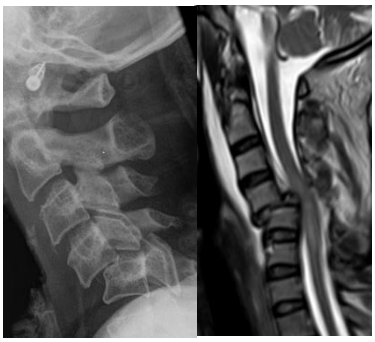

Figure 4: *Lateral x-ray of a C4/5 bifacet dislocation (left) and the sagittal T2 MRI showing associated spinal cord compression (right)*

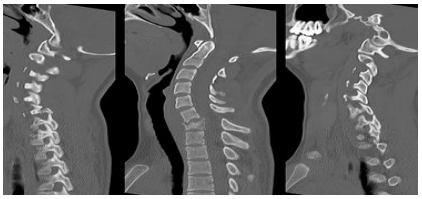

Figure 5: *CT scan images showing a C7 fracture dislocation, with C7 body compression and facet joint fracture with subluxation*

Differential diagnoses

Consider potential causes of the patient's symptoms, such as:

Spinal fractures: Vertebral body fractures, spinous process fractures or facet joint injuries.

Spinal cord injury: Compression, contusion or laceration of the spinal cord.

Disc herniation: Disc material pressing on nerves or the spinal cord.

The American Spinal Injury Association (ASIA) grading scale is used to describe neurological injuries:

- **ASIA A:** A complete spinal cord injury with no sensory or motor function preserved distal to the injured cord segment.
- **ASIA B:** An incomplete injury with sensory preservation distal to the injury, but complete motor function loss.
- **ASIA C:** An incomplete motor injury where there is some motor preservation distally, but functionally useless (0–2 MRC).
- **ASIA D:** An incomplete motor injury with useful motor function distal to the injured cord segment (4/5 MRC).
- **ASIA E:** Normal.

The MRC (Medical Research Council) scale for muscle strength is as follows:

- **Grade 5:** Normal
- **Grade 4:** Movement against gravity and resistance
- **Grade 3:** Movement against gravity over (almost) the full range
- **Grade 2:** Movement of the limb but not against gravity
- **Grade 1:** Visible contraction without movement of the limb (not existent for hip flexion)
- **Grade 0:** No visible contraction

Management

Immediate and appropriate management is crucial in spinal trauma cases, as this can improve the prognosis as well as prevent complications.

Stabilisation: Immobilise the patient's spine with a cervical collar and backboard to prevent further damage during transport.

Emergency referral: Urgently refer the patient to a specialised spinal trauma centre for a thorough assessment and management.

Collaborative approach: A multidisciplinary team of orthopaedic surgeons, neurosurgeons and radiologists should review the case together to determine the best treatment plan.

Non-surgical: Some minimally displaced cervical fractures can be managed conservatively in a rigid

cervical collar (Philadelphia collar) for 3 months and are expected to stabilise once bony union occurs. Unstable displaced cervical injuries of the C1 ring, C2 peg and C2 traumatic spondylolisthesis injuries are mostly managed in cervical skull-tong traction in bed for 6 weeks to maintain alignment, and then a further 6 weeks in a cervical collar until united.

Most stable thoraco-lumbar fractures are managed at home with a brace for pain control until united at 3 months.

Surgery: Unstable spinal fractures and dislocations are managed surgically to restore vertebral alignment, stability and decompression of neural tissue. This is achieved with a variety of spinal instrumentation which allows early mobilisation.

Rehabilitation: Provide comprehensive rehabilitation and physiotherapy, such as range of motion (ROM) exercises, gait training, manual dexterity, aerobic exercises, bladder and bowel training, and workplace assessment or retraining to aid in the patient's recovery and return to maximal function.

Figure 6: *Lateral MRI of the lumbar spine showing a L2 collapse and compressed nerves. Lumbar spondylosis and spinal tuberculosis (TB).*

Complications are common in spinal trauma and immediate and appropriate management is necessary to minimise risk of complications. These complications include but are not limited to:

Spinal instability and deformity: Severe spinal trauma can result in spinal instability and deformities, which may require surgical stabilisation and correction.

Neurological deficits: Spinal cord injuries can lead to partial or complete loss of sensation and motor function below the level of injury. This can result in paralysis or weakness in the limbs, loss of bowel and bladder control, and sensory disturbances. Neurogenic bladder can develop due to loss of innervation following spinal trauma, resulting in symptoms such as urinary tract infections (UTIs), urinary incontinence, frequency and urgency.

Paraplegia or quadriplegia: Severe spinal cord injuries can cause paraplegia (paralysis of the lower limbs) or quadriplegia (paralysis of all four limbs). The extent of paralysis depends on the level of the spinal cord affected. This can then lead to a deep vein thrombosis (DVT) and pressure sores.

Neurogenic shock: A severe spinal cord injury can disrupt the autonomic nervous system, leading to neurogenic shock. This condition results in low blood pressure, bradycardia (slow heart rate) and peripheral vasodilation.

Respiratory problems: Spinal trauma at higher levels of the cervical spine can impact the muscles involved in breathing, leading to respiratory difficulties and the need for ventilatory support.

Gastric ulcers: Spinal cord trauma can alter the equilibrium between parasympathetic and sympathetic neural pathways, as well as cause ischaemia of the gastric mucosa in various ways.

Contractures: Characterised by limited joint range of motion and deformity. This can lead to impairment in mobility and function, and lead to disability and pain. This can be due to the loss of innervation in spinal trauma.

Prevention

Spinal trauma can be avoided by:

- Avoiding or being safe around fall hazards such as ladders.
- Driving safely and wearing seatbelts in motor vehicles. Never speed or drink and drive.
- Wearing appropriate safety gear during sport and recreational activities.

Assessment

1. A 58-year-old male patient presents to the emergency department with after a high-speed MVA. He is conscious, but complains of neck and back pain, as well as weakness and numbness in both arms and legs. Physical examination reveals swelling and tenderness over the cervical and lumbar spine. What is the most appropriate immediate management for this patient?

A. Administer intravenous pain relief medications

B. Immobilise the cervical and lumbar spine with collars and backboards

C. Refer the patient for physiotherapy and rehabilitation

D. Perform emergency surgical decompression of the spinal cord

The answer is (D). The patient's presentation of neck and back pain, weakness and numbness in both arms and legs, along with swelling and tenderness over the cervical and lumbar spine, suggests a potential spinal cord compression. Immediate surgical decompression is the most appropriate management in this scenario.

2. A 40-year-old female patient arrives at the emergency department after a fall from a horse. She experiences severe pain in her neck and back, along with tingling in both legs. The medical history reveals no previous spinal issues or significant medical conditions. On examination, there are signs of vertebral body fractures and facet joint injuries. Which of the following imaging studies is crucial for further assessment?

A. CT scan of the spine

B. MRI of the spine

C. X-ray (AP and lateral views)

D. Ultrasound of the spine

The answer is (B). Given the patient's severe pain, tingling in both legs and signs of vertebral body fractures and facet joint injuries, an MRI of the spine is crucial for further assessment. MRI provides detailed images of the spinal cord, nerve roots and surrounding soft tissues, making it an excellent modality to evaluate the extent of the injury.

3. A 32-year-old male patient presents with a history of gradually worsening back pain and reports intermittent claudication. MRI reveals lumbar disc herniation with nerve compression. Which of the following management approaches is most appropriate for this patient?

A. Immediate surgical intervention

B. Bed rest and analgesics

C. Physiotherapy and exercises

D. Observation and conservative treatment with medications

The answer is (A). The patient's history of gradually worsening back pain and intermittent claudication, along with MRI findings of lumbar disc herniation with nerve compression, may indicate significant nerve impingement. In such cases, immediate surgical intervention may be necessary to relieve pressure on the nerve and prevent further complications.

4. In cases of suspected spinal trauma, which aspect of the comprehensive examination is essential for evaluating peripheral vascular supply and sensory function in all extremities?

A. Measurement of peripheral pulses

B. Assessment of motor strength

C. Evaluation of deep tendon reflexes

D. Examination of range of motion

The answer is (A). In cases of suspected spinal trauma, the measurement of peripheral pulses is essential for evaluating peripheral vascular supply. Checking pulses in all extremities helps assess blood flow and ensures that there are no vascular injuries or compromise following the trauma.

5. A 55-year-old male patient presents to the emergency department with severe back pain following a fall. On examination, there is swelling and tenderness over the lumbar spine. MRI reveals a burst fracture with retropulsion of bone fragments. What is the most appropriate management approach for this patient?

A. Immediate surgical intervention

B. Spinal bracing and pain medications

C. Bed rest and physiotherapy

D. Observation and conservative treatment with analgesics

The answer is (A). The patient's presentation of severe back pain, swelling and tenderness over the lumbar spine, along with MRI findings of a burst fracture with retropulsion of bone fragments, indicates a significant injury to the spine. In such cases, immediate surgical intervention is often necessary to stabilise the spine, decompress neural structures and prevent further damage to the spinal cord.

References and further reading

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ABOUT THE BOOK

This is the second volume of the *Orthopaedics for Primary Health Care* textbook edited by Michael Held, first published in 2021.

Most patients with orthopaedic pathology in low- and middle-income countries are tested by non-specialists. This book was based on a Delphi consensus study* with experts from Africa, Europe and North America to identify topics, skills and cases concerning orthopaedic trauma and infection that need to be prioritised in order to provide guidance to these health care workers.

The aim of this book is to be student-centred.

*Held et al. Topics, Skills, and Cases for an Undergraduate Musculoskeletal Curriculum in Southern Africa: A Consensus from Local and International Experts. JBJS. 2020 Feb 5;102(3):elO.

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This textbook is not intended as a substitute for the medical advice of physicians.

The information in this book is meant to supplement, not replace, orthopaedic primary care training.

The authors, editor and publisher advise readers to take full responsibility for their safety and know their limits. Before practicing the skills described in this book, be sure that your equipment is well maintained, and do not take risks beyond your experience, aptitude, training or comfort level.

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