NURSING MANAGEMENT ON COMPLICATION OF SPINAL INJURY

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Spinal injury can be defined as

- Spinal Column (Bony) Injury
- Spinal Cord Injury
- Combined (both Column & Cord) Injury
Bony spinal injuries may or may not be associated with spinal cord injury.

These bony injuries include:
- Compression fractures of the vertebrae
- Comminuted fractures of the vertebrae
- Subluxation (partial dislocation) of the vertebrae

Other injuries may include:
- Sprains – over – stretching or tearing of ligaments
- Strains – over – stretching or tearing of the muscles
Cutting, compression, or stretching of the spinal cord

Causing loss of distal function, sensation, or motion

Caused by:
- Unstable or sharp bony fragments pushing on the cord, or
- Pressure from bone fragments or swelling that interrupts the blood supply to the cord causing ischemia
Motor vehicle collision 47%
Fall from height 23%
Acts of violence 14% (gunshot wounds, bullet injuries)
Sport injuries 9%
Others 7%
Mechanisms of Spinal Injury

- Flexion (bending forward)
- Hyperextension (backward)
- Rotation (either flexion – or extension – rotation)
- Compression (downward motion)
Figure 57-5  Mechanisms of spinal injury.

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Types of Spinal Injury

- Flexion Injury
- Compression Injury
- Distraction Injury
- Hyperextension Injury
- Flexion-Rotation Injury
- Penetration Injury
Goals of Immediate Management in Hospital

- Sustain life
- Prevent further damage
- Ongoing monitoring and treat of associate injuries
- Prevention of complications
- Initiation of definitive management for vertebral column injury or SCI
A – Airway maintenance + c-spine control
B – Breathing
C – Circulation + hemorrhage control
D – Disability (mini neurological exam)
E – Exposure / Environmental control
F – Full set of vital signs / Five interventions / Family presence
G – Give comfort measures
H – History / Head-to-toe examination
I – Inspect posterior surface
Neurological Assessment

ASIA

STANDARD NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY

MOTOR

KEY MUSCLES

<table>
<thead>
<tr>
<th>C2</th>
<th>C3</th>
<th>C4</th>
<th>C5</th>
<th>C6</th>
<th>C7</th>
<th>C8</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>T7</th>
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- 0 = total paralysis
- 1 = palpable or visible contraction
- 2 = active movement, gravity eliminated
- 3 = active movement, against gravity
- 4 = active movement, against some resistance
- 5 = active movement, against full resistance
- NT = not testable

SENSORY

KEY SENSORY POINTS

0 = absent
1 = impaired
2 = normal
NT = not testable

PIN PRICK SCORE

LIGHT TOUCH SCORE

TOTALS (MAXIMUM, 112)

NEUROLOGICAL LEVEL

SENSEY MOTOR

COMPLETE OR INCOMPLETE?

ZONE OF PARTIAL PRESERVATION

ASIA IMPAIRMENT SCALE

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Spinal Cord Injury (SCI)

- An insult to the spinal cord resulting in changed neurological function
  - Motor
  - Sensory
  - Autonomic
- May be temporary or permanent
- Injuries tend to be physically, emotionally and financially devastating
Level of SCI
SCI Signs and Symptoms

Signs & symptoms based on location & severity of injury

- **Tetraplegia** (Quadriplegia) occurs with C-1 through C-8 injuries
- **Paraplegia** occurs with T-1 thru L-4
Site of Injury and Neurological Level

- C5 most common site of injury
- T12 / L1 most common injuries
What is the difference between neurogenic shock and spinal shock?

<table>
<thead>
<tr>
<th>Pathophysiology</th>
<th>Neurogenic shock</th>
<th>Spinal shock</th>
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</thead>
<tbody>
<tr>
<td>• Temporary loss of autonomic function &amp;</td>
<td>• Temporary loss of autonomic function &amp; control from higher centers on the</td>
<td>• Neurologic, not hemodynamic phenomenon</td>
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<td>control from higher centers on the</td>
<td>descending autonomic pathways</td>
<td>• Temporary suppression of reflexes</td>
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<td>Usually associated with injury at T6 or</td>
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<tr>
<td>above</td>
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<tr>
<td>Signs &amp; Symptoms</td>
<td>Loss of sympathetic nervous system and vasomotor tone</td>
<td>Loss of reflexes</td>
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<tr>
<td>• Hypotension</td>
<td>• Hypotension</td>
<td>• Flaccid paralysis</td>
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<tr>
<td>• Bradycardia</td>
<td>• Bradycardia</td>
<td>• Atonic bladder, bowel dysfunction, priapism</td>
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<tr>
<td>• Hypothermia</td>
<td>• Hypothermia</td>
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<tr>
<td>Onset / Duration</td>
<td>Temporary</td>
<td>Occurs shortly after injury, duration of this state varies (from hours to</td>
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<td>months)</td>
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Initial Management

- **Immobilization**
  - Rigid collar with sandbags
  - Log-roll turning
  - Halo traction
  - Spinal brace
  - Stabilization of the bony elements by surgical approach

- **Maintain airway and oxygenation**
  - O2 supplementation
  - Intubate if needed, protect c-spine

- **Prevent hypotension**
  - Vasopressors: Dopamine
  - Fluid challenge
Nasogastric tube
- Prevent aspiration
- Decompress the abdomen (paralytic ileus is common in the first days)

Foley
- Indwelling catheter initially

Temperature control
- Keep warm

Methylprednisolone
- Beneficial if started within first 8 hours post injury to reduce swelling and pressure on cord
- Methylprednisolone dosage:
  Bolus of 30mg /kg IV given over 1 hour;
  Followed by 5.4mg /kg /hour IV infusion for 23 hours
Physiological
Complications correspond to level of injury

Psychological
Respiratory System
Respiratory Distress / Hypoventilation

- Injury of C3 and above
  - Loss of phrenic nerve
  - Likely to cause death from respiratory arrest
- Injury between C3 and C5
  - Loss of diaphragmatic innervation
  - Likely to cause respiratory insufficiency
- Injury between C6 and T8
  - Involves loss of intercostal and abdominal muscle function
  - Causing increase work of breathing

Impaired gas exchange related to diaphragmatic fatigue or paralysis evidenced by
- Dyspnea
- Use of accessory muscles
- Abnormal ABGs
Respiratory Management

- Maintain patent airway
- Adequate ventilation
- Assess respiratory status closely
- Observe strength of cough
- Monitor ABGs
- Provide chest physiotherapy
- Suction secretions
- Need for ventilatory assistance tracheostomy
- Assist with mechanical ventilation
- Ventilator-associated pneumonia prevention
- Provide emotional support
Cardiovascular System
Bradycardia / Hypotension

Injury above T-6

↓ Sympathetic nervous system to heart

- Bradycardia
- Hypotension
  (due to vasodilation)
Cardiac monitoring

Careful hydration

Drug therapy
- **Vasopressors** to maintain adequate perfusion pressure
  - Dopamine
  - Dobutamine
- **Antimuscarinic agent** to increase heart rate
  - Atropine
DVT is the formation of a blood clot (thrombus) in a deep vein predominantly in the legs.

Increased risk with immobility, fracture with surgery, obesity, history of congestive heart failure ...

Symptoms of DVT include leg(s) pain, swelling, tenderness, redness and warmth.

Diagnosis is based on these clinical findings and by non-invasive Doppler ultrasound studies.
A potentially life-threatening complication, is caused by the embolization of a clot that travels to the lungs.

Classic symptoms of PE are typically sudden onset and include chest pain, dyspnoea, tachypnea, tachycardia.

Diagnosis is by imaging studies of CT thorax.
Mechanical Prophylaxis

- Elastic compression stockings
- Intermittent pneumatic compression devices
- Perform ROM to aid in muscle contraction and venous return

Pharmacological prophylaxis

- Anticoagulant therapy (Low Molecular Weight Heparins or Coumadin)

Close monitoring: vital signs, extremity girth, limb(s) circulation

Early ambulation is vital
Dramatic fall in BP when upright posture is assumed

Disturbed vasomotor control with decreased blood supply returning to heart

Occurs mainly with injury T4-6 or higher, with increased incidence at higher levels
Abdominal binder, calf compressors, TED hose when individual gets up
Assess BP, especially when rising
Use of a reclining wheelchair with elevating foot rests
Assist Physical Therapy with tilt table as individual gradually gets use to being in an upright position
Vasopressor / Anti-hypotensive agent: Midodrine
Patient has *lost the ability* to *sweat* below level of lesion

Lost the ability to have the hair follicles stand upright ("piloerection")

"Poikilothermia": the *inability* to regulate core body temperature
Poikilothermia Management

- Temperature monitoring
- Environmental temperature control
- Hypothermia
  - Prevention of cool draughts
  - Top blanket to protect warmth
  - Forced-air warming blanket (Bair Hugger Therapy)
- Hyperthermia
  - Remove extra clothing
  - Put a cold wet towel/pad on the back of neck
  - Encourage water drinking
Nervous System
Autonomic Dysreflexia

- Occurs mainly when injury is T4–6 or higher
- Characterized by sudden severe headache secondary to a reduced heart rate and high blood pressure
- Caused by any variety of stimuli creating an exaggerated response of the sympathetic nervous system
  - Over-distended bladder, bowel impaction, urinary infection, pain or other infection (like pressure sore, ingrown toe nail)
- Life threatening – the increase in ICP and blood pressure can lead to cerebral hemorrhage
Autonomic Dysreflexia Management

- Assess for severe hypertension, bradycardia, pounding headache, piloerection, sweating, skin flushing
- **Immediately** elevate head of bed
- Identify and eliminate noxious stimuli such as bowel impaction, urine retention, skin pressure or pain
- Remove compression stockings/abdominal binder
- **Closely** monitor blood pressure and pulse
- Inform physician if intervention not effective
- Administer medications (e.g. Valium, Pyridium and Nifedipine) as ordered
Nervous System
Neuropathic Pain

- Nerve pain can occur after a spinal cord injury, especially in someone with an incomplete injury
- Burning and stinging sensations in limbs

Pain control
- Need for ongoing neurological assessments
- Limb splinting
- Medications (e.g. Gabapentin, Pregabalin)
- Acupuncture
- Spinal or brain electrical stimulation
- Surgery
Flaccid (hypotonic) neurogenic bladder
- No reflex from S2, 3, 4
- Urine fills the bladder and dribbles out

Spastic bladder
- Spinal cord damage above T12
- Bladder contraction and external urinary sphincter relaxation are typically uncoordinated

Over distention of the bladder:
- Urinary tract infection (UTIs) and Urinary calculi
- Autonomic dysreflexia
During acute phase, insert indwelling catheter

Begin BLADDER TRAINING when the condition is stable the catheter is removed and intermittent catheterization is started

Palpate bladder and use bladder scan to see amount of urine in bladder
(Goal: residual urine < 100 ml or 20% bladder capacity)

Encourage fluid intake

Keep I & O

Monitor blood for renal function

Assess effectiveness of medications
  - Urecholine to stimulate bladder contraction
  - Urinary antiseptic
  - Blood pressure reduction for autonomic dysreflexia

Some individuals may need suprapubic catheter
Injury above T-5 results in problem with \textit{intestinal hypomotility}:

- Paralytic ileus
- Bowel distention
  - Lack of bowel movement in over 2 days
  - Decrease bowel sounds
  - Palpable impaction
  - Hard stool or incontinence

\textbf{Constipation leads to} \textit{Autonomic Dysreflexia}
Auscultate bowel sounds and monitor *abdominal distention* (+/- intermittent NGT suctioning)

- Note and report any nausea and vomiting

- Begin **BOWEL PROGRAM** when bowel sounds return
  - Give suppository best after a meal when normal peristalsis occurs
  - Do this at same time each day
  - Fiber, fluids and activity are important
  - Assess bowel sounds prior to resume diet for the first time – *paralytic ileus*

- **H2 receptor blockers + proton-pump inhibitors (PPIs)** for ulcer prevention
Muscle atrophy causing weight loss are common soon after a spinal cord injury. Limited mobility may lead a risk of obesity.

Management
- Evaluate swallowing before oral feeding
- Provide nutritious diet to sustain an adequate weight by dietitian
- Develop exercise program by physio and occupational therapists
Below the neurological level of spinal injury, patient may have lost part or all skin sensations.

- Muscle atrophy in flaccid paralysis
- Contractures in spastic paralysis
- Poor body temperature control
- Change position frequently
- Protection from extremes in temperature
- Inspect skin at least 2 times/day especially over bony prominences
- Keep skin clean and dry and use pressure relieving devices
- Avoid shearing and friction to soft tissue with transfers
- Insure adequate nutritional intake
- Passive ROM to improve circulation & stimulate the skin
- Inform family and patient about risk of pressure ulcers
Musculoskeletal System
Joint Contractures / Foot Drop / Muscle Spasms

- Flaccid paralysis --- Joint contractures
  Foot drop

- Spastic paralysis --- Muscle spasms
Joint Contractures / Foot Drop / Muscle Spasm Management

- **Flaccid paralysis**
  - Prevent contractures/foot drop by using **limb splints and/or ankle foot orthosis**
    - Remove at regular intervals for ROM
    - Assess skin breakdown

- **Spastic paralysis**
  - Prevent spasms by **avoiding**
    - Sudden movements or jarring of the bed
    - Internal stimulus (full bladder/skin breakdown...)
    - Staying in one position too long
  - **Treat spasms**
    - Hot or cold pack
    - Passive stretching
    - Antispasmodic medications
Coping with all the changes is difficult and pain. Patients often feel sadness, grief, anxiety, stress, empty, hopeless and helpless which causes some patients to experience depression.

A caring network of professional health care team, family, and friends is very important.