Nursing 202: Advanced Concepts of Nursing
Unit IV: Neurotrauma
Spinal Cord Injuries (SCI)

- **Spinal Cord**

About 18 inches long
The major bundle of nerves that carry nerve impulses from the brain to the rest of the body
Extends from the base of the brain to about the waist

- **Vertebra**

Function = protection & support
"Rings" of bone (33)
Named according to location:
Cervical (7)
Thoracic (12)
Lumbar (5)
Sacral (5) fused as 1
Coccygeal (4) fused as 1

- **Upper Motor Neurons**

Lie within the spinal cord (above L1)
Carry messages back and forth from the brain to the spinal nerves along the spinal tract
Lesions: see spasticity, hyperreflexia below the level of lesion

- **Lower Motor Neurons**

Spinal nerves that branch out from the SC to the body
Exit and enter at each vertebral level and communicate with specific areas of the body
They activate the muscle they innervate
Sensory and motor neurons
Lesions:
Cause weakness, paralysis, flaccidity

- **Vascular Supply**

Arterial
Anterior spinal and two posterior spinal arteries
Arise from Circle of Willis
feed the entire length of the spinal cord

- **History**

Prior to WWII, life expectancy was months-10yrs
Cause of death used to be renal failure
Now many advances in urology
Major cause of death is now compromised respiratory function
Pneumonia, PE or Septicemia
Christopher Reeves had a major impact on research

- Long-term issues remain

Disruption in growth and development
Altered family dynamics
Economic loss
High cost of rehabilitation and long-term care

- Trauma or damage to spinal cord

Temporary or permanent dysfunction

- 17,000 new SCIs each year in United States

- 282,000 Americans living with SCI
- Decreased life expectancy; increased mortality
- 30% rehospitalization rate
- Causes: Most related to trauma

38% motor vehicle collisions
30.5% falls
13.5% violence
9% sports injuries
2/3 from diving incidents

- **Sex**

Males 82%
More risk takers
Usually, a hx of multiple injuries prior to SCI

- **Risk Factors**

Age
Sex
ETOH/Drug Use
Time of year - summer

Classification of SCI

- SCI is classified by:

Mechanism of injury
Level of injury
Degree of injury

- **Knowing the type of collision/accident can aid in assessment of injury** (MOI)

Forces responsible for hyperextension and hyperflexion
Acceleration (hit in the rear when stopped)
Deceleration (stopped while in motion)
Deformity (various alterations in the spinal cord and supporting structures)

- Mechanisms of Injury

Flexion
Flexion-rotation
Most unstable, leading to severe neurologic deficits
Hyperextension
Vertical compression (axial loading)
Extension-rotation
Lateral flexion
Penetrating

- **Hyperextension (head snaps back)**

Usually fracture of posterior element of spinal column and disruption of anterior longitudinal ligaments.

- **Hyperflexion (head snaps forward)**

Head on collision
Deceleration from the front
Head and body continue moving forward until contact is made
The head is forced forward until it rests on the chest

- **Vertical Compression (axial loading)**

Vertical force on the spinal columns

Diving accidents, falls on buttock

- **Rotation**

Wedge fx
Extreme lateral flexion or twisting of the head and neck
May result in posterior ligaments tear, dislocation or fracture

- **Penetrating**

Missiles, bullets, knives

- Types of Injury/ Classification
- **Vertebral Column Injury without SCI**

Immobilize
Protect from SCI – bone fragment or unstable vertebrae can injure the cord

- **Vertebral Column Injury with SCI**

Prevent more damage!

- **SCIWORA Syndrome**

SCI without radiographic abnormality

- **Vertebral**

Fracture
Simple (singular break)
Alignment usually intact
Usually no neural compression
Compression (wedge)
Often caused when vertebral column is flexed
Hard collar for 2 months
Comminuted (burst)
Vertebral column is straight with shattered vertebral body
Fragments can damage the cord
May need rodding and removal of fragments
Dislocation
One vertebrae overrides another
Supporting ligaments often injured
Tx = traction & immobilization
Stable vs. Unstable

Degree of Injury

- Complete

Total loss of sensory and motor function below level of injury

- Incomplete (partial)

Mixed loss of voluntary motor activity and sensation
Some tracts intact
Five major syndromes associated with incomplete injuries (to be discussed)

Special Type Cervical Fractures / Dislocation
Jefferson
Rare
Fx of C1

Burst Fracture
Unstable
From vertebral compression (axial loading)
Special Type Cervical Fractures / Dislocation

Atlanto – Occipital

Dislocation
Avulsion of C1 body from occipital bone
Rare almost always immediately fatal

Odontiod (Dens) Fx

Need to R/O in all pts in MVC with neck pain
Can be missed in X-ray
Standard of care is now CT
Special Type Cervical Fractures / Dislocation

Hangman Fx

Most unstable with neuro deficit
Separation body of C2 from posterior elements
Classified by the amount of displacement in body of C2
Often fatal

- **Partial (incomplete) SCI**

Brown–Sequard Syndrome

Damage to ½ of cord
Typically results from penetrating injury
Ipsilateral paralysis or paresis
Contralateral loss of pain and temperature
Example
Left side of the cord has been transected
Paralysis of all voluntary muscles below the injury on the ***left*** side (ipsilateral)
Loss of the perception of touch, vibration and position on ***left***
Loss of perception of pain and temp on the ***right*** side of the body (contralateral)

- **Partial (incomplete) SCI**

Anterior Cord Syndrome

Injury at the anterior spinal artery causes compromised blood flow
Flexion injury
Loss of pain, temp, motor function below the level of the injury
Light touch, position, vibration intact

- **Partial (incomplete) SCI**

Cauda Equina Syndrome

“Horsetail” below the spinal cord
Lumbosacral nerve roots
Affects lower motor neurons (Flaccid paralysis of lower limbs)
Bowel and bladder dysfunction
Severe asymmetric pain

- **Partial (incomplete) SCI**

Central Cord Syndrome

Injury/edema of the central cord
Commonly cervical region/ older adults
Motor weakening or paralysis in upper extremities
Lower intact

- **Partial (incomplete) SCI**

Conus Medullaris Syndrome

Damage to lowest portion of spinal cord

Decrease in or loss of sensation in perianal area

Areflexic bladder/ bowel

Impotence

Pain is uncommon

- **Levels of Injury**

Dermatone identifies specific areas of the **skin** supplied by sensory fibers.

Touch, vibration, position, pain, temp

Myotone identifies **muscle** group innervated by nerves

Motor function

- Case Study

EMS arrives on scene of a 23 y.o. male diving off the dock into the bay. The patient cannot move his fingers or hands.

What level is his injury?

- Etiology and Pathophysiology

Primary Injury

- Direct physical trauma from blunt or penetrating trauma
- Spinal cord compression by

Bone displacement

Interruption of blood supply

Traction from pulling on cord

- Penetrating trauma, causing tearing and transection
- Predisposed areas= C5-6

Maximum movement of cervical spine takes place, cord largest at this level, multiple nerve fibers that feed the upper extremities

- **Pathophysiology**

Vertebral injury vs. spinal cord injury

Can have a fx without cord injury

R/F Compressing the spine

Initial Injury

Chain of Events

1 hour – petechial hemorrhage in gray matter

4 hours – infarction in gray matter

Hemorrhage, edema, metabolites act together to produce ischemia which progresses to necrotic destruction of cord

Hypoxia results – decreases 0_2 supply below the level to meet the metabolic needs of the cord.

Increase in lactic acid and ↑ vasoactive substances= vasospasm = more hypoxia = more necrosis

24 hours – permanent damage because of the edema that developed secondary to inflammation – cord compressed!

When the cord is compressed more, then inflammation ↑ at the site- = ischemia.

Additional edema extends the level of the injury beyond the immediate level of the injury for 72 hours to 7 days.

Makes it difficult to assess the extent of the injury.

Secondary Injury

- Ongoing, progressive damage that occurs after primary injury

Causes further permanent damage

Begins a few minutes after injury and lasts for months
- Events Leading to Secondary Injury
- Spinal Shock
- Occurs shortly after injury and lasts days to weeks

Temporary syndrome
- Characterized by

Loss of deep tendon reflexes and sphincter reflexes
Loss of sensation
Flaccid paralysis below level of injury
- **Often masks post-injury neurologic function**
- Can last 1-6 weeks, on average
- Ends when spastic paralysis replaces flaccid paralysis
- Prognosis:

A person who gradually loses neurological functioning after an accident has some chance of recovering at least partial function when spinal shock dissipates.

Return of function is not due to regeneration
Spinal shock masks the function which may still be intact
Patient and family will ask about recovery but **there is no way to know at first!!**
- Neurogenic Shock
- Occurs in cervical or high thoracic (at or above T6) injury; can last 1 to 3 weeks
- Loss of SNS (fight or flight) innervation causing unopposed parasympathetic response

Peripheral vasodilation
Venous pooling
Decreased cardiac output
- Characterized by

Hypotension (less than 90 mmHg)
Bradycardia
Temperature dysregulation
- Diagnostics

CT scan
Preferred study for location and degree of injury and degree of spinal canal compromise
Cervical x-rays
MRI
Soft tissue injury and neurologic conditions
Guide decisions about surgery
Comprehensive neurologic examination
CT angiogram
- Emergency Management
- Pre-hospital
- Immediate goals

Patent airway
Adequate ventilation/breathing
Adequate circulating blood volume
Prevent extension of spinal cord damage
- Suspect SCI in any patients with:

Wounds of the face, neck, head, & shoulders
Any unconscious patient
Head injuries

Neck pain
Any motor or sensory losses
Signs of spinal shock
Initial
Patent airway and adequate respirations
Administer O_2; keep >90%
Maintain SBP above 90 mmHg
IV access; infuse NSS or LR
Immobilize and stabilize cervical spine
Assess for other injuries
Control external bleeding
- Immobilization of cervical spine

Jaw Thrust
No head tilt or chin lift
No flexion or extension of neck
Rigid cervical collar
Backboard with straps
Keep supine; log-roll for transfers
Chemical or physical restraints if needed to protect from further injury
- Intubation to secure airway if in respiratory distress
- IV fluids and vasopressors

Treat neurogenic shock
Keep SBP above 90 mmHg
- Stabilize at scene, then transfer to nearest medical facility that ideally specializes in SCI
- Thorough assessment

Determine degree of deficit
Establish level and degree of injury

- Acute Care
- Initial assessment in ED

Managing ABCs and vital signs
Secure airway, intubate if indicated
Maintain: HR, mean arterial pressure above 85 mmHg, SBP above 90 mmHg
Medical interventions and diagnostics for hemodynamic stability
Neurologic assessment
Test muscle groups bilaterally
Record strength, symmetry and spontaneous movement
Sensory assessment
Pinprick
Position sense and vibration, as time permits
Rectal tone and priapism
- Review Priorities of Care…
- Emergency Management
- Primary Survey

Airway, Breathing, Circulation, Disability
- Prevent further cord shock
- Always assume cervical spine injury

Maintain neutral alignment

No head tilt, No flexion of neck

Airway

C1-4 phrenic nerve does not function = loss of ability to cough & deep breath

Jaw thrust

No head tilt or chin lift

No flexion or extension of the neck

Breathing

Above C4 = loss of respiratory muscle

Below C4 = diaphragmatic breathing if phrenic nerve functioning

Hypoventilation r/t decrease vital capacity

Circulation

Hypovolemia

External bleed – can see and control

Internal bleed – more difficult

Remember neurogenic shock!!

Disability

Baseline neuro status

Estimate cord involvement

Need to avoid flexion, extension, rotation of the spine.

Exposure

Remove clothing

Log Roll

Spine must be kept in neutral alignment

Patient must be placed on a longboard with cervical collar– WE move the pt!

Meyer-Cervical Orthosis – provides constant cervical spine traction & reduces the risk of injury during resuscitation and transport

Temperature instability may occur, keep covered & warm

Also remember other injuries – usually have multiple injuries (internal and head)

- Emergency Department Management
- Assessment

Airway

Cervical injury- can identify if they are unable to move their fingers and hands

Clear the c-spine

CT is gold standard

Only medical provider clears

Vital Signs

- Obtain history of accident

Mechanism of injury

Immediate neuro status

Treatment at the scene

Mode of transport

All vital data

- PMH

Pre-existing diseases

Medications

Allergies

- Foley Catheter

Atonic bladder
Prevent urinary distension and retention
- NGT

Decrease gastric distention
Prevent aspiration of vomitus
Consider PPI/ H2 Blocker for stress ulcer prevention

- How It Affects Each System
- Respiratory
- Respiratory complications closely correspond to level of injury
- Above C3

Total loss of respiratory muscle function; will arrest within minutes if not intubated
- C3 to C5

Respiratory insufficiency; loss of phrenic nerve innervation to diaphragm
Decreased strength in chest and abdominal wall
Require intubation
- Incomplete SCI

Respiratory function variable
- Cervical and thoracic injuries

Paralysis of abdominal muscles and often intercostal muscles causing ineffective cough and leading to risk for aspiration, atelectasis, pneumonia
Hypoventilation and impaired intercostal muscles lead to decreased vital capacity and tidal volume
Prevent hypoxemia that can worsen secondary injury
Maintain oxygen saturation >92%
- Assessment:

Dyspnea
pCO2 greater than 20 mmHg above baseline (retaining)
Change in rate, rhythm, or quality of respirations
Note anxiety, cyanosis, altered mental status
ABG's
- Interventions:

Intubation → tracheostomy, if needed
Turning Q 2 hours to promote postural drainage, if possible

- Cardiovascular
- Injury above T6 leads to dysfunction of sympathetic nervous system (SNS)
- Leads to neurogenic shock

Bradycardia
Hypotension
Peripheral vasodilation
Relative hypovolemia because of increased capacity of dilated veins
Reduced venous return decreases cardiac output, causing hypotension
- Identify cause of hypotension

Hemorrhagic from traumatic injuries?
Control any external bleeding
- Chronic Low Blood Pressure:

Improves when spinal shock dissipates
Spasticity can help keep BP increased

Postural hypotension
- DVT

Prevention techniques

- Urinary
- Urinary dysfunction occurs in most patients with SCI
- Neurogenic bladder

Bladder dysfunction related to abnormal or absent bladder innervation
No reflex detrusor contractions (flaccid, hypotonic)
Hyperactive reflex detrusor contractions (spastic)
Lack of coordination between detrusor contraction and urethral relaxation (dyssynergia)
- Urinary retention is common during spinal shock
- Bladder is atonic and over distended causing hydro-ureter and hydronephrosis, infections, & kidney damage
- Need foley cath or self-catherizing program to prevent distention & kidney damage

Scheduled intermittent self-caths (Q 4 hours)
- Complications:

Kidney stones:
Pt is not weight bearing → loses Calcium from bones → excreted via urinary tract
Prevention:
Increased fluids
Cranberry juice to keep urine acidic
Weight bearing ASAP
UTI
Can lead to renal damage, one of the leading causes of death
Prevention:
Aseptic technique during caths
Bladder training program
Increased fluid
Secure catheter properly

- Gastrointestinal
- Decreased GI motor activity leading to gastric distention and development of paralytic ileus

Gastric emptying may be delayed
Excessive release of HCl causing stress ulcers
Dysphagia may be present
- Intraabdominal bleeding

Difficult to diagnose; no pain or tenderness
Monitor BP, Hgb & Hct, and abdominal girth
- Neurogenic bowel

Impaired peristalsis; slow movement of stool
Defecation reflex damaged
Anal sphincter tone relaxed
Results in constipation, incontinence, and possible impaction, ileus, or megacolon
- Treatment:

Bowel Regimen and retraining
After spinal shock dissipates, the patient begins having reflex emptying of the bowel following a stimulus

Meal or abdominal effleurage
Daily rectal stimulant
Suppository, small-volume enema
Digital stimulation or manual evacuation
Establish routine patterns
Plan diet to avoid diarrhea/ constipation
Have patient sit on toiler or commode
Maintain privacy
Goal: BM every day or every other day and will not be incontinent at other times!
Integumentary
- Potential for skin breakdown

Decreased or absent sensation, leading to pressure injuries over bony prominences
Develop quickly
Risk of infection and sepsis

- Integumentary
- Lifelong risk
- Causes:

Inability to move
Sensory losses prevent sensations of discomfort
Cannot recognize need to be moved
Decreased circulation to areas below level of injury
- Decubitus Ulcers

Prevention: skin care measures are imperative!
Turn frequently!- Q 2 hours
Mobilize ASAP
Keep Dry
Careful and ongoing skin assessment
Prophylactic dressings to sacrum/ heels
Aquacel
- Poikilothermia: inability to maintain a constant core temperature

Interruption of SNS prevent peripheral temperature sensations from reaching hypothalamus
Decreased ability to sweat or shiver below the level of injury
More common with high cervical injury

- Musculoskeletal
- Lack of weight bearing causes loss of Ca+

Increased risk for fractures
Progressively, causes skeletal deformities, generalized osteoporosis, joint stiffness, muscle weakness, contractures
- After spinal shock:

Lack of control from brain
Flaccid → spastic phase
Reflexes may be inappropriate and excessive
- After Spinal Shock:

Spinal Automatisms: spinal reflex activities that automatically occur following severance of the cord
Persistent abnormal erection of the penis without sexual desire
Stimulation of skin of the lower abdomen or thigh may precipitate

Autonomic Bladder: stimulation of the lower abdomen causing reflex emptying of the bladder
Mass flexion

- Muscle Spasms

Can occur spontaneously or in response to stimuli and often continue until the stimulus is identified and removed
Mild spasticity can benefit: prevents atrophy & osteoporosis
Severe spasticity: detrimental effects exceed benfits
Difficult to stay in wheelchair
Improper positioning
Affects ADL's
Treatment:
Relaxation
PT
Medications: Dantrum, Baclophen (pump), Robaxin, Valium, Botox injections
Drastic: Rhizotomy (cut abnormally firing sensory nerve)

- Contractures

Affect ADL's

- Neurogenic Heterotopic Ossification

Osteogenesis in a part of the body which does not normally form bone, such as soft tissue
Cause is unknown
30% severe SCI patients develop
Found below level of injury

- Signs and Symptoms:

Redness, warmth, swelling, decreased ROM
Elevated alkaline phosphatase
X-ray: shows osseous formation

- Treatment:

No definitive
Position change, splinting, ROM,
Indocin (NSAID)
Didronel: regulates bone metabolism, slows new bone formation

- Pain

Often have pain present at the level of the injury, which radiates along the spinal nerves originating in that area
I.E.: CP may occur following thoracic injuries, leg pain may follow lumbar injuries
Treatment:
Analgesics
Opiates
Sedatives
Antispasmodics
Pregabalin
Tricyclic antidepressants

- Metabolic Needs
- SCI leads to increased metabolism and increased protein breakdown

Decreased lean body mass, muscle atrophy, and weight loss

- Nutritional support

Start early; enteral or parenteral diet to address caloric, protein, and micronutrient needs
Adequate nutrition
Prevents skin breakdown
Reduces infection
Decreases muscle atrophy

- Psychological

Consider the age group
Loss of body image
Dependency

- Shock/ Denial

Disaster has struck
Reaction is disbelief
Denial is main defense
Other may go along with denial

- Anger

Reality hits hard
Lashes out, pushes blame
Verbal assaults
Be prepared:
Accept the patient, but not their behavior
Try to get the patient involved in their own care
Family needs support
Staff will suffer during this phase

- Factors that affect progress:

Previous personality difficulties, alcohol/ drug use, importance of appearance, livelihood (required mobility, athlete?)

- Depression:

May exhibit regression or severe crying
Suicidal but unable to complete
Allow to vent feelings
Family support

- False Hopes of Cure

Builds unrealistic hopes for new discovery

- Acceptance:

Comes with mature feelings of interdependence
Functions within limits of disability

- Rehabilitation:

Most therapeutic setting is an environment that assesses, treats, and empowers the patient and family
Recovery and limitation depends on the level of injury and motivation

- Sexuality
- Extent of injury depends on level of function:

Affected:
Erections (psychogenic)
Ejaculation
Orgasm

Fertility status
Males: Testicular atrophy → decreased spermatogenesis
Females: precipitous delivery risk, autonomic dysreflexia
Counseling
Wait until person is ready
Involve the family (as appropriate)
Encourage open communication with the partner

- Treatment Measures
- Nonoperative
- Stabilization of injured spinal segment and decompression

Traction or realignment
Eliminates damaging motion
Prevent secondary damage

- Early realignment of unstable fracture-dislocation

Closed reduction through craniocervical traction

- High cervical SCI (most complex)
- Immobilization

Maintain neck in neutral position
Keep body in correct alignment
Logroll to prevent movement of spine
Closed reduction with skeletal traction
Crutchfield or Gardner-Wells tongs or halo
Maintain traction at all times
Disadvantage: pin displacement
Hold head in neutral position and get help

- Cervical Traction

Closed reduction with skeletal traction
Goal: spinal reduction
Monitor with x-ray, neurologic and pain assessments if alert; serial x-rays if comatose
Surgery: cervical fusion or other stabilization procedure
Postoperative: hard cervical collar or sternal-occipital-mandibular immobilizer brace
Halo vest
Spinal fractures with or without acute SCI; no surgery but immobilization needed
Allows movement and ambulation while bones fuse
Contraindicated with:
Ligament instability, severe cervical deformity, morbid obesity, older age, cachexia, or noncompliance
Patient and caregiver teaching
Used following acute SCI to manage instability and decompress the spinal cord
Reduces secondary injury and improves outcomes

- Pharmacology
- Use of methylprednisolone to treat acute SCI—mixed evidence

Not recommended by American Association of Neurological Surgeons and Congress of Neurological Surgeons
Not approved by FDA
AOSPine Guidelines (2017) suggest high-dose within 8 hours of SCI

- VTE prophylaxis

Low-molecular-weight heparin or low-dose heparin (unless contraindicated)

- Vasopressor agents

Maintain mean arterial pressure above 85 to 90 mmHg (e.g., phenylephrine, norepinephrine)
Improve spinal cord perfusion
Significant risk of complications
Ventricular tachycardia, troponin, metabolic acidosis, and atrial fibrillation
Consider level of injury, age, and co-morbidities

- Phenomenas of SCI
- Autonomic Dysreflexia

Hyper-reflexia
Occurs in persons with SC lesions above most of the sympathetic nerve outflow of the cord (T6)
Occurs after spinal shock and return of reflex activity
Occurs in response to visceral stimulation

- **Pathology**

Stimulation of the sensory receptors below the level of the cord lesion
The intact autonomic system below the level of the lesion responds to stimulation with reflex arterial vasoconstriction = ↑ BP
High BP is sensed by the baroreceptors in the carotid sinus and the aorta response is ↓ HR
Visceral and peripheral vessels do not dilate because the efferent (motor) impulses cannot pass through the cord lesion.
Most common cause is **distension of the bladder** or rectum; other causes can be stimulation of the skin or pain receptors.

- **S & S**

Life Threatening!! ⇒ requires immediate intervention
Headache!
Flushing & diaphoresis
Skin becomes pale below the level of the lesion!
Bradycardia
Piloerection (Goose Bumps)
Nasal congestion
Vision changes
Anxiety

- **Treatment:**

Elevate HOB 45 degrees
Monitor BP every 3-5 minutes
Remove the cause:
TEDS
Bladder distention → straight cath, catheter kinked?
Abdominal Binder
Notify Provider
Medicate prn
Teach the patient and family to recognize signs and symptoms

- Nursing Prioritization

Your SCI patient develops sudden onset of diaphoresis, vision changes and a “pounding” headache. Upon your arrival, what are the priority interventions?

1. Check patient’s blood pressure

2. Elevate HOB to 45 degrees
3. Remove the stimulation
    1. i.e. catheter kinked, distended bladder/ rectum, TEDS
4. Notify Provider
    1. May need to administer antihypertensives
5. Continue to reassess blood pressure Q 3-5 minutes until symptoms resolved

- Horner's Syndrome
  Paralysis of cervical sympathetic nerve trunk
- Signs & Symptoms:
  Ptosis of eyelid
  Loss of sweating over the affected side of face
  Recession of eyeball into orbit

- Rehabilitation
- Overall goals
  Maintain optimal level of neurologic functioning
  Have minimal to no complications of immobility
  Learn new skills, gain new knowledge, and acquire new behaviors to care for self or direct others to do so
  Return to home at optimum level of functioning
- Interprofessional team effort
  Rehabilitation nurses, HCPs, PT, OT, speech therapists, vocational counselors, psychologists, therapeutic recreation specialists, prosthetists, orthotists, case managers, social workers, and dieticians
- Patient expected to be involved in therapies and learn self-care
- Progress can be slow
- Can be very stressful
- Nurses provide frequent encouragement, specialized care, patient and caregiver education; and help coordinate efforts of team

- Spinal Cord Tumors, Abscesses, & Vascular Disorders
- Spinal Cord Tumors
- Cause significant spinal compression and neurologic dysfunction
- Classified as:
  Primary: arise from some part of the spinal cord, dura, nerves, or vessels
  Secondary: primary growths from other places in the body that have metastasized to the spinal cord
- Etiology and pathophysiology
- Further classification
  Extradural—outside the dura
  Intradural-extramedullary—between the spinal cord and dura
  Intramedullary—within the substance of spinal cord
- Most tumors are slow growing
- Symptoms arise from
  Compression and irritation of nerve roots
  Displacement of the spinal cord
  Gradual obstruction of blood supply
- Removal of tumor may lead to possible complete restoration of function
- Clinical manifestations

Location and extent of tumor determine the severity and extent of motor and sensory problems
Most common (early): back pain or pain radiating along compressed nerve root
May worsen with activity, coughing, straining, and/or lying down
Increasing clumsiness, weakness, and spasticity
Paralysis
Coldness, numbness, and tingling in one or more extremities
Incontinence, constipation, and urgency

- Diagnostic studies
  Spinal x-rays
  MRI
  CT scan
  CT myelogram
  CSF analysis
- Nursing and interprofessional management
  Spinal cord compression is an emergency to relieve ischemia
  Corticosteroids to relieve edema
  Surgical indications
  Spinal cord compression
  Pathology
  Determine appropriate treatment
- Nursing and interprofessional management
  Primary tumor removal; goal is cure
  Metastatic tumors; palliative
  Goal: restore or preserve function, stabilize the spine, alleviate pain
  Chemotherapy and/or radiation may also be used
- Nursing and interprofessional management
  Treatment goals
  Relieve pain with analgesia
  Maximize neurologic status
  Prognosis varies

- Spinal Cord Abscesses
- Rare
- Cause
  Staph and Strep organisms most often cause from open trauma of spinal cord or osteomyelitis
- S&S
  S&S of infection – fever, chills, erythema, warmth over SC region
- Dx:
  Myelogram, CT Spine, MRI Spine
- Tx:
  Goal: halt the growth of the organisms and restore neuro function
  IV Antibiotics
  Steroids
  Decompressive laminectomy
  Possible reoccurrence, need follow-up!

- Vascular Disorders

- Possible to have rupture, thrombosis, or embolism of SC vessels- usually secondary to meningitis or compression
- Treatment and prognosis vary
- Consult neurosurgeon