CME Objectives

- Describe the pathology and management of neurogenic bowel and bladder
- Demonstrate the skills needed to manage and teach patients about autonomic dysreflexia
- Discuss staging of pressure injuries and options for management

Neurogenic Bowel

The Digestive System

- Oral cavity
- Esophagus
- Stomach
- Small intestine
  - Duodenum
  - Jejunum
  - Ileum
- Large intestine
  - Colon
  - Rectum

Flow of Food

- Mouth and Stomach
  - break down food to enable intestines to extract nutrients
- Small Intestines
  - absorb nutrients and push waste and water into large intestines
- Large Intestines
  - absorb water and forms waste into stool
- Rectum
  - collects and stores stool until full
- Anal sphincter
  - holds anus closed until rectum is full
Parasympathetic efferents come from both the vagus nerve and the pelvic nerve (S2-4).

Sympathetic efferents arise from the superior and inferior mesenteric nerves (T9-T12) and from the hypogastric nerves (T12-L3).

Somatic efferents to the external anal sphincter (EAS) and pelvic floor travel via the pudendal nerve (S2-4).

**GI Reflexes**

- **Gastrocolic**
  - The gut is stimulated by food. Eating initiates mass movements of the colon which signal the brain that it would be a good time to have a bowel movement.

- **Rectocolic**
  - Stretching of the rectal wall by stool (or by irritation from suppository or by a finger) helps to relax the sphincter and initiate movement of stool out of the rectum.

**SCI Effects on the GI Tract**

- Slowed peristaltic activity
  - Normal average colonic transport is 24-36 hours
  - With SCI 65-85 hours
  - Increased potential for acid reflux, constipation, and ileus
  - Interruptions of nerve impulses from brain and GI system result in a neurogenic bowel.

**Two Types of Neurogenic Bowel**

- **Upper Motor Neuron (UMN):**
  - reflexic or spastic
  - anal sphincter generally stays closed
  - usually occurs in injuries above T-12

- **Lower Motor Neuron (LMN):**
  - areflexic or flaccid
  - anal sphincter has no tone and provides no resistance so bowel will leak if stool is loose
  - usually occurs in injuries below T-12

**Bowel Management**

**GOAL:** To ensure complete emptying of bowel while preventing incontinent episodes

**BOWEL TRAINING:** Training the bowel to evacuate at a specific time to achieve goal.
Bowel Program Basics

• Initial programs utilize a combination of oral meds, suppositories, and manual removal of stool
• Selection of meds is based on goal consistency of stool and type of bowel dysfunction
• Many patients are able to wean off bowel meds and suppositories over time

Medications

Oral Agents:
1. Softeners: help stool retain water, stay soft, and slide through colon
   - docusate
2. Osmotic laxatives: increase stool motility by pulling water into colon
   - Miralax, Lactulose, Mag Citrate
3. Bulk forming laxatives: add bulk/fiber to stool
   - Benefiber, Metamucil, Fibercon
4. Stimulants: increase peristalsis, moves stool through colon faster
   - bisacodyl, senna

Rectal Stimulants:

Suppositories
• Bisacodyl: increases colonic activity by stimulating rectal lining
  – Magic bullet (PEG-based) as opposed to vegetable oil based
• Carbon Dioxide: produces gas in rectum which inflates colon and stimulates peristalsis
• Glycerin: lubricates rectum while causing gentle peristalsis

Enemas
• Mini-enemas: stimulates rectal lining and softens stool
  – min fleet, theravac, enemeez
• Mineral Oil: lubricates the intestinal tract

Bowel Program Guidelines

• Establish a regular time, usually 30-60 minutes after a meal
• Eat a well balanced diet with adequate fiber
• Drink adequate fluid
• Avoid large volume enemas for routine management
• Avoid taking strong oral laxatives routinely
• Do not hold bowel program if incontinent
• Start bowel training as soon after injury as possible
• Perform bowel program in the upright position if possible
  – Left side-lying is preferred alternative

Management

UMN = Spastic or reflexic bowel (above T-12)
• Requires digital stimulation to gently stretch and relax rectal sphincter
• Generally requires rectal stimulant (suppository)
• Program is initially performed daily but then often progressed to QOD or 3x/week
• Ideal stool consistency should be formed but soft

LMN = Flaccid or areflexic bowel (below T-12):
• Requires manual disimpaction
• Performed daily or twice a day
• Ideal stool consistency should be more firm, solid

How to: UMN bowel program

1. Position on commode chair or in bed (left side-lying with knees flexed)
2. Wash hands and then glove
3. Examine rectum with lubed finger for stool in rectum (in tetraplegic may want to use Lidocaine to reduce risk for Autonomic Dysreflexia)
   – Evacuate any stool in rectum
4. Apply stimulant: Mini-enema or suppository
   – Must contact rectal wall
How to: UMN bowel program

5. Wait for stimulant to act
   - May see passing of gas or some stool
   - Wait at least 5-15 minutes for peristalsis to kick in

6. Perform digital stimulation:
   - Circulate lubed finger to relax sphincter
   - Must contact rectal wall
   - 15-40 sec per stim
   - Perform dig stim Q5-15 minutes during bowel care to keep peristalsis going
   - Most require 2-3 dig stims to fully evacuate stool

7. Know when stimulant is done:
   - No more gas or stool is passed
   - Passing of clear mucus
   - 2 dig stims with no results
   - Patient may have sensation that they are empty
   - Inner sphincter may tighten

8. Clean up

How to: LMN bowel program

• Plan for bowel elimination with digital evacuation / manual disimpaction
  - Give fiber to form semi-solid stool (Benefiber, Metamucil)
  - Require QD or BID evacuation
  -Valsalva maneuver may help to eliminate stool

Interdisciplinary Management

• All staff can educate
• Nursing is first line in performing and teaching program
• OT can assist with clothing management, toileting, and adaptive devices to improve independence with program
• PT can work on mobility to bathroom
• Incontinence in therapy can be an opportunity for education

Review article summarizing the literature on neurogenic bowel in SCI
• Multifaceted programs are first line approach to neurogenic bowel
• Pharmacologic (prokinetic agents) are common in chronic constipation
• Transanal irrigation and surgical options such as colostomy may be necessary when programs are ineffective
• Review which highlights non-pharmacologic and surgical interventions for bowel management
• Transanal irrigation (Peristeen)
• Antegrade continence enema (Malone)
• Ostomy
Data set is a standardized method of collecting clinical and research information on neurogenic bowel after SCI.

Neurogenic Bladder

- Kidneys produce urine
- Ureters transport urine to the bladder
- Bladder holds the urine until detrusor muscle squeezes to empty
- External sphincter holds bladder closed (under voluntary control)
- Urethra empties urine from body

Overview of the Urinary System

Bladder Innervation
**Neuroanatomy**

- Parasympathetic input from S2-S4 via Pelvic nerve contracts bladder for emptying
  - Cholinergic receptors in the bladder squeeze the detrusor muscle to empty
- Sympathetic input from T10-11 to L1-2 via hypogastric nerves store urine
  - Alpha 1 receptors at internal urethral sphincter and bladder neck contract to store
  - Beta 2 receptors in the bladder relax to allow for urine storage
- Voluntary control from S2-S4 over external urethral sphincter via Pudendal nerve contracts to prevent leakage

**Effects of SCI on Urinary System**

1. No effects on kidney function: kidneys will continue to produce urine
2. No effects on ureters or urethra: urine will flow as normal
3. Signals between the brain, the detrusor muscle, and sphincter will be interrupted causing loss of voluntary control and creating a neurogenic bladder

**Classification of bladder dysfunction:**

- Failure to store
- Upper motor neuron bladder
- Hyperreflexic
- Spastic
- Neurogenic detrusor overactivity
- Failure to empty
- Lower motor neuron bladder
- Areflexic
- Atonic
- Neurogenic detrusor underactivity

**Neurogenic Bladder**

- Spastic (reflexic) Bladder:
  - Bladder muscle is spastic
  - As the bladder fills, contractions will trigger bladder spasms
  - Those who can void have urgency and frequency
  - Most can’t void because the sphincter is also spastic
  - Causes the bladder to squeeze against a closed outlet

- Detrusor Sphincter Dyssynergia
  - Both bladder and sphincter contract at the same time
  - Risks reflux of urine into kidneys

**Flaccid (areflexic) Bladder:**

- Bladder muscles weak and patient is unable to feel when bladder is full
- Results in bladder becoming overly distended or stretched

**Goals of Bladder Management**

- Prevent upper tract (renal) complications
- Provide socially acceptable continence
- Regular voiding with low residuals
- Maintain low baseline bladder pressures
Methods of Bladder Management

- Intermittent Catheterization Program (ICP): straight cathing the bladder at regular intervals
- Indwelling Catheter: catheter inserted into the bladder and left in place:
  - Foley: inserted through the urethra
  - Suprapubic: inserted through small surgical incision on the abdomen
- Condom cath: collects urine when bladder is triggered spontaneously

Intermittent catheterization

- Preferred method for patients with enough hand function to cath themselves
- Mimics normal bladder function by emptying the bladder at regular intervals
- Reduces risk of infection compared to indwelling catheter
  - While ICP is generally considered the safest, healthiest management of the urinary system, patient/family skills and lifestyles will help determine the most appropriate method

Indwelling Catheter

- Option for patients who are unable perform ICP independently or cannot be kept dry between caths
- Catheter in urethra chronically can cause urethral erosion or enlargement resulting in leakage
- Increased risk of infections due to constant presence of catheter
- Suprapubic catheter placement is a surgical procedure
- Increased risk of bladder cancer and bladder stones

Condom Cath

- Males only
- May be used in conjunction with ICP to prevent incontinence between caths
- Not an option for many due to risk for reflux of residual urine into kidneys

Guidelines for Bladder Management

- Ensure proper hydration
- Limit fluid intake after 7-8 pm
- Avoid fluids with high sugar or caffeine content
- Catheterize at regular, scheduled intervals (every 4-6 hours, keeping cath volumes between 400-500cc)

Guidelines for Bladder Management

- Empty drainage bags at regular intervals
- Sterile technique when hospitalized
  - Clean technique for home
- Keep indwelling cath sites clean and drainage bags clean between uses
- Change indwelling catheters monthly
**Medications for Bladder Management**

**Anticholinergics:**
- Relax detrusor muscle allowing the bladder to become a more effective reservoir
- Oxybutynin (Ditropan), tamoerbine (Detrol), solifenacin (Vesicare), etc.
- Side Effects: dry mouth, constipation, blurred vision

**Cholinergics:**
- Cause detrusor muscle to contract more forcefully to promote bladder emptying
- Urecholine (Bethanechol)
- Side Effects: Diaphoresis, diarrhea

**Alpha agonists:**
- Relax sphincter to allow urine to flow more freely from the bladder
- Tamsulosin (Flomax), terazosin (Hytrin)
- Side Effects: Hypotension

**Urinary Antiseptics:**
- Decrease urine pH to inhibit bacterial growth
- Methanamine (Hiprex)

**Medications for Bladder Management**

- (Mirabegron) Myrbetriq — Beta-3 agonist that relaxes bladder with less anticholinergic side effects
- Once studied more in SCI (and becomes affordable) may have potential to be first line treatment of spastic bladder

**Surgical Interventions**

- Botulinum toxin injection
  - Relaxes detrusor to reduce overactivity
- Bladder augmentation / Continent diversions
  - Appendicovesicostomy / Mitroustof
  - Urine drains through appendix to exit at umbilicus
- Sphincterotomy

**Urinary Tract Infections**

- Signs:
  - Increased sediment and mucus in urine
  - Foul smelling urine
  - Blood in urine
- Interventions:
  - Increase fluid intake and cath frequency
  - Avoid caffeine, sugar, and alcohol
  - Treat with antibiotics ONLY if symptoms occur
  - Fever, chills, nausea, headache, increased spasticity, Autonomic dysreflexia, or incontinence

**Urinary Health Maintenance**

1. Teach patient and family the importance of maintaining a proper bladder management program
2. Teach patient and family to recognize the signs and symptoms of a UTI
3. Stress importance of yearly GU evaluations including urinalysis, renal sonogram, and urodynamic studies
• Review of the recommendations of the major international guidelines
• In all the reviewed guidelines, botulinum toxin type A is recommended to treat neurogenic detrusor overactivity in patients who have failed oral therapy

**Recommended Reviews**

*Neurogenic lower urinary tract dysfunction: Clinical management recommendations of the Neurologic Incontinence committee of the fifth International Consultation on Incontinence 2013.*

*Neurologic dysfunction: evaluation, surveillance and therapy.*

**Interdisciplinary Management**

• All staff can educate
• Nursing is first line in teaching program
• OT can assist with clothing management, toileting, and adaptive devices to improve independence with program
• PT can work on mobility to bathroom
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**Autonomic Dysreflexia**

• AD is an emergency condition unique to people with a spinal cord injury at or above T6
• Caused by abnormal response to a noxious stimulus that occurs below the injury
• Sensory signals cannot get through to the brain
• There is a rapid elevation in blood pressure
• If left untreated, BP can reach critical levels and result in stroke, seizure, or death
How does this happen?

- Nociceptors stimulate below T6 send signal to the spinal cord and brain.
- Message unable to get through to the brain because of spinal cord injury.
- Autonomic nervous system kicks in.

What are the symptoms of AD?

- Rapid, major increase in systolic blood pressure (SBP) 20-40mm Hg above patient’s baseline
- Pounding headache
- Flushing above the level of injury, usually face, neck and shoulders
- Sweating above the level of injury
- Goose bumps, or cold and clammy skin
- Blurry vision
- Nasal stuffiness
- Nausea
- Chest tightness
- Anxiety

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What are the most common causes of AD?

1. Bladder issues:
   - Urinary retention, urinary tract infections, bladder or kidney stones
2. Bowel issues:
   - Severe constipation or impaction, stomach ulcers, hemorrhoids
3. Skin issues:
   - Pressure ulcers, burns, ingrown toenails, insect bites
4. Other causes:
   - Too tight clothing, shoes, braces
   - Broken bones or other injuries below T6
   - Blood clots (DVT)
   - Extreme or rapid temperature changes
   - Pregnancy, menstruation, genital infections, sexual activity

How do we treat AD?

- Sit upright and lower legs
- Loosen or remove anything tight: belts, binders, braces, shoes, clothes, catheter straps
- Monitor BP every 5 minutes
How do we treat AD?

- Check bladder status:
  - Intermittent cath/condom cath
  - Straight cath with anesthetic gel
  - Indwelling cath
    - Make sure tubing is not kinked or blocked
    - Make sure drainage bag is not overly full
    - Irrigate with 30cc NSS
  - Check for signs of urinary tract infection

How do we treat AD?

- Check bowel status:
  - Disimpact with anesthetic gel

- Check skin:
  - Remove any source of pressure

If SBP goes above 150 mmHg:

- Apply 1 inch nitroglycerin paste and continue to search for source
- Apply another 1 inch of nitroglycerin paste if SBP stays > 150
  - If SBP drops below 130, wipe off nitro paste
- If BP remains elevated after 2 inches of nitroglycerin paste, have patient BITE and SWALLOW 10mg Nifedipine capsule.
  - Use with caution: Will result in severe hypotension once AD resolved
  - Some institutions prefer oral hydralazine as second line agent

A retrospective review of safety using a nursing driven protocol for autonomic dysreflexia in patients with spinal cord injuries:

- Retrospective review of 78 individuals with 445 episodes of AD while inpatient at a VA hospital
- Target BP reached in 97.6% of episodes
- 23 adverse events (5.2% of episodes) resulted in hypotension after treatment
- Conclusion: High success of nurse driven protocol for AD management

Survey study of SCI staff in the VA system:

- Most common medication used for acute management of AD was nitrates
- Most common medication used for recurrent AD was clonidine

Canadian study looking at emergency room or hospital admissions for AD:

- Found to have “dramatic” healthcare costs related to delayed diagnosis and inefficient management
- Recommendations for intervention included prompt recognition of AD and improved self-management
What do we teach our patients?
• Educate on warning signs
  — Often patients will be discharged without any episodes
• AD Prevention
  — Establish effective bowel and bladder management programs, daily skin checks, properly fitted clothing and braces
• Develop an AD kit
  — Include blood pressure cuff, anesthetic lubricating gel, catheter and supplies, medications
• Recognize this is a medical emergency and to seek prompt professional medical care if unable to resolve
  — Carry information with them to alert hospital staff

AD Alert Cards

Pressure Injuries

Epidemiology
• Historically, more than 1/3 of patients admitted to the specialized SCI units develop pressure injuries during acute care or rehab stays
• Prevalence rates of pressure injuries for persons with SCI in the community range from 17% to 33%
• Pressure injuries remain the second leading cause of rehospitalization after urinary causes for SCI patients in the Model Systems

Risk Factors
• Bowel and Bladder incontinence
• Nutritional status
• Psychological or cognitive issues
• Social support
• Support surfaces for bed, wheelchair, and other durable medical equipment
• Use of medical devices
• Prior history of pressure injury
**Common Areas**

**Evaluating a Pressure Injury**
- Location
- Measurements
- Wound bed description
- Peri-wound area description
- Stage of wound

**Evaluating a Pressure Injury: Measuring**
- Measurement
  - Length x Width x Depth
  - Head-to-toe plane is length
  - Depth is straight depth
- Measure longest length and longest width in the same plane
- Linear dimensions can limit true volume, so picture or an outline may be helping in documentation, particularly in documenting change

**Wound bed description**
- Color
- Granulation
- Slough
- Necrosis
- Eschar
- Odor

**Evaluating a Pressure Injury: Staging**
- Stage I
- Stage II
- Stage III
- Stage IV
- Unstageable
- Deep Tissue Injury
Stage 1
- Skin is intact
- Non-blanchable erythema

Blanchable vs non-blanchable

Stage 2
- Partial thickness loss of dermis
- Shallow open ulcer with pink wound bed and NO slough
- Intact or open serum-filled blister

Stage 3
- Full thickness tissue loss
- May see subcutaneous fat
- No bone, tendon, or muscle exposed
- May have slough, tunneling, undermining
Stage 3

- Full thickness tissue loss
- Bone, tendon, or muscle is exposed
- Often associated with tunneling and undermining

Stage 4

- Full thickness tissue loss
- Bone, tendon, or muscle is exposed
- Often associated with tunneling and undermining

Deep Tissue Injury

- Purple or maroon intact skin which suggests underlying soft tissue injury
- Blood-filled blisters
- May be firm, or mushy as compared to surrounding areas
- May have different temperature as compared to different areas

Unstageable

- Full thickness loss
- Base covered by slough or eschar
Unstaging

Treating A Pressure Injury: Goals
- Control exudate
- Eliminate dead space
- Control odor
- Eliminate or minimize pain
- Protect the wound and the periwound skin
- Remove nonviable tissue
- Prevent and manage infection

Treating A Pressure Injury: Goals
- If it’s wet, DRY it
- If it’s dry, WET it
- If it’s flat, COVER it
- If it’s deep, PACK it

Cleansing
- Cleanse with each dressing change without harming the healthy tissue on the wound bed
- Use normal saline, sterile water, PH-balanced wound cleansers, or lukewarm tap water
- Use diluted sodium hypochlorite (Dakins), 1/4 strength to 1/2 strength for wounds with heavy bioburden for limited time

Non-active agents
- Wet-to-Dry dressings
  - Gauze wet with saline
  - Adheres to wound tissue for nonselective debridement
  - Can also loosely fill large wounds
  - Good to manage exudative wounds

Non-active agents
- Wound Gel
  - Helps to provide moisture
  - Conformable to wound space
  - Requires secondary dressing
  - Make sure to protect periwound skin when using to avoid maceration.
Treating a Pressure Injury: Non-active agents

- Occlusive Hydrocolloid
  - Waterproof and impermeable to bacteria.
  - Facilitates autolytic debridement
  - Also allows clean wounds to granulate

Treating a Pressure Injury: Non-active agents

- Foam
  - Semi-permeable, hydrophilic
  - Good for absorption and insulation
  - Nonadherent and protects periwound skin.
  - Not great for deep wounds or to be used as packing

Treating a Pressure Injury: Non-active agents

- Alginate
  - Made of seaweed, looks like cotton
  - GREAT for absorbing stuff (up to 20 times its weight)
  - Fills dead space
  - Not a good choice if dressing is hard to retrieve

Treating Pressure Injuries: Assistive Agents

- Enzymatic Debriders (Collagenase/Santyl)
  - Biologic enzymatic agents that digest the components of slough and dissolve the collagen that anchors necrotic tissue to the wound bed. Spares non-necrotic tissue.
  - Appropriate for partial and full thickness wounds
  - Good with eschar or necrotic tissue in wound bed
  - Typically discontinue once get rid of slough and start to see good granulation tissue

Treating Pressure Injuries: Modalities

- Hydro/pulsed lavage
- Negative pressure device (wound vac)
  - Evacuates exudate, stimulates granulation tissue formation, reduces the bioburden, increases blood flow to the wound and adjacent tissue, and maintains a moist wound environment
- Electrical stimulation
  - Maintains appropriate transepithelial potential in non-intact skin area, antibacterial, promotes angiogenesis through VEGF, promotes granulation and re-epithelialization
- Sharp debridement

Treating Pressure Injuries: How to Maximize Healing

- Nutrition
  - Calorie and protein intake
  - Prealbumin/albumin
  - Hemoglobin/Hematocrit (>12 g/dL)
  - Total lymphocyte count (>1500/mm3)
- Smoking: Stop it
- Infection/Osteomyelitis: bone biopsy is gold standard
- Incontinence/Contamination
- Support surfaces/transfers
- Noncompliance
Treating Pressure Injuries: Surgical Flaps

- Type of flap will depend on location and availability of viable tissue
- Surgeon will always try to leave tissue for possible future flaps if possible
- Seating protocol
  - Air-fluidized (Clinitron bed) x 30 days
  - Progressive seating protocol bid with regular skin checks
  - Once up 4 hours bid, graduate to home

Resources

- Pva.org
- Spinalcord.uab.edu
- Sci.washington.edu
- American Spinal Injury Association
- CORE curriculum
- National Pressure Ulcer Advisory Panel

Comments and Questions