Spinal Cord Injury Rehabilitation Nursing

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Learning Objectives

At the conclusion of the presentation, the rehabilitation nurse will be able to:

- Understand the consequences of traumatic and non-traumatic SCI
- Understand the implications of age on SCI Rehabilitation
- Differentiate between UMN and LMN bladder, bowel and sexual functioning secondary to SCI
Learning Objectives

- Identify potential secondary complications of SCI
- Select rehabilitation nursing interventions to provide care and education to a patient with a SCI

Case Study 1
Karen is a 40-year-old married mother of a 4 and 10 year old. She was an unbelted passenger in a single car roll over. She was found outside the car complaining of severe neck pain, and not being able to move or feel her arms and legs. Investigation showed a fracture/dislocation at C5/6 with a resultant C5 SCI with quadriplegia. Karen spent three weeks in acute care before her transfer to rehabilitation. Karen works as a full time legal secretary. Ted, her husband, visits daily and brings the children.
Case Study 2

Steven is a 17-year-old Grade 12 student. He was riding his snowmobile when it hit an obstacle and he and his machine went airborne. The snowmobile landed on Steven’s lower back and he remembers the immediate loss of movement in his legs. He has some patchy sensation. He was found to have a burst fracture L₁ with severe spinal cord compression. He was taken to the O.R. Steven is being admitted to your unit for rehabilitation, 8 days after his injury. He has an L₁ SCI with paraplegia.

Anatomy and Physiology Review
Traumatic and Non-Traumatic Causes of Spinal Cord Injury/Dysfunction

Traumatic SCI

- MVC, falls, violence, recreational sports (children parallel adults)
- Can occur with or without vertebral fracture or ligament disruption
- In children, SCIWORA is common
Traumatic SCI

- SCI may be accompanied by other injuries including head injuries
- Multiple trauma patients may have multi-system involvement (challenge)

Non-Traumatic SCI (acquired or congenital)

- Tumors
- AVM
- Disc Disease
- Syrinx
- Ischemia
- Infection
- Demyelination
- Spinal Stenosis
- MS
- ALS
- Spina Bifida
- Tethered Cord
- Myelomeningocele
- Chiari Malformation
- Cerebral Palsy
Spinal Cord Injury Rehabilitation

Review of Concepts and Principles

Spinal Cord Injury and its consequences impact all aspects of a patient’s life and touch to varying degrees, anyone the patient is close to.
Rehabilitation

Rehabilitation begins at moment of injury
As part of a team, nurses work to:

• maximize functional abilities
• achieve optimal health
• provide holistic care
• promote dignity, self respect and autonomy

Rehabilitation

Assisting the patient to achieve a satisfying and fulfilling life is an important outcome

• Rehabilitation nurses have multiple roles
• Nurses provide patient/family centered care
• Rehabilitation is goal oriented and time limited
Barriers to Successful Rehabilitation

Barriers

- Consequences of primary injury; other injuries
- Number and frequency of complications
- Age
- Number and type of co-morbidities
- Emotional and psychological state of patient and family
Barriers

- Unrealistic expectations/uncertain future
- Home accessibility issues
- Unmet care needs
- “Adjustment” issues
- Lack of community resources

Age Related SCI Rehabilitation Issues
Age Issues

SCI can occur at any age, and does!

• ~ 20% of Spinal Cord Injuries occur in children and adolescents

• With pediatric patients, developmental, cognitive and behavioral impact of SCI is unique – not little adults

Age Issues

For those injured earlier in life, issues of growing and aging with a disability present a challenge

• A new SCI in addition to normal aging changes adds complexity

• Issues with delirium or dementia may impact rehabilitation outcomes in geriatric patients
Neurogenic Bladder Function and Management

Neurogenic Bladder

- Any bladder disturbance caused by a problem with motor or sensory pathways within the CNS or PNS with input to bladder will result in a NEUROGENIC BLADDER
Process of Micturition

- Intact neural pathway
- Intact functioning structures
- Coordination between pathway and structures
- Filling and storage phase
- Contraction and emptying phase

Complex Reflex Arc
Filling and Storage Phase

- Bladder able to accommodate increasing volume of urine at low pressure; appropriate sensation present
- Intraurethral pressure exceeds bladder pressure
- Absence of involuntary bladder contractions
Contraction and Emptying Phase

- Detrusor muscle must contract
- Internal sphincter must relax (involuntary)
- External sphincter must relax (voluntary)
- No obstructions to outflow
- Bladder pressure exceeds urethral resistance

COORDINATED!

Overall Goals of Neurogenic Bladder Management Include:

- Set in collaboration with patient
- Maximize emptying (low residuals)
- Minimize risk of complications
- Minimize risk of UTI
- Reduce/eliminate incontinence
Overall Goals

• Achievable plan that promotes patient independence
• Patient compliance
• I = O
• Promotion of long term bladder health
• Well educated patient, able to problem solve

Upper Motor Neuron Bladder
Pathology

• SCI above T12-L1
• Disruption of sensory and/or motor tracts between brain and spinal cord; includes ANS disruption
• Bladder filling, storing and emptying controlled by micturition reflex

Pathology

• Micturition is involuntary because of lack of cerebral control
• Incomplete emptying may occur because of lack of coordination between bladder and sphincters
Patient Presentation

- Depends on level and completeness of injury
- Out of spinal shock
- Unable to stop or start voiding volitionally
- No sense of fullness
Patient Presentation

- Uninhibited bladder contractions
- Bladder-sphincter dyssynergia common
- Sphincter may also be spastic (resistance)

Lower Motor Neuron Bladder
Pathology

- SCI below T₁₂-L₁
- Direct damage to sacral micturition centre in spinal cord (S₂,₃,₄)

OR

Pathology

- Damage to sacral nerve roots (S₂,₃,₄) involved in micturition reflex arc
- LMN bladder dysfunction also occurs during spinal shock regardless of level of SCI
- Low pressure bladder; low urethral pressure
Patient Presentation

- Depends on level and completeness of injury
- No sensation of bladder fullness or urge to void
- Overflow incontinence (distention)
- No bladder contractions
- Absence of perianal reflexes
UMN Bladder Management Options

- Eliminate spontaneous voiding and incontinence
- Manage bladder with intermittent catheterization (IC)
- +/- medications

OR

UMN Management

- Promote voiding with low residuals
- Manage voiding with external collection system and/or incontinence products
- Reduce/eliminate IC’s
- +/- medication
- Reflex voiding techniques
LMN Bladder Management
Options

- Eliminate intermittent catheterization (IC)
- Maintain continence with external collection device and/or incontinence products
- Manual emptying techniques

OR

LMN Management

- Manage bladder with IC
- Eliminate voiding and incontinence
- +/- medications

-OR-

- Controlled/timed voiding +/- appropriate manual techniques
- Eliminate IC
- Eliminate external collection system
In Summary, When Implementing a Bladder Management Plan You:

• Choose:
  – Method of emptying
  – Frequency
  – Amount and scheduling of fluids
  – +/- medications
  – Method to manage incontinence

Summary

• Teach/educate patient and family
• Prevent/monitor/treat complications
• Evaluate and change plan to meet patient’s reality for discharge
Neurogenic Bowel Function and Management

Neurogenic Bowel

- Damage to the CNS pathways between the brain, spinal cord and GI tract and/or damage to the motor and sensory pathways of the ANS or somatic nervous system results in a NEUROGENIC BOWEL
Normal Bowel Functioning

Innervation

Intrinsic Control

• Gut can function in isolation
• Degree of activity modified via brain, ANS
Innervation

Extrinsic Control

• PSNS – vagus nerve, sacral nerves (S₂, 3, 4)
• Increase activity of GI tract; relax sphincter
• SNS – T₅ – L₂ outflow
• Decrease activity of GI tract; maintain sphincter contraction
Sigmoid Colon, Rectum, Anal Canal

- Internal anal sphincter (involuntary)
- External anal sphincter (voluntary)
- Usually in contracted state
- Stretch receptors activated as stool enters rectum
- Impulses sent to sacral spinal cord, cortex
- “Urge” felt

Defecation

- Governed by reflexes and voluntary control
- Defecation reflex and sacral reflex arc stimulation increases persistalsis
- Awareness of sensation occurs (cortex)
Defecation

- Increase intra-abdominal pressure
- Pelvic musculature relaxes
- Simultaneous relaxation of both sphincters until complete emptying occurs

COORDINATED!

Management of the Neurogenic Bowel in Patients with SCI

Giant colonic contractions (GMCs)
Propel feces to rectum
Rectal distention occurs

Reflex relaxation of internal anal sphincter

Contact of feces with upper anal canal stimulates mechanoreceptors and chemoreceptors

Initiates reflex contraction of external anal sphincter

Reflex Activity
### Management of the Neurogenic Bowel in Patients with SCI

<table>
<thead>
<tr>
<th>Voluntary Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrarectal pressure elevated by closure of glottis, abdominal, and pelvic muscle contraction</td>
</tr>
<tr>
<td>Pelvic muscle relaxation</td>
</tr>
<tr>
<td>Voluntary relaxation of external anal sphincter</td>
</tr>
<tr>
<td>Fecal evacuation from rectum</td>
</tr>
</tbody>
</table>

*Figure 2. Normal pattern of voluntary defecation*

### Overall Goals of Neurogenic Bowel Management

- Begins in acute care
- Based on knowledge of SCI; normal processes
- Outcome of thorough data analysis
- Efficient, effective, predictable/reliable
Goals

- No incontinence
- Promotes patient independence
- Prevents/minimizes risk of complications
- Achievable; promotes compliance
- Promotes bowel health
- Routine re-evaluation

Upper Motor Neuron Bowel
Pathology

- SCI above $T_{12} - L_{1}$
- Pathways between brain and reflex defecation centre ($S_{2,3,4}$) disrupted
- Pathway between reflex defecation centre and bowel intact

Pathology

- Usually no voluntary control of defecation or anal sphincter; bowel emptying controlled by reflexes
- Bulbocavernosus Reflex (BCR) and anal wink present (out of spinal shock)
Patient Presentation

- Depends on level and completeness of injury
- Bowel sensation and saddle sensation diminished or absent
- BCR and anal wink can be elicited
- Patient does not feel “urge to go”
Patient Presentation

- Contracted anal sphincter with retention of stool
- Sudden, unexpected expulsion of stool when rectum full (reflex)
- Defecation can be planned by using intact reflexes

Lower Motor Neuron Bowel
Pathology

- SCI at or **below** T_{12} - L_{1}
- Direct damage to sacral defecation centre
  - And/Or
- Damage to S_{2,3,4} sacral nerve roots involved in reflex arc

Pathology

- Reflex pathway interrupted (no reflex emptying)
- Pathway between defecation centre and brain interrupted
- BCR and anal wink not present
- LMN dysfunction is seen regardless of injury level when spinal shock is present
Patient Presentation

- Depends on level and completeness of injury
- Sensations are diminished or absent in rectum and perineum
- Unable to elicit BCR or anal wink
Patient Presentation

- Internal and external sphincters lack tone resulting in frequent fecal incontinence
- Patient does not feel “urge to go”

Upper Motor Neuron Bowel Management
Goal is planned, effective reflex emptying of bowel with no incontinence

Timing

• Daily or every second day
• Same time each day
• Time with meal, warm drink
• Consistency crucial
  (stimulus: response)
Medications

- Individualized; kept to minimum
- May take more time to work
- Stool softeners, bulk forming agents, Senna, Milk of Magnesia/Lactulose, suppository (Ducolax/Glycerin)
- Timing is based on am/pm routine; onset of action
- Wean medications when able

Diet/Fluids

- Soluble/insoluble fibre
- At least 2 litres/day

Positioning

- Up on commode
- In bed, on left side
Digital Stimulation

- Technique used to induce reflex contraction of colon and relaxation of sphincter resulting in descent and expulsion of stool
- Gloved, lubricated finger inserted ½ to 1”
- Finger is gently rotated, clockwise against anal sphincter 3-4 times over 1 minute; feel sphincter relax; wait and check

Digital Stimulation

- Repeat ~ q5-10 minutes, 3-4 times until bowel is empty
- Risk of trauma
- Autonomic dysreflexia (>=T₆)
- +/- digital removal of stool
Lower Motor Neuron Bowel Management

Goal is daily (or more frequent) planned effective emptying with no leakage of stool in between
Timing

- Daily; am/pm
- Rectal check as needed before outings
- Predictability crucial

Medications

- Same
- Little role for suppositories due to lack of reflexes

Diet/Fluids

- Same

Positioning

- Commode
- In bed, left side
Digital Removal of Stool

- Primary method to achieve emptying
- May need physician order
- Risk of trauma
- Consistency of stool important

Digital Stimulation

- **Not** effective as no reflex activity; sphincter already relaxed

Toileting

For mobile patients, some sensation and control, timed toileting may be option
Summary

- Appropriate technique(s) based on UMN/LMN presentation
- Timing
- Medications
- Diet and Fluids
- Positioning
- Activity
- Fits lifestyle, abilities

Sexuality and Disability
Sexuality

- Values
- Beliefs
- Personality
- Gender
- Spirituality
- Socialization
- Societal Attitudes
- Physical Expression
- Communication
- Self Concept
- Body Image
- Culture
- Health
- Orientation
- Age

Sexual Response

- Involves both neurological and psychological processes
- Master and Johnson – excitement, plateau, orgasm, resolution
- Kaplan (1979) – desire, arousal, orgasm
- Any type of disability has potential to impact a patient’s sexuality (major fear)
Disability Can Affect

- Mobility
- Sensation
- Vision
- Communication
- Cognition
- Pain
- Fatigue
- Emotions
- Bladder & Bowel
- Reproduction
- Cardiovascular
- Respiratory
- Behaviour
- Relationships
- Roles
- Body Image
- Self Concept

Sexual Function in Men with SCI
UMN Injury

- Injury above T_{12}
- Sexual response will vary with completeness of injury
- Reflexogenic erections occur with direct stimulation of genital area
- Intact sacral reflex centre
- Reflex and psychogenic erection possible with incomplete injury
- Erections are difficult to maintain
- Orgasms vary

LMN Injury

- Response will vary with level and completeness
- T_{11}-L_{3} varying degrees of psychogenic erection depending on completeness of injury
- L_{3}-S_{1} psychogenic and reflexogenic erections possible; uncoordinated, difficult to maintain
- Damage to sacral reflex centre (S_{2,3,4}) no reflexogenic erection; psychogenic erection possible
- Orgasms vary
Fertility

Ejaculation
- Ability to ejaculate varies with level and completeness of injury
- Ejaculations typically retrograde
- Can ejaculate without erection

Quality of Sperm
- Low sperm counts
- Impaired motility
- Many will need assistance to father child

Issues Include

Erectile Dysfunction
- Oral/injectable medications
- Surgical implants
- Tension rings
- Vacuum devices

Ejaculation
- Vibratory stimulation
- Electroejaculation (complete; risk of AD)

Sperm Quality
- Prevention
Sexual Function in Women with SCI

Issues Include

- Erection of clitoris
- Vaginal lubrication
- Contraction of smooth muscle of tubes & uterus
- Contraction of vaginal sphincter and pelvic floor
- Sensation to genital area
- Orgasms vary
Fertility

• No change
• Menses may be interrupted (weeks-months)
• May still ovulate without menses having returned (pregnancy risk)

Pregnancy
• Can carry baby to term
• Early involvement of OB/GYN (before!)
• 1st & 3rd trimesters – more issues with bladder and bowel
• Increases in AD, spasticity (UMN)

Labor & Delivery
• Difficult to recognize labor
• Epidural to decrease risk of AD (T₆)
• Vaginal delivery (norm)
• Slightly higher risk of forcep use
The PLISSIT Model of Intervention

- 4 ascending levels of education/counseling
- Each stage requires increased skills
- Level of involvement is based on practitioner’s comfort and knowledge level
- Assists practitioner in determining when to refer patient

The PLISSIT Model

P = Permission
LI = Limited Information
SS = Specific Suggestions
IT = Intensive Therapy
Nursing Interventions

- All nurses have role in assessment and education (age appropriate)
- Create environment of trust
- Don’t assume information is wanted
- Stay within your comfort zone (V,B,K)
- Know your patient’s history
- Readiness is crucial (OPEN THE DOOR)
- Resources
- Answer the question(s); accuracy
- Refer if necessary

Nutrition Assessment, Issues and Interventions Following SCI
Nutrition Considerations

• Hypermetabolism/catabolism of lean tissue (weight loss)
• Route(s) of nutrition support
• Dysphagia
• Neurogenic bowel and bladder
• Presence of/risk for skin breakdown

Nutrition Considerations

• Impaired nutrition/hydration bloodwork
• Co-morbidities
• Nutrient/medication interactions
• Diet history; culture; psychosocial
• Alterations in taste/smell
Fibre

Insoluble
• Bulk and form to stool
• Optimal fluid intake necessary
• Wheat bran, whole grain, fruits, vegetables

Soluble
• Softens stool
• May be gas producing
• Oat bran, legumes, barley seeds

Nutrition for Pressure Ulcers

• Stage(s)
• Weight/ bloodwork analysis
• Adequacy of oral/enteral intake
• Extent of losses
• Precautions/contraindications
• Patient tolerance to supplementation
• Blood glucose control
Interpretation of Blood Work

- CBC, TIBC, % saturation, ferritin
- Albumin/prealbumin
- BUN > creatinine
- Electrolytes
- FBS, glycated hemoglobin
- Vitamin B₁₂, folate

Alteration in Skin Integrity
Secondary to SCI
Risk Factors

- Immobility
- Insensate Skin
- Age
- Edema
- Pressure
- Moisture
- Circulation
- Muscle Mass
- Stress
- Body Image
- Self Concept
- Friction
- Shearing
- Heat
- Cold
- Nutrition

Nursing Interventions

- Assessment and documentation
- Education for prevention
- Skin checks (self, mirror, attendant)
- Pressure relief bed/wheelchair (self, others)
- Treat skin issues aggressively
- Careful positioning
- Reduce/eliminate incontinence
Respiratory Issues in SCI
Normal Respiratory Innervation

Inspiratory Muscles
- Diaphragm C3-5 (phrenic nerves)
- Rib elevating muscles (scalenes, sternocleidomastoid, external intercostals (T1-8))
- Forced inspiration aided by accessory muscles of neck and upper chest

Expiratory Muscles
- Normally passive
- Diaphragm relaxes
- Forced expiration, internal intercostals (T1-8) and abdominal muscles (T7-12)

Forced I & E required for deep breathing and effective cough
Pathophysiology

• Depends on level and completeness of SCI
• Pre-existing pathology; lung/chest injuries
• Inspiratory muscle weakness
• Expiratory muscle weakness
• Autonomic dysfunction
• Sleep disordered breathing

Patient Presentation

• Shallow, paradoxical breathing
• Secretion retention
• Impaired cough
• At risk for atelectasis, pneumonia, aspiration, mucus plugging
Nursing Interventions

- Prevention/education
- Assessment (chest, cough, VS)
- Mobilize/position changes
- Lung volume augmentation (breath stacking 3-4x/day)
- Assistive cough; chest physio; suctioning
- P.T., R.T., S.L.P. involvement as needed
Temperature Regulation in SCI

Poikilothermia

Loss of hypothalamus thermoregulatory mechanisms results in the patient assuming ambient temperature
Pathophysiology

• Autonomic disruption; hypothalamus disconnect
• Impaired ability to vasodilate/constrict below level of injury
• Impaired shivering (can’t gain heat)
• Impaired sweating (can’t lose heat)
• At risk for hypothermia/hyperthermia

Nursing Interventions

• Rule out other sources of fever
• Educate to prevent
• Avoid outings on hot, humid days
• Clothing, sunscreen, fluids, shade
• Appropriate heating/air conditioning (house, vehicle)
Secondary Complications Associated with SCI

Deep Vein Thrombosis Pulmonary Embolism
Risk Factors

• Increased risk first 3 months
• Venous stasis; impaired mobility
  Trauma to vessel wall
  Hypercoaguability
• Altered ability to feel pain

PREVENT/MONITOR/TREAT

Orthostatic Hypotension
Pathophysiology

- Interruption in sympathetic outflow
- Impaired ability to vasoconstrict
- Lack of muscle contraction in LE, abdomen
- Worse $\geq T_6$; will improve
- Venous pooling, decreased CO, hypotension, syncope with position changes

Nursing Interventions

- Positional BP monitoring
- Early and gradual mobilization
- Compression stockings, abdominal binder
- If syncope, tilt chair and elevate legs
- Medication if impacting rehabilitation
Autonomic Dysreflexia (AD)
Mr. Blake is a 31-year-old gentleman with a T4 complete paraplegia as a result of a MVC 3 three weeks ago. He is on a q4h intermittent catheter routine and is non-adherent with his drinking schedule. He rings his call bell complaining of a pounding headache. He is flushed, sweaty; BP 150/90; HR 56.

As his nurse, what is going on? What must you do?

Spasticity in SCI
**Pathophysiology**

- Injury above $T_{12}-L_1$
- Loss of descending supraspinal inputs (UMN) on alpha motor neurons (LMN); excitement > inhibition
- Increased firing or decreased threshold for firing of alpha motor neurons (loss of inhibition)
- Result is exaggerated reflex activity at level of spinal cord (spinal spasticity vs cerebral)

**Patient Presentation**

- Degree of spasticity varies
- Begins weeks to months post injury
- Worst 1 ½ - 2 years post injury
- Increased muscle tone
- Increased resistance to passive stretch
- Uncontrollable muscle contractions; clonus
- Advantages and disadvantages for patient
Management

• Treatment is goal driven
  – Assessment/monitoring/safety
  – Conservative management
  – Eliminate triggers
  – Medications
  – Botox
  – Surgery
  – Education

Pain Associated with SCI
Pain

- Alteration in sensation secondary to trauma/disease in CNS and/or PNS
- Multiple types; varying severity; multiple areas
- Affects all ages
- Complete and incomplete injuries
- 40-75% SCI patients report chronic pain
- Disabling
- Neuropathic pain is common (central)

Nursing Interventions

- Accurate assessment and documentation
- Minimize triggers
- Communicate, advocate, collaborate
- Non-pharmacological strategies
- Monitor effects/side effects of drug therapy
- Education
- Ongoing evaluation
Osteoporosis in SCI

Osteoporosis

- Screening (bone mineral density)
- No current Best Practice Guidelines in SCI
- Vit D₃, 1000 IU daily
- Calcium carbonate 1250 mg twice/day
- Consider bisphosphonate
- More research is needed
Heterotopic Ossification (HO)

• Formation of “true” bone in soft tissues
• Below level of injury
• 90% hip; other: knee, elbow, shoulder
• Fever, swelling, redness, ROM and +/- pain
• Early diagnosis and treatment is goal
• Meds, surgery, prevent complications
Psychosocial Issues With SCI

Psychosocial Issues

• Affects patient and family
• Multiple losses; multiple reactions
• Autonomy/control compromised
• Changes in roles/responsibilities
• +/- coping strategies
• Developmental stage
Discharge Readiness

- Goals met?
- Emotional/psychological readiness?
- Family and social supports?
- Knowledge and skill acquisition?
- Equipment?
- Discharge environment (safety)?
- Community resources?  Follow-up?
References


References


• *Stroke Facts: Sex After Stroke*. Heart and Stroke Foundation of Ontario.

