1 NURSING CARE OF CLIENTS EXPERIENCING STRESSORS OF MUSCULOSKELETAL FUNCTION
Part I
NR 40
FLORENCE MULLARKEY

2 Selected Musculoskeletal Stressors
- Osteoporosis
- Osteomyelitis
- Spinal disorders with low back pain
- Musculoskeletal trauma
  - Fractures
  - Amputation

3 Cycle of Bone Formation and Resorption
- Bone reaches maturity and maximal growth after puberty
- Formation and resorption rates equal until 35 years
- In later years, bone resorption or destruction accelerates, predisposing to injury

4 Minerals And Hormones Involved In Bone Growth And Metabolism
Review role of each substance below in bone growth & metabolism
- Calcium and Phosphorus-
- Calcitonin-
- Vitamin D-
- PTH-
- Growth Hormone-
- Glucocorticoids-
- Estrogens and Androgens-
- Thyroxine-
- Insulin-

5 Collaborative Management
Assessment of Musculoskeletal System
Self Study Review - Chapter 53 in Iggy text.
Review full battery of assessment parameters to assist in diagnosis of stressor:
- History and Physical exam
- Laboratory tests
- Radiographic examinations
  - Standard radiography
  - Computed tomography
  - Myelography
  - Arthrography
- Bone and Muscle biopsy
- Electromyography
- Arthroscopy
- Scans
- Magnetic Resonance Imaging
- Ultrasonography
Common Spinal Deformities

Bone Density T Scores
Developed by WHO. T-score represents number of standard deviations above or below average BMD for young healthy white females
- 0 to 1.0 Bone Mass is normal
- -1.0 Bone Mass is 10% below normal
- -1.5 Bone Mass is 15% below normal
- -2.0 Bone Mass is 20% below normal
- Osteopenia: T-score between -1 and -2.5 Osteoporosis: T-score greater than -2.5
- Fracture risk calculator on this site
  http://courses.washington.edu/bonephys/opTZconvert.html

NURSING CARE OF THE CLIENTS EXPERIENCING OSTEOPOROSIS
“Porous Bones”

Osteoporosis
- Metabolic disease caused by ↓ bone mass, demineralization = ↓ bone density = fractures
- Bone resorption exceeds bone formation
- Wrist, hip, vertebral column commonly affected
- Low bone mass (osteopenia) T-score -1 to -2.5
- Osteoporosis in postmenopausal women = BMD T-score at or below -2.5
- BMD ↓ rapidly as serum estrogen levels ↓

Osteoporosis
- Occurs frequently in females ages 50 - 70.
- Most common in fair skinned, light weight, post menopausal females.
- Baseline DEXA scan recommended in 40’s age group
- Osteoporosis education should begin in childhood
- Males have lower incidence r/t greater bone mass & less hormonal changes.

Osteoporosis classification and Pathophysiology
- Primary
- Secondary
  - Exact pathophysiology unknown
  - Two theories in literature
    - Decreased osteoblastic activity, osteoblasts have a shortened life span or are less efficient
More popular theory suggests increase in osteoclastic (bone resorption) activity

12 Clinical Manifestations
- Early stages – no symptoms, “silent disease”
- Can have bone loss of 50% before symptoms
- Loss of 1”- 6” of height
- “Dowager’s” hump: kyphosis of dorsal spine with shortened height
- Low back pain with voluntary restriction of spinal movement suggests compression fx, most common at T8-L3

13 Clinical Manifestations
- Abdomen protrudes r/t postural changes
- Constipation, abdominal distention, reflux esophagitis
- Pulmonary insufficiency
- Fatigue and chronic muscle pain
- May present with wrist fracture, or spinal compression fracture

14 Risk Factors for Osteoporosis

Summary Table

15 Normal spine at 40 years, osteoporotic changes at ages 60 and 70 years

16 Diagnostic tests
- 30%-50% of bone mass lost before seen on simple x-ray
- Dual Energy x-ray absorptiometry (DEXA). Measures bone mineral density (BMD)
- Ct and MRI – good for visualizing spine changes
- Alkaline phosphatase-elevated
- uPYR Crosslinks assay measures urinary concentration of pyridium, a collagen substance found in bone and cartilage. Elevated levels r/t bone resorption – detects bone loss early.

17 Nursing Diagnoses and PC’s
- Imbalanced nutrition-less than body requirements
- Impaired physical mobility
- Ineffective health maintenance
- Pain
- Additional nsg dx ?
- PC’s ?
Review nursing care plan Iggy, pp. 1161-1165

18 Management
- Exercise: weight bearing, Tai Chi
- Injury prevention
- Diet therapy
- Orthotics
Management

Drug therapy
- SERM’s: Raloxifene (evista)
- Bisphosphonates (BP’s) (only 1% absorbed, review parameters for maximizing absorption) see s/e
  - Alendronate (Fosamax)
  - Risedronate (actonel)
  - Ibandronate (boniva)
- Calcitonin
- Androgens
  - Testosterone propionate (Testex, Malogen)
- Daily s/q Injectable Forteo or PTH - to build bone.

Low-cost Ways to Get Medications
- (www.needymeds.com)
- AARP Bulletin online has a state-by-state, plan-by-plan guide to pharmacy assistance programs at http://www.aarp.org/bulletin/prescription/Articles/statebystate.html.
- Seniors Inc. (http://www.seniorsinc.org/medication.htm, or (303) 300-6945)
- Partnership for Prescription Assistance (www.pparx.org),
- The Medicine Program (www.themedicineprogram.com)

Hip Protectors

Nursing Care of the Client Experiencing Osteomyelitis

Osteomyelitis
- Infection of the bone, marrow, and often soft tissue surrounding the bone
  - Acute
    - Most common in children
    - Infection moves from another part of body to the bone tissue
    - Penetrating trauma
  - Chronic
  - Results from acute type
  - Common in older adult with PVD and DM
Etiology/Causes

Exogenous sources
- Bacteria –most common Staphylococcus aureus
- Viral
- Fungal
- Direct invasion of organism via open fracture

Endogenous sources
- Indirect or Hematogenous
  - UTI's
  - CVAD’s long term use
  - Hemodialysis
  - IV drug users
  - Poor dental hygiene and gum infections

Pathophysiology
- Occurs in long bones
- Abscess forms
- Bone necrosis occurs
- New bone is formed over dead bone by the body
- Dead bone –environment for bacterial invasion

Assessment/Clinical Manifestations
- Chills, high fever, diaphoresis
- Tenderness, constant intense pain, localized, pulsating. If severe vascular compromise, nerve damage prevents pain sensation
- Redness, swelling
- Foul smelling drainage
- Tachycardia
- Nausea, fatigue, malaise
- Lymph nodes in affected extremity

Diagnostic Tests
- Bone scan
- Bone biopsy
- MRI, CAT Ultrasound, X-ray
- Elevated ESR, WBC, Alkaline Phosphotase, C-Reactive Protein
- Positive blood cultures in about 50% cases

Osteomyelitis: Plan of Care

Nursing diagnoses and PC’s
Nursing interventions
Long term Antibiotics using CVAD
- Megalone (fleroxacin) or antibiotics as determined by wound C & S
- Strict sterile technique for treatments - may be on contact precautions.
- If extremity casted, a window will provide access

30 Topical Hyperbaric Chamber

31 Surgical Interventions
- Sequestrectomy
- Bone grafts
- Bone segment transfers
- Muscle flaps
- Amputation

32 Nursing Care of Clients Experiencing Musculoskeletal Trauma

Fractures
Amputations

33 Etiology/Causes of Fractures
Fracture can occur anywhere in the body and at any age
- When bone is subjected to stress greater than it can absorb, fracture occurs.
- Direct force-fracture occurs at point of contact
- Torsion or Sudden twisting of limb
- Extreme muscle contraction
- Pathological (spontaneous) r/t other stressors: Osteoporosis, malnutrition, malabsorption syndrome, medication adverse effects
- Compression fracture: bones collapse, seen in vertebra r/t osteoporosis, aging bones

34 Common Types of Fractures

35 Common Types of Fractures

36 Collaborative Management - Assessment
Pre-hospital assessment (at scene of accident)
- Airway
- Breathing
- Circulation
- Cervical or other spinal cord injury
- Assess all major body systems FIRST, look for life threatening signs – spinal cord, head, thoracic, cardiac, abdominal injury
- Neurovascular assessment: 7 p’s
Collaborative Management/Assessment
- History - Events leading up to injury
- Type of force experienced
- Substance use/abuse
- Occupation, recreational activities
- Be aware of concurrent systemic injuries or complications
- Current medical history
- Medication history

Collaborative Management Assessment - Fracture site
- Deformity - changes in bone alignment
- Internal or external rotation of limb
- Shortening of extremity
- Edema of soft tissue overlying fracture, occurs rapidly – think N/V compromise (assess 7p’s)
- Ecchymosis
- Muscle spasm - natural splinting to minimize movement.

Collaborative Management Assessment - Fracture site
- Tenderness - due to underlying injuries
- Pain - may be excruciating at site or distant
- Pain - may be absent for a brief period immediately after injury
- Crepitation (grating sound of bone fragments upon movement)
- ROM decreased
- Sensation impaired

Collaborative Management - Assessment
- Labs are nonspecific
  - Hemoglobin and hematocrit often low
  - ESR elevated
  - Serum calcium and phosphorus levels increased during bone healing
  - X-rays and CT’s will show fracture
- Generate pertinent nursing diagnoses and PC’s

Fractures - Interventions
- Emergency care
- Reduction or realignment of bone ends
- Immobilization
• Nonsurgical management
  • Closed reduction
  • Bandages and splints
  • Casts
  • Traction
• Surgical management
  • ORIF
  • Hex-Fix external fixation system

42 The stages of bone healing

43 Splints

45 Types of Casts

46 Nursing Priorities for Cast Care
  • Drying cast- never use finger tips when handling a wet cast, causes indentation resulting in pressure areas. Use palm of hand.
  • DO NOT USE HEAT WHEN CAST IS DRYING, IT GIVES OFF HEAT DURING DRYING PROCESS
  • Assess 7 p’s frequently
    □ Indications for windowing cast
    □ Indications for bivalving cast
  • Cast Complications
    □ Impaired blood flow- producing soft tissue ischemia due to pressure in casted extremity
      What clinical findings would you assess for?
    □ Infection, tissue necrosis- due to skin breakdown
      What clinical findings would you assess for?

47 Cast Pressure Points

48 Fractures-Interventions- Casts
  Windowing a cast , used for:
  ■ observation of complications
  ■ prevent uncomfortable abdominal distention in spica or body casts
  ■ permit taking radial pulse to check circulation
  ■ inspect areas of discomfort and pressure points - impaired tissue perfusion

49 Fractures-Interventions- Casts
  ■ Bivalving a cast- splitting it along both sides lengthwise, be sure to cut cotton batting also
  ■ permits room for tissue swelling
  ■ as a splint or half cast
Two halves reunited by elastic bandage wrap

**Traction**
- Application of pulling force to the body to provide reduction, alignment, and rest at that site
- Types of traction: skin, skeletal, plaster, brace, circumferential
- Skeletal traction
  - Accomplished by first surgically inserting metal wires (Kirschner wire) or pins (Steinman pin) through bones or by anchoring metal tongs in skull (Crutchfield, Vinki, Gardner) uses 15-25 lbs.
  - Leg- Thomas Splint and balanced suspension traction.
- Direct pull exerted on bone

**Nursing priorities - Traction**
- Maintain established line of pull. Weights should never rest on the bed or floor.
- Prevent friction on traction rope
- Maintain counter traction by not allowing patient’s foot to touch the foot of the bed
- Maintain neutral body alignment
- Assess skin for evidence of pressure or breakdown
- Perform neurovascular check
- Address problems of immobility
- Assess and care for pin site
- Provide trapeze if ordered

**Fractures - Operative Procedures**
- Open reduction with internal fixation
  - Open Reduction- reduce and align fracture.
  - Internal Fixation- stabilizing reduced fracture with screws, plates, nails internally
- Closed reduction with External fixation
  - Accomplished with pins, traction and/or splints, casts

**Open Reduction With Internal Fixation (ORIF)**

**Fractures - Interventions**
- Surgical Management
  - Circular external fixation
- Ilizarov External Fixator- wires attached to rings for correction of angulation and rotation defects, treatment of non-union and limb lengthening.
- Bone formation is stimulated by daily adjustment to rods.
- Pt is taught how to adjust the rods.
- May be casted after removal of fixator

59
The Hex-Fix external fixation system for tibial fractures

60  
Fractures-Interventions
Surgical Management
  - Procedure for non-union
    - Electrical bone stimulation
    - Bone grafting or transplantation- establish bony joint fusion, fill in gaps or defects in bone or, facilitate the healing of fractures which are difficult to heal otherwise (Autogenous, homogenous, heterogenous)
    - Ultrasound fracture treatment

61
Bone Stimulator

62
Types Of Hip Fractures

63
Fractures
  - Interventions in preparation for surgery
    - Start IV
    - Relieve pain
    - Assess for signs of shock
    - Apply BUCKS Traction-a TEMPORARY MEASURE-to maintain alignment and lessen the pain of muscle spasm as per MD order

64
Figure 52-5
Buck’s traction with a hook-and-loop fastener

65
A compression hip screw used for open reduction internal fixation of the hip

66
Figure 52-9
The Moore prosthesis, used for hip fractures

67
Total Hip Replacement
  - Replacement of both acetabulum and the head of the femur with a prosthesis.
  - Performed for:
    - Osteoarthritis
    - rheumatoid arthritis
Hip fracture.

Non-cemented, porous-coated hip replacement system

Nursing Goals and Interventions
- Alleviate pain
- Maintain neurovascular integrity
- Prevent adduction-abduction pillow between legs when turning or lying on side.
- Prevent external rotation with trochanter rolls along the affected leg
- Assess for infection
- Prevent flexion of hip, use raised seats
- Assess for dislocation of prosthesis
  - Pain in affected hip, not relieved by analgesics
  - Shortening of affected leg
  - Internal rotation of affected leg

Post-op Course
- Pressure dressing with wound suction
- DVT prophylaxis
- Impaired physical mobility
- Muscle strengthening and ROM exercise
- Plaster cast for bone grafts-in place for several months. No weight bearing until graft incorporates
- Neurovascular assessment
- Wound infection
- Dislocation or loosening of implants

Fractures- Complications
- R/T fracture:
  - Fat embolism, Osteomyelitis, arterial damage, peripheral nerve damage, shock, non union and avascular necrosis,

- R/T immobility:
  - pneumonia, thrombophlebitis, PE. Skin breakdown, atelectasis, urinary stasis, muscle weakness, bone demineralization and constipation.

Fractures- Complications
- Fat embolism- generally occurs 48 hrs after surgery, may occur at any time post fracture
- Management of fat embolism
  - High flow oxygen
  - Possibly blood transfusions
  - Fluids
  - bedrest
  - maintenance of hemodynamic status and urinary output
Compartment Syndrome

Possible Results of Acute Compartment Syndrome
- Infection
- Motor weakness
- Volkmann’s contractures
- Myoglobinuric renal failure
- Hyperkalemia: damaged muscles release K that cannot be excreted due to kidney damage, leads to arrhythmias

Compartment Syndrome/Emergency Care
- ↑ pressure (buildup of blood or fluid) within one or more compartments causes massive compromise of circulation to the area
- Pathophysiologic changes sometimes referred to as ischemia-edema cycle
- Within 4 to 6 hr after the onset of acute compartment syndrome, neuromuscular damage is irreversible
- Fasciotomy may be performed to relieve pressure.
  - Incision through the skin and subcutaneous tissue into the fascia of the affected compartment - wound packing until closure 4-5 days later - may require a skin graft for healing

Orthopedic Surgical Procedures
Self study: review following procedures utilized in diagnosis and/or care of orthopedic client
- Tenotomy
- Tendon lengthening
- Tendon transplantation
- Capsulotomy
- Synovectomy
- Osteotomy
- Arthrotomy
- Arthrodesis
- Arthrolysis
- Arthroplasty
- Total joint replacement
- Meniscectomy

Amputation
- Performed to preserve function in a remaining body part or at times to prevent death.
- Total or partial removal of a body part.
- Loss experienced complete & permanent
- Change in body image and self esteem
- Not as common as 20-30 years ago, because revascularization and limb
salvaging techniques have improved

79 Etiology/Cause
- Severe trauma, secondary to MVA or MCA, DWI, or industrial equipment
- Cancer
- Ischemic or infective gangrene as a result of peripheral vascular disease
- 60-80% amputations r/t diabetes and long history of smoking

80 Common levels of lower-extremity amputation

81 Surgical Approaches/Amputations
- Open or Guillotine- major indication is infection. Stump is not closed and allows the free flow of drainage of purulent or infectious material. Once infection is completely eradicated the patient undergoes stump revision and closure
- Closed or Flap- stump is covered by a flap of skin sutured over the bone end of stump. Performed when there is no evidence of infection. A rigid dressing or cast without drains or an elastic dressing with drains used

82 Diagnostic tests
- Doppler studies
- Segmental blood flow and pressure determinations
- Transcutaneous oxygen readings
- Standard pre-op work-up

83 Post-op nursing diagnoses
- PC: hemorrhage, infection, delayed wound healing, contraction
- Pain
- Body image disturbance
- Risk for dysfunctional grieving.
- Risk for injury
- Impaired physical mobility

84 CARE OF THE PERSON UNDERGOING AN AMPUTATION

  Lower Extremity Amputation
  - Pre Op- Diagnostic evaluation
  - Psychological Preparation
  - Physical Preparation
  - Transfer activities, strengthening of upper extremities for walker, crutch walking.
  - Use of overhead trapeze
  - Evaluation of Rehab Potential
  - Conditions that prohibit prosthesis fitting and ambulation

85 Amputation Post-op goals
- Vascular status of residual limb.
Creation of a stump that can most effectively utilize a prosthesis
- Stump must be shaped by casting or with elastic bandaging.
- Redevelopment of proprioception and sensory feedback
- Facilitate ambulation
- Preparation for prosthesis
  - Arrange for consult with certified prosthetist-orthotist
  - Temporary prosthesis or Delayed Fitting
  - Shaping residual limb very important
    - Jobst air splint (inflated to 20mmHg for 22 of every 24 hrs.
    - Elastic bandages as in previous slide
    - Shrinker sock

Selected Interventions-Early post-op
- Elevate the stump on a pillow or elevate foot of bed for 24 hours only
- After 24 hours do not elevate
- Keep stump wrapped with an elastic compression bandage
- Relieve pain
- Monitor for hemorrhage
- Hematoma- from bleeders-
- Phantom limb pain

Later Post Op Care
- Do not elevate stump
- Discourage fowlers position -AKA
- Encourage prone position, prevents Flexion contractures
- Wound care
- Wrap stump 2x a day from distal to proximal.
- ROM , PT to all extremities
- Teach client how to care for stump at home-no alcohol-no lotion
- Phantom limb pain

Phantom Limb Pain (PLP)
- More common in clients who experience chronic limb pain before surgery and rare in traumatic amputation
- The brain receives messages that cause a client to feel that the missing extremity feels numb, itchy, crushed, trapped , twisted or burning.
- Occurs almost immediately after surgery and may last for months

Phantom Limb Pain (PLP)
- Triggered by touching residual limb, temperature or pressure changes, fatigue, emotional stress
- Long standing PLP can be triggered by any stimulus, even touching any part of the body
- 85% clients experience it
- Must be distinguished from stump pain, managed differently. Stump pain is post-
op pain and managed as any incisional pain

90  Phantom Limb Pain (PLP) Interventions
- IV infusions of Calcitonin (Miacalcin or Calcimar) during week after amputation reduces PLP
- Beta blockers- for constant, dull, burning pain
- Anticonvulsants- Dilantin, Tegretol Neurontin for knife-like pain.
- Antispasmodics- Baclofen for muscle cramps and spasms
- Complementary and Alternative Therapies

91  Additional Therapies for PLP
Complementary and Alternative Therapies
- Transcutaneous electrical nerve stimulation (TENS) most consistent pain relief
- Massage
- Exercise
- Biofeedback
- Hypnosis
- psychotherapy

92  Traumatic Amputation
- Cleanse wound
- Control bleeding
- Cover wound with pressure dressing
- Wrap the amputated body part in sterile gauze moistened with saline
- Place in sterile container with iced saline
- Do not allow amputated body part to freeze or tissue will be damaged
- Replantation is usually successful