



The Canadian Orthopaedic Nurses Association
Association Canadienne des Infirmières
et Infirmiers en Orthopédie

ORTHOPEDIC REVIEW FOR NURSING PRACTICE

The Rapid Reviews have been revised with permission from the Orthopaedic Specialty Preparation Program at **Vancouver Coastal Health**. They provide a synopsis of key information versus a comprehensive coverage of the topics.

Updated August 2019

Dedicated to orthopaedic nurses who strive to gain further knowledge and understanding of Reconstructive Orthopaedics in a rapid paced environment.

Orthopedic Review for Nursing Practice

This document is considered one of several tools available to assist orthopaedic nurses to prepare for certification for orthopaedic nursing through CNA. Note: this document contains summary information versus comprehensive coverage.

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OVERVIEW

Reconstructive-orthopaedic nurses care, support and educate people and their families who are coping with orthopaedic conditions and surgeries. Conditions that afflict the orthopaedic population may be degenerative, traumatic, inflammatory, neuromuscular, congenital, or oncologic in nature. Reconstructive surgery may be performed to relieve pain, restore function, reconstruct limbs and eradicate disease or infection. While the adult reconstructive population represents the full spectrum of ages from adolescence onwards, the majority of patients are older and many have complex health problems. Pre-existing illness, social and emotional conditions may have a profound effect on the person's coping style, recovery and maintenance of health. Patients are viewed in the context of their unique biological, social, family, psychological, cultural and spiritual dimensions.

Reconstructive-orthopaedic nurses are attuned to the complex needs of this population and are prepared to prevent, detect and effectively intervene with clinical problems. They provide expert care, comfort and support. They promote healing, self-care, optimal health and the prevention of illness and injury. They assess the person's unique health and social needs and coordinate care with the interdisciplinary team and community supports.

Anatomy & Physiology

Understand the structure, development & function of different components of the body and how they affect mobility and healing for an orthopaedic patient.

Knowledge of Underlying Conditions

Describe/define the condition; identify characteristics of the population at risk. Describe the prevention, detection and/or management of the condition. Identify pertinent assessments, interventions and patient teaching strategies for reconstructive-orthopaedic nurses.

Surgeries

Specify for each surgical procedure: indications for surgery, population characteristics, description of surgery/prosthesis, common clinical problems and why they occur, and postoperative care considerations.

Clinical Problems & Complications

Identify who is at risk and why and how to prevent, detect and manage.

Psycho-Social Support

Loss & Grief, Anxiety – related to surgical procedure, hospitalization, recovery period, devastating diagnosis, or loss of independence.

- Counseling skills for anxious/grieving patient/family
- Support for patient/family with chemical dependency

Frail Older Adult

Recognize the common clinical problems that present. Identify who is at risk and why. Prevent, detect and manage each problem/condition.

- Age related changes versus clinical problems
- Delirium
- Osteoporosis
- Depression
- Fluid & electrolyte imbalances
- Malnutrition / anemia
- Constipation
- Falls (prevention), minimizing restraint use

Skills

Know why, when and how to competently perform psycho-motor skills

Transition Planning Considerations

Coordinate individualized transitions for complex patients.

- Common needs of orthopaedic patients
- Community resources
- Transportation
- Rehab/convalescent facilities
- Team roles in transition planning

ANATOMY AND PHYSIOLOGY

Bone Structure, Development, and Function

There are 206 bones in the human body. Humans are born with nearly 300 bones, but many fuse together over time. Bones vary widely in size ranging from the tiny ear bones to the large (nearly 2 feet long) femur bone that is strong enough to withstand 30 times one's body weight. There are two different types of bones: cortical bone and cancellous bone. Cortical bone, also known as compact bone, is a very dense type of bone. Around 80% of the skeleton is composed of cortical bone and its primary functions are to provide structural strength to the skeleton, and help maintain homeostasis through the release and reabsorption of calcium. Cancellous bone, also called trabecular bone or spongy bone, houses both red and yellow marrow. Red marrow is the site of blood cell production (hematopoiesis), where yellow marrow is mostly composed of fat cells. Most bones contain a combination of approximately 80% cortical and 20% cancellous bone (Bergeron, et al., 2018).

Physiological and biomechanical differences of growing bones

Bone Tissue and Bone Cells

Bone is living and growing tissue with porous mineralized structure, comprised of cells, vessels, and crystals of calcium compounds. Bone cells are separated into two classifications: osteoblasts make bone, and osteoclasts resorb/dissolve bone (Schoenly, NAON, 2013). The osteoblasts become osteocytes, or mature bone cells, which are merged into compact bone. About 90% of all bone cells are osteocytes and their life span is decades long. Although they no longer build bone, osteocytes are important to bone maintenance and homeostasis.

Osteoclasts, in comparison, remodel bone by breaking it down to release minerals and other materials into the body. Their activity is stimulated by the osteoblasts.

Bone plays a vital role in storing and releasing minerals. Approximately 60% – 70% of bone matrix is composed of the minerals calcium and phosphate (Bergeron, et al., 2018).

Dynamic state of the immature skeleton

The osteoid density of a child's bone is less than adults. Juvenile bone is more porous than adult bone because the Haversian canals occupy a much greater part of the bone. This explains why a child's bone can bend more than adults.

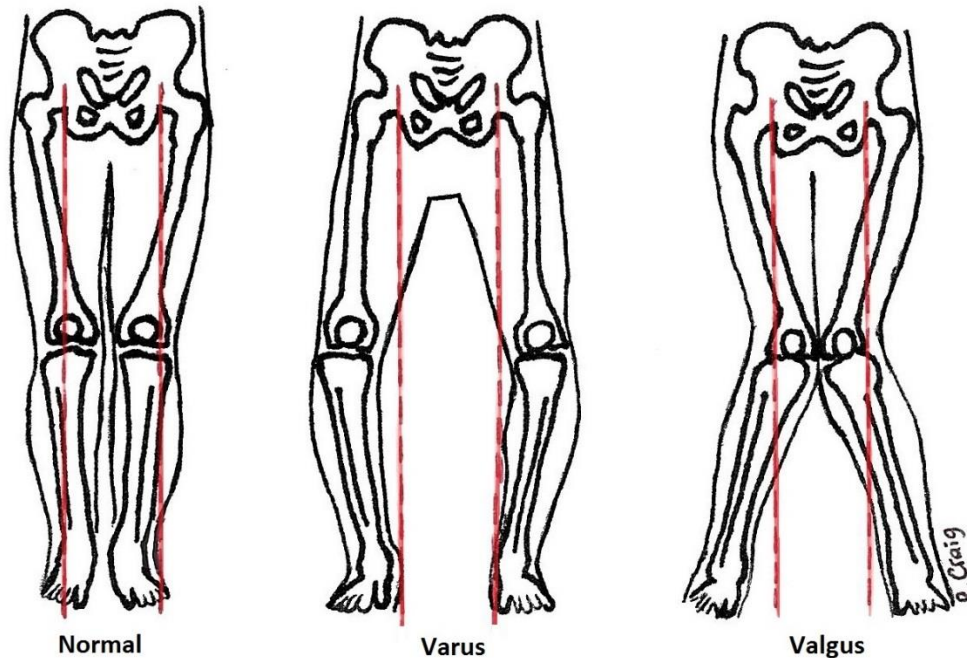
Remodelling

- Wolff's Law of Remodeling states that bone will remodel itself over time to become stronger if loading on a particular bone increases. The outside cortical bone becomes thicker to better withstand a load. A bone will become weaker if the loading decreases. This is the rationale behind early weight bearing during bone healing.

Body alignment

Varus deformity: This condition gives a bow-legged appearance and may be inherited or could be the result of uneven degeneration of the knee joint articular cartilage (Bergeron, et al., 2018).

Valgus deformity: Frequently the result of uneven degeneration of the knee joint articular cartilage, this condition gives the appearance of being knock-kneed (Bergeron, et al., 2018).



Factors that influence bone mineral density

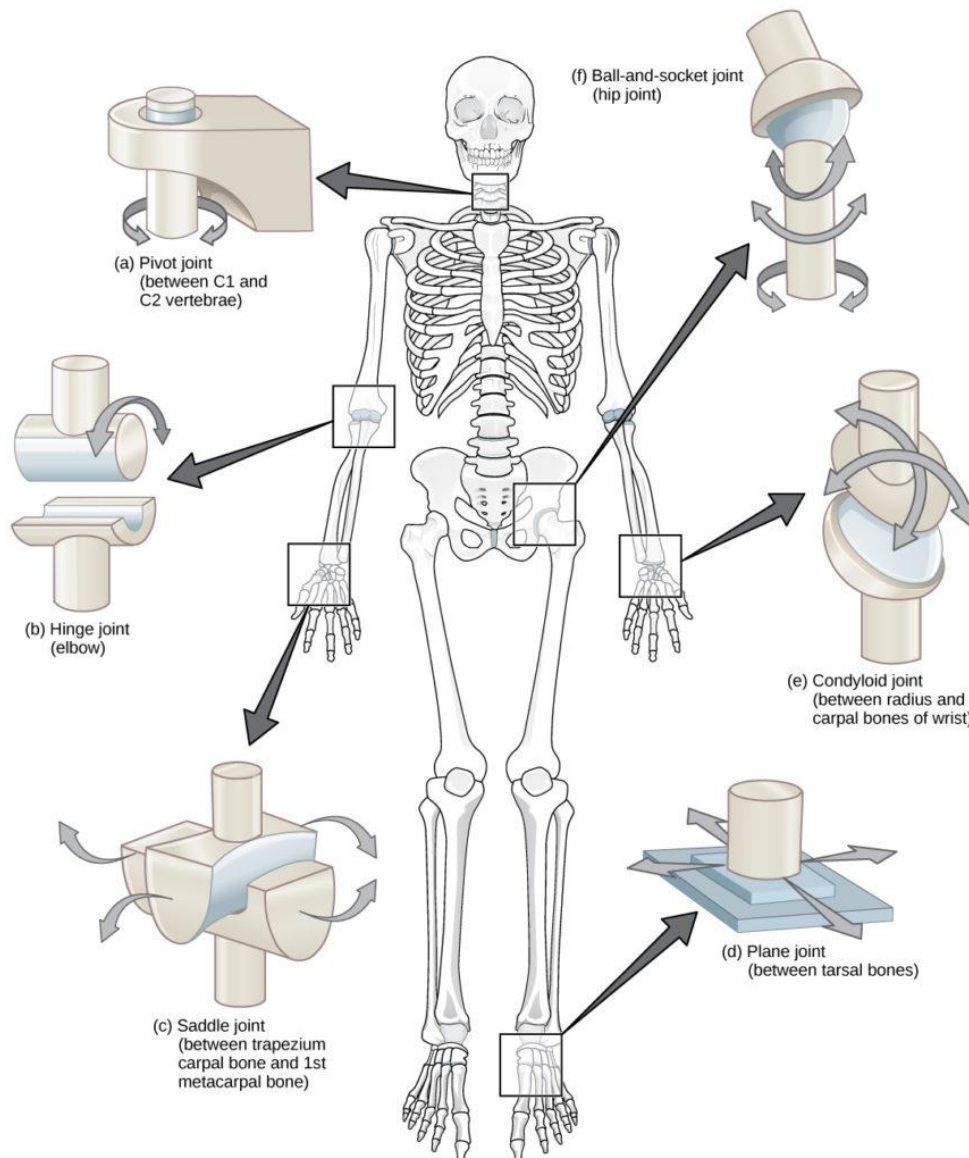
- **Genetics** (ie: Caucasian race, having a parent who broke a hip)
- **Medications:** (ie: long term use of corticosteroids (3+ months), medications that affect calcium and Vitamin D absorption (anticonvulsants, phosphate-binding antacids, tranquilizers, sedatives & muscle relaxants)
- **Smoking**
- **Viral infection:** (ie: HIV, Hep B & C)

- **Diet:** (ie: eating disorders (cause amenorrhea in women which leads to ↑bone loss caused by estrogen deficiency), frequent Caffeine use, regular alcohol consumption, diet low in calcium and Vitamin D)
- **Activity:** (ie: weight bearing exercises increase bone mineral density (see Wolff's Law), inactivity or weight bearing restrictions on long bones decrease bone absorption)
- **Age:** (ie: women over the age of 60 (lack of estrogen), men over the age of 70 (lack of testosterone))

Joints

Joint: a joint, or articulation, is the place where two bones come together (National Association of Orthopaedic Nurses, 2013).

Immovable joint (synarthroses)	Bones are in very close contact and are separated by a thin layer of fibrous connective tissue. Ex: the suture in the skull between skull bones.
Slightly movable joint (amphiarthroses)	Characterized by bones that are connected by hyaline cartilage. Ex: the ribs that connect to the sternum
Freely movable joint (amphiarthroses)	Most of the joints in the adult human body are freely movable, there are 6 types: <ol style="list-style-type: none"> 1. Ball-and-socket <ul style="list-style-type: none"> • The ball-shaped end of one bone fits into a cup-shaped socket on another, allowing the widest ROM, including rotation. ie: shoulder & hip 2. Condylloid <ul style="list-style-type: none"> • An oval-shaped condyle of one bone fits into an elliptical cavity of another, allowing angular motion but not rotation. ie: metacarpals (hands & feet), phalanges (fingers & toes) 3. Saddle <ul style="list-style-type: none"> • The touching surfaces of two bones have both concave and convex regions, with the shapes of the two bones complementing one other and allowing a wide range of motion. ie: thumb 4. Pivot <ul style="list-style-type: none"> • Rounded or conical surfaces of one bone fit into a ring of another bone or tendon, allowing rotation. ie: axis & atlas in the neck 5. Hinge <ul style="list-style-type: none"> • A convex projection of one bone fits into a concave depression in another, permitting only flexion and extension. ie: elbow 6. Gliding <ul style="list-style-type: none"> • Flat or slightly flat surfaces move against each other, allowing sliding or twisting without any circular movement. ie: carpals in the wrist & tarsals in the ankle



19.26 Types of Synovial Joints by Molnar & Gair is used under a CC BY 4.0 License

Clients with the following conditions are at risk for joint stiffness:

- *Juvenile Arthritis*: like adults, children can get arthritis. Arthritis is caused by inflammation of the joints and can cause pain, swelling, stiffness, and loss of motion (National Institutes of Arthritis and Musculoskeletal and Skin Diseases, 2015).
- *Rheumatoid Arthritis*: a chronic, progressive disease that is characterized by inflammation of connective tissue with or without destruction of the joint. Unexplained periods of remissions and exacerbations also occur (Bergeron, et al., 2018).
- *Osteoarthritis*: a joint disease marked by the degeneration of articular cartilage, hypertrophy of bone at the margins, and changes in the synovial

membrane accompanied by pain, stiffness and some swelling (Bergeron, et al., 2018).

- *Polymyalgia Rheumatica*: causes muscle pain and stiffness in the neck, shoulder, and hip that often lasts longer than 30 minutes. Usually occurs in the morning or after periods of no movement. This condition typically develops gradually and generally goes away within one year (National Institute of Arthritis and Musculoskeletal and Skin Diseases, 2016).
- *Rheumatic Fever (Group A Strep)*: it is an acute multi-system inflammatory disease that occurs as a delayed result of pharyngeal infection with streptococcal bacterial. It can affect the heart, joints, skin, and brain. It is not directly contagious but the streptococcal infection that triggers rheumatic fever can be highly contagious (National Association of Orthopaedic Nurses, 2013).
- *Gout*: a type of arthritis that causes painful and stiff joints that often starts in the big toe. Uric acid crystallizes and becomes supersaturated in joint fluid, especially in peripheral joints. Could cause kidney stones and/or lumps under the skin (National Institutes of Arthritis and Musculoskeletal and Skin Diseases, 2016).
- *Lyme disease*: it is a tick-borne multi-system inflammatory disease. It is also referred to as the “great imitator” because its symptoms can mimic those of mononucleosis, meningitis, multiple sclerosis, and other diseases. It is caused by the spirochete *Borrelia burgdorferi* transmitted by a bite from an infected tick. Person-to-person transmission does not occur. 60% of affected people experience joint pain and swelling and knees and hips are typically affected. Antibiotic treatment is critical (National Association of Orthopaedic Nurses, 2013).
- *Seronegative Spondyloarthropathies*: these are an interrelated group of multi-system inflammatory disorders that affect the axial spine, asymmetric peripheral joints, and peri-articular structures in the absence of serum rheumatoid factor (RF) (National Association of Orthopaedic Nurses, 2013). They include the following:
 - Ankylosing Spondylitis
 - Reactive Arthritis
 - Psoriatic Arthritis
- *Systemic Lupus Erythematosus*: a condition that damages many parts of the body like joints, skin, kidneys, heart, etc., which occurs when the body’s defense system attacks healthy cells and tissues rather than viruses and bacteria (National Institute of Arthritis and Musculoskeletal and Skin Diseases, 2016).

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Muscle, tendon and ligaments

Muscle is classified in three categories: cardiac muscle, smooth muscle, and skeletal muscle. Skeletal muscle is comprised of many cylindrical muscle fibers that often run from point of origin to point of insertion. Connective tissue binds the fibers and provides a path for blood vessels and nerves (National Association of Orthopaedic Nurses, 2013). Muscles contract and relax to bring about movement and perform three main functions: movement, maintenance of posture, and heat production (Begley, et al., 2014). Movement is produced by the skeletal muscles exerting force on tendons which in turn pull on bones. When a muscle contracts it draws one articulating bone toward the other. Levers are produced by the bones and joints (National Association of Orthopaedic Nurses, 2013).

Ligaments and tendons are similar as they both serve as connectors. They contract and shorten or relax to allow two bones to move closer or further away from one another. **Ligaments** join bone to bone, and **tendons** join muscle to bone (National Association of Orthopaedic Nurses, 2013). Ligament elasticity allows stretch and stabilizes the joint to ensure that the movement remains normal. Ligaments, tendons and cartilage connect bones, joints, and muscles. Their purpose is to guide and protect the movement initiated by muscles (Begley, et al., 2014).

Cartilage is formed by dense irregular connective tissue. There are two types of cartilage: hyaline, which provides flexibility and support, and fibrocartilage, which allows greater resistance to compression and tension. Unlike with ligaments and tendons, fibers are arranged irregularly, and therefore allow more stress than ligaments and tendons. There is no blood or nerve supply and minimal capability for healing (Begley, et al., 2014).

Effects of mobility on the health and healing of muscles

- Your skeletal muscles are responsible for the movements you make. Skeletal muscles are attached to your bones and partly controlled by the central nervous system (CNS).
- You use your skeletal muscles whenever you move. Fast-twitch skeletal muscles cause short bursts of speed and strength. Slow-twitch muscles function better for longer movements.
- Diminished muscle mass is common in the geriatric population as muscle mass loss reduces overall strength and contributes to fatigability

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Begley, T., Blair, V., Clarke, S., Collins, A., Davis, P., & al., e. (2014). *Orthopaedic and Trauma Nursing: An evidence-based approach to musculoskeletal care*. (S. C. Santy-Tomlinson, Ed.) West Sussex: John Wiley & Sons, Ltd.

The Neurovascular System

Neurovascular is the structure and function of the vascular and nervous systems combined. It is a standard for any patient with a musculoskeletal injury or surgery to receive a neurovascular assessment. CMS is a mnemonic of the components of the neurovascular exam used by nursing staff to that stands for Circulation, Motion, and Sensation. One additional part of the examination includes the assessment of deep tendon reflexes or superficial reflexes (Bergeron, et al., 2018).

Monitoring neurovascular status is vital in preventing both acute and long-term debilitating outcomes caused by neurovascular deterioration or compromise. Delay in identifying neurovascular compromise can lead to loss of a limb, permanent deficits, and can even be fatal. Outcome can be dependent on a number of factors such as the location of the injury, the time between the injury and evaluation, and the mechanism of injury. Characteristics of compromise include change in colour, sensation, temperature or movement, pulses, motor or sensory innervation or pain. Neurovascular deterioration can occur late after trauma, surgery or cast application (The Royal Children's Hospital Melbourne, 2015). Patients who require an assessment include but are not limited to:

- Musculoskeletal trauma to the extremities
 - Fracture
 - Crush injury
- Post-operative
 - Internal or external fixation or fractures
 - Orthopaedic and spinal surgery
 - Plastic surgery on extremities or phalanges
- Application of cast
 - Restrictive dressing
- Application of traction (skin and skeletal)
- Burns patients
 - Circumferential burns
- Signs of infection in the limb

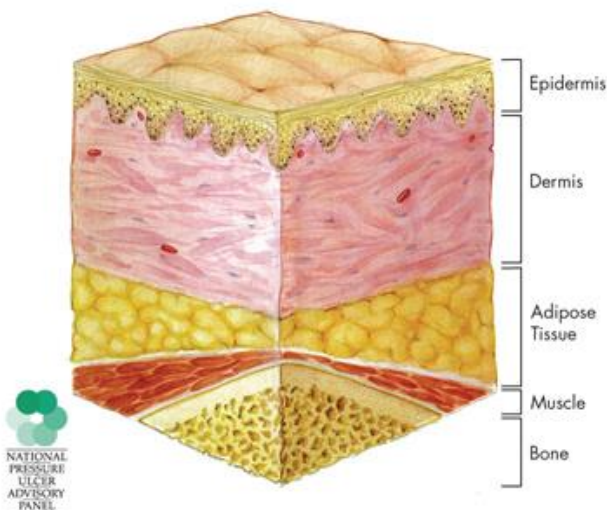
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The Integumentary System

Intact skin is the body's first line of defense against invasion by infectious microorganisms. The skin defends the body from heat, light, injury and infection as well as helps regulate body temperature, store vitamin D, fat, and water, and it helps to sense pain and other stimuli. The skin, or integument, is the largest external organ. It has three layers: the epidermis, the dermis, and the subcutaneous tissue (Perry & Potter, 2010). Collagen, blood vessels, and nerves compose the dermal layer of the skin. About 70% is composed of collagen, and is crucial in wound healing. The dermis "restores the physical properties of the skin and its structural integrity" (Perry & Potter, 2010). Restoration of both the epidermal and dermal layers is essential to stimulate healing. Risk for infection, impaired circulation, and break-down of tissue directly impact the wound-healing ability of the skin layers (Perry & Potter, 2010).



*Used with permission from the National Pressure Ulcer Advisory Panel: www.NPUAP.org/resources/education-and-clinical-resources/pressure-injury-staging-illustrations/

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Skin, Muscle, & Bone Grafts

Skin grafts are thin sheets of healthy skin removed from one part of the body (donor site) and put on another part. Grafts can be used to treat skin damaged by burns, infection, ulcer or a large surgical wound.

Care after skin grafting (from Healthwise, 2018):

- There will be a bandage over the skin graft. The area may be sore for 1 to 2 weeks. Keep the area of the skin graft dry while it heals, unless the doctor gives other instructions. No bathing for the first 2 weeks.
- If possible, prop up the area of the body that has the skin graft. Keeping it raised will reduce swelling and fluid buildup, which can cause problems with the graft. There will also be a bandage on the donor site.

- Avoid getting sunlight on the skin graft for several months. This helps to prevent a permanent change of colour in the grafted skin.
- Avoid exercise that stretches the skin graft for at least 3 weeks after surgery, unless the doctor gives other instructions.
- If the graft was placed on the legs, arms, hands, or feet, physiotherapy to prevent scar tissue from limiting your movement may be required. This therapy is very important. It may involve wearing splints and doing stretches and range-of-motion exercises. These may be painful, but they help proper healing.
- It may take months to regain some feeling in the grafted area. The feeling will be different than it was before the injury.
- There may not be sweat glands in the skin graft area. If the grafted area is large, this may make it hard for the area to cool off when the body is hot. The grafted area may not have oil glands. This can make the skin graft dry and flaky. After the graft heals, use of lotion to keep the skin moist may be needed. The skin graft may not grow hair.

Muscle flaps are versatile tool in the surgical treatment of the complex wounds, management of osteomyelitis, infected vascular grafts, treatment of recalcitrant venous stasis ulcers, preservation of amputation levels, and restoration of motion following compartment syndrome. The malleability of muscle eliminates dead space in the compromised area while the dense capillary network facilitates antibiotic deposition. Additionally, muscle flaps are more effective than their counterparts in overcoming varying degrees of bacterial colonization and infection (Klebuc & Menn, 2013)

Bone grafting is a surgical procedure that repairs damaged or diseased bone that would otherwise fail to heal properly, or pose a significant health risk to the patient. Bone generally can regenerate completely but requires a very small fracture space or some sort of scaffold to do so. Bone grafts may be harvested from the patient's own body (autologous), taken from a cadaver (allograft), or made of artificial material with similar mechanical properties to bone (synthetic). Most bone grafts heal within a few months.

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CONGENITAL DISORDERS

Cerebral Palsy (CP)

Definition:

CP is defined as a disorder of movement and posture characterized by persistent motor delay and a range of non-motor disabilities including cognitive, neurobehavioural, neurosensory, and orthopedic. Damage usually occurs before birth and is non-progressive (however motor and non-motor manifestations can change with the child's development)

Etiology:

- Higher prevalence in black infants, twin pregnancies, maternal or fetal infection
- 8-12% brain injury occurring at birth
- 10% postnatal etiology, such as traumatic brain injury and meningitis
- Most common: developmental brain anomalies and prenatal insults

Orthopedic concerns: scoliosis and hip dislocations may develop during childhood, and disuse osteopenia may predispose a child with CP to fractures.

Clinical Classifications of Cerebral Palsy

Spastic CP

- Persistent velocity-dependent hypertonus (increased muscle tone of clasp-knife character), increased deep tendon reflexes, pathologic reflexes, spastic weakness and loss of motor control & dexterity

Dyskinetic CP

- Prominent involuntary movements, fluctuating muscle tone, or both

Ataxic CP

- Associated with comorbidities in hearing, vision, cognition, feeding, epilepsy & balance disturbances (brain lesion is located in the cerebellum)

Bulbar CP (Worster-Drought Syndrome)

- Motor disability with perisylvian microgyria (issue with cranial nerves)

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Cerebral Palsy. Online article: <https://www.mayoclinic.org/diseases-conditions/cerebral-palsy/symptoms-causes/syc-20353999>. Retrieved April 2018.

National Association of Orthopaedic Nurses, 7th edition. (2013). Schoenly, L. Chapter 11, pp 272-278.

Development Dysplasia of the Hip

Definition

Developmental dysplasia of the hip is the abnormal development of the proximal femur and acetabulum. In a normal hip, the acetabulum sits horizontally and covers the femoral head. In a dysplastic hip, the acetabulum has a higher than normal slope which allows the femoral head to slide out of the acetabulum. The acetabulum then only partially covers the femoral head, creating a decreased joint surface area. This decreased surface area leads to an increase in contact pressure, cartilage degeneration and osteoarthritis.

At one time this disorder was referred to as “Congenital Dislocated Hip”, however, it is not always present at birth, and the hip is not always dislocated. It also encompasses children presenting with acetabular dysplasia (shallow or misshaped hip socket).

Population

- The most common hip disorder in children under three years of age
- The incidence of DDH is approximately 1-2 per 1,000 births
- More common in females, breech positioning at delivery and if there is a family history of DDH
- Other associated factors include oligohydramnios, first born, high birth weight, post maturity and infant swaddling
- Caucasians have a higher incidence of developmental dysplasia than other groups.

Manifestations

- Early detection and diagnosis allows for simpler and more effective treatment.
- Often detected with routine screening at birth for hip dislocation and hip instability. Assessment for equal leg lengths and asymmetry of the gluteal and thigh folds is done. Reduced hip abduction and instability are indicative of DDH. Ultrasound is used to clarify clinical findings
- Individuals may be asymptomatic until adulthood
- If diagnosis is **not** made at birth or during childhood the primary manifestations in young adults include:
 - Acute sharp groin pain
 - “Catching” or “giving way”, a feeling of instability of the hip and leg
 - Unexpected falls
 - Pain, usually with activity

Treatment

- The goal of treatment is obtain and maintain concentric reduction of the femoral head in the acetabulum thus restoring normal biomechanics.
- Treatment depends on the age of the child at presentation.
- In the infant and young child, treatment may include observation, Pavlik harness, closed and/or open reduction and/or spica (body) cast.
- For the young, active adult with developmental hip dysplasia every effort is made to preserve the hip joint for as long as possible.
- Prevention or delay of the onset of osteoarthritis is a key consideration. Surgical intervention is indicated for pain relief, preserving the joint, and potentially delaying the onset of osteoarthritis. For those who present without advanced osteoarthritis, a pelvic acetabular osteotomy is the treatment of choice. See Pelvic Acetabular Osteotomy Rapid Review.
- For those presenting with advanced osteoarthritis, hip replacements are the treatment option. See Hip Replacement Rapid Review.

Considerations for Orthopaedic Nurses

- Children in braces/splint or hip spica require considerable care
- Emotional support and education is required for the parents
- Adolescents requiring surgery may have never been hospitalized before and may hesitate to ask questions. In addition, they may be struggling to appear 'normal' and may not have told their friends about their disease. Surgery and rehabilitation may isolate them from their friends and activities which can cause considerable stress

Questions

1. Which of the following is not a risk factor for DDH?
 - a. Breech presentation
 - b. Gender
 - c. Lower limb deformity
 - d. Fetal alcohol syndrome
2. Which of the following statements is false?
 - a. There is no known associated heredity component in DDH
 - b. DDH may be treated with open or closed reduction in infants
 - c. Catching, giving way and falls are common in young adults
 - d. Surgery is considered a late option for managing DDH

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Hemophilia A (Factor VIII) & B (Factor IX)

Definition

Hemophilia is a rare bleeding disorder that results from reduced levels or lack of clotting factors. The most common is hemophilia A or classical hemophilia (a factor VIII deficiency) and hemophilia B, a factor IX deficiency (FIX) or Christmas disease (as it was first reported in the medical literature in 1952 in a patient with the name Stephen Christmas). These disorders disrupt the blood clotting cycle. For a clot to form, a chain of factors is activated in a specific order. If there is interference in the chain, the process of clot formation will be disrupted. Hemophilia A (85%) is the most common form and is caused by a lack of factor VIII. Hemophilia B (15%) occurs when there is a lack of factor IX.

- The condition is lifelong
- Bleeds can happen most commonly into joints (hemarthrosis) muscles, or any soft tissue. (Hemarthrosis is bleeding into a joint space. It is a common feature of hemophilia caused by trauma, a blunt injury or fracture of a joint). Intracranial, spinal cord, throat, intraabdominal, limb compartment, or ocular bleeds can seriously threaten life, limb, or function. Bleeds can be due to trauma, or in the most severe forms of hemophilia, can occur spontaneously. As joints are vascular, bleeding is likely to occur with hemophilia
- Chronic hemarthrosis damages joints similar to arthritis. With hemarthrosis, the synovium absorbs the blood in an effort to remove it. It is believed that iron in the blood accumulates causing the synovial lining to thicken. The

- thicker synovium forms the more blood vessels and increases the risk of bleeding
- Bleeding into muscle tissue may cause pressure on the nerve and may result in loss of sensation to an area. Muscle bleeds can be limb threatening (e.g. severe compartment syndrome). See Compartment Syndrome Rapid Review
 - The degree of severity in hemophilia correlates to the amount of clotting activity in the blood. Normal factor VIII levels fluctuate between 50-150%. Hemophilia is considered severe if levels are less than 1%, moderate if between 1-5%, and mild if greater than 5%

Population

- One in 100 Canadians carry an inherited bleeding disorder gene, and 1 in 10 of these, or 35,000 Canadians, have symptoms severe enough to require medical care. Hemophilia A and B affects 3,000 Canadians
- As hemophilia A and B are X-linked chromosomes, males get the disease and females carry the disease. Males only have one X chromosome and females have two X chromosomes
- Women carriers of hemophilia may bleed easily if their clotting factor levels are low
- Hemophilia occurs worldwide in all races
- Hemophilia may not be diagnosed until later in life

Manifestations

- Hemophilia is a genetic disease and is caused by a mutation within the genes for coagulation factors VIII or IX. In approximately 70% of cases hemophilia is inherited from a parent but in 30% of patients, the family history may be absent or not apparent. In such cases, the condition is often caused by a spontaneous gene mutation at the time of fertilization
- Severity stays the same throughout the life span unless the person develops inhibitors to factor replacement and becomes resistant to treatment. Inhibitors are antibodies produced by the immune system
- Pain, loss of ROM and joint damage occur as a result of repeated bleeding into the joint(s)

Treatment

- Priority treatment is prompt infusion of factor replacement.
- RICE-rest, ice, compression and elevation also assist in the treatment of bleeds
- Factor replacement is given IV, and may be needed once or more. These infusions help to replace the clotting factor that's missing or low
- Most severe and moderate hemophiliacs are trained to administer their own treatments. You can take clotting factor concentrates that aren't made from human blood. These are called recombinant clotting factors. Clotting factors

- are easy to store, mix, and use at home-it only takes about 15 minutes to receive the factor
- Desmopressin (DDAVP) is a man-made hormone used to treat people who have mild hemophilia A. DDAVP isn't used to treat hemophilia B or severe hemophilia A. DDAVP stimulates the release of stored factor VIII and von Willebrand factor; it also increases the level of these proteins in your blood. Von Willebrand factor carries and binds factor VIII, which can then stay in the bloodstream longer
 - Antifibrinolytic medicines (including tranexamic acid and epsilon aminocaproic acid) may be used with replacement therapy. They're usually given as a pill, and they help keep blood clots from breaking down
 - Pain medicines, steroids, and physical therapy may be used to reduce pain and swelling in an affected joint. Emphasis on good muscle strengthening (physio) to protect joints from further bleeds is important
 - Medicine precautions: Some medications increase the risk of bleeding such as: Aspirin and other medications that contain salicylates. Ibuprofen, naproxen, and some other nonsteroidal anti-inflammatory medicines

Consideration for Orthopaedic Nurses

- Patients and family members are usually very knowledgeable about their disease and its management and should be involved in treatment decisions
- Assess patient for problems with ADL's, sleep, and pain management
- Patients may have experienced chronic pain for years and tolerance to opioids may have occurred. This may necessitate increased analgesia dosing post-operatively for appropriate pain management

Questions

1. Which of the following statements about hemophilia are true? (Choose two)
 - a. Hemophilia is characterized by a deficiency in clotting factors
 - b. The condition is life long
 - c. Males can be carriers of the disease
 - d. Bleeding is always caused by trauma
2. Hemophilia A, the most common type of hemophilia is caused by a lack of which clotting factor:
 - a. 6
 - b. 9
 - c. 8
 - d. 1
3. Hemarthrosis is believed to cause damage to the joint by the accumulation of copper into the synovium. True or false?

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Osteogenesis Imperfecta (Brittle Bone Disease)

Definition

- Congenital disorder of collagen synthesis resulting in weak, bony matrix leading to bone fragility, fractures and deformity
- X-rays showing frequent fractures can raise the question of physical abuse
- OI can lead to perinatal death or early osteoporosis in middle age
- Secondary clinical manifestations include growth impairment such as dwarfism, cardiopulmonary complications, dentinogenesis imperfect (genetic disorder of tooth formation), hearing loss, blue schlerae, seizures and neurological compromise caused from the narrowing of the opening in the skull where the spinal cord passes through to the brain

Population

- 1:20,000 births
- Male and females are equally as likely to inherit this condition.

Clinical Features

Type 1 (60% of people with OI)

- Best prognosis (mild type)
- Normal to mild-moderate shortness in stature
- Little to no abnormalities
- Fractures occur with moderate trauma (decrease at puberty)
- Blue sclera

Type II (most severe form)

- Lethal in perinatal period (respiratory/cv compromise, many are stillborn)
- Numerous #s at birth
- Beaded ribs
- Compressed femurs/skulls
- Small extremities
- Marked long-bone deformity
- Kyphosis

Type III

- Moderate-severe form
- Severe osteoporosis
- Progressive bony deformity
- Frequent #s with minimal trauma
- Dentinogenesis common
- Very short stature
- Often non-ambulatory by adolescence
- Large skull, triangular face

Type IV

- Mild type
- Normal sclera or bluish sclera that lightens with age
- Mild-moderate bony deformity, bowing of legs
- Stature variable
- Dentinogenesis
- Often spontaneously improves at puberty
- No hearing loss

Nursing Assessment

Subjective

- Number of fractures, type of trauma associated with fractures
- birth history, any fractures occurring during delivery or neonatal period
- family history

Objective

- Rule out child abuse; differentiation between OI and battered child syndrome is partially dependent on presence of other signs of physical abuse (bruises, welts, burns, lacerations, abdominal and head injuries)
- Presence/absence of blue sclera
- Shape of face (triangular-shaped)
- Spine (scoliosis/kyphosis)
- Chest may be conical in shape
- Note height

Diagnostics

- Prenatal ultrasound
- Amniocentesis
- Bone densitometry

Treatment

- Fracture management
- Fracture reduction
- Osteotomies and IM fixations to correct long-bone deformity

Considerations for Orthopaedic Nurses

Parental/patient education (normal intelligence, set realistic goals, set limits and plan appropriate and safe activity, access to education and social environments)

- Fracture reduction and promotion of highest level of mobility, independence and social interaction as possible
- Early interventions (careful handling and positioning with head supports and devices)
- Muscle strengthening and aerobic conditioning (swimming increases muscle strength of hips and spine), and
- Protected ambulation (orthoses and splints)

Questions

1. Brittle bone disease is a congenital disorder of collagen synthesis resulting in weak, bony matrix leading to bone fragility, fractures and deformity. True or false?
2. Which of the following statements is not true?
 - a. Considerations include: fracture reduction and promotion of highest level of mobility, independence and social interaction as possible
 - b. Treatment includes: fracture management, fracture reduction, osteotomies and IM fixations
 - c. Diagnosis includes prenatal ultrasound, amniocentesis and bone densitometry
 - d. It is more prevalent in males than females

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Scoliosis

Deformity of the spine

- 80% of cases are idiopathic, most common curve is right-sided thoracic
- Congenital: caused by an anomaly in the bony structure of one or more vertebral bodies, resulting in longitudinal spinal growth imbalance
- Neuromuscular: muscle imbalance due to muscular dystrophy, cerebral palsy, polio, spina bifida, spinal muscular atrophy and paralysis from spinal cord injury
- Non-structural (postural): causes include leg length discrepancy, pelvic tilt, hip/knee flexion deformities, spondylosthesis, tumours and disc herniations

Complications:

- Untreated scoliosis can lead to cardiopulmonary compromise, leg length discrepancy, altered gait pattern, trochanteric bursitis (hip pain), and debilitating back pain with loss of motor function in the lumbar spine for degenerative scoliosis

Treatment:

- Curves of 15-20 degrees: Conservative. Most curves less than 15-20 degrees are observed for progression at 6 month intervals during peak growths and annually as it is unlikely they will progress further. Postural exercises and active exercises may be helpful.
- Curves of 20-40 degrees: require bracing in a growing child to prevent further progression of the curvature
- > 40 degrees: Surgical. A patient with severe, inflexible curve may need more extensive treatment prior to surgery to improve spinal alignment.

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Spina bifida (Myelomeningocele)

Neural tube defect involving the spinal cord, the meninges, and the vertebral bodies.

- Spinal cord has failed to fuse, resulting in an open defect with no dura, bone, muscle or skin covering
- Mostly occurs in the low thoracic and lumbosacral regions
- Development of the neural tube occurs during day 21-29 of embryonic life

Characteristics:

- Leg weakness or paralysis
- Orthopaedic abnormalities (e.g. club foot, hip dysplasia, scoliosis)
- Bladder and bowel control problems (e.g. incontinence, UTIs, poor kidney function)
- Pressure sores from skin irritations

- Abnormal eye movement.
- Children with spina bifida have an increased likelihood of latex allergy
- *Hydrocephalus* occurs in 90% of patients and results from the obstruction of the flow of CSF at the 4th ventricle, or from the obstruction of flow from an Arnold-Chiari malformation
 - Shunt malfunctions (to treat the hydrocephalus) may cause symptoms of increasing paralysis and/or spasticity of the lower limbs, weakness of the hands and upper limbs, and occasional back pain.

Etiology of Spina Bifida:

- Environmental factors (e.g. exposure to valproic acid, decreased folate in mother's diet). Prevention programs aimed at reducing the likelihood of spina bifida have increased awareness of the need for folic acid supplementation. When folic acid supplementation is started before conception and within the first month of pregnancy it has been shown to reduce the rate of neural tube defects by 70%.
- Chromosomal abnormalities or single-gene mutations

Treatment:

- Before surgical repair, key objectives include:
 - prevention of the infection of the sac
 - protection of the exposed spinal cords and the nerves from injury
 - prevention of skin breakdown while the infant is in prone position
- After surgical repair, treatment objectives are the prevention of complication and maximizing independence in activities of daily living
- Orthopaedic interventions include recommending orthotics to support the trunk in sitting and standing, stabilizing weight-bearing joints, treating hip dysplasia, and maintaining corrected position after surgical procedures

References

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Talipes Equinovarus (Club Foot)

Definition

Foot deformities present at birth caused when tissues connecting the muscles to the bone are shorter than usual. They can be mild or severe.

Presentation

- Idiopathic in nature
- Not painful
- Top of foot is usually twisted downward and inward, turning the heel inward
- Calf muscle usually underdeveloped
- Affected foot is usually 1/2inch shorter than the other foot
- Family history

Risk Factors

- Family history
- Associated with other conditions such as spina bifida
- Environmental issues (an increase if woman with family history smokes during pregnancy or is exposed to recreational drug use or infection during pregnancy)
- Amniotic fluid (an increased risk if there is too little amniotic fluid)

Complications

- Mobility may be slightly limited
- Shoe size of affect foot may be smaller than unaffected foot
- Calf size of affected side may be smaller than unaffected side
- If left untreated: Arthritis
- Poor self-image
- Inability to walk normally; problems stemming from gait adjustment (decreased natural growth of calf muscle, calluses or large sores on feet)

Diagnosis

- Recognizable upon assessment of shape and positioning of foot
- X-rays upon birth (to determine severity)
- Some cases can be visualized on prenatal ultrasound

Treatment

- Serial stretching and casting (Ponseti Method) once or twice a week for several months
- Percutaneous Achilles tenotomy
- Maintenance: After alignment is achieved maintain by performing stretching exercises. Child may require special shoes or braces

Surgery

- If deformity is severe or doesn't respond to Ponseti Method surgeons may lengthen tendons to achieve position and casting up to 2 months followed by bracing for a year to prevent recurrence.

Nursing Considerations

- Education and anticipatory guidance – reinforcement that children are expected to develop normally and participate in normal activities. Club foot is most often an isolated condition
- Prepare child and family for disruptions in care dressing, rest and play due to serial casting and bracing. Reinforce that children adapt to changes within 24-48hrs
- Educate regarding skin, neurovascular and pain assessments to prevent potential problems. Positioning, bathing and skin care must be clearly addressed both verbally and with written instructions
- Provide contact information for questions/concerns
- Reduction of pain/discomfort
- Provide calm, warm environment with parental involvement
- If TAL (Tendo Achilles Lengthening) is required pre-medicate with topical anesthesia
- Distraction and relaxation
- If surgery: pain management includes elevation of limbs, provision of analgesia and neurovascular assessment every 2 hours
- Patient advocacy
- Continual support and frequent reinforcement of treatment protocol, follow up phone calls to address concerns and facilitate parent support networks

Questions

1. Foot deformities present at birth are caused when tissues connecting muscles to the bone (tendons) are shorter than usual. True or false?
2. All of the following are potential presentations of club foot except:
 - a. Idiopathic in nature
 - b. Painful in nature
 - c. Top of foot is usually twisted downward and inward
 - d. Calf muscle is usually underdeveloped

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DEGENERATIVE CONDITIONS

Chondromalacia Patella (Patellofemoral Pain Syndrome)

Definition

- Often referred to as “runners knee”
- Cartilage under the kneecap deteriorates and softens
- Dull aching pain or tenderness in front of your knee aggravated by stairs, kneeling, squatting or sitting with knee bent for long periods of time
- Grinding or cracking sensation in the knee

Manifestations

- Overuse - repetitive actions (running or jumping) causes irritation under the kneecap
- Poor alignment due to congenital conditions
- Muscle imbalances/weaknesses – inability of muscles around hip and knee to keep kneecap aligned
- Injury – trauma such as dislocation or fracture
- Surgery – surgeries such as ACL with patellar tendon grafts

Predisposing Factors

- Age – typically young adults
- Gender –two times more females than males (wider pelvis increases the angle where the bones of the knee joint meet)
- Sports – running and jumping activities increases stress on the knee
- Flat footedness – increases stress to knees more than people with higher arches
- Arthritis

Diagnosis

- History of knee problems, swelling, tenderness, alignment of knee to femur
- Physical exam
- Diagnostic tests –X-rays
- CT scan
- MRI scan

Treatment

Conservative measures

- Rest – avoid activities that aggravate symptoms
- Acetaminophen/NSAIDS
- Physio – muscle strengthening, hamstring and hip muscles
- Bracing
- Taping
- Ice
- Knee friendly sports/non-weight bearing activities (cycling, swimming, water sports)

If conservative measures fail:

- Surgery (scope or realignment procedures for more severe cases)

Considerations for Orthopaedic Nurses

- Pain management
- Exercise promotion and good body mechanics
- Patient education re disease, progression and care of bracing supports
- Coping strategies (self-management – be organized, manage pain and fatigue, stay active, balance activity with rest, balanced diet, improve sleep)

Questions

1. Chondromalacia Patella (Patellofemoral Pain Syndrome) is often referred to as “runners knee.” True or false?
2. All of the following statements are true except:
 - a. Some of causes include: overuse; repetitive actions (running or jumping) causes irritation under the kneecap; poor alignment due to congenital conditions
 - b. Treatment includes conservative measures such as rest and avoiding activities that aggravate symptoms
 - c. Diagnostics include: history of knee problems, swelling, tenderness, alignment of knee to femur, a physical exam, and X-rays
 - d. Higher arches increases stress to knees

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Degenerative Disc Disease

Increased wear on intervertebral discs over time is a natural progression with age, but becomes problematic when it is accompanied by pain. As the discs shrink in size, the lack of cushioning can cause pressure on the nerve roots, causing acute neck, back or leg pain. Symptoms vary based on the location of the affected disc(s). Is not life-threatening but a life-modifying condition.

Treatment:

- Initially, conservative management includes modifying lifestyle activities, physiotherapy, heat & ice modalities and anti-inflammatory medications
- Steroids (oral or epidural injections)
- Alternative therapies: Acupuncture, massage, prolotherapy, rolfing, yoga, and spinal decompression with chiropractic care
- IDET (*IntraDiscal ElectroThermal Annuloplasty*): an electrode is placed inside a disc and an electric current (heat) is passed through the disc, reducing pain
- Surgical Intervention (spinal fusion with or without instrumentation on the involved discs) may be performed if other treatments have been exhausted

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Osteoarthritis (OA)

Definition

OA is defined as slowly progressive degeneration and loss of the hyaline cartilage leading to a narrowing of the joint space, and grinding and wear of the joint surface down to subchondral bone. This condition leads to the formation of bone spurs called osteophytes, small abnormal bony outgrowths that inhibit movement.

Population

- Most common type of arthritis joint disease
- Affects 1 in 10 Canadian adults
- Most common reason for disability in persons over age 65, but it can occur at any age.
- Twice as common in obese people
- More common as we age but people of any age can get OA
- Familial tendency
- More common in women than men
- May be a result of several conditions including trauma, metabolic disease, over use of the joint, inflammation, infection, joint instability, and increased body weight
- When no predisposing cause can be found, it is called primary OA
- When the predisposing cause is known, it is called secondary OA

Manifestations

- Progresses slowly over a period of months to years
- Pain, stiffness, and swelling around joints, that lasts longer than two weeks
- May affect the spine, hips, knees, hands and shoulders. May be asymmetric
- Slow progression of localized pain
- Limitation of joint motion
- May hear grating sound and see swelling at the affected joints

Treatment

- Heat - heat to relax aching muscles and decrease joint pain and soreness.
- Cold - cold lessens pain and swelling
- Protect joints by avoiding heavy work, using proper body mechanics and using helpful devices i.e. Grab bars, etc.
- Weight loss. The risk of obesity increases when activity is limited by pain.
- Pain management: may include Non-steroidal anti-inflammatory drugs (NSAIDs), Tylenol and other analgesics, glucosamine and chondroitin sulfate, or steroid injections into the joint. Coxib anti-inflammatories are superior to traditional NSAIDs because there is less GI irritation
- Topical Medication (non-prescription) may help decrease pain and inflammation though there is limited evidence to support this
- Topical Medications (NSAIDs) (prescription) such as Pennsaid may be a reasonable alternative for people who cannot tolerate oral medication
- Viscosupplementation –involves a series of intra-articular injections of hyaluronic acid, a clear gel-like substance. Can be a single injection or a series of injections. It can restore the elastic and viscous properties of synovium that have been disrupted in the degenerative joint. The exact mechanism of action of viscosupplementation is unclear. Most effective in early OA.
- Knee braces to offload weight, thus reducing the wear and tear on the joint.

- The use of a cane for stabilization and offloading of the joint
- Physiotherapy to improve muscle strength, balance and range of motion
- Osteotomy may be indicated to realign the pressure points within the joint and temporarily improve pain and joint motion. See Osteotomy Rapid Review
- Joint replacement or resurfacing. See Knee and Hip Joint replacement Rapid Reviews

Considerations for Orthopaedic Nurses

Patients are often in the late stage of their joint disease when they are admitted for surgery. They may have experienced chronic pain leading to diminished socialization and decreased quality of life.

It is important to assess for the following:

- Pain management strategies currently in place. Tolerance to opioids due to long-term use. May need increased dosing of analgesia to control pain.
- Adverse effects from traditional NSAIDS are common – particularly gastrointestinal irritation, and renal impairment. Older adults are more at risk for these adverse effects.
- The impact of pain on ADLs, sleep, appetite, mood and relationships with others.
- Depression is a frequent companion to chronic pain and without treatment may delay recovery.
- The use of alcohol and non-prescription drugs to cope with pain.
- Nutritional status. People who are overweight or undernourished may benefit from a nutritional consult.

Questions

1. Patients with osteoarthritis coming for orthopaedic surgery are often in the late stage of their joint disease:
 - a. True
 - b. False
2. Osteoarthritis maybe the result of any of the following except:
 - a. Overuse of the joint
 - b. Infection and inflammation
 - c. Increased body weight
 - d. Diabetes
3. Considerations in managing OA pain include all of the following except:
 - a. Opioid tolerance may occur
 - b. Depression is common
 - c. Coxibs increase GI irritation
 - d. Sleep disturbance may exacerbate pain.

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Spinal Stenosis

Definition

A stenosis by definition is a narrowing of a hollow tubular structure. A spinal stenosis is a narrowing of the spinal canal, nerve root canals, or intervertebral foramina. Lumbar sacral and cervical stenoses are much more common than those in the thoracic (middle portion) of the spine. Three types of stenosis occur:

1. Local, affecting only one nerve root on one side of the body
2. Segmental, involving one specific area in the lumbar region
3. Generalized involving a large part of the lumbar spine from excess bone, soft tissues or a combination of the two

Population

- Spinal stenosis is often a part of the general arthritic degeneration that occurs with ageing. Commonly affects those over 60 years.
- Other causes: congenital, developmental (forming during growth and development), trauma (from a fracture pushing a bone or soft tissue into the spinal canal or neural foramen), tumours.

Manifestations

-
- Intensity and presentation varies depending upon the severity and location of the stenosis
 - Bilateral leg pain after exercising or walking for a variable period of time
 - Pain may be relieved by bending forward or flexing knee
 - The most common pain pattern is neurological claudication, presenting as leg pain after walking, which is relieved by sitting or squatting

Investigations

- Radiology, MRI, or CT scan findings may confirm diagnosis

Management

- Conservative approaches are tried first with medication and exercise programmes, analgesics, NSAIDS, muscle relaxants. TENS, heat, ice, massage, brace or corset, weight loss in indicated, and abdominal strengthening exercises, lifting restrictions, etc.
- Surgical intervention may include a decompression of spinal cord and or vertebral fusion.

Considerations for Orthopaedic Nurses

- Determine whether the person is experiencing neuropathic pain and ensure that the appropriate pain management modalities are in place.
- Some patients may have difficulty adhering to activity restrictions. Ensure that they are clear on what the limitations are and reinforce the importance and rationale for any restrictions.

Questions

1. Which of the following is false regarding spinal stenosis:
 - a. May be caused by arthritis
 - b. Pain radiates down one leg after walking
 - c. Pain may be relieved by bending forward or flexing knee
 - d. Conservative treatment is tried first
2. The term spinal stenosis best describes:
 - a. Narrowing of the spinal canal in the lumbar sacral region
 - b. Forward slippage of one vertebral body over another
 - c. Narrowing of the spinal canal in the thoracic lumbar region
 - d. Extrusion of disc material applying pressure on the spinal nerves.

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Spondylolisthesis

Definition

Spondylolisthesis describes the forward slippage of one vertebral body over another. This may occur at any level of the spine and is most common at the L4-L5 or L5-S1 level. There are numerous causes; congenital (especially spina bifida occulta), spondylosis, degeneration of the facet joints, trauma and bone tumour. It is usually the result of degenerative of the intervertebral disc. It may also be caused by an acute or chronic stress fracture involving part of the vertebral body.

Note: Spondylolysis only refers to the separation of the pars interarticularis (a small bony arch in the back of the spine **between** the facet joints), whereas spondylolisthesis refers to anterior slippage of one vertebra over another (in front of the spine). Literally, 'spondy' refers to the vertebrae and 'listhesis' means to slip.

Population

- Seen in a wide spectrum of patients from children to elderly

Manifestations

- May be asymptomatic
- Local signs and symptoms include: low back pain, step evident in lumbar region, prominent buttocks
- Neurological signs and symptoms may include: pain radiating down one or both legs, weakness, bowel or bladder dysfunction

Investigations

-
- Radiographs, AP and lateral X-rays along with flexion and extension views, gives some idea of the degree of instability present. Bone scan, CT scan and MRI may help confirm diagnosis and help visualize any defect and ascertain its severity

Management

- Conservative treatment focuses on elimination of pain, preparation for return to full activities, prevention of recurrence. Often involves NSAIDs, analgesics, physical therapy, activity modification, and weight loss if applicable. (Bracing is not used in adult patients as it tends to decondition the muscles)
- In patients with intractable symptoms, surgical interventions include decompression of the neural elements such as nerve roots with instrumented fusion of the vertebrae. Persistent unresponsive disabling back pain after conservative management is often considered an indication for surgical intervention. Traumatic spondylolisthesis almost always requires surgical stabilization

Questions

1. The term spondylolisthesis describes the:
 - a. Backward slippage of one vertebral over another
 - b. Protrusion of disc onto spinal nerve root
 - c. Forward slippage of one vertebral body over another that may cause low back pain.
2. Spondylolisthesis neurological signs may include all of the following except
 - a. Pain radiating down one or both legs
 - b. Weakness
 - c. Prominent buttocks
 - d. Bowel or bladder dysfunction
3. Spondylolisthesis may occur at any level of the spine but the most common site is:
 - a. L4-L5 or L5-S1 level
 - b. C5-C6 or C6-C7 level
 - c. L3-L4 or L4-L5 level
4. The most common treatment for spondylolisthesis are the following except:
 - a. Use of NSAID's and analgesic for pain
 - b. Physical activity and activity modification
 - c. Weight loss if indicated
 - d. Bed rest for 72 hours

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DEVELOPMENTAL CONDITIONS

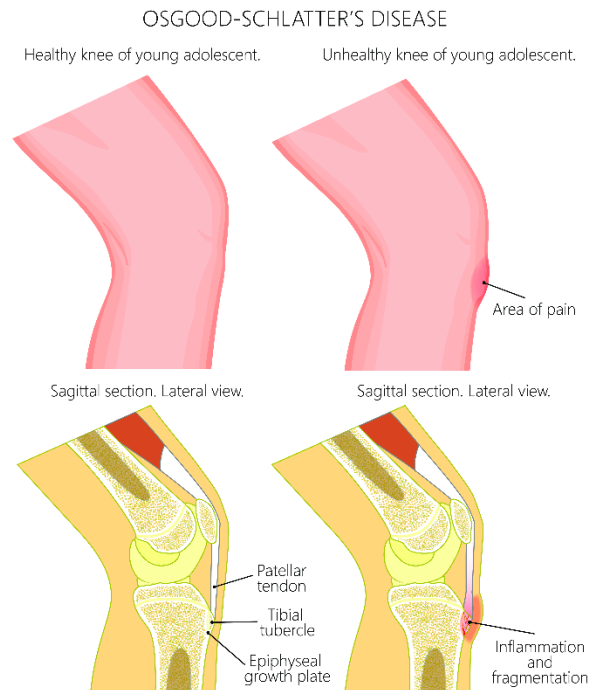
Osgood-Schlatter Disease (OSD)

Inflammation at tendon to growth plate (at the tibial tubercle) which causes painful swelling of the knee. Although this condition is usually self-limiting, rare complications can occur such as persistent enlargement of the tibial tubercle that causes a bony prominence.

- Rapid growth and increased physical activity predispose the early adolescent to the development of this condition
- Pain is aggravated by sports

Treatment:

- To reduce stress on the apophysis (a natural protuberance from a bone)
- Symptom management such as decreased activity and promotion of rest
- Because it is a self-limiting condition, over treatment should be avoided
- Pain relieved by icing, application of knee sleeves, NSAIDs



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Legg-Calve-Perthes

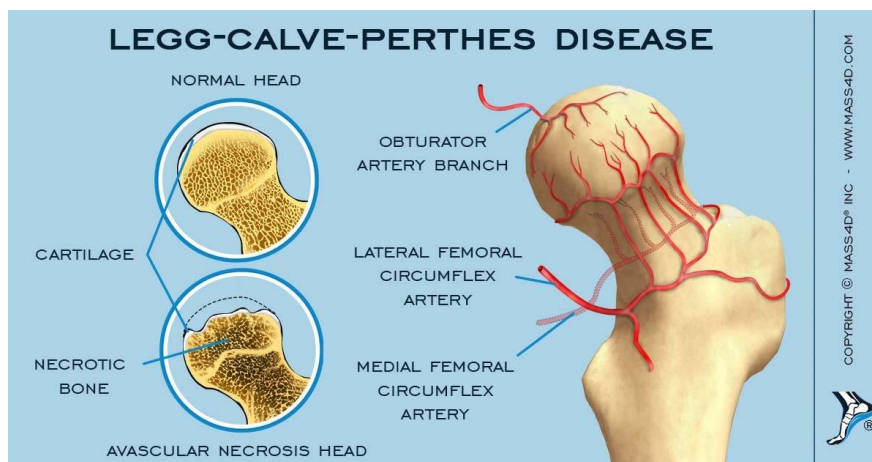
Legg-Calve-Perthes disease is an idiopathic juvenile avascular necrosis of the femoral head. Due to poor vasculature, blood supply to the area is compromised and the bone breaks easily and heals poorly. Goal in treatment is to preserve the sphericity of the femoral head to reduce the risk of stiffness and degenerative arthritis.

Manifestations

- Pain localized to the hip, groin, medial thigh or knee
- Typically presents when the child is 4-8 years of age
- More common in males than females
- Child may have had a limp for several months
- Limited range of motion of the hip joint
- Stages (seen radiographically):
 1. Initial: failure of the femoral head to increase in size due to lack of blood supply
 2. Fragmentation: the bony epiphysis begins to fragment (repair)
 3. Re-ossification: normal bone density returns, alterations in the shape of the head and neck become apparent
 4. Healed: the proximal femur may have residual deformity from the disease & repair process

Treatment:

- Rest
- Traction (if pain is severe)
- Cast (to keep the femoral head deep within its socket) – typically 4-6 weeks
- Surgery (typically for older children): includes a varus osteotomy of the proximal femur, and innominate osteotomy of the pelvis to better position the femoral head in the acetabulum



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Slipped capital femoral epiphysis (SCFE)

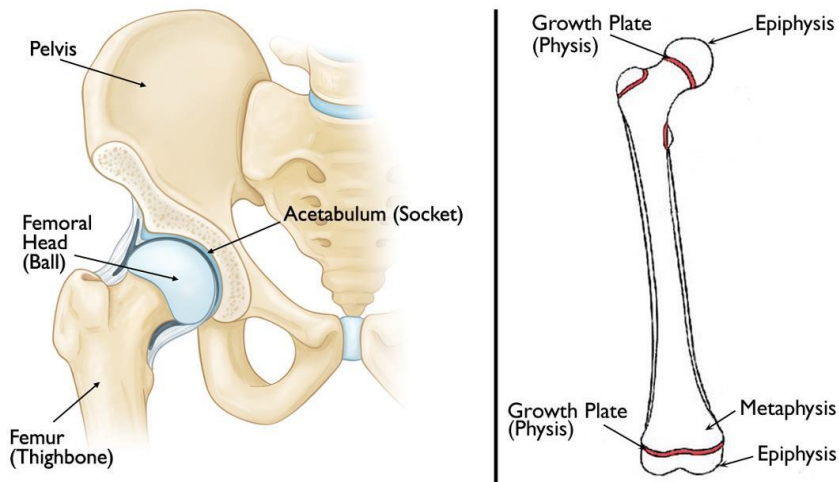
SCFE occurs when the ball at the head of the femur slips off the neck of the bone in a backwards direction. It is a fracture through the growth plate of the proximal femoral physis that is classified as a Salter-Harris type 1 fracture.

Population

- Obesity is the greatest risk factor
- More common in males
- Occurs during a period of rapid growth (typically between the ages of 10-16).
- More common specific ethnicities: Black, Latinos or Pacific Islander descent
- Associated with some endocrine disorders (e.g. hypothyroidism, growth hormone abnormalities, panhypopituitarism, renal osteodystrophy)

Manifestations

- Chronic SCFE Symptoms: intermittent pain in the groin, hip, knee and/or thigh for several weeks or months. This pain usually worsens with activity. The patient may walk or run with a limp after a period of activity.
- Acute SCFE Symptoms: sudden onset of pain (often after a fall or injury), Inability to walk or bear weight on the affected leg, Outward turning (external rotation) of the affected leg, Discrepancy in leg length—the affected leg may appear shorter than the opposite leg
 - Acute SCFE must be treated surgically, as there is a risk of avascular necrosis and chondrolysis
- *Avascular Necrosis (AVN)*: spontaneous osteonecrosis of the knee, caused by an interruption in the blood supply to the femoral head from SCFE
- *Chondrolysis*: the articular cartilage on the surface of the hip joint degenerates very rapidly, leading to pain, deformity, and permanent loss of motion in the affected hip.



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<http://orthoinfo.aaos.org>

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INFLAMMATORY & AUTOIMMUNE DISORDERS

Ankylosing Spondylitis (AS)

Definition

Ankylosing spondylitis (AS) is a chronic, systemic, inflammatory arthritis which primarily affects the spine and pelvis. The cause is unknown, but there is a strong genetic link – 90% of individuals with AS have the HLA-B27 gene. Of note, not all individuals with HLA-B27 gene develop AS. It is for this reason that AS diagnosis cannot be made by presence of HLA-B27 gene alone.

- Inflammation occurs in the joints and ligaments, impeding movement and flexion of the spine
- Usually begins in the sacroiliac joint and spine
- Inflammation may involve eyes (25%), peripheral joints (25%), heart and lungs (1%)
- Inflammation may result in new bone formation which can cause the vertebrae to fuse
- Outcome of AS is variable – there is no cure but most patients are able to work and to maintain a high level of functioning

Population

- Three times more common in males than females
- Onset between 16-30 years of age
- Affects less than 1% of the general population
- More common in Caucasians

Manifestations

- Sacroiliitis is the hallmark feature of AS (sacroiliitis is an inflammation of one or both of your sacroiliac joints situated where your lower spine and pelvis connect)
- May experience neuropathic pain. See Neuropathic Pain Rapid Review.
- Gradual onset of 1-3 months
- Pain, stiffness in lower back/hips which may progress to upper spine, ribcage and neck
- Pain and stiffness are worse with rest and inactivity; improved with movement and exercise

Treatment

- Reduce joint inflammation to improve function and mobility
- Exercise, flexibility, strengthening, endurance, posture
 - Relaxation and coping skills

- Joint positioning, protect joints, assistive devices
- Eat well, control weight
- No cure, but early diagnosis and treatment can control pain, stiffness and reduce or prevent major deformities

Medications

- Non-Steroid Anti-Inflammatory Drugs (NSAIDs): ibuprofen, naproxen, indomethacin
- Disease Modifying Anti- Rheumatic Drugs (DMARDs) sulfasalazine, methotrexate
- (Biologics) some Biologics block tumour necrosis factor (TNF) which is a molecule that has been found in the inflamed joints of the spine
- Biologics are given by injection or infusion only. Etanercept (Enbrel), Adalimumab (Humira), Infliximab (Remicade)
- Antibiotics – effectiveness not well documented

Surgery

- Surgery for severe pain, limited movement, joint destruction
- Total hip replacement – See Hip Arthroplasty Rapid Review
- Spinal osteotomy

Considerations for Orthopaedic Nurses

- Assess for hazards of disease modifying drugs. See Rheumatoid Arthritis Rapid Review
- Ensure patient understands their disease condition
- Determine and advise on ADLs, sleep patterns, appetite, and sexual issues
- Review pain management with patients
- Physiotherapy, exercise programs
- Firm mattress
- Avoid smoking due to possibility of rib cage involvement
- Remind patients of danger of trauma which could lead to fractures of the spine.

Questions

1. Which of the following is the hallmark feature of AS:
 - a) The involvements of the sacroiliac (SI) joints.
 - b) Heart and lung involvement.
 - c) Neuropathic spinal pain.
 - d) Incapacitating rigidity of the spine.
2. All of the following are true when describing ankylosing spondylitis (AS) except:
 - a. Chronic, systemic inflammatory arthritis
 - b. 90% of individuals have the HLA-B27 gene
 - c. Has no cure
 - d. Affects the shoulder and elbow joints

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Chronic Childhood Arthritis (Juvenile Idiopathic Arthritis)

Definition

Childhood arthritis is defined as continuous inflammation of one or more joints lasting at least six weeks or longer, for which no other cause can be found.

This is often called Juvenile Idiopathic Arthritis (JIA) or Juvenile Rheumatoid Arthritis (JRA).

Population

- Approximately one in 1,000 children under the age of 16 suffers from arthritis
- Twice as many girls as boys have childhood arthritis
- Less common in North Americans of Chinese ancestry
- There is a genetic predisposition to certain types of childhood arthritis
- The cause is unknown. Possible causes may include infection, autoimmunity, trauma, and stress.

Manifestations

- Common features are joint inflammation, joint contracture, joint damage and altered growth. If arthritis is severe, a slowing of growth may occur. There

- may also be a faster rate of bone growth at the affected joint causing one limb to be longer than the other.
- Inflammation inside the eye can occur in children with arthritis. Generally, this is asymptomatic; therefore regular eye checks are important
 - Pain is not always associated with childhood arthritis.

Types of Childhood Arthritis

Systemic Arthritis

- Less common but often more severe
- Any number of joints can be involved and can affect any joint
- Boys and girls affected equally
- Children often have spiking fever and a rash. They appear listless and unwell; they may have swollen lymph glands, and enlargement of the liver and spleen. Joint inflammation may accompany the fever or may not start for several weeks.
- Can affect internal organs, such as heart, liver, spleen and lymph nodes, but usually not the eyes.

Pauciarticular Onset Juvenile Arthritis

- Most common form of Juvenile Arthritis.
- Four or fewer joints are affected.
- Girls are affected more commonly than boys.
- Usually affects the large joints, knees, ankles or elbows and is usually one sided.
- Painless joint swelling with little redness.
- Rash is absent.
- Little or no disturbance to general health or growth.
- Up to 50% of these children will develop eye inflammation.

Polyarticular Onset Juvenile Arthritis

- Five or more joints are affected
- Girls are affected more commonly than boys (2:1)
- Usually starts in several joints at the same time and is usually symmetrical
- Can affect any joint, but usually there is symmetrical involvement of the small joints
- Stiffness and minimal joint swelling
- Rash is rarely seen
- Rheumatoid nodules on elbow or other body areas receiving pressure from shoes etc.
- Duration lasts from six months to many years.

Psoriatic Arthritis

- This arthritis is associated with psoriasis. The child may not have psoriasis but there may be a family history
- Large and small joints are involved. It is usually asymmetrical and scattered.
- Pitting of nails is seen in 75% of children
- Enthesitis (inflammation at the site of the ligaments, tendon, fascia or capsule to bone) is a common feature
- Inflammatory arthritis associated with psoriasis affecting the axial spine, asymmetric peripheral joints, and peri-articular structures.
- Cause is unknown, but suspected to be a combination of immunologic, genetic and environmental factors (Streptococcus and HIV)
- Psoriasis found on knees, elbows, trunk, umbilical area and/or scalp or hairline, and includes pitted, ridged and partially discoloured nails
- Psoriatic Arthritis is accompanied by a high prevalence of joint damage and associated loss of motion
- Asymmetric swelling (“sausage digit”) and erythema are noted in small peripheral joints

Diagnosis:

- RF (serum), patient will typically have a history of nail changes including pitting of nails with appearance of fungal infection, and the development of pruritic silver scales on patches of bright red skin.

Treatment:

- Goals of care include symptom relief, disease suppression, and rehabilitation
- Treatment remains suppressive rather than curative
- Generally, begin with NSAIDs to address pain and inflammation. Patients with aggressive or potentially destructive disease need early treatment with DMARDs (disease-modifying anti-rheumatic drugs) or biologics. Given its efficacy and tolerability methotrexate is often the first choice.
- Physical and occupational therapy often are needed to protect involved joints and maintain function

Spondyloarthropathy

- Generally affects children over the age of 10 and more common in boys
- Involves a few joints in the lower limbs and commonly affects the hips
- Enthesitis is often present
- One of the few types of arthritis that may be hereditary
- Many children with a Spondyloarthropathy test positive for the gene HLA-B27
- Pain and stiffness of the back may be a complaint later in the disease

Treatment

Early and aggressive treatment is the current approach to arthritis management (Rheumatoid Arthritis Rapid Review for more information on drug therapy)

- The goals of treatment are to prevent or control joint damage, control inflammation, relieve pain and maximize functional ability
- Physiotherapy and occupational therapy are essential in the treatment program to minimize joint damage and to preserve function
- Surgery is rarely used in the early stages of the disease. In older children with advanced disease, joint replacement may be warranted. Soft tissue releases may be used to improve position of a joint

Considerations for Orthopaedic Nurses

- These adolescents have lived with their disease for many years. They are often very knowledgeable and have very good coping strategies. They need to be informed of all procedures and involved in treatment plans
- The under reporting of pain may occur in some of the patients as their experience with pain may be longstanding
- Most of these adolescents have never been hospitalized before and may hesitate to ask questions
- Adolescents with arthritis are struggling to appear “normal” and may not have told their peers about their disease
- Being excluded from their circle of friends and activities due to surgery and rehab can be quite stressful

Questions

1. Which of the following is true about Psoriatic Arthritis?
 - a. Psoriasis is present for all patients
 - b. Pitting of the nails is common
 - c. Affects symmetrical joints
 - d. Affects large joints only

2. Which of the following is true about Spondyloarthritis?
 - a. Leads to slowing of bone growth
 - b. It is more common in boys
 - c. It is more common in North Americans of Chinese ancestry
 - d. Pain is always present

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Rheumatoid Arthritis (RA)

Definition

Rheumatoid Arthritis (RA) is a systemic inflammatory disease characterized by the involvement of multiple joints. RA may affect other organ systems in the body as well (see systemic manifestations). The cause of RA is not known but it is thought to be the result of malfunction of the immune system. Its cause is uncertain, its course is unpredictable, and the cure is unknown.

The joints most commonly involved early in the course of RA are the small joints of the hands and feet, wrists, elbows, shoulders, knees and ankles.

- The inflammatory process in Rheumatoid Arthritis causes synovium hyperplasia and loss of cartilage and bone resulting in damage to the joints
- Synovitis is associated with pain, swelling, and inflammation in and around the joints
- In many patients, the synovium hypertrophies dramatically and can invade and erode cartilage, bone and adjacent structures (pannus)

Population

- About one in every 100 adult Canadians has RA
- Women are three times more affected than men.
- RA can occur at any age, but the onset of RA in women is often much younger than men
- The peak incidence in women is between the fourth and sixth decades
- Affects approximately 1% of the population.

Manifestations

Patient history, physical examination, x-rays and blood tests Rheumatoid Factor (RF) and Cyclic Citrullinated Peptide (CCP antibody) may help confirm a diagnosis of RA. There are two manifestations of Rheumatoid Arthritis, joint and systemic.

Joint

- Signs of synovial inflammation may be subtle and are often subjective
- Warm, swollen and obviously inflamed joints are usually seen in the active phase
- Stiffness in and around joints in the morning and after periods of rest lasts more than 30 minutes. The duration of morning stiffness correlates with the degree of synovial inflammation and disappears with remission
- Persistent joint pain can be both acute and chronic in nature. Person may have experienced prolonged periods of unrelieved pain due to failures of pharmacologic and/or surgical interventions
- Wrists are affected in almost all patients
- Metacarpophalangeal joint (MCP) and proximal interphalangeal joints (PIP) are often involved
- Cervical spine involvement is common
- Shoulder joint involvement often interferes with sleep
- Hip and knee involvement is common. Weight-bearing foot and ankle joints cause greater functional impairment and pain than in the upper extremity joints
- Inflammation of the elbow joint is common and easy to detect
- Joint space narrowing due to loss of cartilage and erosion of peri-articular bone may be detected on X-ray
- Flexion deformities may develop in early stages
- “Bone-on-bone” crepitus, a high-pitched screech may be heard with mobility

Systemic

- Significant inflammation of other organ systems can occur and is seen predominantly in people who are serum rheumatoid factor positive. Systems affected include the skin, respiratory, cardiovascular, gastrointestinal, renal, neurologic, hematologic and eyes
- Hypochromic-microcytic anemia is an almost universal finding in patients with active RA. See Anemia Rapid Review
- Fatigue is generally present
- Pain is associated with depression, anxiety, stress, and fear of unpredictable flares
- High risk of neuropathic pain with advanced disease. See Neuropathic Pain Rapid Review

Treatment

Early and aggressive treatment is the current approach to RA management

May require up to five different types of medications at a time depending on disease severity.

- NSAIDS to help control pain & inflammation.
- Acetaminophen
- Cortisone – prednisone for short or long term systemic relief of inflammation
- Joint injections for swelling and pain relief
- Diseases modifying anti-rheumatic drugs (DMARDS) to control disease activity & progression
- Biologic Response Modifiers – to control disease activity & progression

DMARDs (disease modifying anti-rheumatic drugs)

- Most commonly used include Hydroxychloroquine (Plaquenil), Methotrexate, Gold, Sulfasalazine, Cyclosporine, and Leflunomide
- Approximately 25% of patients with RA are on combinations of two to three DMARDs. Evidence suggests that this approach improves both local and systemic disease, with increase in remission periods and less joint destruction
- DMARDs require regular monitoring of blood and sometimes urine for adverse effects

Biologic Response Modifiers (BRMs)

- Enbrel, Humira, & Remicade are drugs that block activated tissue necrosis factor alpha (TNF α) cytokine found in the joints of people with rheumatoid arthritis
- Kineret inhibits the cytokine interleukin 1 (IL-1)
- May be taken alone or in combination with other DMARDs. Evidence suggests that BRMs in combination with Methotrexate delays joint destruction better than the BRM alone
- For pharmacare coverage the person must have tried the standard combinations of DMARDs (BRMs are expensive)
- Tricyclic-antidepressants may be adjuvants to pain management. It is thought that they interfere with the re-uptake of serotonin and norepinephrine, thereby increasing their availability to inhibit pain transmission. A low dose is frequently prescribed to promote sleep and control pain.
- Opioid therapy may also be used to control pain for selected patients

Complementary Therapy

- Complementary and alternative therapies such as naturopathic medicine, acupuncture and meditation may be used to help manage symptoms. These therapies fall outside of traditional North American medicine
- Physical and occupational therapy interventions are used to relieve pain, minimize disability, and improve or preserve function
- Surgical interventions to restore function and control pain.

- Synovectomy – reduces swelling, pain, improves function and provides temporary pain relief
- Fusion – ankle, foot, spine, wrist joints
- Joint replacement (hands, shoulders, hips, knees)
- Cognitive-behavioural interventions to improve pain, emotional status and self-management skills

Considerations for Orthopaedic Nurses

- RA influences many facets of individuals' lives, including functional ability, work, economic status, family/ social relationships, and psychological health. The patients perceive fatigue, pain and functional impairment as having the greatest impact on the quality of life
- Education and self-management programs have the greatest impact on patient compliance with treatment. This results in a reduction of symptoms
- All disease modifying drugs may increase the risk of postoperative complications. Long-term use of corticosteroids is associated with susceptibility to infection. Long term corticosteroid use combined with systemic effects of the disease can cause connective tissue changes that make the skin and superficial blood vessels friable. Even mild pressure can cause hematoma or skin ulceration, and adhesive tape can tear the skin. Patients may require “stress-dose” steroids preoperatively because adrenal function is inhibited
- The patient's rheumatologist/physician should be consulted re postoperative monitoring and titration of steroids. Sudden cessation of steroids can lead to adrenal crises
- Cervical spine involvement should be assessed. The degrees of atlantoaxial and subaxial involvement warrant caution during intubation and positioning.
- Falls risk is increased due to immobility and deconditioning resulting from pain and deformity
- Higher incidence of osteoporosis due to the use of steroids and immobility

The systemic manifestations of rheumatoid arthritis

Ocular

- *Keratoconjunctivitis*: when the cornea and conjunctiva is inflamed (Lacrimal and salivary gland secretion are significantly reduced in patients with RA, causing dry eyes)
- *Sjogren's Syndrome*: a disorder of your immune system identified by its two most common symptoms — dry eyes and a dry mouth.

Gastrointestinal

Higher levels of inflammation and medications used to treat RA contribute to GI issues

- Fibromyalgia - abdominal pain, bloating, and alternating constipation and diarrhea (irritable bowel syndrome)

- Imbalance of intestinal bacteria contributes to constipation (66%) or diarrhea (11%)
- ↑ NSAIDs use can lead to upper-GI events (mouth →stomach) include bleeding, GI perforation, ulcers, obstruction and esophagitis
- ↑ Corticosteroid use can lead to lower-GI events (large and small intestines) include bleeding, perforation, ulcers, obstruction, diverticulitis and colitis

Cardiopulmonary

- Obstructive airway disease (even in the absence of smoking)
- Rheumatoid nodules in the lungs can create cavitation similar to cancer or infection.
- Pericarditis – patients present with chest pain, fever, and a pericardial rub that may resolve spontaneously

Musculoskeletal changes

- Sensory peripheral neuropathy
- Deformities of the hand result in diminished grasp
- RA in foot and ankle results in pronation deformities, eversion of the foot (caused by erosion of ligaments) and burning paresthesia on the sole of the foot.

Hypochromic-microcytic anemia (HCMC)

Body has low levels of red blood cells that are both smaller and paler than normal.

Questions

1. The onset of RA in women is much younger than men:
 - a. True
 - b. False

2. Rheumatoid Arthritis is a disease caused by abnormalities in which system of the body?
 - a. Nervous system
 - b. Immune system
 - c. Digestive system
 - d. Respiratory system

3. The two most common physical manifestation of rheumatoid arthritis are:
 - a. Inflamed joints (synovial inflammation), systemic organ involvement
 - b. Joint deterioration, inflamed synovium
 - c. Joint pain, immobility
 - d. Inflamed joints, depression

4. The four common treatment options for Rheumatoid Arthritis are:
 - a. Pharmacological interventions, cognitive behavior interventions, surgical interventions and physical therapy
 - b. NSAIDs, Cortisone, DMARDS and physical therapy
 - c. Biologic Response Modifiers, NSAIDs, surgical intervention and physical therapy
 - d. Pharmacological intervention, antidepressants, surgery and exercise

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Systemic Lupus Erythematosus (SLE)

Definition

SLE is a chronic autoimmune disease of unknown cause that affects 1 in every 1,000 Canadians (approximately 15,000 Canadians). In SLE the immune system malfunctions and generates antibodies that attack healthy tissue. Inflamed tissues produce the symptoms that characterize lupus.

- External factors such as viruses, sun exposure, medications, prolonged and severe stress are thought to trigger the onset of SLE
- Inflammation can occur in the skin, muscles, joints, heart, lungs, kidneys, blood vessels, and the nervous system
- SLE can fluctuate between exacerbations and remissions
- Other types of lupus are discoid lupus erythematosus (DLE) and subacute cutaneous lupus (SCLE). In DLE and SCLE, skin rashes and sun sensitivity are the primary symptoms. Although there are no internal organ problems in DLE and SCLE, approximately 10% will go on to develop SLE

Population

- Men, women and children can be diagnosed with SLE but it is far more common in women
- Nine times more women than men are diagnosed with Lupus and the common age of diagnosis is in the child bearing years, age fifteen to forty-five

Manifestations

SLE is known as the disease of 1000 faces as it can target several organs and each person has their own combination of symptoms ranging from mild to severe. Diagnosis is often difficult and is made over a period of time.

Based on abnormal antibodies, plus any four of the main features of SLE listed below.

- A red rash called a butterfly rash across the cheeks and bridge of the nose
- Photosensitivity or an unusually extreme reaction to sunlight
- Presence of a red, scaly rash on the face, scalp, ears, arms or chest called discoid lupus
- Small, usually painless sores in the moist lining of the mouth or nose called mucosal ulcers
- Painful arthritis of the joints of the hands, arms, shoulders, feet, knees, hips, or jaw. The pain may move from joint to joint and may be accompanied by heat, redness, and swelling
- Pleuritis, an inflammation of the lining of the lungs or pericarditis, an inflammation of the lining of the heart, which will cause chest pain when lying down or taking deep breaths
- Decreased kidney function, which may be mild or severe. Weight gain or swelling of the feet and legs may indicate kidney involvement.
- Central nervous system involvement exhibited by memory impairment, seizures or psychosis

- Decreased red blood cells, white blood cells, or platelets
- The presence of any autoantibodies pointing to an immune abnormality such as:
 - o LE cell
 - o Anti-native DNA autoantibodies
 - o Anti-Sm autoantibodies
 - o A false-positive test for syphilis
 - o The presence of antinuclear antibodies in the blood.
- Psychological concerns:
 - o Pain, fatigue, side effects of medications and stress diminish quality of life and may lead to self-image disturbances and depression

Treatment

The goal of treatment is disease and symptom control. The treatment plan is always based on the type and severity of symptoms. Some people with SLE may require no treatment if their symptoms are not severe and the disease is mild, however, continued medical follow-up is always necessary.

Medications commonly used depend on the organ(s) involved and the degree of involvement. Early treatment can reduce the chance of permanent tissue damage and may reduce the amount of time a person with SLE needs to stay on high doses of a medication. Commonly prescribed medications include the following:

1. **Acetaminophen** is often used to manage the pain of arthritis associated with SLE.
2. **Non-steroidal anti-inflammatory drugs (NSAIDs)** are often used when acetaminophen does not control the pain of arthritis. They decrease inflammation. They may have gastrointestinal, renal and cognitive adverse effects which can imitate or exacerbate lupus. Cox 2 NSAIDs may have fewer side effects.
3. **Corticosteroids** have anti-inflammatory properties and can influence regulation of the immune system.
 - Used when symptoms are not well controlled by other treatments, to prevent an imminent flare-up, or the disease is severe
 - Side effects increase with dose and duration of therapy. They include mood swings, weight gain, a round face, easy bruising, acne, osteoporosis, high blood pressure, onset of diabetes, increased risk of infections and stomach ulcers
 - Careful monitoring of its many side effects is essential
 - The goal is to maintain the person on the lowest dose that will achieve an optimal anti-inflammatory and anti-immune response
 - These drugs should not be discontinued abruptly

4. **Disease-modifying anti-rheumatic drugs (DMARDs) such as Anti-malarials**, including Chloroquine and Hydroxychloroquine, have been found to be effective in managing fatigue, skin rashes, and joint pain.
 - May take several months to experience therapeutic benefits
 - Stomach upset is the main side effect
 - A loss of vision can occur with the use of some anti-malarials taken in high doses for long periods of time. An eye examination before commencing this medication is necessary and yearly eye examinations are advised
5. **Cytotoxic or immunosuppressive drugs, such as** Cyclophosphamide and Azathioprine, suppress inflammation and the immune system. They are prescribed when Prednisone is not well tolerated or not effective.
 - Adverse reactions are serious and include decreased blood cell counts, increased risk of infection, and a risk of developing certain types of cancer
 - Regular blood tests and close monitoring by physician is advised
 - Cyclophosphamide may be given intravenously for persons with severe kidney disease to reduce inflammation and side effects of immunosuppressive drugs

Controlling Flares

Self-management is a key strategy in managing the disease, and preventing and controlling flares.

- The pattern of lupus flare ups tends to be unique. Patients can learn to recognize early signs of flare ups which can lead to more effective treatment.
- Sun exposure, excessive fatigue, uncontrolled stress, poor diet, smoking, or excessive alcohol use are all factors, which contribute to flare ups.
- Lifestyle changes will contribute to better overall management of SLE. Steps to take include:
 - o Regular application of sunscreen
 - o Regular exercise
 - o Routine immunizations
 - o Eating a well-balanced diet
 - o Seeking support and counseling for dealing with stress
 - o Learning about the disease of SLE and its management
 - o Consulting a physician about birth control
 - o Choosing the best time for pregnancy
 - o Using appropriate judgment about complementary therapies

Considerations for Orthopaedic Nurses

- Surgery may exacerbate the symptoms of SLE
- There are currently no specific dietary recommendations for persons with SLE, although a restricted diet plan may be prescribed when fluid retention, hypertension, kidney disease, or other problems are present
- Cardinal signs of infection may be masked by SLE treatments
- Objective data, such as sedimentation rate or anemia, may not support subjective reports of fatigue or pain
- No two lupus patients are alike. Management is based on illness and symptom severity
- Observe and report depression or concerns with mood
- The patient will tell you if something unusual or new is occurring with regard to their illness. View them as the expert
- Nursing role is to coach patients in self-management, life style, medications, recognizing and preventing flares

Questions

1. SLE is known as the disease of 1,000 faces as it can target several organs and each person has their own combination of symptoms ranging from mild to severe and diagnosis is often difficult. True or false?
2. Which of the following statements is true?
 - a. Objective data, such as sedimentation rate or anemia, supports subjective reports of fatigue or pain
 - b. No two lupus patients are alike. Management is based on illness and symptom severity
 - c. Regular blood tests are not required
 - d. Acetaminophen is not helpful in the management of pain of arthritis associated with SLE

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Systemic Sclerosis (Scleroderma)

Definition

Systemic Sclerosis is a multi-system autoimmune disease characterized by abnormal vasculopathy, fibrosis of internal organs and connective tissue, and impairment of antibodies. Due to the skin characteristics, it is also termed scleroderma.

Excessive production of collagen affecting skin, gastrointestinal, lungs and kidneys.

- Small-vessel endothelial cell damage produces blood vessel fibrosis and ischemic injury
- Abnormal activation of the immune system → T cells accumulate in skin and release cytokines → attract inflammatory cells that result in collagen synthesis and development of fibrosis

Localized Scleroderma (most common): skin changes are confined to the face, fingers and distal extremities with no trunk or internal organ involvement. Accompanied by CREST syndrome:

- Calcinosis: calcium deposits on the skin
 - Raynaud's Phenomenon: vasospasm of small blood vessels in peripheral structures (fingertips, toes, nose, ears) that results in numbness & cold sensation
 - Esophageal Dysmotility
 - Sclerodactyly: thickening and tightening of the skin on digits with loss of skin folds
 - Telangiectasias: capillary dilation causing red lesions on the skin
- *Diffuse Systemic Sclerosis*: severe fibrosis of the skin and diffuse disease associated with internal organ involvement
 - High morbidity and mortality

Population

- 4 times more common in women
- More common in Black, Native American and Japanese descent
- Rare in children, usually presents between the ages of 30-50.

Complications

- Skin fibrosis and flexion contractures (loss of hand grasp ability)
- Trophic ulcers of the fingers
- Skin fibrosis around the mouth (results in difficulty eating)
- Malabsorption syndrome and peritonitis
- Pulmonary fibrosis, pulmonary hypertension and congestive heart failure (CHF)

Treatment

- No medication significantly alters the course of the condition but pharmacologic treatment can address symptoms and dysfunctional organs.
- NSAIDs can be used to address arthritis symptoms. Corticosteroids may be helpful for myositis or mixed connective tissue disease, but may predispose the patient to renal crisis.
- Immunosuppressants such as methotrexate, azathioprine, cyclophosphamide may be prescribed to alleviate pulmonary alveolitis.
- Physical therapy can help with progressive diffused disease and joint contractures.
- Regular exercise helps improve joint flexibility and circulation
- Diet should focus on maintaining the patient's weight and decreasing elimination and reflux problems (small, frequent meals with high-calorie, high-fibre foods)

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METABOLIC DISORDERS

Gout

Gout is an acute form of inflammatory arthritis caused by monosodium urate crystal deposits in articular, periarticular, and subcutaneous tissues. Crystals are deposited in a joint because decreased temperature of peripheral structures (e.g. toes) allows for decreased solubility of monosodium urate. These needle-like crystals cause sudden pain, tenderness, and swelling.

Manifestations

- Severe pain to the affected joint, accompanied by redness, warmth, swelling & disability
- Gout flares are more common at night or in the early morning due to a combination of low blood cortisol levels, lower body temperature and relative dehydration
- Typically involve one joint only in the lower extremities initially. Polyarticular flares are more common in subsequent flare-ups.

Stages of Gout

1st stage: *asymptomatic hyperuricemia* (increase in serum uric acid). The period prior to the first gout attack where the patient has no symptoms.

2nd stage: *acute gouty arthritis* – deposit of uric acid crystals in joint spaces, creating sudden, intense joint pain and swelling (often occurs at night). The symptoms ease after a few days and likely dissipate over 3-10 days.

3rd stage: *interval gout*. The period between attacks in which there is no pain and low-level inflammation. This period is an opportunity to treat and manage gout before another attack (Arthritis Foundation, n.d.).

Chronic Tophaceous gout is the most disabling, marked by permanent damage to affected joints, surrounding connective tissue and kidneys.

Treatment

- NSAIDs (e.g. Indomethacin): effective in treating an acute attack
- Colchicine: effectively decreases joint pain 12-24 hours after treatment, IV does not cause GI upset
- Corticosteroids: useful for multiple joint involvement, but inflammation may continue while symptoms are masked by treatment
- Allopurinol: impairs conversion of xanthine to uric acid, inhibiting urate synthesis
 - Only drug to delay progressive joint damage associated with gout

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Hyperparathyroidism

The parathyroid glands produce parathyroid hormone, which helps sustain an appropriate balance of calcium in the bloodstream and in tissues that depend on calcium to function properly (Mayo Clinic, 2018). Parathyroid hormone is the “chief regulator of calcium homeostasis in the human body” (MacKenzie-Feder, Sirrs, Anderson, Sharif, & Khan, 2011).

Definition

This condition occurs when 1 of the 4 parathyroid glands are enlarged (National Association of Orthopaedic Nurses, 2013). Three kinds of hyperparathyroidism exist: primary, secondary, and tertiary.

Primary: benign solitary encapsulated adenoma in parathyroid gland

Secondary: hyperplasia excessive PTH production (rare, underlying disease pathology)

Tertiary: occurs after renal transplant following ESRD – all 4 parathyroid glands are enlarged

- All 4 parathyroid glands are enlarged
- Excessive secretion of PTH, interrupts the metabolism of calcium and phosphorus, leading to hypercalcemia.
 - When sensing receptors detect \uparrow Ca, \downarrow PTH secretion
 - When sensing receptors detect \downarrow Ca, \uparrow PTH secretion

Assessment

- Generalized bone weakness from osteodystrophy & defects in bone development
- Anemia
- Hypercalciuria, kidney stones, polyuria
- Hypercalcemia: anorexia, N&V, constipation, peptic ulcers, pancreatitis

- Cardiac: shortened QT interval, prolonged PR interval, dysrhythmias including heart block & cardiac arrest
- CNS: reflexes become sluggish, weakened muscles

Complications

- Hypertension and nephrolithiasis (kidney stones) are most common complications
- Bones become brittle due to osteoporosis
- Renal insufficiency and renal failure due to elevated serum calcium
- Central nervous system (CNS) disorders ranging from mild personality disorders to severe psychiatric disorders

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Osteitis Deformans (Paget's Disease)

When rapid bone resorption is followed by rapid bone formation, the structure of the bone is disorganized and susceptible to deformity, fracture and pain. Bone marrow is frequently replaced by fibrous tissue that has increased vascularity and the remodeled bone is enlarged and less compact than normal bone.

Etiology

- Genetic predisposition to a viral response that causes dormant skeletal effects
- Slightly more common in males, of European ancestry
- 2nd most common bone loss disease after osteoporosis
- Usually occurs in adults over 50

Assessment

- Early stages are typically asymptomatic; by the time the patient experiences pain, the bone deformity may be extensive, especially with weight bearing activities
- Gait may be affected due to impingement on the spinal cord nerves and root
- Most common bones affected are the skull, spine, pelvis and long bones of the legs
- Skull involvement results in an enlarges cranium, with a prominent visible frontal lobe
- Kyphosis (with a barrel shaped chest) affects cardiac and pulmonary function with advanced disease
- Bowing and hypertrophy of the femur and tibia may lead to reduced height and problems with ambulation.

Treatment

- Bisphosphonates are the primary treatment, used to decrease the rate of bone resorption
- Aspirin, NSAIDs or opioids for pain and symptom management
- Calcitonin decreases serum calcium levels by promoting calcium secretion through the kidneys. This inhibits bone resorption and decreases bone lesions. Calcitonin also has analgesic properties for bone pain.
- Surgical intervention may be needed for pathological fractures, to realign deformed bones, reduce pressure on nerves or replace joints that have been damaged by osteoarthritis.

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Osteomalacia

Also known as “Adult Rickets”, *osteomalacia* is the softening of the bone due to poor mineral content that is comprised by marked deformity of weight-bearing bones, distortion of the bone structure and possible pathologic fractures. This condition is caused by inadequate intake of vitamin D.

Population

- More common in women
- People with Vitamin D deficiencies:
 - Inadequate sunlight exposure
 - Diet low in Vitamin D
 - Chronic disease of the liver, kidney or small intestine
 - Adults taking medications that inhibit calcium & vitamin D absorption: anticonvulsants, phosphate-binding antacids, tranquilizers, sedatives, or muscle relaxants

Symptoms

- Myalgias
- Fatigue
- Muscle weakness
- Bone pain (leading to distal femur fractures)

• Osteomalacia	Osteoporosis
Impaired bone mineralization due to inadequate vitamin D dietary intake and inadequate synthesis of vitamin D in the skin due to lack of exposure to sunlight	Rate of bone reabsorption more rapid than bone formation leading to porous, fragile bones
Bone density and bone mass normal	T score representing the bone density in adults falls below -2.5 SD
Symptoms include myalgias, fatigue, muscle weakness and bone pain	No pain or symptoms reported
Vitamin D needed for intestinal absorption of calcium	Hereditary, decreased levels of estrogen and testosterone, lack of weight-bearing exercises, chronic disease, and side effects of medications can lead to osteoporosis
Less common than osteoporosis	Most common in post-menopausal aged women
Treatable and preventable with medications and exposure to sunlight to avoid vitamin D deficiency	Treatment can delay complications. With hereditary predisposition, symptoms and bone loss can be delayed with healthy diet, exercise and weight bearing exercise and medications.

*From Geriatric Review Syllabus: A Core Curriculum in Geriatric Medicine, 7th Edition by K. Prestwood, 2010.

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Osteoporosis

Definition

Osteoporosis is a skeletal disorder characterized by compromised bone strength predisposing a person to an increased risk of fracture. Bone strength reflects the integration of two main features: bone density and bone quality.

Under normal circumstances, bones are continually remodeling in a cyclical fashion of breaking down bone and rebuilding. Osteoclasts activate the remodeling process and resorb bone. Osteoblasts build new bone in the resorbed spaces.

The remodeling cycle may be disrupted by factors such as alterations in the parathyroid hormone, estrogen, lymphokines, or interferon.

Disruption of the cycle may lead to the rate of bone resorption exceeding bone formation, resulting in decreased bone mass and altered bone strength. Bones become thin and porous

Osteoporosis is often known as “the silent thief” because bone loss occurs without symptoms until the fracture occurs. Osteoporotic fractures are more in the wrist, shoulder, spine, pelvis and hip. Osteoporosis can result in disfigurement, lowered self-esteem, reduction or loss of mobility, and decreased independence.

Osteopenia (low bone mass) defined as a T score value for bone density between -1 and -2.5 SD below the mean value for young adults. People with osteopenia have weaker than normal bones, but not weak enough to characterize as osteoporosis.

Population

- Women and men alike begin to lose bone in their mid-30s; as they approach menopause, women lose bone at a greater rate, from 2-3 per cent per year
- At least **1 in 3 women** and **1 in 5 men** will suffer from an osteoporotic fracture during their lifetime

- **Each year in Canada there is about 30,000 hip fractures and many more Canadians suffer osteoporotic fractures of the spine, wrist, shoulder and pelvis**
- 1 in 2 fracture patients will suffer another fracture within 5 years
- 1 in 3 hip fracture patients will re-fracture within one year
- 28% of women and 37% of men who suffer a hip fracture will die during the following year
- 15-25% of hips fracture patients will require admission to a nursing home
- 80% of all fractures in persons over the age of 50 years are caused by osteoporosis
- **Fractures from osteoporosis are more common than heart attack, stroke and breast cancer combined**
- 80% of all fracture patients are never offered screening and/or treatment post fracture
- A **fragility fracture** is any fall from a standing height or less, that results in a fracture. Our bodies should be able to sustain a fall from this height without a fracture unless there is an underlying cause that makes the bones fragile.

Risk Factors

Detection of Fracture Risk

Osteoporosis Canada recommends women and men over the age of 50 should be assessed for risk factors for osteoporosis and fracture to identify those at high risk for fractures.

The four key risk factors for fracture are:

- a. Low Bone Mineral Density (BMD)
- b. Prior fragility fracture – minimal trauma involved
- c. Age over 65 years.
- d. Family history of osteoporosis

Risk factors for disruption in rate of bone resorption and formation are:

- High-risk medication use (glucocorticoids, aromatase inhibitors, androgen deprivation therapy, proton pump inhibitors, excessive thyroid hormone replacement, anti-seizure medication, blood pressure medications, diuretics, alpha adrenergic blockers)
- Hypogonadism or premature menopause (age <45yr)
- Malabsorption syndrome
- Primary hyperparathyroidism
- Chronic inflammatory conditions (Rheumatoid arthritis)
- Chronic Pulmonary, kidney or liver disease
- Diabetes
- Fragility fractures after the age of 40
- Parental hip fracture

- Vertebral fracture
- Osteopenia identified on X-ray
- Current smoker
- High alcohol intake
- Low body weight (<60kg) or major weight loss (>10% of body weight at age 25yrs)

Investigation

- Bone Mineral Density (BMD) – All women and men 65 years or older and all individuals who have experienced a fragility fracture
- Height measurement annually
- Vertebral X-ray if there is a 25% or more loss of height on annual measurement
- Falls assessment
- Diagnostic Lab testing to rule out secondary causes of osteoporosis

Treatment

- Goal is to provide treatment as early as possible to maintain bone health, muscle strength, balance and co-ordination through healthy eating, physical activity and the prevention of fragility fractures.
- **Pharmacological Therapy**
 1. **Bisphosphonates** bind to the surface of the bones and slows down the bone resorption (Alendronate, Etidronate, Risedronate, Zoledronic Acid)
 2. **Selective Estrogen Receptor Modulators-SERMS-** act like estrogen hormone to build and maintain bone density (Raloxifene)
 3. **Hormone Therapy (HT)**
 4. **Bone Metabolism Regulator**, an anti-absorptive therapy that inhibits osteoclast formation (Denosumab)
 5. **Parathyroid Hormone (PTH)**, a bone remodeling medication that activates osteoblast cells (Teriparatide)
- **Non-Pharmacological Interventions**
 1. **Supplements** (recommended by Osteoporosis Canada)- men and Women over 50 years require 1000-1200mg of calcium daily (including diet and supplements) & 800-2,000 IU of Vitamin D 3 daily
 2. **Nutrition** - consultation with a Dietitian. A diet rich in calcium and vitamin D is required to maintain healthy bones.
 3. **Physical activity** – consultation with Physiotherapy re strength training, posture training, balance training, weight-bearing physical activity
 4. **Falls prevention**-consultation with Falls Clinic, Occupational Therapy, Home Care recourses
 5. **Avoid smoking** - (kills osteoblasts) and alcohol (decreases absorption of calcium).

Considerations for Orthopaedic Nurses

- As so many post-menopausal and older orthopaedic patients have osteoporosis, screening for this condition and patient teaching are warranted. Early intervention may prevent a subsequent fracture
- Since the publication of the Osteoporosis Canada guidelines in 2002, there has been a paradigm shift in the prevention and treatment of osteoporosis and fractures. The focus now is on preventing fragility fractures and their negative consequences, rather than on treating low bone mineral density which is viewed as only one of several risk factors for fracture
- Provide teaching related to prevention, modifying risk factors, exercise, hip protectors, and diet. Osteoporosis Canada website is one of many resources available for nurses and the public
- Pain medications may be required. Exercise, heat and massage are a few other options for pain management

Questions

1. A fragility fracture is:
 - a. Sustained during moderately severe trauma
 - b. A fracture occurring spontaneously or following minor trauma
 - c. An increase osteoblast performance
 - d. Occurring from an underlying disease process
2. Bisphosphonates:
 - a. Add calcium to bone through absorption
 - b. Inhibit osteoclast mediated bone resorption
 - c. Increase osteoblast performance
 - d. Decrease acidity in the stomach

References

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Rickets

Rickets is a deficiency in the mineralization and formation of the growing skeleton in infants and young children (Cafasso, 2017). This is caused by inadequate calcium and phosphate prior to epiphyseal fusion. Rickets is a preventable & treatable deficiency.

Risk Factors

- Most common at 6-36 months of age
- Children with insufficient mineral digestion (celiac disease, cystic fibrosis) or kidney disease (high excretion of minerals through the kidneys)
- Vegetarian diet (that doesn't include fish, eggs, or milk)

Assessment Findings

- Restlessness at night
- Profuse diaphoresis
- Inflammation of the mucous membranes
- Frequent infections (poor immune system based on Vitamin D deficiencies)
- Diarrhea
- Stunted growth or short stature
- Delay in developmental milestones
- Teeth deformities (e.g. delayed formation, holes in the enamel)
- Bone fractures
- Skeletal deformities (e.g. enlarged cranium, bowlegs, bumps in ribcage, "pigeon breast" ribs, curved spine)
- Poor muscle tone

Treatment

- Importance of vitamin D nutritional requirements early in life, especially supplements for breastfeeding infants
- Exposure to sunlight for premature infants with feeding difficulties
- Supplemental vitamin D for children with celiac disease and cystic fibrosis due to absorption problems of calcium and vitamin D in the intestine
- Occasionally, an osteotomy is necessary after growth is complete to correct bone deformities (National Association of Orthopaedic Nurses, 2013).

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ONCOLOGY DISORDERS

Sarcoma

Definition

Sarcomas are malignant tumors of either soft tissue or bone. Tumors are staged according to size, structures involved, and presence of metastasis. The stages are denoted as:

- 1A ▪ 1B ▪ 2A ▪ 2B ▪ 3A ▪ 3B
- In general, the lower the stage (i.e. number), the better the prognosis. Accurate staging helps determine appropriate intervention
- Tumors are graded by how aggressive they are likely to be. Low-grade tumors are at low risk of metastasis, while high-grade tumors pose a higher risk of metastasis

Sarcomas are divided into two groups:

- Soft Tissue
- Bone

Soft Tissue Sarcoma

Definition

- Soft tissue sarcomas are defined according to the type of tissue they resemble

Examples of Soft Tissue Sarcomas

- Liposarcoma resembles fat. Liposarcoma is one of the most common forms of sarcoma. Surgery is recommended, radiation and rarely chemotherapy may follow
- Malignant Fibrous Histiocytoma is a common form of soft tissue tumor. Cell of origin is unknown. Tumors may range in presentation from low to high grade. Surgical removal is recommended if there is no spread of the primary tumor. When spread has occurred, radiation may be the only treatment
- Fibrosarcoma resembles fibrous tissue. Presents between the ages of 50 and 70 years but may occur in children. Surgery is the standard treatment. May be followed by radiation, and rarely chemotherapy for primary disease

Population

- Rare – 1% of all cancer, 1/100,000 population
- Predominantly males and the elderly

Causes

- Most etiologies unknown
- Environmental factors i.e. chemicals
- Genetic i.e. inherited bilateral retinoblastoma – rare childhood disorder where babies develop malignant retinal tumors
- Immune mechanisms i.e. regional immune deficiency syndrome may be associated with localized swelling and chronic lymphedema predisposing the individual to angiosarcoma and lymphangiosarcoma
- Previous radiation. In some cases, large pelvic tumors may be radiation induced
- Viral link being explored i.e. Aids-Kaposi's Sarcoma

Manifestations

- Reports of pain are rare unless tumor is massive in size. Tumor usually asymptomatic when located in the thigh region.
- May present with one or more of following symptoms: painless hard lump growing in muscle or under skin, peripheral neuralgia, paralysis, ischemia, bowel obstruction, weight loss, fever, general malaise. Tumor may exhibit rapid growth over a short time frame.
- Patient may present with a coincidental injury i.e. sprain their ankle and notice some swelling and a lump. Research indicates no association between trauma and tumors.

Diagnosis

- Physical Examination: deep mass greater than 5 cm in diameter is of the greatest concern
- Investigation:
 - MRI: done preoperatively to assist in staging tumor, by detecting soft tissue involvement, location of tumor, and neurovascular structure involvement
 - Needle Biopsy: done under supervision of the oncological surgeon. Technique is critical as contamination may cause spread of the tumor. Biopsy will ascertain if tumor benign or malignant
 - CXR and CT lungs to investigate presence of metastatic spread
 - Other investigations may be warranted

Prognosis

- Good Indicators: superficial; size <5 cm in dimension; distal (i.e. foot opposed to buttock); low grade
- Poor Indicators: > 5cm in dimension; proximal location; high grade
- Prognosis varies with type, size, location and grade of lesion
- 80% of all recurrences happen within two years – patients are followed for 10 years

There is no correlation between local excision and metastatic disease. If the tumor is resected and then later recurs, it does not follow that the tumor will metastasize. Limb sparing procedures are attempted if clear margins are large enough. Average five-year survival rate after surgery is 60%.

Bone Sarcoma

Definition

Cancer arising from cells within the bony structure and includes the marrow and the cartilage.

Examples of Bone Sarcoma

- Osteosarcoma: Malignant primary tumor of the bone that is aggressive and characterized by rapid growth and metastasis. Usually occurs in the metaphyseal region of long bones. Most common type of bone cancer
- Ewing's Sarcoma: A malignant tumor of bone that arises in medullary tissue, occurring more often in cylindrical bones (pelvis, tibia, femur)
- Malignant Fibrous Histiocytoma of Bone: Rare malignant tumor of bone, which arises from the bone. Exact cell of origin is unknown. Affects all age groups

Population

- Primary bone cancers make up less than one half of one percent of all cancers. It is more common for other types of cancer to metastasize to the bone
- Predominantly less than 20 years old
- Incidence slightly higher in males than females
- More common in families with retinoblastoma

Manifestations

- Patient often presents with a coincidental injury (example: sprain their ankle and notice some swelling and a lump). Research indicates no association between trauma and tumors
- May present with bone and joint pain (most common symptom) not relieved by NSAIDS, or opioids. Presence of mass (initially painless), functional deficit, and pathologic fracture. Specific complaints vary. Symptoms may resemble injuries, bursitis, arthritis or benign bony tumors making diagnosis more difficult
- May have weight loss, fatigue and/or anemia

Investigation

- X-ray of painful or symptomatic area
- Computerized tomography of affected bone
- MRI
- CXR or CT lungs
- Bone Scan with x-rays of the abnormal areas
- Blood tests – tumor markers, half of patients will have increased alkaline phosphatase
- Biopsy

Prognosis

- Good indicators: low grade, small size
- Poor indicators: high grade, large size
- Prognosis varies with type, size, location and grade of lesion
- 80% of all recurrences happen within two years – follow-up on all patients for 10 years

Treatment for Bone and Soft Tissue Sarcoma

The choice of treatment depends upon the goals of the patient, the stage of the tumor, and the responsiveness of the tumor type to specific modalities. The three main modalities include surgical excision, chemotherapy and radiation. These modalities may be used alone but are frequently used in combination.

- Small tumors may be managed by local excision and postoperative radiotherapy. Bulky sarcomas of the extremities may require amputation (See Rapid Review) followed by irradiation for local control and combination chemotherapy to eliminate small foci or neoplastic cells
- Radiotherapy: if margins are narrow, radiotherapy is given pre-operatively to reduce local recurrence. Radiotherapy may inhibit wound healing post-operatively

- Chemotherapy is given either preoperative, adjuvant, and/or for palliative therapy. Useful for systemic relapse or locally advanced disease. Often used preoperatively to shrink tumor size prior to resection
- Bone sarcoma usually does not require radiotherapy, with the exception of Ewing's sarcoma. Osteosarcoma and Malignant Fibrous Histiocytoma of bone require preoperative and postoperative chemotherapy
- Types of resections:
 - Intralesional resection: removes the sarcoma only not recommended as there is a high rate of local recurrence
 - Marginal resection: removes the **reactive zone** and sarcoma (high rate of local recurrence). The reactive zone is an area of variable size that is comprised of compressed normal tissue, tumor pseudocapsule and microscopic foci of the tumor
 - Wide resection: removes tumor, reactive zone and some surrounding tissue, followed with adjuvant radiotherapy. 1mm of normal tissue may be the difference between limb sparing and amputation procedure
 - Compartmental resection: Removes entire compartment within a limb, resulting in an amputation or limb sparing procedure

Considerations for Orthopaedic Nurses

- Grief reactions to a devastating diagnosis vary and may include shock, anxiety depression and anger. Verbalization of feelings and support are key aspects of care
- Counseling and spiritual care may be indicated
- Satisfactory Pain Management: Perioperative Pain Service, Complex Pain Service or psychiatry may be indicated. See Rapid Review Amputation
- Alteration in sexuality: supportive environment to discuss feelings. Consult as appropriate to sexual medicine professional
- Skin grafts or muscle flaps may be necessary to cover tissue defects resulting from tumor excision. Careful monitoring of vascular status is imperative
- Maintain preferred activities as long as possible
- Demonstrate acceptance of body image changes resulting from surgery, chemotherapy and radiation

Questions

1. All of the following are true about soft tissue sarcoma except:
 - a. Pain is the primary symptom present
 - b. More common in males
 - c. Fibrosarcoma occurs between ages 50 and 70
 - d. Chemotherapy is rarely used to manage it.

2. The following are all correct statements about sarcomas except:
- Tumors are staged according to size, structures involved and presence of metastasis.
 - Low grade tumors are at low risk of metastasis; high grade tumors pose a higher risk of metastasis.
 - Sarcomas are benign tumors of either soft tissue or bone
 - Intralesional resections are not recommended because they remove the sarcoma only and there is a high rate of local reoccurrence.

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ORTHOPAEDIC INJURIES

Fractures

Breaks (or disruption in the continuity of bones) are the result of musculoskeletal trauma from high-energy impact (typically in children and young adults) or low-energy impact (in elderly or frail patients).

Implications of the mechanism of injury

Acceleration and deceleration

- The larger the mass object, the more kinetic energy it may be able to absorb. But as the speed of the object increases, the potential energy (injury) increases
- Deceleration injuries may prove to be more traumatic in severity than a slow action collision

Falls

- Most common MOI for the elderly trauma patient
- Need to be evaluated for the underlying cause: unsafe home environment, underlying medical condition (hypotension, arrhythmias), medication side effects

Blunt

- Motor vehicle collision (MVC) or collision during a sporting event

Crush

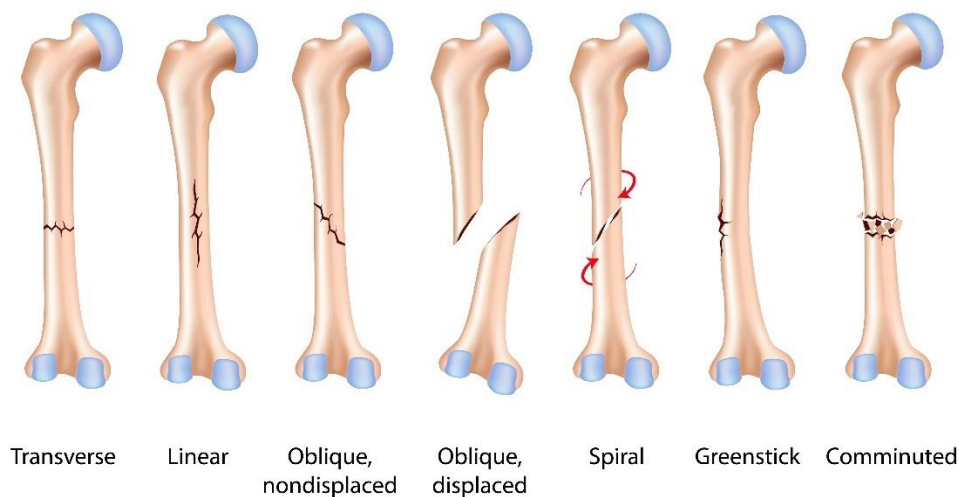
- MVC (check pelvis)

Penetrating

- Gunshot wounds, stabbings or blasts/explosions

Fracture classifications

Fractures can be classified by different features:










When assessing a fracture, describe the way you see it:

1. Name of bone
2. Area of bone (distal, proximal, medial)
3. Displaced (bone pulled out of normal alignment)
4. Angulated (varus = medial or valgus = lateral angulation)
5. Intra-articulated (fracture crosses the surface of the joint; results in damage to the cartilage)
6. Comminuted: How many pieces? Butterfly?
7. Open/Closed





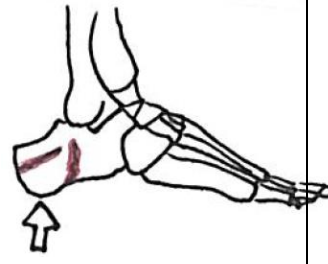

Types of Orthopaedic fractures

Upper extremities


Name of #	Region	Definition	Treatment	Picture
<i>Colles</i>	Distal radius, sometimes the ulna	Dorsal angulation (outstretched hand)	Splinting Sx: volar plate or perc pins with external fixator	
<i>Smith's</i>		Volar angulation (flexed wrist) - very unstable		
<i>Bennett's Fracture</i>	Thumb, caused by forward falling, contact sports, MVC	An oblique intraarticular fracture of the 1 st metacarpal of the thumb	Splinting, thumb spica cast, percutaneous pinning (k-wire) or ORIF	
<i>Rolando's Fracture</i>		Similar to Bennett's fracture, but more comminuted fracture fragments		
<i>Boxer's Fracture</i>	4 th or 5 th finger	Fracture of the MCP, sometimes involving the head of the metacarpal	Ulnar gutter splint, sometimes closed reduction and/or perc pinning	
<i>Monteggia Fracture</i>	Elbow – radial head is dislocated or fractured, allowing the compression forces to break the ulna	Combination injury with an ulna fracture and disruption of the radiohumeral joint	Conservative or Surgical (if radial head is fractured)	

<i>Supracondylar Fracture</i>	Distal 3 rd of the humerus, just above the elbow	Type 1: non-displaced	Splint	
		Type 2: displaced with posterior cortex intact Type 3: complete displacement with no contact between fragments	ORIF, Total elbow arthroplasty may be required if the elbow is significantly comminuted	

Lower extremities

Name of #	Region	Definition	Treatment	Picture
<i>Lateral Malleolus</i>	Distal fibula		Rest the bone (6-8 weeks)	
<i>Medial Malleolus</i>	Distal tibia		Taping, splinting, bracing or special fracture shoes	
<i>Cotton's Fracture (Trimalleolar)</i>	Lateral malleolus, Medial & posterior malleoli of the tibia		<ul style="list-style-type: none"> ○ Crutches or knee walkers may be used for NWB 	
<i>Pilon Fracture</i>	Ankle	<p>When an ankle # extends into the tibiotalar joint</p> <p>Caused by high energy impact (ex: fall from height, MVC, skiing)</p>	<p>Sx for: intraarticular, open, comminuted, or displaced fractures.</p> <p>Internal fixation, plates, screws or nails or external fixation.</p>	
<i>Calcaneal</i>		Associated with axial loading, ex: falling from height		
<i>Jones Fracture</i>	4 th & 5 th metatarsals	Fracture at the metaphyseal-diaphyseal junction in the region of or just distal to the articulation between 4 th & 5 th metatarsals		

Pelvis and hip

Name of #	Definition	Treatment	Picture
<i>Intracapsular</i>	Within the joint capsule and includes femoral neck & subcapital fractures	Sx: threaded pins, compression hip screws, femoral head replacement, THR or hemiarthroplasty	
<i>Extracapsular</i>	Outside the joint capsule: interchanteric & subtrochanteric *males, active elderly, greater trauma/force	Interochanteric Sx: ORIF may require nails, pins, and compression hip screws Subtrochanteric Sx: ORIF with intermedullary nail, sliding plate or fixed plate	
<i>Periprosthetic</i>	Within the area below or between replaced joints	Sx: Revision of the component to a larger stemmed prosthesis that bypasses the fracture site. Plates, cables and/or strut grafting may be needed.	
<i>Acetabular</i>	Fracture in the socket part of the joint	SX: ORIF or THR	
<i>Pelvic</i>	Any fracture to the ilium, ischium or pubic bone	Because major blood vessels are located in the pelvic region, high volume blood loss is a concern. Sx: ORIF using plates, pins & screws	

Spine

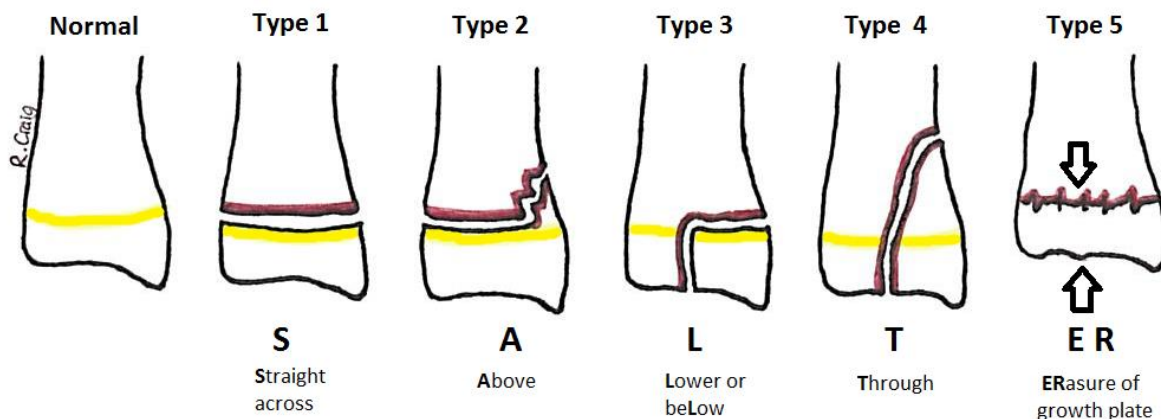
Most spinal fractures and ligamentous injuries occur as a result of a high velocity injury such as a motor vehicle accident, falls, diving, or blunt trauma. Most thoracic and lumbar spine fractures are related to osteoporosis and involve minimal or no trauma. Neurological injury needs to be assessed initially and treatment starts immediately (National Association of Orthopaedic Nurses, 2013).

Pediatric Fracture Patterns

- Pediatric bones are more porous and have a higher cartilage-to-bone ratio than adult bones, and children's soft tissues are more flexible than adults' tissue
- The ability of the bone to bend before breaking leads to unique fracture patterns in children.
 - Example: Avulsion fractures occur more commonly in children as pediatric ligaments may be stronger than bone. For example, if a tendon pulls the bone, it can result in a bone chip fracture
- Greenstick and buckle fracture are more common in children due to a thick periosteum that limits the fracture line from extending across the entire bone
- The periosteum in children is thick and promotes faster healing of the fracture
- Children are more prone to supracondylar fractures as their ligaments are more lax
- Spiral (or Torsion fractures) are common in cases of child abuse & osteogenesis imperfecta
- "Toddler's fracture" = spinal fracture that occurs when a child falls short on an extended leg while jumping
- Children have a unique ability for healing fractures and remodeling deformities.
- Remodeling will not improve displaced fractures involving the joint or the growth plate.
- Children usually remodel and younger children, especially those with two or more years of growth left, have better remodeling potential.
- The distance of the fracture from the end of the bone should be considered when evaluating the remodeling ability of the bone. A fracture in the metaphysis, near the growth plate remodels better than a fracture in the middle of the bone.
- A fracture located in the middle of the bone, away from the growth plate, has less potential for remodeling. The severity of the angulation can also play a role in remodeling of the bone. When there is minimal angulation, the bone could remodel completely. Where angulation is more severe, the bone will partially remodel. Angulation in the plane of joint movement is most likely to improve with growth and remodeling (Ebraheim, 2016).

Salter-Harris Grading System

When a fracture involves the epiphyseal, healing and treatment will vary depending on the type of fracture around the growth plate. The Salter-Harris grading system is used to describe the fracture pattern around the epiphyseal:



Type I: Injury through the growth plate, no sign on x-ray (tender, swelling).

Treatment: cast

Type II: Fracture through the growth plate (most common).

Treatment: closed reduction, maybe percutaneous pin.

Complications: mal-union, more likely to break

Type III: Fracture through the physis, exits through the joint.

Treatment: joint surface must be restored (make sure surface is congruent)

Type IV: Cross through the growth plate (due to high energy injury)

Type V: Axial load, squished growth plate (high energy injury), not as visible on x-ray

Treatment: none at the time of fracture, treat the leg discrepancy later

Pathological fractures

Also known as fragility fractures, these fractures are caused by disease (ie: cancer, osteoporosis) that lead to weakness of the bone structure. They are a result of low-energy impact, such as a fall from standing height.

- Present as a chalk-stick fracture in long bones, and appear as a transverse fracture nearly 90 degrees to the long axis of the bone.
- The most common location of fragility fractures are : hips, proximal humerus, shoulder, spine, radial fracture.
- Vertebrae, hip, wrist, forearm (Colles)

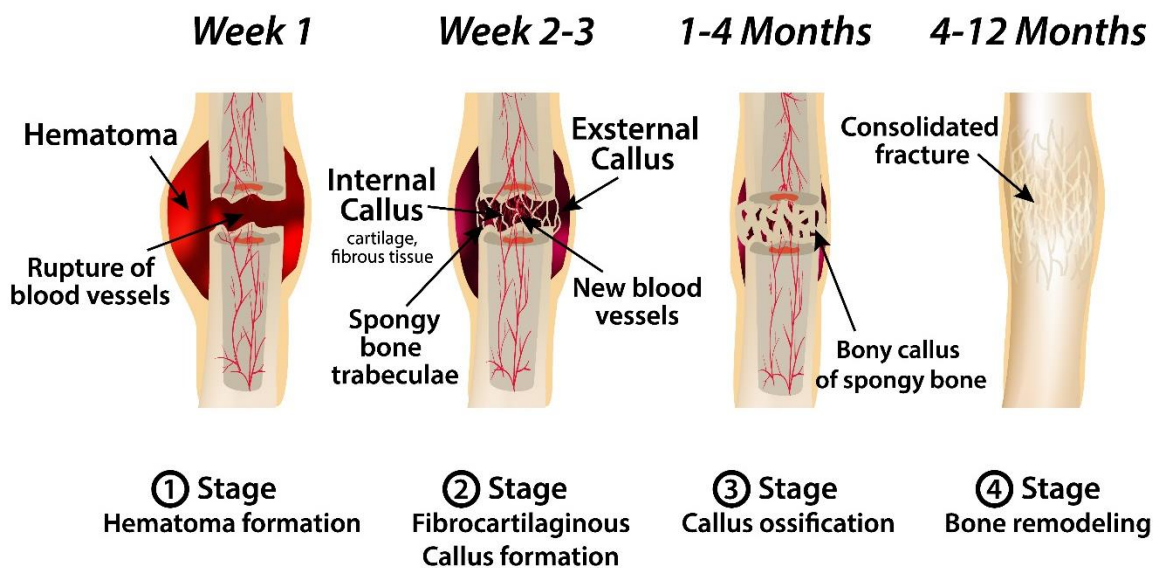
Fracture Healing Stages:

1. Hematoma Formation (1-3 days)
2. Granulation (3 days-2 weeks)
3. Callus Formation (2 weeks – 6 weeks)
4. Consolidation (3 weeks – 6 months)
5. Remodeling

Factors that affect healing include trauma severity, bone loss, type of bone, vascular support of the bone, bone health at the time of injury, infection or wound contamination, intra-articular fractures, and fractures involving growth plates.

Comorbidities that slow the healing process include: osteoporosis, PVD, diabetes, age, radiated bone and smoking

Stages Of Healing Bone Fracture



Effects of mobility on the health and healing of bones

Bone growth

- If the patient cannot bear weight through the injury, it is important for the limb to be dependent, using gravity to create the load, to help stimulate bone growth.

Weight-bearing status

- Weight bearing during healing is important as loading on bones makes them stronger (Wolff's Law)

Factors that influence bone healing in delayed union and non-union of fractures

- Infection
- Type of fracture
- Bone
- Malnutrition
- Lifestyle patterns
- Metabolic bone disease, tumour
 - Children have a greater potential for fracture remodeling during the healing process, so we try to do manipulation & casting instead of surgery

Joint and growth plate fractures that extend to the joint, should be reduced anatomically and perfectly.

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Herniated Disc

Definition

Herniated disc is the protrusion of the central disc material. The protrusion may apply pressure to the spinal nerve or cord. A slipped disc or prolapsed intervertebral disc commonly occurs in the lumbar and cervical areas. These areas of the spine have the most mobility, putting the discs at high risk of damage. The primary symptom is pain which is intermittent in both severity and frequency. Sciatica is experienced if the damage is in the L4 region, whereby the herniation irritates the sciatic nerve. The pain at this level might differ in intensity and type, as patients describe numbness, tingling, burning, aching, or a shooting pain down a limb. The pressure that the disc puts on the nerve roots often causes neurological symptoms in addition to the pain, with some patients developing motor weakness.

Population

- More common in men than women
- Lumbar disc herniation is most common in ages 20-45
- Cervical herniation is more common in older people

Manifestations

- Motor and sensory deficits to the nerve involved
- Pain radiating down one or both legs
- Bowel and bladder dysfunction

Management

- Conservative management is usually tried first and includes analgesics, NSAIDS, muscle relaxants along with nonpharmacological management. These include TENS, heat, ice, massage, exercise programs, bracing or corsets. Epidural injection of local anaesthetics or steroids are also considered
- The decision for surgery depends on three key indicators: unrelenting leg pain despite adequate conservative measures, neural damage, and cauda equine syndrome (a serious condition that comes with extreme pressure and swelling of the nerves at the end of the spinal cord)
- Surgical interventions may include a discectomy/laminectomy (the process of removing the lamina. The lamina is the bony roof of the spinal canal. It can be performed on all regions, lumbar, thoracic, cervical, or the spinal column to relieve pressure on the spinal cord or the nerve roots). A combination of spinal fusion and discectomy adds risk of postoperative complications and the benefit of this over a simple discectomy is not proven

Questions

1. Which of the following is true regarding herniated disc:
 - a. It is a protrusion of central bone that may apply pressure to the spinal nerve or cord.
 - b. Conservative management is usually tried first
 - c. It tends to occur in the thoracic region of the spine
 - d. Lumbar protrusions are more common in older people.
2. All of the following are manifestations of a herniated disc except:
 - a. No sensory deficits in the nerve involved
 - b. Local back pain
 - c. Pain radiating down both legs
 - d. Bowel and bladder dysfunction

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Humphrey, S.C. and Eck, J. (1999). Clinical Evaluation and treatment for herniated lumbar disc. American Family Physician, 59(3). On line <http://aafp.org/afp/990201ap/575.html>. Retrieved June 30, 2005.

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<https://www.spine-health.com/conditions> retrieved from WWW October 2017.

Conditions associated with the Overuse of joints

Carpal tunnel

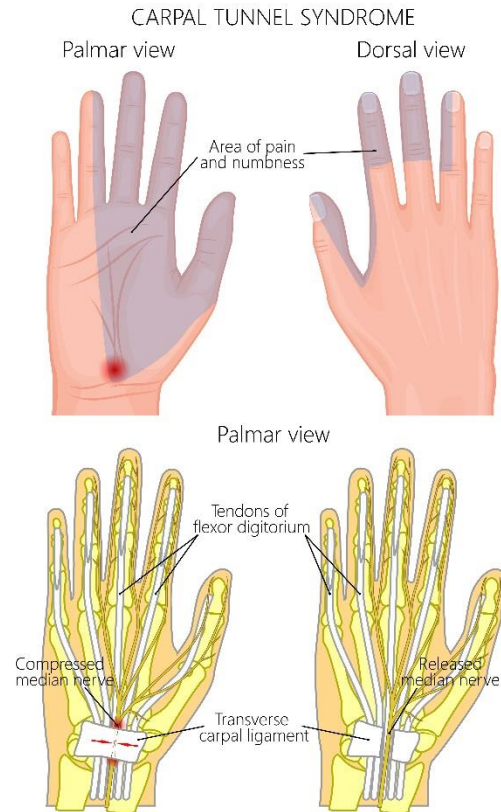
Entrapment of the median nerve between the carpal bones and the transverse carpal ligament. As the ligament thickens, it presses on the median nerve, causing numbness, tingling and pain.

Risk Factors

- Women (pregnancy and menopause)
- People with repetitive work (Especially the dominant hand)
- Diabetics
- Thyroid Imbalances

Treatment

- Treat the underlying cause
- Avoid activities that exacerbate the symptoms
- NSAIDs to decrease inflammation
- Corticosteroids – injected into the carpal tunnel ligament
- Occupational Therapy & Physiotherapy
- Surgical Decompression – endoscopic or open to release the transverse carpal tunnel ligament



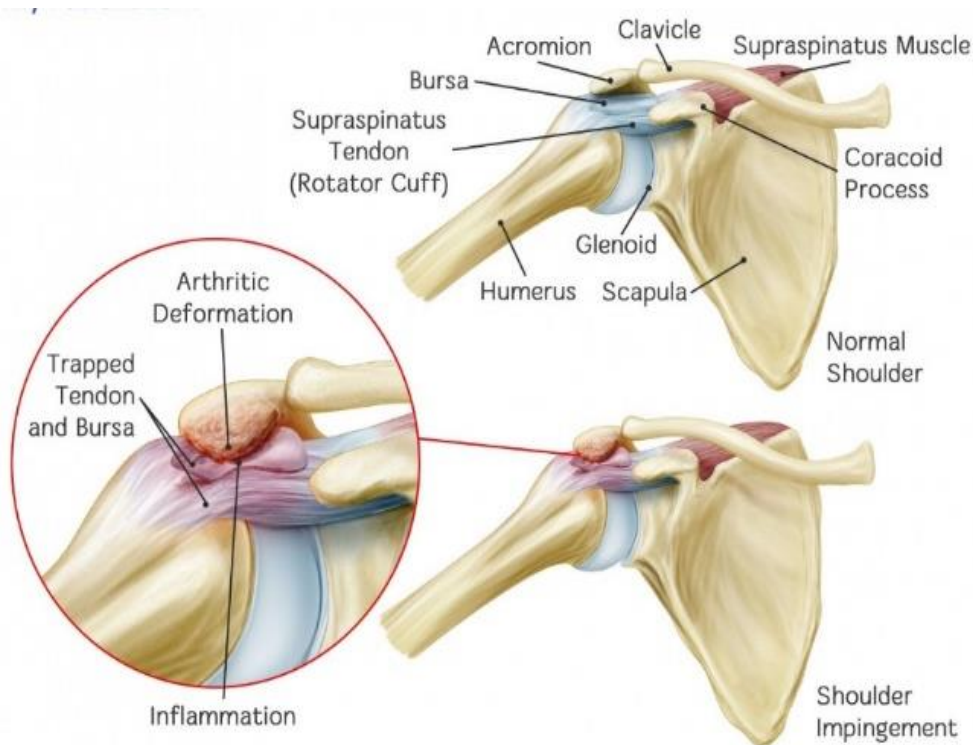
Impingement syndrome (Tendonitis)

Progressive pain and impaired function of the shoulder caused by encroachment of soft tissues against bony structures.

- An abnormally shaped acromion may contribute to impingement
- Anterior shoulder instability may also cause impingement

Prevalence:

- Affects both genders equally
- Ages 40-50, or younger if an athlete



*Image used with permission from Rehab my Patient: www.rehabmypatient.com

Stages:

Stage 1: edema and hemorrhage (< 25 years, reversible, conservative treatment)

Stage 2: fibrosis and tendonitis (25-40 years, recurrent pain with activity)

Stage 3: bone spurs and tendon rupture (40 years, progressive disability, anterior acromioplasty, rotator cuff repair)

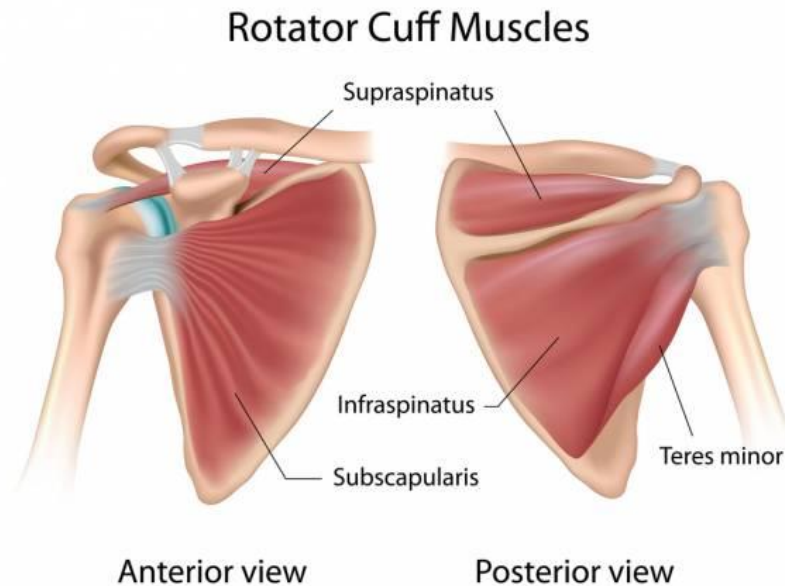
Treatment: consider bursectomy, coracoacromial ligament division

Rotator Cuff Tears

Tearing of one or more of the rotator cuff tendons, often involving inflammation of the subacromial bursa. Primary symptoms include shoulder pain and weakness.

Four muscles attach to the humeral head:

- **S**upraspinatus (most commonly torn)
- **I**nfraspinatus
- **T**eres Minor
- **S**ubscapularis



Types of tears:

- Partial Thickness Tear: only part of the tendon has torn off the bone
- Full Thickness Tear: the entire tendon has separated or torn from the bone
- Complete Tear

Etiology

-
- decreased blood flow to the tendon (age related)
 - disuse and intra-tendinous degeneration (common in the elderly)
 - acromial abnormalities
 - separations
 - impingement syndrome
 - overuse
 - instability & fractures

Complications

- Pain
- Loss of motion
- Persistent weakness
- Shoulder stiffness
- Frozen shoulder
- Tear propagation
- Functional limitations

Diagnostic Tests

- Xray
- Ultrasonography
- MRI
- Arthroscopy

Treatment

- Physical therapy & strengthening exercises
- Rest (sling may be suggested) and avoidance of activity that aggravates symptoms
- NSAIDs
- Subacromial corticosteroid injections
- Surgery: reattach the tendon to the bone using open, arthroscopic or mini-open repair

Joint & Soft Tissue Injuries

Assessment of the orthopaedic injury is based on the clinical exam of the injured part and diagnostics. X-ray in the case of soft trauma confirms the preliminary diagnosis by ruling out other issues such as fracture or disease. CT or MRI may be used to identify specific structures involved such as a meniscus tear vs. an anterior cruciate ligament (ACL) tear in a knee injury. Immediate treatment involves splinting and supporting the injured part (National Association of Orthopaedic Nurses, 2013).

Dislocation is the complete displacement of the articulating surfaces within the joint such as when the ball of the joint is forced out of its socket. Subluxation is the partial displacement, or brief separation of the articulating surface which immediately reduces (pops back in place). The greatest risk with a dislocation injury is neurovascular dysfunction. If nerves are compressed, stretched, lacerated, conduction pathways are interrupted. Blood vessels can be disturbed, interfering with blood flow to the distal tissues (National Association of Orthopaedic Nurses, 2013).

Soft tissue injury

A soft tissue injury is the damage of muscles, ligaments, and tendons throughout the body. Common soft tissue injuries occur from sprain, strain, a hit resulting in a contusion or overuse of a particular part of the body. Examples include: ligament tears, tendon disruption, muscles injury, joint capsule disruption.

Soft tissue surgery

The Achilles tendon connects the large calf muscles to the heel. It is responsible for the push-off motion with walking and running. Partial or complete Achilles tendon ruptures can be treated conservatively or surgically. Surgery is usually indicated for acute complete rupture, large partial rupture, or re-ruptures of the tendon. Immobilization for several after surgery with the goal of getting the foot in a neutral position (National Association of Orthopaedic Nurses, 2013).

Concurrent injuries associated with orthopaedic trauma

Original assessment of the trauma patient starts with evaluating and stabilizing the ABCs. Once stabilized the next concern is “D” (Disability); the head, neck and cervical spine (National Association of Orthopaedic Nurses, 2013). Assess for urological, abdominal, thoracic, neurovascular, integumentary injuries.

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SURGERIES AND OTHER INTERVENTIONS

Amputations

Definition

Amputation is the removal of part or all of a limb through bone. Amputation through a joint space is called disarticulation. Amputations are done in extreme cases of injury, neuro-vascular compromise, and life threatening infection and for some musculoskeletal tumours. The extent or height of the amputation depends on the location and spread of the tumour. Amputations are classified according to the level of dissection:

- Above knee amputation (transfemoral)
- Below knee amputation (transtibial)
- Hip disarticulation-the femur is dislocated from the femur and amputated
- Hemipelvectomy-a portion of the pelvis is amputated along with the limb

Additional types:

- Below elbow (transradial)
- Above elbow (transhumeral)
- Forequarter amputation (amputation of arm, scapula and clavicle)
- Hemiorpectomy (below waist amputation)
- Symes (ankle disarticulation)
- Rotationplasty – modified amputation done on skeletally immature child with malignant tumor near the knee. Done due to tumor's proximity to growth plate. The knee joint and tumor is removed, turning distal portion of lower leg 180 degrees and attaching remaining tibia and foot to distal portion of remaining femur. The ankle joint becomes the new knee joint and patient will function as a below-knee amputee. Prior to this procedure the only option was above-knee amputation.

Population

- **Across the age spectrum**
- **Oncological etiology: Sarcoma of the bone and soft-tissue. See Sarcoma Rapid Review section. In rare cases, amputation occurs for severe metastatic cancer.**
- **Vascular insufficiency:** Blockages and narrowing of arteries supplying your legs can lead to reduced circulation. If severe arterial disease is left untreated, the lack of blood circulation will increase pain, tissue in the leg will die due to lack of oxygen and nutrients, which can lead to infection and gangrene which could be life threatening. Amputation is always a last resort.

- **Additional causes: Atherosclerosis, birth defects, infection, gangrene, diabetes, frost bite, Buerger's disease, prolonged lack of blood to the limb, necrotizing fasciitis (most commonly caused by streptococcus), Raynaud's Phenomena (a disorder in which the fingers or toes (digits) suddenly experience decreased blood circulation) and tumor/oncological conditions.**

Manifestations and Preoperative Concerns

- **Enlarging mass over a short period of time**
- **Neurologic symptoms from nerve impairment**
- **Pain due to pressure of the tumour on soft tissue, nerve, and bone**
- **The patient and family will likely exhibit a range of emotional, cognitive, physical and behavioral reactions prior to and following the procedure.**
- **Shock and distress may hamper the person's ability to learn**
- **Grief related to the change in function and body image is expected. Anxiety, distress and depression related to the diagnosis are common. Emotional support and counseling needs to be assessed and provided on individual basis**
- **Early involvement of rehabilitation team can facilitate postoperative adjustment. The patient may be assessed in hospital and prepared for prosthetic fitting and possibly an Amputee Peer when available**
- **Teaching is tailored to person's emotional status, and may include stump care, and understanding of rehabilitation process**

Pain Management: Pre and Post-Operative Concerns

Patients with unmanaged pain pre-operative are more likely to have difficulty with post-operative pain control. These patients are at high risk for neuropathic pain. See Neuropathic Pain Rapid Review.

Pharmacological approaches in pain management include: preoperative and postoperative epidural and ketamine infusions, postoperative infusion of continuous regional analgesia, intrathecal, parenteral and oral analgesics, opioids, anticonvulsants, tricyclic anti-depressants and beta blockers.

Non-pharmacological techniques in pain management may include: TENS (transcutaneous electrical nerve stimulation), early prosthetic fitting, distraction therapy, desensitization, massage, biofeedback, hypnosis, mirror therapy and acupuncture.

Phantom Limb Pain

- **Phantom limb pain is considered a neuropathic pain and most treatment recommendations are based on recommendations for neuropathic pain syndromes. Most successful treatment outcomes include multidisciplinary measures**
- **Pain experienced to the missing body part characterized as: cramping, burning, electric shocks, stabbing from knives/hot needles. It can occur immediately after surgery or two or three months after amputation. Phantom limb pain is generally more severe when pain is experienced postoperatively**
- **Epidural analgesia and anesthesia pre and post operatively can be very effective in preventing this pain. Longer term therapy with anti-convulsants and anti-depressants may be required**
- **Timely prosthetic fitting has been found to assist in the prevention of chronic phantom limb pain**

Phantom Sensation

This is a non-painful sensation to the missing limb. The sensation may have a tingling quality or feeling that the limb is in use. Almost all patients experience phantom limb sensation in the early post-operative period and it is usually self-limiting. These sensations are usually felt in the phantom foot with lower extremity amputations.

Stump Pain

- **Stump pain arises at the amputation site**
- **Stump pain may have multiple causes including: wound tissue pain, nerve-related pain, joint pressure or mal-alignment, muscle aches and/or discomfort from the prosthesis. Assessment of the underlining cause of pain is key**
- **Because of its multi-casualty, stump pain requires a multi-modal approach. For example, NSAID may be used in combination with an opioid for wound and muscle pain**
- **Positioning techniques and ice may be used to address joint and muscle pain**

Management/ Post-operative Considerations

- **Prevention of complications include: breathing exercises, assisted range of motion exercises, resistance exercises, passive range of motion exercises, stump management (including dressings, prevention of edema, wound healing, pain), bed mobility transfers, positioning, ADL's, and walking and wheelchair use**
- **Stump complications include residual limb pain, phantom sensation, edema, bleeding and hematoma formation, infection, contracture and wound dehiscence**
- **The limb should be elevated to prevent edema for the first 24-48 hours post-op. After 48 hours the limb should be placed flat to prevent hip flexion contractures in above knee amputations, or to prevent knee flexion contractures in below knee amputations. Lying prone is an effective positioning technique to prevent these contractures in above knee amputations. When the patient is sitting in a chair the limb should be elevated on a leg rest to prevent dependent edema**
- **Post-operative dressings protect the limb, reduce swelling, promote limb maturation, and prevent contractures. Traditionally soft dressings and elastic bandages were used to prevent post-operative edema. Current practice involves applying rigid or semi-rigid dressings to prevent edema. This is followed by compression socks.**
- **Rigid dressings can be either:**
 - **Non-removable. These are made from multi-layered dressings and a plaster of paris cast which extend beyond the joint. They protect the stump and keep the joint in extension. They remain on for 7-14 days postoperatively**
 - **Removable: cast encloses the stump just below the joint. This allows flexion and inspection of the stump**
- **Semi-rigid dressings are vacuum-formed removable dressings. They are applied and removed easily allowing for wound inspection. They remain on for 5-7 days post operatively**
- **Compression socks (sometimes called shrinker socks) are applied after the rigid/semi-rigid dressings come off. They come in different sizes and they help control swelling, promote healing and assist in shaping the stump. They may also reduce phantom sensation**

- Sutures/staples out 10-14 days
- Assess for wound infection/dehiscence
- Pain management
- Exercises to prevent against muscle contractures
 - Do not flex stump in any way
 - Do not curve your spine
 - Do not put pressure on the tip
 - Do not place a pillow between the legs if the amputation is in the lower limbs
 - Do lay prone twice a day for 10 minutes
 - Stretching exercises to prevent contractures

Considerations for Orthopaedic Nurses

- Neuroma at site of amputated nerve
- Bone overgrowth especially in children
- Prosthesis are fitted when wound healed
- Phantom limb sensation/ phantom limb pain
- Falls prevention and coping strategies should a fall occur
- Referral to amputee rehab
- Consults to Radiation +/- medical oncology
- Special emotional needs related to medical diagnosis, alteration of body image, depression, reduced mobility, work and life changes; reflection on self-mortality
- Body image enhancement
- Coping assistance(mental health practitioners, support groups)
- Nutritional management (increased caloric and protein intake)
- Education re stump care (daily cleansing, dry thoroughly, Ensure to inspect skin for redness, abrasion, irritation, and pressure injuries from prosthesis)

Transition Planning

The patient is transferred to home when medically stable, pain is well controlled, and home supports are in place for safety, mobility, and activities of daily living. Some patients transfer to an inpatient rehab unit while others may attend rehab on an outpatient basis. Involvement of the post-acute rehab team is advised.

Planning for a successful transition includes:

- arrangements for ongoing disease related therapy, i.e., chemo/radiation
- convenience and set up of home
- required equipment including ambulation aids and wheelchair
- support for ADL's
- need for nursing care on outpatient basis including suture removal, stump care
- access to rehab facility
- supports for loss and grief counselling

Patient Teaching

While teaching the patient and family during this period of crisis the care provider must be attuned to the patient's potential reactions to the impending loss. Reports of difficulty concentrating and making decisions are common as individuals cope with feelings of grief, loss, and uncertainty. Recognize the need for repetition in teaching and offer clear and concise material to reinforce learning.

Note that the course of rehab is individual and patients are frequently discouraged with their slow progress due to unrealistic expectations. This is especially true of the person who is adapting to prosthesis, a process that may take several months of hard work and discomfort.

Questions

1. Which of the following is true about patients with amputations?
 - a. Most people adapt quickly to a prosthetic limb
 - b. Phantom limb pain is a painful sensation described as a tingling feeling
 - c. Timely prosthetic fitting has been found to assist in the prevention of chronic phantom limb pain
 - d. The prosthetist should first visit the patient at home

2. The following statements are correct except:
- a. Stump pain may have multiple causes including wound nociception, nerve pain, and joint pressure
 - b. The limb should not be elevated post op due to the risk of flexion contractures in the first 48 hours
 - c. Stump socks and bandages are used to protect and shape the stump
 - d. Patients with amputations are at risk for neuropathic pain

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Anterior Cervical Discectomy and Fusion

Definition and Indications

The anterior cervical discectomy and fusion is done primarily to relieve the pressure of disc herniation's or bone spurs on the spinal cord (causing a myelopathy) or on the nerves that exit the spinal cord and go down the arm (causing a radiculopathy). Another common indication is to stabilize the cervical spine after a fracture or dislocation. In rare circumstances, the procedure is done for people who have neck pain only.

Population

- **Cervical radiculopathy (severe pain radiating down the arm)**
- **Cervical myelopathy (symptoms of spinal cord compression)**
- **Fracture or dislocations**

Manifestations

- **Arm pain, numbness, weakness (radiculopathy)**
- **Neck pain, often radiating down between the shoulder blades**
- **Hand dysfunction, balance problems, bladder/bowel incontinence (myelopathy)**

Treatment: Surgical Procedure

An incision is made over the folds of the neck to the side of the trachea. The carotid sheath containing the jugular vein and carotid artery are located and mobilized laterally. The trachea and the esophagus are gently retracted medially. This creates a corridor to the anterior aspect of the neck. The disc of interest is identified by taking an x-ray. The disc is then removed, all the way back to the spinal cord and exiting nerve root, with a combination of curettes and graspers. When the disc has been totally removed and the decompression of neural elements is complete, a graft is placed within the empty "interspace" between the two vertebral bodies. Usually this graft is bone taken from the anterior iliac crest. Because this incision and bone graft harvest is painful (often more painful than the neck surgery itself), surgeons are often using cadaveric bone instead. A small titanium plate is then applied to the vertebral body above and below to hold the graft in place. A drain is placed. The surgery time is from 2 to 5 hours and blood loss is usually 100 to 300 mLs.

Potential Post-Operative Complications

Patients who have an anterior cervical fusion are at risk for clinical problems related to the proximity of critical blood vessels and the trachea, blood loss, and the length of the surgical procedure:

- **Airway obstruction secondary to hematoma or edema – this is a rapidly life-threatening condition and requires emergency management. Any patient complaining of difficulty breathing because of a “tightness” in their throat area after an anterior cervical fusion warrants a STAT page to the attending surgeon**
- **Sore throat, swallowing difficulties, altered voice – this is universally observed in patients having an anterior cervical fusion; in almost all cases, it goes away within a few weeks**
- **Hip pain from the anterior iliac crest bone graft harvest site. In patients who have their own bone taken, the hip incision is often more painful than the neck incision. This is common, and tends to get better over time**
- **RARE: CSF leaks, esophageal tear (causing mediastinitis), and deep wound infection**

Post-operative Care

- **Head of the bed should be elevated 30 – 40 degrees**
- **Drain is usually discontinued in 24 hours**
- **A soft collar is worn at all times while in bed**
- **A Philadelphia collar is usually fitted pre-op and applied on Day 1 post-operatively. This should be worn while the patient is upright. Sometimes, the patient will not need the collar– the surgeon will specify this in the orders**
- **Maintain alignment of the spine: log roll only to side or back; place a folded towel under the head while side-lying**

Pain Management

While pain is a subjective experience and varies widely from person to person, most people experience mild to moderate pain following this surgery. For some patients the pre-operative pain may be present until the post-operative swelling subsides. The hip incision is often the most painful part of the surgery. A combination of opioid and Tylenol or NSAID administered regularly may provide effective post-operative pain control. After the acute post-operative period, usually around day two or three, oral analgesia may be effective. Tylenol plain may be an effective alternative for some patients. Analgesic dosing should be tapered as pain decreases. Patients who are receiving opioids at home may require higher doses of post-operative analgesics to manage pain. Some patients may have neuropathic pain, characterized by sharp, shooting, burning, or lancinating sensations. Early recognition and treatment of neuropathic pain is essential to achieve effective pain relief. See Neuropathic Pain Rapid Review. A prescription for analgesic is provided upon discharge.

Patient Education

Patients receive education regarding the expected course of recovery, exercise, recommended activity, restrictions, and signs of complications. A guideline is available from Occupational Therapy entitled "Post-Operative Management for a Cervical Spine Fusion".

Questions

1. Any patient complaining of difficulty breathing because of "tightness" in their throat after an anterior cervical fusion warrants this action from a nurse:
 - a. Maintain spine alignment
 - b. Elevate HOB 90 degrees
 - c. Stat call to the physician
 - d. q1h vital signs

2. Common indications for anterior cervical discectomy fusion are all of the following except for:
 - a. Cervical radiculopathy
 - b. Cervical myelopathy
 - c. Neck pain radiating down the lower back
 - d. Fracture or dislocation

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Hip Arthroplasty

Definition

A total hip replacement (THR) is a surgical procedure in which the diseased hip joint is replaced with a prosthesis. The goal of surgery is to improve quality of life, relieve pain, and restore mobility and function to perform activities of daily living.

Population

- Adults with osteoarthritis (most common), rheumatoid arthritis, juvenile rheumatoid arthritis, ankylosing spondylitis, systemic lupus erythematosus, Paget's disease. See Rapid Review for each condition
- Those with avascular necrosis (AVN). Avascular necrosis is the destruction of bone that occurs when the blood supply to the bone is disrupted. It may be caused by femoral fractures, hip dislocation, high doses of steroids, alcoholism, radiation, chemotherapy, and decompression sickness. It is also seen in patients with chronic conditions such as alcohol abuse, diabetes, and gout

Manifestations

- Chronic pain
- Anemia
- Multiple medical conditions (e.g. diabetes, obstructive sleep apnea, hypertension)
- Immobility and weakness
- Depression

Hip Prosthesis

The artificial joint comes in various sizes and materials (cobalt, chromium, titanium, ceramic). The average life expectancy is 15 years.

The main components of a hip replacement are:

- The ball, which replaces the head of the femur. This is attached to the stem
- Stem, which is inserted into the femur to provide stability
- Cup/shell, which fits into the acetabulum
- Liner (High density polyethylene , ceramic, metal)

Surgical Procedure

Traditional:

An incision approximately eight to ten inches is made and the muscles are incised or displaced to expose the hip joint. The femoral head is dislocated from the joint and excised. The surgeon prepares the acetabulum by reaming the surface, and removing any bone spurs. The surface is then fit with the appropriate sized acetabular cup. The intramedullary canal is reamed in order to prepare for placement of the femoral prosthesis. The surgeon checks the prosthesis to ensure it is the correct size by evaluating leg length, motion and stability. The prosthesis is sized for the patient's femur, then press-fit or cemented (acrylic or antibiotic cement) into place. The incision is closed with staples, and a drain (uncommon) may be inserted.

Minimally Invasive:

The surgical procedure is similar to a traditional total hip replacement but there is less tissue cutting and disturbance. Specially designed instruments are used and the surgeon may use fluoroscopy to visualize and prepare the hip socket. Minimally invasive total hip replacements can be performed using one or two incisions.

- a. **Single-incision surgery:** a smaller three to six inch versus ten inch incision for a traditional hip. The size of the incisions depends on the patient's size and the difficulty of the procedure.
- b. **Two-incision surgery:** a 2-3 inch incision is made over the groin for placement of the acetabulum. A 1-2 inch incision is made over the buttock for placement of the femoral stem

Minimally invasive total hip replacement is not suitable for all patients. Generally patients are thinner, younger and healthier. Those that are overweight, have had previous hip surgery, have significant hip deformities, are more muscular or who may have difficulty with wound healing are not candidates.

Arthroplasty Approaches

Lateral/ antero-lateral

- Abductor muscles are split with increases the incidence of muscle weakness and increases the chance of a limp post-operatively
- Preserves the posterior capsule reducing the risk of posterior dislocation post-operatively

Posterior

- Preserves muscle weakness as the abductor muscles are not split
- Weakens the posterior capsule which increases the risk of dislocation

Direct Anterior

- Small incision that is located on the anterior side of the hip
- Preserves muscle weakness as the abductor muscles are not split
- Decreased risk of dislocation
- Thought to decrease muscle damage, decrease post-operative pain and quicken the recovery
- Requires intraoperative fluoroscopy

Implant Fixation

There are three general fixation types for arthroplasties: **cemented, cementless and hybrid.**

Cemented arthroplasties last on average 10 to 15 years. Bone cement (methyl methacrylate) allows for immediate fixation of the replaced joint and full weight bearing. However, over time cement tends to break down, particularly in the joint socket. In general, heavier or more active people have a faster rate of deterioration. Revision arthroplasty can be performed, but it is more complex and tends not to be as successful as the primary surgery. Cemented arthroplasties may be indicated for older persons and those who may be unable to adhere to weight bearing restrictions.

Cementless arthroplasties were developed in response to the problem of cement deterioration. These arthroplasties are fixed in place with screws or spikes and have a porous coating that promotes growth of the surrounding bone into the artificial joint. Weight bearing may be restricted during the six weeks after surgery while tissue growth and integration of the replaced joint occurs. The hope is that cementless arthroplasties will prove to be longer lasting than the cemented ones, but research has yet to prove this. Cementless arthroplasties may be used in patients who are active, younger, and who can adhere to weight bearing limitations.

Hybrid arthroplasty, the femoral component is cemented and the acetabular component is uncemented. This reduces the risk of cement failure and at the same time allows for full weight bearing.

Other Hip Arthroplasty Procedures

Hip Resurfacing (e.g. Birmingham, Durham):

This is a surgical procedure in which the femoral head is reshaped and resurfaced with a titanium shell. Overall, there is a less bone loss and the risk of dislocation is less than with a total hip replacement because of the larger contact area between components. These are indicated for younger patients with good bone stock and contraindicated for extensive joint disease (e.g. bone cysts).

Note: This is a newer procedure and long-term results are unknown.

Hemi-arthroplasty

This procedure is performed for a fracture of the femoral neck where there is a high risk of avascular necrosis due to a disruption of the blood supply. The acetabulum is intact and only the femoral head requires replacement. The femoral component is cemented or press-fit into place.

Hip Revision

A surgical procedure in which the previous hardware and cement is removed and exchanged with a new prosthesis. The magnitude of the surgery depends on the complexity of the prosthetic removal and the extent of bone loss.

Indications:

- Hardware (aseptic) loosening or failure (most common)
- Repeated dislocation
- Infection
- Osteolysis
- Fracture

Patients undergoing revision arthroplasty surgery are at risk for increased complications and often have a longer hospital stay. Those that have undergone several hip surgeries have poor abductor muscles and are at increased risk of dislocation.

Potential Post-operative Problems

Patients who have had hip arthroplasty may be at risk for an array of clinical problems related to their age, pre-existing health status, the length of surgery, anaesthetic, surgical method, and medications such as opioid analgesics and anticoagulants. All surgeries have potential post-operative risks/complications (delirium, constipation, paralytic ileus, atelectasis, urinary retention, pain, nausea and vomiting, myocardial infarction, stroke, bleeding, falls). The following are more specific to total hip replacement:

- Infection (superficial/deep)
- DVT, PE
- Dislocation (sudden, sharp, severe pain on movement)
- Limb length discrepancy
- Impaired neurovascular status
- Fracture
- Hip stiffness
- Leg swelling

Pain Management

- While pain is a subjective experience, most people experience moderate pain following this surgery. Severe pain may be indicative of injury or infection and should be investigated

- In general, removal of the arthritic joint results in decreased pain. People will typically continue to experience surgically related pain while tissue healing occurs, usually over the first six weeks post-operatively
- It is imperative that pain is managed so that the patient can tolerate the necessary rehabilitation needed. Uncontrolled pain can inhibit mobility and post-operative exercises
- Oral analgesics should be started as soon after surgery as the patient can tolerate. Other pain modalities should be incorporated (e.g. icing, elevation, distraction/relaxation techniques)
- Older patients tend not to request analgesia. They should be assessed and offered analgesics on a regular basis. A combination of opioid and Tylenol or NSAID administered regularly may provide effective post-operative pain control
- Patients who are receiving opioids at home may require higher doses of post-operative analgesics to manage pain
- Tylenol plain alone may be an effective analgesic for some patients after the acute phase of recovery. Analgesic dosing should be tapered as pain decreases

Transition Planning Considerations

Transition planning is a team effort that begins when the patient becomes a surgical candidate. It is important the person is educated and supported to:

- Ensure that all health concerns are addressed before surgery; this includes completing dental work and tobacco cessation if necessary
- Prepare for discharge. Ensure that the home environment is safe and adapted for post-op recovery. Arrange help with activities of daily living (homemaking, meals, financial and social supports). Ensure that there is a support person to assist with transfer home and ongoing care
- Learn and practice exercises and mobilization techniques. Ensure that the appropriate mobilization aids are available

The following need to be considered when planning a successful transition:

- Safe home environment and home help
- Clear understanding of hip precautions
- Education for the signs and symptoms of complications (infection/DVT/PE etc.)
- Incision care
- Measures to decrease pain and swelling (ice and elevation)
- Rehabilitation- mobilization, exercises, physical therapy if indicated
- Follow up care- appointments for staple removal/wound assessment and for surgeon follow-up
- An understanding of post-operative prescriptions (analgesic and anticoagulant)

Questions

1. Total hip replacement is most commonly done for?
 - a. Osteoarthritis
 - b. Rheumatoid Arthritis
 - c. Avascular necrosis
 - d. Ankylosing spondylitis

2. Goals of pain management after surgery include the following except:
 - a. Use of oral route whenever possible
 - b. Ensure the patient has a PCA pump throughout recovery
 - c. Ensure the patient can mobilize comfortably
 - d. Ensure the patient knows how and when to administer analgesics at home

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Knee Arthroplasty

Definition

Knee arthroplasty is the replacement of a diseased knee joint with an artificial or prosthetic joint. This surgery is done to relieve pain and restore mobility to patients with end-stage degenerative joint disease.

Population

- Adults with osteoarthritis, rheumatoid arthritis, juvenile rheumatoid arthritis, ankylosing spondylitis, systemic lupus erythematosus, and osteonecrosis of the knee. See Rapid Review for each condition
- Persons with severe trauma or infection of the knee joint

Common Pre-operative Conditions

- Chronic pain
- Multiple medical conditions (e.g. anemia, diabetes, obstructive sleep apnea, hypertension)
- Immobility
- Depression

Knee Prosthesis

The prosthesis comes in various sizes and materials (cobalt chromium, titanium, ceramic). The average life expectancy of a total knee prosthesis is 10-15 years and 10 years for a partial knee replacement.

The main prosthetic components for a total knee replacement

- Femoral component
- Tibial plate
- Patellar component (button)
- Polyethylene liner

Surgical Procedure

Traditional:

The surgical approach is usually medial or lateral parapatellar, and the incision is over the knee or curved around the patella. The soft tissues are balanced across the joint and any existing contractures are corrected. The proximal tibia and distal femur are trimmed and resurfaced in preparation for the chosen prosthetic components, which are pressed into place. If the patella is replaced, the osteoarthritis is removed and a polyethylene button is applied. A drain may be placed (uncommon) and the incision is closed with staples/dissolvable sutures. A dressing is placed over the incision.

Minimally Invasive:

The surgical procedure is the same as a traditional total knee replacement except that the incision is smaller (three to six inches). This results in less tissue disruption, shorter length of stay, and decreased pain.

Implant Fixations

There are three general fixation types for arthroplasties: **cemented, cementless and hybrid.**

Cemented arthroplasties are the most common option and typically last 10 to 15 years. Bone cement (methyl methacrylate) allows for immediate fixation of the replaced joint and full weight bearing, but cement tends to break down over time. The more active and/or heavier the person is; the faster the rate of deterioration. Revision arthroplasty can be performed, but it is more complex and tends not to be as successful as the primary surgery.

Cementless arthroplasties were developed in response to the problem of cement deterioration. These arthroplasties are fixed in place with screws or spikes and have a porous coating that promotes growth of the surrounding bone into the artificial joint. It was hoped that cementless arthroplasties would last longer than the cemented ones, but this hypothesis has yet to be supported in clinical studies. Cementless arthroplasties may be used in patients who are younger with good bone stock and who can adhere to precautions.

In hybrid fixated arthroplasties the femoral component is uncemented and the tibial component is cemented. This may reduce the risk of cement failure and at the same time allows for full weight bearing.

Other Knee Arthroplasty Procedures

Unicompartmental/Unicondylar/Partial Knee Replacement

Some patients have osteoarthritis in the medial (more common) or lateral compartment only and may not need to have a total knee replacement. This type of surgery replaces one compartment with a prosthetic implant. The artificial joint does not interfere with the existing ligaments, tendons or nerves and preserves the anterior cruciate ligament and posterior cruciate ligament. These patients have less post-operative discomfort, shorter length of stay and a faster recovery compared to a patient with a total knee replacement.

Note: This surgery is only indicated for patients who have joint disease limited to either the medial compartment.

Surgical Procedure

A medial approach is the standard for a unicompartmental knee. The knee is flexed at a 90-degree angle and a small incision approximately three inches is made over the knee. The damaged cartilage and meniscus is removed and one side of the patella and tibia bones is trimmed and resurfaced to fit the implant. The implant is cemented in place and the incision is closed with staples/dissolvable sutures. A dressing is placed over the incision. Patients may go on to a total knee replacement if they develop osteoarthritis in their other compartments.

Knee Revision

A surgical procedure in which the previous hardware and cement is removed and exchanged with a new prosthesis. The magnitude of the surgery depends on the complexity of the prosthetic removal and the extent of bone loss.

Indications:

- Hardware (aseptic) loosening (most common)
- Hardware/mechanical failure
- Osteolysis
- Infection
- Decreased range of motion

Patients undergoing revision arthroplasty surgery are at risk for increased complications and often have a longer hospital stay.

Potential Post-operative Problems

Patients who have had hip arthroplasty may be at risk for an array of clinical problems related to their age, pre-existing health status, the length of surgery, anaesthetic, surgical method, and medications such as opioid analgesics and anticoagulants. All surgeries have potential post-operative risks/complications (delirium, constipation, paralytic ileus, atelectasis, urinary retention, pain, nausea and vomiting, myocardial infarction, stroke, bleeding, falls). The following are more specific to total knee replacement:

- Infection (superficial/deep)
- DVT, PE
- Dislocation (sudden, sharp, severe pain on movement)
- Limb length discrepancy
- Impaired neurovascular status
- Fracture
- Knee stiffness
- Leg swelling

Pain Management

- While pain is a subjective experience, most people experience moderate pain following this surgery. Severe pain may be indicative of injury or infection and should be investigated
- In general, removal of the arthritic joint results in decreased pain. People will typically continue to experience surgically related pain while tissue healing occurs, usually over the first six weeks post-operatively
- It is imperative that pain is managed so that the patient can tolerate the necessary rehabilitation needed. Uncontrolled pain can inhibit mobility and flexion/extension exercises
- Oral analgesics should be started as soon after surgery as the patient can tolerate. Other pain modalities should be incorporated (e.g. icing, elevation, distraction/relaxation/meditation techniques)
- Older patients tend not to request analgesia. They should be assessed and offered analgesics on a regular basis. A combination of opioid and Tylenol or NSAID administered regularly may provide effective post-operative pain control
- Patients who are receiving opioids at home may require higher doses of post-operative analgesics to manage pain
- Tylenol plain alone may be an effective analgesic for some patients after the acute phase of recovery. Analgesic dosing should be tapered as pain decreases

Transition Planning Considerations

Transition planning is a team effort that begins when the patient becomes a surgical candidate. It is important the person is educated and supported to:

- Ensure that all health concerns are addressed before surgery; this includes completing dental work and tobacco cessation if necessary
- Prepare for discharge. Ensure that the home environment is safe and adapted for post-op recovery. Arrange help with activities of daily living (homemaking, meals, financial and social supports). Ensure that there is a support person to assist with transfer home and ongoing care
- Learn and practice exercises and mobilization techniques. Ensure that the appropriate mobilization aids are available

The following need to be considered when planning a successful transition:

- Safe home environment and home help
- Clear understanding of hip precautions
- Education for the signs and symptoms of complications (infection/DVT/PE etc.)
- Incision care
- Measures to decrease pain and swelling (ice and elevation)
- Rehabilitation- mobilization, exercises, physical therapy if indicated

- Follow up care- appointments for staple removal/wound assessment and for surgeon follow-up
- An understanding of post-operative prescriptions (analgesic and anticoagulant)

Questions

1. The key to a successful transition for elective hip and knee surgical patients includes:
 - a. Prepare their home before surgery
 - b. Start planning for recovery once the patient becomes a surgical candidate
 - c. Obtain safety and convenience devices before surgery
 - d. All of the above
2. All of the following are true following total knee replacement except:
 - a. Patient may experience anemia
 - b. Patient is at increased risk for falling
 - c. Hardware loosening does not occur with cementless arthroplasties
 - d. Staples are usually removed 10 – 14 days post-op

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Lumbar Laminectomy

Definition

The lumbar laminectomy is a decompression surgery to relieve pressure on nerves or spinal cord as a result of osteoarthritis or degenerative disease. The goal of surgery is to alleviate disabling symptoms or neurological deficits such as immobility, weakness, numbness, tingling, leg and back pain.

Surgery is only done when back pain fails to improve with more conservative medical treatment. Surgical procedure involves a posterior incision one to three inches in length over the lumbar spine and the lamina is removed to decompress the nerve and/or to visualize the disc. During a lumbar laminectomy, a small section of the bony roof of the spine, the lamina, is removed to create more space for the nerves. The surgeon may remove one or more lamina depending on the levels involved. If the disc is herniated, it is excised and the herniated portion is removed. A surgeon may perform a lumbar laminectomy with or without fusing vertebrae (lumbar spinal fusion) or removing part of a disc (lumbar microdiscectomy).

Population

- Congenital or late onset spinal stenosis
- Bony degeneration of the spine due to osteoarthritis, spondylolisthesis
- Persons with herniated or diseased discs
- Bone spurs; abnormal growths of bony process on vertebral bodies that compress the spinal nerve/cord

Manifestations

- Acute/chronic leg or back pain
- Immobility due to pain or neurological deficit
- Waddling gait
- Bowel and bladder dysfunction
- Motor and sensory deficits; numbness, tingling, weakness in the legs

Potential Post-operative Problems

Patients who have a lumbar laminectomy are at risk for clinical problems related to blood loss, the surgical site, and the procedure:

- Urinary retention (most common)
- Cerebrospinal fluid leaks due to dural tears
- Cauda Equina Syndrome – rare but serious. Surgical trauma or hematoma formation may disrupt the circulation to the lower spinal cord, resulting in: alteration in sensory and/or motor function, severe pain, bowel and bladder dysfunction. Requires immediate imaging and surgical intervention
- Deep wound infection
- Instability of the spine
- Post-operative complications including: constipation, paralytic ileus, DVT, PE

Post-operative Care

- Sensory and motor assessment using dermatome for the lower extremities – report any changes or unexpected deficits to surgeon
- Assess bowel function. Implement bowel protocol
- At risk for urinary retention. Assess need for post void residual urine. In and out catheter as indicated
- Assess for CSF leak: headache and/or clear fluid leaking through the incision
- The incisional drain, if present, is usually removed on Day 1-2
- Increased temperature, suspicious drainage, pain at the site, and elevated white blood cell count may be indicative of wound infection. Avoid changing dressing until Day 2 or as per physician orders
- Patients are mobilized once the effects of the anaesthetic have resolved and the patient has been assessed as able to mobilize with support initially from the healthcare team. Mobilization and activity levels as prescribed by the physician. Mobilization should be individually assessed by the physiotherapist
- If the patient has an epidural, do not assume that any motor deficit is due to the epidural. If weakness occurs, notify the surgeon STAT. Weakness may be indicative of a post-operative hematoma

Pain Management

- While pain is a subjective experience, most people experience pain following this surgery
- Severe pain may be indicative of injury, or infection, and should be investigated
- Older patients tend not to request analgesia. They need to be assessed and offered analgesics on a regular basis. A combination of opioid and Tylenol or NSAID administered regularly may provide effective post-operative pain control
- Oral analgesics should be started as soon after surgery as the patient can tolerate
- Patients who are receiving opioids at home may require higher doses of post-operative analgesics to manage pain
- Tylenol plain alone may be an effective analgesic for some patients after the acute phase of recovery. Analgesic dosing should be tapered as pain decreases
- Some patients may have neuropathic pain, characterized by sharp, shooting, burning, or lancinating sensations. See Neuropathic Pain Rapid Review. Early recognition and treatment of neuropathic pain is essential to achieving effective pain relief

Transition Planning Considerations

Transition planning is a team effort that begins when the patient becomes a surgical candidate. It is important the person is educated and supported to:

- Prepare their home
- Use and obtain safety and convenience devices
- Learn and practice mobilization techniques
- The importance of maintaining proper body alignment and log-rolling side to side when in bed
- Exercises that will prevent complications, improve strength and function
- Avoid lifting more than 5-10 pounds and avoid twisting for 6 weeks or as per physician's instructions
- Arrange homemaking, financial and social supports.

The following need to be considered when planning a successful transition:

- Convenience of the home, e.g. stairs, location of bathroom, set-up of kitchen
- Safety in the home, e.g. lighting, grab bars, clutter
- Support for ADLs, e.g. meal preparation, house cleaning, dressing assistance
- Access to physiotherapy
- Transportation, e.g. getting home from the hospital
- A staple remover is provided to the patient, and staples are removed in the family doctor's office, local clinic, or home care nurse 7-10 days after surgery
- The patient may have dissolving sutures
- Instruct patient not to have a tub bath and swim for the first two weeks after their surgery
- The patient calls the surgeon's office to schedule a follow up appointment approximately one month to six weeks following surgery

Patient Education

Patients receive education regarding the expected course of recovery, exercise, recommended activity, restrictions, and signs of complications. Some sites have teaching booklets that are given to the patients in the surgeons' office.

Questions

1. All of the following are true about lumbar laminectomy except:
 - a. Decompression surgery to relieve pressure on nerves or spinal cord as a result of degenerative disease or osteoarthritis
 - b. The surgeon may remove one or more lamina depending on the levels involved
 - c. Bed rest is recommended for the first 48 hours post-operative
 - d. Potential post-operative complications may include constipation, DVT and PE

2. Teaching post-operative care involves:
 - a. Need to report any signs of wound infection
 - b. Need to report any instability of the spine
 - c. Following mobility recommendations as directed by physiotherapist/surgeon
 - d. All of the above

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Lumbar Laminectomy and Spinal Fusion

Definition

The lumbar laminectomy and spinal fusion is a surgery done to relieve pressure on nerves and to stabilize the lumbar vertebrae. The goal of surgery is to alleviate disabling symptoms or neurological deficits such as immobility, weakness, numbness, tingling, leg and back pain.

Population

- Persons with herniated or diseased discs
- Failed fusion
- Congenital or late onset spinal stenosis

Manifestations

- Acute/chronic low back pain or radicular pain
- Immobility due to pain or weakness

Surgical Procedure

A posterior incision four to six inches in length is made over the lumbar spine. The lamina is excised and the disc contents are removed to decompress the nerve. Bone is harvested from the posterior iliac spine (autologous bone graft) through the same incision. Sometimes the surgeon will use donor bone from the bone bank (allograft). Then the spine is fused between two or more vertebrae. Sometimes, the bone graft is secured with a **spinal instrumentation** such as rods, screws, hooks, wires, and plates. The surgery time is two to five hours and there is usually a large amount of blood loss, between 1,000-2,000 mls. Blood loss is highest in patients undergoing revision surgery, which tends to be more complex and longer.

Potential Post-operative Problems

Patients who have a lumbar laminectomy and fusion are at risk for clinical problems related to blood loss, the surgical site, and the procedure:

- Anemia due to blood loss
- Urinary retention (most common)
- Cerebrospinal fluid leaks due to dural tears
- Cauda Equina Syndrome – rare but serious. Surgical trauma or hematoma formation may disrupt the circulation to the lower spinal cord, resulting in: alteration in sensory and/or motor function, severe pain, and bowel and bladder dysfunction. Requires immediate imaging and surgical intervention
- Instability of the spine
- Post-operative complications including constipation, paralytic ileus, DVT, PE

NOTE: Post-operative care, pain management, transitional planning considerations and patient education remain the same for both lumbar laminectomy and lumbar laminectomy and spinal fusions.

Questions

1. The most common post-operative complication for patients having back surgery is:
 - a. Cauda Equina Syndrome
 - b. Urinary retention
 - c. Myocardial infarction
 - d. All of the above
2. Considerations in post-operative assessment for patients having lumbar fusion surgery includes all of the following except:
 - a. Epidural may cause sensory and motor deficits
 - b. Glasgow comma scale should be done routinely
 - c. Vital signs
 - d. Using dermatomes to assess the lower extremities

3. Patient teaching for a postoperative patient who has had a lumbar laminectomy and spinal fusion includes:
 - a. Avoid lifting more than 5-10 pounds for six weeks
 - b. Avoid twisting for 6 weeks or as per physician's instructions
 - c. The importance of maintaining proper body alignment and log-rolling side to side when in bed
 - d. All of the above

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Pelvic Acetabular Osteotomy

Definition

A pelvic acetabular osteotomy is a surgical procedure performed to improve the position of the acetabulum in relation to the proximal femur also known as hip dysplasia. This surgery is indicated when the proximal femur is out of its usual position in the acetabulum or if there is an abnormality of the shape or size of the acetabulum. If abnormal positioning is not corrected, osteoarthritis, cartilage degeneration, and permanent damage to the acetabulum and femur may occur as a result of stress on the hip joint.

The goals of this surgery include: reducing pain, maintaining or improving activity level by decreasing stress on the hip joint, and delaying or preventing the onset of osteoarthritis. See Osteoarthritis Rapid Review.

Population

- Young, active adults with developmental acetabular hip dysplasia. See Developmental Dysplasia Rapid Review
- Candidates may have mild osteoarthritis. There must be viable cartilage remaining to be placed on the weight-bearing surface. This procedure is not suitable for those individuals presenting with advanced osteoarthritis
- Other mechanical etiologies include:
 - Legg-Calve-Perthes Disease – a self-limiting disease of the hip which occurs in children, characterized by avascular necrosis of the femoral head

- Slipped Capital Femoral Epiphysis – A common disorder of the hip in adolescents, produced by posterior displacement of the proximal femoral epiphysis on the femoral neck

Manifestations

- Pain: presenting as sharp groin pain with activity. Patient may describe a feeling of “catching” or “giving way”
- Hip locking sometimes resulting in unexpected falls
- Evidence of excessive joint stress as confirmed by x-ray examination

Surgical Procedure

There are two subgroups of surgical procedures: **reconstructive** and **salvage**.

Reconstructive Procedure: There are a number of different procedures, but the preferred method is the **Bernese Periacetabular Osteotomy**. The procedure involves five cuts of the pelvis. These cuts free the acetabulum from the pelvis, allowing for reorientation of the acetabulum relative to the femoral head. Screws are used to stabilize the acetabulum to the pelvis. A hemovac drain is placed near surgical incision.

Salvage Procedure: Performed on a patient with established arthritis, or when congruency between femur and acetabulum is not possible. The goal is to increase the life of the joint and add functional years until an arthroplasty or arthrodesis is required. The two most common surgical options are the **Chiari Osteotomy** and the **Shelf Arthroplasty**.

Potential Post-operative Complications

Patients who have acetabular osteotomies may be at risk for an array of clinical problems related to the length and location of surgery, and blood loss:

- Anemia
- Pain
- Constipation, paralytic ileus
- DVT, PE
- Infection: UTI, respiratory, wound. The risk of infection is about 0.5-1.0%.
- Nerve damage intra-op/impaired neurovascular status; may have numbness to thigh
- Immobility due to pain, fear, and weakness
- Delayed union of bone or non-union of bone if bone cuts do not heal. In most cases no intervention is required and the patient will be asymptomatic
- Painful instrumentation: may necessitate screw removal on a day surgery basis

Pain Management

- While pain is a subjective experience, most people experience moderate to severe pain following this surgery. The pain should subside over the first five days
- A combination of opioid and Tylenol or an NSAID administered regularly may provide effective post-operative pain control. After the acute post-operative period, usually around Day 3, Tylenol 3 or Oxycodone may be effective. Analgesic dosing should be tapered as pain decreases
- People will typically continue to experience surgically related pain while tissue healing occurs, usually over the initial six-week period following surgery

Transition Planning Considerations

- Average length of stay five to seven days.
- The following should be assessed well in advance of the patient's transition:
 - o Required equipment, e.g. raised toilet seats, ambulation aids
 - o Support for ADLs, e.g. meal preparation, house cleaning, and dressing assistance
 - o Home nursing required, e.g. suture or staple removal, wound care
 - o Ensure patient knows when to follow up with the surgeon

Patient Teaching

- Review the signs and symptoms of infection with the patient.
- Ensure patient is aware the follow-up with a physiotherapist will not occur until approximately eight weeks following surgery.
- Ensure the patient is aware that the primary goals of post-operative recovery include:
 - o Prevention of infection/wound healing
 - o Adherence to activity level outlined by surgeon and physiotherapist
 - o Reinforcing the importance of not flexing the joint, as hip flexors are cut during surgery. Strict activity guidelines must be followed as per surgeon/physiotherapist
 - o Six to eight weeks after surgery, the patient's weight-bearing status will be assessed by the surgeon
 - o For up to one year all sports may be restricted. After one year the patient may assume normal activities within the limits of their individual surgery

Questions

1. In the osteotomy procedure, the femoral head is excised and several cuts are made into the acetabulum. True or False?
2. Predictable post op complications signs may include all of the following except:
 - a. Delayed bone healing
 - b. Nerve Damage
 - c. Anemia
 - d. Delirium

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Principles of cast care

Cast Care

- Once casting is complete, elevate the casted extremity to heart level
- Use pillows for positioning
- Pain is managed with analgesics / NSAIDS
- Activity orders will follow weight bearing limitations
- Rest and elevation are stressed to decrease edema and neurovascular compromise
- Assess skin regularly for circulation and prevention of skin breakdown

Prostalac

Definition

A Prostalac is a temporary prosthesis designed to treat hip or knee infections in patients who have had a joint replacement. The surgery is done in two stages. In Stage 1 the infected prosthesis is removed and replaced with the Prostalac. The Prostalac is designed to elude antibiotic medication into the infected joint space for about 3 months. The Prostalac maintains limb length, retains stability, and achieves mobilization. Stage 2 occurs after approximately 3 months, when the PROSTALAC is removed and a permanent joint prosthesis is surgically inserted. The infection must be eradicated prior to reinsertion of the prosthesis.

Population

- Patients with an infected knee or hip prosthesis
- Patients who are immunocompromised, malnourished, diabetic or have multiple co-morbidities are more susceptible to infection

Pre-operative Preparation

- Work up for infection: this includes blood work for infection markers (C-reactive protein (CRP)/erythrocyte sedimentation rate (ESR)) and aspiration of the joint for culture and sensitivity. The most common organisms are staphylococcus epidermis or staphylococcus aureus
- Patient may experience pain and difficulty ambulating preoperatively
- Medical optimization for co-morbidities prior to surgery
- Pre-op x-rays are done

Surgical Procedure – Stage 1:

- Prosthesis is removed and infected tissue is debrided. Wound is irrigated.
- Intra-operative C & S cultures are taken from the infected joint tissue
- Prostalac is inserted and the wound is closed without any suction drains in situ, so that antibiotic-rich peri-prosthetic fluid is not removed
- 6 weeks of IV antibiotic therapy is started. Long term venous access must be established (PIC line, Hickman line). Home IV program may be initiated.
- Restricted weight bearing may be ordered
- Blood work for CRP/ESR may be done at intervals to monitor infection
- Joint aspiration for culture may be repeated after all antibiotic therapy is finished
- Infection must be eradicated before re-implantation of prosthesis

Surgical Procedure – Stage 2 (3 months later):

- Performed only if culture from the last joint aspiration is negative, and there are no visible signs of infection. If cultures test positive, further IV antibiotics/debridement may be necessary
- Intra-operative cultures are taken and antibiotics are administered intra-op
- PROSTALAC is taken out, and new permanent prosthesis implanted.
- IV antibiotics are administered for five days post-op, until report of five day intra-op cultures are negative
- If five day post-op cultures are positive, further IV antibiotic therapy will be ordered and/or further surgical intervention may be required
- The rehab program is prescribed on the basis of the stability of the reconstructed joint

Potential Post-operative Problems

- Recurrent infection
- Pain
- Anemia
- Dislocation
- Constipation
- Deep vein thrombosis, pulmonary emboli, fat emboli

Pain Management

- In general, debridement and removal of the infected joint results in decreased pain. People may experience surgically related pain while tissue healing occurs, usually for the first 6 weeks following each surgery
- Severe pain may be indicative of dislocation
- Patients who are receiving opioids at home may require higher doses of post-operative analgesics to manage pain
- A combination of opioid and Tylenol administered regularly may provide effective post-operative pain control. Multi-modal therapies are recommended. Analgesic dosing should be tapered as pain decreases

Post-Operative Considerations

- Consultation with Infectious Disease physician
- Home IV program for antibiotic administration
- Home care nursing for venous access maintenance and/or dressing changes
- If patient is prescribed IV Vancomycin/Gentamicin, serum antibiotic levels and serum creatinine should be monitored in order to obtain safe therapeutic dosing. Audiology vestibular testing should also be done on patients who require long term Gentamicin due to potential toxic effects, e.g. ototoxicity
- Home assessment for required equipment and help needed for activities of daily living

Patient Education

- Self-administration of antibiotics if patient is able
- Signs and symptoms of infection and other potential post-operative complications
- Potential side effects of prescribed antibiotic
- Post-operative wound care
- Follow-up care with Infectious Disease physician and surgeon
- Pain management

Questions

1. Which of the following best describes what a PROSTALAC is?
 - a. A suction drain containing antibiotic fluid
 - b. A temporary prosthesis designed to treat hip or knee infections
 - c. A type of prosthesis used for primary hip or knee replacements
 - d. An antiemetic used to decrease nausea and pain secondary to surgery
2. When is the second stage surgery performed on patients who have received a PROSTALAC?
 - a. When joint aspiration cultures test positive
 - b. When the patient is fully mobilizing comfortably
 - c. When there are no signs of infection and joint aspiration cultures are negative
 - d. When the wound is fully healed at approximately 2 weeks post op

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Resection Arthroplasty – (Girdlestone)

Definition

A resection arthroplasty involves excision of the femoral head. It is primarily a salvage procedure for failed total hip arthroplasty as a result of infection. It is also indicated for removal of hip joint tumors. The space that is left from removal of the head of the femur fills with fibrous tissue.

Indications

- **Recurrent or resistant peri-prosthetic infection**
- **Failed hip replacements or failed construction after hip trauma**
- **Septic arthritis**
- **Tumors of the hip or pelvis**
- **Non-ambulatory patients seeking relief from retractable pain due to a destroyed hip joint or femoral neck fracture**
- **Persons with hip deformities that interfere with sitting and/or hygiene**

Surgical Procedure

A longitudinal incision is made. The femoral head is dislocated from the joint and excised along the intertrochanteric line. If the bone is infected, all foci of infection are removed including the cartilage and any sinus tracts. Antibiotic impregnated spacers and/or antibiotic beads may be put in place in preparation for future re-implantation of a prosthesis. See Prostalac Rapid Review. The incision is closed with staples/sutures and a drain may be placed. Protected weight bearing is indicated, usually for six weeks postoperatively until healing has occurred. Progressive weight bearing is indicated after this surgery. There is usually shortening of the affected leg and the patient has a Trendelenburg gait. A shoe lift may be required. Ambulation aids are required on a permanent basis.

Potential Post-operative Problems

Patients who have a resection arthroplasty may be at risk for an array of clinical problems related to their age, pre-existing health status, infection, possible chronic pain, and instability of the hip joint.

- **Septicemia**
- **Pain**
- **Post-operative complications including: delirium, constipation, paralytic ileus, DVT, PE**
- **Falls due to limb shortening and joint instability**
- **Immobility due to pain, fear, weakness**

Pain Management

- While pain is a subjective experience, most people experience moderate to severe pain following this surgery
- A combination of opioid and Tylenol administered regularly may provide effective post-operative pain control. After the acute post-operative period, oral analgesia may be effective. Tylenol plain may be an effective alternative for some patients, with breakthrough opioid dosing prior to painful activities. Analgesic dosing should be tapered as pain decreases
- Patients who are receiving opioids at home may require higher doses of post-operative analgesics to manage pain
- Removal of the diseased or infected joint usually decreases pain. People may experience surgically related pain while tissue healing occurs, usually up to 6 weeks following surgery

Transition Planning Considerations

The following should be assessed well in advance of the patient's transition:

- Long-term venous access may be established, and home IV program initiated if long term IV antibiotic therapy is indicated
- Home care nursing for venous access maintenance and/or dressing changes
- Convenience of the home (stairs, bathroom, kitchen)
- Required equipment (raised toilet seats, ambulation aids)
- Homemaker support required
- Transportation to home/community hospital

Patient Education

- Teach S&S of infection, potential side effects of prescribed antibiotic
- Ensure the patient knows when staples should be removed and by whom
- Ensure the patient knows when to follow up with the surgeon
- Ensure the patient has prescriptions and knows how to safely take medications
- Falls prevention strategies

Questions

1. Which of the following statements is false?
 - a. Girdlestone arthroplasty is the removal of the femoral head and acetabulum.
 - b. Girdlestone arthroplasty is a salvage surgery to eradicate infection and or tumor
 - c. After Girdlestone arthroplasty, the patient may be immobile due to disability, chronic pain and osteomyelitis
 - d. After Girdlestone arthroplasty the patient may be at risk for DVT, PE, pain, anemia, septicemia.

2. Which of the following statements is false?
- The patient is usually full weight bearing and there is no shortening of the affected leg.
 - Joint pain is usually increased after the surgery.
 - The Girdlestone prosthesis may trigger metal detectors at the airport.
 - Girdlestone arthroplasty does not restore joint function.

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Traction

The application of a pulling force to an injured or diseased body part while a counter traction pulls in the opposite direction. Purposes:

- Reduce fractures
- Maintain alignment
- Correct, lessen, or prevent deformities, contractures
- Promote rest
- Provide immobilization to prevent soft tissue damage
- Expanded joint space during arthroscopic procedures or before joint reconstruction

Three types of traction are manual, skin and skeletal.

Manual traction is applied via hands with a steady pull maintained, used during emergencies ie. fracture reduction.

Skin traction attaches to the skin and soft tissue, provides a light pull. Maximum weight is 5-8lbs for adult and 1-5lbs for children. The weight is applied with a skin adherence strip, foam, traction boots, pelvic belts, etc.

Skeletal traction attaches directly to the bone with skeletal pins and weight applied.

COMPLICATIONS

Anemia

Definition

Anemia is a condition in which the hemoglobin concentration is lower than normal. Anemia is not a disease state but a sign of an underlying disorder. It is the most common hematologic condition. Anemia reflects the presence of fewer than the normal number of erythrocytes within the circulation. It is classified according to whether the deficiency in erythrocytes is caused by a defect in their production (hypoproliferative anemia), by their destruction (hemolytic anemia) or by their loss (bleeding). In general the more rapidly an anemia develops, the more severe its symptoms. Complications include heart failure, paresthesia, and delirium.

Anemias are conditions in which the number of red blood cells or amount of hemoglobin (the protein that carries oxygen) is below normal. Normally RBCs have a lifespan of about 120 days. In adult's anemia is present when the number of red blood cells, or the Hgb in them, falls below normal range and the body gets less oxygen. This results in the body having less energy than it needs to function properly:

- Hgb < 135 g/L (hematocrit < 40%) for males
- Hgb < 115 g/L (hematocrit < 35%) for females

Anemia can be acute or chronic and can be caused by either:

- Excessive bleeding i.e. trauma, surgical blood loss
- Decreased red blood cell production
- Increased red blood cell destruction

Contributing Factors

There exists a wide range of contributing factors for anemia. Patients at risk of nutritional related anemia include the elderly and those with chronic disease.

Nutritional deficiencies include: iron, vitamin B12, and folic acid. Other important nutrients are vitamin C, riboflavin, and copper.

Some types of anemia can be associated with alcohol consumption, chronic disease, or inherited blood disorders.

Manifestations

Anemia can range from mild to severe. Some people may be asymptomatic while others will have symptoms such as:

- Orthostatic hypotension
- Severe fatigue
- Chest pain
- Enlarged spleen
- Dizziness
- Thirst
- Diaphoresis
- Weak or rapid pulse
- SOB (shortness of breath)

As well as the usual symptoms associated with anemia, iron deficiency may produce its own symptoms. Pica (a craving for nonfoods such as ice, dirt, or pure starch).

Tongue irritation (glossitis), cracks at the sides of the mouth (cheilosis) and fingernails, which have a spoon-like deformity (koilonychias), are all indicators of an iron deficiency.

Treatment

- Will depend on the cause and symptom. Type and cause of anemia must be determined before implementing treatment
- Transfusion of RBCs is the treatment indicated only when it is necessary to replace oxygen-carrying capacity
- Iron is required to produce RBCs so most people who have anemia need to take iron supplements. Iron supplements are contra-indicated for some patients such as those diagnosed with Hemochromatosis (an inherited disorder of iron metabolism which results in excessive absorption and storage of iron)

Special Considerations

Sudden blood loss or large amount of blood loss creates two problems:

- Hypotension due to decreased blood volume
- Decreased oxygen-carrying capacity

Either problem may lead to a delay in recovery, organ failure, heart attack, stroke, or death. Patient may require transfusion or fluid resuscitation. Patients with heart conditions are at high risk of MI with anemia.

Pre-operatively, anemia should be medically evaluated and intervention initiated depending on the underlying cause.

Post-operatively, nursing care needs to be planned according to the symptoms the patient may be experiencing.

- Implement fall prevention strategies
- Push oral fluids
- Provide teaching regarding diet, medications, and supplements
- Monitoring of CBC/ HBG

Pathophysiology Risk Factors

Depression

Presents as somatic symptoms (constipation, fatigue, anorexia, psychomotor retardation) or behavioural symptoms (withdrawing, crying, anxiety or cognitive impairment).

- Prolonged pain
- Immobility
- Loss
- Medications: analgesics, steroids, digoxin, anti-Parkinson drugs, antibiotics and anti-hypertension

Questions

1. Anemia may be caused by which of the following conditions:
 - a. Excessive alcohol intake
 - b. Blood loss
 - c. Chronic disease
 - d. Nutritional deficits
 - e. All of the above

2. Anemia may cause the following symptoms:
 - a. Increased risk of falls
 - b. Shortness of breath
 - c. Chest pain
 - d. Dizziness
 - e. All of the above

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Compartment Syndrome

Definition

Compartment syndrome is a progressive condition that occurs when pressure increases (edema builds-up) in a muscle compartment. A muscle compartment is a closed space surrounded by an inelastic fascia (a layer of fibrous connective tissue) that contains muscle, blood vessels and nerves. As edema increases, the fascia does not expand. Increased pressure within the compartment exerts pressure on the blood vessels diminishing capillary perfusion. This increased pressure compromises muscle and nerve viability. These changes lead to the release of histamine, which causes further vasodilatation, increased edema and increased compartmental pressure. This cycle will continue and results in further edema, decreased tissue perfusion and ischemia. Edema, hemorrhage, restrictive cast, bandages and burns are contributing factors that can lead to compartment syndrome. Without diligent assessments, compartment syndrome may cause irreversible damage within 6 hours. After prolonged increased pressure, loss of motor function and sensation may cause lifelong functional deficits. Compartment syndrome is a potentially limb threatening complication that can be prevented if recognized and treated early.

The degree of damage that occurs is related to the amount and duration of the pressure within the compartment. Damaged muscle cells excrete myoglobin. High levels of circulating myoglobin lead to acute renal damage and failure.

For suspected compartment syndrome pain is the most common and important presenting symptom; it is caused by muscle ischemia and necrosis. The patient describes pain out of proportion to the magnitude of the injury or restriction which is poorly localized, not relieved by analgesia and can be elicited on passive movements such as extending the fingers or toes.

Most commonly occurring site is the forearm, followed closely by the tibia. However, compartment syndrome may involve the hand, upper arm, shoulder, foot, and abdomen. Compartment syndrome can be either acute or chronic. Acute compartment syndrome is a medical emergency. It is usually caused by a severe injury. Without treatment, it can lead to permanent damage.

Conditions that can cause an acute compartment syndrome include:

- A fracture
- A badly bruised muscle
- Re-established blood flow after blocked circulation
- Crush injuries
- Anabolic steroid use
- Constricting bandages

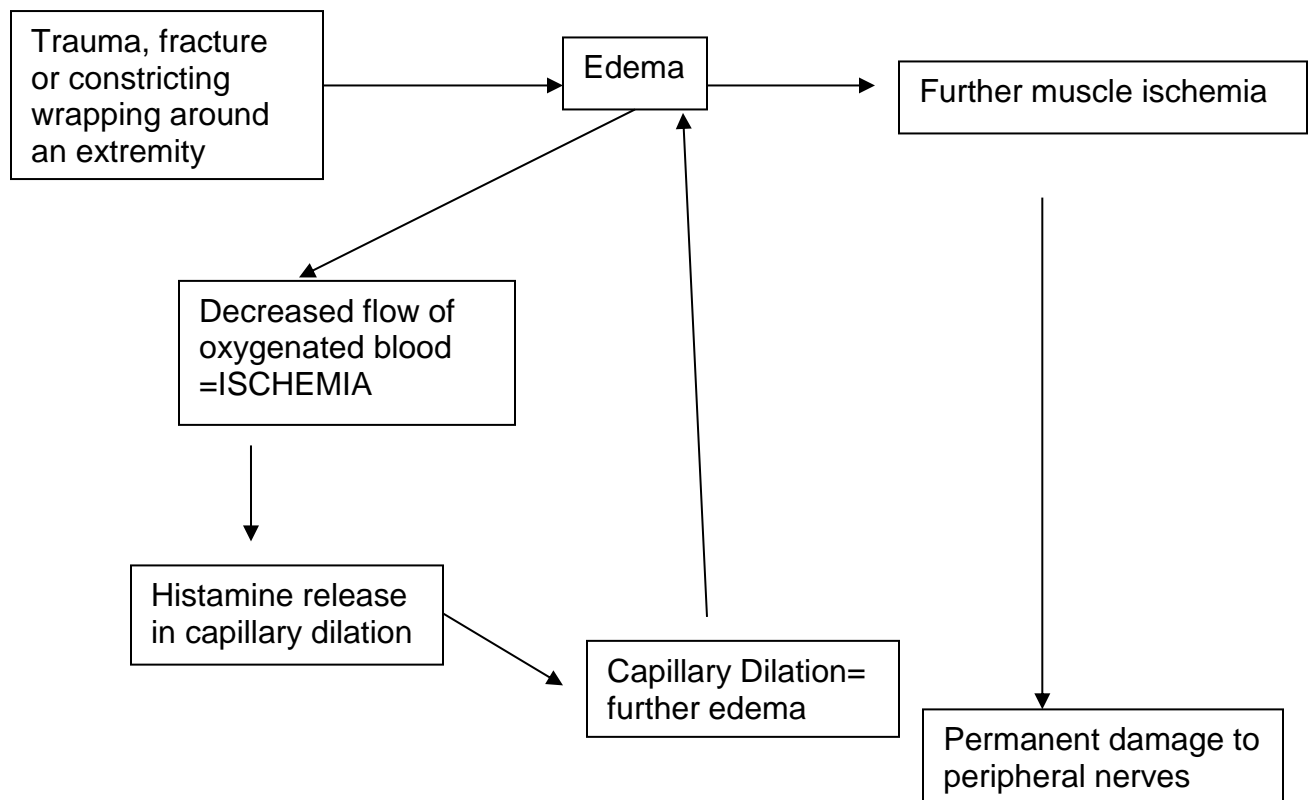
Chronic compartment syndrome is also known as exertional compartment syndrome, is usually not a medical emergency. It is most often caused by athletic exertion. Athletes who participate in activities with repetitive motions such as running, biking, or swimming

are more likely to develop chronic compartment syndrome. This is usually relieved by discontinuing the exercise, and is usually not dangerous.

Population at Risk

1. Most common with fractures of the extremities, especially the tibia and forearm, but also occurs with other fractures e.g. femur, feet and hands
2. People with casts, splints or restrictive or circumferential bandages
3. People with severe crush injuries
4. Extremity burns due to constriction of eschar. (Eschar: a dry scab formed by coagulated skin following a burn or cauterization. Skin is dry and leathery in appearance).
5. People who are immobilized for a prolonged period of time resulting in prolonged limb compression. e.g. lithotomy position or overdose arm
6. People with abdominal injuries i.e. seatbelt (rare)

Compartment System Flowchart



Manifestations

Signs & Symptoms (The 6 P's)

Early signs:

1. Pain: progressive severe pain with passive motion that is out of proportion to the injury and unrelieved with opioids.
 - Increased pain with passive extension to affected extremity
 - Escalating severe pain is the cardinal sign of compartment syndrome
2. Pressure: skin is tight and shiny, swollen, a muscle compartment may feel tense or rock hard on assessment, increase in compartment pressure >30 mmhg (normal is 0-20 mmhg).
3. Paresthesia: decrease sensation and/or tingling sensation cause by pressure on nerves.

Late Signs (Irreversible damage may occur):

4. Paralysis: progressive motor weakness and decreased movement of the affected extremity. Any progression of weakness should be reported the physician immediately for further assessment.
5. Pallor: prolonged capillary refill >3 sec
 - Eventually decreased circulation: decreased peripheral pulses, poor capillary refill, decrease in peripheral perfusion, decrease pulses, pale cool feel to touch
6. Pulselessness: very weak or lack of pulses due to lack of arterial perfusion.

Clinical Assessment

This is the minimum standard and does not replace nursing judgment. The primary treatment for compartment syndrome is to relieve the source of pressure. The following interventions include:

1. Limb Positioning:
 - o To ensure maximal arterial pressure without compromising venous drainage it is important to **position the limb at the level of the heart**.
 - o Do **not** elevate limb above or position below the level of the heart when compartment syndrome is suspected, as this will cause further ischemia as blood flow is compromised. As a result, this will increase pressure within a muscle compartment.
2. Frequent Neurovascular checks (q 1-2) with pain level assessments:
 - o Note the effects of analgesic 30 min after administration.
 - o Use clinical judgement.
 - o Watch for trends and report any changes promptly.
3. Assess for swelling, tightness around the cast or bandage
4. Remove or loosen constrictive circumferential bandages.
5. Call the doctor to obtain an order to bivalve a cast
6. Notify physician immediately if there is any deterioration in neurovascular status (including escalating, severe pain)
7. Check urine for presence of myoglobin when there is extensive soft tissue /crush injury.

Orthopaedic Movement and Sensation Testing

SENSATION / MOVEMENT:

NERVE TESTING FOR SENSORY FUNCTION / NERVE TESTING FOR MOTION FUNCTION

RADIAL NERVE



Touch the web space between thumb and index finger (dorsal surface).



Ask patient to hyper-extend his thumb or his wrist.

ULNAR NERVE



Touch the distal fat pad of the small finger (palmar surface).



Ask patient to abduct all of his fingers or move the index finger laterally against resistance.

MEDIAN NERVE



Touch the distal surface of the index finger (palmar surface).



Ask the patient to oppose his thumb and little finger. Note whether patient can flex his wrist.

FEMORAL NERVE



Touch the anterior surface of the thigh.



Ask the patient to lift his foot off of the bed or press his knee into the bed.

TIBIAL NERVE



Touch the middle surfaces of the sole of the foot.



Ask the patient to plantar flex his great toe (if you get them to just plantar flex ankle you will miss a deep posterior compartment syndrome).

PERONEAL NERVE (Deep)



Touch the web space between the first and second toes.



Ask the patient to dorsiflex his ankle and/or toes.

PERONEAL NERVE (Superficial)



Touch top of the foot -but not the web space between the first and second toes.



Ask the patient to evert his foot.

Prevention

- Padding and repositioning in OR
- Early identification through the use of neurovascular and pain-level assessments
- Notify the physician immediately of a deterioration in neurovascular status or increased pain with passive motion and/or pain that is disproportionate to the injury.
- Know the high risk population and identifications of early signs and symptoms

Treatment

- Clinical symptoms of compartment syndrome or pressures >30 mmHg requires surgical intervention. Normal compartment pressure is 0-20mmHg and surgical intervention may occur between 30-45 mmHg. This is relative to BP and based on clinical assessment.. The physician measures compartment pressure with a Stryker Pressure Monitor

Fasciotomy

The purpose of fasciotomy is to relieve tissue pressure and re-establish tissue perfusion. At least one skin incision is made and the fascia is relaxed with dissecting scissors. The incision is open for several days and bulky wet dressings are applied. The patient will have an additional surgery that may include skin grafts to close the open fascia. This occurs in approximately three days for an upper extremity and five days for a lower extremity. Rehabilitation may be required if the patient requires a skin graft.

Questions

1. The correct position of the limb if compartment syndrome is suspected is:
 - a. Above the level of the heart
 - b. Below the level of the heart
 - c. At the level of the heart
 - d. None of the above
2. The cardinal sign of compartment syndrome is:
 - a. Paresthesia to affected extremity
 - b. Rubor and warmth to affected extremity
 - c. Progressive unrelieved pain to affected extremity
 - d. Pulselessness to affected extremity

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Contractures

Fibrosis of connective tissue in skin, fascia, muscle, or a joint capsule that prevents normal mobility of the related tissue or joint (National Association of Orthopaedic Nurses, 2013). Can result in permanent shortening of a muscle or joint.

Risk Factors:

- Any kind of neuromuscular diseases including:
 - Cerebral palsy
 - Muscular Dystrophy
 - ALS
- Dupuytren's contracture (deformity of the hand, usually the ring finger)
- Elbow fracture guaranteed to lose range of motion

Characteristics:

- Decreased motor performance, mobility limitations, reduced functional range of motion, loss of function for activities of daily living (ADL), and increased pain

Treatment:

- Bracing, stretching programs, and surgery have all been utilized in the prophylaxis and treatment of limb contractures (Skalsky & McDonald, 2012)

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Deep Vein Thrombosis (DVT) & Pulmonary Embolism (PE)

Definition

- A DVT is a large blood clot that typically forms in one or more major deep veins: the iliac, femoral, popliteal, or calf veins
- The main concern related to DVT is that it can lead to a PE (pulmonary embolism). A PE is a very serious condition. It can damage the lungs and other organs in the body and cause death
- The rate of hospital acquired VTE if thromboprophylaxis is not used is 40-60% after hip surgery
- When proper prevention measures are taken, it is estimated that 3% of orthopaedic surgical patients will develop DVT and 1.5% will develop PE
- DVT and PE remain the most common cause for re-admission and death following joint replacement surgeries. (National Blood Clot Alliance)

Population at Risk

- Orthopaedic patients post trauma and lower extremity surgery
- Persons with any of the following: advanced age, obesity, immobility due to prolonged bed rest or long distance travel, prior history of vascular problems, oral contraceptive use, history of myocardial infarct, atrial fibrillation, congestive heart failure, smoking, malignant neoplasms, peri-partum, polycythemia, extensive burns, acute paraplegia, sickle cell anaemia, lower extremity surgery, pelvic trauma, spinal cord injury, diabetes, trauma and pregnancy.

Rudolph Virchow Triad as risk factors for clot development:

1. Venous Stasis: This occurs when blood movement is diminished and results in venous congestion (blood pooling) to the extremity.
 - Immobilization and bed rest (greatest risk factor)
 - Tourniquet
2. Vessel Injury: Damage to the vessels wall (endothelium) initiates the clotting cascade
 - Surgical manipulation
 - Fractures
 - Burns
 - Endothelial injury (Intravenous insertion)
3. Hypercoagulability: There is an increased risk of a blood clot based on the following risk factors:
 - Hereditary conditions
 - Reaming of any intramedullary canal
 - Increased age
 - Malignancies (i.e. breast cancer, brain tumors)

Detection

- 50% of DVTs are clinically silent in a trauma or elective arthroplasty patient. The severity of the risk is related to the size & location of the clot. With DVT, the patient may experience the following symptoms;
 - o Warmth, edema, pain, and tenderness usually along a vein.
 - o The affected leg may appear larger than the other leg. Homan's sign (pain with passive dorsiflexion) may be positive, although this test is non-specific in many cases and is therefore, not warranted in the assessment of orthopaedic patients.
 - o Low grade temperature due to the accumulation of tissue metabolites at the site of thrombosis.

Diagnostic Tests

- **Duplex Doppler** - examines the blood flow in the arteries and veins of the arms and legs with the use of ultrasound. The test combines ultrasound, which uses audio to "hear" and measures blood flow with duplex ultrasound providing a visual image.
- **Impedance plethysmography (IPG)** - measures the change in blood volume (venous blood volume as well as the pulsation of the arteries). As the blood volume changes, the electrical impedance (resistance) also changes. By measuring the changes in blood volume, doctors can detect blood flow disorders such as arterial occlusive diseases (and estimate severity), early stage arterioscleroses, functional blood flow disturbances, deep venous thromboses, migraines, and general arterial blood flow disturbances.

- **Invasive Venogram** - A venogram is a procedure that looks at blood vessels (veins) by injecting radiopaque dye and taking x-rays. Risks include clot formation and allergic reaction.
- **D-Dimer – (not conclusive)** – A blood test that measures the presence of Fibrin Degradation Fragment. This is present in the blood stream as a by-product of clot breakdown.
- **Magnet Resonance Venography:** A non-invasive procedure that detects distal and proximal DVT.

Prevention of DVT - See Anticoagulant Rapid Review

1. Administer prophylactic anticoagulant as ordered (LMWH, Coumadin)
Most effective preventive treatment if not contraindicated
2. Apply sequential compression devices, combined with early ambulation and foot/ankle pump exercises.
3. Pain management to facilitate exercise and early mobility.

Special Considerations - For patient receiving pre-existing anticoagulant therapy Warfarin (Coumadin) pre-op/ pre injury.

- INR level pre-op should be close to normal range prior to surgery and patient may be instructed by the physician to stop Coumadin a few days before surgery
- INR should be measured on admission preoperatively; the patient may receive fresh frozen plasma or Vitamin K to normalize INR level before surgery
- May be started on heparin infusion or LMWH for peri-operative period.

Chest Guidelines (September 2016) for prophylaxis anticoagulant therapy:

Prophylaxis LMWH (gold standard)

- 10 days for TKR and THR
- 28 - 35 days for extended prophylaxis treatment for THR and hip fractures

Patients on pre-existing Coumadin:

- Pre-operative INR levels: see above under special considerations.
- Post-operative INR levels:
 - Target INR 2.5 (INR range 2-3)
 - INR 2.5 –3.5 (mechanical valve)

4. Early ambulation
 - a. Frequent ankle pump exercises
 - b. Pain management to facilitate exercise and early mobility

Treatment of Established DVT & Prevention of PE

- Monitoring of diagnostic studies to identify presence of DVT
- Careful monitoring to detect signs of PE
- SEE Anticoagulation Rapid Review - Initiate administration of anticoagulation –heparin infusion, therapeutic doses of Low Molecular Weight heparin (LMWH). Coumadin may be started in conjunction with heparin infusion or LWMH until patient has reached therapeutic INR level
- An Intravenous vena cava (IVC) filter may be inserted to trap and prevent emboli from migrating. This may be considered for a high-risk patient who is unresponsive to anticoagulation, who has had a previous history of PE or patients for whom anticoagulation is contraindicated (i.e. brain injury)

Definition of a PE

- A complete or partial obstruction in one of the pulmonary arteries.
- 95% of PE's begin as thrombus that forms in the deep veins of the proximal lower extremity (DVT).

Detection

- PE usually occurs 48-72 hours after surgery, injury or immobility.
- Signs and symptoms of PE may include: apprehension, dyspnea, chest pain, anxiety, tachypnea, tachycardia, diaphoresis, confusion, increased temperature, and hemoptysis
- The diagnosis of PE is often difficult to make and is based on several indicators including the patient's clinical presentation, arterial blood gases (ABGs), chest x-ray (CXR) to rule out alternate diagnosis, electrocardiogram (ECG), a ventilation perfusion scan (VQ), and pulmonary angiography
- The characteristic early ABG readings for PE show a decreased PO₂ (10% of patients have no such decrease), a decreased PCO₂ due to tachypnea – blowing off the CO₂. Later readings of severe advanced PE show decreased PO₂ and PCO₂
- Unexplained decreases in oxygen saturation and increased need for oxygen therapy should be reported and investigated

Nursing Interventions for a patient with a PE

- Upon discovery: Elevate head of bed, initiate O₂, monitor vital signs, and notify physician stat. (This is an Emergency Situation)
- If the patient's status is deteriorating rapidly, call a Code Blue. Don't wait for a full arrest

- Have team member prepare for IV start, ABG, ECG, and CXR
- Respiratory assessment. (Call Respiratory Therapist for support if available)
- Stay with the patient and provide emotional support
- Administer analgesic to reduce anxiety and improve ventilation
- Anticoagulation: Prepare for initiation of heparin infusion pump
- May require transfer for higher level of care

Patient Teaching

- Risk factors pertinent to the person
- Signs and symptoms of DVT/PE and the importance of reporting any signs or symptoms that occur
- Importance of using sequential compression devices, exercise, mobility, and not smoking
- Rationale and safety precautions related to anticoagulation
- Signs and symptoms of bleeding while on anticoagulants and the importance of reporting any signs or symptoms that occur

Questions

1. What is the gold standard for prophylaxis anticoagulant therapy for elective hip and knee arthroplasty patients?
 - a. Aspirin
 - b. Low Molecular weight heparin (LMWH)
 - c. Heparin infusion drip
 - d. Ted stockings
 - e. None of the above
2. The three main risk factors for clot development according to the Virchow Triad are:
 - a. Limb positioning, pain management and poor circulation
 - b. Patients on Coumadin, early mobilization, and smoking
 - c. Venous Stasis, vessel Injury and hypercoagulability
 - d. Sequential compression devices, vessel injury and anticoagulant therapy
3. You suspect that a patient has a DVT based on the following clinical findings:
 - a. Numbness and tingling to the extremity
 - b. Rubor, warmth, pain, swelling and tenderness along the vein of the extremity
 - c. Patient requires high flow oxygen to maintain saturation and has a temperature
 - d. Patient complaints of chest pain and SOB

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Fat Embolism (FE) Syndrome

Definition

Fat embolism (FE) is the occlusion of small blood vessels by fat droplets originated mainly from femur, tibia, and pelvis fractures, as well as knee and hip arthroplasty. It usually does not cause damage to the involved organs, unless when it is massive. In a few cases, FE evolves to the “fat embolism syndrome” (FES) affecting most often the lungs and the brain, although any organ or structure of the body can be damaged.

Although controversy still exists about the cause of fat emboli, it is generally thought to occur when fat globules and free fatty acids enter the vascular system following a fracture. The syndrome can occur after 6 hours of injury and can occur up to 72 hours following trauma or surgery. For clinically significant fat embolism, the mortality rate is in the range of 5-10% for multiple fractures.

Population

- Patients with trauma or surgery of the long bones (fibula, tibia) or pelvis are at greatest risk for developing FE
- About 0.5 –2% of patients with long bone fractures and between 0.5-3.5% of patients with a single fracture may develop fat embolism syndrome

- FE is more likely to occur when there is a long delay (24-48 hours) between the occurrence of the fracture and its fixation (e.g. MVA victim who is not discovered for several hours), or delayed surgery
- Also occurs in patients with severe burns, severe osteomyelitis, acute pancreatitis, and sickle –cell crisis

Manifestations

Patients at risk should be observed for the following signs and symptoms:

- Tachycardia
- Tachypnea (Shortness of breath)
- Restlessness, disorientation, and confusion
- Anxiety, fear
- Increased temperature
- Petechiae on the chest, axillae, base of neck, and conjunctivae – this is the most specific sign, however, it may not be present in all cases, and is often a late sign 12-96 hours post injury.
- Drop in Hematocrit, platelet count, or Hgb
- Pulmonary edema
- Fat in urine

Diagnostic Tests

- A chest x-ray may demonstrate a “snow storm” characterized by wide spread pulmonary infiltrates
- The characteristic early ABG readings for FE show a decreased PO₂ (10% of patients show no such decrease), a decreased PCO₂ due to tachypnea (blowing off the CO₂). Later readings of advanced FE show decreased PO₂ and increased PCO₂
- As demonstrated on a VQ scan, as the condition progresses, marked ventilation/perfusion changes will be noted

Interventions

Prevention:

- Advocate prevention by early fracture stabilization and operative bone stabilization within 24 hours of a major long bone fracture
- The fracture should be promptly realigned and fixed whenever possible.
- Ongoing Assessment
- Frequently monitor respiratory status and maintain adequate oxygenation
- Monitor neurological status for increased confusion, restlessness, and agitation.
- Monitor blood work for changes: ABGs, platelets, Hgb.
- Management: when patients are exhibiting acute signs and symptoms:
- Elevate the HOB
- Initiate O₂ by mask

- Monitor vital signs q 15 minutes with O2 saturation
- Notify physician
- Respiratory assessment (Call Respiratory Therapy for support)
- Stay with patient and reassure him/her
- Prepare for ABGs and portable chest x-ray
- Provide analgesic for chest pain as needed
- Prepare IV line and administer IV fluids as ordered
- Strict Intake and output
- The management of fat embolism involves respiratory support for hypoxia and maintenance of fluid balance. The patient should be monitored closely for respiratory distress. The patient may need higher level of care with
- ventilation.
- Prepare for transfer for higher level of care. Management of FES is primarily supportive, including intubation, ventilator support and ICU monitoring.

Questions

1. Patients at greatest risk of developing a fat embolism are those with:
 - a. Trauma or surgery of the long bones (fibula, tibia)
 - b. Compartment syndrome
 - c. Previous history of DVT or PE
 - d. Elective hip or knee arthroplasty
2. Management for a patient with FE includes all of the following except:
 - a. Anticoagulant therapy to prevent further clots
 - b. Adequate oxygen therapy and frequent oxygen saturation monitoring
 - c. Analysis for chest pain
 - d. Emotional support and calm manner

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Fracture blisters

Fracture blisters are a complication of traumatic fractures, that occur when hydrostatic pressure separates the epidermis from the dermis. Most prevalent in the first 1-2 days after injury, especially in lower limb fractures because it is difficult for fluid to exit the limb. The fluid may be serous fluid (partial thickness skin injury) or blood (full thickness, hemorrhagic injury).

Risk Factors:

- Anatomical sites with thinner skin without the underlying protection of muscle or adipose (ankle, wrist, elbow, foot, and distal tibia)
- Conditions that predispose to poor wound healing (e.g. peripheral vascular disease, collagen vascular disease, hypertension, smoking, alcoholism, diabetes mellitus, and lymphatic obstruction)
- High energy injury, such as falls from a significant height, motor vehicle accidents, pedestrian vs. motor vehicle accidents and grade I and II open tibia fractures
- Delayed surgical intervention (>24 hours after initial injury); those that develop fracture blisters prior to surgery have a higher rate of post-operative wound infections

Treatment:

- If possible, do not disrupt the blister to maintain a sterile environment. The blister should start to heal and new skin will form. New skin typically forms in about one to two weeks. Hemorrhagic blisters take longer to heal.
- If the blister is disrupted, drain and cover with silver sulfadiazine. Keep the bandaged area clean and dry and follow the doctor's instructions.

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Infection – Post Arthroplasty

Definition

Infection, though an uncommon complication of arthroplasty, may be among the most devastating complications for the patient as well as the surgeon. Currently the reported infection rate after arthroplasty is about 1%.

Deep sepsis following an arthroplasty is a serious complication that occurs in approximately 1% of patients. The most common organism is *Staphylococcus epidermidis* or *aureus*, with contamination most likely to occur in the operating room, in the case of chronic infections. Joints with the least soft tissue coverage (elbow, knee, etc.) are most likely to become infected. Three stages of infection have been described:

- Stage 1: acute post-operative surgical infection
- Stage 2: chronic infection that presents with joint pain developing 6-24 months post joint replacement
- Stage 3: Hematogenous spread sometime after joint replacement.

Population at risk

- Prior surgery at the site of the prosthesis
- Surgery greater than one hour
- Immunocompromised due to steroid use
- Diabetes, undernourishment, HIV infection, IV drug users, sickle cell disease other immune compromising conditions
- Surgical site hematoma

Detection

It involves progressive joint pain, swelling, and erythema around the joint, drainage, decreased range of motion. Joint aspiration is usually positive for organisms.

Prevention

- Prophylactic antibiotic dose prior to any surgery or dental procedure - usually for two years – longer if patient is high risk for infection.
- Infection control measures (e.g. aseptic technique, hand washing, etc.).
- Prompt detection and treatment of any infection (e.g. urinary tract infection or dental abscess).
- The patient should be referred to the surgeon immediately if there is an indication of joint infection. Antibiotic therapy alone is never indicated for an acute joint infection.

Management

- Early acute or hematogenous infections may be treated with an aggressive debridement, with an expected cure rate of 50-60%. Chronic infections

- require removal of the implant and a course of long term antibiotic therapy. Another implant may be re-implanted at a later date (at least six weeks later). See Rapid Reviews for Girdlestone and Prostalac.
- Long term antibiotic therapy alone is only appropriate for patients who cannot tolerate any further surgery.

Patient Teaching

- Signs and symptoms of wound/joint infection and the importance of reporting these to their orthopaedic surgeon.
- The importance of informing health care providers about the prosthesis, prior to any dental or surgical procedure, particularly in the case of infection elsewhere. Usually will require one prophylactic antibiotic dose prior to procedure for 2 years after joint replacement, longer if at increased infection risk
- Infection control measures e.g. wound care, no baths until wound is healed.
- Importance of seeking treatment for any infection, e.g. throat, urinary tract, dental abscess etc.

Questions

1. Which of the following is true about stage 2 joint infection?
 - a. Presents with joint pain 6 to 24 months after surgery
 - b. It is most often caused by streptococcus
 - c. Occurs most often in the hip joint
 - d. Hematogenous spread of infection after surgery
2. Which of the following is false about infection post arthroplasty?
 - a. It is more common in people with prior surgery at the site
 - b. It is more likely to occur in someone who is malnourished
 - c. A prolonged course of antibiotic therapy is likely to resolve it
 - d. Patients with hematomas are at increased risk for infection

Osteomyelitis

Definition

Osteomyelitis is an acute or chronic infection of bone and its structures. The most common organism responsible is staphylococcus aureus. It is a progressive condition and the associated inflammation leads to necrotic destruction of bone that can lead to an acute infection that can become chronic. It is difficult to treat because of necrosis and disruption to blood supply to bone which means that systemic and local antibiotic therapy is not successful. Different classifications of osteomyelitis depend on the source of infection. They include:

Endogenous (haematogenous) osteomyelitis occurs from pathogens carried in the body from sites of infection from other areas in the body; “remote seeding”. The

infection spreads from bone to adjacent soft tissue or remote infections such as urinary tract infection. Prevention is key; including avoidance of urinary catheters.

Exogenous osteomyelitis is a key route of transmission; the infection enters through open fractures, penetrating wounds and surgical procedures.

Population at Risk

It is relatively uncommon as bone is resistant to infection so it tends to occur in people with significant risk factors that reduce their resistance or make their bones more vulnerable through surgery or trauma. Its severity and progression can depend on the source of infection and virulence of the organism involved and the overall health of the patient.

Prevention

Prevention following injury and surgery involves infection prevention and control practices throughout the patient's care journey. Prophylactic antibiotic is often given following open fracture and orthopaedic surgery. (Antibiotics have been found to reduce the incidence of early infections in open fractures of the limbs).

Investigations

- History and physical exam
- Blood counts
- Blood cultures of blood and wound
- Aspiration of material from the site of infection
- X-ray
- Bone scan/CT/MRI

Stages

I Medullary: restricted to the bone marrow

II Superficial: restricted to cortical bone

III Localized: infection with clearly defined edges & bone stability is preserved

IV Diffuse: infection is spread to the entire bone circumference, with instability before and after debridement

Management

It can be difficult to treat because of necrosis and disruption to blood supply to bone which means that systemic and local antibiotic therapy is unsuccessful. It is always important to manage pain and support limb. Intravenous antibiotic therapy is initiated with 4-6 weeks for treatment of acute infection. High doses of antibiotics are needed to achieve bone penetration in high enough concentrations in necrotic avascular bone. For chronic osteomyelitis, treatment includes antibiotic therapy for 6-12 weeks. Surgery is almost always needed as necrotic and dead bone needs to be debrided. Management might include vacuum assisted closure with flaps, antibiotic impregnated beads, bone grafting, soft tissue management and stabilisation.

Considerations for orthopaedic nurses

- Explain to patient that antibiotic therapy will be needed for extended period of time
- Consider the psychological impact on the patient as recovery may be slow and pain needs to be addressed and managed. Provide necessary supports.

Questions

1. It can be difficult to treat osteomyelitis because of necrosis and disruption of blood supply to the bone. True or false?
2. Which of the following statements is not true?
 - a. Osteomyelitis is an acute or chronic infection of bone and its structures
 - b. The most common organism responsible is staphylococcus aureus
 - c. It is a progressive condition and the associated inflammation leads to necrotic destruction of bone that can lead to an acute infection that can become chronic
 - d. Rarely is there pain involved

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Necrotizing fasciitis

Acute infection of the fascia and surrounding muscle that can quickly become life-threatening. The most common is *group A streptococcus*.

Signs & Symptoms:

- Fever
- Swelling & erythema
- Complaints of excessive pain when compared to a small, benign swelling on the skin
-

Medical Emergency: Aggressive wound debridement (removal of unhealthy tissues) is always necessary to keep it from spreading and is the only treatment available

- Broad spectrum antibiotics that covers the gram positive, gram negative, and anaerobes should be used

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Pain

Pain is often classified by the type of damage that causes it. Pain caused by tissue damage is referred to as nociceptive pain and pain caused by nerve damage is called neuropathic pain.

Acute and chronic pain are different entities. Acute pain is provoked by a specific disease or injury, serves as a useful biologic purpose and is self limiting. Chronic pain is a pain that outlasts the normal time of healing.

It is importance to take a preventative approach to pain. This involves regular analgesic administration, dosing, to decrease the chance of developing chronic pain.

Consequences of unrelieved pain include delirium, increased blood clotting, cardiac stress, depression. Unrelieved acute pain delays healing and may lead to chronic pain.

Management of nociceptive pain includes multi-modal pain medication strategies, non-pharmacological strategies, and complementary therapy. Factors contributing to the pain presentation include culture, age, addictions, stage of illness, comorbidities, pre-existing pain experiences.

Neuropathic Pain (NP)

Definition

Neuropathic pain is pain caused nerve injury or nerve damage. It may be central or peripheral or both.

Central neuropathic pain is pain resulting from an injury, lesion or disease in the central nervous system (e.g. spinal cord injury, stroke). Peripheral neuropathic pain is pain resulting from an injury, lesion or disease in the peripheral nervous system (e.g. diabetic neuropathy, post-amputation phantom limb pain).

Neuropathic pain is different than nociceptive pain, which is pain from damage to non-neural tissue (skin, muscle, bone, visceral organs).

<http://www.iasp-pain.org/Taxonomy#Peripheralneuropathicpain>

There is an estimated prevalence of 3% of people in the developed world who experience chronic neuropathic pain (approximately 1 million Canadians) (Moulin et al, 2007).

Population at Risk includes people with:

- Spinal cord injuries 60%.
- Back surgery
- Amputation 40-50%
- Major trauma of the spine, pelvis, and limbs 10-20%
- Knee injuries
- Long incisions

Manifestations

- Persistent escalating pain
- Limited response to standard analgesics
- Hyper-sensitivity to touch
- Intense/episodic pain at rest

Neuropathic pain related terms:

- Dysesthesia: an unpleasant abnormal sensation when being touched
- Hyperalgesia: increased pain response from a painful stimulus

Assessment

Early identification and treatment is critical. Anticipate pain and take a preventive approach to managing pain in the populations at risk. Well-established NP is difficult to control. The patient's description of the pain is a key to identification of NP.

- Obtain information regarding the quality of the pain. Ask the patient to describe how the pain feels. Adjectives characteristic of NP include – burning, tingling, shooting, stabbing, shock like, cramping, radiating and numb. Dysesthesia or hyperalgesia often associated with pain that is out of proportion to a stimulus (e.g. light touch) is also an indicator.
- Assessment of neuropathic pain can be completed by using valid and reliable tools such as the DN4, LANSS (Leeds assessment of neuropathic symptoms and signs), or the Neuropathic Pain Scale.

Management

Primary agents:

- Anticonvulsant medications: Gabapentin or Pregabalin are calcium channel blockers and are commonly used as first line to manage neuropathic pain. The most common adverse effect is sedation. Carbamazepine is primarily indicated for trigeminal neuralgia
- Antidepressants:
 - Can be effective for neuropathic pain but have drug interactions and should be used cautiously with patients with abnormal heart rhythms or narrow angle glaucoma. These medications have analgesic effects that are independent of their anti-depressant action
 - Tricyclic antidepressants: such as Amitriptyline, Nortriptyline and desipramine are effective to manage neuropathic pain. These medications are anticholinergic drugs and the most common adverse effects are sedation, dry mouth, urinary hesitancy. These medications are also prescribed to help with sleep. Amitriptyline does have more documented severity of adverse effects therefore Nortriptyline and desipramine are used more often
 - Antidepressants – serotonin noradrenaline reuptake inhibitors: such as duloxetine (Cymbalta) can be effective to reduce pain resulting from diabetic neuropathy, fibromyalgia or osteoarthritis
 - Topical lidocaine: this is a local topical local anesthetic that is most useful for patient with peripheral neuropathic pain that is localized (eg: post-herpetic neuralgia). This is not readily available in Canada but can be compounded by a pharmacy if needed. It can provide up to 8 hours of pain relief.

Opioids and Cannabinoids:

- Tramadol weakly binds to the mu opioid receptor blocking agent that can be effective in reducing pain for those patients with diabetic neuropathy or other causes of neuropathic pain. It does have drug interactions so the patient's history and medications should be reviewed prior to starting this analgesic

- Morphine and oxycodone bind to the mu opioid receptor have been shown to reduce neuropathic. The watchful dose for an opioid is 90mg of morphine per day. Patients needed higher doses should be carefully assessed
- Methadone is a synthetic opioid that is commonly used to assist in withdrawal from illicit drugs. It is also used to manage pain, including neuropathic pain. It has a long duration of action, and is challenging to manage. Physicians who prescribe this analgesic require special federal approval
- Cannabinoids may be helpful in managing neuropathic pain and spasms in patients with neuropathic pain. It can be administered in tablet, spray or inhalation

Non-pharmacological Modalities:

- Acupuncture or TENS may be helpful in reducing pain

Advanced Analgesic Techniques:

- Nerve blocks: spinal, peripheral, ganglion blocks
- Rhizotomy: temporary relief, pain usually reoccurs
- Indwelling epidural pumps

Special Considerations for Orthopaedic Nurses

- Appropriate assessment is an important first step when determining the location of the pain, type of pain a patient is having, and the severity of the pain
- Providers have mistakenly labeled some patients as 'drug seeking' or having 'psychogenic pain'. These patients may mistrust a health care system that has failed them. Nurses need to earn trust by skillfully assessing pain and advocating for effective treatment
- Early detection and treatment is key to successful management
- Disturbed sleep is common and exacerbates symptoms
- Patients with longstanding severe pain are at high risk for depression and suicide
- Consult with physician or nurse practitioner re: appropriate modalities for the management of neuropathic pain
- People with long term pain that is not well-managed should be referred to a physician, nurse practitioner or clinic that specializes in chronic pain in their community

Questions

1. Dysesthetic pain can best be described as:
 - a. Sharp, shooting and lancinating
 - b. Hypersensitive to touch
 - c. Burning, freezing, pins and needles
 - d. Localized and severe.

2. Which of the following is true about the management of NP:
 - a. Anticonvulsant therapy is primarily used to manage dysesthetic pain.
 - b. Opioid therapy alone is an effective strategy for the management of NP.
 - c. Tricyclic antidepressants are used primarily for the management of dysesthetic pain.
 - d. NSAIDS do not have a role in the management of NP.

References

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Post-polio disease

Post-polio disease involves a cluster of potentially disabling signs and symptoms that appear decades after the initial poliomyelitis infection. The poliovirus often damages or destroys nerve cells. To compensate for the resulting neuron shortage, the remaining neurons sprout new fibers, and the surviving motor units enlarge. Over the years, this stress may be more than the neuron can handle, leading to the gradual deterioration of the sprouted fibers and, eventually, of the neuron itself. (Mayo Clinic, 2017).

In most people, post-polio syndrome tends to progress slowly, with new signs and symptoms followed by periods of stability.

Signs & Symptoms

- Progressive muscle and joint weakness and pain
- General fatigue and exhaustion with minimal activity
- Muscle atrophy
- Decreased ability to ambulate
- Breathing or swallowing problems
- Sleep-related breathing disorders, such as sleep apnea
- Decreased tolerance of cold temperatures

Complications

- Falls
- Malnutrition, dehydration and pneumonia (with *bulbar polio*, which involves *chewing and swallowing problems*)
- Chronic respiratory failure
- Osteoporosis (due to prolonged inactivity)

Treatment/Symptom Management

- Physical therapy to strengthen muscles
- Assistive devices to help conserve energy
- Rest intervals to conserve energy
- Speech therapy for swallowing difficulties
- CPAP if sleep apnea is present
- Pain relievers for muscle & joint pain

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Pressure Injuries (formerly pressure ulcers)

A *pressure injury* is localized damage to the skin and/or underlying soft tissue usually over a bony prominence or related to a medical/other device. The injury can present as intact skin or an open ulcer & may be painful. The injury occurs as a result of intense and/or prolonged pressure or pressure in combination with shear. Pressure injuries serve as a key indicator of the overall quality and safety of health-care organizations and facilities.

Stages

Stage 1: Non-blanchable erythema of intact skin

Stage 2: Partial-thickness skin loss with exposed dermis

Stage 3: Full-thickness skin loss

Stage 4: Full-thickness skin and tissue loss

Unstageable: Obscured full-thickness skin and tissue loss

Deep tissue: Persistent non-blanchable deep red, maroon, or purple discoloration

Risk factors

- Increased age
- History of diabetes mellitus
- Anemia
- Malnourishment
- Low mental test scores
- Impaired mobility
- Surgical patients (sensory loss from anesthesia & surgical duration >2 hours)
- Orthopaedic: cast or brace immobilization, traction use, and weight-bearing restrictions

Treatment

- Assess and/or Reassess
 - Regular skin assessments starting on admission
- Use validated risk assessment tool (e.g. Braden Risk scale)
- Identify risk and causative factors (e.g. nutrition) that may impact skin integrity and wound healing
- Treat the cause, implement off-loading strategies and treat pressure injury wounds with best practice protocols regarding wound care

References

National Association of Orthopaedic Nurses, 7th edition. (2013). Schoenly, L. Chapter 13, pp 322-338 and Chapter 39, 990-1011.

Septic joint arthritis

Inflammation of a synovial membrane with purulent effusion into the joint capsule, due to infection. Originates from bloodstream infection or penetrating trauma and can be caused by bacterial, viral or fungal infections. Bacterial infection with *Staphylococcus aureus* is the most common cause.

Risk Factors

- Existing joint problems (osteoarthritis, gout, rheumatoid arthritis or lupus, artificial joint, previous joint surgery, joint injection or joint injury)
- Skin fragility – gives bacteria access to the body
- Weak immune system – diabetes, kidney and liver problems, and those taking drugs that suppress their immune systems (e.g. Prednisone for RA)
- Joint trauma – Animal bites, puncture wounds or cuts over a joint can put a person at risk of septic arthritis
- Patients with indwelling catheters
- Advanced Age
- Young children (especially those that are not immunized)
- iV drug use

Manifestations

- The affected joint is painful and swollen with restricted movement
- 80% of cases occur in a single joint

Diagnosis

- Positive culture and elevated leukocytes from synovial fluid analysis
- X-rays may display joint effusion, soft tissue swelling and synovial thickening

References

Goldenberg, D., Sexton, D. (2019). Septic arthritis in adults. *UpToDate*, article online: https://www.uptodate.com/contents/septic-arthritis-in-adults?search=septic%20joint%20arthritis&source=search_result&selectedTitle=1~150&usage_type=default&display_rank=1#H24 Retrieved August 2019.

Schoenly, D. (2013). Core curriculum for orthopaedic nursing, 7th ed. *National Orthopaedic Association of Nurses*. pp. 222-224.

Substance withdrawal

Many facilities across Canada have substance (alcohol) withdrawal assessments and protocols to prevent seizure from withdrawal. The Clinical Institute Withdrawal Assessment for Alcohol, commonly abbreviated as *CIWA*, is a 10 item scale used in the assessment and management of alcohol withdrawal.

The evidence on which to base alcohol withdrawal anti-seizure prophylaxis comes from small trials with small numbers. Benzodiazepines are used and are effective but dosing for patients who have underlying medical problems is not clear. Lorazepam (anticonvulsant effects for 12-24 hours) is more effective than Diazepam (anticonvulsant effects for 15-30 minutes) in preventing seizures. For patients with a history of alcohol withdrawal seizures, many addiction units will give Diazepam in a prophylactic treatment plan. For patients with severe asthma, respiratory failure, elderly, debilitated, or those with increased albumin, lorazepam is used, and the dose individualized. Patients treated with lorazepam may “rebound” after initially settling and require later treatment with lorazepam. Patients with an underlying non-alcoholic withdrawal seizure disorder should be on their regular anti-convulsive medications as well as the benzodiazepines (Horizon Health Network, 2012).

References

Horizon Health Network, 2012. *Alcohol Withdrawal Order Sheet*. Retrieved February 6, 2019 from Skyline:
<http://skiline/DepartmentsPrograms/technology/allscripts/Documents/archive/CIWA-Ar.pdf>

FRAIL ELDERLY

Constipation in Older Adults

Definition

Constipation is an abnormal decrease in bowel movement frequency with prolonged difficulty passing stool. Stool is hard, formed and there may be incomplete evacuation of the bowel. Normal bowel frequency ranges between three times per day and three times per week. A decrease in the patient's bowel movement pattern may signify constipation.

Population

All orthopaedic and trauma patients are at risk for constipation. Constipation increases delirium risk and may lead to obstruction and bowel infarction.

Cause

- Opioid use
- Reduced mobility
- Dehydration
- Toilet arrangements that inhibit fecal evacuation e.g. bedpans
- Positioning that impairs evacuation e.g. in bed
- Decreased muscle tone.

Functional	Drug Therapy	Dietary	Metabolic
<ul style="list-style-type: none"> ▪ Reduced mobility 	<ul style="list-style-type: none"> ▪ Opioid analgesics ▪ Antacids which contain aluminum 	<ul style="list-style-type: none"> ▪ Low fiber intake ▪ Poor fluid intake 	<ul style="list-style-type: none"> ▪ Chronic renal failure ▪ Diabetes
<ul style="list-style-type: none"> ▪ Inadequate toilet arrangements, e.g. lack of privacy / inability to self-toilet 	<ul style="list-style-type: none"> ▪ Anticholinergics 		<ul style="list-style-type: none"> ▪ Hypercalcemia
<ul style="list-style-type: none"> ▪ Cognitive impairment 	<ul style="list-style-type: none"> ▪ Antidepressants 		<ul style="list-style-type: none"> ▪ Hyperparathyroidism
<ul style="list-style-type: none"> ▪ Depression 	<ul style="list-style-type: none"> ▪ Beta-blockers 		<ul style="list-style-type: none"> ▪ Hypothyroidism
<ul style="list-style-type: none"> ▪ Weakness 	<ul style="list-style-type: none"> ▪ Calcium channel blockers ▪ Cholestyramine ▪ Diuretics ▪ Kaopectate ▪ Laxative overuse ▪ Loperiamide ▪ Phenothiazines ▪ Sucralfate 		<ul style="list-style-type: none"> ▪ Hypokalemia

Manifestations

In addition to changes in stool and decreased frequency of BMS, older adults may exhibit behavioural changes indicating constipation:

- Decreased stool frequency
- Hard formed BMs
- Small leakage of liquid stool – may indicate obstruction
- Abdominal pain
- Delirium
- Irritability and agitation
- Insomnia
- Headache
- Foul breath and furred tongue

Interventions

Prevention is key to avoiding constipation.

Assessment:

- Usual bowel patterns and habits.
- Identify potential contra-indications to using bowel protocols, e.g. bowel disease
- Changes in bowel patterns or habits
- Date of last bowel movement
- Measures used and their effectiveness e.g. foods, laxatives, suppositories and or enemas
- Mobility level
- Use of medications which decrease bowel function

Interventions:

- Assess and modify risk factors
- Monitor and document bowel movements and size
- Promote fluid and fibre intake (25 gms per day is optimal)
- Encourage ambulation and bed mobility
- Regular toileting e.g. every 3 hours while awake. Avoid bedpans. Provide privacy
- If on regular opioids, administer preventative laxatives daily. Appropriate laxatives include: 1) bulking agents to draw water into stool e.g. lactulose 2) Stimulants to promote peristalsis e.g. sennakot and 3) suppositories to aid with lower bowel evacuation e.g.. Glycerin or dulcolax suppositories

Patient Teaching

Ensure patient understands the need for maintaining:

- Regular bowel habits
- Mobilization
- Adequate intake of dietary fiber and fluid
- Use of appropriate laxatives as required

Questions

1. Which of the following describes the purpose of a stimulant laxative?
 - a. Facilitates emptying of the lower bowel.
 - b. Draws fluid into the bowel
 - c. Promotes absorption of nutrients
 - d. Promotes peristalsis
2. Which of the following would be most important in preventing constipation for the person taking opioid analgesics?
 - a. Regular toileting
 - b. Prunes with breakfast
 - c. Prophylactic administration of laxatives
 - d. Reviewing the patient's medication usage

References

Maher A, Meehan A, Hertz K., Hommel A, MacDonald V, Specht K, Taylor A. (2013) Acute nursing care of the older adult with fragility hip fracture: An international perspective International Journal of Orthopaedic and Trauma Nursing 17, p 14-18.

Mounsey A., Raleigh M., Wilson A. (2015) Management of Constipation in Older Adults. American Family Physician . Vol. 92 Issue 6, p 500-504.

Delirium

Definition

- Delirium is an acute syndrome with disruption of attention and cognition. Delirium often resolves when the underlying cause is addressed
- Delirium is associated with increased mortality, morbidity and length of hospitalization
- Patients with delirium are at high risk for pneumonia, urinary tract infections, decubitus ulcers, falls, temporary and often permanent loss of function, nursing home placement, and death
- Delirium is preventable in most hospitalized patients

Population

- 20% of patients over age 75 with joint replacements, and 60% of patients with hip fracture repair may experience delirium post-operatively
- Adults age 75 or older, after major surgery and/or underlying health problems.
- Persons who became delirious during prior hospitalizations
- Persons with a pre-existing cognitive impairment

Detection

The CAMI (Confusion Assessment Method Instrument) may be used to detect delirium. This tool assesses the following characteristics of delirium:

- Acute onset – change from baseline in cognitive function or behaviour.
- Inattention
- Disorganized thinking
- Altered LOC
- Sleep disturbances
- Fluctuating course – patient appears lucid for periods, then confused again

Interventions

Prevention

- Medication review especially anticholinergics, antidepressants, anti-emetics, anti-hypertensives, cardiac meds, and analgesics. See the Beers list
- Provide effective pain management
- Ensure patient has visual and hearing aids accessible/in place
- Encourage and support family presence and involvement with care
- Regular toileting schedule
- Prevent constipation and urinary retention
- Early detection and treatment of infection, especially urinary tract and respiratory
- Monitor and maintain food intake
- Monitor and maintain fluid and electrolyte balance
- Prevent dehydration

- Prevent anemia
- Promote mobility
- Avoid using benzodiazepines. If patient is taking benzos at home, consider weaning, with physician and pharmacy involvement
- Avoid restraints- use Bed Alarm or sitter if possible
- Avoid foley catheters
- Provide familiar personal items: e.g. clock, pictures, comforter from home

Management

- Anticipate that older patients may become delirious after major orthopaedic surgery. Confer with family/care givers. Note any history of cognitive impairment or prior delirious episodes
- Investigate and correct the underlying causes – **PRISME**:

Pain

Retention of urine, Restraint

Infection of urine, lungs, and wound. Impaction/constipation

Sensory impairments, Sleep deprivation

Medications – post-op avoid: Benzos, gravol, tricyclics, Demerol, NSAIDs

Metabolic disturbances – rule out hypoxia, anemia, fluid, and electrolyte imbalances especially dehydration, hypo or hypernatremia. Withdrawal from alcohol or drugs e.g. benzodiazepines

Environment – over/under stimulation, unfamiliar setting, lack of family presence

Patient Teaching

Family and patient may be anxious about the delirium. Many patients recall the experience and are ashamed of their behavior. They will need teaching and support.

- Communicate clearly and simply who you are and what the plan is when providing care.
- Debrief with patient when delirium clears – explain nature of delirium, risk factors, and increased risk for recurrence with next illness/hospitalization.
- Encourage them to talk about their experience. Provide support.

Questions

1. Patients will not recall being delirious.
 - a. True
 - b. False
2. Which of the following indicators will contribute to a diagnosis of delirium?
 - a. Altered LOC
 - b. Inattention and disorganized thinking
 - c. Sleep disturbances
 - d. Fluctuating course
 - e. All of the above

References

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Falls

The Problem of Falls

- Falls are a leading cause of injury and disability in the elderly and the chronically ill
- Falls contribute to increased length of stay, morbidity and mortality

Population

- 25-35% of people over 65 years of age fall annually
- Women fall more often before the age of 75, but after age 75 rates tend to be equal for both sexes
- Fall rates are higher in hospitalized patients
- Those who have fallen once in the past 6 months are at greater risk for repeated falls

Causes

Any patient with one or more of these associated risk factors is at risk for a fall.

Impaired Cognitive Function

- Past history of stroke, brain injury, dementia, delirium or Parkinson's
- Impaired decision making ability and/or judgment
- Perceptual deficits and inability to coordinate thoughts/actions
- Difficulty understanding activity limitations

Past History of Falls

A reduction in activity level related to the fear of falling again is common. This reduction may lead to further declines in function and strength, and increased susceptibility to falls.

Pre-Existing Medical Conditions

The following conditions may increase the risk of a fall:

- CHF, cardiac dysrhythmias, stroke, dementia, Parkinson's, and osteoarthritis
- Postural hypotension with dizziness
- Cardiovascular/respiratory disease affecting perfusion and oxygenation

De-conditioning

- Decreased muscle strength due to immobility
- Bed-rest, even 24 hours in bed can predispose an older person to a fall due to de-conditioning

Impaired Mobility

- Patients with poor standing balance, unsteady gait, hemi-spatial neglect, poor posture.
- Weak or impaired dorsi/plantar flexion (critical for recovery of balance with tripping)
- Conditions of the foot that may affect balance, e.g. bunions, toe deformities, neuropathies, and poorly fitting footwear

Use of Ambulatory Assistive Devices

- Assistive devices are not readily available to the patient (walker located on the other side of room)
- Improperly used or stored walkers, crutches, canes, and wheelchairs can be a tripping hazard

Impaired Elimination

- Urinary urgency, fecal urgency, incontinence, constipation, or nocturia

Impaired Sensory Function

- Visual impairments and poor hearing affects the ability to interpret verbal instructions
- Vestibular system impairment impacts balance and stability
- Language and speech impairments may prevent the patient from communicating their needs

Medications

- Diuretics impact fluid balance, electrolytes, and blood pressure
- Anti-hypertensives may cause postural hypotension
- Sedatives, benzodiazepines, and antidepressants may cause fatigue, dizziness, and impaired muscle coordination
- Other medications such as alcohol and amino glycosides may affect the vestibular system

Environmental Factors

- In the home such things as throw rugs, stairs, poor lighting, and slippery surfaces may pose a risk. Lack of safety railings in bathrooms and tub areas increase susceptibility to falls
- In hospital the unfamiliar environment, and equipment (IV, catheter, oxygen, wheelchair footrests etc.)

Interventions

- Identify and address individual patient risks in the Patient Care Plan
- Intentional hourly rounding to assess and address the 4Ps:
 - **Pain:** assess comfort. **Provide:** analgesics or comfort measures. **Peri-needs:** toileting. **Positioning:** mobilize/reposition. **Possessions:** ensure items are within reach. Inform patient that staff will address their concerns at least every hour
- Discuss risks with patient's family to assist in care planning
- Consult with occupational therapist to review equipment needs. Consult physiotherapist to assess the need for exercise programs and ambulation aids. Keep aids within reach of patient. Ensure brakes are in working order on commodes and wheelchairs
- Consult pharmacist/physician to review if 5 or more medications
 - Assess for postural hypotension prior to mobilizing patient
 - Ensure sufficient night lighting in rooms and hallways
 - Leave bathroom door ajar
 - Teach patient how to use the call system and ensure within reach
 - Supportive footwear when up and non-slip socks while in bed
 - Glasses and hearing aids when mobilizing
 - Clutter-free environment
 - Use only two top side rails if patient is at risk for going over rails
 - Ensure bed is in the lowest position and brakes are on
 - Use Bed/Chair Alarm and/or sitter
 - Offer toileting every 3 hours
- Screen patient for osteoporosis risk, and determine the need for medical follow-up. Refer for medical treatment if warranted. See Osteoporosis Rapid Review.
- Cognitively impaired/agitated, or restless patient
- Assess/address underlying cause (see PRISM-E under Delirium RR)
 - Check patient every 15-30 minutes
 - Consider moving a restless patient for close observation
 - Ask roommates to alert staff if patient is restless
 - Pin call bell to patient gown so movement will activate the call system
 - Encourage and support family to stay with patient
 - Consider Hip Protectors
 - Place mattress on floor if appropriate
 - Consider using a sitter if all fall prevention strategies fail. Review need for sitter within eight hours
 - Avoid restraints whenever possible. Restraints contribute to functional decline and can cause serious injury. See Avoiding Restraint Rapid Review for help on reducing restraint use

Transition Planning

- Occupational therapist may assess the patient's home for safety concerns, lighting, and set-up of kitchen. They may also provide guidance on the need for assistive devices such as bathroom grab bars
- Consult with physiotherapist regarding ongoing strength and mobility training

Patient and Family Education

- Patient and family will require ongoing involvement in planning transition care based on individual risks.
- Provide teaching to mitigate risks.

Many pamphlets are available for falls prevention. One example:

- Reducing Falls and Injuries from Falls. Source: Safer Healthcare Now, www.patientsafetyinstitute.ca.

Questions

1. Which of the following are included in the hourly rounding 4 Ps?
 - a. Possessions
 - b. Pain
 - c. Position
 - d. Peri needs
 - e. All of the above
2. Which of the following options will increase patient safety:
 - a. All patient rails up
 - b. 1 top and 1 bottom rail up
 - c. 2 bottom rails up
 - d. 2 top rails up

References

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Preventing Falls: From Evidence to Improvement in Canadian Health Care (2014)A Collaboration From Accreditation Canada/ the Canadian Institute for Health Information/ the Canadian Patient Safety Institute.

Malnutrition

Description

- 17 to 65% of hospitalized older adults are seriously undernourished
- The most common nutritional deficits are protein, iron, vitamin B12 (leading to dementia), and calcium

Malnutrition has serious consequences patients including:

- Susceptibility to infection
- Delayed wound healing
- Increased pressure ulcer risk
- Weakness/ immobility
- Falls/ fractures
- Prolonged hospital stays
- Premature death- (Middle aged and older people who are underweight are at increased risk of death)

Population

- Older patients due to decreased taste and hunger drive, physical impediments to cooking/eating, limited income, poor dentition
- Those who eat alone or are socially isolated
- Depression
- Those taking medications that cause nausea, anorexia, fatigue, weakness, or increased metabolism/ e.g. digoxin quinidine, psychoactives, Vitamin A, and statins
- People with diseases that cause nausea, anorexia, or increased metabolism/ e.g.: hyperthyroidism, infection, some cancers
- Alcoholism
- Comorbidities, impaired cognition, dementia or delirium
- Anorexia nervosa
- Dysphagia
- Inappropriate food beliefs or practices
- Prolonged periods of fasting while awaiting surgery

Detection

- Screen for malnutrition
- Height/ weight ratio. BMI (Body Mass Index) not generally used for 65 years and older due to secondary morphological changes and increase occurrence of edema
- Anemia
- Albumin less than 3.5 g/dL (a score of less than 3.2 predicts death) when used in conjunction with other indicators such as APACHE (Acute physiology and chronic health evaluation). APACHE is a risk adjustment

methodology utilizing predictive variables such as diagnosis, age, chronic health status, and physiological measures

- Physical exam

Treatment

- Assess and address correctable underlying cause.
- Assess for swallowing difficulties. Refer to Occupational or Speech Language Pathologist
- Monitor food/fluid intake carefully. 50-75% of meal taken is a concern.
- Avoid unnecessary fasting. Clear fluids (e.g. apple juice) can be given up to 2 hours pre surgery for most patients
- Provide a nutrient dense diet with high protein and calories
- Consult to Dietician if inadequate intake or special diet needs
- Assess social factors: e.g. barriers to food preparation, eating alone
- Evaluate swallowing as well as functional ability to manage eating
- Obtain a social services' assessment of living situation
- Home support as required
- Provide high protein, high calorie supplements every 6 hours e.g. with medications for older or malnourished patient

Questions

1. All of the following are risk factors for malnutrition except:
 - a. Decreased taste
 - b. Eating disorder
 - c. Depression
 - d. Sufficient income
2. All of the following are appropriate assessments for malnutrition in the elderly except:
 - a. BMI
 - b. Anaemia
 - c. Physical Exam
 - d. Albumin

References

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Avoiding Restraints

Definition

- Restraints are an extreme form of behaviour management. Often restraints are applied in an effort to control behaviour that may be harmful to self or others, e.g. agitation, wandering, interfering with equipment
- The literature shows that restraints may not prevent falls, but may instead increase the risk of injury. Demonstrated adverse effects of restraint use include psychological trauma, de-conditioning, skin breakdown, pneumonia, and even death from strangulation
- Sedatives and hypnotics are forms of chemical restraint with serious side effects and should also be used with caution

Population

Cognitively impaired persons are most at risk of being restrained. Understanding the underlying causes of the following behaviours may lead to effective interventions to minimize harm without the use of restraints:

- Wandering (usually seen in the cognitively impaired)
- Unsafe mobilizing
- Physical aggression
- Interference with essential therapies

Assessments and Interventions

The key to avoiding restraint use is to detect and manage the underlying cause of the behavior. Patients are attempting to meet a need or satisfy a goal through their behavior.

Prior to using restraints the patient's physical, cognitive and psychological needs must be assessed.

Only after all other reasonable alternatives have been considered should restraints be used as a temporary short term measure.

Wandering – Underlying Causes

- Patients are often seeking socialization or a physical outlet for energy
- Seek familiar landmarks, continually disoriented patients with memory loss
- Restricting activity often increases stress, agitation and wandering

Interventions:

- Encourage and support family and friends to visit
- Assist patient to take long walks, at least twice daily
- Engage in constructive activity
- Arrange for volunteer visits

- Employ the use of an electronic wandering system for patients at risk of elopement

The Unsafely Mobile – Underlying Causes

- Poor memory and judgment – unable to adhere to instructions
- Muscle weakness, postural hypotension, poor balance
- Pursuing purposeful activity: bathroom trips, to reach desired object, hunger, and thirst

Interventions:

- Anticipate and meet needs of patient: e.g. toileting every 2-3 hours, snacks, fluids within reach
- Reminder signage, e.g. “Mr. Moris, please call your nurse when you want to get up.”
- Strength/balance exercises with physiotherapist
- Assess environmental hazards, footwear, ambulation aids
- Provide visual and hearing aids
- Sitter/physio aid to assist with mobilization

Aggression/Agitation – Underlying Causes

- Assess for factors contributing to delirium – PRISM See Delirium Rapid Review.
- Assess for unmanaged pain
- Loss of control
- Unmet needs
- Misperceptions of the environment
- Alcohol withdrawal
- Dementia or depression

Interventions:

- Manage PRISM factors. See Delirium Rapid Review.
- Decrease noise and stimulation
- Use consistent staff and develop care plan for consistent care
- Calm, friendly approach
- Preserve privacy when possible
- Frequent toileting, bowel protocol
- Distract/redirect patient
- Chemical dependency management
- Do not enter private space without permission
- Consider nutrition

Interfering with Treatment – Underlying Factors

- Assess pain/irritation from equipment
- Interference with needs, e.g. mobility
- Dementia, delirium, alcohol withdrawal

Interventions:

- Assess equipment, e.g. blockage of a catheter
- Remove devices if possible or consider alternatives
- Provide a simple explanation or guided exploration of the device. Repeat PRN, as patient may not remember
- Reminder signage
- Disguise equipment where possible, e.g. long gown over IV site
- Provide materials for distraction that patient may manipulate in hands, e.g. sponge, kling

If restraints are used a care plan must be developed to address the following:

- Continuous assessment and reduction of restraints as soon as possible
- Care of the restrained patient, e.g. frequency of checks, nutrition, and toileting
- Psychological support of family and patient
- Documentation of application and planned review of restraint use

Patient/Family Teaching

- Family teaching regarding the underlying causes for restraint use
- Support and encourage the family to sit with the patient
- Debrief with patient when appropriate

Questions

1. Which of the following strategies may reduce the risk of a patient pulling out her IV:
 - a. Remove IV if possible
 - b. Provide materials for distraction
 - c. Provide guided exploration of the device
 - d. Assess for pain or irritation at the site
 - e. All of the above
2. All of the following statements are true regarding the use of restraints except:
 - a. Sedatives and Hypnotics are forms of restraint with serious side effects and should be used with caution
 - b. Restraints decrease the risk of injury
 - c. Anticipating patients' needs such as toileting may decrease the need for restraints
 - d. Restraints are an extreme form of behaviour management.

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MEDICATIONS

Anticoagulation

Deep vein thrombosis (DVT) and pulmonary embolism (PE) are two important venous thromboembolism (VTE) complications in high-risk surgical populations. Without prophylaxis, the incidence of proximal DVT is 10-20% and the incidence of clinical PE is 4-10% in patients undergoing hip or knee arthroplasty, hip fracture surgery, major orthopedic trauma, and acute spinal cord injury (SCI). The thrombi that form in the patient with a DVT consist primarily of fibrin and red blood cells. These thrombi can break off and travel to the lung to cause a PE. Anticoagulants are used to prevent the formation of this fibrin matrix, and reduce the rates of DVT and PE.

Patients may receive anticoagulants for the following reasons:

- Prophylactically to prevent VTE
- Therapeutically to treat patients diagnosed with VTE

Commonly used anticoagulants for orthopaedic surgery

- Low molecular weight heparin (LMWH), e.g. Dalteparin, Enoxaparin
- Unfractionated heparin (UFH)
- Oral anticoagulants, e.g. Rivaroxaban (Xarelto)
- Warfarin (Coumadin)

Prophylactic Anticoagulation

Low Molecular Weight Heparin (LMWH)

Indications

LMWH is a class of anticoagulant medications. LMWH is administered routinely for surgical VTE prophylaxis in total knee and hip replacement surgery, major orthopedic trauma with pelvic, femoral shaft, or other complex lower-extremity fractures (open fractures or multiple fractures in one extremity) and acute spinal cord injury.

Action

LMWH inactivates primarily Factor XA, a factor involved in clotting. This inhibits thrombin production.

Examples of LMWH include Dalteparin, enoxaparin and tinzaparin. These agents have been studied in a variety of populations for prophylaxis and therapeutic indications. The choice of agents depends on the indication (prophylaxis or treatment) and the specific patient population.

Benefits of LMWH

- Provides a predictable and stable dose response
- Longer half-life than UFH
- Does not require PTT monitoring when used for prophylaxis or treatment.
- Standard pre-printed orders may be used to guide administration and monitoring
- Prophylactic regimens are fixed dose schedules, whereas treatment regimens may be based on patient weight

Administration

LMWH prophylaxis is initiated 12 – 24 hours after surgery. LMWH comes in pre-filled syringes that should not be refrigerated. The site recommended for administration by the manufacturer is the abdomen, as absorption is faster and more consistent from this site. The syringe should be held at a 90-degree angle for injection, and the site should be rotated to prevent potential tissue damage. To avoid potential drug loss, do not expel the air bubble in the syringe prior to administration.

Adverse Effects

- Bleeding, thrombocytopenia, local irritation, hematoma formation, and hypersensitivity
- Depending on the surgery performed and the patient population, administration of LMWH may be delayed for 12 – 72 hours after surgery, and only in the presence of adequate hemostasis. This is to try to minimize the risk of post-operative bleeding

Nursing Considerations

- Platelet and hemoglobin levels are drawn and should be carefully monitored
- Monitor for signs and symptoms of abnormal bleeding (e.g. wounds, drains, stools, gums, and epidural catheter site)
- Patients receiving post-operative prophylactic LMWH and continuous epidural anaesthesia should NOT receive concomitant antiplatelet agents (ASA, NSAIDS, ticlopidine, or clopidogrel) or other anticoagulants (UFH, warfarin, or dextran)
- If possible, avoid ASA and NSAIDS even in patients not receiving epidural anaesthesia
- Patients receiving enoxaparin prophylaxis q12h should have epidural catheters removed at least 12 hours after the previous dose, while patients receiving dalteparin prophylaxis q24h should have their epidural catheters removed at least 24 hours after the previous dose. Subsequent dosing of LMWH should not occur for at least two hours after catheter removal
- No IM injections should be given while the patient is receiving the LMWH
- In patients undergoing THA or TKA, CHEST guidelines recommend use for minimum 10-14 days

Warfarin (Coumadin)

Indications

Orthopaedic indications may include some patients with hip fractures, hip replacement surgery, and some oncology procedures. It is no longer recommended as the preferred therapy as prophylaxis for VTE for patients undergoing hip and knee arthroplasty.

Action

Warfarin prevents the formation or extension of clots by depressing hepatic synthesis of vitamin K-dependent clotting factors. Without these clotting factors, the body cannot activate the clotting cascade and form and maintain a fibrin clot.

Administration

Prophylactic warfarin dosing is usually determined using a nomogram and is based on the INR value that is drawn daily.

INR (International Normalized Ratio): This is a standardized measure of the intensity of anticoagulation, and is the gold-standard for monitoring warfarin therapy. The ideal INR range will depend on the indication for using warfarin.

Adverse Effects

As listed for LMWH including potential risk for bleeding. There are also many drug interactions between warfarin and other medications, so the dispensary and clinical pharmacists will attempt to screen, avoid, or anticipate these interactions, and adjust the dosage accordingly.

Nursing Considerations

- Daily INR every morning
- Advantages include low cost and ability to give orally
- Hemoglobin and platelet count should be monitored
- If possible, avoid ASA and NSAIDS in patients receiving warfarin
- No IM injections should be given while the patient is receiving warfarin
- Monitor for signs and symptoms of abnormal bleeding (e.g. wounds, drains, stools, gums, and epidural catheter site)
- Counsel patient in conjunction with the pharmacist on key issues to ensure the drug is used effectively and safely
- The antidote for warfarin is vitamin K, and should be readily accessible in the event of dangerously high INR values or active bleeding. Dosages of vitamin K that are appropriate for specific circumstances are listed in the Parenteral Drug Therapy Manual (PDTM). Frozen plasma can also be given in the event of active major bleeding

Therapeutic Anticoagulation

Warfarin (Coumadin)

Indications

Warfarin may be administered to prevent stroke in patients with previous transient ischemic attacks or previous strokes, atrial fibrillation, mechanical heart valves, or severe dilated cardiomyopathy. It may also be used to prevent DVT or PE in some high-risk patients such as those with a malignancy. Warfarin may also be used to treat patients diagnosed with established DVT or PE for a period of 3-6 months.

The goal INR range will depend on the diagnosis, but is usually either 2 to 3 or 2.5 to 3.5.

The physician or pharmacist will order daily warfarin based on the patient's INR levels. Patients are usually discharged from the hospital on long-term warfarin and are followed by their family physicians in the community.

Heparin (UFH)

Indications

A UFH bolus and infusion is usually administered to a patient with a newly-diagnosed DVT or PE. This therapy is guided by the weight-based IV UFH nomogram on the physician's PPO. Unless contraindicated, oral warfarin can begin on the same day the IV UFH is started, as recommended in the VGH IV UFH nomogram PPO. To ensure a safe conversion, the warfarin must overlap with UFH for at least five days, and the patient must have an INR within the therapeutic range for at least two consecutive days before UFH is stopped.

Action

UFH binds to antithrombin III and works to inhibit the formation of clotting factors II, VII, IX, and X. Thus, it is able to block the clotting cascade, and prevent the formation of thrombin, and ultimately a fibrin clot.

Administration

- UFH is administered intravenously by continuous infusion (therapeutic anticoagulation), or by subcutaneous injection (prophylactic indications). A patient weight-based nomogram allows individual dosage titration and is currently the preferred means of determining the appropriate dose of therapeutic doses of IV UFH to achieve a target PTT value.
- PTT (Activated Partial Thromboplastin Time): measures the clotting activity and thus is a good indication of the intensity of the effect of UFH on the coagulation system.

Adverse Effects

- Minor (ecchymosis, hematoma, hematuria, epistaxis, etc.) and major bleeding (intracranial hemorrhage, gastrointestinal bleeding, retroperitoneal bleeding, etc.), heparin-induced thrombocytopenia (HIT), local irritation, and hypersensitivity (characterized by fever, chills, urticaria).

Nursing Considerations

- See LMWH section for clinical and laboratory monitoring.
- Body weight is the biggest factor in determining the initial bolus and infusion dosage of IV UFH, so the patient should be accurately weighed.
- IV infusions of UFH should be started promptly and should be continued without interruption. Laboratory and clinical monitoring should be guided by the IV UFH nomogram PPO.
- UFH has a half-life of 60 – 90 minutes, so dosage adjustments and subsequent PTT monitoring (usually 6 hours after a dosage change) should be based on the IV UFH nomogram PPO.
- PTT measures the clotting activity and thus is a good indication of the intensity of the effect of UFH on the coagulation system. PTTs should be drawn according to the IV UFH nomogram on the PPO.
- INR is a standardized measure of the intensity of anticoagulation from warfarin, and is the gold-standard for monitoring warfarin therapy.
- The antidote for UFH is protamine sulphate and should be readily accessible in the event of dangerously high PTT/INR values or active major bleeding.

Questions:

1. When administering Low Molecular Weight Heparin to a patient, the nurse does **NOT** need to:
 - a. Monitor PTT to determine effectiveness of drug
 - b. Monitor for bleeding, thrombocytopenia and hematoma formation
 - c. Monitor for local irritation and hypersensitivity
2. What lab value do physicians base a daily Coumadin order on:
 - a. Hemoglobin
 - b. Daily INR
 - c. Weekly IRN
 - d. Daily PT

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Biologics and disease modifiers

Disease Modifying Anti-Rheumatic Drugs (DMARDs): for patients with confirmed RA and persistent synovitis (prevents joint damage)

- Patients respond better to treatment if it is taken early in the disease
- Choice of drug is based on disease activity and/or progression, the patient's functional status, relevant lifestyle considerations (childbearing for women), cost, and side effect profile

Drug	Mechanism of Action	Indications	Special Considerations
Methotrexate (weekly)	interfere with combinations of critical pathways in the inflammatory cascade,	*preferred for early treatment of patients with RA	folic acid ≥ 5 mg/ week (except the day of methotrexate) to reduce hematologic, gastrointestinal, and hepatic adverse events
Hydroxychloroquine	Anti-malarial	Used to treat rheumatoid arthritis and lupus	Effective in managing fatigue, skin rashes & joint pain for SLE A loss of vision can occur if taken in high doses for long periods of time.
Sulfasalazine	Reduces inflammation, pain and swelling in joints	Used to treat rheumatoid arthritis, ulcerative colitis and Crohn's disease	Blood monitoring q1-3 months

Leflunomide	Immunosuppressive disease modifying antirheumatic drug	Moderate to severe RA and psoriatic arthritis	*Teratogenic
Cyclosporine	Immunosuppressant medication	RA, psoriasis, Crohn's nephrotic syndrome	Used to prevent rejection in organ transplant
Gold	Reduces joint inflammation and reduces activity of the immune system	Treats RA, juvenile RA and psoriatic arthritis	Appears to work best in early stages of arthritis but can be used with anyone with active joint pain & swelling

Biologic Response Modifiers

Genetically engineered proteins that control specific aspects of the inflammation process (inhibit chemicals your body makes to worsen the inflammation process)

- Increased risk of infection with all BFM
- Expensive, sometimes areas will only cover if the patient has already tried DMARDs
- BRMs in combination with methotrexate delays joint destruction better than BRMs alone
- Tricyclic antidepressants may be adjuvants to pain management

Drug	Mechanism of Action	Indications	Special Considerations
Enbrel (SC weekly)	block activated tissue necrosis factor alpha (TNF α) cytokine found in the joints of people with RA	Rheumatoid arthritis	Also for juvenile arthritis
Humira (SC biweekly)			
Remicade (IV q4 weeks)			Should be given in conjunction with methotrexate
Kineret (SC daily)	Inhibits the cytokine interleukin (IL-1)	Rheumatoid arthritis	Can lead to bone erosion

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Bisphosphonates

Bind to the surface of bones and slow down the bone resorption (↓ osteoclast mediated bone resorption)

Drug	Mechanism of Action	Indications	Special Considerations
Alendronate (Fosmax) (PO weekly)	Impairs function of the osteoclasts	<ul style="list-style-type: none"> • Reduces post-menopausal bone loss • ↑bone density in spine & hip, ↓#’s 	<ul style="list-style-type: none"> • Esophageal irritation, patient remains upright for 30 minutes after taking the medication
Risedronate (Actonel) (PO weekly)		<ul style="list-style-type: none"> • Used for treatment/prevention of glucocorticoid-induced osteoporosis for people on prednisone • ↑bone mass from glucocorticoid-induced bone loss 	
Zoledronic Acid (IV annually)		<ul style="list-style-type: none"> • Post-menopausal osteoporosis treatment • Glucocorticoid osteoporosis treatment • Paget’s disease treatment 	

Adverse effects of Biphosphonates:

- Atypical femoral fractures: bisphosphonates suppress bone remodelling to the extent that normal bone formation is impaired
- Osteonecrosis of the jaw: dental evaluations prior to the initiation of therapy and annual dental health assessments are encouraged

Denosumab

A bone metabolism regulator that is an anti-absorptive therapy that inhibits osteoclast formation (injection every 6 months)

Corticosteroids

Decrease edema of damaged tissues, therefore decrease pressure on pain nociceptors (e.g. Prednisone, Decadron, and Methylprednisone)

Indications:

IV/Oral: ↓ neuropathic Pain, ↓ICP, lymphedema, ↓metastatic bone pain

- Drug of choice for polymyalgia rheumatica
- SLE: IV Methylprednisone for acute, organ-threatening exacerbations; low dose oral prednisone for milder disease

Intra-articular: decreased pain/inflammation for RA patients with limited joint involvement, OA (patients with effusions or local inflammation)

Special Considerations:

- Medications must be tapered slowly or they can cause adrenal crisis
- Used with RA patients for a limited time until DMARD effect is seen
- Long-term use can cause avascular necrosis and osteoporosis (BMD recommended)
- Calcium and vitamin D supplements should be used

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Answers

Development Dysplasia of the Hip

1. D
2. A

Hemophilia A (Factor VIII) & B (Factor IX)

1. A&B
2. C
3. False

Osteogenesis Imperfecta (Brittle Bone Disease)

1. True
2. D

Club foot (Talipes Equinovarus)

1. True
2. B

Chondromalacia Patella (Patellofemoral Pain Syndrome)

1. True
2. D

Osteoarthritis (OA)

1. True
2. D
3. C

Spinal Stenosis

1. B
2. A

Spondylolisthesis

1. C
2. C
3. A
4. D

Ankylosing Spondylitis (AS)

1. A
2. D

Chronic Childhood Arthritis

1. B
2. B

Rheumatoid Arthritis

1. True
2. B
3. A
4. A

Systemic Lupus Erythematosus (SLE)

1. True
2. B

Osteoporosis

1. B
2. B

Sarcoma

1. A
2. C

Herniated Disc

1. B
2. A

Amputations for Oncological Conditions

1. C
2. B

Anterior Cervical Discectomy and Fusion

1. C
2. C

Girdlestone Arthroplasty – (Resection Arthroplasty)

1. A
2. A

Hip Arthroplasty

1. A
2. B

Knee Arthroplasty

1. D
2. C

Lumbar Laminectomy

1. C
2. D

Lumbar Laminectomy and Spinal Fusion

1. B
2. B
3. D

Pelvic Acetabular Osteotomy

1. False
2. D

Prostalac

1. B
2. C

Anemia

1. E
2. E

Compartment Syndrome

1. C
2. C

Deep Vein Thrombosis (DVT) & Pulmonary Embolism (PE)

1. B
2. C
3. B

Fat Embolism (FE) Syndrome

1. A
2. A

Infection – Post Arthroplasty

1. A
2. C

Osteomyelitis

1. True
2. D

Neuropathic Pain (NP)

1. B
2. A

Constipation in Elderly Patients

1. D
2. C

Delirium

- 1. False
- 2. E

Falls: The Frail Elderly

- 1. E
- 2. D

Malnutrition in the Frail Older Adult

- 1. D
- 2. A

Avoiding Restraints

- 1. E
- 2. B

Anticoagulation

- 1. A
- 2. B

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The following list of references is provided from CNA for Orthopaedic Nursing Certification. Noting all references are important, but **bolded** references were chosen by members of the Orthopaedic Nursing Examination Committee from CNA as key references for nurses preparing for the orthopaedic nursing certification exam.

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