

Orthopedic & Wound

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Orthopedic

Ortho Pediatric Considerations

- Infant and young child more cartilaginous (bones narrow/flexible)
- Periosteum is thicker and resists disruption
- Greenstick and Torus fractures
- Open epiphyses (growth plate)
- Ligaments more resistant to epiphyses trauma
- Infants have bowed legs up to 3yr
- May appear knock-kneed between 18-36mo
- Normal leg configuration by 6-7yr

Thicker periosteum provides circulation and nutrients to bone, allows bone to be more elastic
Greenstick: shaft of bone fractured on one side, cortex intact on other side
Torus (buckle): compression fracture at metaphysis and diaphysis—present with pain, no deformity
Open epiphysis until after adolescence—more susceptible to trauma, described using Salter-Harris classification system

Pediatric Considerations

Pearls

- History should match injury/mechanism
- Warning signs for maltreatment:
 - Fractures <1yr, spiral fracture, unfitness/unexplained injury, fractures in various stages of healing
- 25% of fractures in children = NAT
- Nursemaid's Elbow
- Limping uncommon—suspect hip disorder
- Unwillingness to bear weight requires investigation

Nursemaid's elbow (subluxation of the radial head), common age 2-3

Geriatric Considerations

- Loss of bone and mineral mass
- Muscle changes

Pearls

- Gait affected by posture, balance, strength and flexibility
- Foot size decreases
- Skin is drier: corns and calluses form at pressure points
- Decreased circulation—slower healing
- Osteoporosis, osteoarthritis, rheumatoid arthritis
- Fractures may be caused by other disease

Brittle bones, prolonged regeneration, kyphosis

Muscles lose ability to regenerate new fibers or replace ones lost d/t aging/atrophy

Decreased muscle strength and endurance (shuffling gait)

Longer contraction time, fatigue more easily—may cause muscle tremors even at rest

Sprains/Strains

- Sprains = stretch or tear in ligament
- Strains = injury in muscle or tendon
 - 1st degree: minor tear, minor swelling, mild discomfort, minimal swelling
 - 2nd degree: partial tear, joint intact, moderate swelling visible ecchymosis
 - 3rd degree: complete disruption of ligament, joint may be open, separation of muscle from muscle (or tendon, or bone)
- Ottawa Rules for Radiographs—determine when to xray
- RICE

Rest—non weight bearing with crutches, ROM exercises x4 per day
 Ice—20min at a time x4 per days (vasoconstriction and reduces swelling)
 Compression—Ace wrap, rewrap x2 per days, none at night
 Elevation x24 hours (>heart level)

Dislocations

- Emergency because potential danger to adjacent nerves and blood vessels (compression, stretching, ischemia)
- Subluxation: part of the articular surface contact remains, but isn't complete
- Consider fracture with dislocation—xray 1st if possible
- Always assess CMS before and after any procedure—not sure if you need to—assess it and DOCUMENT
- Treat pain (meds, splint, ice)

If neurovascular compromise is suspected, do not wait for xray
SQUIRL: YouTube Cunningham
 Technique for shoulder reduction (not pertinent to your test)

Dislocations

Treatment for most: xray, reduce, splint, xray

Variances:

Shoulder—sling and swathe

Elbow—may need surgical repair if fx to radial head or olecranon

Patella—may reduce spontaneously, knee immobilizer

Fractures

- Xray should include entire bone as well joint above and below
- In children consider comparison views
- Open Fractures

Comminuted: multiple splinted bone fragments

Avulsion: fragment of bone connected to ligament breaks off from rest of bone

Impacted: bone end driven into end of another bone end

Comparison Views for the WEAK (wrists, elbows, ankles, knees)

Open Fracture: skin is broken—high risk for osteo-infection. Abx and careful monitoring

Fractures Special Considerations

- Clavicle: concurrent pneumo/hemothorax, sling and swath
- Shoulder: often r/t FOOSH (old=fx, young=dislocation), sling and swath
- Humerus: assess for nerve damage. If midshaft break—sugar tong splint
- Elbow: assess brachial artery laceration, median, radial, or nerve involvement
- Wrist: angulates up (Smith's fx) angulates down (Colles' fx), assess median nerve damage

Fractures Special Considerations

- Scaphoid: pain in snuffbox
- Pelvis: risk for hemorrhage, stabilize pelvis, coopernail sign, bleeding at urinary meatus
- Knee: Peroneal or tibial nerve damage, popliteal artery
- Tib/fib: open fx? Can lose up to 2L blood
- Ankle: risk for neurovascular compromise

Cooper nail sign (bruising of perineum, or genitals) indicative of pelvic fx

Fractures: Fat Embolism

- Small globules of fat may appear in blood
- Globules can cause occlusion of vessel in Brain, Kidney, Lungs, other organs
- Most at risk: long bone and pelvic fracture
- Usually within 24-48hours of injury
- s/s AMS, Fever, petechiae rash
- Support A-E, high flow O2, symptom management

Amputation

- Consider other trauma (tearing, crushing, lacerating forces)
- Prevent hemorrhage
- Warm ischemia tolerated for 6-8 hours
- Cooling extends time up to 24 hours
- Include amputated part in xray

Bleeding: direct pressure, elevation, pressure at arterial site, tourniquet
 Rule of 2s: 2" wide, 2" above site, at least 2 twists, if 2nd tourniquet needed 2" above the 1st one

Prognosis: poor if—excessive bacterial contamination, prolonged time between injury and cooling, severe degloving or avulsion

Replant within 12 hours, or 6 if containing significant muscle (fingers up to 24 hours with appropriate cooling)

Children have better success than adults

Function of part s/p replantation considered in decision as well as patient's ability/willingness to rehab

Amputation

- Care of Amputated Part
 1. Clean part with NS (no soap or antiseptic)
 2. Wrap in sterile gauze and moisten with NS or LR (not soaked)
 3. Place wrapped part in securely sealed bag
 4. Place on ice—no body part touching ice (frostbite)
 5. Label part

Some teaching states that amputated parts should be in ½ ice and ½ water, not just ice

Compartment Syndrome

- Swelling in compartment expands the capacity of the fascia
- The 5 Ps
 1. Pain
 2. Paresthesia
 3. Paralysis
 4. Pallor
 5. Pulselessness
- NO ICE (vasoconstriction)
- Elevate to level of heart
- Maybe fasciotomy

Normal pressure
 Less than 10
 30 is dirty

Pain—deep, throbbing, boring, no relieved by regular interventions. Also not pain with passive stretch
 Paresthesia—pins and needles, starts distal from injury

Paralysis—nerve is so compressed it can't mobilize

Pallor—pale, polar, delayed CR

Pulselessness—pressure in compartment has exceeded systolic BP and tissue is dying—VERY LATE

Crush Injury

- Monitor Hemodynamics
- Monitor for compartment syndrome
- Hyperkalemia (K from muscle damage)
 - Arrhythmias
 - Peaks at 12-36hr
- Rhabdomyolysis
 - Pain, weakness, malaise
 - Red/brown urine
 - Very high CK

Hyperkalemia: tx with albuterol or insulin/glucose drip (temporary).

Dialysis, fluids, Kayexalate (permanent management)

Rhabdo: myoglobin crystalizes in kidney and occludes glomerulus—renal failure

Tx: urine output >100ml/hr (flush kidney), bicarb in urine (prevent crystallization), dialysis

Osteomyelitis

- Possible causes: open wounds, punctures, compound fx, surgical procedure with fixation.
 - Exogenous route
 - Hematogenous
- Treatment
 - Immobilize extremity
 - protect other patients
 - IV antimicrobials for up to 6 weeks

Exogenous rout—direct invasion of

organism to the bone from the outside

Hematogenous rout—organism comes

from another primary source such as

skin abscess, otitis media, UTI,

pneumonia, dental abscess

Common offenders: Staph, strep,

salmonella, pseudomonas, and fungal

Costochondritis

- r/o rib fracture or MI
- Reproducible pain (pinpoint tenderness)
- Treatment
 - Rest
 - Deep breathing (Incentive spirometer)
 - Avoid activities that make it worse

Acute, self-limiting inflammation of

costal cartilage of the ribs and sternal

junctions (single or several)

Bursitis and Tendinitis

- Overuse injuries. Cause microtears and inflammation
- r/o infection
- Bursitis: inflammation of bursa sac that covers bony prominences
- Tendinitis: inflammation of tendon, or tendon muscle attachments. Acute or chronic.

Common bursitis sites: shoulder, elbow, hip, knee, heel of foot
 Bursitis assessment: pain, tenderness, redness, swelling, heat, limited ROM
 TX: NSAIDS, abx if bursa aspirated and proven infected. RICE, possible bursa injection or aspiration

Common Tendonitis sites: rotator cuff, elbow (tennis elbow), medial epicondylitis (golfer's elbow), knee and heel (Achilles tendinitis)

Assess: tender especial with rolling motion,

Tx: xray b/c calcification can occur because tendons are less vascular, rest, compression dressing

Joint Effusion

- Knee most common site
- Assess: swelling of area and erythema
- Immobilize site, pain meds, NSAIDS, steroids, abx
- Arthrocentesis
 - WBC 20,000-60,000 = inflammatory process
 - WBC 100,000 = bacterial infection
- Teach patient to watch for infection

Collection of fluid in joint r/t inflammation process, previous surgery, or trauma

Extreme stretching of knee ligaments may result in microscopic tears of meniscus causing synovial fluid to collect.

Pt with hemophilia at risk for hemarthrosis (blood in joint space)

Crutches

- 1-1.5" below axilla when standing straight
- Elbows with slight bend
- Crutches 12" forward, 6" out
- Body swings through
- Stairs:
 - Going up: good leg first
 - Going down: crutches first, then good leg, then bad leg

Hand grips absorb weight—no for leaning

Gout/ Pseudogout

- Crystal induced arthropathy
- Gout
 - Thiazide diuretics and purine foods increase attacks
 - 1st attack usually metatarsophalangeal joint (big toe)
- Pseudogout
 - Clinically difficult to differentiate from Gout
 - No treatment for underlying cause
- 3 phases
- Uric acid >7 (males) : >6 (females)
- Arthrocentesis and xray

Caused by monosodium urate monohydrate (MSU) → overproduction or or reduced secretion of uric acid
Pseudogout: calcium pyrophosphate (CPP)

Possible Causes: Gout--lead poisoning, hemoproliferative disorders, renal dz.
Pseudogout—aging, trauma, metabolic abnl

Phases:

1. Asymptomatic hyperuricemia.
2. acute gout.
3. topaceous gout

Gout/ Pseudogout

- Treatment
 - Avoid ETOH, thiazide diuretics (HCTZ), purines in diet (organ meats, anchovies/mackerel, bacon)
 - Weight loss
 - Corticosteroids
 - Indocin or Colchicine or NSAIDs
 - Antihyperuricemic Agents (Aloprim)
 - Avoid ASA—interferes with uric acid excretion

Steroids work best (side effects), Indocin next, then colchicine
Take colchicine until it works or until the NVD limits consumption

Low Back Pain

- Common causes: Intervertebral disk disease or disk herniation
- Assess gait, Motor function, sensory testing, rectal tone
- Tx with rest, NSAIDS, narcotics
- Patient Education:
 - Physical assisting devices (cane, walker)
 - Proper body mechanics
 - Home safety (railings, no loose floor mats)

60-80% of population at some point
Disk degeneration is normal process of aging
90% of low back pain is MSK, but never precisely diagnosed

Wound

Wound

Key Terms

Contusion/Hematoma

Closed wound, ruptured blood vessel hemorrhaged into surrounding tissue

Ecchymosis

Leakage of capillary blood from place other than the site of injury—non tender

Abrasion

- Partial or full thickness denuding skin

Avulsion

- Full thickness caused by ripping or tearing (degloving)

Abrasions—must clean well to avoid infection and tattooing.

Wound

Pearls

- No shaving, clip hair
- NS or soap and water to clean wounds (lots and lots)
- Lido with epi—avoid finger, nose, ears, toes, and the hose
- Must be sure not FB
- Large objects should be left in place until ready—may bleed

Xray for glass/metal—organic material and plastic don't show up

Puncture Wounds

- Very high risk for infection
- Consider Foreign Body
- Soak the wound 2-3 times per day for 2-4 days

Lacerations

- Evolution of the wound
- Assess CMS distal to wound, tendon involvement?
- Lidocaine or Bupivacaine...or Benadryl
- Esters vs. amides
- Irrigate well—NS or soap and water
- RICE
- Clean, dry and covered for first 48 hours
- SPF for 6 months (or forever)

Lido: onset 1-5min, lasts 30-60min, w/ epi a little long

Bupivacaine: onset 2-30min, lasts 8-16 hours

Diphenhydramine hydrochloride—if allergic to others, onset 1-5min, lasts 30-60min

Topical agents: onset 15-20min, duration 30-60min

Amides= i before caine Esters= no i before caine

Wound Closure

- Primary: minimal tissue loss (glue, sutures, staples)
- Secondary: wound needs to close on it's own because of risk of infection (avulsions, bites)
- Tertiary: granulation needs to happen first (prevent infection) but then will be closed after
- Suture/staple removal: 7-10 days (face 5 days)
- Abx ointment, no scabs
- Reinforce wound after sutures/staples removed in areas of flexion or extension

Missile Injuries

- GSW, Stabbing, other high pressure penetrating wounds
- Energy Transfer
- Three Considerations
 1. Permanent Cavity—missing tissue
 2. Temporary Cavity—displacement of tissue
 3. Pressure wave—cavitation
- Forensic considerations
- Irrigation with sedation (OR)

Forensic consideration: law enforcement, careful documentation, evidence preservation, bag hands if hx of holding weapon
Control bleeding, medications as needed (abx, pain, TD)

Blast Injury

- Injury Classification
 - Primary
 - Pressure wave from blast damages hollow organs
 - Secondary
 - r/t flying debris (shrapnel) from blast
 - Penetrating trauma and lacerations
 - Tertiary
 - Pressure wave causes victim to be thrown a distance
 - Acceleration/deceleration injuries

Primary: ruptured TM, pneumothoraces, gastric or intestinal rupture

Injection Injury

- Grease gun, pressure washer, paint sprayer
- Oil, grease, fuel, solvents, water, air infiltrated into tissue
- Consider high priority
- Can inject substance high up into the tissue

Bites

- Dog Bites
 - Often avulsions
 - May also be a crush injury
- Cat Bites
 - High risk for infection (puncture)
- Human Bites
 - High risk for infection
 - More likely to bruise than break skin
 - Closed fist injury

Wounds from punching someone in the teeth should be treated like bites...also high risk because tendons are close to wound

Wound Complications

- Staphylococcus
- Pasteurellosis
- Cat-Scratch Fever!
- Wound Botulism
- Gas Gangrene
- Group A Strep
- Tetanus and rabies

Staphylococcus—gram positive, most common for skin infections, localized abscess, MRSA

Pasteurellosis—necrotizing infection associated w/ animal bites esp cats

Cat-Scratch Fever—afipia felis or bartonella henselae, cat/dog

scratches, regional or local lymphadenitis, fever, self limiting

Wound Botulism—anaerobic clostridium botulinum, associate w/ crush injuries or major trauma, s/s: dysphagia, dilated fixed pupils, muscular paralysis

Gas Gangrene—anaerobic clostridium perfringens, hx gallbladder surgery, or trauma to old scar containing spores, hard abdomen → hypoxia, tissue crepitus, fever, NVD, coma

Group A Strep—found in throat and on skin, necrotizing fasciitis, TSS

Tetanus and rabies—next slides

Tetanus

- Rusty metal, animal and human intestines (feces)
- Tdap or TD
- If never immunized
 - immune globulin (immunity for 1 month) **and** active immunization-tetanus toxoid



Anaerobic clostridium tetani

s/s: HA, restlessness, muscle spasms, pain in back, neck, or face

Progression: extreme stiffness → tonic spasms ☒ exaggerated reflex activity ☒ generalized convulsions ☒ respiratory depression

Rabies

- Rabies is a neurotoxin
- The most common animals are wild animals. Household animals can also become infected if bitten by a wild animal.
- The signs and symptoms: fever, headache, confusion, anxiety, excessive salivation.
- Vaccine
- Clean wounds with diluted iodine
- Update Tetanus
- If not pre-vaccinated will also need passive immunity

Virus enters through saliva and replicates in the muscle near the bite, then travels through the nervous system reaching the brain and causing fatal encephalitis.

Pressure Ulcers

- Ischemia to tissue
- 4 stages

First step is always relieve the pressure (turning frequently if not possible)

- Skin redness, pad area
- Blistering: pad area, ointment/lotions
- Extends through all layers of skin, high risk of infection, cover wound, prevent infection
- Through skin and possibly into muscle, tendon, bone. Surgery may be necessary

Reference

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