

# Therapeutic Modalities in Orthopaedics

## Non-operative Treatment Options

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- No financial disclosures.

# Therapeutic Modalities

- Treatment options to consider when surgery is not indicated or not safe for patient.
- *“Overall, 79.3% of patients were non-surgical, with highest proportions in the 0-24 and 25-44 age groups. Patients aged less than 45 years made up to 40% of all patients with visits, and 45% of non-surgical patients.”*
  - Surgery or Consultation: A Population-Based Cohort Study of Use of Orthopaedic Surgeon Services. Plos One. 2013; 8(6): e65560.
  - Initial visits October 2004 – September 2005 and care within 18 months

# Therapeutic Modalities

- Physical Therapy
  - Blood Flow Restriction (BFR)
  - Ultrasound Treatment
  - Electrical-Stimulation
  - Tissue Flossing
  - Dry Needling
  - Cupping
  - Bone Stimulators

# Physical Therapy

***“I’m very active and work a physically demanding job. Why do I need to go to Physical Therapy?”***

**- Every Patient**

- Goals of Physical Therapy:
  - Strengthen your muscles, reducing the strain on your joints
  - Improve balance and/ or mobility
  - Relieve joint pain
  - Injury prevention
  - Restore function, stability and mobility after an injury or surgical procedure

# Physical Therapy



Sleeper Stretch

# Physical Therapy

- Blood Flow Restriction (BFR)
  - Training in which there is a partial vascular occlusion induced in the most proximal muscles by the help of pneumatic tourniquet system.
  - ACSM guidelines state that for optimal strength training a weight of 70% of 1 rep max is required to build hypertrophy. The goal of BFR is to build strength/ hypertrophy with less resistance.
  - Specific protocols should be utilized for appropriate occlusion percentages and length of training

# Blood Flow Restriction





# Blood Flow Restriction

## Physiological Response

Adaptive response to hypoxic stimulus



Greater accumulation of metabolites due to both increased production in the more hypoxic state and limited removal due to BFR itself



Primary moderator of anabolic response



Accumulation of metabolites



Increased muscle swelling



Intra-muscular anabolic/ Anti-catabolic signalling muscle fibre recruitment beneficial for muscular adaptation



Further, hypoxic environment created increased activation and proliferation of stem cells



Increased hypertrophic response

## Hormonal Response

Blood Flow Restriction in respected muscle



Anaerobic environment is created



Production of lactic acid and hydrogen



Acidity



Decreased pH within blood



Decrease in actin and myosin cross-fibres



GH and IGF 1 response



Release bands



Reactive hyperemia



Increase blood flow to an area after it has been diminished



Large surge of blood flow and hormones come through area



Cellular swelling

# Physical Therapy

- Ultrasound Treatment
  - US is a deep-heating modality and is used primarily for elevating tissue temperatures in the form of acoustic energy
  - Phonophoresis: method of transporting medications through the skin using the mechanical vibrations produced by an ultrasound generator



# Physical Therapy

- **Electrical Stimulation**
  - Use of electrical current for nerve depolarization
  - Pain Modulation- stimulation causing the sensory nerves to fire, causes the gate to pain fibers to close
  - Muscle Contraction- used to minimize atrophy and loss of muscle function after immobilization/ surgery
  - Muscle Reeducation- reduce muscle inhibition
  - Iontophoresis
    - Introduction of ions into the body tissues by means of a direct electrical current

# Electrical Stimulation Therapy



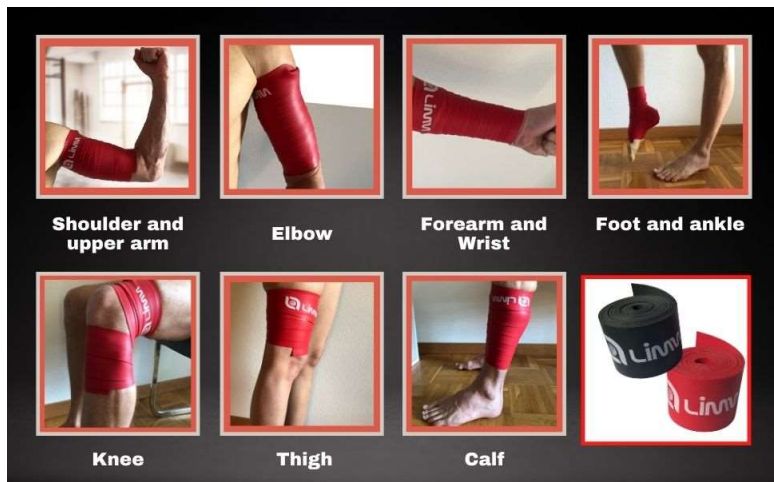
# Physical Therapy

- Tissue Flossing
  - The application of the tissue flossing band under tension causes compression and venous constriction
  - Little evidence to currently support this technique but viewed similar to Blood-Flow Restriction Training
  - Primary theory is fascial shearing or re-perfusion of blood to muscle
  - Potential benefits: reduced pain, increased ROM, improved performance, injury prevention, reduced delayed onset muscle soreness
  - May be referred to as VooDoo Floss (Cross Fit)

# Tissue Flossing



- Application
  - Firmly overlap the floss tape around the limb from proximal to distal
  - Keep on for 2-4 minutes
  - The joint or muscle is moved through active or passive ROM



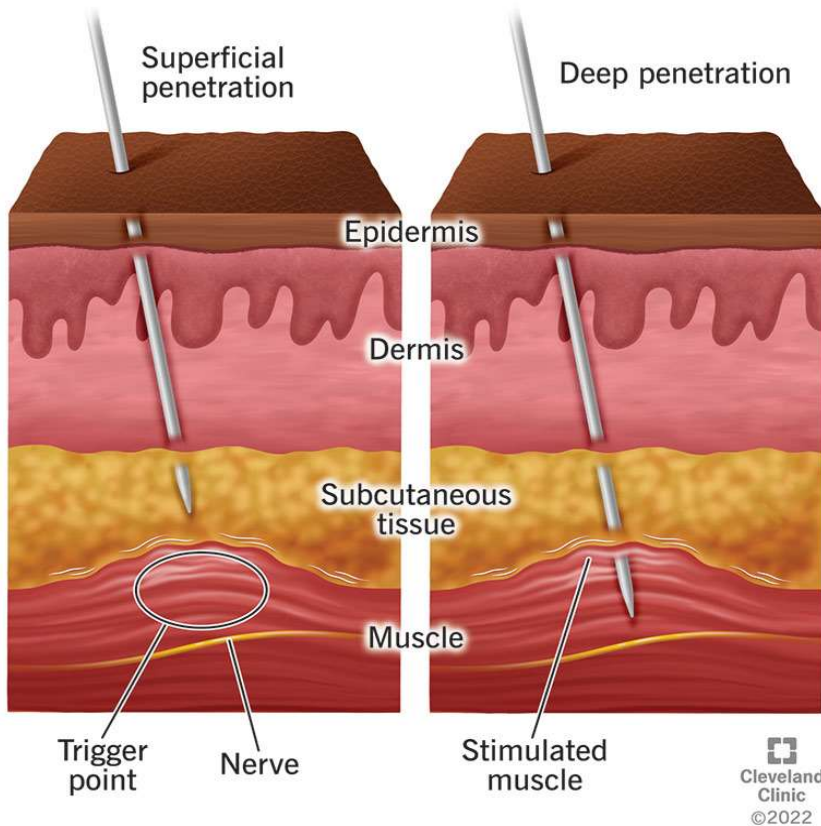
# Physical Therapy

- Dry Needling
  - Insertion of thin monofilament needles without the use of injectate; needles are inserted into nodules within taut bands of muscle (myofascial trigger points)
  - Releases muscle tension and pain by generating a twitch response at myofascial trigger points
  - Limited research studies proving benefit
  - State law varies on allowing Physical Therapists to practice Dry Needling



# Dry Needling

**Dry Needling**  
*Intramuscular manual therapy*





# Physical Therapy

- Cupping
  - Involves creating suction on the skin using a glass, ceramic, bamboo or plastic cup.
  - Started in ancient Egyptian and Chinese medical practices
  - Theory is the suction created by the cup encourages increased blood flow, and the increased circulation may promote healing and reduce pain.
  - May be used to treat tight muscles, scars, tendinitis, bursitis, fibromyalgia and release of trigger points.
  - Limited research with minimal evidence to support.

# Cupping



# Physical Therapy

- Bone Stimulators
  - *“Out of the 7.9 million fractures that occur annually in the US, 5-10% of them develop nonunions and/ or delayed unions.”*
    - *Musculoskeletal injuries report: Incidence, risk factors and prevention.*  
Rosemon, IL: American Academy of Orthopaedic Surgeons; 2000.
  - Reasons: inadequate mobilization of fracture, excessive early motion, excessive periosteal stripping, distraction of fracture fragments
  - Risks: Contamination at time of injury or operation/ Infection, smoking, diabetes, skeletal location, poor nutrition (decreased Vitamin D), older age

# Bone Stimulators

- Electrical Stimulation
  - Mimics the effect of mechanical stress on bone
  - Can be externally applied or implanted
  - Stimulates synthesis of extracellular matrix proteins for production of growth factors
- Pulsed Electromagnetic Field (PEMF)



# Bone Stimulators

- LIPUS



- Low-intensity Pulsed Ultrasound
  - Enhances bone healing by increasing the incorporation of calcium ions in cultures of cartilage and bone cells to stimulate growth factors
  - Stimulates undifferentiated mesenchymal stem cells to differentiate into osteoblasts
  - Periosteal tissue increases expression of osteocalcin, alkaline phosphatase and growth factor

# Bone Stimulators

- Extracorporeal Shock Waves (ESWT)
  - More recently being investigated but mechanism of action is not well-known
  - Not currently used as standard treatment
  - Currently used for standard treatment of ureter stones



# Physical Therapy

- Other treatment options may include:
  - Heating pads/ Whirlpools/ Cryotherapy/ Ice Massage
  - Paraffin Wax Bath
  - Laser Therapy
  - Traction (Cervical and Lumbar)
  - Intermittent Compression Devices- control swelling
  - Massage Therapy/ Scar Massage/ Desensitization
  - Instrument Assisted Soft Tissue Mobilization (IASTM)
    - Graston/ Scraping techniques
  - Acupuncture



# Therapeutic Modalities

- Injections
  - Platelet Rich Plasma (PRP)
  - Hyaluronic Acid Injections (HA)
  - Corticosteroid Injections
  - Stem Cell Injections
  - Prolotherapy
  - Neurolysis
  - Nerve Blocks (single shot/ On-Q catheters/ Exparel)

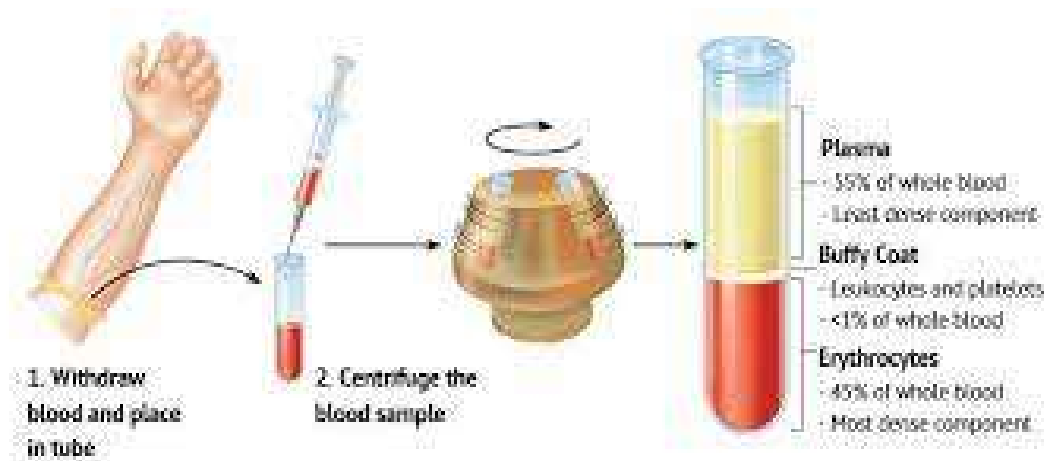


# Injections

- Platelet Rich Plasma (PRP)
  - Minimally invasive method of obtaining a natural concentration of autologous growth factors by centrifugation of autologous blood to separate and extract the plasma and buffy coat portion of the blood, which contain high concentration of platelets
  - Platelets are the 1<sup>st</sup> cell type to arrive at tissue injuries and are particularly active in the early inflammatory phase of tissue healing through degranulation and production of growth factors to enhance tissue repair
  - Concentration of platelets (growth hormone) can be 5-10 times greater in PRP preparations
  - NOT covered by most insurance plans, including Medicare

# Platelet Rich Plasma (PRP)

- Conditions to Treat:
  - Chronic tendon injuries (lateral epicondylitis)
  - Acute Ligament (UCL) and Muscle (Hamstring) Injuries
  - Surgery Adjunct (RTC, Meniscus, ACL)
  - Knee Arthritis
  - Fracture Healing
- Leukocyte-Rich vs Leukocyte-Poor



# Injections

- Hyaluronic Acid Injections (HA)
  - Hyaluronic acid is a naturally occurring substance found in the synovial fluid surrounding joints. (Molecular weight for normal human synovial fluid is equal to 6000-7000 kDa)
  - HA acts as a lubricant to enable bones to move smoothly and provides shock absorption for the joint
  - Joints with osteoarthritis have a lower concentration of Hyaluronic acid
  - May be effective in early stages of arthritis but more research is needed to support
  - Does NOT reverse arthritic changes or grow cartilage

# Hyaluronic Acid (HA) Injections

Brand Name Manufacturer	Generic Content	Molecular Weight (kDa)	Dosage
Hyalgan (Fidia Pharma)	1% sodium hyaluronate	500–730	20 mg weekly (five injections)
Synvisc (Sanofi)	0.8% hylan G-F 20	6000	16 mg weekly (three injections)
Synvisc-One (Sanofi)	0.8% hylan G-F 20	6000	48 mg one-time injection
Supartz (Bioventus)	1% sodium hyaluronate	620–1170	10 mg weekly (five injections)
Euflexxa (Ferring B.V.)	1% sodium hyaluronate	2400–3600	20 mg weekly (three injections)
Gel-One (Zimmer)	1% cross-linked hyaluronate	Not disclosed	30 mg one-time injection
Orthovisc (DePuy Synthes)	1.5% sodium hyaluronate	1000–2900	30 mg weekly (three to four injections)
Monovisc (Anika/Pendopharm)	2.2% cross-linked hyaluronan (proprietary cross-linking agent)	1000–2900	88 mg one-time injection
GenVisc 850 (Adant) (OrthogenRx)	1% sodium hyaluronate	620–1170	25 mg weekly (five injections)
Hymovis (Fidia Pharma)	0.8% hexadecylamide derivative of hyaluronan	500–730	24 mg weekly (two injections)
Gelsyn-3 (Gel-Syn) (Bioventus LLC)	0.84% sodium hyaluronate	1100	16.8 mg weekly (three injections)
Durolane (Bioventus LLC)	non-animal stabilized hyaluronic acid	Not disclosed	60 mg one-time injection

# Injections

- Corticosteroid Injections
  - Depo-Medrol/ Kenalog/ Celestone/ Dexamethasone
  - Typically buffered with Lidocaine/ Marcaine to reduce injection site pain, provide immediate pain relief and dilute the steroid to distribute it throughout joint
  - Limit joint injections to every 3-4 months
  - Avoid repetitive injections around tendons
  - Side effects: Patients may experience a steroid flare for 24-48 hours, elevated blood sugars, skin atrophy and bleaching of skin pigment at injection site
  - Repetitive doses may increase chondrotoxicity

**TABLE 1****Corticosteroid Preparations<sup>a</sup>**<sup>a</sup>Sources: Caldwell,<sup>6</sup> Douglas,<sup>9</sup> Dragoo et al,<sup>10</sup> Food and Drug Administration,<sup>12</sup> Godwin and Dawes,<sup>15</sup> Hameed and Ihm,<sup>16</sup> and Pharmacopeia.cn.<sup>30</sup>

<b>Corticosteroid</b>	<b>Preparation</b>	<b>Solubility (in water)</b>	<b>Intra-articular Action Duration, d</b>	<b>Clinical Dose, mg</b>
Hydrocortisone	Hydrocortisone acetate (HCA)	Insoluble	6	25
Methylprednisolone	Methylprednisolone acetate (MPA)	Insoluble	7	10-30
Dexamethasone	Dexamethasone sodium phosphate (DSP)	Soluble	6	4
	Dexamethasone (DEX)	Insoluble	8	8
Betamethasone	Betamethasone acetate (BMA)	Insoluble	9	6
Prednisolone	Prednisolone	Soluble	10	10-30
Triamcinolone	Triamcinolone acetonide (TA)	Insoluble	14	10-40
	Triamcinolone hexacetonide (THA)	Insoluble	21	20

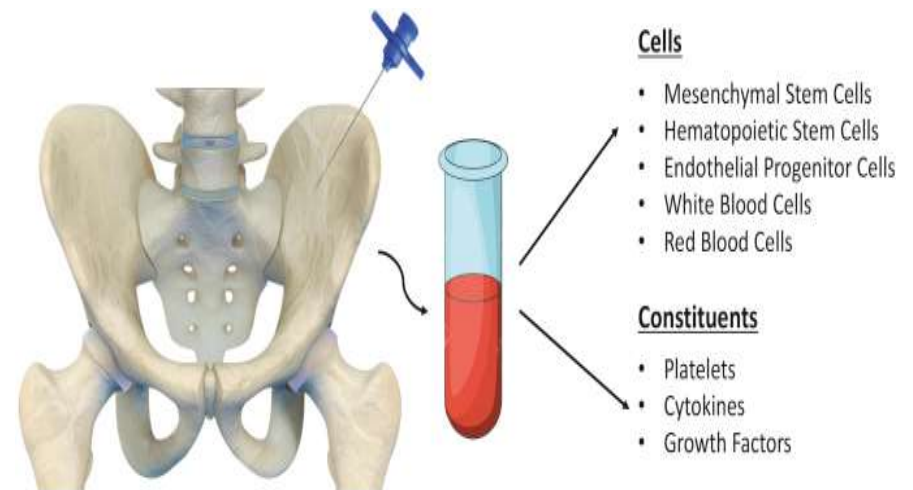
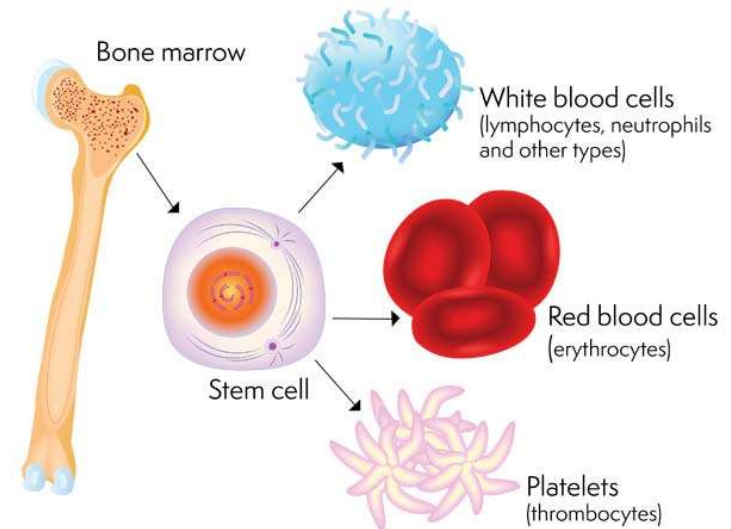
# Injections

- Stem Cell Therapy
  - Autologous stem cells have the natural ability to accelerate healing and promote regeneration after an injury
  - Mesenchymal stem cells (MSC) are specific cells to the musculoskeletal system which are able to differentiate into different tissue types such as ligament, tendon, muscle and even bone
  - May be used to treat bone fractures, soft tissue injuries and osteoarthritis
  - More research is evolving; still considered experimental



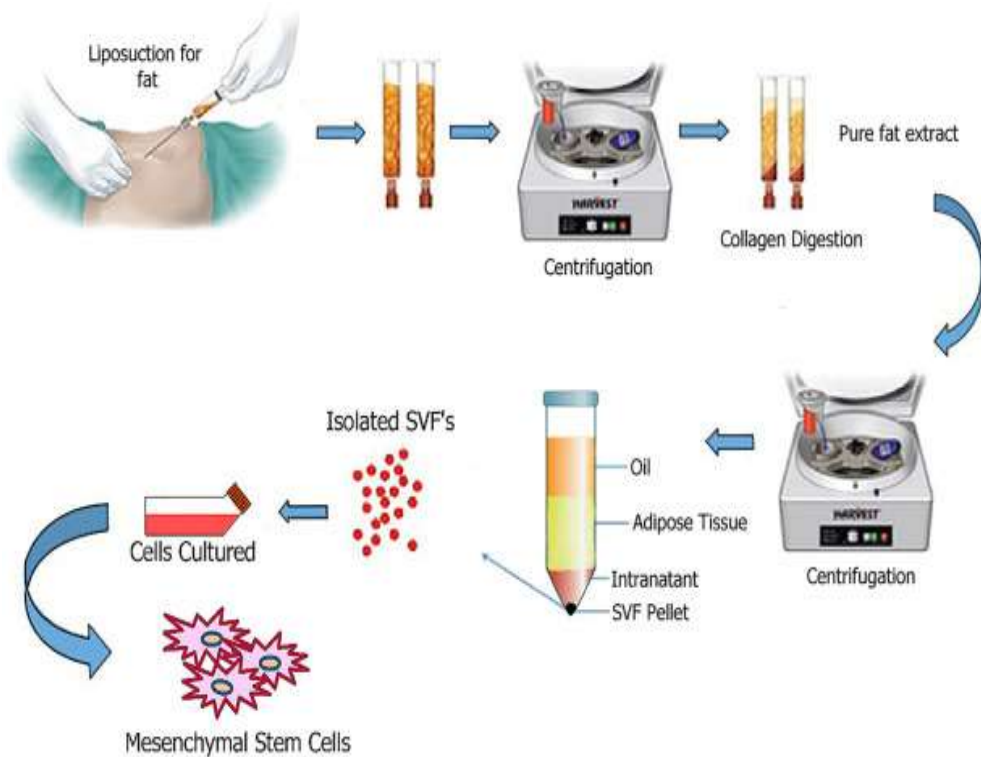
# Stem Cell Therapy

- Bone Marrow-Derived Stem Cells (BMAC)
  - Gathered by aspirating bone marrow from the back of a patient's pelvis
  - Machine is used to isolate the platelets and stem cells from the blood products (bone marrow aspirate) and injected into the injured area





# Stem Cell Therapy



- Lipo-aspirate (Fat-Derived Stem Cells)
  - Adipose tissue is an excellent source of regenerative stem cells
  - Adipose-derive stem cells can be collected in a minimally invasive procedure similar to liposuction
  - Stem cells from adipose are abundant and capable of differentiation into numerous cell types

# Prolotherapy

- Injection treatment used to relieve pain by injecting a small amount of a Dextrose (sugar) solution into the affected joint, ligament or tendon.
- Previously termed Sclerotherapy
- Injectate creates an inflammatory response (3-7 days) followed by proliferation (72 hours after injection and lasts 6 weeks) which assist in formation of type 1 and 3 collagen
- NOT FDA Approved \*\*\*\*

# Injections

- Neurolytic Blocks- targeted destruction of a nerve or nerve plexus
  - Pre-operative nerve blocks
    - Single shot (interscalene/ adductor/ femoral/ fascia iliaca/ etc/); Exparel (Bupivacaine Liposome)
    - On-Q catheters: slow, controlled flow of anesthetic to surgical site
  - Epidural Steroid Injections- herniated disk/ spinal stenosis
  - Cryoneurolysis- direct application of cold temps ( $-70^{\circ}$  C) to ablate the targeted nerve, resulting in reversible neuronal injury to the peripheral sensory nerve

# Therapeutic Modalities

- Medications
  - Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)
  - Tylenol
  - Opioid Pain Medication
  - Gabapentin
  - Oral Steroids
  - Glucosamine Chondroitin
  - Osteoporosis Medications
  - Antibiotics
  - DVT Prophylaxis

# Non-Steroidal Anti-Inflammatory Drugs

- Mechanism of Action
  - NSAIDs work by inhibition of the enzyme cyclooxygenase (COX-1 and COX-2)
  - Cyclooxygenase converts arachidonic acid into thromboxanes, prostaglandins and prostacyclines
  - The effects of NSAIDs is due to lack of these Eicosanoids
  - Thromboxane- platelet adhesions
  - Prostaglandins- cause vasodilation and increase temperature
- COX-1
  - Expressed in the body
  - Maintains GI mucosal lining, kidney function and platelet aggregation
- COX-2
  - Expressed during an inflammatory response

# Non-Steroidal Anti-Inflammatory Drugs

- Nonselective COX Inhibitors
  - Diclofenac
  - Etodolac
  - Ibuprofen
  - Indomethacin
  - Meloxicam
  - Naproxen



- COX-2 Inhibitors
  - Celecoxib (Celebrex)
  - Rofecoxib (Vioxx)
  - Valdecoxib (Bextra)
- Lower risk of GI issues/ulcers with COX-2 Inhibitors
- Monitor kidney function with any use of NSAIDs
- Avoid in patients taking blood thinners and patients with concussions

# Non-Steroidal Anti-Inflammatory Drugs

- Aspirin (Acetylsalicylic Acid)
  - Non-selective and irreversibly inhibits both COX-1 and COX-2
  - Low dose (81 mg/day): inhibits platelet generation of thromboxane resulting in an antithrombotic effect
  - Intermediate dose (4 g/day): inhibits COX-1 and COX-2, blocking prostaglandin production, as well as analgesic and antipyretic effects
  - High dose (8 g/ day): anti-inflammatory agents in rheumatic disorders
    - Toxicity may include tinnitus, hearing loss and gastric intolerance
- DO NOT give Aspirin to children and teenagers recovering from chickenpox or flu-like symptoms due to the risk of Reye's syndrome (swelling of liver and brain)

# Tylenol (Acetaminophen)

- Tylenol (Acetaminophen)
  - Analgesic- elevates the pain threshold
  - Antipyretic (fever reducer)- works on the heat-regulating center of the brain
  - Typical dose: 500 mg every 8 hours; Maximum daily dose is 4 grams
    - May be packaged as 325 mg/ tab or 500 mg/ tab
  - Post-op: 1000 mg oral every 6 hours SCHEDULED
  - Metabolized by the liver (limit with hepatic impairment)
  - Ofirmev (IV Acetaminophen)- 15-minute IV infusion of 1000 mg Acetaminophen



# Opioid Pain Medication

- Oxycodone (OxyContin, Roxicodone, Percocet)
  - Hydrocodone/ Acetaminophen (Vicodin, Norco, Lortab)
  - Morphine (MS Contin)
  - Hydromorphone (Dilaudid and Exalgo)
  - Fentanyl (Abstral, Duragesic, Fentora)
  - Meperidine (Demerol)
  - Methadone (Dolophine, Methadose)
  - Codeine
- Mechanism of Action
    - Influence the release of chemical from the brain's internal reward system that can calm our emotions and give you a sense of pleasure
    - Slow down autonomic functions such as breathing and heart rate
    - Slow or reduce pain signals before they get to the brain
  - Side Effects
    - Nausea/ fatigue/ Constipation
  - Reversal with Narcan (Naloxone)- opioid antagonist, blocks receptors

# HOW DRUGS ARE CLASSIFIED IN THE US

SCHEDULE	DESCRIPTION	EXAMPLES
<b>Schedule 1</b>	Drugs with no currently accepted medical use and a high potential for abuse. They are the most dangerous drugs of all the drug schedules with potentially severe psychological or physical dependence.	<ul style="list-style-type: none"> <li>- Heroin</li> <li>- Lysergic acid diethylamide (LSD)</li> <li>- Marijuana (Cannabis)</li> <li>- Methylenedioxyamphetamine (Ecstasy)</li> <li>- Methaqualone</li> <li>- Peyote</li> </ul>
<b>Schedule 2</b>	Drugs with a high potential for abuse, with use potentially leading to severe psychological or physical dependence. These drugs are also considered dangerous.	<ul style="list-style-type: none"> <li>- Combination products with less than 15mg of hydrocodone per dosage unit (Vicodin)</li> <li>- Cocaine</li> <li>- methamphetamine</li> <li>- Methadone</li> <li>- Hydromorphone (Dilaudid)</li> <li>- Meperidine (Demerol)</li> <li>- Oxycodone (OxyContin)</li> <li>- Fentanyl</li> <li>- Dexedrine</li> <li>- Adderall</li> <li>- Ritalin</li> </ul>
<b>Schedule 3</b>	Drugs with a moderate to low potential for physical and psychological dependence. Schedule 3 drugs abuse potential is less than Schedule 1 and Schedule 2 drugs but more than Schedule 4.	<ul style="list-style-type: none"> <li>- Products containing less than 90mg of codeine per dosage unit (Tylenol and codeine)</li> <li>- Ketamine</li> <li>- Anabolic steroids</li> <li>- Testosterone</li> </ul>
<b>Schedule 4</b>	Drugs with a low potential for abuse and low risk of dependence.	<ul style="list-style-type: none"> <li style="width: 50%;">- Xanax</li> <li style="width: 50%;">- Ativan</li> <li style="width: 50%;">- Soma</li> <li style="width: 50%;">- Talwin</li> <li style="width: 50%;">- Darvon</li> <li style="width: 50%;">- Ambien</li> <li style="width: 50%;">- Darvocet</li> <li style="width: 50%;">- Tramadol</li> <li style="width: 50%;">- Valium</li> </ul>
<b>Schedule 5</b>	Drugs with lower potential for abuse than Schedule 4 and consist of preparations containing limited quantities of certain narcotics. Schedule 5 drugs are generally used for antidiarrheal, antitussive, and analgesic purposes.	<ul style="list-style-type: none"> <li>- Cough preparations with less than 200mg of codeine per 100ml (Robitussin AC)</li> <li>- Lomotil</li> <li>- Motofen</li> <li>- Lyrica</li> <li>- Parepectolin</li> </ul>

SOURCE: Drug Enforcement Administration

BUSINESS INSIDER

# Medications

- Gabapentin (Neurontin)
  - May be effective in treating peripheral neuropathy and/ or radiculopathy (nerve pain)
  - Typically start Gabapentin 300 mg QHS; can titrate up to a max of 900 mg/ day
  - In older adults, start at 100 mg and titrate every 3-4 days
  - Consider drug cost: trial Gabapentin over Pregabalin (Lyrica)
  - Taper Gabapentin over 7 days or more to D/C

# Medications

- Muscle Relaxers:
  - Antispasmodic- more for myofascial pain
    - Methocarbamol (Robaxin)
    - Flexeril (Cyclobenzaprine)
    - Carisoprodol (Soma)
    - Metaxalone (Skelaxin)
  - Antispastic- treat spasticity associated due to damaged nerve pathways (MS, CP, Stroke, ALS, etc.)
    - Baclofen (Gablofen)
  - Antispastic and Antispasmodic
    - Tizanidine (Zanaflex)

# Glucocorticoids

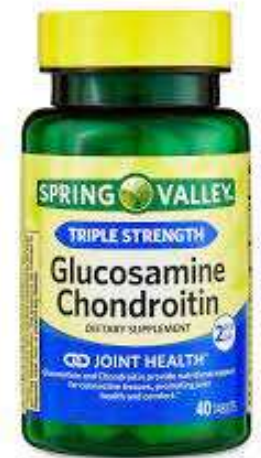
- Prednisolone/ Betamethasone/ Dexamethasone/ Hydrocortisone/ Methylprednisolone/ Deflazacort
- Work by reducing inflammation or the effect of the persons immune system
- May help with Rheumatoid Arthritis, Polymyalgia Rheumatica, nerve root irritation from disk herniation
- If taking high dose (40 mg more than 1 week) or any dose longer than 3 weeks, don't D/C suddenly

# Glucocorticoids

- Side-effects of Oral Steroids
  - Osteoporosis
  - Weight gain
  - Increased chance of infection
  - Increase in blood pressure
  - Hyperglycemia
  - Mood and Behavioral changes
  - Cushing Syndrome
  - Skin problems
  - Muscle Weakness
  - Increased risk of cataracts
  - Avascular Necrosis
  - Increased risk of ulcers

# Glucosamine Chondroitin

- Components of normal cartilage and appear to stimulate the body to make more cartilage
- Evidence to support is very conflicting
- Supplements are very well tolerated with little to no side effects
- May take up to 6 months to notice any improvements



# Osteoporosis Medications

- Vitamin D (1,500-2,000 IU/ daily in adults)
  - Increases absorption of calcium, magnesium, phosphate
  - Foods (fatty fish, dairy products) and Sun exposure
  - Deficiency (<30 mg/mL): 50,000 IU/ weekly for 8 weeks
- Prolia® (Denosumab)
  - Treatment of postmenopausal women with osteoporosis at high risk for fracture
  - Inhibits osteoclast formation to decrease bone breakdown
- Bisphosphonates (Fosamax/ Reclast)- slows down bone resorption to strengthen bones



# Tetanus Vaccination

- Anaerobic conditions carry risk of germination of *C. tetani* spores
- Always check Tetanus status particularly with open fracture!
- Tetanus toxoid-containing vaccine indicated (Tdap preferred)
  - Less than 3 tetanus toxoid containing vaccines in the past
  - More than 5 years has passed since last tetanus toxoid containing vaccine

# Antibiotic Medications

- Dental Antibiotic Prophylaxis
  - 1. Amoxicillin 2 grams
  - 2. Ampicillin 2 gm IV/ IM
  - 3. Ceftriaxone 1 gm IV/ IM
  - 4. Cephalexin 2 gm
  - 5. Clindamycin 600 mg
  - 6. Azithromycin 500 mg
- Take 1 hour prior to dental work

# Antibiotic Medications

- Lyme Disease
  - Tick born illness caused by infection with bacteria *Borrelia burgdorferi* (transmitted through deer ticks)
  - Prophylaxis
    - Doxycycline 200 mg within 72 hours of tick removal
  - Early Localized Lyme disease
    - Doxycycline 100 mg for 10-21 days
  - Late Lyme disease (Lyme Arthritis)
    - Doxycycline for 28 days
  - Refractory cases may require IV antibiotics (Ceftriaxone)

# Joint Aspiration

## Synovial Fluid Analysis

	NORMAL	Non-Inflammatory	Inflammatory	Septic	Hemorrhagic
Clarity	Transparent	Transparent	Translucent	Opaque	Bloody
Colour	Clear	Yellow	Yellow	Dirty/Yellow	Red
Viscosity	High	High	Low	Variable	Variable
WBC/mm <sup>3</sup>	<200	200-2,000	2000-10,000 (up to 100,000)	>80,000	200-2,000
PMNs %	<25%	<25%	>50%	>75%	50-75%

Depending on the clinical scenario, synovial fluid is analysed for:

- Cell count and differential
- Crystals
- Culture and sensitivity (if septic arthritis suspected)
- Cytology (if malignancy suspected)

# Medications

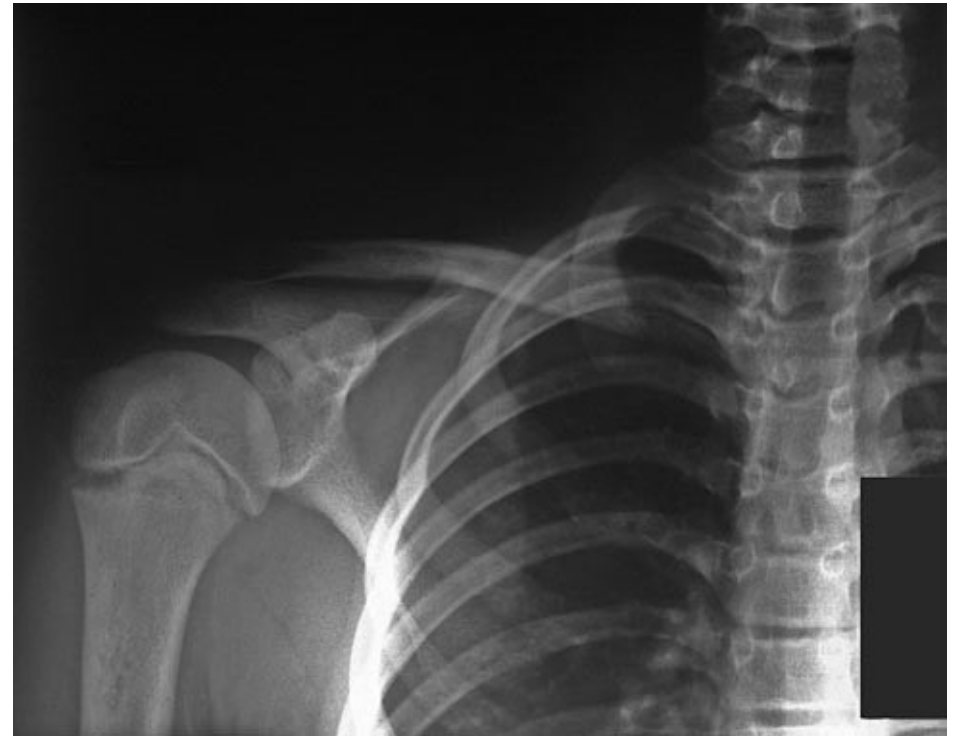
- DVT Prophylaxis
  - High risk surgeries: TKA, THA, hip fracture surgery
  - Agents of Choice
    - Low- Molecular Weight Heparin (LMWH)
      - Enoxaparin 40 mg SC daily
    - Direct Oral Anticoagulants (DOACs)
      - Apixaban (Eliquis) 10 mg PO daily
      - Rivaroxaban (Xarelto) 2.5 mg PO BID
      - Dabigatran (Pradaxa)
      - Edoxaban (Savaysa)
    - Aspirin 81 mg BID for 4-6 weeks (Arthroplasty)
  - Start POD1 and treat minimum of 10-14 days

**What did we miss?**

**Please don't miss  
these!**

# Little Leaguer's Shoulder

- Overuse shoulder injury in young baseball pitchers resulting in epiphysiolysis of the proximal humerus (Salter Harris Type 1)
- Diagnosed with widening of proximal humeral growth plate
- Tx: shoulder rest from throwing, PT and gradual return to throwing after sufficient rest



# Little Leaguer's Elbow

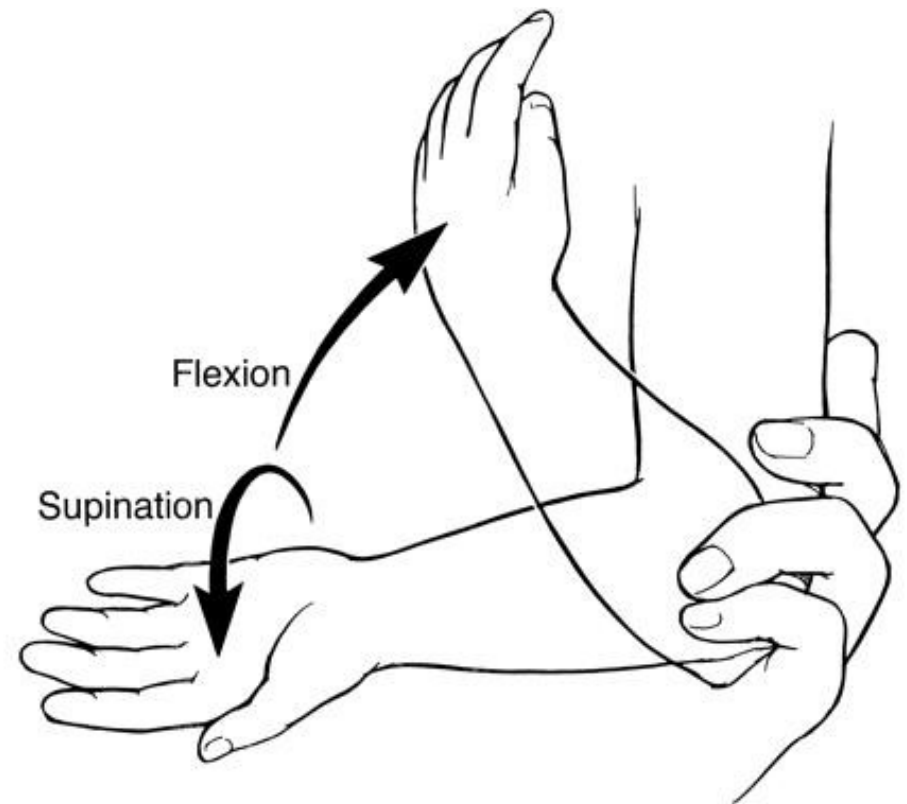
- Overuse elbow injury in young/ skeletally immature baseball players
- Pain and tenderness over the medial elbow worse with valgus stress
- ENFORCE pitch counts in all players...particularly youth.
- Tx: rest, PT and activity modification





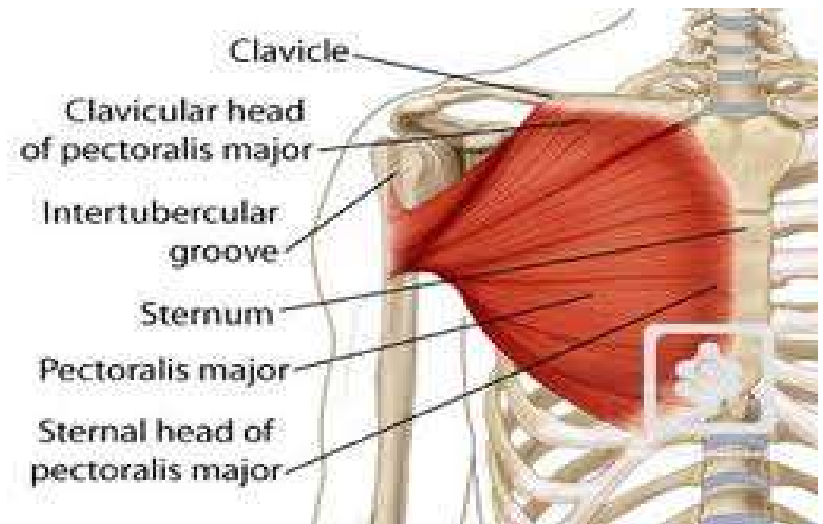
# Nursemaid's Elbow

- Common in children from 1-4 years of age
- MOI: sudden, longitudinal traction applied to hand with elbow extended
- Annular ligament becomes interposed between radial head and capitellum
- May present with limited supination and refusing to move elbow



# Pectoralis Rupture

- Typically associated with bench pressing
- May experience “tearing” sensation
- Ecchymosis, swelling and deformity seen on exam
- Surgical repair for tendon avulsions



# Compartment Syndrome

Medical condition where pressure inside a myofascial compartment exceeds the perfusion pressure of the contents causing ischemia and necrosis.

- Causes...
  - Trauma – crush injury
  - Reperfusion
  - Iatrogenic
  - Tight dressings/casts
  - External compression
- Surgical emergency
- We infrequently measure compartments
  - Diagnosis of clinical experience

# Compartment Syndrome

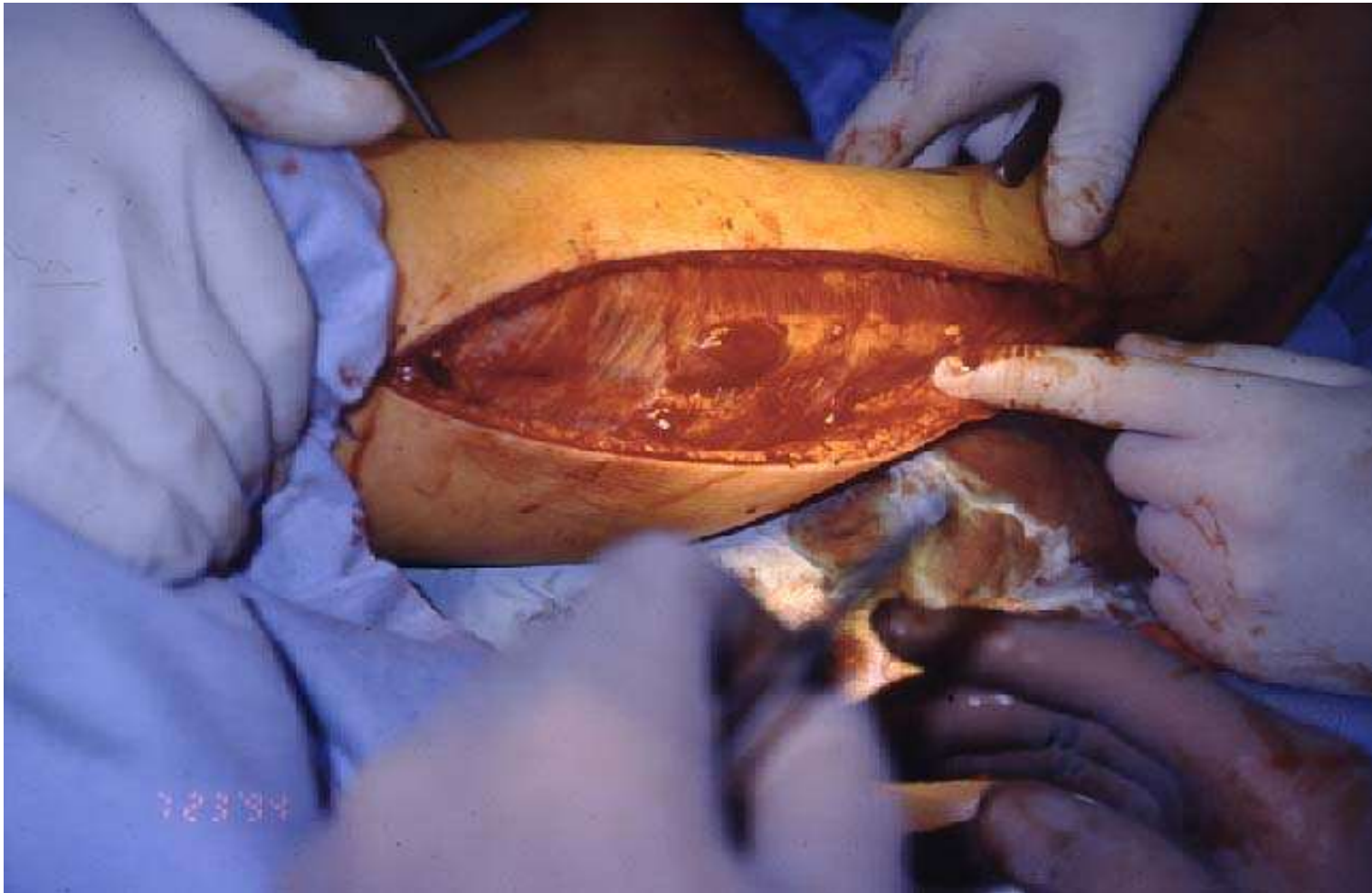
- Long bone fractures
  - Tibial shaft fractures
  - Femur
- Forearm fractures
- Pediatric supracondylar humerus fractures
- Other areas
  - Hand, foot, buttock,

Skin ALWAYS SHINES like this





# Notice the skin edges



# REASSESS YOUR PATIENTS

- Compartment syndrome can develop within hours of the injury
- Limb is TIGHT (very swollen and skin is stretched and shiny) and FIRM (not supple)
- Symptoms/Exam
  - PAIN OUT OF PROPORTION...severe, deep, constant, poorly localized
  - TENSE COMPARTMENT (wood like feeling)
  - PAIN WITH PASSIVE ROM

Other stuff that doesn't matter b/c it's too late

- Pale (arterial injury)
- Pulseless (arterial injury)
- Paresthesias (numb and tingling-diminished blood supply to limb) or Paralysis
- Poikilothermia (failure to thermoregulate)

# Closed Reduction of Fractures/ Joints

Orthopaedic Trauma Association (OTA)

Closed Reduction, Traction, and Casting  
Techniques

Jason Tank, MD March 2014 Original Authors:  
Dan Horwitz, MD; March 2004; David Hak,  
MD; Revised January 2006 & October 2008  
New Author: Jason Tank, MD



# Closed Reduction Principles

- Most displaced fractures should be reduced to minimize soft tissue complications and injury
- Evaluate skin, compartments and neurovascular status (absent pulses, skin tenting, etc.)
- Goals: restore length, alignment and rotation
- Anesthesia Options for muscle relaxation:
  - IV Sedation (Versed/ Morphine/ Demerol/ Ketamine)
  - Hematoma Block
  - Intra-articular Block

# Closed Reduction Principles

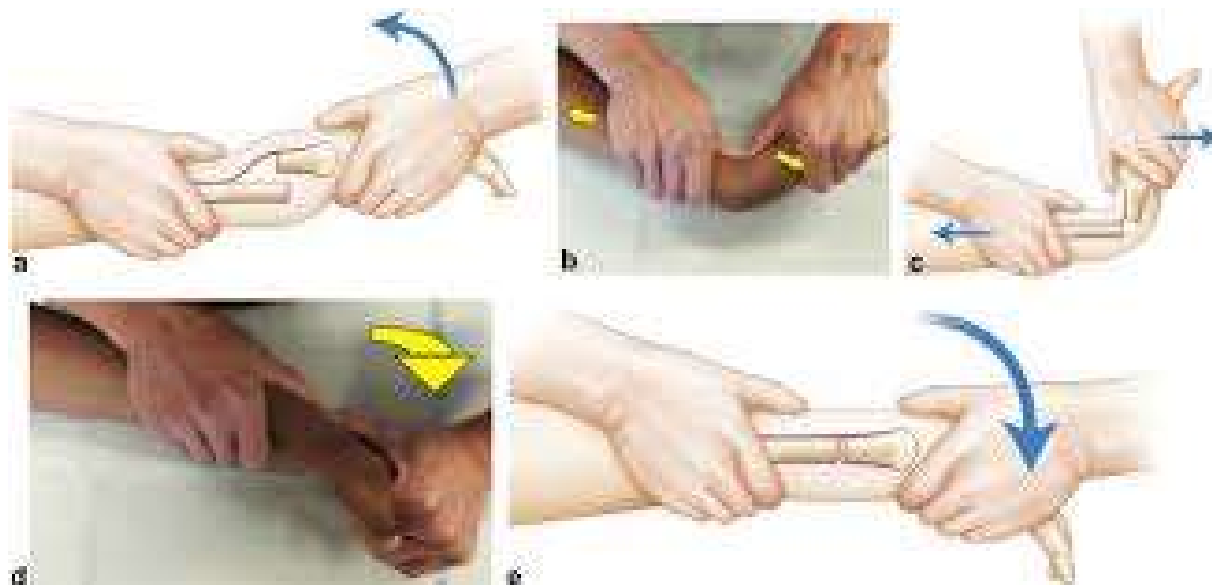
- Prepare immobilization prior to reduction
  - Splint pre-measured and ready for efficient application
  - Sling or knee immobilizer in close proximity
  - Have extra supplies close
  - Assistant or assistive device (i.e. finger traps, etc.)
- Document post-reduction neurovascular status
- Quality post-reduction radiographs

# Closed Reduction Principles

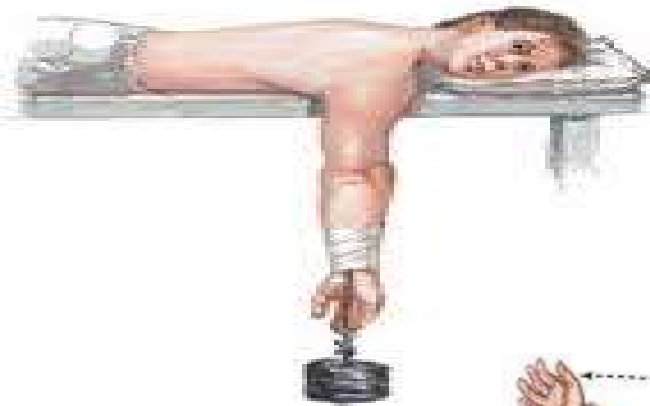
- Reduction requires reversal of mechanism of injury
  - Especially in children with intact periosteum
- The soft tissues may disrupt on the convex side and remain intact on the concave side
- Longitudinal traction alone may not allow the fragments to be disengaged and length re-established if there is an intact soft-tissue hinge
  - Especially in children with intact periosteum

# Closed Reduction Principles

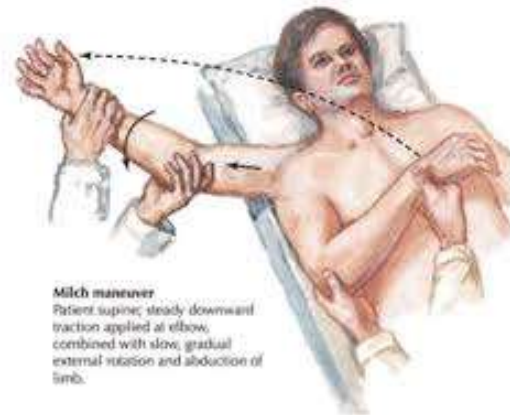
1. Reproduce the fracture mechanism
  2. Traction to disengage fracture fragments
  3. Re-align fracture
- \*\* Angulation beyond 90 degrees may be required



# Shoulder Dislocation



Stimson Maneuver



**Milch maneuver**  
Patient supine; steady downward traction applied at elbow, combined with slow, gradual external rotation and abduction of limb.



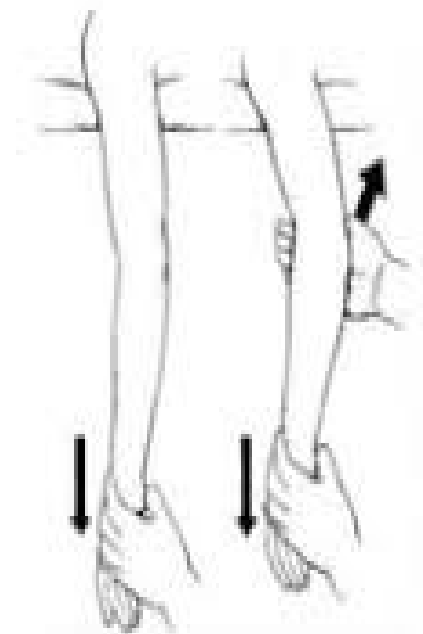
- Relaxation key
- Traction to disengage humeral head from glenoid
- +/- gentle rotation
- Many techniques described
- Immobilize in sling after reduction

# Elbow Dislocation

- Traction, flexion and direct manual palpation of olecranon
  - Reduce medial/ lateral displacement 1<sup>st</sup>
  - Address ant./ post. Next
  - Sup./ Pro may assist in reduction
- Immobilize in posterior long arm splint +/- sugar tong

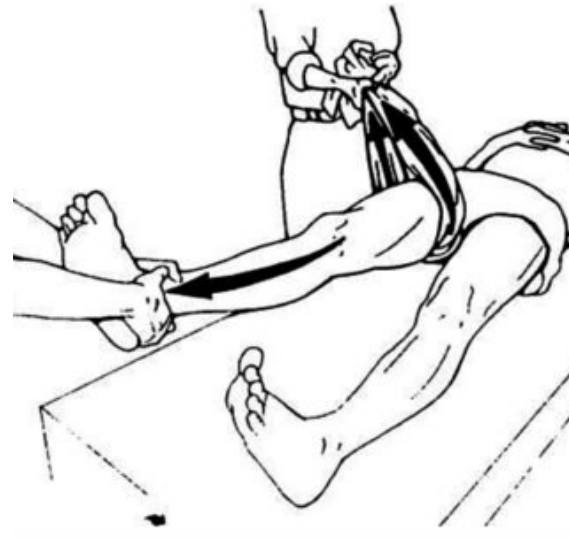
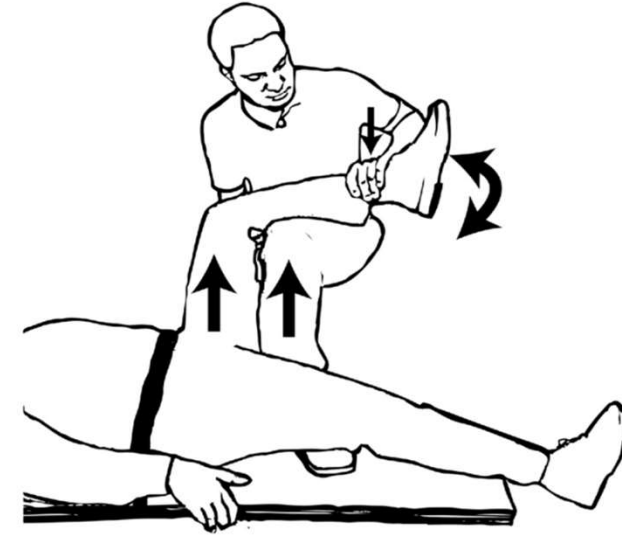
## PARVIN'S METHOD

- Patient in prone
- Gentle downward traction of the wrist for few minutes
- As the olecranon fossa begins to slip distally, physician lifts up gently on arm.



# Hip Dislocation

- **Posterior**: flexion, traction, adduction and internal rotation
- **Anterior**: traction, abduction, lateralization, rotation
- Reduction palpable and permits improved ROM
- Immobilize with knee immobilizer and abduction pillow



# Distal Radius Fracture

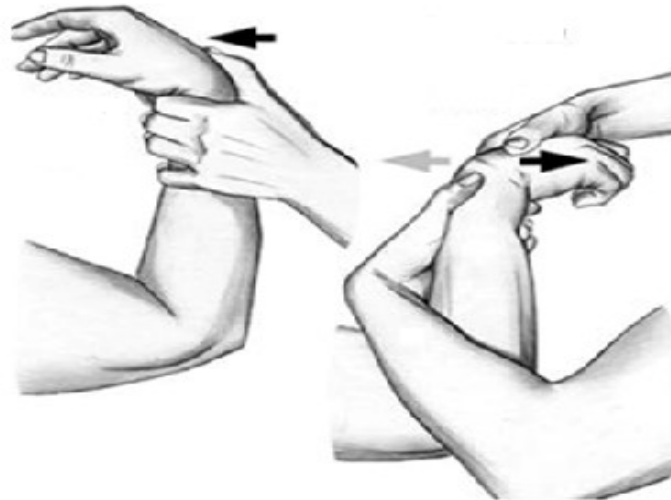
- Hematoma block
  - Longitudinal Traction
    - Finger traps or manual
  - Exaggerate the deformity
  - Push distal fragment and pull hand for length and deformity reversal
  - Immobilize in Sugar tong splint
- Apply ulnar deviation to reestablish radial height length
  - Keep patient's thumb collinear with forearm
  - Volar directed distal force over Lister's tubercle (Colles)



Step 1: stretch the fracture part



Step 2: move the distal fragment



Step 3: maintain the position of flexion and ulnar deviation



# Ankle Fracture/ Dislocation

- Traction with deformity correction
- Bend knee to relax gastric/ soleus complex
- Posterior and Lateral dislocation
  - Quiggly Maneuver
  - Posterolateral to anteriomedial directed mold on splint
- Medial dislocation
  - Traction to reduce
  - Medial to lateral directed mold



# Gout vs Pseudogout

## Gout

- Patients tend to be over 40
- Small joints
- Severe joint pain and swelling
- Soft tissue swelling on radiographs
- Uric acid crystals
- Negatively birefringent needle shaped crystals
- Rest, NSAIDs, Allopurinol

## Pseudogout

- Elderly population
- Large joints (most commonly in knee)
- Moderate joint pain and swelling
- Chondrocalcinosis
- Calcium Pyrophosphate Dihydrate crystals
- Positively birefringent Rhomboid- shaped crystals
- Rest, NSAIDs, joint aspiration

# Gout vs Pseudogout

**Gout**



**Pseudogout**



# Billing and Reimbursement

- PAs/ NPs can always treat new Medicare patients and established patients with new medical conditions when billing under their own name and NPI with reimbursement at 85% following state law guidelines
- There is no requirement for a physician to be on-site or to interact with patients when PAs/ NPs deliver care in the office/ clinic when submitting claims under PAs/NPs name

# Billing and Reimbursement

- “Incident to” Billing is a Medicare billing convention
- Medicare restrictions (physician treats on first visit, physician must be on site) exist only when attempting to bill Medicare “incident to” the physician to receive 100% payment rather than 85%
- “Incident to” is generally a Medicare term and not always applicable with private commercial payers or Medicaid
- Only applies in non-facility-based/ owned medical offices (place of service 11); not used in hospitals or nursing homes

# Billing and Reimbursement

- “Incident to” can’t occur at the patient’s 1<sup>st</sup> visit; must be at subsequent visits.
- The original treating physician performs initial exam/ diagnosis and plan of care; original physician or another physician in that group must be present in the same office suite with direct supervision for subsequent visits
- Does NOT apply to: New patients, New medical problems, Physician NOT on-site

# Billing and Reimbursement

- Split/ Shared Visit Billing
  - PA/NP and physician must work for the same group
  - Services must be delivered on the same calendar day
  - Physician must provide a substantive portion of care
  - FS modifier must be included on claim
- “Substantive Portion”
  - Physician must perform one of the key components (history, exam, MDM) in its entirety **OR**
  - Spend more than half of the total visit time with the patient

# Billing and Reimbursement

- PAs/ NPs are covered by Medicare for 1<sup>st</sup> assist at 85% of Physician's first assisting fees
  - PAs get 85% or 13.6% of primary surgeon's fee
  - AS modifier on case for Medicare
- Special rules for PAs/ NPs when residents/ fellows are available in the hospital (Medicare guidelines)
  - No qualified resident available (hour restrictions)
  - Physician NEVER uses a resident in pre-, intra-, post-op care
  - Exceptional medical circumstances



# Billing and Reimbursement

- When no qualified resident is available:
- Physician must certify:
  - I understand that 1842(b)(7)(D) of the Social Security Act generally prohibits Medicare physician fee schedule payment for the services of assistants at surgery in teaching hospitals when qualified residents are available to furnish such services. I certify that the services for which payment is claimed were medically necessary and that no qualified resident was available to perform the services. I further understand that these services are subject to post-payment review by the A/B MAC (B).
- Must use a second modifier -82 (teaching hospital) in addition to modifier -AS

# Billing and Reimbursement

- Global Surgical Package
  - Pre-op work up 10%
  - Intra-op work 69%
  - Post-op work 21%
  - Example
    - 27130 Total Hip Arthroplasty (payable at \$1,322)
    - Pre-op: \$132.20
    - Intra-op: \$912.18
    - Post-op: \$277.62
    - 1<sup>st</sup> Assist Fees: Additional \$179.99
- Potential PA/ NP Value or Contribution??

# Billing and Reimbursement

## Physician \$250,000

- 21 visits (99213 @ \$98)
- \$2,058 revenue per clinic day
- Avg. \$960 wages for 8-hour day (\$120/hr)
- Contribution margin of \$1,098 per day

## PA/ NP \$110,000

- 21 visits (99213 @ \$83.30)
- \$1,749 revenue per clinic day
- Avg. \$424 wages for 8-hour day (\$53/hr)
- Contribution margin of \$1,325

**Don't let the 15% difference stop you from seeing patients independently**

# The Value of PAs/ NPs

- Increase reimbursement and revenue
- Improve access to care and patient throughput
- Provide expanded hours and services
- Facilitate care coordination and communications
- Contribute to process/ quality improvement and outcomes
- Improve patient and staff satisfaction

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