



ANDREWS  
Sports Medicine and Orthopaedic Center



American Sports Medicine Institute

# PAIN MANAGEMENT IN ATHLETES

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# Objectives

- ▶ Definition of pain
  - ▶ Types of pain
    - ▶ Somatic, Visceral, Neuropathic, & undetermined
  - ▶ Medications for somatic pain
    - ▶ Guidelines
    - ▶ Pharmacology
    - ▶ Side Effects
  - ▶ Injectable Medications
- 

I have no conflicts of interest with regards to this presentation. Viewer discretion is advised due to graphic images.



# What is pain?

- “An unpleasant **sensory** and/or **emotional** experience associated with **actual** or **potential** tissue damage”
  - International Association for the Study of Pain

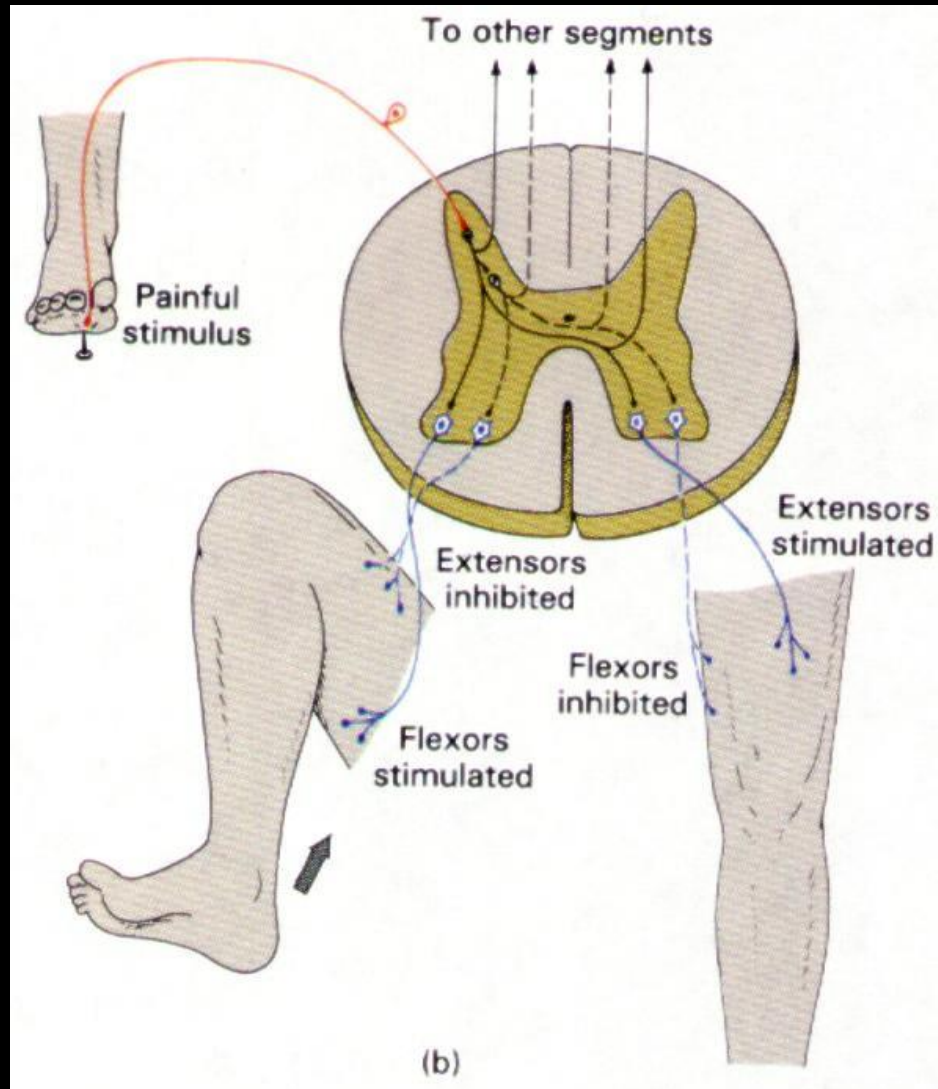


# Why pain?

- The body's protective mechanism
- Acts as a warning that tissue is being damaged



# Protective Mechanism

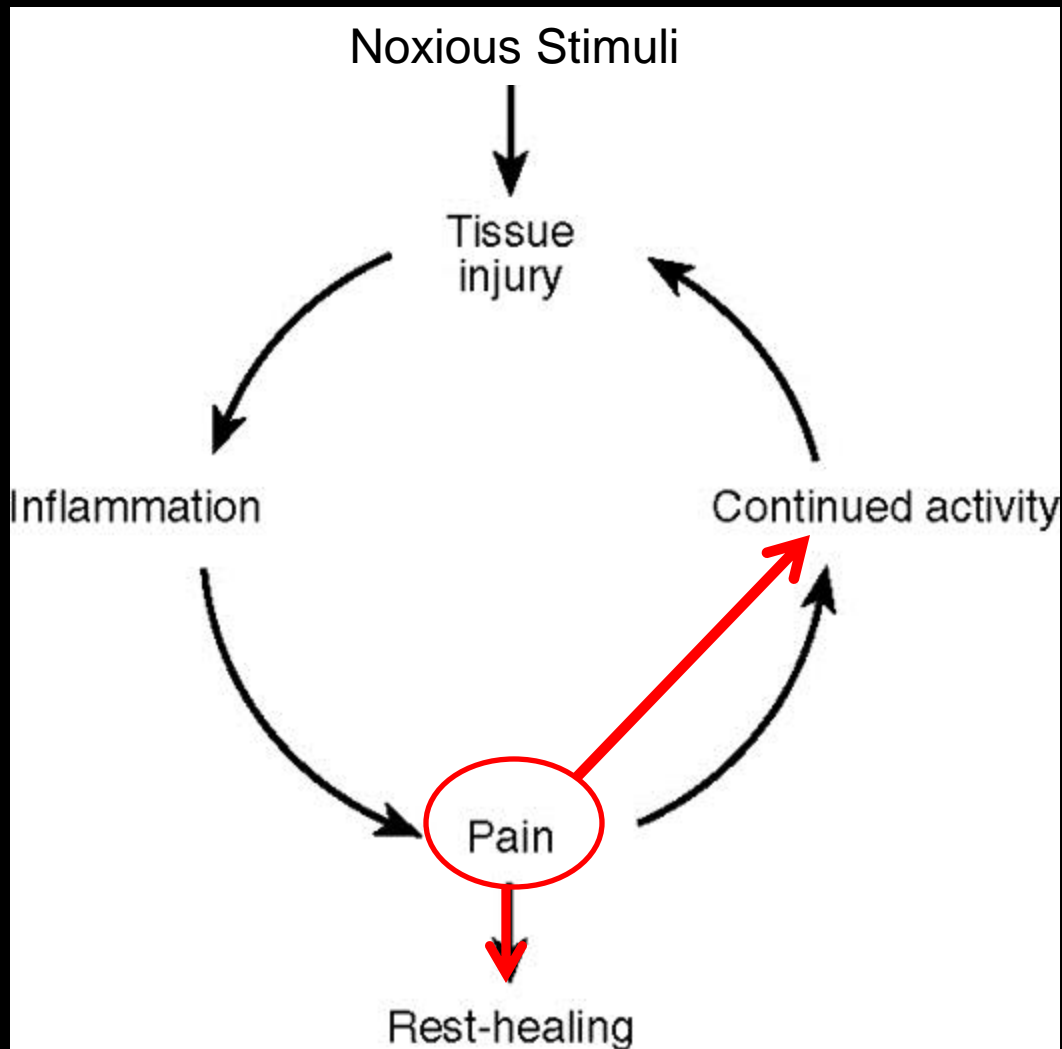


# Acute Pain

- Localized, due to a noxious stimuli
- Usually 80 to 90% resolve in less than 6 weeks
  - Ex. Trauma, surgery, acute illness

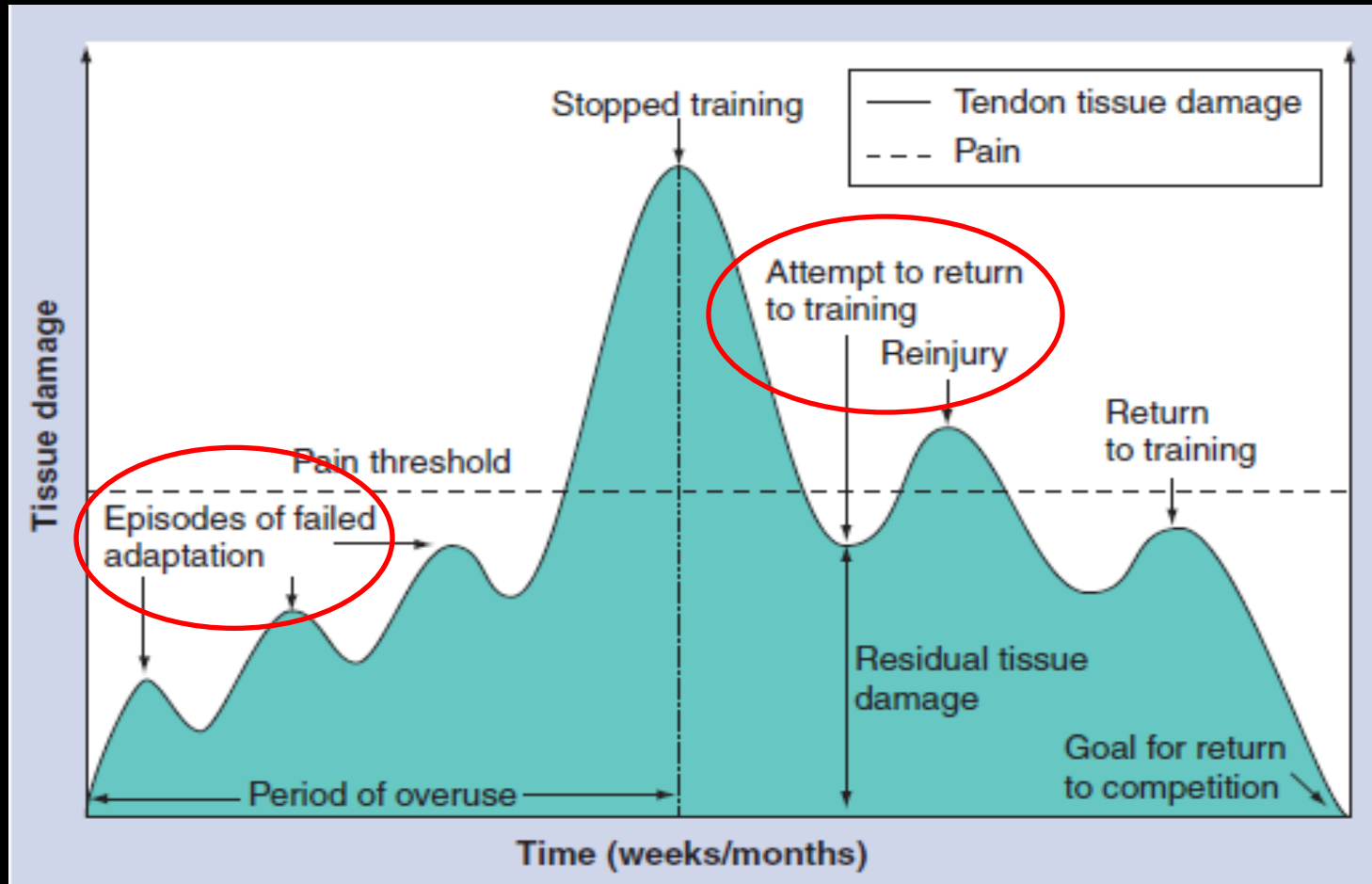


# Acute Pain in athletes may lead to Chronic Pain





# Accelerated versus Appropriate Return to Play



# Chronic Pain

- Pain that exceed the usual course of an injury
  - Usually more than 3 months
  - Median prevalence: 15% in the US
  - Have not responded to standard treatments
- Patients frequently have seen other physicians for the condition
  - They may have been treated for the wrong diagnosis or may have developed complications

# Chronic Pain Syndrome

- Patients may behave in a learned pattern in order to maintain secondary gains such as:
  - narcotic medications
  - work limitations
  - collect compensation
- Often justify themselves
  - adopt a self-image
  - perceive themselves as “disabled”



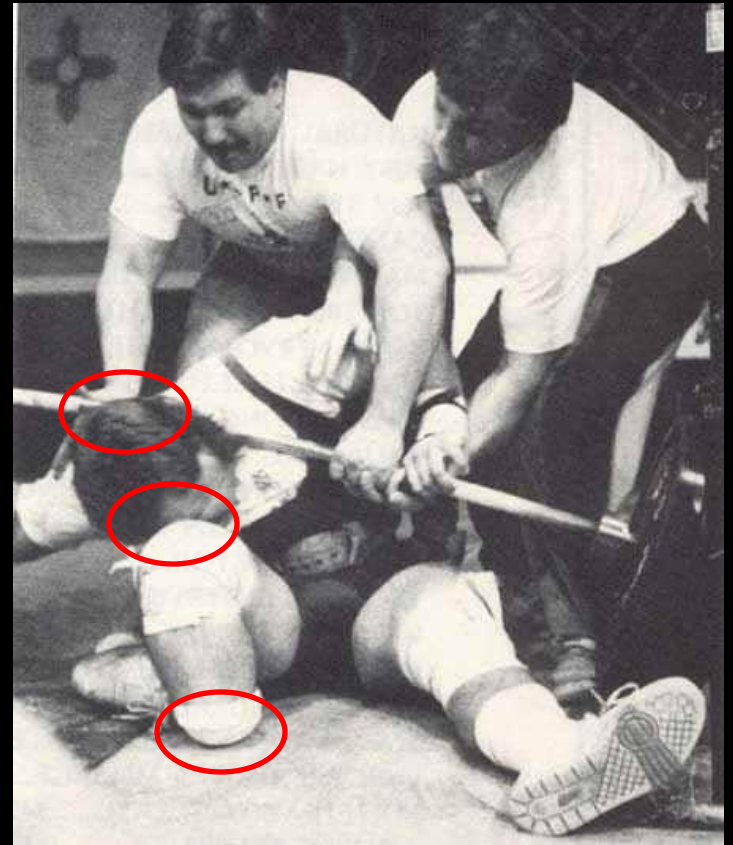
# Causes of pain

- Nociceptive – Somatic
- Nociceptive – Visceral
- Neuropathic
- Undetermined



# Nociceptive Somatic Pain

- Noxious stimuli to a peripheral nerve in the injured tissue
  - i.e. bones, muscles, skin
- Ex. fracture, lacerations, etc.



# Nociceptive Somatic Pain

- Description:
  - Well localized
  - Constant
  - Aching, stabbing
- Initial management:
  - PRICE
  - Acetaminophen, NSAIDS or narcotics
  - Physical Therapy



# Nociceptive Visceral Pain

- Noxious stimuli to an internal organ
- Visceral Injury: i.e. heart, appendix, etc.
- Ex. Kidney stone, myocardial infarct



# Nociceptive Visceral Pain

- Description:
  - Poorly localized
  - Referring to other sites
  - Dull, colicky
  - Accompanied by N / V, diaphoresis
- Initial management :
  - Find noxious stimuli !! → ER work-up
  - Monitor for hemodynamic instability
  - No NSAIDs
  - Acetaminophen, Opioids



# Neuropathic Pain

- Peripheral or central nerve damage
- Description:
  - Burning, tingling
  - Associated with sensorymotor disturbances:
    - numbness
    - Weakness
- Ex: Cervical radiculopathy, Carpal Tunnel

# Neuropathic Pain

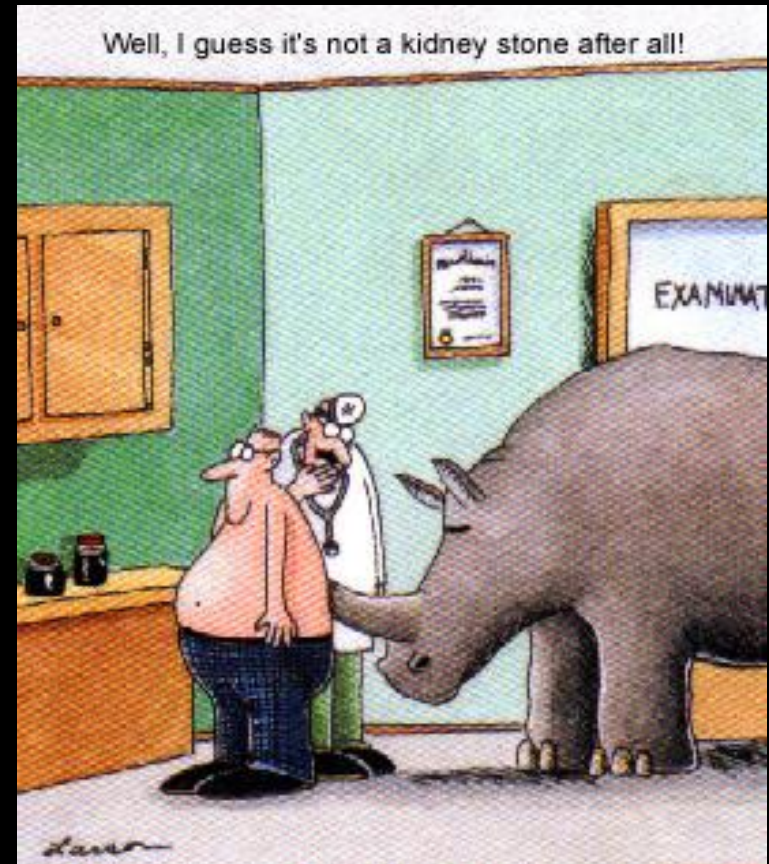
## Initial management :

- ▶ Physical therapy
- ▶ NSAID's
- ▶ Antidepressants
  - ▶ TCA's, SNRI's
- ▶ Anticonvulsants
  - ▶ gabapentin, pregabalin
- ▶ Topical creams
  - ▶ lidoderm, capsacin



# Undetermined Pain

- Abnormal central processing of a stimuli with normal peripheral tissues and nerves
- Associated with:
  - Somatoform pain disorders
  - Fibromyalgia



# Undetermined Pain

- No identifiable pathologic process
  - Widespread musculoskeletal pain and stiffness
  - Pain to light touch
- Management
  - Behavioral and psychological therapies
  - Antidepressants (Nortriptyline, duloxetine, etc.)
  - Anxiolytics (Diazepam, Alprazolam)

# Pharmacology of Medications for Somatic Pain



# Selection of agents for an acute injury

- ▶ Non-opioids for mild to moderate pain (rating 1-6/10)
  - ▶ Ex: Acetaminophen, NSAIDs
- ▶ Mild opioids for moderately severe pain (rating 7-9/10)
  - ▶ Ex: Tramadol, Hydrocodone, Oxycodone
- ▶ Potent opioids for severe pain (rating 10/10)
  - ▶ Ex: Morphine, Dilaudid, Demerol, etc.
  - ▶ Usually reserved for ICU and ER setting
- ▶ Goal: Treat effectively with the least potent medication



# Equivalency to Morphine

Analgesic	Strength (relative)	Half-life (hours)
<u>Aspirin</u> (non-opioid)	$\frac{1}{360}$	3-9
<u>Ibuprofen</u> (non-opioid)	$\frac{1}{222}$	1-3
<u>Naproxen</u> (non-opioid)	$\frac{1}{138}$	12-24
<u>Tramadol</u>	$\frac{1}{10}$	5-7
<u>Hydrocodone</u>	1	3-6
<u>Morphine</u> (oral)	(1)	2-3
<u>Oxycodone</u>	1.5	3-5
<u>Morphine</u> (IV/IM)	3	2-3
<u>Methadone</u>	3-4	15-60
<u>Hydromorphone</u> (Dilaudid)	5	2-3
<u>Buprenorphine</u> (Suboxone)	40	20-70, mean 37
<u>Fentanyl</u>	50-100	0.04 (IV); 7 (TD)

# Acetaminophen (pain rating 1-6/10)

- Antipyretic, analgesic
  - Equivalent analgesia to NSAIDs
  - Less renal and gastric toxicity than NSAIDs
  - Risk of liver toxicity
- Max daily dose:
  - Young adults: 4 g per day
  - Elderly: 2 g per day
- Guidelines: **first line in OA**





# Tramadol (pain rating 7-9/10)

- Mechanism of action
  - Weakly binds to opioid receptors
    - One-tenth as potent as morphine
- Adverse reactions
  - dizziness, somnolence
  - Hives, itchiness
- Schug. Clin Rheumatology, 2006
  - addictive qualities, although significantly less than opioids
  - Marked reduction in adverse events



# Opioid Analgesics (pain rating 10/10)

- Most potent analgesic
  - Not a good first line agent unless severe pain
  - Easily addictive
  - No ceiling effect
- Side effects (80% of patients): Constipation (41%), N/V (32%), sedation (29%), urinary retention, dry mouth, hypotension
- Best when used in acute episodes
  - Limited benefit after 28 days when compared to placebo

Trescot AM, Manchikanti L, et. al. *Opioid Guidelines in the Management of Chronic Non-Cancer Pain*. Pain Physician. 2006; Vol 9, No1: p.1-40.

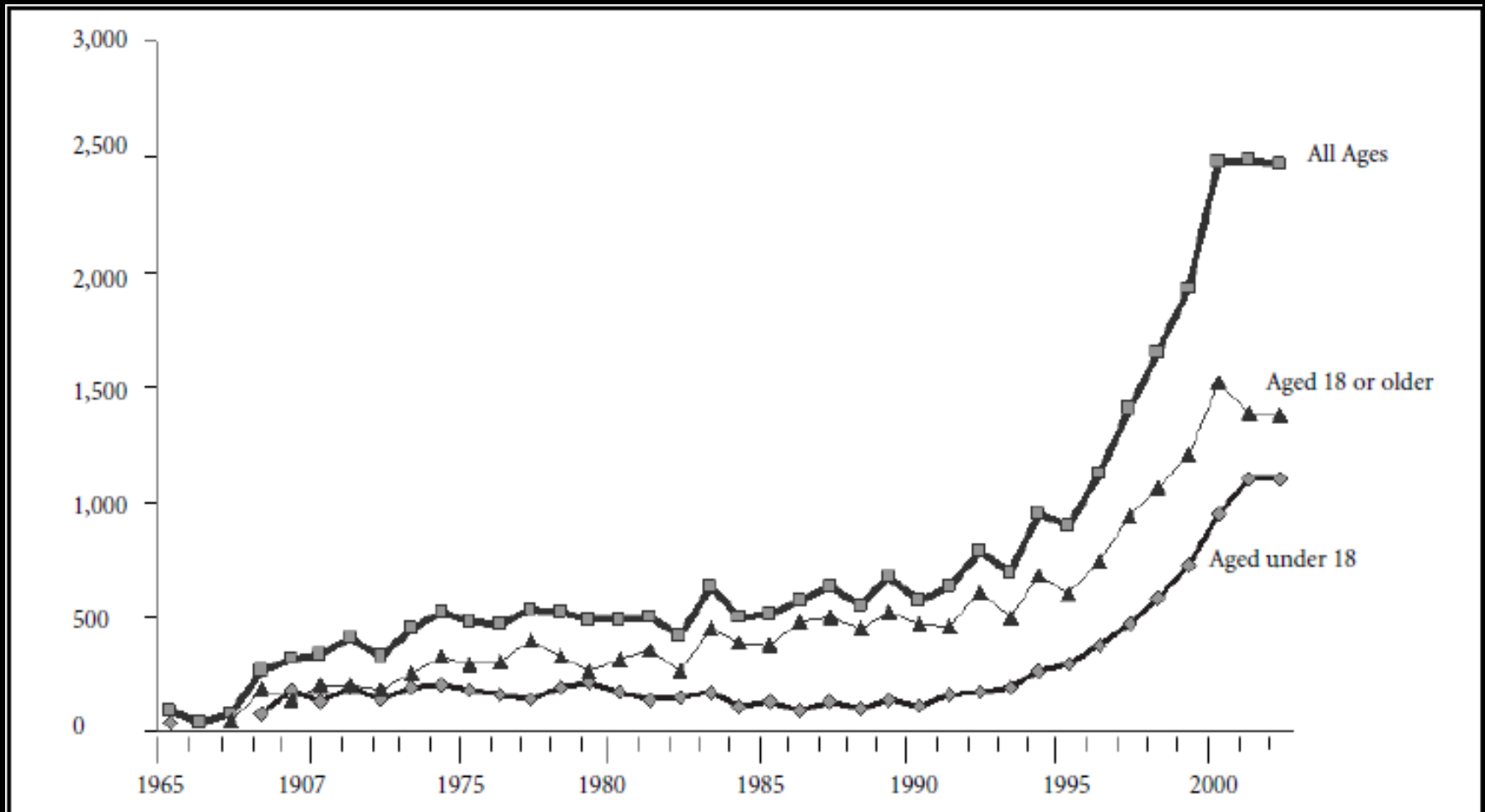


Fig. 1. *Annual numbers of new non-medical users of pain relievers: 1965-2002*  
Adapted from Ref. 112.

Trescot AM, Manchikanti L, et. al. *Opioid Guidelines in the Management of Chronic Non-Cancer Pain*. Pain Physician. 2006; Vol 9, No1: p.1-40.

- Consensus statement of the American Society of Interventional Pain Physicians
  - Systematic Review of the literature

**Table 2. Retail sales of opioid medications (grams of medication) 1997-2002**

	1997	2002	% change
Morphine	5,922,872	10,264,264	73.3
Hydrocodone	8,669,311	18,822,618	117.1
Oxycodone	4,449,562	22,376,891	402.9
Methadone	518,737	2,649,559	410.8



Soviet-era foreign media apparatus. One country of focus is Germany, the European economic powerhouse that has both close ties to Russia and rising

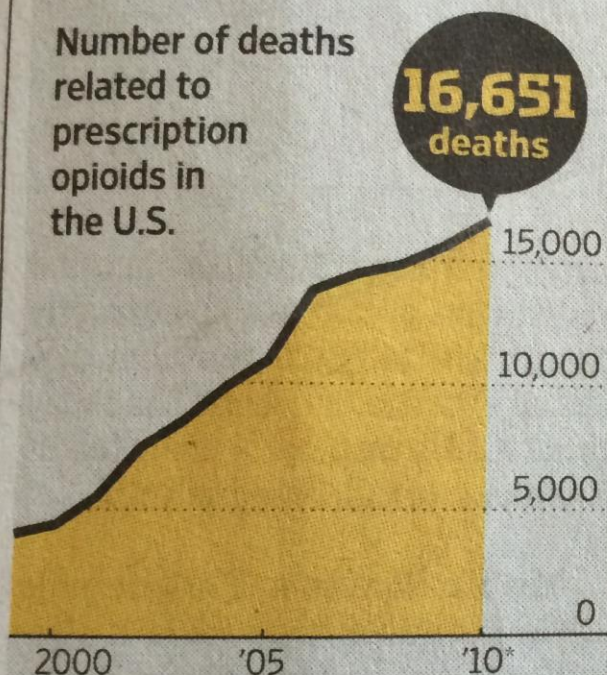
fensive represents another arm of Mr. Putin's increasingly direct confrontation with the West.

"We simply want to end the dominance of the so-

*Please turn to page A10*

## Clampdown on Painkiller Prescriptions

Number of deaths related to prescription opioids in the U.S.



\*Most recent data available

Source: Centers for Disease Control and Prevention

The Wall Street Journal



Associated Press

**DRUG CONTROL:** The Obama administration will toughen prescription regulations for hydrocodone-based medicines, the most commonly used narcotic painkillers, in an effort to curb widespread abuse. **A3**

# Management strategies to prevent medication abuse

- Use fixed schedule medications for a short period of time
  - Patients are more compliant with a fixed schedule
  - Ex. Naproxen 500mg BID for 10 days
- Specify dosage and frequency on prn medications
  - Ex: hydrocodone/APAP 5/325mg; 1 tab q 6 hrs prn pain
- Offer non-narcotic & non-pharmacologic therapies
  - Ice, heat, PT, brace, Lidoderm patch, etc.
- Identify other factors
  - Socioeconomic issues, psychological factors

# Muscle Relaxants

- Often prescribed in combination with analgesics or NSAIDs
- Work mainly on sedation and relaxation
  - Cyclobenzaprine (Flexeril)
  - Metaxalone (Skelaxin)
  - Orphenadrine (Norflex)
  - Tizanadine (Zanaflex)
- Only Baclofen and Dantrolene have been proven to reverse or modify muscle spasms
  - Risk: Have a higher incidence of withdrawal



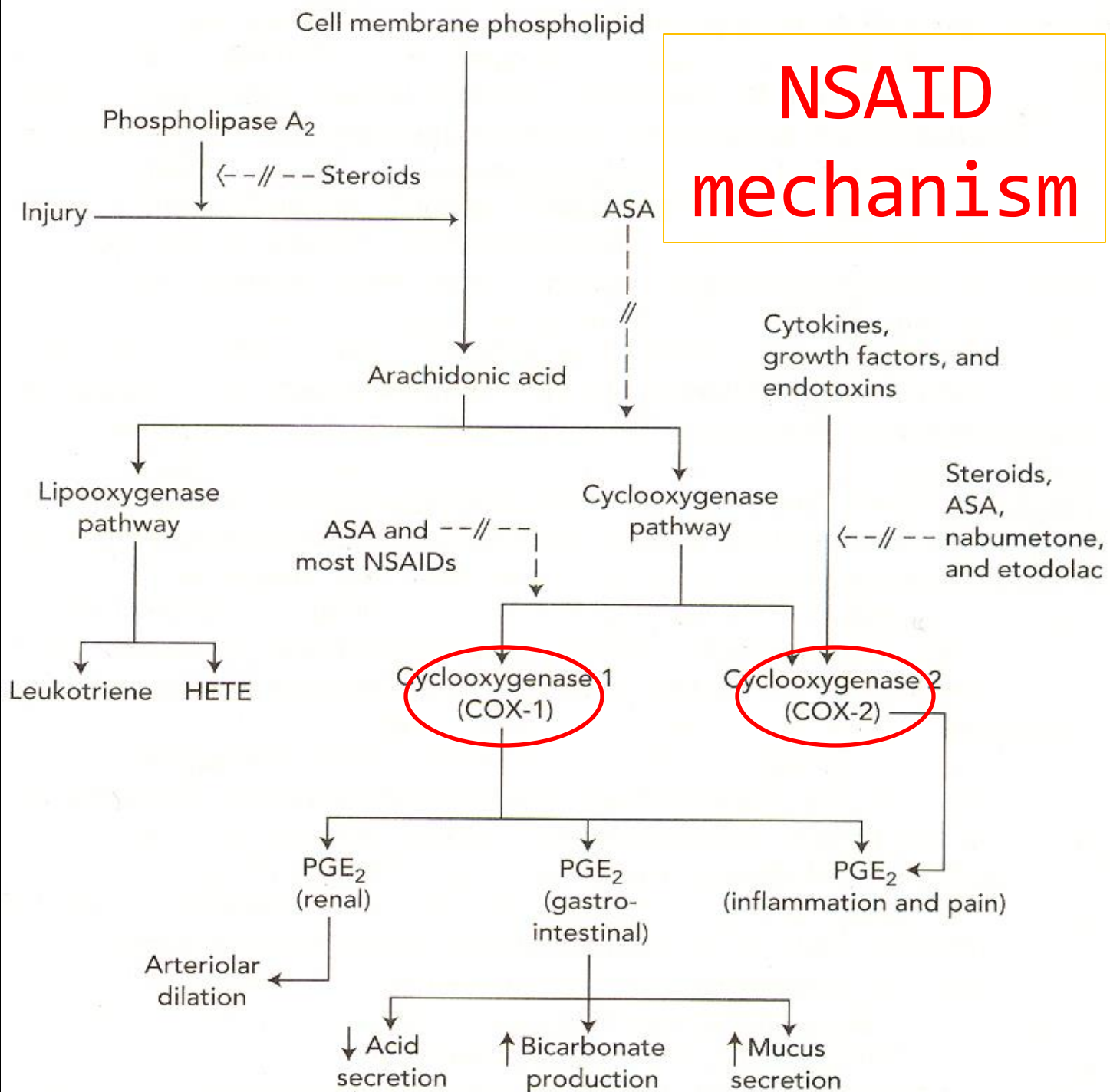
# NSAID's

- Market
  - 100 million prescriptions/year in U.S.
  - 30 billion non-Rx NSAIDs sold/year
- Dose-dependent Therapeutic Effects:
  - Anti-pyretic
  - Analgesic
  - Anti-inflammatory
- Prevalence of use in high school athletics
  - 75% had used NSAIDs in the last 3 months
  - 15% were daily users prophylactically prior to practices and games





# NSAID mechanism



# NSAIDS

- Available forms:
  - Oral
  - Topical
  - Transdermal
  - IM
  - IV
  - Rectal
  - Intranasal



# NSAID classes

- Salicylates, acetylated
  - Aspirin
- Salicylates, non-acetylated
  - Salsalate (Disalcid)
  - Diflusal (Dolobid)
- Acetic acids
  - Diclofenac (Voltaren)
  - Etodolac (Lodine)
  - Indomethacin (Indocin)
  - Sulindac (Clinoril)
  - Ketorolac (Toradol)
- Naphylalkalones
  - Nabumetone (Relafen)
- Oxicams
  - Piroxicam (Feldene)
  - Meloxicam (Mobic)
- Propionic acids
  - Ibuprofen
  - Naproxen (Naprosyn)
  - Ketoprofen (Orudis)
  - Oxaprozin (Daypro)
- Cox- 2
  - Celecoxib (Celebrex)

# NSAID absolute contraindications

- Allergic reaction
  - Anaphylaxis
  - Angioedema
  - Urticaria
- Aspirin sensitivity
- 3<sup>rd</sup> trimester pregnancy
- Peri-operative pain post-CABG



# NSAID relative contraindications

- Anemia
- Asthma
- CHF
- CV disease
- Cardiogenic edema
- Hypertension
- Sepsis
- Hepatic impairment
- Dehydration
- Bleeding disorder
- Geriatric patients
- Renal impairment
- Alcoholism
- h/o GI bleed
- Prolonged use

# GI toxicity

- Epidemiology
  - ~30% of NSAID-users develop GI side effects
  - Economic burden estimated to exceed \$500 mil/yr
- Risk Factors
  - H/o GERD, age >50, concurrent anticoagulant use
- Strategies to limit side effects
  - Limit duration
  - Consider other meds (Tylenol) and modalities (ice, e-stim, PT)
  - Concomitant anti-acid medication (e.g. Ranitidine)

# CV toxicity

- Aspirin is the only cardio-protective NSAID
- Cox-1 inhibitors worsen hypertension
  - Decrease renal blood flow and increase Na<sup>+</sup> retention
- Cox 2 inhibitors increase risk of MI and stroke (e.g. Celebrex)
  - Promotes thrombosis



sometimes,  
saying hello is just as painful  
as saying goodbye,  
unless...

**CELEBREX**

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Celebrex. The first arthritis medicine that targets only the COX-2 enzyme.  
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stomach ulcers or ulcers elsewhere in your digestive system or other serious medical conditions. In rare cases serious stomach problems such as bleeding can occur without warning. The most com-  
mon side effects in clinical trials were indigestion, diarrhea and abdominal pain. Tell your doctor if you have  
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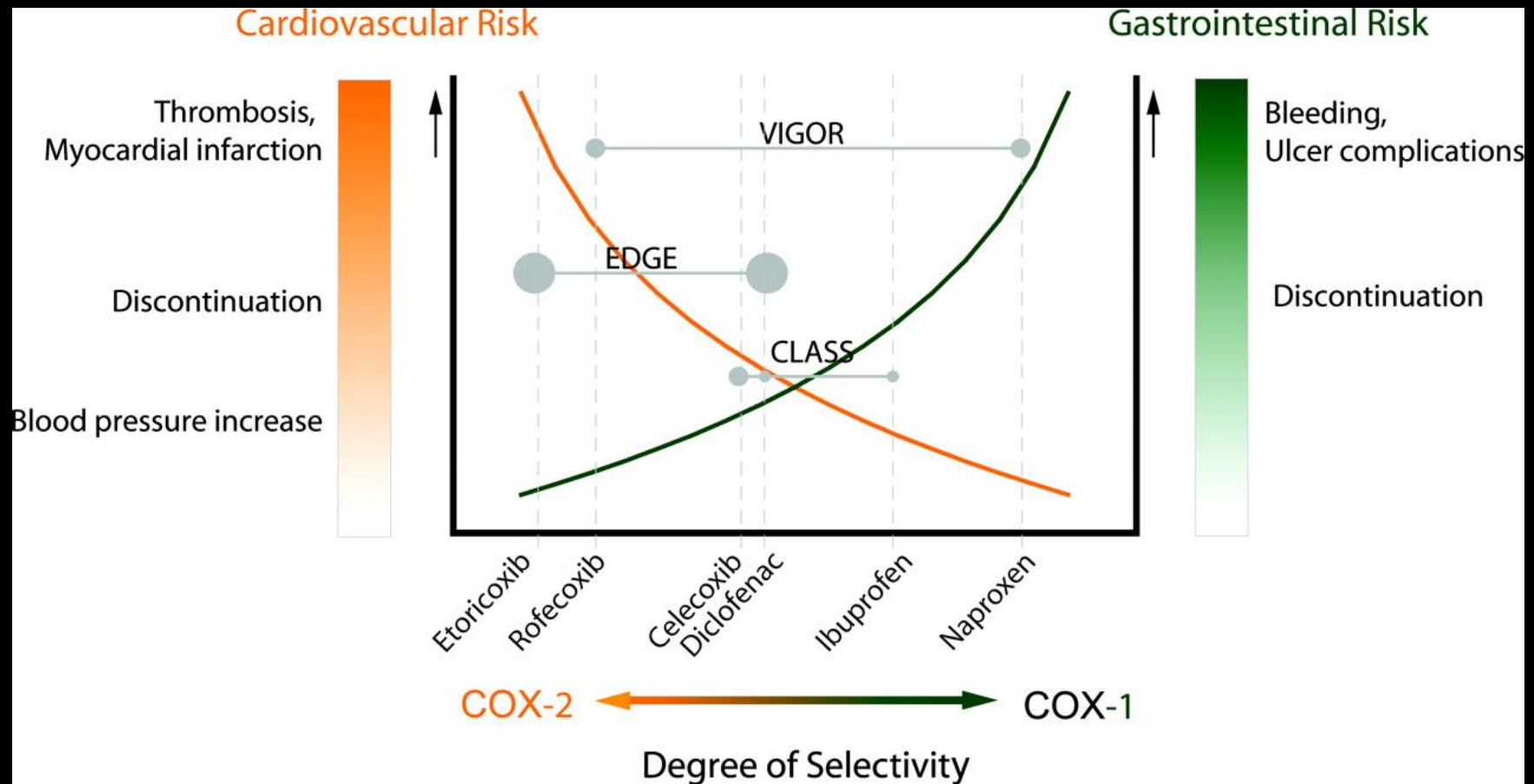
# AHA recommendations

- With all NSAIDs:
  - Monitor closely for side effects
  - Avoid giving for extended periods
- In patients with increased GI and CV risk:
  - Try acetaminophen and PT first
  - Then consider NSAID with PPI
  - Then consider selective COX-2 inhibitor

*Antman, E. M. et al. Circulation 2007;115:1634-1642*

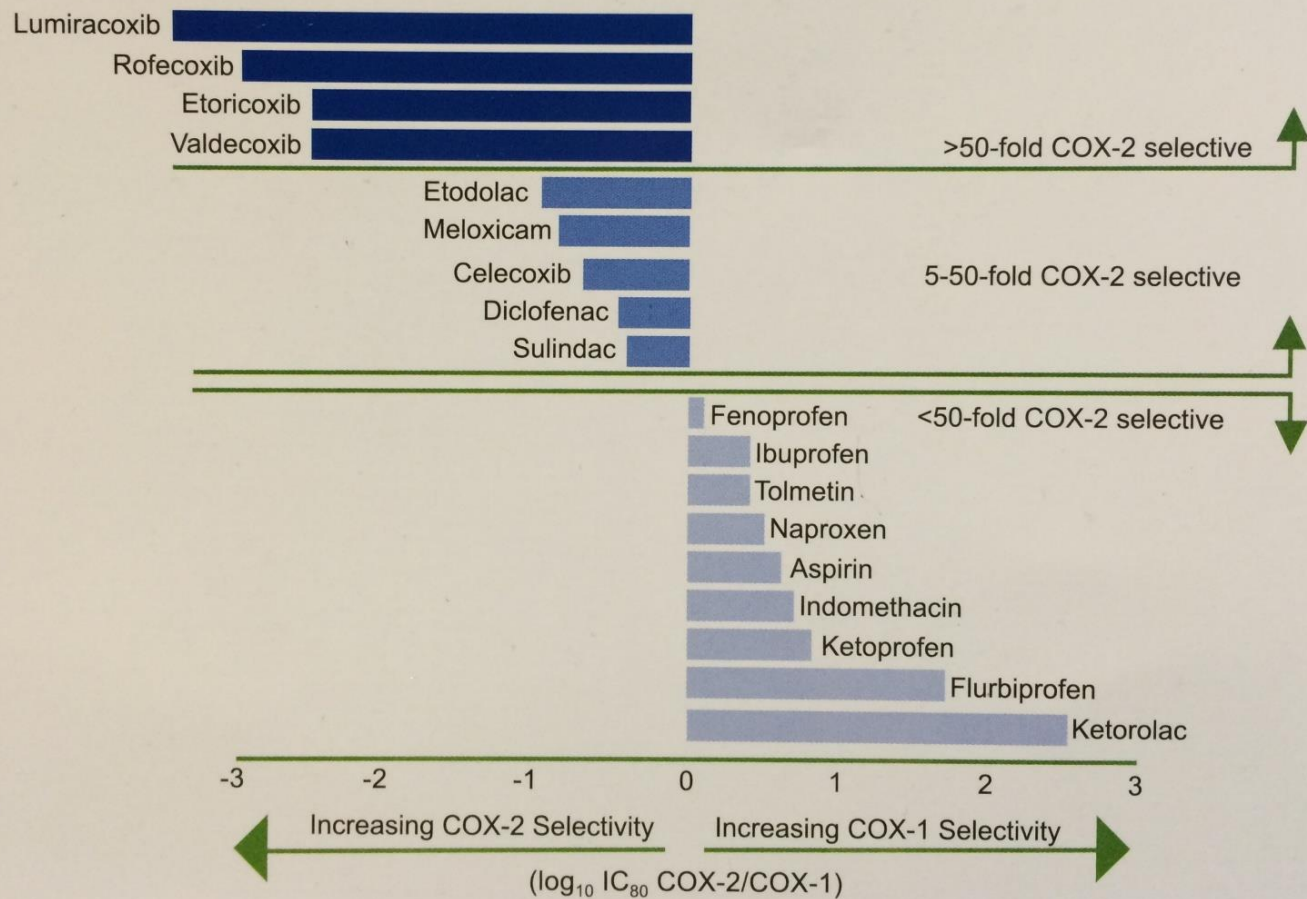


# Degrees & implications of COX selectivity



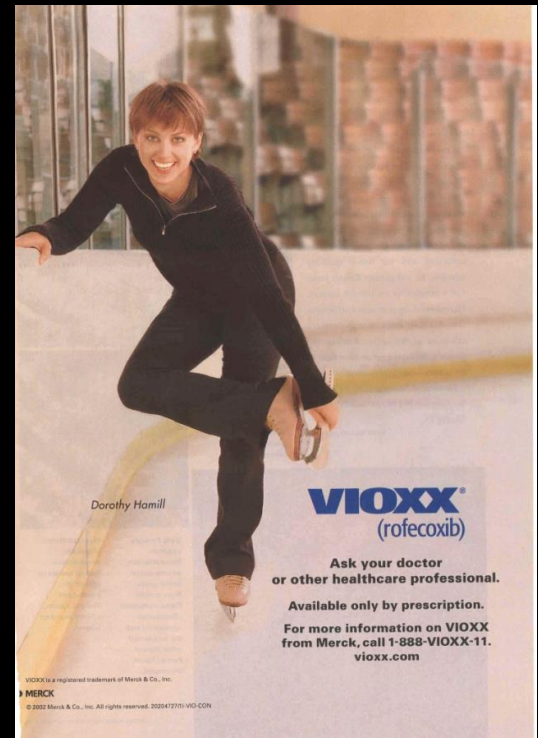
# Cox Selectivity of NSAIDs

## Selectivity for Cyclooxygenase (COX) Enzymes of Various NSAIDs



# How do you select an NSAID based on side effects profile?

- GI disturbance
  - High risk: Ibuprofen, naproxen
  - Low risk: Celecoxib, Diclofenac, nabumetone
- CV toxicity
  - High risk: Celecoxib
  - Low risk: Aspirin, Naproxen
- Hepatic toxicity
  - High risk: Diclofenac, Etodolac
  - Low risk: Ibuprofen, naproxen
- Renal Dysfunction
  - Sulindac is the least renal toxic NSAID



# NSAID cheat sheet

- Young athlete – Ibuprofen 800mg TID x 7 days or BID x 2 weeks
- Adult under 40 – Naproxen 500mg BID x 2 weeks
- Adult over 40 – Diclofenac 75mg DR BID x 2 weeks
- Elderly >65 y/o – Nabumetone 500mg BID or Celebrex 100mg BID
- GERD or prolonged used– any NSAID + PPI (or H<sub>2</sub>B) or same as elderly
- Stage 1 CRI – Sulindac 200mg BID (and Renal Panel in 1 m)
- Gout – Indomethacin 50mg TID x 5 days
- Adult w OA for maintenance – Mobic 15mg q day prn pain
- Peripheral edema – Celebrex 100mg BID or Diclofenac 50mg BID
- Heart Disease – Naproxen 375mg BID
- Blood thinners – topical NSAID, ideally diclofenac

# NSAID use in Sports Medicine

- Pros:

Control pain + decrease inflammation = Early return to play

- Cons:

- May interfere with healing (e.g. fractures)
- May increase swelling and bleeding into injured tissue
- Systemic side effects
  - Ex. Acute Renal Failure, GERD



# Toradol (ketorolac)

- Commonly used IM before/during games
- Anecdotal improvement of pain
- Ketorolac's peak plasma concentration:
  - 20 minutes – oral route
  - 45 minutes - intramuscular (IM) route
- Common SE:
  - Headache, dizziness, drowsiness
- Risks:
  - Acute Renal Failure, GI, CV



# Toradol in the NFL

## The NFL's Physician Society Task Force:

- Recommendations were established based on the available medical literature taking into consideration:
  - The pharmacokinetic properties of ketorolac
  - Accepted indications and contraindications
  - The unique clinical challenges of the NFL

- Matava M, Brater DC, et al. Recommendations of the National Football League Physician Society Task Force on the Use of Toradol® Ketorolac in the National Football League. *Sports Health: A Multidisciplinary Approach* September/October 2012 vol. 4 no. 5 377-383

# The Task Force's recommendations:

- 1) Ketorolac should only be administered by a team physician
- 2) It should not be used prophylactically
- 3) Use should be limited to those players diagnosed with an injury **and** listed on the teams' injury report
- 4) Ketorolac should be given in the lowest effective oral dose
  - It should not be used in any form for more than 5 days
- 5) ketorolac should not be taken concurrently with other NSAIDs



# Local anesthetic use in sports

- Benefits
  - For contact injuries with good prognosis for healing but painful in short term
  - Earlier return to play
- Injuries acceptable to inject
  - AC sprain
  - Phalangeal injuries
  - Bruised Iliac crest (hip pointer)
  - Chronic plantar fasciitis
- Potential adverse effects
  - Worsen the injury
  - cardiac block
  - respiratory arrest
  - Seizures



# Injectable Anesthetics

Agent	Onset	Duration	Maximum Dose	Potency	Toxicity
Lidocaine	<1 minute	30 minutes to 2 hours	3 mg/kg	Moderate	Moderate
Ropivacaine	5 to 15 minutes	2 to 6 hours	3 mg/kg	Moderate	Low
Bupivacaine	5 to 10 minutes	3 to 8 hours	2.5 mg/kg	High	High

- Duration of effect is longer with epinephrine
- They each have maximum dosages (ex. Lidocaine 300mg)

# Corticosteroids

- First used in the 1950's
- **Potent anti-inflammatory**
  - Inhibits accumulation of inflammatory cells
    - Inhibit leukocyte secretion in the joint
- Some conditions treated with CSI:
  - Subacromial Bursitis
    - Effective for up to 9 months vs. placebo
    - Probably more effective than NSAIDs
  - Knee Osteoarthritis
    - Better pain reduction than placebo



# Common Injectables

Medication	Relative Potency	Onset	Duration
Hydrocortisone (Cortisol)	1	Fast	Short
Methylprednisolone acetate (Depo-Medrol)	4	Slow	Intermediate
Triamcinolone acetonide (Kenalog)	5	Moderate	Intermediate
Betamethasone (Celestone)	25	Fast	Long
Dexamethasone (Decadron)	30	Fast	Long

Consider the risk versus benefits of the particulate vs non-particulate steroids

# Contraindications for CSI

- Absolute:
  - Infection
  - True hypersensitivity to CS
  - Uncontrolled bleeding problem
  - Poorly controlled diabetes
- Relative:
  - Anticoagulation therapy
  - Adjacent skin abrasion



# Complications of CSI

- Local (> triamcinolone)
  - cutaneous atrophy
  - pigmentation change
  - infection
  - tendon / ligament rupture
    - Controversial
  - Chondrolysis
- Systemic (>Dexamethasone)
  - Hyperglycemia
  - allergic reaction
  - avascular necrosis
  - suppression of H-P-A axis
    - high doses



# Take-Home Message



Be Reasonable

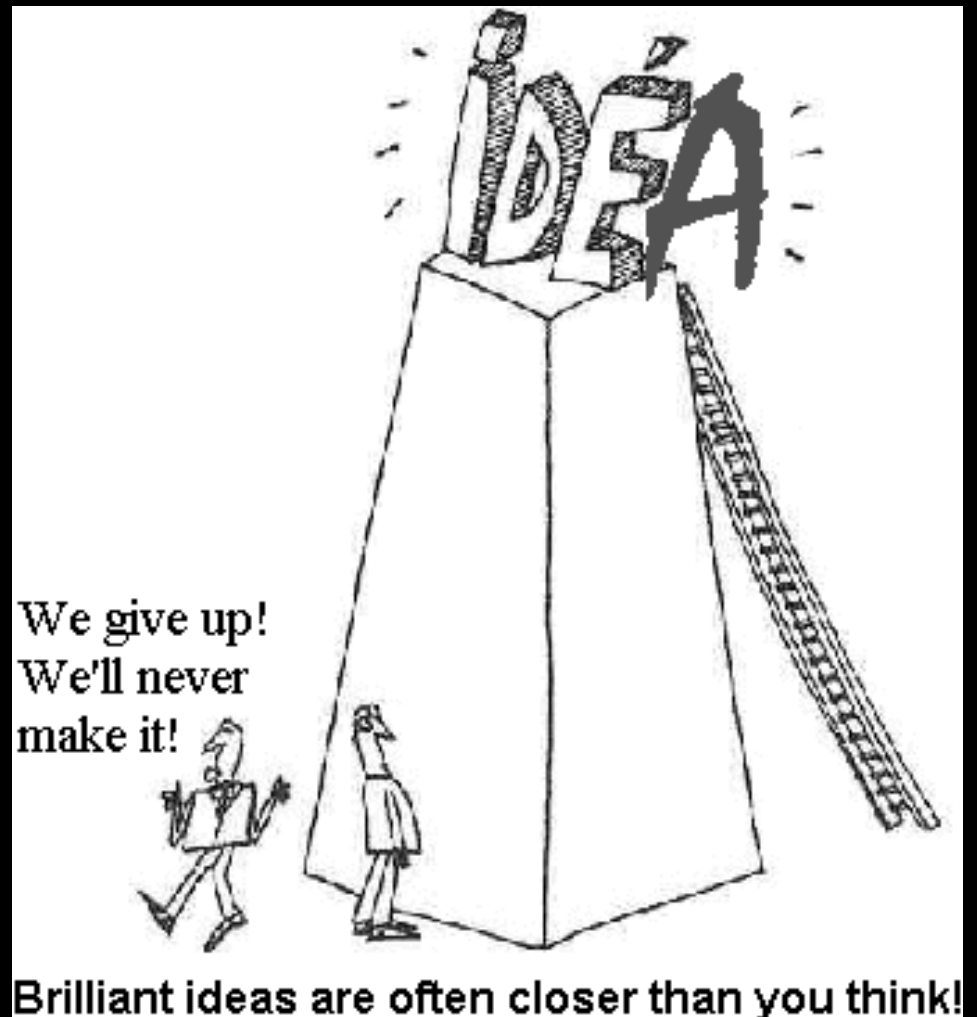




# Be creative

- *"Don't expect things to change if you keep doing the same things."*

-- Albert Einstein

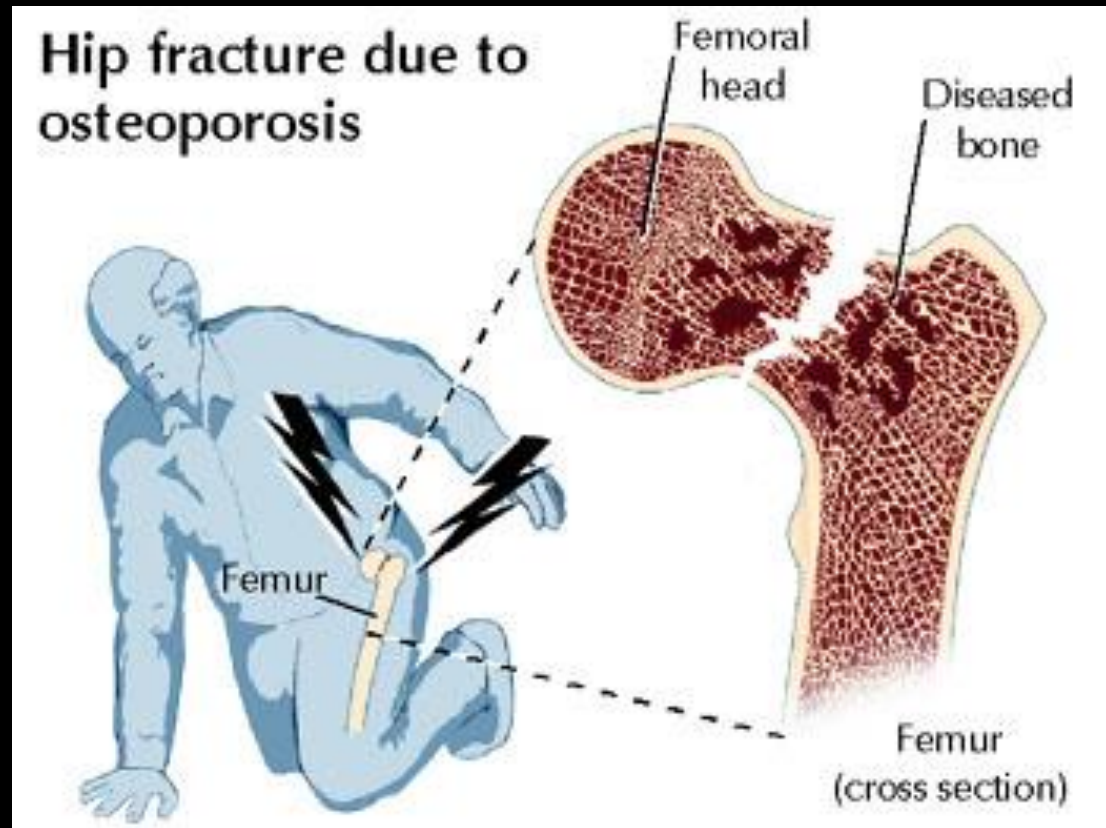


# Be realistic with expectations



"It's simple. My nurse blindfolds me, I spin around a few times, and then I try to reattach your tail."

# Always expect the Worst



# Questions?



**I HAVE ONLY ONE QUESTION:**

What do you need the helmet for?

# Additional References

- International Association for the Study of Pain website: <http://www.iasp-pain.org//AM/Template.cfm?Section=Home>
- Trescot AM, Manchikanti L, et. al. *Opioid Guidelines in the Management of Chronic Non-Cancer Pain*. Pain Physician. 2006; Vol 9, No1: p.1-40.
- Reuben, DB, Herr KA, Pacala JT, et. al. *Geriatrics at Your Fingertips: 2009 11<sup>th</sup> edition*. New York: The American Geriatrics Society: 2009.