Inpatient Management of Trauma Related Pain

STOMP Summit

September 9, 2016

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Our patient

- Small SDH
- Intubated
- Hemopneumothorax with multiple rib fx and chest tube
- Open abdomen, s/p splenectomy, bladder repair
- Pelvic fracture, ex fix
- Open femur, ex fix
- Compartment syndrome, calf
- Extensive soft tissue injury

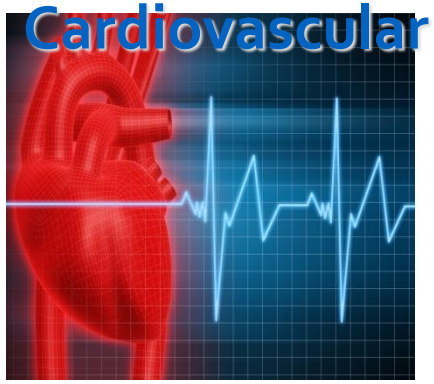
Why do we treat acute pain?

- Reduce suffering
- Increase activity levels
- Prevent complications
  - Pneumonia
  - DVT
  - Cardiovascular
- Prevent chronic pain

- REMEMBER:

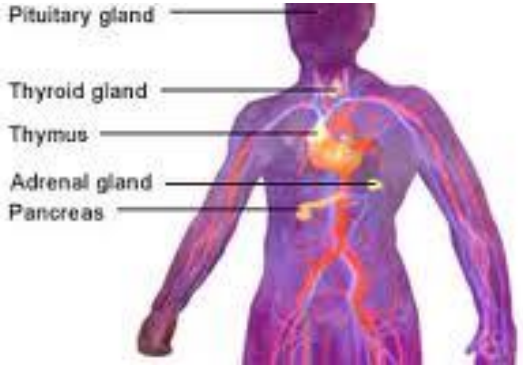
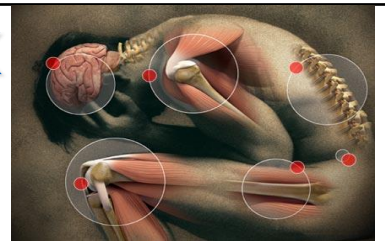
pain is a sign of life!

Adverse effects of unrelieved Pain

	↑Heart Rage ↑Blood Pressure ↑Increased myocardial demand Hypercoagulation	Unstable angina Myocardial infarction DVT PE
	↓Lung Volumes ↓Decreased cough Splinting	Atelectasis Pneumonia Hypoxemia
	↓Gastric Emptying ↓ Bowel Motility	Constipation Anorexia Ileus

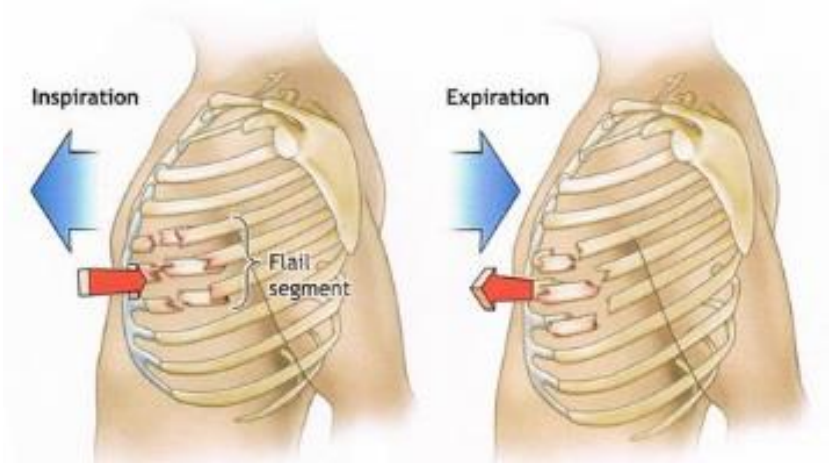
National Pharmaceutical Council (2001). Macintyre & Schug (2007).Cohen et al (2004)

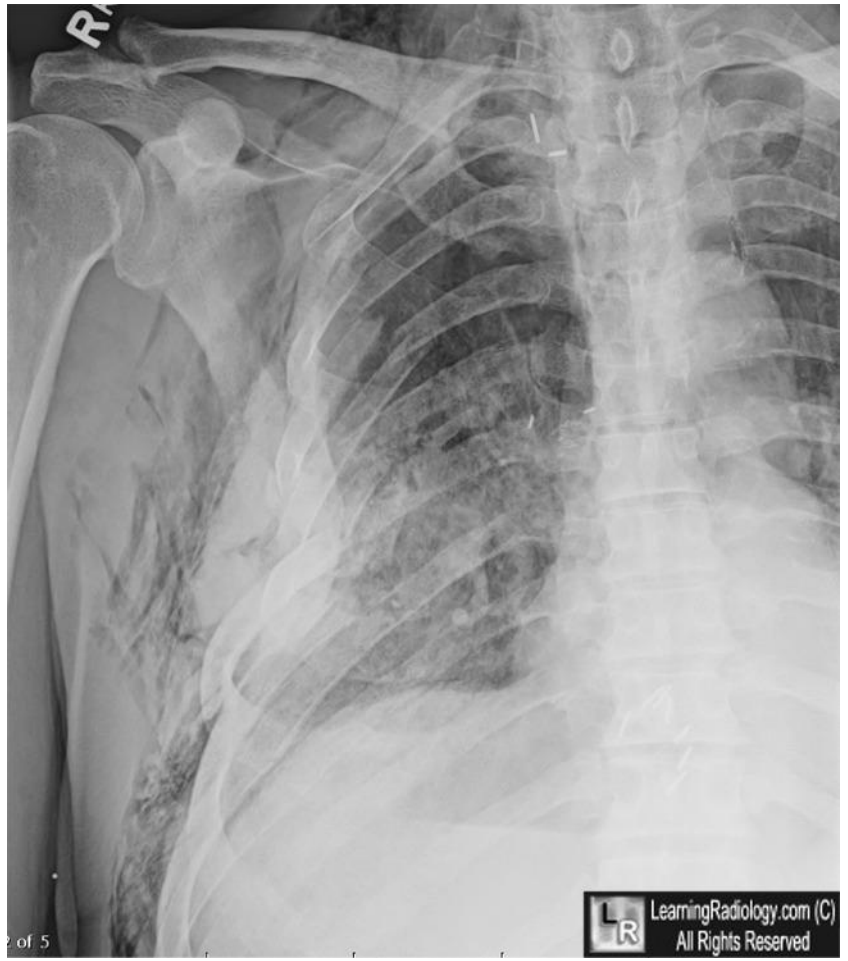
Adverse effects of unrelieved Pain

Neuroendocrine 	**Altered release of multiple hormones**	**Hyperglycemia** **Wt loss/ muscle wasting** **Impaired wound healing** **Impaired immune function**
MSK 	**Muscle spasm** **Impaired muscle mobility & function**	**Immobility** **Weakness** **Fatigue**
Psychological 	**Anxiety** **Fear**	**Sleep deprivation** **Impact on coping** **Post traumatic stress disorder**

National Pharmaceutical Council (2001). Macintyre & Schug (2007).Cohen et al (2004)

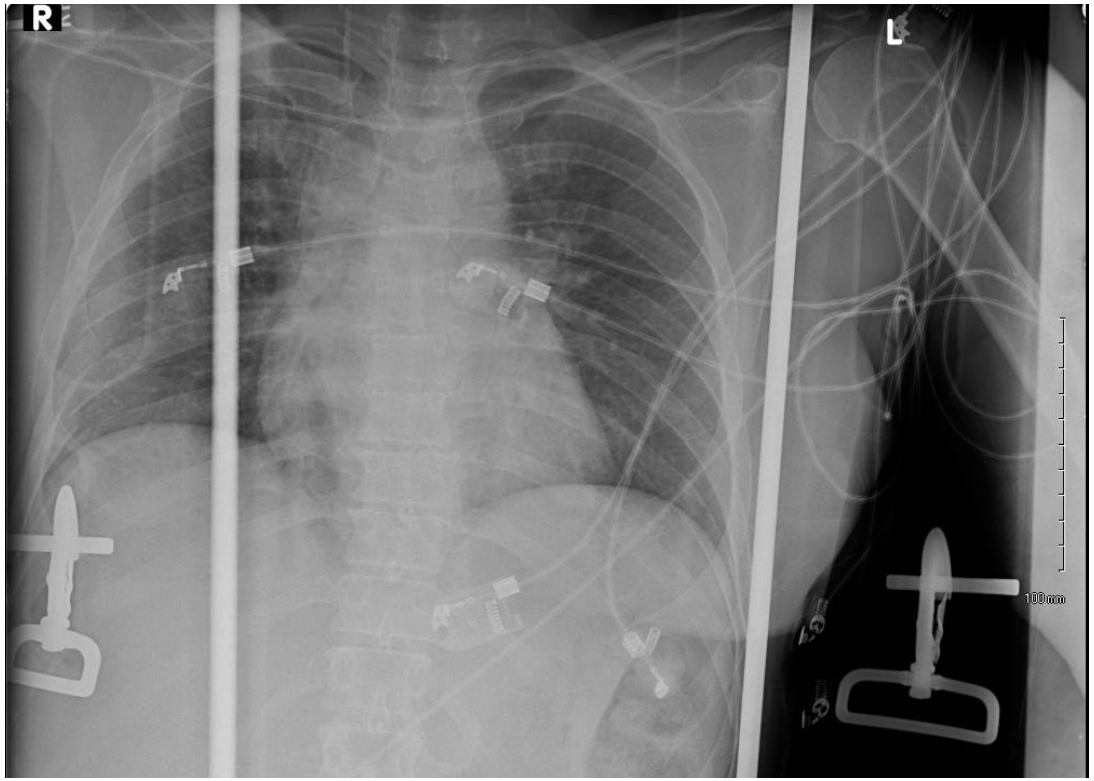
Are rib fractures a big deal?



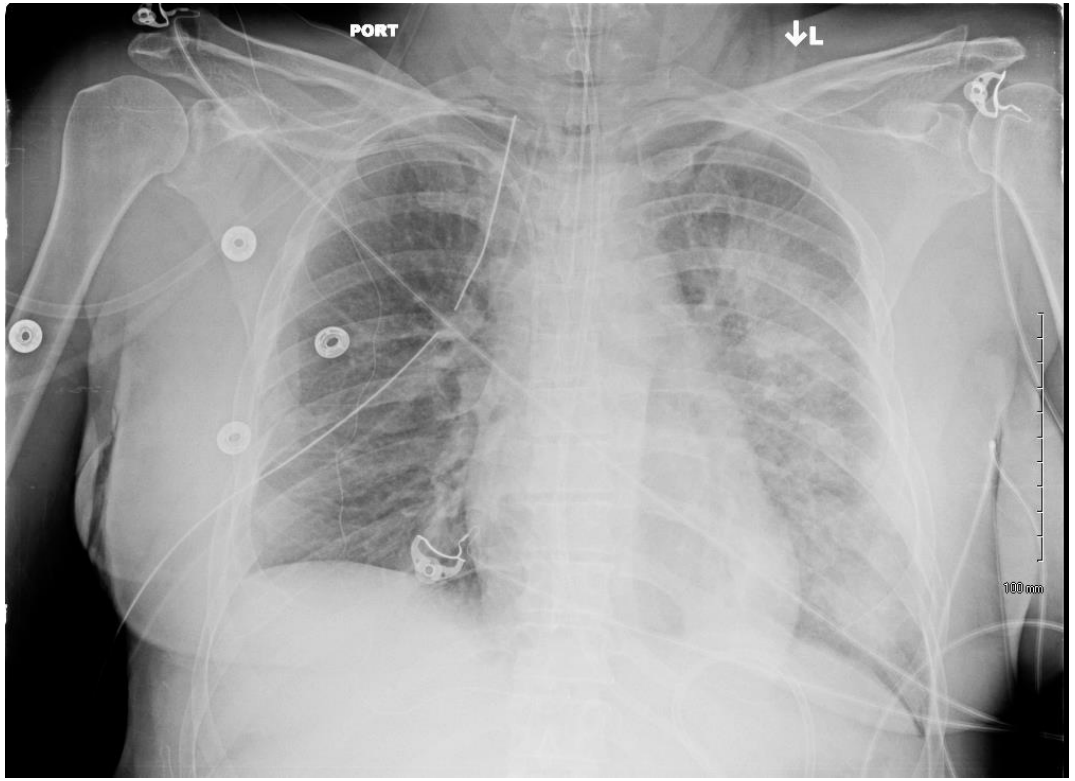


Are rib fractures a big deal?

In ED



Hospital Day 3



Rib fractures

- Rib fractures are seen in 10-26% of trauma patients
- Account for 25% of deaths
- If there is enough force to break a rib, extrathoracic injury is found 85-90% of the time
- Mortality is DIRECTLY correlated with the number of rib fractures

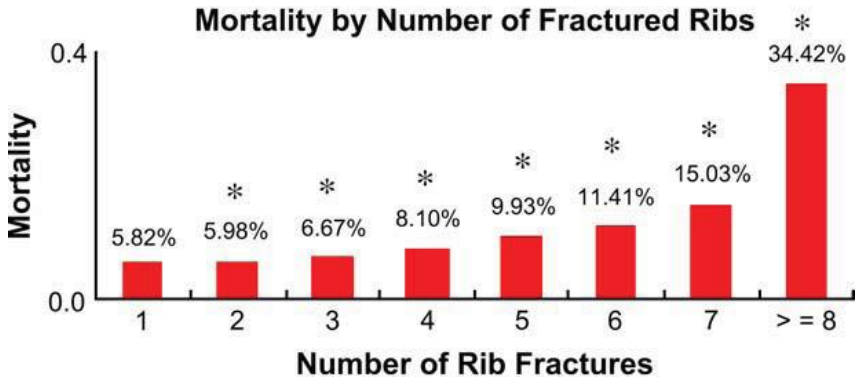
Rib fracture correlation with mortality

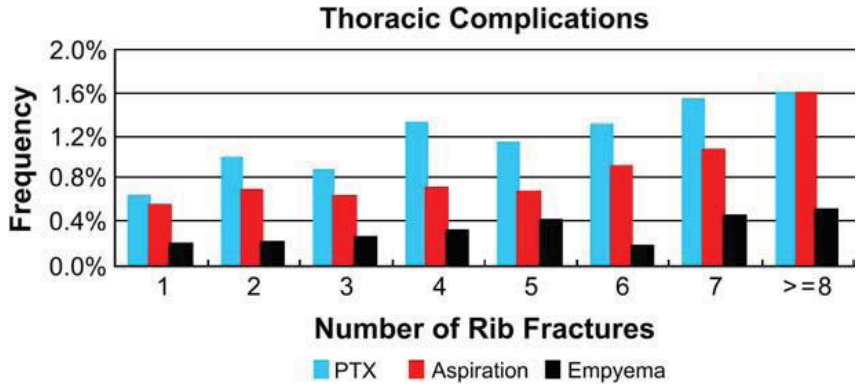
Table. Total cases and mortality rates of NTDB cases with rib fractures classified by ICD-9 codes and/or AIS codes

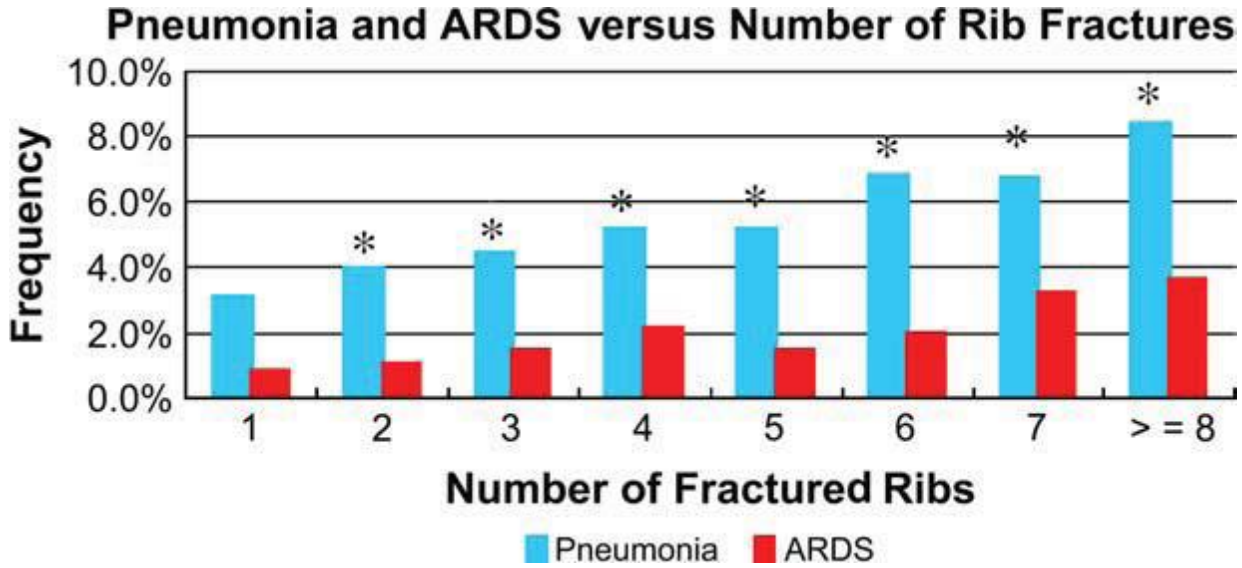
ICD-9 code				*AIS code*				*Either ICD-9 or AIS code*		
No. of rib fractures	*No. of cases*	*Total*	*Mortality*	*No. of rib fractures (grouped)*	*No. of cases*	*Total*	*Mortality*	*No. of cases*	*Total*	*Mortality*
1	15,613	24.15%	5.82%	1	10,651	22.35%	5.82%	16,001	23.80%	5.74%
2	9,784	15.13%	5.98%							
3	7,482	11.57%	6.67%	2-3	18,484	38.78%	7.90%	23,980	35.67%	7.46%
4	4,784	7.40%	8.10%	4-6	8,709		13.54%	12,081	17.97%	11.73%
5	2,824	4.37%	9.93%							
6	1,771	2.74%	11.41%							
7	1,114	1.72%	15.03%							
≥8	1,994	3.08%	34.42%	>6	1,729	3.63%	42.36%	2,738	4.07%	32.96%
Unspecified	19,295	29.84%	14.65%	Unspecified	8,085	16.96%	19.24%	12,421	18.48%	18.03%
Totals	64,661	100.00%	10.12%	Totals	47,658	100.00%	11.64%	67,221	100.00%	10.79%

Half-a-dozen ribs: The breakpoint for mortality. Flagel, et al. *Surgery* 2005;138:717-25

From the National Trauma Data Bank all ages







Half-a-dozen ribs: The breakpoint for mortality. Flagel, et al. *Surgery* 2005;138:717-25

Rib fractures in the elderly

- Twice the morbidity and mortality of younger
- Patients with 3-4 fractures have 19% mortality and 31% pneumonia
- ≥6 fractures 33% mortality and 51% pneumonia
- For each additional fracture, mortality increases by 19% and 27% increase in risk of pneumonia

Rib fractures in the elderly. Bulger et al. *J Trauma.*2000;48:1040- 47

Does pain control in rib fx help?

Table 1 Demographics, injury characteristics, and mortality across samples matched for TEA candidacy

	Non-TEA	TEA	*P*
N	753	212	
% male sex	65.7	67.9	0.552
Age (years)	54.5 ± 20.5	58.2 ± 18.0	0.011
Number of ribs fractured (mean ± SD)	3.1 ± 2.1	5.7 ± 2.4	<0.001
Injury severity score (mean ± SD)	12.8 ± 7.0	15.7 ± 7.4	<0.001
% flail segment	2.0	16.5	<0.001
% bilateral fracture	8.9	17.3	0.001
% pulmonary contusion	13.0	28.8	<0.001
% pneumothorax	23.5	47.6	<0.001
% hemothorax	5.5	18.4	<0.001
% hemopneumothorax	2.0	9.9	<0.001
% urinary retention	3.8	6.7	0.102
% mortality	1.9	0.5	0.149

Table 2 Demographics, injury characteristics, and treatment outcomes of survivors and nonsurvivors who did and did not receive TEA across samples matched for TEA candidacy

	TEA Died	TEA Survived	No TEA Died	No TEA Survived	*P*
N	1	211	14	739	
% male sex	Male	67.8	64.3	65.8	0.787
Age (years) (mean ± SD)	86	58.0 ± 17.9	74.6 ± 21.3	54.1 ± 20.3	0.001*
N ribs fractured (mean ± SD)	7	5.7 ± 2.4	4.1 ± 2.3	3.1 ± 2.1	0.021*
Injury severity score (mean ± SD)	17	15.6 ± 7.4	14.4 ± 6.0	12.8 ± 7.0	0.549
% flail segment	No	16.6	0.0	2.0	0.097
% bilateral fracture	No	17.4	0.0	9.0	0.100
% pulmonary contusion	No	28.9	0.0	13.3	0.018*
% pneumothorax	No	47.9	21.4	23.6	0.055
% hemothorax	No	18.5	21.4	5.1	0.784
% hemopneumothorax	No	10.0	0.0	2.0	0.145
% pneumonia	Yes	10.0	21.4	4.5	0.178
% needing ventilation	Yes	11.4	64.3	4.8	<0.001*
Vent duration (days) (mean ± SD)	15	12.8 ± 9.6	7.4 ± 5.1	9.9 ± 12.3	0.125
LOS in hospital (days) (mean ± SD)	24	8.5 ± 5.9	8.1 ± 7.2	5.1 ± 5.8	0.839
% admitted to icu	Yes	59.7	92.9	33.8	0.013*
LOS in icu (days) (mean ± SD)	23	5.4 ± 6.7	7.0 ± 5.9	3.8 ± 5.7	0.395
% acute respiratory failure	Yes	2.4	14.3	0.5	0.013*
% respiratory distress syndrome	Yes	0.9	0.0	0.4	0.714

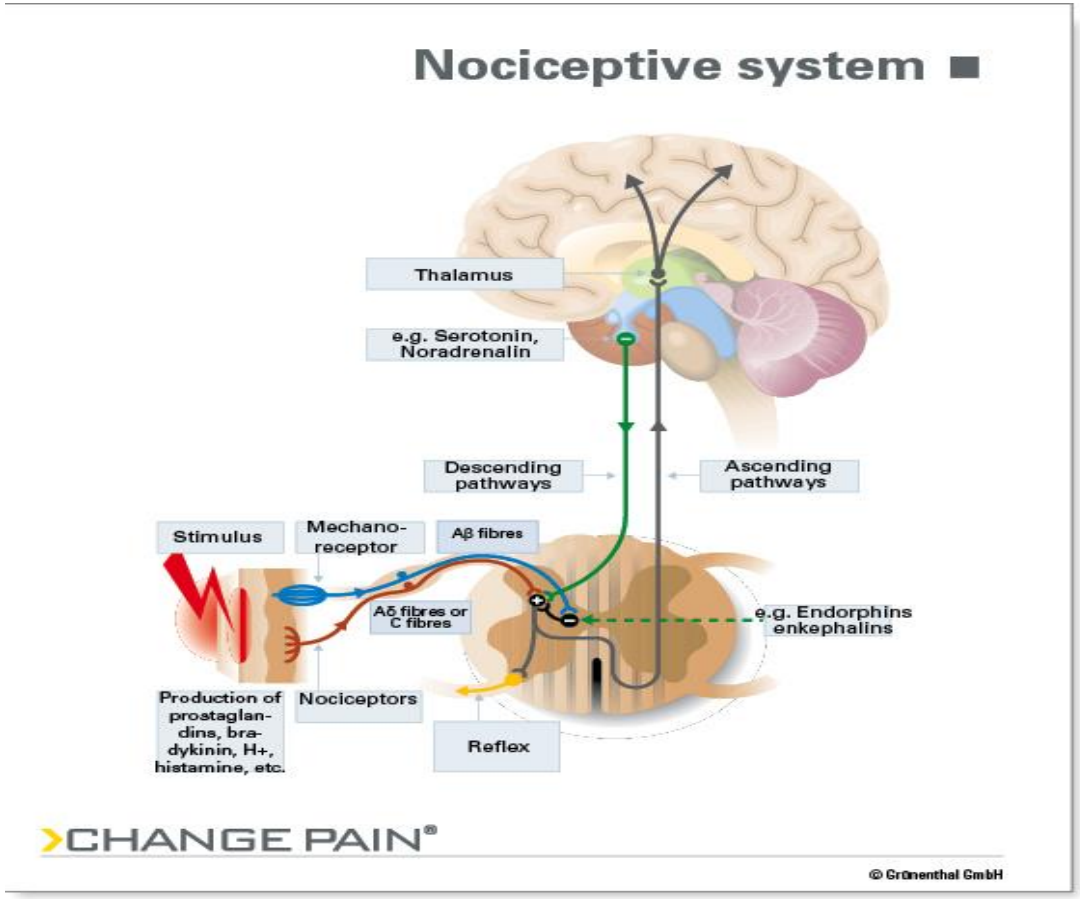
*= significance between subjects who received TEA and survived and those who did not receive TEA and died.

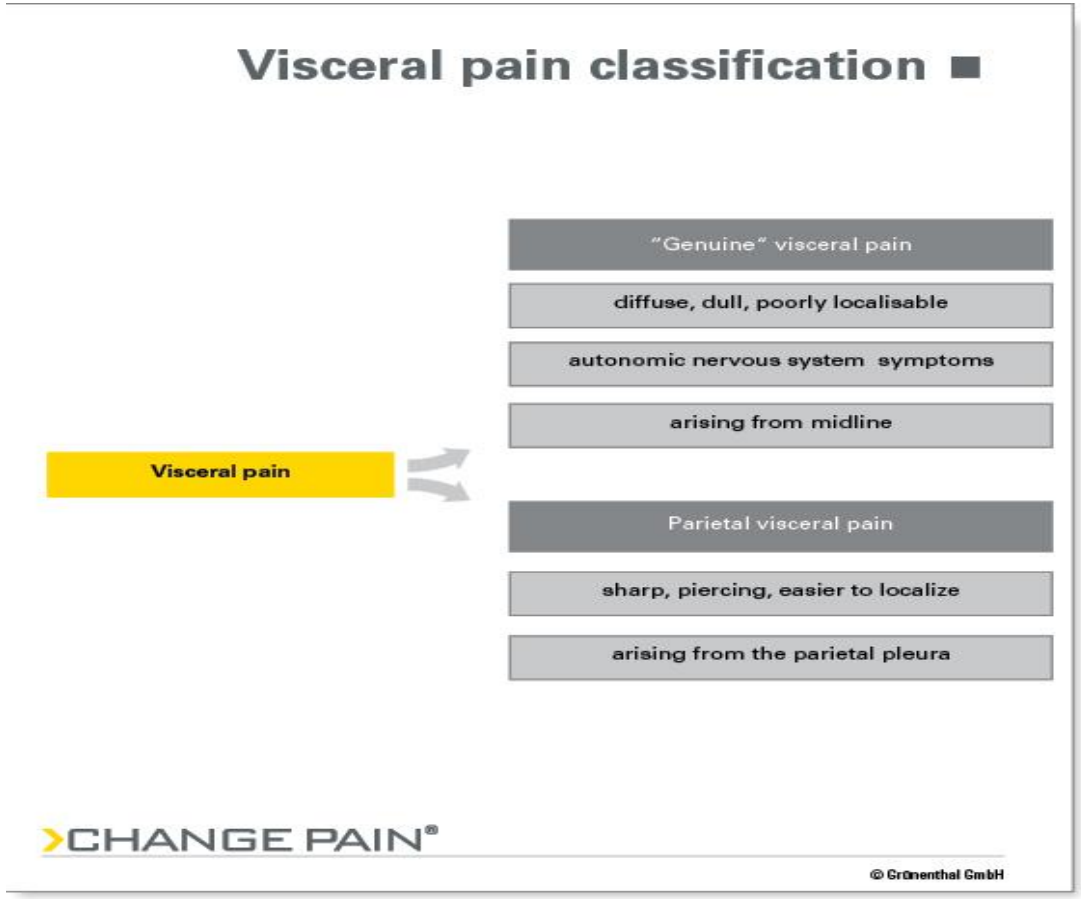
Improved Outcomes Associated with the Liberal Use of Thoracic Epidural Analgesia in Patients with Rib Fractures. Jensen CD, et al. *Pain Medicine* Aug 2016

Classification of pain

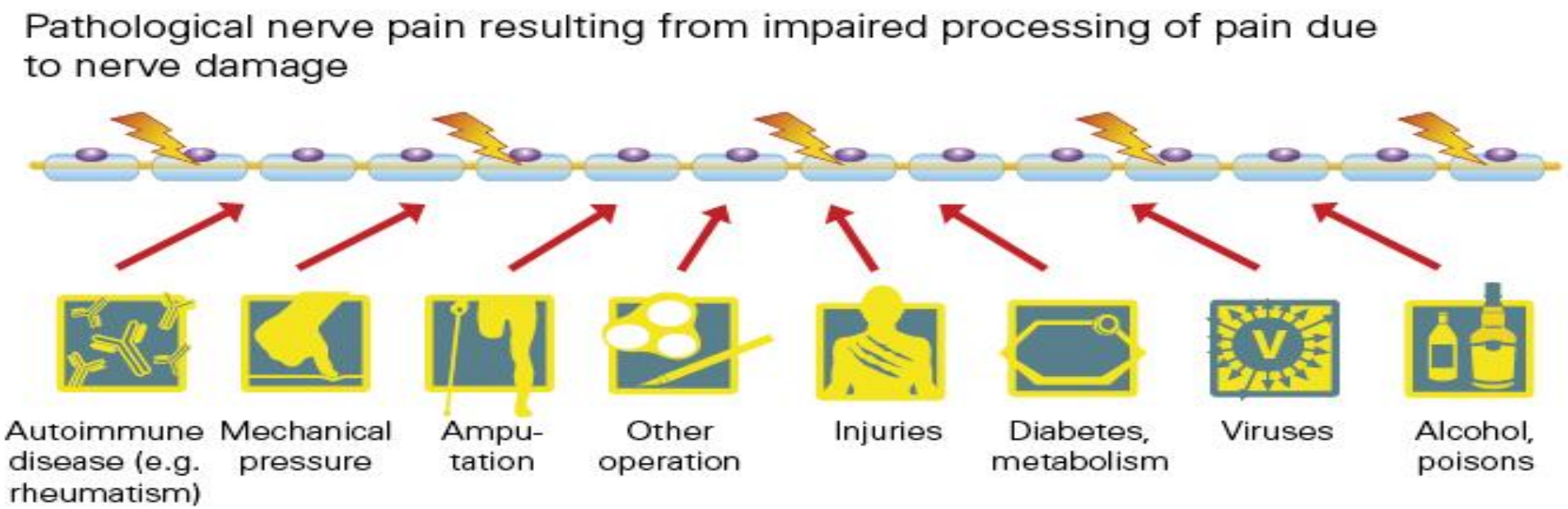
	Nociceptive Pain		Neuropathic Pain
	Somatic Pain	Visceral Pain	
Location	Localized	Generalized	Radiating or specific
Patient Description	Pinprick, stabbing, or sharp	Ache, pressure, or sharp	Burning, prickling, tingling, electric shock-like, or lancinating
Mechanism of Pain	A-delta fiber activity Located in the periphery	C Fiber activity Involved deeper innervation	Dermatomal (periphery), or non-dermatomal (central)
Clinical Examples	•Periosteum, joints, muscles •Sickle cell •Superficial laceration •Superficial burns •Intramuscular injections, venous access •Otitis media •Stomatitis •Extensive abrasion	•Colic spasm pain •Appendicitis •Kidney stone •Chronic pancreatitis •IBS •Angina •Menstrual cramps	•Trigeminal neuralgia •Avulsion neuralgia •Posttraumatic neuralgia •Peripheral neuropathy (diabetes, HIV) •Limb amputation •Herpetic neuralgia

Nociceptive pain

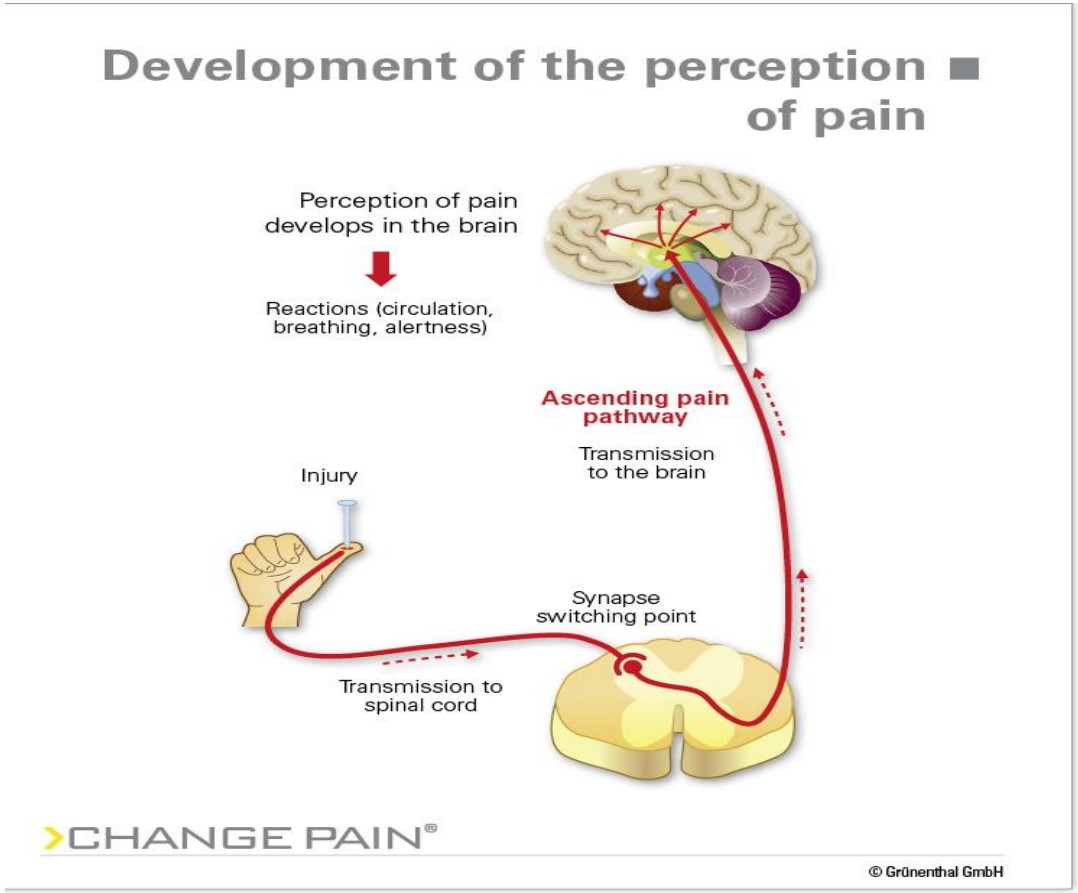


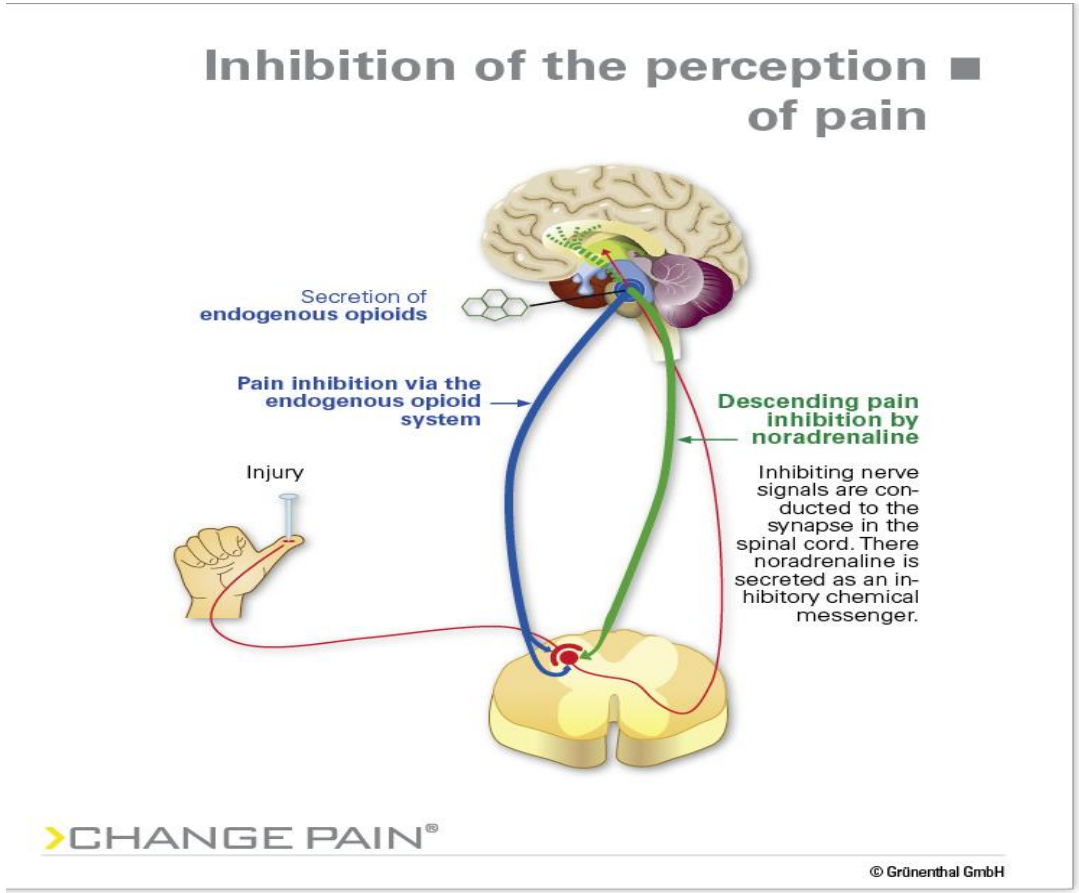


Neuropathic pain

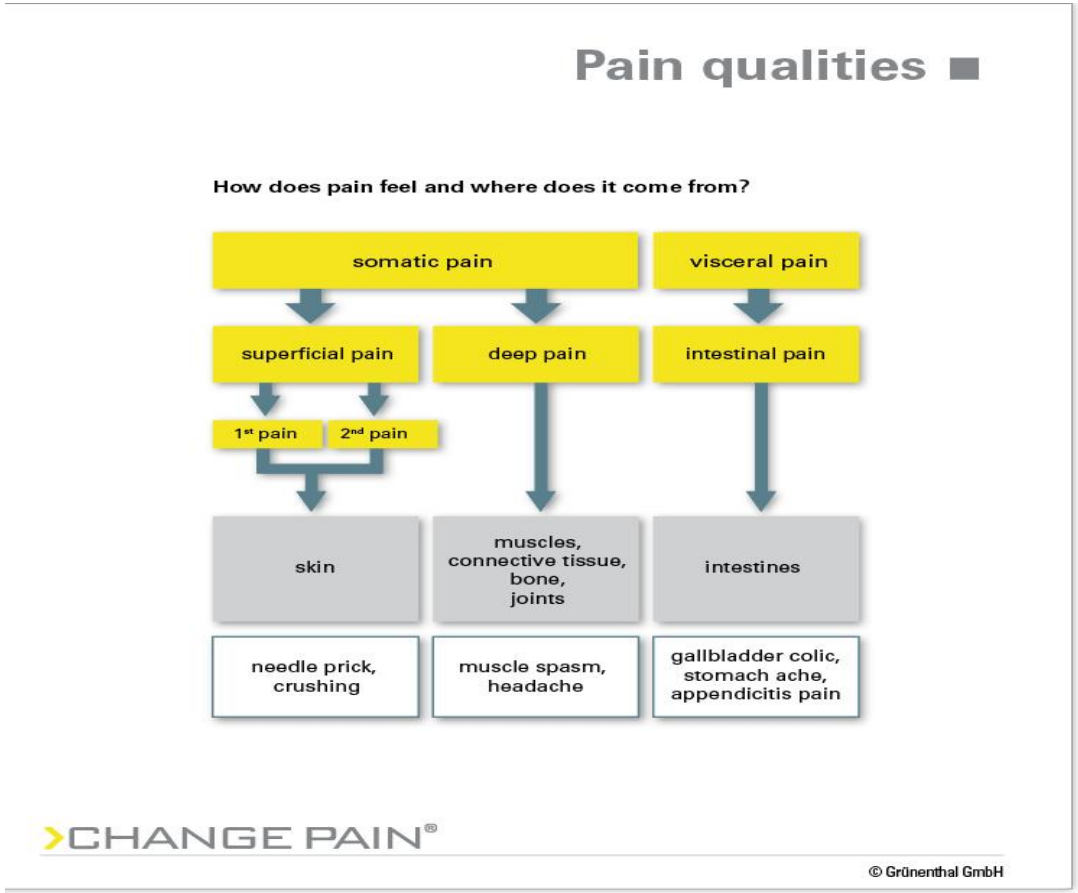


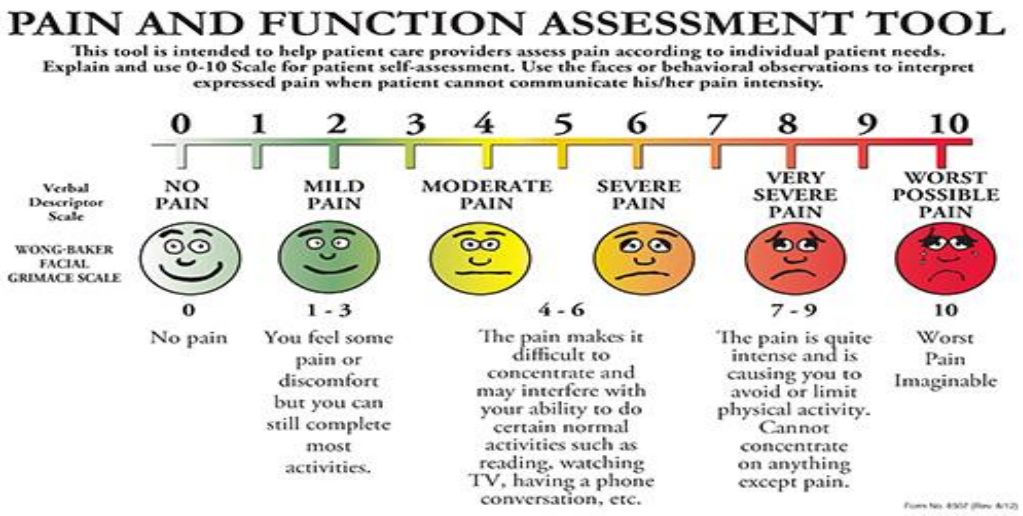
Perception of pain



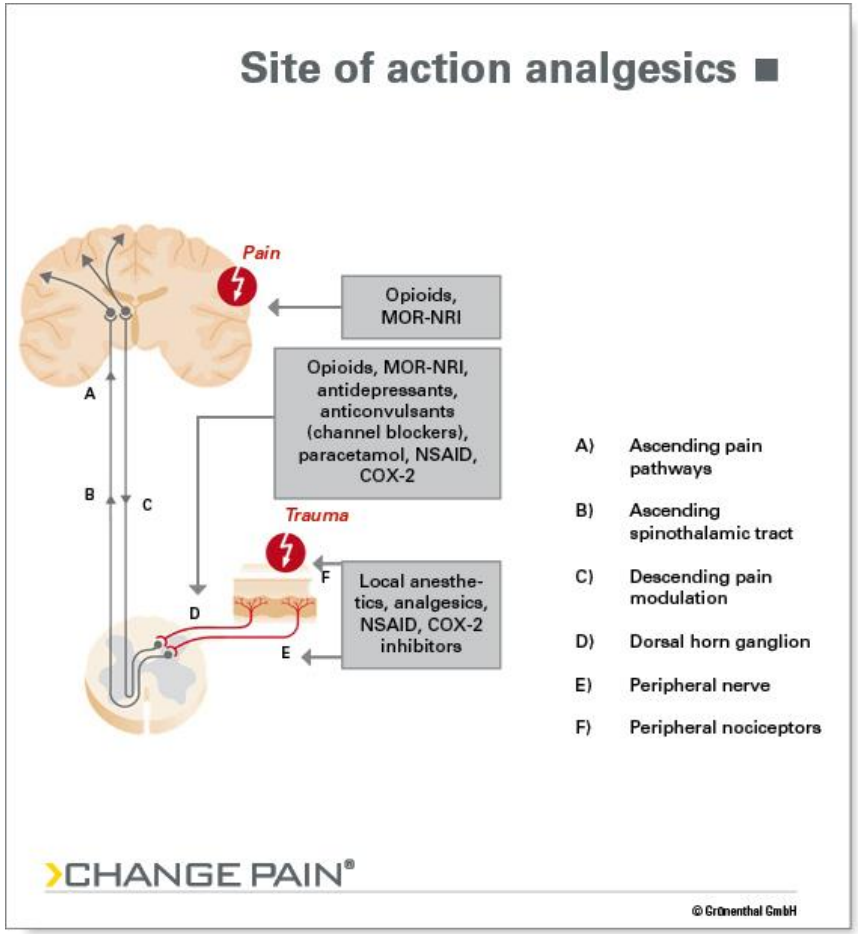


Pain assessment



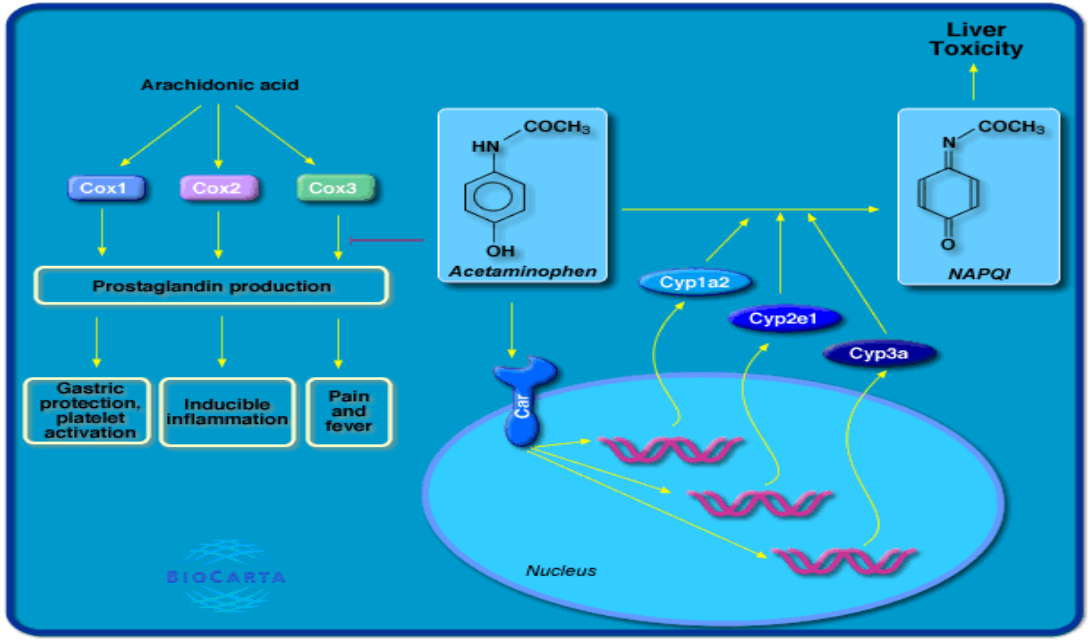


Sites of action



Nonopiods: acetaminophen

- Example: tylenol, combo drugs (percocet, etc)
- Delivery: PO, PR, IV
- MOA:
  - Not entirely understood
  - Inhibits prostaglandin production in CNS; antipyretic
  - No effect on blocking peripheral prostaglandin; no anti-inflammatory
- Common adverse events:
  - Liver toxicity

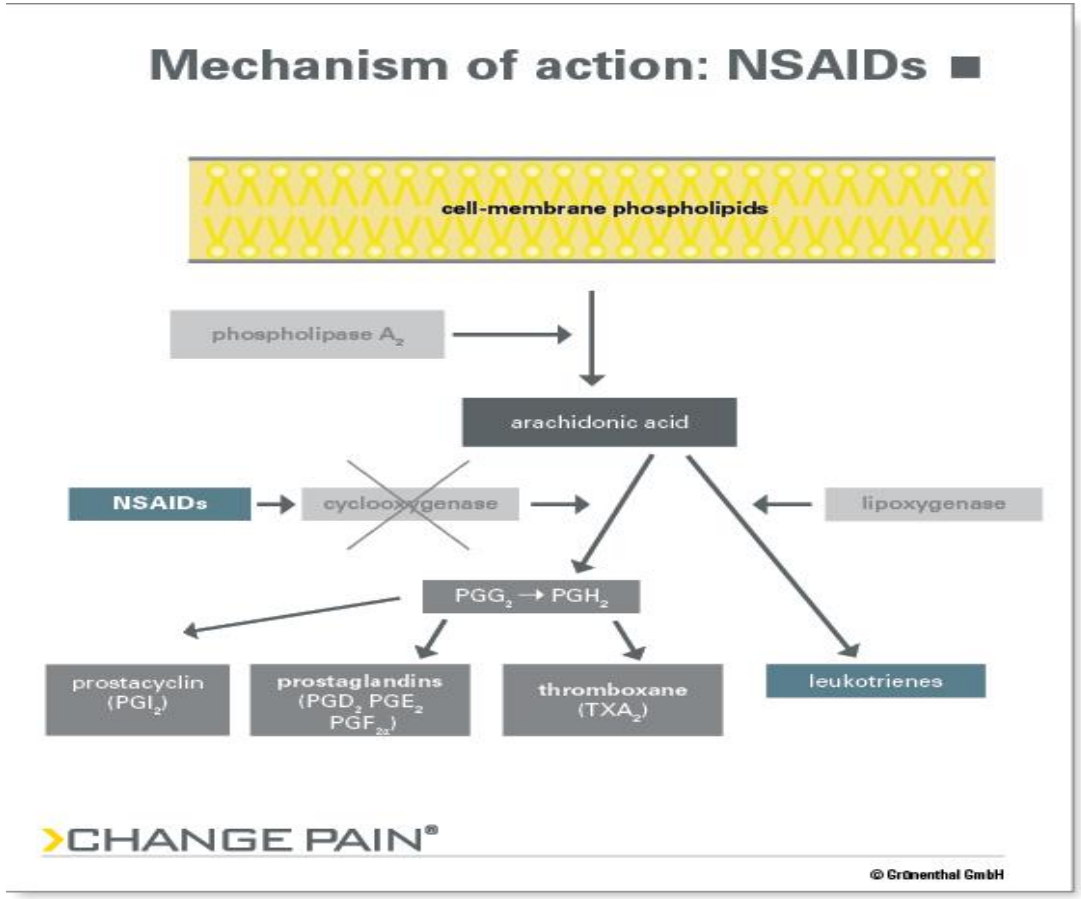


Acetaminophen cont'd

- Maximum daily dose: 4000 mg.
  - 3200 mg in chronic users (healthy adults).
  - 2400 mg in elderly patients or those with liver, renal or cardiac impairment.
- Good for
  - Headaches associated with intracranial blood
  - Multimodal therapy

Nonopiods: NSAIDs

- Examples: ASA, ibuprofen, ketorolac, naproxen
- Delivery: IV, PR, PO
- MOA:
  - Peripheral and central anti-inflammatory and analgesia
  - Inhibit cyclooxygenase and prostaglandin production
  - Inhibit leukatrine B4 production
- Adverse
  - Platelet inhibition
  - GI bleeding
  - Renal toxicity
  - Inhibit bone healing?

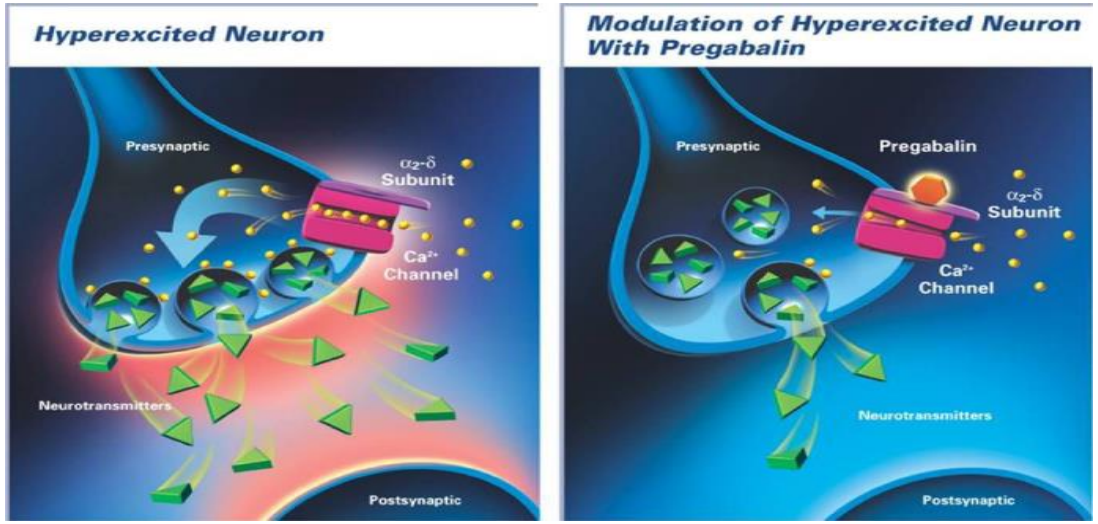


NSAIDs cont'd

- Risk factors associated with GI bleed:
  - History of Peptic Ulcer Disease or Upper GI Bleed – risk ↑4–5x
  - Oral steroid – risk ↑4–5x
  - Age > 65 – risk ↑5–6x
  - High (>2x normal) dose – risk ↑10x
  - Anticoagulants – risk ↑10–15x
- Good for:
  - Inflammatory component of pain, esp early
  - Multimodal therapy

Nonopioids: antiepileptics

- Example: gabapentin, pregabalin
- Delivery: PO
- MOA: structural analog of GABA
  - suppress neuronal hyperexcitability
  - Reduced neuronal influx Ca^{2+}, reducing excitatory neurotransmitter release
- Adverse effects: somnolence, dizziness, peripheral edema



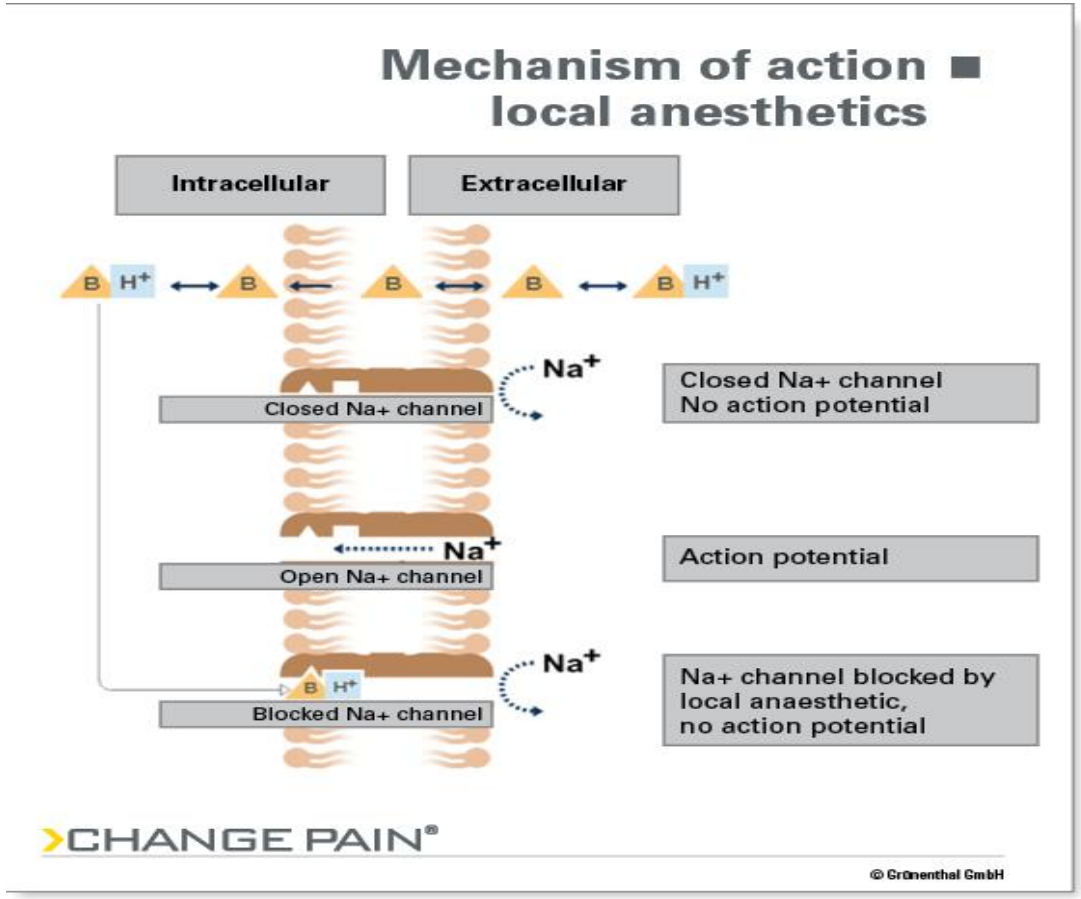
Antiepileptic, cont.

- Good for
  - Neuropathic pain
  - Acute pain multimodal therapy
    - 2010 prospective randomized trial, which included pregabalin as part of a multimodal analgesia regimen, has shown a significant decrease in chronic pain at 6 months after Total Knee Arthroplasty.
    - Opioid sparing
    - Anxiolytic

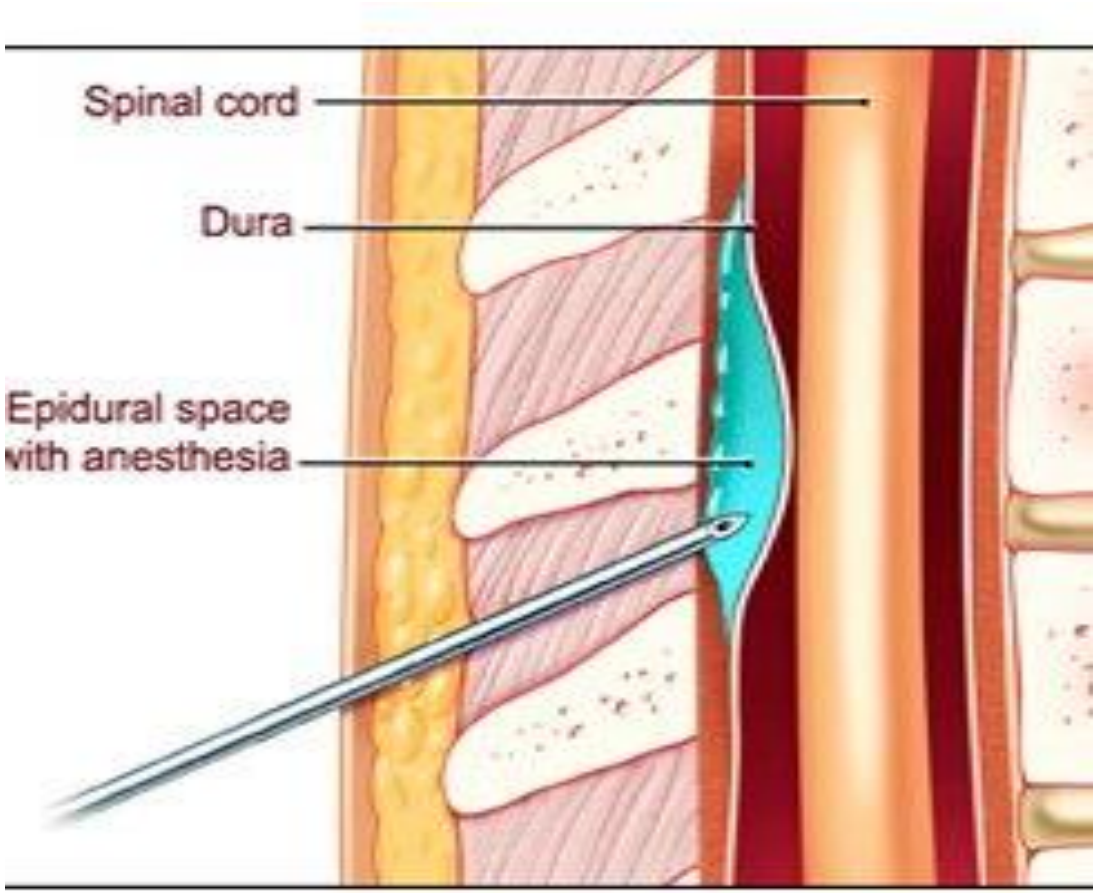
Perioperative oral pregabalin reduces chronic pain after total knee arthroplasty: a prospective randomized, controlled trial. Anesth Analg 2010;110(1):199-207. Buvanendran A, et al

Nonopioids: local anesthetics

- Examples: lidocaine, bupivacaine, Lidoderm patch, Capsaicin cream
- Delivery: topical, SC, IV, perineural, epidural
- MOA:
  - block Na channels, inhibit generation impulses by nerves
  - Deplete substance P in sensory nerve endings
- Adverse events: local allergic reactions, arrhythmia, seizure, masking of clinical signs

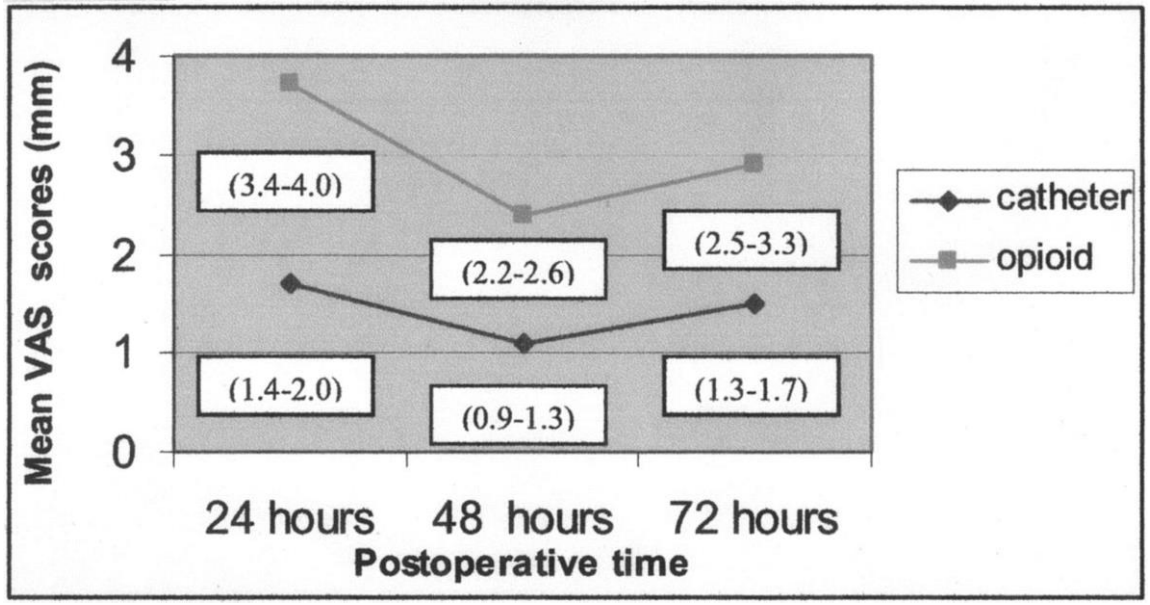


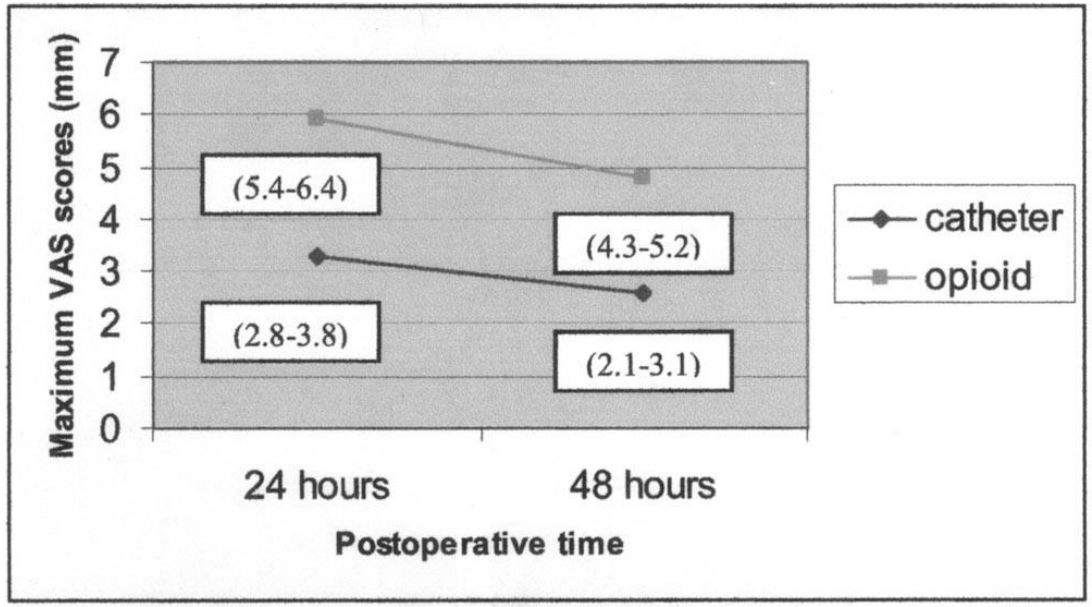
Local



Comparison of Opioid vs. CPNB

Mean Visual Analog Pain Scores

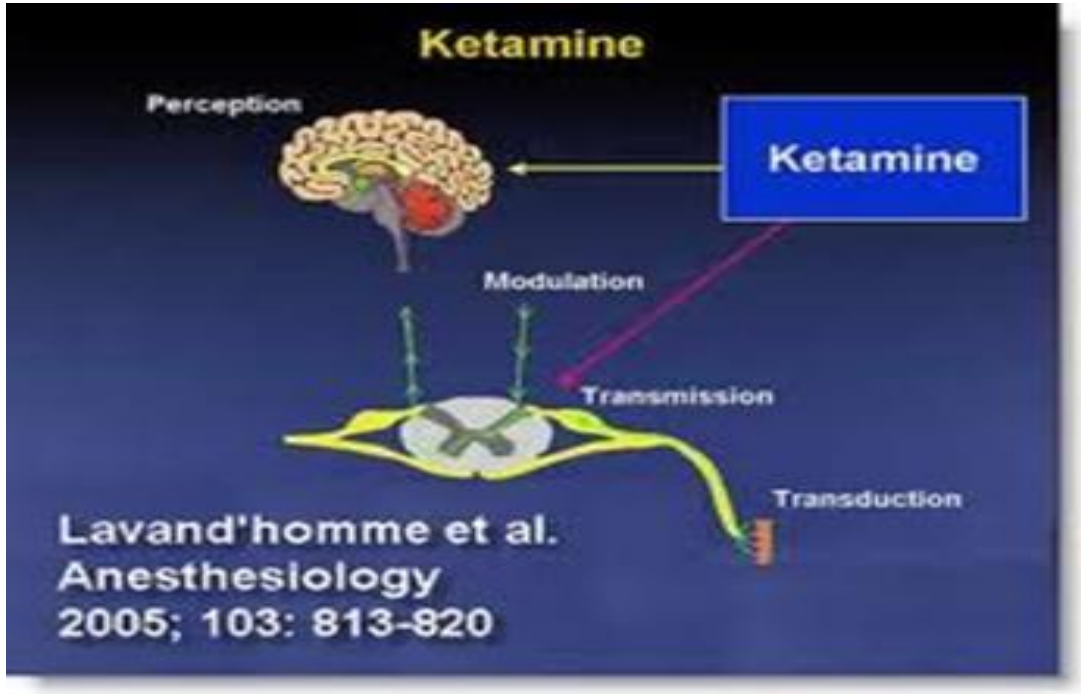




Does Continuous Peripheral Nerve Block Provide Superior Pain Control to Opioids? A Meta-Analysis. Richman et al. *Anesthesia and Analgesia* Jan2006

Nonopioids: NMDA receptor agonist

- Examples: ketamine
- Routes: IV, IM, PO
- MOA:
  - NMDA antagonist
  - Interacts with μ and κ opioid receptors
  - NE uptake blocker
  - Muscarinic cholinergic antagonist
- Adverse: “bad trip”, wide safety profile

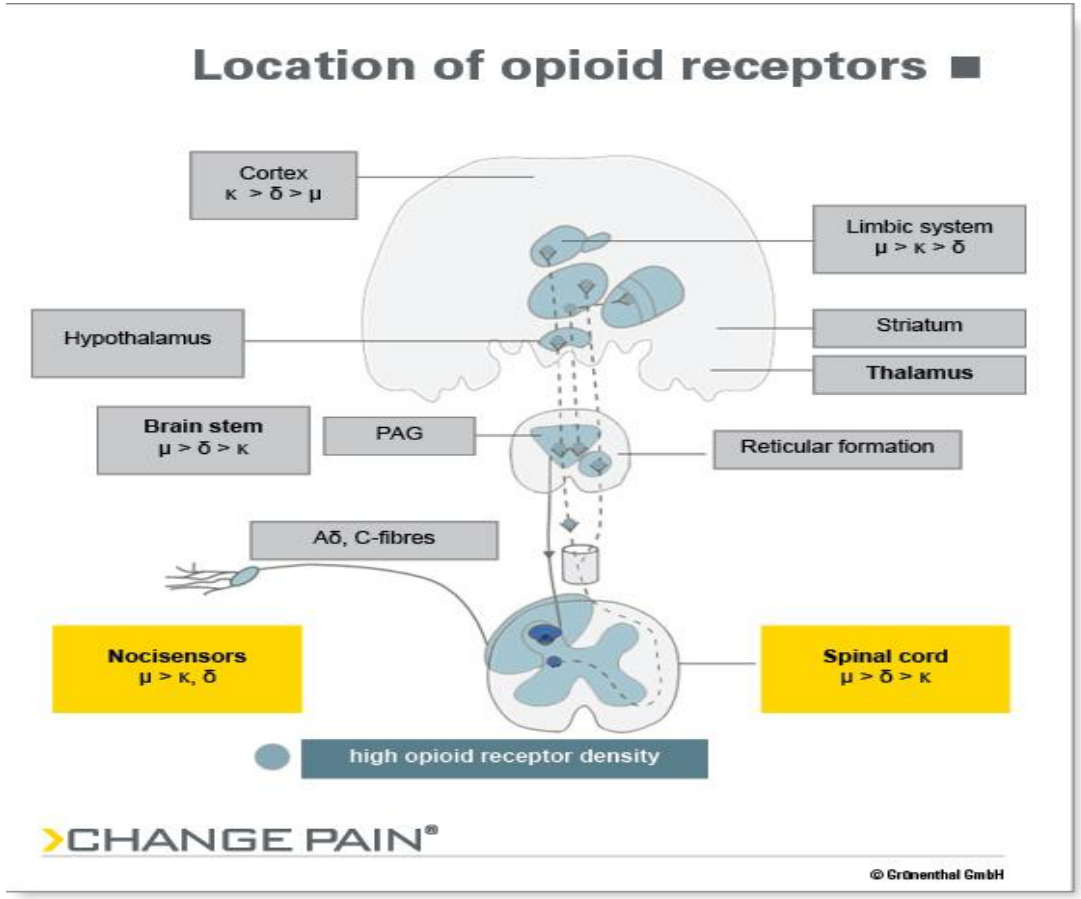


Ketamine, cont.

- Anesthetic in doses >2mg/kg
- Analgesic at 1-10mcg/kg/min
- May decrease “wind up” at the spinal cord level and central sensitization
- Role in patients with opioid tolerance and opioid hypersensitivity

Opioids

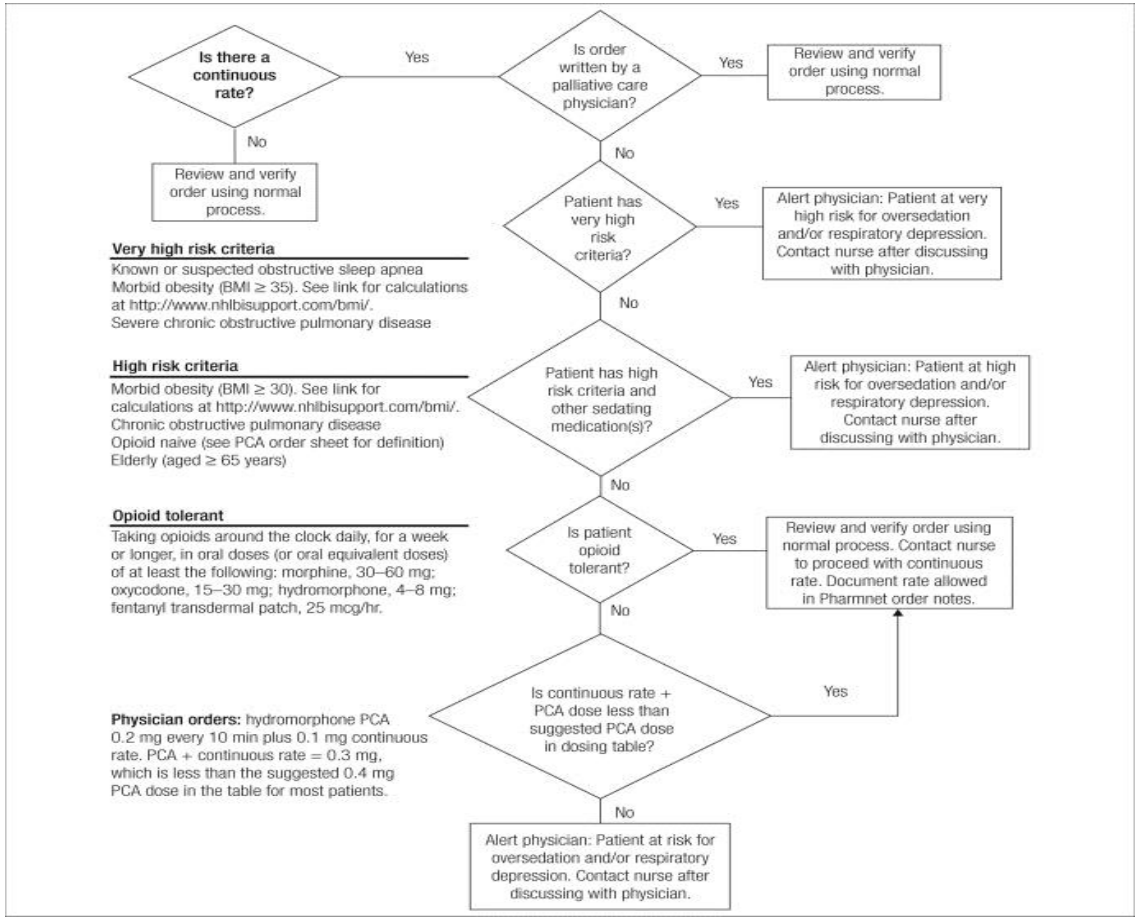
- Examples: morphine, hydromorphone, fentanyl, oxycodone, codeine, hydrocodone, methadone, tramadol(?)
- Delivery: IV, IM, PO, mucosal, transdermal, intranasal, epidural
- MOA:
  - Bind to opioid receptor in CNS to inhibit nociceptive input from periphery to spinal cord
  - Activate descending pathways that modulate transmission in spinal cord
  - Alter limbic system; modify sensory and affective pain aspects
- Adverse events: sedation, confusion, respiratory depression, pruritus, nausea, constipation



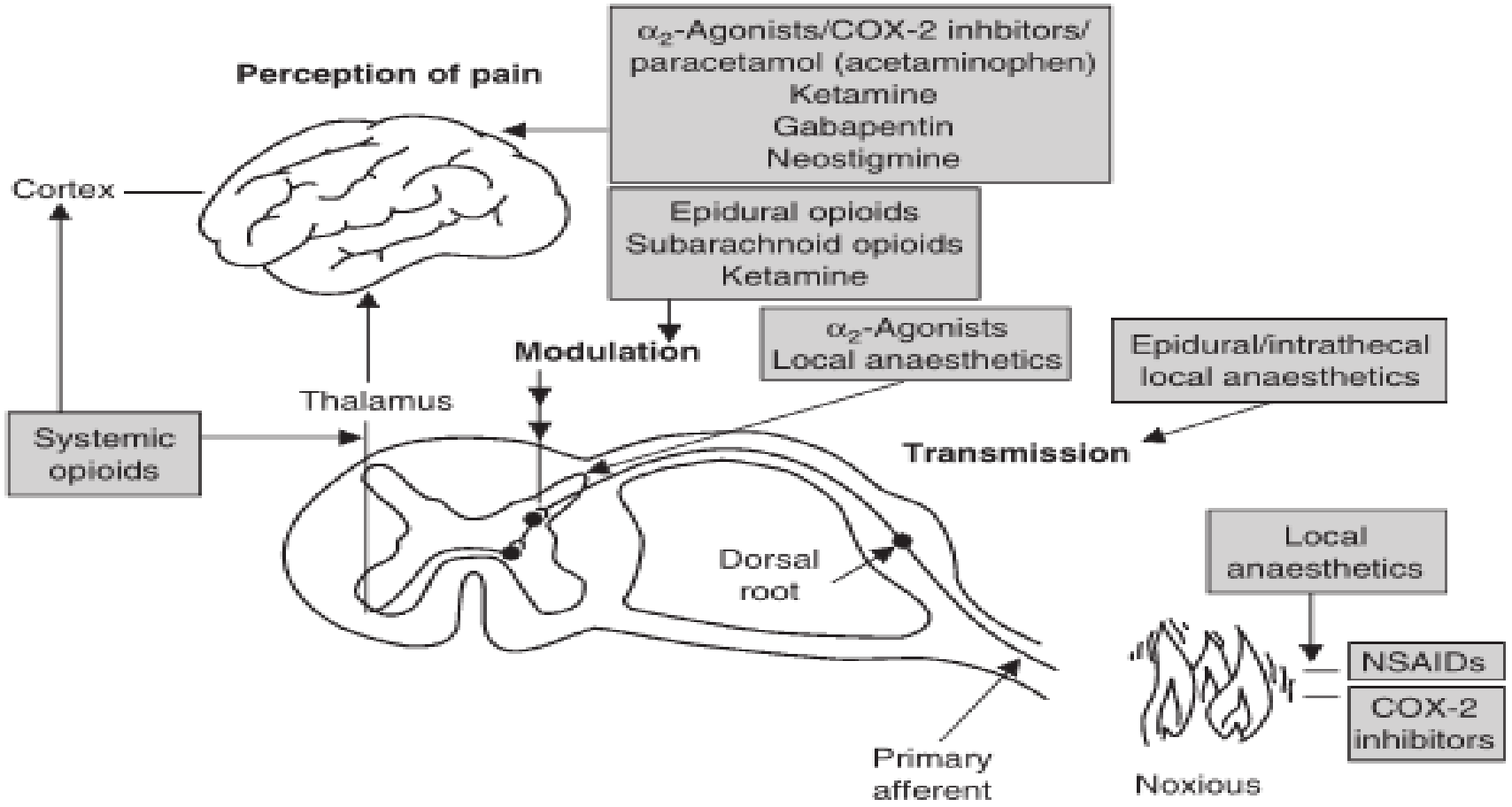
Opioids, cont.

- Mainstay in trauma pain
- Better when used as part of multimodal therapy
- PCA when unable to take PO
  - Basal rate considered if opioid tolerant and in a monitored bed
- Add long extended release if maxed out on immediate release and multimodal therapies

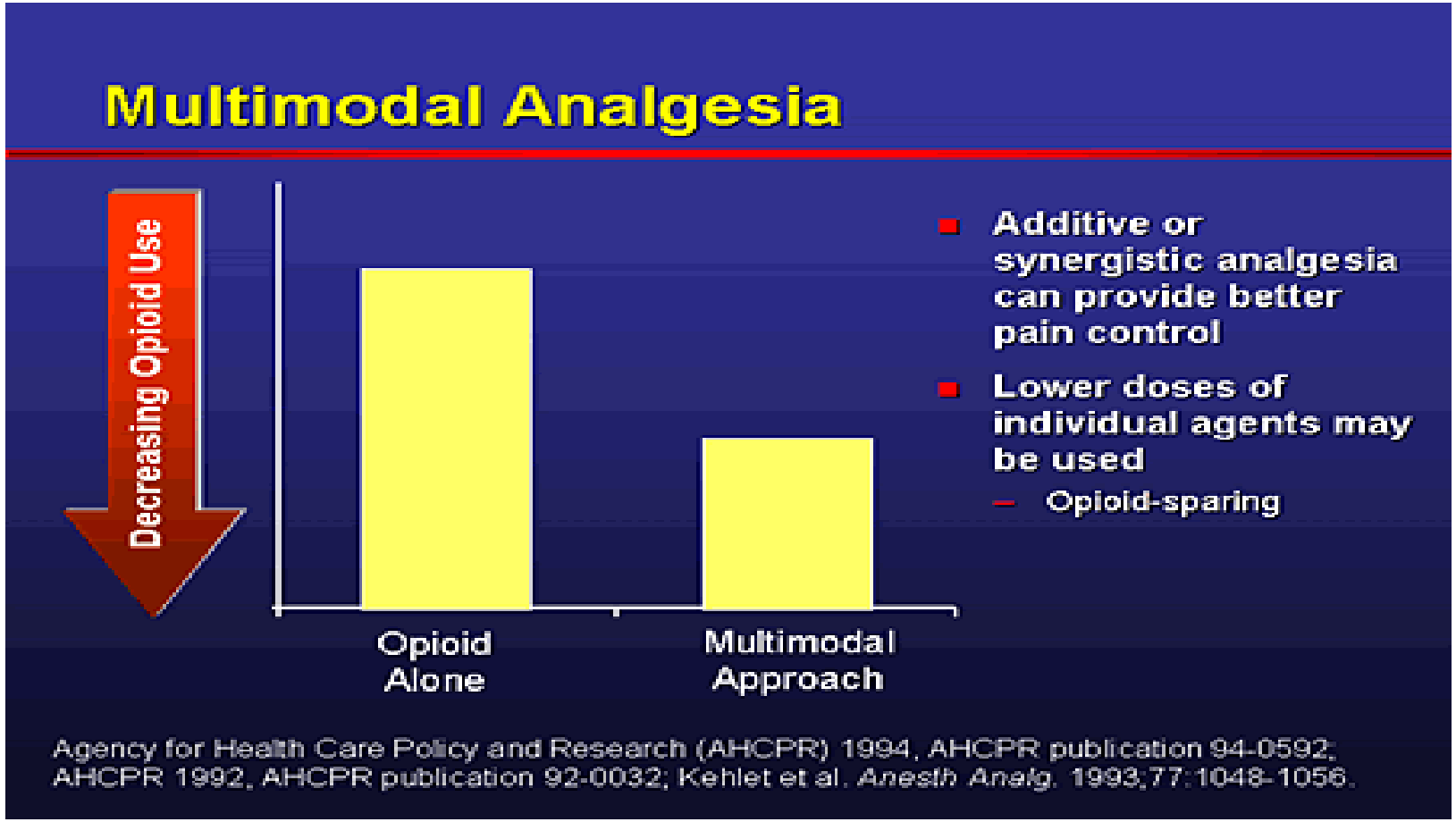
Safety check for PCA



Multimodal therapy



Multimodal analgesia



Acute pain in patient with chronic pain

Pain-related assessment in opioid-tolerant patients

Information from all opioid-tolerant patients	Additional information in patients with CNCP or cancer pain	Additional information in patients with an addiction
Current treatment providers	Pain diagnosis	Opioid substitution therapies and doses (methadone, buprenorphine)
Opioid and non-opioid medications	Usual pain scores	Other prescribed or illicit substance use (polyabuse is common)
Dose verification of all relevant medications	Functional status	Routes of administration
Non-prescribed drugs (e.g. over-the-counter and illicit drugs, alcohol, nicotine)	Prognosis (cancer pain)	Where relevant, registered prescriber and dispensing pharmacy
Drug allergies and reactions	Psychospiritual issues (including end-of-life issues, anxiety, depression, coping style and strategies)	Medical and psychiatric co-morbidities (e.g. blood-borne viruses, hepatic disease, other infections, chronic pain, personality disorder)
Experiences and expectations of acute pain management	Where relevant, the authorised prescriber of any opioids	
Support systems after discharge	Presence of invasive pain treatment (e.g. intrathecal pump, spinal cord stimulator)	
	Medication misuse or addiction	
	Expectations about their admission (e.g. expectation that chronic back pain will be improved after spinal surgery; palliative vs curative surgery in patients with cancer)	

CNCP=chronic non-cancer pain.

Managing pain in patients with chronic pain

- If not opioid naïve, need to provide baseline opioid needs plus additional medication for new pain
- Multimodal therapy
- Work closely with outpatient prescriber of chronic regimen
- Set boundaries and expectations

Acute pain in patients on suboxone

- Determine last dose and temporarily stop
- Provide opioid agonist treatement
- Will need higher doses of opioid as these patients are not naïve, and they still have antagonist on board
- Monitor for over-sedation 72 hours after last dose of suboxone
- Allow patient to experience mild-moderate opioid withdrawal for safe reintroduction of suboxone

Prevalence of Pain after Major Trauma

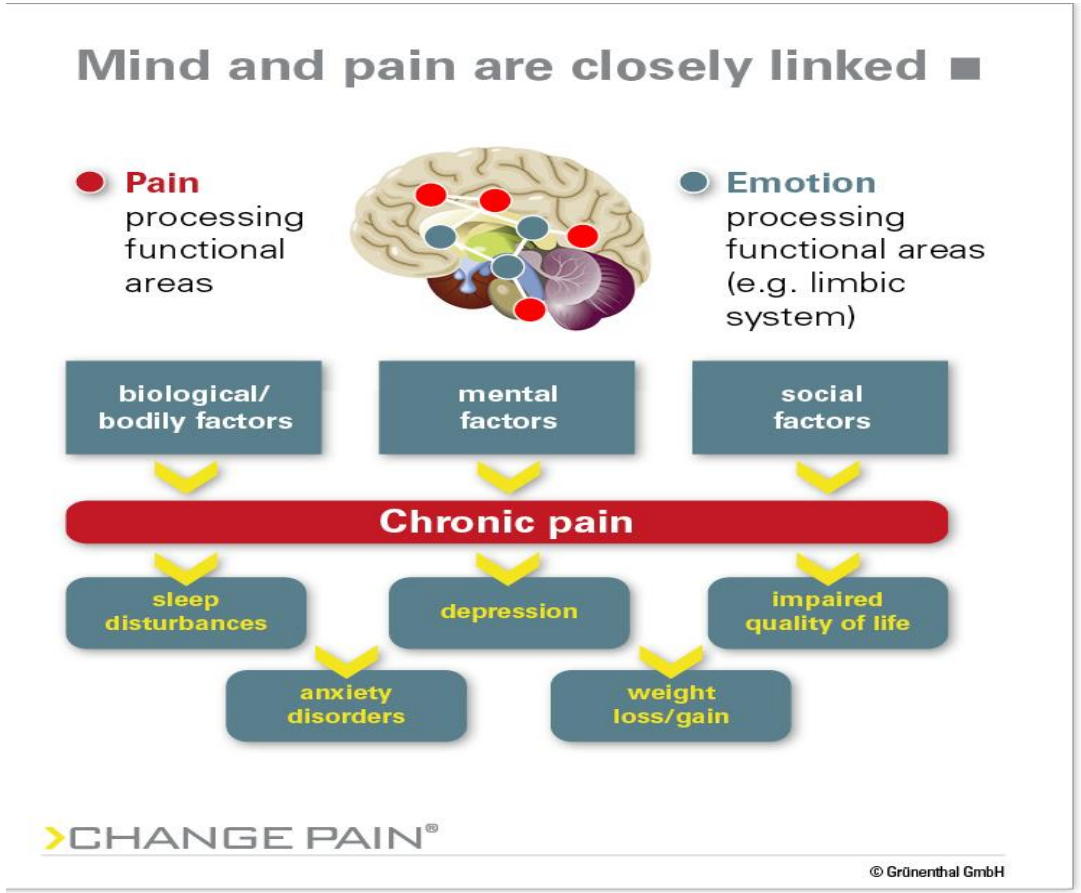
- 3047 adults patients admitted with acute trauma
- 12 months post – 62.7% of patients reported injury-related pain
- Mean severity was 5.5/10
- Pain at 3 months was predictive of both the presence and higher severity of pain at 12 months
- More common in women and those who had untreated depression before injury
- Lower pain severity was reported by patients with a college education and those with no previous functional limitations

Prevalence of Pain in Patients 1 Year After Major Trauma (2008) Rivara et. al *Arch Surg*;143(3):282-287

Factors associated with the development of persistent pain after Trauma

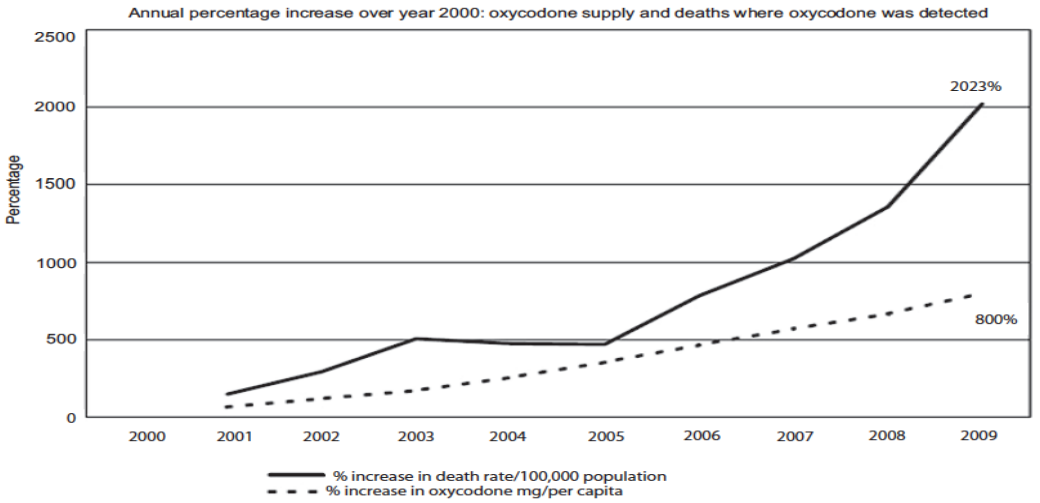
- Younger age
- Multiple surgeries
  - Length of sx
  - Type of sx
- Poorly managed pain
- Nerve injury
- Duration of disability (time to return to work)
- Psychological – ↑ anxiety, depression, stress, pain catastrophizing

Macrae (2008), Keene et al (2011) , Sommer et al (2010)



Concerns about opioid addiction

- Cases where it does occur are usually in patients with previous substance abuse problems
- Dependence-withdrawal symptoms upon discontinuation
- Tolerance-physiologic response to fixed dose decreases over time
- Pseudoaddiction-pattern of behavior that superficially resembles some behaviors of addiction
- Addiction-neurobiological disease, inability to control use, compulsive use, continued use despite harm, craving



Identify high risk patients

Item	Mark each box that applies	Item score if female	Item score if male
1. Family history of substance abuse:			
Alcohol	☐	1	3
Illegal drugs	☐	2	3
Prescription drugs	☐	4	4
2. Personal history of substance abuse:			
Alcohol	☐	3	3
Illegal drugs	☐	4	4
Prescription drugs	☐	5	5
3. Age (mark box if 16-45)	☐	1	1
4. History of preadolescent sexual abuse	☐	3	0
5. Psychological disease			
Attention-deficit disorder, obsessive–compulsive disorder, bipolar disorder, schizophrenia	☐	2	2
Depression	☐	1	1
Total		—	—
Total Score Risk Category: Low Risk: 0 to 3 Moderate Risk: 4 to 7 High Risk: 8 and above			

FIGURE. Opioid Risk Tool.

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Tapering down post injury

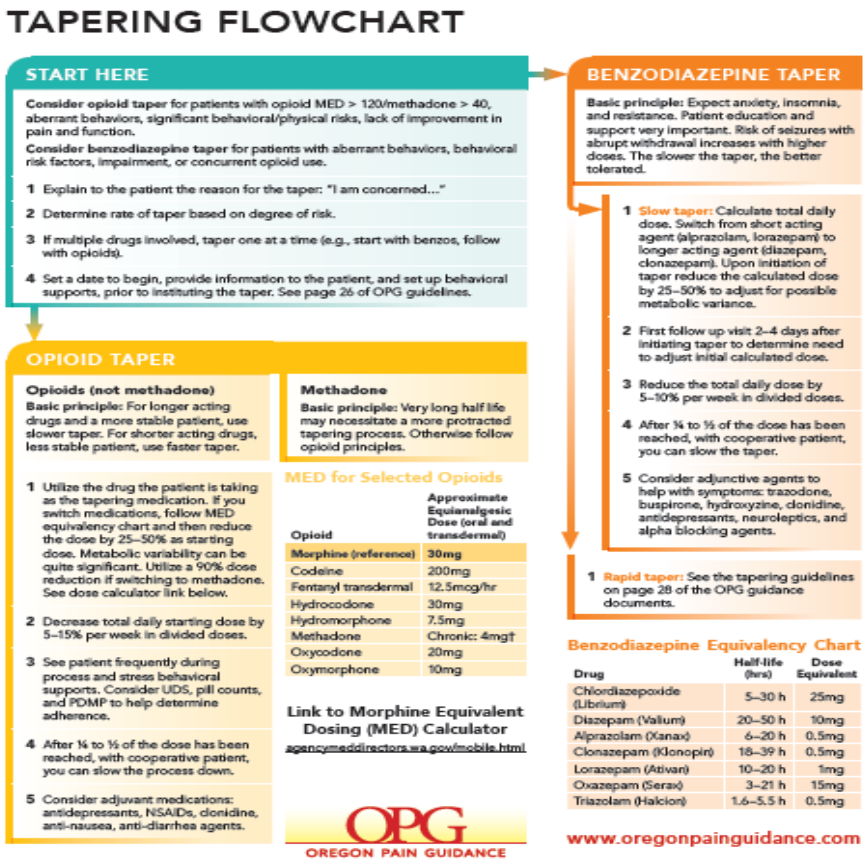
- Set expectations:
  - You will not be pain free
  - The worst of the pain will be better in 2 weeks
  - Withdrawal symptoms
- Timing:
  - The longer they've been on the slower the taper
  - Patient centered when they need less (day vs night)
- Taper long acting first
- Use pain scores at home to dose immediate release-most will auto taper

Tapering protocols

Suggested Tapers for...

- Methadone:
  - Decrease dose by 20-50 percent per day until you reach 30 mg/day
  - Then decrease by 5 mg/day every three to five days to 10 mg/day
  - Then decrease by 2.5 mg/day every three to five days
- Morphine SR/CR:
  - Decrease dose by 20-50 percent per day until you reach 45 mg/day
  - Then decrease by 15 mg/day every two to five days
- Oxycodone CR:
  - Decrease dose by 20-50 percent per day until you reach 30 mg/day
  - Then decrease by 10 mg/day every two to five days

http://www.healthquality.va.gov/guidelines/Pain/cot/OpioidTaperingFactSheet23May2013v1.pdf



TAPERING FLOWCHART

START HERE

Consider opioid taper for patients with opioid MED > 120/methadone > 40, aberrant behaviors, significant behavioral/physical risks, lack of improvement in pain and function.

Consider benzodiazepine taper for patients with aberrant behaviors, behavioral risk factors, impairment, or concurrent opioid use.

1 Explain to the patient the reason for the taper: "I am concerned..."

2 Determine rate of taper based on degree of risk.

3 If multiple drugs involved, taper one at a time (e.g., start with benzos, follow with opioids).

4 Set a date to begin, provide information to the patient, and set up behavioral supports, prior to instituting the taper. See page 26 of OPG guidelines.

OPIOID TAPER

Opioids (not methadone)

Basic principle: For longer acting drugs and a more stable patient, use slower taper. For shorter acting drugs, less stable patient, use faster taper.

1 Utilize the drug the patient is taking as the tapering medication. If you switch medications, follow MED equivalency chart and then reduce the dose by 25–50% as starting dose. Metabolic variability can be quite significant. Utilize a 90% dose reduction if switching to methadone. See dose calculator link below.

2 Decrease total daily starting dose by 5–15% per week in divided doses.

3 See patient frequently during process and stress behavioral supports. Consider UDS, pill counts, and PDMP to help determine adherence.

4 After ¼ to ⅓ of the dose has been reached, with cooperative patient, you can slow the process down.

5 Consider adjuvant medications: antidepressants, NSAIDs, clonidine, anti-nausea, anti-diarrhea agents.

Methadone

Basic principle: Very long half life may necessitate a more protracted tapering process. Otherwise follow opioid principles.

MED for Selected Opioids

Opioid	Approximate Equianalgesic Dose (oral and transdermal)
Morphine (reference)	30mg
Codeine	200mg
Fentanyl transdermal	12.5mcg/hr
Hydrocodone	30mg
Hydromorphone	7.5mg
Methadone	Chronic: 4mg†
Oxycodone	20mg
Oxymorphone	10mg

Link to Morphine Equivalent Dosing (MED) Calculator

agencymeddirectors.wa.gov/mobile.html

OPG

OREGON PAIN GUIDANCE

BENZODIAZEPINE TAPER

Basic principle: Expect anxiety, insomnia, and resistance. Patient education and support very important. Risk of seizures with abrupt withdrawal increases with higher doses. The slower the taper, the better tolerated.

1 **Slow taper:** Calculate total daily dose. Switch from short acting agent (alprazolam, lorazepam) to longer acting agent (diazepam, clonazepam). Upon initiation of taper reduce the calculated dose by 25–50% to adjust for possible metabolic variance.

2 First follow up visit 2–4 days after initiating taper to determine need to adjust initial calculated dose.

3 Reduce the total daily dose by 5–10% per week in divided doses.

4 After ¼ to ⅓ of the dose has been reached, with cooperative patient, you can slow the taper.

5 Consider adjunctive agents to help with symptoms: trazodone, buspirone, hydroxyzine, clonidine, antidepressants, neuroleptics, and alpha blocking agents.

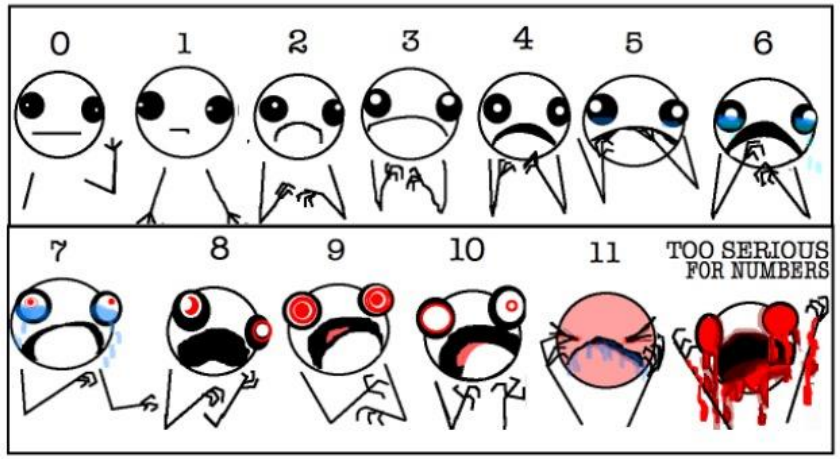
1 **Rapid taper:** See the tapering guidelines on page 28 of the OPG guidance documents.

Benzodiazepine Equivalency Chart

Drug	Half-life (hrs)	Dose Equivalent
Chlordiazepoxide (Librium)	5–30 h	25mg
Diazepam (Valium)	20–50 h	10mg
Alprazolam (Xanax)	6–20 h	0.5mg
Clonazepam (Klonopin)	18–39 h	0.5mg
Lorazepam (Ativan)	10–20 h	1mg
Oxazepam (Serax)	3–21 h	15mg
Triazolam (Halcion)	1.6–5.5 h	0.5mg

www.oregonpainguidance.com

A BETTER PAIN CHART



0: Hi. I am not experiencing any pain at all. I don't even know why I'm here.

1: I am completely unsure whether I am experiencing pain or itching, or maybe I just have a bad taste in my mouth.

2: I probably just need a Band Aid.

3: This is distressing. I don't want this to be happening to me at all.

4: My pain is not f_cking around.

5: Why is this happening to me??

6: Ow. Okay, my pain is super legit now.

7: I see Jesus coming for me and I'm scared.

8: I am experiencing a disturbing amount of pain. I might actually be dying. Please help.

9: I am almost definitely dying.

10: I am actively being mauled by a bear.

11: Blood is going to explode out of my face at any moment.

Too Serious For Numbers: You probably have ebola. It appears that you may also be suffering from Stigmata and/or pinkeye.