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This program was sponsored by Pfizer Inc.

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Learning Objectives

- After completing this module, participants will be able to:
 - Discuss the prevalence of acute pain
 - Understand the impact of acute pain on patient functioning and quality of life
 - Explain the pathophysiology of acute pain
 - Apply a simple diagnostic technique for the differential diagnosis of acute pain
 - Select appropriate pharmacological and non-pharmacological strategies for the management of acute pain

Table of Contents

- What is acute pain?
- How common is acute pain?
- What is the impact of acute pain on patient functioning and quality of life?
- How should acute pain be assessed in clinical practice?
- How should acute pain be treated based on its pathophysiology?

Pain Is the 5th Vital Sign



Overview of Pain



Protective role: vital early warning system

- Senses noxious stimuli
- Triggers withdrawal reflex and heightens sensitivity after tissue damage to reduce risk of further damage



Unpleasant experience:

- Suffering physical, emotional and cognitive dimensions
- Continuous unrelieved pain can affect physical (e.g., cardiovascular, renal, gastrointestinal systems, etc.) and psychological states



Maladaptive response:

- Neuropathic and central sensitization/dysfunctional pain
- Not protective
- Lessens quality of life

Costigan M et al. Annu Rev Neurosci 2009; 32:1-32; Wells N et al. In: Hughes RG (ed). Patient Safety and Quality: An Evidence-Based Handbook for Nurses. Agency for Healthcare Research and Quality; Rockville, MD: 2008; Woolf CJ et al. Ann Intern Med 2004; 140(6):441-51.

The Pain Continuum

Time to resolution

Acute pain

nsult

Normal, time-limited response to 'noxious' experience (less than 3 months)

- Usually obvious tissue damage
- Serves a protective function
- Pain resolves upon healing

Chronic pain

Pain that has persisted beyond normal tissue healing time (usually more than 3 months)

- Usually has no protective function
- Degrades health and function

Acute pain may become chronic

Chapman CR, Stillman M. In: Kruger L (ed). *Pain and Touch*. Academic Press; New York, NY: 1996; Cole BE. *Hosp Physician* 2002; 38(6):23-30; International Association for the Study of Pain. *Unrelieved Pain Is a Major Global Healthcare Problem*. Available at: <u>http://www.iasp-pain.org/AM/Template.cfm?Section=Press</u> <u>Release&Template=/CM/ContentDisplay.cfm&ContentID=2908</u>. Accessed: July 24: 2013; National Pain Summit Initiative. *National Pain Strategy: Pain Management for All Australians*. Available at: <u>http://www.iasp-pain.org/PainSummit/Australia_2010PainStrategy.pdf</u>. Accessed: July 24, 2013; Turk DC, Okifuji A. In: Loeser D *et al* (eds.). *Bonica's Management of Pain*. 3rd ed. Lippincott Williams & Wilkins; Hagerstown, MD: 2001.

Somatic vs. Visceral Pain

Somatic

- Nociceptors are involved
- Often well localized
- Usually described as throbbing or aching
- Can be superficial (skin, muscle) or deep (joints, tendons, bones)

Visceral

- Involves hollow organ and smooth muscle nociceptors that are sensitive to stretching, hypoxia and inflammation
- Pain is usually referred, poorly localized, vague and diffuse
- May be associated with autonomic symptoms (e.g., pallor, sweating, nausea, blood pressure and heart rate changes)

McMahon SB, Koltzenburg M (eds). *Wall and Melzack's Textbook of Pain*. 5th ed. Elsevier; London, UK: 2006; Sikandar S, Dickenson AH. *Curr Opin Support Palliat Care* 2012; 6(1):17-26.

Referred Pain



Hudspith MJ *et al.* In: Hemmings HC, Hopkins PM (eds). *Foundations of Anesthesia*. 2nd ed. Elsevier; Philadelphia, PA: 2006; Schmitt WH Jr. *Uplink* 1998; 10:1-3.

Prevalence of Acute Pain

- Lifetime prevalence in general population:
 - Approaches 100% for acute pain leading to use of analgesics¹
- Emergency room patients:
 - Pain accounts for >2/3 of emergency room visits²
- Hospitalized patients:
 ->50% report pain³

1. Diener HC *et al. J Headache Pain* 2008; 9(4):225-31; 2. Todd KH, Miner JR. In: Fishman SM *et al* (eds). *Bonica's Management of Pain*. 4th ed. Lippincott, Williams and Wilkins; Philadelphia, PA: 2010; 3. Dix P *et al. Br J Anaesth* 2004; 92(2):235-7.

Discussion Question

WHAT ARE THE MOST COMMON TYPES OF ACUTE PAIN YOU SEE IN YOUR PRACTICE?

Nociceptive Pain

Somatic



Musculoskeletal injury



Trauma



Post-operative pain

Burn pain



Visceral



Ischemic, e.g., myocardial infarction



Abdominal colic



Fishman SM et al (eds). Bonica's Management of Pain. 4th ed. Lippincott, Williams and Wilkins; Philadelphia, PA: 2010.

Epidemiology of Pain in General Practice

- 1 in 3 patients reported pain
- Of patients in pain:
 - 47.2% had acute pain
 - Location of pain was mainly in musculoskeletal areas and the limbs
 - 2 in 3 pain patients had a drug prescription
- Pain was more frequent in women

Most Common Types of Pain in General Practice



Note: types of pain are based on ICD-9 codes

*The use of the symptom code suggests clinician could not identify the underlying cause of the pain **MSK – other refers to musculoskeletal pain at sites other than the neck, back or soft tissue ICD = International Classification of Disease; MSK = musculoskeletal Hasselström J *et al. Eur J Pain* 2002; 6(5):375-85.

Impact of Acute Pain on Daily Activities



Consequences of Unrelieved Pain



Institute of Medicine. *Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research.* The National Academies Press; Washington, DC: 2011.

Post-operative Pain





Pain accounts for 38% of unanticipated admissions and readmissions following ambulatory surgery

*Depending on type of surgery

Coley KC *et al. J Clin Anesth* 2002; 14(5):349-53; Institute of Medicine. *Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research.* The National Academies Press; Washington, DC: 2011.

Importance of Pain Assessment

Pain is a significant predictor of morbidity and mortality.

- Screen for red flags requiring immediate investigation and/or referral
- Identify underlying cause
 - Pain is better managed if the underlying causes are determined and addressed
- Recognize type of pain to help guide selection of appropriate therapies for treatment of pain
- Determine baseline pain intensity to future enable assessment of efficacy of treatment

Discussion Question

HOW DO YOU ASSESS ACUTE PAIN IN YOUR PRACTICE?

Assessment of Acute Pain

- Site of pain
- Circumstances associated with pain onset
- Character of pain
- Intensity of pain
- Associated symptoms (e.g., nausea)
- Comorbidities

• Treatment

- Current and previous medications, including dose, frequency of use, efficacy and side effects
- Relevant medical history
 - Prior or coexisting pain conditions and treatment outcomes
 - Prior or coexisting medical conditions
- Factors influencing symptomatic treatment

Australian and New Zealand College of Anaesthetists and Faculty of Pain Medicine. *Acute Pain Management: Scientific Evidence.* 3rd ed. ANZCA & FPM; Melbourne, VIC: 2010.

Locate the Pain



Body maps are useful for the precise location of pain symptoms and sensory signs.*

*In cases of referred pain, the location of the pain and of the injury or nerve lesion/dysfunction may not be correlated Gilron I *et al. CMAJ* 2006; 175(3):265-75; Walk D *et al. Clin J Pain* 2009; 25(7):632-40.

Determine Pain Intensity



International Association for the Study of Pain. *Faces Pain Scale – Revised*. Available at: <u>http://www.iasp-pain.org/Content/NavigationMenu/GeneralResourceLinks/FacesPainScaleRevised/default.htm</u>. Accessed: July 15, 2013; Iverson RE *et al. Plast Reconstr Surg* 2006; 118(4):1060-9.



Look for Red Flags for Musculoskeletal Pain

- Older age with new symptom onset
- Night pain
- Fever

- Sweating
- Neurological features
- Previous history of malignancy

Acute Pain Evaluation and Treatment Patient presenting with acute pain Perform diagnostic evaluation Perform assessments Yes Pain is severe/disabling: requires opioids Refer to specialist No **Treat appropriately** Re-evaluate and adjust treatment if indicated

Ayad AE et al. J Int Med Res 2011; 39(4):1123-41.

Goals in Pain Management

- Involve the patient in the decision-making process
- Agree on realistic treatment goals before starting a treatment plan



Farrar JT et al. Pain 2001; 94(2):149-58; Gilron I et al. CMAJ 2006; 175(3):265-75.

Multimodal Treatment of Pain Based on Biopsychosocial Approach



Gatchel RJ *et al. Psychol Bull* 2007; 133(4):581-624; Institute of Medicine. *Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research.*; National Academies Press; Washington, DC: 2011; Mayo Foundation for Medical Education and Research. *Comprehensive Pain Rehabilitation Center Program Guide*. Mayo Clinic; Rochester, MN: 2006.

Discussion Question

WHAT NON-PHARMACOLOGICAL APPROACHES TO MANAGING ACUTE PAIN DO YOU INCORPORATE INTO YOUR PRACTICE? ARE THERE NON-PHARMACOLOGICAL MODALITIES YOUR PATIENTS REGULARLY ASK ABOUT?

Physical Interventions for Acute Pain

Intervention	Potential utility
Transcutaneous electrical nerve stimulation	• Certain stimulation patterns effective in some acute pain settings (e.g., post-operative pain)
Acupuncture	 Reduces post-operative pain as well as opioid-related adverse effects May be effective in some other acute pain settings
Massage and manual therapy	Little consistent evidence for use in post-operative pain
Heat and cold therapy	• Evidence for benefits from post-operative local cooling is mixed

Australian and New Zealand College of Anaesthetists and Faculty of Pain Medicine. *Acute Pain Management: Scientific Evidence.* 3rd ed. ANZCA & FPM; Melbourne, VIC: 2010.

Cognitive Behavioral Interventions for Acute Pain

Intervention	Potential utility
Reassurance and provision of information	 Evidence that information is effective in reducing procedure-related pain is tentatively supportive and not sufficient to make recommendations
Relaxation training	Evidence is weak and inconsistent
Attentional techniques (e.g., imagery, distraction, music therapy)	 Listening to music produces a small reduction in post-operative pain and opioid requirement Immersive virtual reality distraction is effective in reducing pain in some clinical situations
Hypnosis	Evidence of benefit is inconsistent
Coping methods/ behavioral instruction	• Training prior to surgery reduces pain, negative affect and analgesic use

Australian and New Zealand College of Anaesthetists and Faculty of Pain Medicine. *Acute Pain Management: Scientific Evidence.* 3rd ed. ANZCA & FPM; Melbourne, VIC: 2010. Ideal Characteristics for Acute Analgesic Therapy

• Ideal drug characteristics for acute pain therapy:



Baumann TJ. In: DiPiro JT et al (eds). Pharmacotherapy: A Pathophysiologic Approach. 5th ed. McGraw-Hill; New York, NY: 2002.

Patients Prefer Avoiding Side Effects to Complete Pain Control

Relative Importance Placed by Patients on Different Attributes of Acute Pain Therapy



Proportion of Patients Experiencing Adverse Events

Adverse event	Total n (%)
Constipation	25 (50%)
Mental cloudiness/dizziness	41 (82%)
Itching	27 (54%)
Nightmares/hallucinations	16 (32%)
Mood changes/alterations	17 (34%)
Nausea	35 (70%)
Sleep disorders	24 (48%)
Vomiting	16 (32%)

Why should we treat acute pain?

If acute pain <u>IS NOT</u> treated effectively:

- It may cause severe suffering, loss of quality of life, loss of productivity, have economic considerations
- Is associated with morbidity and even mortality
- May develop into chronic pain

Australian and New Zealand College of Anaesthetists and Faculty of Pain Medicine. *Acute Pain Management: Scientific Evidence.* 3rd ed. ANZCA & FPM; Melbourne, VIC: 2010.

So how do we treat acute pain?

Treat according to pain mechanisms involved



Multimodal analgesia

Voscopoulos C, Lema M. Br J Anaesth 2010; 105(Suppl 1):i69-85.

Multimodal or Balanced Analgesia



- Improved analgesia
- ↓ doses of each analgesic
- ↓ severity of side effects of each drug

Coxib = COX-2 inhibitor; nsNSAID = non-specific non-steroidal anti-inflammatory drug Kehlet H, Dahl JB. *Anesth Analg* 1993; 77(5):1048-56.

Analgesics Should Be Given at Regular Intervals During Acute Pain Episodes



Nociception: Neural Process of Encoding Noxious Stimuli



Consequences of encoding may be autonomic (e.g., elevated blood pressure) or behavioral (motor withdrawal reflex or more complex nocifensive behavior). Pain perception is not necessarily implied.

Scholz J, Woolf CJ. Nat Neurosci 2002; 5(Suppl):1062-7.

Inflammation



CNS = central nervous system Scholz J, Woolf CJ. *Nat Neurosci* 2002; 5(Suppl):1062-7.

Mechanism-Based Pharmacological Treatment of Nociceptive/Inflammatory Pain



Coxib = COX-2 inhibitor; nsNSAID = non-specific non-steroidal anti-inflammatory drug Scholz J, Woolf CJ. *Nat Neurosci* 2002; 5(Suppl):1062-7.

Discussion Question

HOW DO THESE MEDICATIONS WORK TO REDUCE ACUTE PAIN?

What are NSAIDs (nsNSAIDs/coxibs)?

NSAID = Non-Steroidal Anti-Inflammatory Drug

- Analgesic effect via inhibition of prostaglandin production
- Broad class incorporating many different medications:

Examples of nsNSAIDs:

- Diclofenac
- Ibuprofen
- Naproxen

Examples of Coxibs:

- Celecoxib
- Etoricoxib
- Parecoxib

Coxib = COX-2-specific inhibitor; nsNSAID = non-specific non-steroidal anti-inflammatory drug

Brune K. In: Kopf A et al (eds). Guide to Pain Management in Low-Resource Settings. International Association for the Study of Pain; Seattle, WA: 2010.

How do nsNSAIDs/coxibs work?



Adverse Effects of nsNSAIDs/Coxibs

All NSAIDs:

- Gastroenteropathy
 - Gastritis, bleeding, ulceration, perforation
- Cardiovascular thrombotic events
- Renovascular effects
 - Decreased renal blood flow
 - Fluid retention/edema
 - Hypertension
- Hypersensitivity
- **Cox-1-mediated NSAIDs (nsNSAIDs):**
- Decreased platelet aggregation

Coxib = COX-2-specific inhibitor; NSAID = non-steroidal anti-inflammatory drug; nsNSAID = non-specific non-steroidal anti-inflammatory drug

Clemett D, Goa KL. *Drugs* 2000; 59(4):957-80; Grosser T *et al.* In: Brunton L *et al* (eds.). *Goodman and Gilman's The Pharmacological Basis of Therapeutics*. 12th ed. (online version). McGraw-Hill; New York, NY: 2010.

Discussion Question

HOW DO YOU EVALUATE GASTROINTESTINAL RISK IN PATIENTS YOU ARE CONSIDERING PRESCRIBING A NSNSAID OR A COXIB?

Risk Factors for Gastrointestinal Complications Associated with nsNSAIDs/Coxibs



Odds ratio/relative risk for ulcer complications

ASA = acetylsalicylic acid; coxib = COX-2-specific inhibitor; GI = gastrointestinal; NSAID = non-steroidal anti-inflammatory drug; nsNSAID = non-specific non-steroidal anti-inflammatory drug; SSRI = selective serotonin reuptake inhibitor

1. Garcia Rodriguez LA, Jick H. Lancet 1994; 343(8900):769-72; 2. Gabriel SE et al. Ann Intern Med 1991; 115(10):787-96;

3. Bardou M. Barkun AN. Joint Bone Spine 2010; 77(1):6-12; 4. Garcia Rodríguez LA, Hernández-Díaz S. Arthritis Res 2001; 3(2):98-101.

Guidelines for nsNSAIDs/Coxibs Use Based on Gastrointestinal Risk and ASA Use

	Gastrointestinal risk		
	Not elevated	Elevated	
Not on ASA		Coxib	
NOU ON ASA	IISNSAID dione	nsNSAID + PPI	
	Coxib + PPI	Coxib + PPI	
UIIASA	nsNSAID + PPI	nsNSAID + PPI	

ASA = acetylsalicylic acid; coxib = COX-2-specific inhibitor; nsNSAID = non-selective non-steroidal anti-inflammatory drug; PPI = proton pump inhibitor Tannenbaum H *et al. J Rheumatol* 2006; 33(1):140-57.

How Opioids Affect Pain

Brain

Perception

Modify perception, modulate transmission and affect transduction by:

- Altering limbic system activity; modify sensory and affective pain aspects
- Activating descending pathways that modulate --transmission in spinal cord
- nerve impulses



Reisine T, Pasternak G. In: Hardman JG et al (eds). Goodman and Gilman's: The Pharmacological Basics of Therapeutics. 9th ed. McGraw-Hill; New York, NY: 1996; Scholz J, Woolf CJ. Nat Neurosci 2002; 5(Suppl):1062-7; Trescot AM et al. Pain Physician 2008; 11(2 Suppl):S133-53.

Discussion Question

WHAT POTENTIAL SIDE EFFECTS DO YOU DISCUSS WITH PATIENTS FOR WHOM YOU ARE CONSIDERING PRESCRIBING AN OPIOID?

Adverse Effects of Opioids

System	Adverse effects
Gastrointestinal	Nausea, vomiting, constipation
CNS	Cognitive impairment, sedation, lightheadedness, dizziness
Respiratory	Respiratory depression
Cardiovascular	Orthostatic hypotension, fainting
Other	Urticaria, miosis, sweating, urinary retention

CNS = central nervous system

Moreland LW, St Clair EW. *Rheum Dis Clin North Am* 1999; 25(1):153-91; Yaksh TL, Wallace MS. In: Brunton L *et al* (eds). *Goodman and Gilman's The Pharmacological Basis of Therapeutics*. 12th ed. (online version). McGraw-Hill; New York, NY: 2010.

Acetaminophen

- Action at molecular level is unclear
- Potential mechanisms include:
 - Inhibition of COX enzymes (COX-2 and/or COX-3)
 - Interaction with opioid pathway
 - Activation of serotoninergic bulbospinal pathway
 - Involvement of nitric oxide pathway
 - Increase in cannabinoid-vanilloid tone

Peri-operative Pain Management Aims to Control Pain and Decrease Likelihood of Developing Chronic Pain



Joshi GP et al. Anesthesiol Clin N Am 2005; 23(1):21-36; Kehlet H et al. Lancet 2006; 367(9522):1618-25.

Controlling Post-operative Physiology



Reduced morbidity and accelerated convalescence

Kehlet H. Br J Anaesth 1997; 78(5):606-17.

Recommendations for Management of Acute Pain

Acetaminophen



Add nsNSAIDs/coxibs

If ineffective

Add opioids

(preferably short-acting agents at regular intervals; ongoing need for such treatment requires reassessment)

Coxib = COX-2-specific inhibitor; nsNSAID = non-selective non-steroidal anti-inflammatory drug

Australian and New Zealand College of Anaesthetists and Faculty of Pain Medicine. *Acute Pain Management: Scientific Evidence.* 3rd ed. ANZCA & FPM; Melbourne, VIC: 2010.

Algorithm for Treatment of Acute Pain Based on Severity



Coxib = COX-2 inhibitor; nsNSAID = non-specific non-steroidal anti-inflammatory drug Ayad AE *et al. J Int Med Red* 2011; 39(4):1123-41.

Analgesia for Post-operative Pain Based on Type of Surgery



*Unless contraindicated

Coxib = COX-2-specific inhibitor; IV = intravenous; nsNSAID = non-selective non-steroidal anti-inflammatory drug

Sivrikaya GU. In: Racz G (ed). Pain Management – Current Issues and Opinions. InTech; Rijeka, Croatia: 2012. PROSPECT Working Group. Procedure Specific Postoperative Pain Management. Available at: <u>http://www.postoppain.org/frameset.htm</u>. Accessed: July 24, 2013.

Discussion Question

IN YOUR PRACTICE, DO YOU REGULARLY ASSESS RISK FOR DEVELOPING CHRONIC PAIN? IF SO, HOW?

Risk Factors for Chronic Post-operative Pain

Pre-operative factors

- Moderate to severe pain, lasting >1 month
- Repeat surgery
- Psychologic vulnerability (e.g., catastrophizing)
- Pre-operative anxiety
- Female gender
- Younger age (adults)
- Workers' compensation
- Genetic predisposition
- Inefficient diffuse noxious inhibitory control

Intra-operative factors

• Surgical approach with risk of nerve damage

Post-operative factors

- Moderate to severe acute pain
- Radiation therapy to area
- Neurotoxic chemotherapy
- Depression
- Psychological vulnerability
- Neuroticism
- Anxiety

Australian and New Zealand College of Anaesthetists and Faculty of Pain Medicine. *Acute Pain Management: Scientific Evidence.* 3rd ed. ANZCA & FPM; Melbourne, VIC: 2010.

Acute Pain Can Become Chronic

Life Cycle Factors Associated with Development of Chronic Pain

From birth			
Genetics	Childhood	-	
Female sex Minority race/ethnicity	Physical/sexual abuse	Adolescence	
Congenital disorders	and other traumatic events	Changes of puberty	Adulthood
Prematurity Parental anxiety Irregular feeding/sleeping Parents' pain exposure and reactions	Low socioeconomic status Emotional, conduct and peer problems Hyperactivity Serious illness or injury	Gender roles Education level Injuries Obesity Low levels of fitness	Vivid recall of childhood trauma Lack of social support Accumulated stress Surgery
Personality	Separation from mother Acute or recurrent pain experience		Overuse of joints and muscles Occupation Chronic disease

Aging

Institute of Medicine. *Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research.* The National Academies Press; Washington, DC: 2011.



- Acute pain is extremely common, with musculoskeletal pain being the most common presentation in primary care
- Clinicians should maintain high degree of awareness for "red flags" indicating potential serious disorders and should, when possible, treat the underlying cause of pain
- In acute pain, normal nociception is modified by inflammation
 - Acetaminophen, nsNSAIDs/coxibs and opioids target common mechanisms of acute pain
 - Pain severity and individual patient risk profile should be considered when selecting pain management therapies
- Timely and appropriate treatment may help prevent acute pain from becoming chronic pain

Coxib = COX-2-specific inhibitor; nsNSAID = non-selective non-steroidal anti-inflammatory drug;