Mind Matters: A Mechanism-Based Approach to Pain Management

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Disclosures

- Previously served as consultant for DJO, Abbott, Regeneron, Pfizer, Medtronic
- Research funding Medtronic, Inc., Gruenenthal
- TENS units for research donated by DJO, Inc.
- Royalties IASP Press
Objectives

- Understand peripheral and central mechanisms underlying chronic musculoskeletal pain
- Identify psychosocial factors that influence treatment of chronic pain
- Identify methods to assess peripheral and central mechanisms, and psychosocial factors
- Apply a mechanisms-based approach to pain management
Questions

- Do you currently have pain?
  - Majority of people have pain (70-80%)

- Has your pain lasted longer than a year?
  - 20-40% of people have persistent pain (100 million Americans)

- Do you regularly see people with pain?
  - Nearly all PTs see people with pain
  - Occurs across all practice domains
  - Pain is number 1 reason a person comes to PT

- Do you choose to work with chronic pain patients?
  - 96% of PTs - prefer not to work with chronic pain patients (APTA-Ortho Section)

- Do you believe your education in PT school was sufficient for you to manage chronic pain?
  - 72% PTs - entry-level education in pain management was very inadequate to handle chronic pain (APTA-Ortho Section)
What is Pain?

Pain
An unpleasant sensory and emotional experience that is associated with actual or potential tissue damage or described in terms as such (IASP)

Chronic Pain
Pain that outlasts normal tissue healing time or after noxious stimulus is no longer active (IASP)

Pain Research Program
IASP=International Association for the Study of Pain
Which person is in pain?
Dimensions of Pain

- **Sensory Discriminative**
  - Location
  - Magnitude
  - Duration
  - Quality

- **Motivational Affective**
  - Unpleasantness
  - Emotional component

- **Cognitive Evaluative**
  - past experiences
  - probability of outcome
Clinical Problem: Chronic Muscle Pain

- IOM Report 2011
  - 116 million US adults
  - Costs society at least $560–635 billion annually (chronic pain)
  - Chronic pain is a disease

- Chronic musculoskeletal pain affects up to 30-50% US population

- Treatment for musculoskeletal pain is not adequate

- Most chronic muscle pain not associated with distinct muscle injury or inflammation

Against the Barrier to Life
Judith Ann Seabrook
painexhibit.com
Pain is Common and Widespread

- **Pain free** in last 7 days
  - Female: 23%
  - Male: 38%
- **Pain in one spot** only
  - Female: 15%
  - Male: 18%
- **Pain in ≥ 5 spots**
  - Female: 23%
  - Male: 11%

Sex Differences in Chronic Pain

- Prevalence greater in women
  - Osteoarthritis
  - Rheumatoid Arthritis
  - Fibromyalgia
  - Low Back Pain/Neck Pain

- Muscle Pain
  - more common
  - more widespread
  - greater intensity
CHRONIC PAIN IS A DISEASE
Founding Father of Pain Management and Research
John Bonica

- John Bonica
  - 1953 The Management of Pain first edition published
  - 1960 First interdisciplinary pain management clinic at the University of Washington led by John Loeser a psychologist
  - Promoted chronic pain as a disease
  - Founded the International Association for the Study of Pain (IASP)
  - Founded the American Pain Society (Chapter of IASP)
  - 1990 The Management of Pain, second edition published

“John Bonica was a unique and great man who made pain management a subject of scientific and clinical importance, and he did it by himself. He was a major force in the development of this field.” - John Loeser
# Mechanism-based approach to pain

## Nociceptive (peripheral driver)
- Inflammation, injury or mechanical damage
  - Examples: Osteoarthritis, Rheumatoid arthritis, Myofascial pain

## Neuropathic
- Damage or entrapment of peripheral nerves
  - Examples: Carpal tunnel syndrome, Diabetic neuropathy, Postherpetic neuralgia

## Central (non-nociceptive)
- Central amplification of pain processing
  - Examples: Fibromyalgia, TMD, Non-specific low back pain
Biopsychosocial Model

- Alternative to the Biomedical Model
- Takes patient and patient experiences into account
- Recognizes that pain is influenced by psychosocial factors
- Model Proposed 1980’s (Loeser, Turk)
- Psychological approaches for pain 1950s (Fodyce, Loeser)
Nociceptors

- damage/threatened damage to skin

- principal nociceptors (cutaneous):
  - Aδ- mechanonociceptors
  - C polymodal nociceptors
  - silent (sleeping) nociceptors

- defining characteristic: they sensitize
Central Neurons

- Multiple sites involved
  - Cortical
  - Brainstem
  - Spinal Cord

- Plastic

- Nociceptive specific

- Multimodal

- Sensitize
What is Sensitization?

- Definition: Increased responsiveness of nociceptive neurons to their normal input, and/or recruitment of a response to normally subthreshold inputs (www.iasp-pain.org)

- Peripheral Sensitization - nociceptors

- Central Sensitization - nociceptive neurons
  - www.iasp-pain.org, IASP
- Enhanced nociceptor activity
- Enhanced input to central neurons
- Activation of cortical sites
- Pain
  - Sensory
  - Emotional
Peripheral and Central Neurons Sensitize Nociceptor Spinal Cord Neuron

**Nociceptor**
- Decreased Threshold
- Increased Magnitude

**Spinal Cord Neuron**
- Increased Magnitude

Data from work by the laboratories of Brennan; Schaible; Willis
Central Sensitization

- **1983** First description of central sensitization by Clifford Woolf
  - Enhanced neuronal excitability in pain pathway

- **Current**
  - Central sensitization is now common terminology in both basic science and clinical research
  - Clinicians devising up with ways to measure and assess central excitability
    - Temporal summation
    - Referred pain
    - Secondary hyperalgesia
  - Accepted as a common component of most chronic pain conditions

Injury
Chronic Pain: 
Altered Central Excitability

- Enhanced central excitability
  - Referred pain
  - Secondary Hyperalgesia
  - Enhanced Temporal Summation
  - Widespread pain

- Enhanced in pain conditions
  - Osteoarthritis
  - Fibromyalgia
  - Low back pain
  - Neck pain
Signs of Central Involvement

- **Pain**
  - Widespread
  - No injury
  - Out of proportion to injury

- **Fatigue**
  - Physical
  - Mental

- **Sleep Disturbances**

- **Cognitive Dysfunction**

Central Inhibition of Pain

- Cortical and brainstem sites inhibit pain
  - Insular and cingulate cortex
  - Amygdala
  - PAG-RVM-spinal cord

- Endogenous opioids located in these sites

- Stimulation inhibits nociceptive responses and pain
  - Animals
  - Humans
1960s

- 1969 Discovery of descending inhibition by Reynolds
- Current: Conditioned Pain Modulation
  - Test of integrity of central inhibitory pathways
  - Inhibition of pain in response to a noxious stimuli outside the site of injury
  - Reduced in patients with chronic pain
Multiple stimuli or stressor
- Tissue insult
- Fatigue
- Physical Inactivity
- Stress/Anxiety
- Depression
- Obesity
- SLEEP

Chronic Pain

Disturbances in other systems
- SLEEP
- Fatigue
- Physical Inactivity
- Depression
- Stress/Anxiety

Chronic pain
Increased risk in females

Increased risk in females
Transition from Acute to Chronic Pain

- Changes in nociceptor pathways
  - Nociceptor
  - Spinal neurons
  - Brainstem sites
    - Midbrain: PAG
    - Pons: parabrachial nuclei/Locus coeruleus
    - Medulla: RVM (NRM)
  - Cortical sites
    - Somatosensory cortex
    - Prefrontal cortex
    - Amygdala
    - Insular cortex
    - Cingulate cortex
Psychosocial Factors

- Perception and presentation of pain
- Response to treatment
- Transition from acute to chronic pain

Catastrophizing
Fear of Movement
Anxiety
Self-efficacy
Depression
Social Support
Pain catastrophizing

- Set of negative cognitions, emotions, attitudes and beliefs related to pain
- Ruminate about their pain
- Magnify pain
- Feel helpless to manage pain
  - I worry all the time about whether the pain will end
  - It’s awful and I feel that it overwhelms me
  - I become afraid that the pain will get worse

Sullivan and colleagues
Concerns

- High Pain Catastrophizing
  - Increased pain
  - Fibromyalgia
  - Low Back Pain
  - Osteoarthritis
  - Higher pain and more disability postoperatively
  - OA/TKA
  - More widespread pain
  - Fibromyalgia

- Leads to stress, avoidance, and fear responses to the pain

- In healthy controls-cold water bath pain stimulus
  - Increased PCS
  - Increased level of IL-6, in those with high PCS
Fear of Movement/Pain

- Beliefs about how physical activity affect pain
- Leads to sedentary lifestyle
- Reduced physical fitness
- Fear Avoidance Questionnaire, Tampa Scale of Kinesiophobia
Fear of Movement/Pain

- **Fear Avoidance Beliefs Questionnaire**
  - Beliefs about how physical activity and work affect their current low back pain
    - My work might harm my back
    - My pain was caused by physical activity
    - Physical activity might harm my back

- **Tampa Scale of Kinesiophobia**
  - Measures fear of pain and movement
    - I’m afraid that I might injury myself if I exercise
    - My body is telling me I have something dangerously wrong
    - Although my condition is painful, I would be better off if I were physically active
    - I can’t do all the things normal people do because it’s too easy for me to get injured
Concerns

• Fear of Pain and Movement
  ○ Higher fear decreased physical performance
  ○ Higher fear increased disability
  ○ True for Acute and Chronic Pain

○ Treat with Education and Exercise (slow progression)
Chronic Neck Pain

- Non-symptomatic at 6 months
  - Better self-efficacy
    - Lower disability
    - Different coping strategies
    - Better compliance with exercise program
    - TREATMENT: home exercise on strength and ROM, relaxation, advice

Sterling; Thomas Graven-Nielsen; Soderland;
Identify Predictors
Identify Mechanisms
Identify Psychosocial Factors
Assessment: Peripheral Mechanisms

- **Peripheral**
  - Acute Injury
  - Localized pain
  - Primary Hyperalgesia
Assessment: Neuropathic Mechanisms

- Signs and Symptoms
- Allodynia
- PainDETECT
  - Is light touching ever painful?
  - Do you suffer from a burning sensation?
  - Does your pain radiate to other areas of your body?
Assessment: Central Mechanisms

- Pain that outlasts normal tissue healing time
- Referred pain
- Secondary hyperalgesia and allodynia
- Enhanced temporal summation
- Widespread pain
- Fatigue
- Sleep disturbances
- Mood changes
- Conditioned Pain Modulation
Assessment: Psychosocial and Predictors

- **Scales**
  - Pain Catastrophizing
  - Fear of Movement and Pain
  - Self-efficacy

- **Screen**
  - Depression
  - Anxiety
  - Stress
  - Obesity
  - Activity

- **Other scales and screening questionnaires**
  - Start Back
  - Are you afraid of harm? Afraid of physical activity?
Fill out Biopsychosocial Worksheets
Management of Chronic Pain

- Mechanism based
- Patient is an active participant
- Change behavior
- Provide self-management skills
- Patient centered, function oriented goals
Mechanism-Based Pain Management

- Decrease Peripheral Excitability
  - Exercise
  - TENS
  - Cold/Ice
  - Heat/US

- Decrease Central Excitability
  - Education
  - Exercise
  - TENS

- Increase Central Inhibition
  - Education
  - Exercise
  - TENS
  - Joint Manipulation
  - Ice bath
Mechanism-Based Pain Management

- **Decrease Fear, catastrophizing**
  - Education
  - Exercise
  - Behavior Changes

- **Modification of Predictors**
  - Education
  - Exercise
  - Behavior changes
How to treat fear and catastrophizing

- **Education**
  - Disease process - central sensitization, chronic pain mechanisms
  - Remaining active
  - Pain Coping Skills
  - Recognition of pain response to movement and activity
  - Active management plan
    - What do if your pain gets worse and sets you back?
    - What do you do if you are doing really well?

- **Graded activity increases**

- **Psychology referral**
  - Cognitive Behavioral Therapy
Psychosocial Factors

Peripheral Sensitization
InCREASED Excitability
Central Sensitization
Decreased Inhibition
Chronic Pain
Case I

- A 59 year-old Hispanic female is referred to you for treatment of whiplash after being rear-ended by another vehicle while she was stopped at a light, 2 weeks ago. Neither vehicle sustained damage beyond minor scratches. The patient reports that although she was “very shaken up” immediately after the accident, she did not think she had suffered any injuries. Within a few days, however, she developed severe neck pain and began to experience throbbing headaches that are generally accompanied by fatigue.

- She describes her pain as aching and says that it sometimes produces shooting and sharp pain in the upper arms and neck, which frightens her. As the day progresses, she feels that her head becomes very heavy. The patient reports that these symptoms are debilitating, and she is afraid that they will have a long-lasting impact on her active and very social lifestyle.
Case I

- In addition, she cares for her young grandchildren during the week. Her children have had to find alternative caretakers for the kids, which is expensive. She is very worried about her financial situation and, making matters worse, the driver who hit her did not have insurance. She has not driven herself since the accident, and even being a passenger in a car makes her nervous. When talking with her you notice she holds her head very still and moves her whole body to face you instead of the head.

- Upon examination, you find that her posterior neck feels spongy and is very tender. The patient has very limited range of motion and extending her neck causes her a great deal of pain. She is able to move her arms and shoulders, but she reports that she has moderate pain in her upper back and shoulders that sometimes seems to extend to her upper arms. You do not find any evidence for cranial nerve involvement. The patient states that her pain is a 3/10 at best, a 9/10 at worst, and tends to be 6/10 during the day.
A 42 year-old African American male comes to you after his brother-in-law encourages him to make an appointment. He reports that he has been experiencing progressively worsening lower back pain for several months, despite not having had an initiating injury. Six weeks ago his primary care physician diagnosed bulging disks at L4-L5 and L3-L4 on MRI and prescribed NSAIDs and, when they were ineffective, tramadol. The patient reports that his doctor suggested that the pain is simply a part of getting older, and that he will likely have to learn to live with it. While discussing his concerns with his family, his brother-in-law recommended that he visit a PT for a second opinion.
As you discuss your patient’s history, you discover that he has intermittent mild pain that is widespread. He specifically cites occasional sharp shoulder pain that may radiate down his arm, and says that he has experienced numbness in his lower arm during episodes of shoulder pain. He is a career businessman with a high level of education and is the sole breadwinner. He continues to work without excessive increases in pain. His wife stays home to care for their teenage children, and he describes his family life as happy and rewarding. There are no signs of depression or anxiety, and you feel that your patient has a healthy outlook on dealing with his pain. His lowest pain rating is a 2/10, his highest is 7/10, and he says that throughout the day his pain rating will be about a 4/10. His low back pain worsens with prolonged sitting and is greatly improved when he is able to exercise regularly. He goes to the gym 2-3x per week where he exercises by performing light weight strengthening of his upper limbs and legs, and bikes for 30 minutes.
A 50 year-old Caucasian male is referred to you for examination of his left knee. His primary care physician has diagnosed grade II osteoarthritis in his left knee, but has not been able to provide effective therapy and the patient is clearly frustrated. He states repeatedly that he shouldn’t have to suffer with chronic pain, and he’s sure that his physician would have provided better treatment (specifically, prescription pain medication) if he wasn’t a Medicaid patient. You learn that the patient is recently divorced, and that he had to move to a second-floor apartment. There is no elevator in his complex, and in order to do laundry he must carry his clothes to the basement. He feels that his quality of life is worsening, and he doesn’t have much hope that he will be able to manage his pain.
Case III

• Upon examination, you find that the knee has some swelling and is moderately tender. Range of motion is not significantly limited, and you find no evidence of advanced deterioration of the joint. The patient reports that his pain is at its lowest in the morning (score: 2/10) and worsens as the day progresses (average score: 6/10). His pain rating is highest when using the stairs (score: 8/10). You find that temporal summation to pressure on the knee is increased and that DNIC testing does not provide relief. You also note that the patient has a BMI greater than 30.
How to assess?

‘Start Back Tool’, Generic Condition Tool

The Generic Condition Screening Tool
Patient name: _______________________________ Date: ______________
Thinking about the last 2 weeks tick your response to the following questions:

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<thead>
<tr>
<th></th>
<th>Disagree</th>
<th>Agree</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>It’s really not safe for a person with a condition like mine to be physically active</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Worrying thoughts have been going through my mind a lot of the time in the last 2 weeks</td>
<td>□</td>
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<tr>
<td>3</td>
<td>I feel that my problem is terrible and that it’s never going to get any better</td>
<td>□</td>
</tr>
<tr>
<td>4</td>
<td>In general in the last 2 weeks, I have not enjoyed all the things I used to enjoy</td>
<td>□</td>
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5. Overall, how bothersome has your condition been in the last 2 weeks?

<table>
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<tr>
<th>Not at all</th>
<th>Slightly</th>
<th>Moderately</th>
<th>Very much</th>
<th>Extremely</th>
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Score ______________

Distressed if score is 4 or more.