Educating Patients on the Physiology of Central Sensitization and the Neurochemical Relationship to Chronic Pain

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Friday, September 9, 2016

Conflict of Interest Disclosure

Authors Conflicts of Interest

A. Mary  No Conflict of Interest
B. Connie No Conflict of Interest

Objectives

After attending this session the learner will be able to

1. Define chronic pain mechanisms, central sensitization (CS) and other neurochemical processes
2. Relate the connection between patients’ understanding of the physiological aspects of their symptoms to their ability to improve symptoms by making behavior changes
3. Describe ways to help patients re-conceptualize their experience of pain/symptoms, by turning their focus to the development of coping skills, promoting quality of life
Introduction

• “I’m not crazy”
• Why are we so convinced about the importance of this?
• Comments from patient evaluation forms

Review of Chronic Pain Mechanisms

• Acute vs Chronic
• Wind-up and Recruiting as factors
• Role of Neurochemicals
• Contributing Factors

Acute Pain

1. Pain nerve stimulated by damage
2. Message travels to spinal cord
3. Spinal cord amplifies or reduces message to brain using neurochemicals
4. Message is sent to sensation, thinking, emotional parts of brain
Chronic Pain
1. Pain nerves too easily stimulated, or misfire (with or without injury)
2. Nerve connections are altered; recruitment
3. Spinal cord does not reduce messages or over amplifies messages
4. More pain pathways, more neuronal activity = increased and more chronic pain

What Starts the Process…?

Genetic Predisposition
Poor Sleep
Physical Trauma - Peripheral Nociception
Infections Inflammation
Other Factors
Hyper-excitement of Central Neurons
Central Sensitization
ANS Dysfunction
Psychological Factors – Stress
Neonatal or Childhood Trauma
Environmental Noise Chemicals Others

Modified from Yunus 2007, Simplified bio-psycho-social model
Central Sensitivity Syndromes

- Fibromyalgia
- POTS
- RLS
- TMJ
- IBS
- Interstitial cystitis
- Migraines/Headaches
- Chronic Fatigue
- Other Pain problems
- Depression/Anxiety
- PTSD
- Multiple chemical sensitivities

Stress

- Normal part of life
- Reaction to an event, not the event itself
- Meant to be temporary
- Body responds by facing challenge with release of hormones—“Fight or Flight”

Autonomic Nervous System

- Sympathetic
  - Initiates stress response
- Parasympathetic
  - Initiates relaxation response
- Balance is disturbed by chronic stress
Effects of Chronic Stress

Breaking Point
Stress Level Response

Stress Signals

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Chemical Changes In Central Sensitization

PAIN AFFERENTS
Glutamate
Substance P
Calcium
Increased

Increased CCK-mediated Opioid antagonism

Perceived Pain

Ascended input to brain

Pain transmitting to spinal cord

Descending modulation

Source of pain

CENTRAL

MIDAS activation
Endogenous opioids
Serotonin
SN1224 up-regulation
Noradrenergic changes
Dopaminergic changes

Google Images
Review of Central Sensitization

• CS represents enhancement in the function of neurons and circuits in nociceptive pathways caused by increases in membrane excitability as well as reduced inhibition

Latremoliere & Woolf 2009

Review of Central Sensitization
Patient Education Verbiage

• Increase in the excitability of neurons within the central nervous system (spine and brain)

• Results in an abnormal enhancement of pain and general hypersensitivity
Sensitivities
Heightened response to any stimuli:
• Light
• Sounds
• Smells
• Stress
• Touch
• Foods
• Medications
• Pain

How Can Bodies just Change?

Neuroplasticity
• Changing the structure, strength, organization, and function of neurons in response to experiences
• "Neurons that fire together, wire together"
• Axonal and Dendritic sprouting and pruning
Recruitment: Neuroanatomic Spreading

Review of Central Sensitization

When neurons in the dorsal horn spinal cord are subject to CS, they exhibit some or all of these:

- development of or increases in spontaneous activity
- increased responses to suprathreshold stimulation

Adapted from Nils J, et al. 2011

Latremoliere & Woolf 2009
Review of Central Sensitization

When neurons in the dorsal horn spinal cord are subject to CS, they exhibit some or all of these:

➢ pain is exaggerated and prolonged in response to noxious stimuli
➢ there is reduction of the threshold for activation by peripheral stimuli
➢ pain spreads beyond the site of injury with enlargement of receptive field

Latremoliere & Woolf 2009

What this looks like in the office or hospital room:

• Pain that comes on without any triggering event
• Patients complaining about high levels of pain from experiences that shouldn’t cause pain at all, or minimal pain if any

What this looks like in the office or hospital room:

• Patients complaining of diffuse pain in an area that used to be very defined
• Pain doesn’t dissipate as quickly as it once did
• Multiple complaints that seem to be unrelated to pain

In other words:
Behavioral amplification

- Hypervigilance
- Conditioning / Anxiety

Symptoms:
- Visceral pain
- Myofascial pain
- Headache
- Chronic Fatigue

Visceral sensation

Nociceptor sensitization

Hypothalamus (stress response)

Periaqueductal gray (pain modulation)

Benarroch 2012 Mayo Clinic Proceedings

Garcia-Larrea and Peyron's Proposed Pain Matrix

Why Teaching CS Matters

• Fear of the unknown or the undiagnosed escalates maladaptive illness perceptions, and keeps them focused down the road of “WHY” or “How can I fix this?”

• The thalamus and memory impacts perception and response to pain

• Catastrophizing, somatization, kinesiophobia, and avoidance all influence pain perception via modulation of the descending pain pathways

(Hooten, 2016, Mayo Clinic Proceedings)
Why Teaching CS Matters

- Acknowledging the organic processes and teaching the science helps to establish trust
- Empowering patients through knowledge of what is going on with their body and giving them tools to change how they approach pain

(Oosterwijck, Meeus et al., 2013; Skula, 2016)

Why Teaching CS Matters

- Action and education also increase motivation and mood
- Studies to underpin face to face education combined with written material

(Oosterwijck, Meeus et al., 2013; Skula, 2016)

Teaching Methods

- Adult learning
- Face to face
- Written materials
- Storytelling
- Hands on practice
- Goal setting to have a plan to go forward
- Leaving with tools in hand
- Processing and motivational enhancement
Teaching Content

- Pain physiology (face to face and written)—studies have shown that written information alone is insufficient
- Supplement with Audio-video material
- Connection with memory and emotions

(3 Tiered Matrix)

Tools for Patient Education
Teaching Content

- Lifestyle and behavioral changes introduced only after the cognitive anchor is established
  - Use of Evidence Based Studies to support

- Relaxation, movement including Tai Chi and yoga, moderation, decrease symptom focus, time management, socialization, positive thinking, CBT

Biofeedback Experience & Stretching

Implications for Clinical Practice

- HCPs’ working knowledge of CS is essential
- Explaining CS and how it effects intensity and range of symptoms has been shown to impact patients’ ability to make positive behavioral changes
- A variety of teaching methods can reach all types of learners
References