The Psychology of Pain

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Relevance

• The attention in pain medicine
  – Pathophysiology
  – Pharmacology
  – Interventions

• Results of treatment
  – “30% improvement at 1 year”
    • Opioids
    • Anti-epileptics
    • Antidepressants
    • Intrathecal therapies
  – Many remain miserable, dysfunctional

• The key, often, is the psyche
Chronic Non-cancer Pain

- Neurobiology
- Psychology
- Environmental contingencies

Biopsychosocial Model

Looks like a duck
Walks like a duck
Quacks like a duck
Not always a duck
Why Does Pain Vary after Identical Lesions?

- Rat models
  - Neuroma
  - Sciatic nerve ligation
- Cross-breeding based on propensity to neuropathic pain
- Same genetic polymorphism(s) determine
  - Spontaneous pain in neuroma
  - Tactile allodynia, tactile hyperalgesia, and heat allodynia in SNL
- Single, recessive gene transmission

Genetic Polymorphism and Pain Perception

- More than 150 genetic polymorphisms have been identified that confer relative resistance or sensitivity to pain
- Variable opioid response correlates with polymorphisms in the gene encoding the μ receptor
  - In animal models, this correlates with pain sensitivity
Functional MRI vs. Subjective Pain Intensity

- Pain intensity ratings
- During functional MRI
- Subjective pain
- 49°C stimulus

Coghill RC et al. PNAS 2003

![Graph showing VAS intensity vs. Subjects Ranked by Sensitivity]

High subjective pain

Anterior cingulate somatosensory cortex

Low subjective pain

Prefrontal cortex

Coghill RC et al. Proc Nat Acad Sci 2003
Implications

- Pain is what the patient says it is?
- When incentives removed from the situation

- “Unexplained pain” ≠ “psychogenic”

- Does (psychic) trauma alter the CNS in such a way as to potentiate pain?
- Would we call that psychogenic?
Early-life Stress → Muscle Hyperalgesia, Nociceptor Sensitization in Adult

- Neonatal rats stressed days 2-9 by limited bedding in cage
- As adults:
  - Lower mechanical nociceptor threshold in skeletal muscle
  - Prolonged hyperalgesia following PGE2


Abuse Produces Nociceptive Sensitization

Abuse hx Non-abused

- 10 IBS patients +10 controls
- Half reported history of abuse
- fMRI and pain ratings obtained during rectal distentions
- Abuse → more pain, more activation

Psychological Modulation of Pain

- Attention, expectations, excitement modulate pain
- Electrical / opioid stimulation of DLF → analgesia
- Activation
  - pain, fear, acupuncture, counterirritation, antidepressants
- Analgesia antagonized by coadministered 5-HT and NE antagonists

Descending Pain Facilitation / Inhibition

- Rostral Ventromedial Medulla (nucleus raphe magnus)
- On cells excite pain receptors
- Off cells inhibit pain receptors
- Opioids disinhibit off cells, inhibit on cells
- May generate pain without peripheral stimulus
- Tasks requiring attention to nociception or to visual cues cause activation of on cells prior to pain stimulus.
- During opioid abstinence, on-cell firing markedly increases

Guyton Medical Physiology, 1996
Attention to Pain Modulates S1 Activity

- Pain-related activity
- Attention directed to painful heat stimulus (Left)
- Or to auditory stimulus (Right)

Amygdala – Inputs

- Nociceptive-specific information from cord and brainstem
- Highly processed information from the thalamus and cortex
- Integrates information, attaching emotional significance to painful stimuli.

Amygdala – Outputs

- Widespread connections with forebrain and brainstem
- Projections to thalamus and cortex may be related to cognitive and conscious components of pain.
- Autonomic and endocrine pain responses via hypothalamus
- Emotional expression and modulation of pain regulated through projections to brainstem pain-modulating system


Visceral Hyperalgesia

- IBS, noncardiac chest pain, nonulcer dyspepsia
- Previously considered psychogenic or due to anxiety
- Now known to result from encoding innocuous stimuli as pain
- Visceral hyperalgesia easier to elicit in genetically high anxiety rats

Gunter WD, et al. Physiol Behav 2000

- Drug response similar to neuropathic pain
  - Doxepin
  - Pregabalin
Visceral Hyperalgesia

- Rat pups
- 3 hrs/d maternal separation postnatal days 2-14
- At 2 mo:
  - ↑ visceromotor responses to colorectal distension
  - ↑ stress-induced fecal pellet output
- Conclusion:
  Early life events predispose to visceral hyperalgesia and increased colonic motility in response to psychological stress


Somatic Hyperalgesia

- Idiopathic CLBP, fibromyalgia
  - Thumb pressure, quantified
  - Patient report
  - fMRI

- Findings
  Both CLBP and fibromyalgia patients
  - Increased pain report vs. controls
  - Increased activation of pain-sensitive brain areas

How did they get this way?

Neurobiology
Psychology
Environmental contingencies

Vigilance / Behavior

- Psychology impacts pain largely through the mediators of vigilance and behavior
- Vigilance augments pain
- Behavior augments deconditioning / disability
Critical Psychological Issues in Pain and Disability

- Pathogenic cognitions
  - Self
  - Condition
  - Others
- Fear
- Incentives
- Axis II

- Psychiatric illness
  - Addiction
  - Depression
  - Anxiety disorders
  - Somatoform disorders
  - Other Axis I

Cognitive Causes of Disability

- Misunderstanding, misinformation
- Inactivity
- Deconditioning
- Cycle of escalating pain, disability

Fitness and education can be curative
Feelings Derive from Beliefs, Perceptions

- The aversive quality of pain is modified by its interpretation
- Catastrophic interpretations worsen pain and hinder coping


- My nerves are being crushed.
- These exercises must be tearing something loose.
Pathogenic Cognitions – Negative

- Pain
  - Mysterious
  - Indicative of body damage
- Self
  - Helpless
  - Fragile
- The world
  - Indifferent – hostile
  - Without opportunity

Fault / Blame

- 200 chronic pain patients
- "Who do you think is at fault for your pain?"
  - employer
  - other
  - no one
- Blamers:
  - ↑ mood distress, behavioral disturbance
  - ↓ past treatment response, expectation of future benefit
- Bosses’ fault worse than other-fault (primarily doctors, other drivers)

DeGood DE, Kiernan B. Pain;64(1), 1996
Acceptance

• A disengagement from the struggle and an engagement in positive everyday activities.
  McCracken & Eccleston, Pain 2003

• N = 230 pain center assessments
  – Acceptance correlated with less
  – Pain
  – Depression
  – Anxiety
  – Physical, social, work disability
  – Downtime

  L.M. McCracken, C. Eccleston; Pain 105, 2003

“I had an epiphany.”
Fear

- Belief that hurtful = harmful
- Fosters deconditioning
- Fear of self injury $\rightarrow$ kinesophobia
- Incentive for disability, pain behavior

Mood and Pain

- Anxiety
- Depression
- Anger
Profile of Mood States
Ratings > Moderate

- Pain rehabilitation admissions
- n=300
- Rated moods
  - Not at all
  - A little
  - Moderately
  - Quite a bit
  - Extremely

Covington EC. Unpublished data 2002

Mood Modulates Pain

- Mood induction by reading
  - Tolerance to experimental pain
    - Increased by induction of elation
    - Diminished by induction of sadness

- Similar effects of hypnotically induced mood states
Psychiatric illness in CPPs

- 200 CLBP patients entering functional restoration
- Structured psychiatric interview
  - 59% had current symptoms of ≥ 1 psychiatric diagnosis (excluding somatoform pain disorder)
  - Most common:
    - major depression (45%)
    - substance abuse (19%)
    - anxiety disorders (16%)

Polatin PB, et al. Spine 1993

In LBP, Psychiatric History Predicts Chronification

- Prospective cohort study
- N = 140 men with first onset LBP
- Diagnostic Interview Schedule (DIS-III-R) 8 wks post pain onset
- Predictors of pain and perceived disability at 6 months
  - Lifetime history of major depressive disorder
    - OR = 4.99
  - Lifetime generalized anxiety
    - OR = 2.45
  - Post-traumatic stress
    - OR = 3.23
  - Current nicotine dependence
    - OR = 2.49

Shaw WS et al. Pain Medicine 2010;11(9):1391-1400
Persistent Postop Pain

• Ss: 632 TKR, 662 THR
  – 44% of TKR patients and 27% of THR patients reported persistent postop pain
  – 15% of TKR patients and 6% of THR patients reported severe-extreme

<table>
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<tr>
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<th>THA odds ratio</th>
<th>95% CI</th>
<th>TKA odds ratio</th>
<th>95% CI</th>
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<td>1.12–1.43</td>
<td>1.29</td>
<td>1.17–1.43</td>
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<tr>
<td>1–2 pain problems</td>
<td>2.57</td>
<td>1.11–5.92</td>
<td>3.48</td>
<td>1.63–7.41</td>
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<tr>
<td>3–4 pain problems</td>
<td>7.02</td>
<td>3.01–16.24</td>
<td>8.45</td>
<td>3.89–18.35</td>
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Depression and Pain Mutually Reinforcing

• N = 483 neurology outpatients
• Evaluated at 0, 3, 12 mo
• Depression severity at f/u predicted by
  – Baseline depression severity
  – Baseline pain severity
  – Lack of pain improvement
• Pain severity at follow-up predicted by
  – Baseline pain
  – Depression severity
  – Lack of depression improvement

• Conclusion:
  Pain is more persistent in depression, and vice versa

Pain and Sleep – Reciprocal Relationship

• N = 28 hospitalized burn patients
  – 5 consecutive observations
  – Night of poor sleep was followed by more pain
  – Day of pain did not predict night of poor sleep
    Raymond I et al., Pain 2001

• Stimuli that disrupt SWS → musculoskeletal pain, tenderness, and fatigue in normal healthy subjects.
  Moldofsky H, Sleep Medicine Reviews, 2001

• REM deprivation increases pain sensitivity in the rat.
  Hakki Onen S, et al., Brain Res. 2001

Pain / Mood / Sleep Interaction

Pain / Depression / Anxiety / Sleep disruption
Psychiatric Hurdles

Addiction & Somatization

Addiction is Epidemic Among Opioid Users

- N = 705 long-term opioid users
  - Randomly selected from electronic records of Geisinger Health System
- Structured diagnostic interviews
- Lifetime DSM-5 opioid-use disorder = 34.9%
- Lifetime DSM-4 opioid-use disorder = 35.5%

Dilemma of Addiction Diagnosis

• Ignore a treatable, potentially fatal condition

• Add insult to injury

• Bottom line:
  Significant lasting help for pain is unlikely absent addiction recovery
“Psychogenic Pain”

- Psychogenic "experience" may be tautologous
- Facile explanation for mysterious conditions
- Software vs. hardware
- When pain behavior does not reflect activity in pain transmission pathways, it will fail to respond to their "correction"
  - surgery, drugs, cord stimulation

Clues to Non-organic Pain Complaints

- Unexplained dysfunction, impairment
  - Back patient can't complete paper work
- Extreme somatic preoccupation
  - Unable to redirect from symptoms, doctors, treatments
- Inconsistencies - with time, audience, anatomy
- Pain disproportionate to disease?
  - Sensitization, central and peripheral
Response to Extreme Trauma

- N = 520 traumatized subjects
- Assessed for PTSD, dissociation, somatization, affect dysregulation
- All 4 highly interrelated
- Scores
  - Disaster victims < adult interpersonal trauma < childhood trauma
- Conclusions
  - Spectrum of responses to trauma: PTSD, dissociation, somatization, affect dysregulation

How did they get this way?

Neurobiology
Psychology
Environmental contingencies

Pain as Behavior – Operant Conditioning

• Behavior rewarded is behavior repeated

• Behaviors not reinforced are "extinguished"

• It has to be that way

• Changes often occur without awareness of subject or person who reinforces
  – Enabling
Predictors of LBP Onset

• 1,412 pain-free employees x 12 mo
• Primary care records monitored
• Odds of LBP
  – Dissatisfied with work – doubled
  – Perceive income as inadequacy – odds ratio 3.6
  – Social class IV/V – odds ratio 4.8


Radiculopathy Outcome

• Acute radicular pain + disc prolapse/protrusion
• N = 111
• Application for retirement at 6 months was best predicted by depression and daily hassles at work
• The only predictive somatic factor was degree of disc displacement
  – The less the displacement, the worse the outcome

Gain as a Prognostic Sign

- Meta-analysis: compensation \( \alpha \) pain
- 136 comparisons: 3,802 patients – 3,849 controls
- Pain clinic type patients
- Compensated patients:
  - reduced medical / surgical treatment efficacy
  - less education
  - more pain
- Illness severity did not appear to explain, though not entirely ruled out.


Weekly Wages Predict Return to Work

Reinforcement Promotes Pain Behavior – and Pain Perception?

- Patients with low back pain
  Known to have a solicitous spouse
- Noxious electrical stimulation given
- Measured pain intensity and cingulate activation by EEG
- The presence of the solicitous spouse
  - increased pain intensity
  - > doubled cingulate activation from the electrical stimulus
  - when the stimulus was presented to the back, but not to the finger


Gains and Losses

Security  Pride
Nurture  Camaraderie
Safety  Identity
Stress reduction  Money
Drugs  Future
Money  Hope
Gains
Losses
Psychological Interventions
Somatic Presentation of Anxiety and Depression

- International study of 1146 patients with major depression
  - 69% reported only physical symptoms as the reason for the visit
    - % with pain not specified
    - typical symptoms: "headache, constipation, weakness, back pain"

- Canadian family practice
  - 76% of patients diagnosed with depression or anxiety made “somatic presentations”
    - Kirmayer LJ et al., Am J Psychiatry 1993

Major Depression

![Pie chart showing 69% Somatic and 31% Non-somatic]

Depression or Anxiety

![Pie chart showing 76% Somatic and 24% Non-somatic]

Multifactorial Illness / Multifactorial Treatment

- Fitness
  - Restore function
  - Normalize mood

- Psychotherapy
  - Improve coping
  - Treat depression/anxiety

- Pharmacotherapy
  - Analgesic
  - Anxiolytic
  - Antidepressant

Regardless of which came first
### Treatment Targets

- **Pain**
- **Function**
  - Work, play, socialization, sex
- **Affect**
  - Depression, anger, anxiety
- **Inappropriate health care seeking**
- **Psychiatric / Addictive disorder**

### Education for Patient and Family

A man with a watch knows what time it is.  
A man with 2 watches is never quite sure.

- Enabling usually results from faulty beliefs, information
- Uncertainty, misconceptions increase pain, debility
- **Teach:**  
  - Physiology of the pain  
  - What the pain means  
  - Pain is real but benign  
  - Distinguish hurt from harm
Fitness – Essential Psychotherapy

• Best documented
  – Mild to moderate unipolar depression
  – Chronic fatigue

• Probably beneficial
  – Panic
  – GAD
  – Conversion/somatoform disorder
  – Alcohol abuse


Reconditioning PT

• Counteracts learned helplessness
• Decreases fear of injury
• Gives realistic hope
• Restores access to lost gratification
Self Regulation Training

- Techniques
  - Biofeedback training
  - Yoga
  - Guided imagery
  - Transcendental meditation
  - Progressive muscular relaxation
  - Autogenic training
  - Self-hypnosis

- Targets
  - Anxiety
  - Anger
  - Autonomic arousal
  - Skeletal muscle tension

“I'm learning how to relax, doctor—but I want to relax better and faster! I want to be on the cutting edge of relaxation!”
BFT in Chronic Pain - Review

- Usually as effective as other relaxation strategies
- Outcomes correlate poorly with physiologic changes
- Headache - 60 studies, 2,445 patients, efficacy ~ propranolol
- Musculoskeletal pain - almost as effective as for headache
- Neuropathic pain - unclear
- GI pain - effective for IBS
- Changes patient’s view of symptom and its meaning

Douglas E. DeGood, APS Bulletin 3(3), 1993

Mindfulness Meditation

- 3 days training
  - 20 min/d
- High vs low pain stimulus
- Reading vs math task vs meditation

Behavior Modification

- Consistent reinforcement of well behaviors
- Avoid reinforcing illness behavior
- Reward small successes, not great efforts
- Distinguish help from enabling
- Promotes functional restoration, distraction from pain, mood normalization, quality of life

Train Families / Staff

- Help can harm
- Enabling
  - Patient tends to regress
- Help
  - Patient tends to progress
- Ignore maladaptive behaviors
  - Not people
- Reward desirable behavior vs. punish undesirable
Psychotherapies

- Cognitive
- Psychodrama
- Gestalt techniques
- Assertiveness
- Coping skills

- Individual
- Group
- Vocational counseling
- Chemical dependency
- Family

She says she was trying acupuncture in an attempt to relieve his chronic headaches.
Instruction Manual for Families of CNCP Patients

Pain is neurology
Behavior is psychology

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<th>Do</th>
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Addiction Treatment

- Untreated addictive disorder renders pain interventions futile
- Strategies
  - Counseling
  - 12-step meetings
  - Sponsor
  - Pharmacotherapy
    - Campral
    - Naltrexone
    - Antabuse
Rational Polypharmacy

• Most chronic pain patients will be on multiple drugs

• Choosing analgesics with psychotropic effects
  – Reduces side effects
  – Reduces interactions
  – Reduces cost
  – Improves compliance

Antidepressant
- SSRIs
- TCA
- SNRI

Anxiolytic
- Benzodiazepines
- TCAs
- SSRIs
- Bupropion

Analgesic
- NSAIDs
- Local anesthetics
- Topical
- Antiarrhythmics
- Opioids

Parsimonious Polypharmacy
Multidisciplinary Pain Management Program - Typical Components

- Education
- Reconditioning PT
- Medications
- Nerve blocks
- Biofeedback / relaxation training
- Operant conditioning
- Psychotherapies
- Chemical dependence treatment
- TENS
- Detoxification / weaning
- Treatment of psychiatric comorbidity

Effects of MPC Treatment – Review

- 14-60% pain reduction
- Up to 73% decrease opioid use
- Dramatic increases in activity levels
- 43% more working after rx than before, twice the untreated rate
- 90% reduction in physician visits (1study)
- 50 - 65% fewer surgeries than untreated patients
- 65% fewer hospitalizations than untreated
- 35% fewer on disability

Turk, D in Pain Treatment Centers at the Crossroads; 1995
Economic Effects of MPC Treatment

• 27 fewer surgeries/100 pts = $4050 saved per patient (@15k/op)
• Annual medical costs:
  – Average $13,000+ medical costs/yr pre treatment
  – Average $5,600 in yr after treatment
  – $7,700 / yr / patient saved following treatment
• $400,000 saved / person removed from permanent disability

Turk, D in Campbell, Cohen: Pain Treatment Centers at the Crossroads: A Practical Conceptual Reappraisal IASP Press 1996

Multidisciplinary Rehabilitation Programs – 10 year f/u

• N = 214 patients
• 10 years post MPRP treatment
  – RCT
  – PT, CBT, and vocational rehabilitation vs treatment-as-usual
• Ss in MPRPs had 43 fewer days sick leave vs treated-as-usual

Self-Help Organizations

• American Chronic Pain Association
  – Support
  – Exercises
  – Relaxation
  – Assertiveness
  – Coping skills
  – Escape from the patient role

Conclusions

• In chronic pain, the psyche always plays a role – asset or liability
  – When the psyche defeats appropriate pain care
  – Psychological interventions can reverse this

• With successful treatment chronic pain patients and families commonly experience a sense of rebirth after having their lives "on hold" for years.

• Successful management enables them to live better and suffer less, even when pain is intractable.

• Selecting psychotropics with analgesic properties minimizes toxicity, maximizes benefit