Neuropathic Pain and Pain Management Options

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International Association for the Study of Pain (IASP): Definition of Pain

• “Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage”
Multiple Types of Pain

A. Nociceptive Pain
   Noxious Peripheral Stimuli → Nociceptor Sensory Neuron → Brain

B. Inflammatory/Joint Related Pain
   Inflammation → Tissue Damage → Nociceptor Sensory Neuron → Brain

C. Neuropathic Pain
   Peripheral Nerve Damage → Multiple Mechanisms → Brain

D. Noninflammatory/Non-neuropathic Pain
   Normal Peripheral Tissue and Nerves → Abnormal Central Processing → Brain

Processing of Pain in the Brain Occurs in Several Regions

- Somatosensory cortex
- Insular cortex
- Prefrontal cortex
- Thalamus
- Anterior cingulate cortex
- Hippocampus
- Amygdala

Image courtesy of Apollo Macom.
Pain Sufferers in the U.S.

Estimated Incidence*

- Pain: 26%
- Diabetes: 7%
- Coronary Heart Disease & Stroke: 6%
- Cancer: 0.4%
Pain Sufferers in the U.S.

Pain duration, 1999-2002

- **20-44 years**
  - 25% reported pain

- **45-64 years**
  - 30% reported pain

- **65 years and over**
  - 21% reported pain

**Sources:** Centers for Disease Control and Prevention, National Center for Health Statistics, *Health, United States, 2006*, Figure 29. Data from the National Health and Nutrition Examination Survey.
Common Myths About Chronic Pain

• There is no standard of care to treat pain.

• Everybody gets addicted to pain medication.

• Patients just have to live with their pain.

• All pain patients have psychological issues.
What Is Chronic Pain?

• Pain that has lasted for more than 6 months, in general with significant psychological and emotional features, limiting a person’s ability to fully function.

• Types of chronic pain:
  – Nociceptive
  – Neuropathic
  – Mixed
Neuropathic Pain

• The result of an injury or malfunction in the:
  – Peripheral nervous system
  – Central nervous system

• Examples:
  – Lumbar radiculopathy (sciatica)
  – CRPS/RSD/causalgia (nerve trauma)
  – Peripheral neuropathy (widespread nerve damage)
  – Entrapment neuropathy (carpal tunnel syndrome)
  – Post-herpetic (post-shingles) neuralgia
  – Phantom limb pain
How is pain measured?

• Pain scales
  – Visual Analog Scale (VAS) is a measurement instrument that tries to measure a characteristic or attitude that is believed to range across a continuum of values and cannot easily be directly measured*.
  – The amount of pain that a patient feels ranges across a continuum from none to an extreme amount of pain.

• Psychological testing
  – Measure the psychological impact and the disability produced by the pain symptoms.

Importance of Effective Pain Management

• Poorly managed pain can result in:
  – Chronic debilitated state
  – Chronic medication with increasing doses
  – Deconditioning of muscle groups
  – Repetitive tests
  – Psychological deterioration

• Quick reversal is important
  – Get pain under control within 5-7 days
  – Start rehabilitation after pain is under control
Treating pain requires teamwork

- Primary Care Physician
- Pain Management Specialist
- Psychologist/Psychiatrist
- Rehabilitation Specialist
- Physical Therapist
- Nurse
Pain management continuum: a flexible approach

NSAIDs and over-the-counter drugs

- Standard treatment option
- Typically the first line of treatment
- Acetaminophen (Tylenol)
- Non-steroidal anti-inflammatory drugs:
  - OTC: ibuprofen, Aleve, Advil, aspirin
  - By prescription: Celebrex, Mobic, Zipsor
  - Side effects
  - Caution if taken with aspirin
Pain management continuum: a flexible approach

Physical Therapy/Modalities

• Physical therapy:
  – Stimulates the body to release its own natural pain endorphins.
  – Promotes strength, flexibility, endurance and relaxation.

• Chiropractor:
  – Adjustments/manipulation
  – Spinal decompression
  – Massage therapy

• Modalities:
  – TENS (transcutaneous electrical nerve stimulation). Low voltage electrical impulses transmitted via patch electrodes placed on the skin.
  – Ultrasound-driven medications in the painful areas.
  – Desensitization therapy for CRPS.
Pain management continuum: a flexible approach

- NSAIDS, Over-The-Counter Drugs
- Physical Therapy, TENS
- Complementary Medicine, Behavioral Programs, Adjuvant Medicine
- Corrective Surgery
- Long-Term Oral Opioids
- Neurostimulation or Intrathecal Therapy
- Neuroablation

Chronic Pain Patient
Complementary Medicine

- Complementary medicine is a group of diverse medical and health care systems, practices, and products that are not generally considered part of conventional Western medicine.
- Complementary medicine is used together with conventional medicine.
- Examples:
  - Aromatherapy (to help lessen discomfort during surgery)
  - Acupuncture
Behavioral programs

• Psychological counseling:
  – Psychiatrists: M.D. or D.O
  – Psychologists: Ph.D.

• Relaxation techniques:
  – Cognitive behavioral therapy
  – Biofeedback
  – Meditation
  – Tai-Chi
  – Yoga
Adjuvant medicine - medications

• Drugs initially designed to treat other conditions, found to have a beneficial role in pain management

• Adjuvant medications:
  – Antidepressants
  – Anticonvulsants (anti-seizure drugs)
  – Alpha 2 adrenergic agonists
  – GABA analogs
  – Topical drugs
Adjuvant medication - antidepressants

- **Cymbalta (duloxetine)**
  - Major depressive disorder
  - Diabetic neuropathy
  - Generalized anxiety disorder
  - Fibromyalgia
  - Chronic musculoskeletal pain
  - Inhibits serotonin (primarily) and norepinephrine (secondarily) uptake.

- **Savella (milnacipran)**
  - Fibromyalgia
  - Inhibits norepinephrine (primarily) and serotonin (secondarily) uptake
Adjuvant medicine: anticonvulsants

- Initially developed for seizure control, now primarily used for neuropathic pain - act on the ion/calcium channels at the neuronal level to reduce neurotransmitter release.
- Neurontin (gabapentin)
- Lyrica (pregabalin)
  - Peripheral neuropathy
  - Post-herpetic neuralgia
  - Fibromyalgia
- Tegretol
  - Trigeminal neuralgia
- Carbamazepine
  - Trigeminal neuralgia
- Requip (ropinirole)
  - Restless leg syndrome
Adjuvant medicine: GABA analogs

• Baclofen (lioresal)
  – Centrally acting muscle relaxant
  – Inhibits pain transmission in the spinal cord and maybe the brain
  – GABA is an inhibitory neurotransmitter
Adjuvant medicine: topical drugs

- Lidoderm patches (lidocaine 5%)
- Topical NSAIDs
  - Flector patch
  - Voltaren gel
  - Penn-said
- Topical compounded creams
  - May contain gabapentin, flexeril, ketamine, diclofenac, etc
Adjuvant medicine - interventional procedures

• Precise injections at or near the site of pain:
  – Radiologically/fluoroscopically guided
  – Local anesthetics - for diagnosis
  – Corticosteroids - for long term relief

• Many different kinds:
  – Selective nerve blocks
  – Epidural injections
  – Facet joint injections/medial branch blocks
  – Sympathetic blocks
  – Intra-discal procedures
  – Radiofrequency treatment
Pain management continuum: a flexible approach
Corrective surgery

- Aimed at correcting the underlying problem such as structural back problems (scoliosis, kyphosis, etc.) or removing herniated disks.
- Types:
  - Laminectomy/discectomy
  - Spinal fusions
  - Vertebral augmentation (vertebroplasty/kyphoplasty)
- Repeated surgery may bring little or no relief.
- Risks
Pain management continuum: a flexible approach
Long-term oral opioids

• Aimed at bringing a consistent level of pain relief 24/7
• Short-acting formulations:
  – Designed to be taken as needed, for a short period of time.
  – Tramadol, hydrocodone, oxycodone, morphine, hydromorphone, oxymorphone, tapentadol, etc.
• Long-acting formulations
  – Designed for chronic pain, to avoid fluctuations in pain intensity.
• Physiological dependence
• Tolerance
• Addiction
Long-term oral opioids

- The most widely abused drugs in the United States today.
- More abused than any illegal drug.
- Side effects:
  - Sedation/drowsiness/psychomotor impairment
  - Constipation
  - Respiratory depression
- Regulatory environment
  - Pain physicians and urine drug screens
Pain management continuum: a flexible approach
Neuroablation

• The nerve that transmits or causes the pain is surgically removed or altered, interrupting pain messages to the brain.

• Types:
  – Radiofrequency ablation (use of heat or electromagnetic field to either destroy or change the target nerves)
  – Cryoablation (use of cold temperature to destroy the targeted nerves)

• Contrary to popular belief, not an irreversible option.
Neurostimulation/neuromodulation

- Systems have provided chronic pain relief since 1967
- More than 200,000 people have a neurostimulation system (in the U.S.)
- Also known as Spinal Cord Stimulation (SCS) Therapy
- Usually reserved when conservative and surgical treatments fail
- Benefits:
  - Drug free
  - Reversible
  - Trial before permanent implant
- Risks
  - Surgical risks: infection, bleeding
  - Lead migration and loss of pain relief
Neurostimulation/neuromodulation

1. **Pain signals** travel along the spinal cord to the brain.

A small, rechargeable **Implantable Pulse Generator (IPG)** produces electrical impulses. These impulses travel along one or two small wires called **Leads**, which are attached to the IPG.

2. **Electrode contacts** are engineered to deliver the electrical impulses to specific locations on the spinal cord to mask the pain signals.

3. The **masked signals** then travel to the brain where they are often perceived or felt as a smooth, tingling sensation called **paresthesia**, and the feeling of pain is reduced.
What is Neuromodulation?

- SCS is an FDA approved therapy for the treatment of chronic intractable pain of the arms, legs and trunk of the body
- Used for over 40 years for chronic conditions of the nervous system
- Intractable neuropathic pain
NEUROMODULATION

Tiny electrical pulses delivered to nerves that trigger a neurological response that can interfere with the transmission of pain or motor signals to the brain.
Gate Control Theory - Proposed by Melzack and Wall (1965)
- A neural "gate" in the spinal cord that regulates the experience of pain
- SCS near the dorsal column stimulates the pain-inhibiting nerve fibers, masking painful sensation with a tingling sensation (paresthesia)
Clinical Applications for SCS

- Failed back surgery syndrome
  - *Chronic low back pain and limb pain*

- Neural injury
  - *Traumatic-CRPS, cord injury, MS, PHN*

- Peripheral vascular disease
  - *Angina*

- Peripheral neuropathies
  - *Phantom limb pain*