

INTERVENTIONAL APPROACHES IN THE TREATMENT OF COMPLEX REGIONAL PAIN SYNDROME

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No Disclosures

OVERVIEW

- Brief historical perspective
- Nomenclature & common clinical terminology
- Diagnostic criteria- 2013
- Case studies - interventional therapies
- Advanced pain therapies - SCS and ITDDS
- Newer therapies – High frequency SCS and IT ziconotide
- Concluding remarks

Complex Regional Pain Syndrome

Nomenclature

- Historically, among the many terms used to describe the syndrome the best known are:
 - Reflex Sympathetic Dystrophy
 - Causalgia

RSD: because of its link to the sympathetic nervous system

Causalgia: Greek: kausos=heat, algos=pain

Why CRPS and not RSD

Although “RSD” became the most common name to describe the condition, the name is problematic due to:

- 1) “R” There may or may not be a true “reflex” involved?
- 2) “S” Sympathetic changes may not be a constant component
- 3) “D” Actual dystrophy is present in only 15%

Standard CRPS Terminology

- Hyperalgesia – exaggerated sense of pain
- Allodynia – pain that results from a stimulus that is not usually painful
- Vasomotor- affecting the diameter of blood vessels (by the nervous system)
- Sudomotor- relating to nerves that stimulate sweat gland activation
- Trophic- relates to atrophy







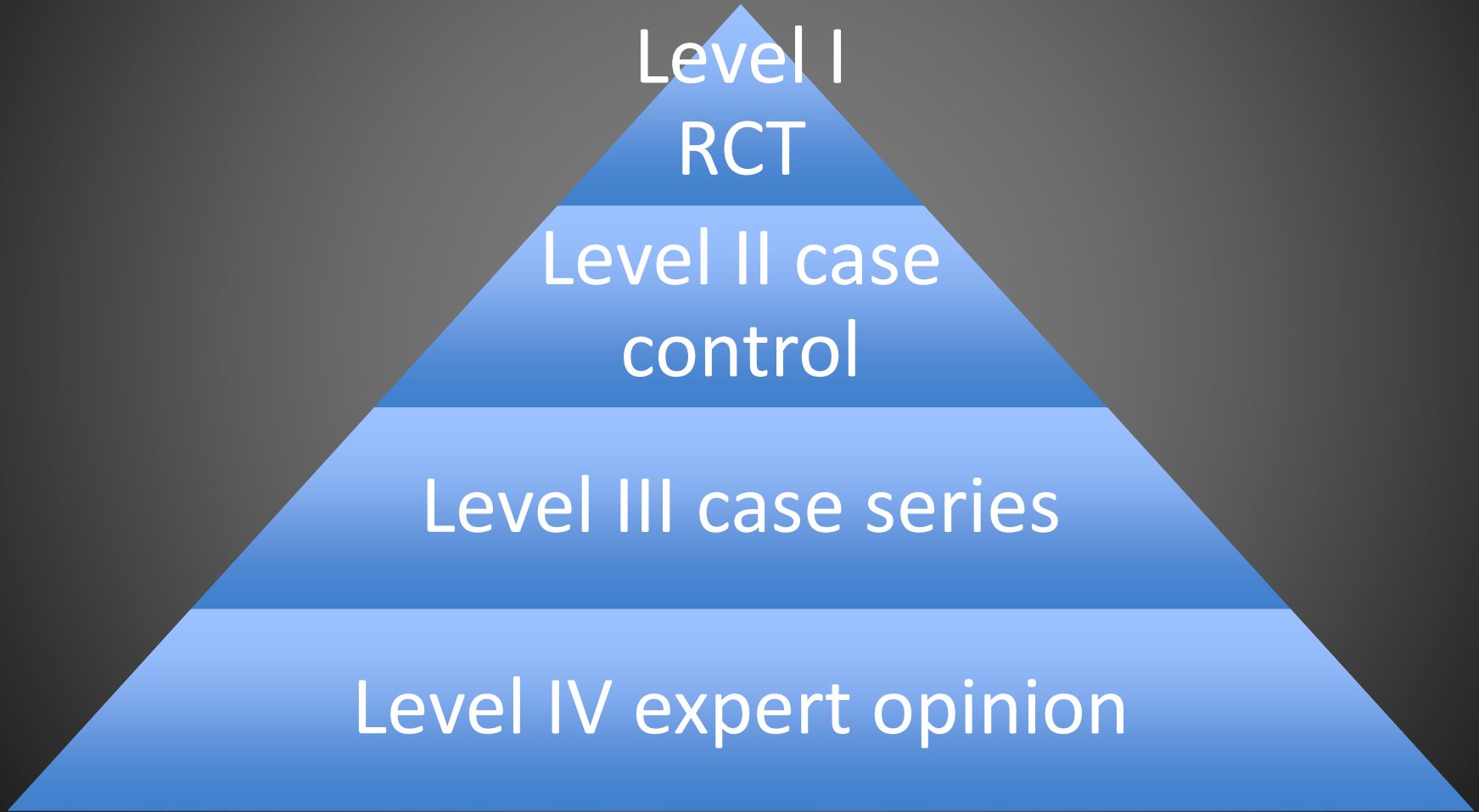
Clinical Studies

Level I
RCT

Level II case
control

Level III case series

Level IV expert opinion



Complex Regional Pain Syndrome: Practical Diagnostic and Treatment Guidelines, 4th Edition

- Sponsored by RSDSA
- R. Norman Harden, MD –lead author, serves as Research Committee Chairman
- Set of guidelines based on existing research
- Identifies a lack of level 1 and level 2 studies

Pain Medicine 2013; 14: 180-229

Revised CRPS Criteria/General Features of the Syndrome – Budapest Consensus Group

- Continuous regional pain disproportion in time or degree to usual course of trauma
- Pain is regional and not dermatomal specific
- Usually a distal prominence of abnormal sensory, motor, sudomotor, vasomotor, and/or trophic changes

Complex Regional Pain Syndrome: Practical Diagnostic and Treatment Guidelines, 4th Edition. Harden et al, Pain Medicine 2013; 14: 180-229.

Clinical Diagnostic Criteria

- 1) Continuing pain, disproportionate to injury
- 2) At least 1 symptom in 3 of the 4 following categories:
 - Sensory: hyperalgesia +/- allodynia
 - Vasomotor: temperature asymmetry +/- skin changes
 - Sudomotor/edema: edema +/- sweating changes
 - Motor/trophic: decreased range of motion +/- motor dysfunction

Complex Regional Pain Syndrome: Practical Diagnostic and Treatment Guidelines, 4th
Ed. Pain Med 2013; 14: 180-229

Clinical Diagnostic Criteria

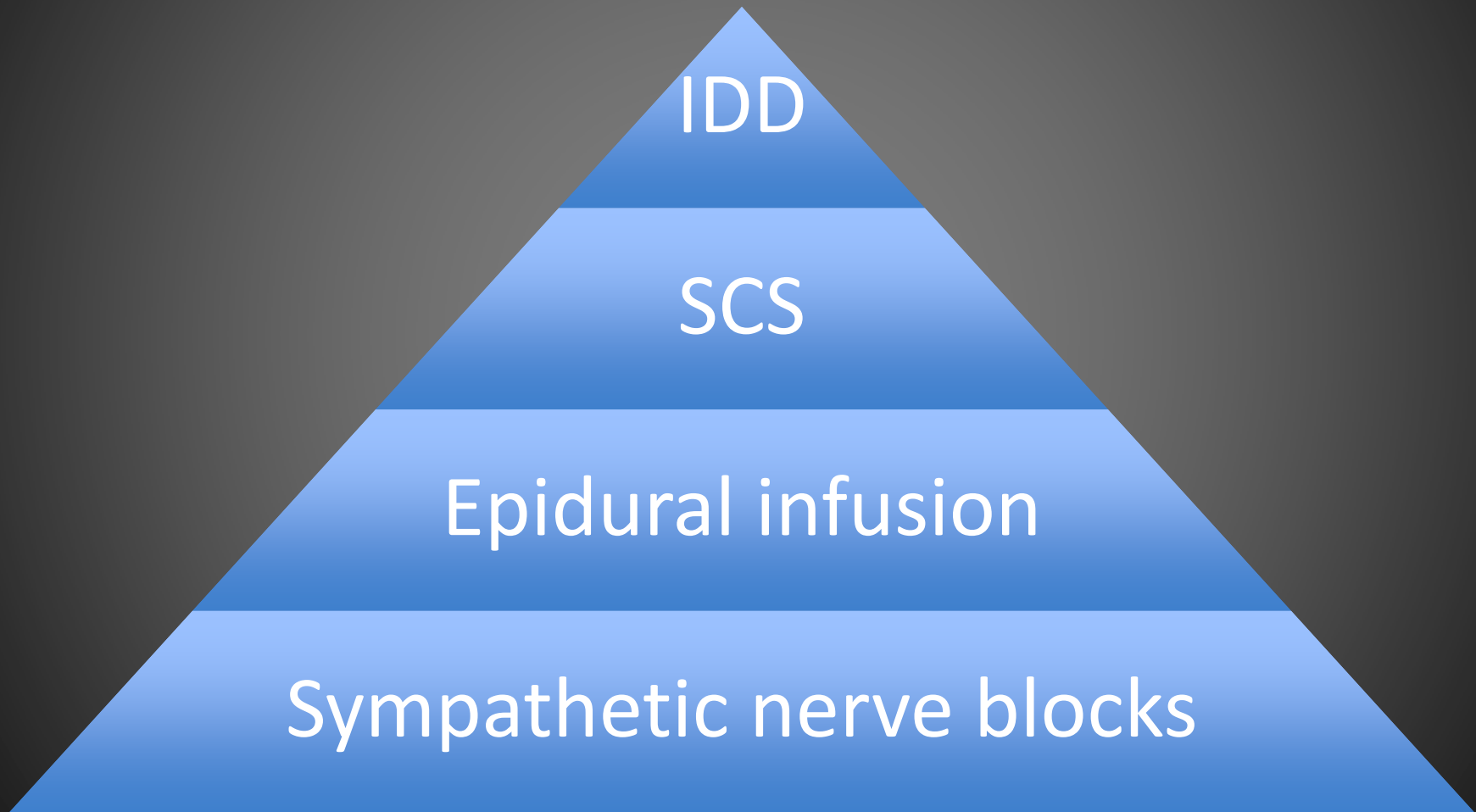
3) At least one sign at time of evaluation in 2 or more of the following:

- Sensory: hyperalgesia (to pinprick) +/- allodynia (to light touch +/- or deep pressure)
- Vasomotor: temperature asymmetry +/- skin color changes
- Sudomotor/edema: edema +/- sweating changes
- Motor/trophic: decreased range +/- motor dysfunction

4) There is no other diagnosis that better explains the signs and symptoms

Complex Regional Pain Syndrome: Practical Diagnostic and Treatment Guidelines,
4th Ed. Pain Med 2013; 14: 180-229

Interventional Algorithm



Interventional Procedures

- SNB – traditionally recognized as important in both diagnosis and treatment
- What is considered a successful SNB?
- SNB: looking for pain relief that is prolonged and has a duration that far outlast the duration of the local anesthetic utilized
- Current thought is SNB used to classify CRPS as SMP or SIP

Interventional Procedures

- If the SNB is “successful” (based on duration of relief) then a short series of SNB’s along with PT is suggested based on consensus recommendations

Complex Regional Pain Syndrome: Practical Diagnostic and Treatment Guidelines, 4th Edition. Harden et al, Pain Medicine 2013; 14: 180-229.

Interventional Procedures

- Intravenous Regional Anesthesia –injection of medications into the extremity
- Several medications have been utilized – guanethedine, lidocaine, bretylium, reserpine and others
- Level I and level II evidence demonstrating lack of efficacy

Interventional Procedures

- Epidural Infusions – insert epidural catheter and titrate local anesthetic to desired effect
- Allows for aggressive PT
- Level II studies
- Complications rare but serious

Interventional Approach Case #1

- 20 year old female college student - injury to left elbow January 2006
- No fracture, immobilized for 6 weeks
- Cast removed – left distal upper extremity discolored, swollen and burning pain
- PT attempted – increased pain
- Initially seen in June 2006 – full range, left forearm muscle atrophy, mottled, hypersensitive to stimulation.

Case #1 cont.

- MRI of cervical spine – unremarkable
- July 2006 – cervicothoracic sympathetic ganglion block X two – 3-4 days of partial relief
- Underwent left ulna nerve transposition 8/2006 – “O.K.” through remainder of 2006
- Returned in Jan. 2007 marked increase sx’s
- Repeated sympathetic nerve block X 1 – significant response, not seen again until May 2008 (>one year later)

Case #1 cont.

- June 2008 – SNB repeated X 1 with moderately good response but short lived
- July 2008 – SNB repeated X 1 without response, began discussing other therapies
- November 2008 – trial of SCS with encouraging response, > 90% relief
- SCS implanted Dec. 2008
- PT initiated in early 2009

TestStimULTRA 37022

Last session: 11/03/2008

Active Group: **D**

Available groups: 8

Use (%): 64

Group	Usage
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D	 93%
E	 7%

Session date 06/03/2010
Programmer 8840 SN NHF014470N r03.06

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Summary Report
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Profile

Patient diagnosis:
CRPS Type I

Physician information:
DR BOYAJIAN

Notes:
CERVICAL PLACEMENT C2-C3
RSD PREDOMITANTLY LEFT SHOULDER TO
FINGERS

Lead configuration 1x8

Leads:	Model
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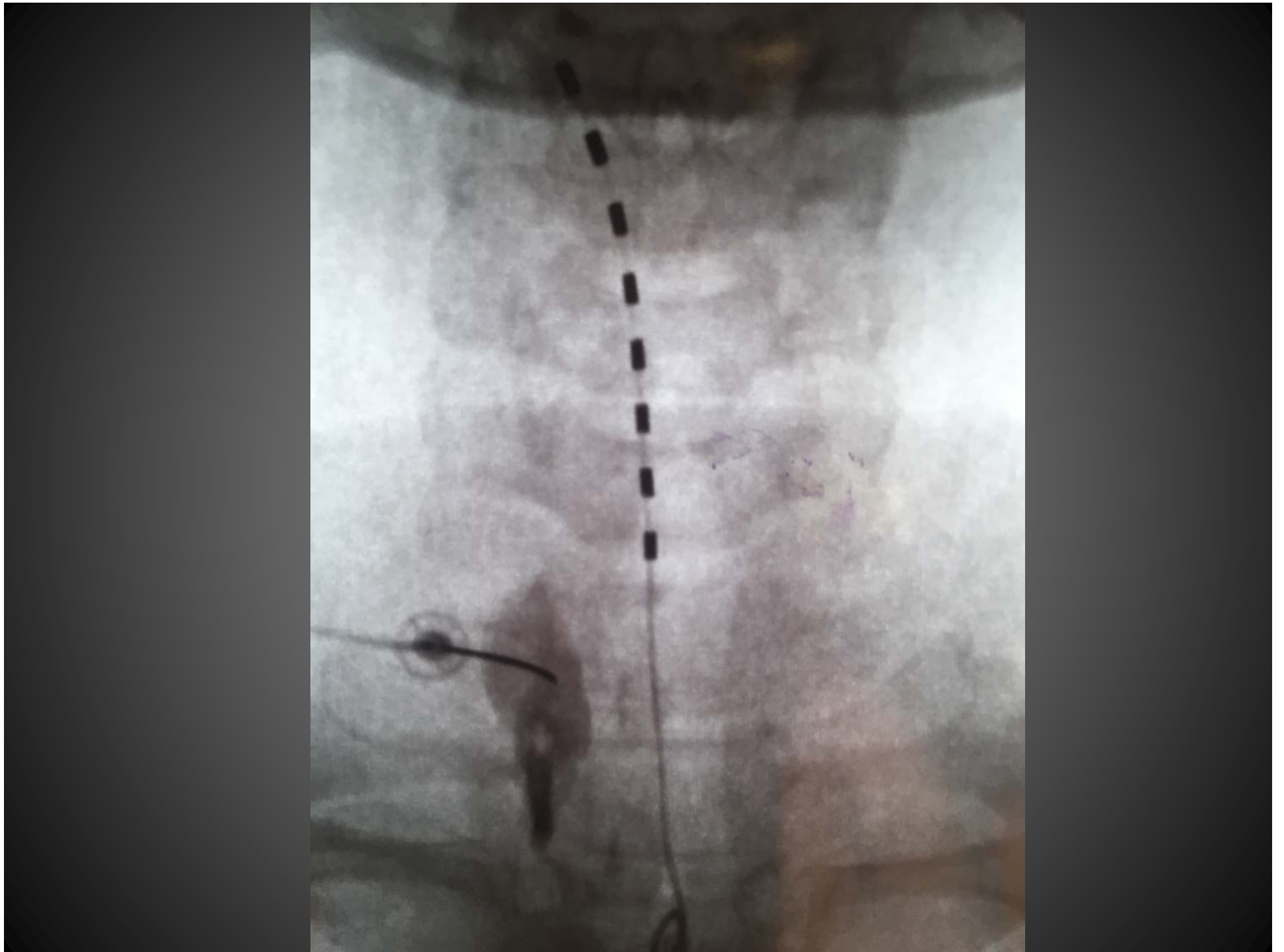
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12/15/08

Case #1 cont.

- August 2010 – fell at home, increased left upper extremity pain
- X-ray – lead maintained in original position
- Oral steroids – no response
- Sept. 2010 – repeat SNB – less need for pain medications
- March 2011 – increased pain with no provocation– repeat SNB with good response

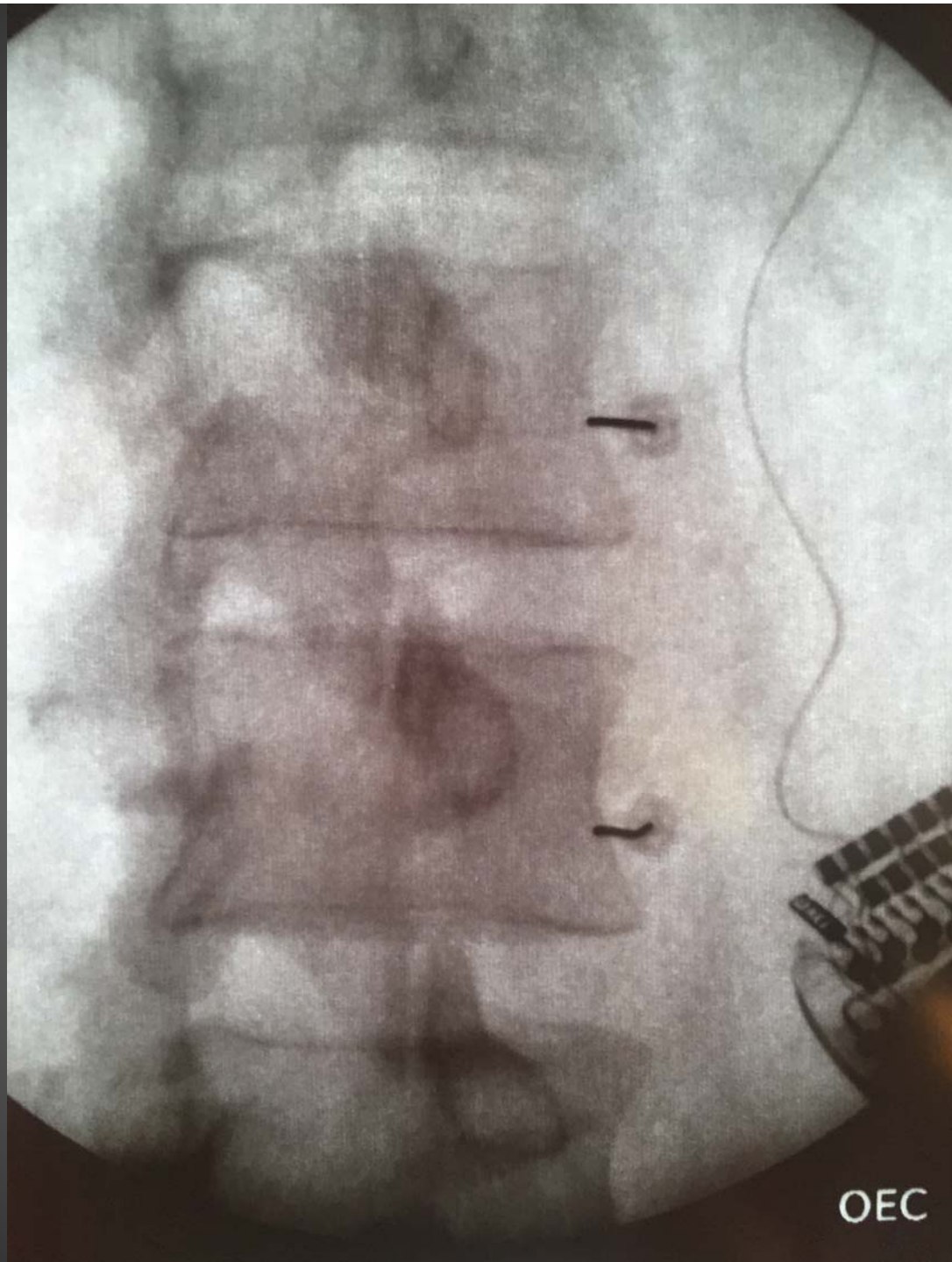


Case #1 cont.

- Spring 2011 – graduated from college and began working part time
- Ongoing PT
- Full time employment – using SCS 24/7, taking duloxetine and prn hydrocodone
- Not seen again until Jan. 2013 – now with right low back pain and right lower extremity pain

Case # 1 cont.

- CT scan of L-spine unremarkable
- Jan. 2013 – lumbar SNB X 1 with 60-70% relief followed with PT
- Right lower extremity symptoms exacerbated in August and October 2014 with moderate response to single lumbar SNB
- Working F/T: SCS, duloxetine, prn hydrocodone and occasional SNB (Oct 2014 and Sept. 2015)



OEC







Case #2

- 46 year old male initially presented in June 2013 with LBP, left hip and lower extremity pain and burning in both feet.
- Prior history of L1 burst fracture early 90's, spinal fusion T10 – L3 with pedicle screws and Harrington rods and a previous left L5 hemilaminectomy.
- Injured at work in auto body shop March 2013

Case #2 cont.

- Initially seen by Orthopedics – aquatic therapy
- Underwent CT myelogram 6/2013 – post op. changes from prior laminectomy with mild arachnoiditis
- Initially placed on gabapentin, oxycodone ER and SMR and scheduled for caudal cath. L5-S1 level – no relief
- 2013 – left L5 transforaminal injection – minimal response

Case # 2 cont.

- 9/2013 – left lumbar SNB – no response
- Failed 2 spinal injections, SNB and on 3 medications – VPS 10/10
- Oct. 2013 – discussed IT therapy
- May 2014 - trial of IT hydromorphone and bupivacaine with 70% relief of LBP and 50% relief of burning feet (0.96 mg/day hydromorphone and 14.4 mg/day of bupivacaine)

Case #2 cont.

- June 2014 – implant of IT pump
- Discontinue oxycodone ER with VPS decreased from 10/10 to 7/10 immediately
- Slow titration of IT hydromorphone and bupivacaine – VPS 4-5, marked LE edema
- Switched to IT MSO4 3 months following implantation – nausea with loss of appetite and weight loss

Case #2 cont.

- May 2015 – trial of IT ziconotide
- Marked reduction in pain with no adverse side effects
- Slow titration of IT ziconotide with VPS 4 and improved function (Oswestry)

GCS
HARD
99915
YAJIAN
PAIN MGMT

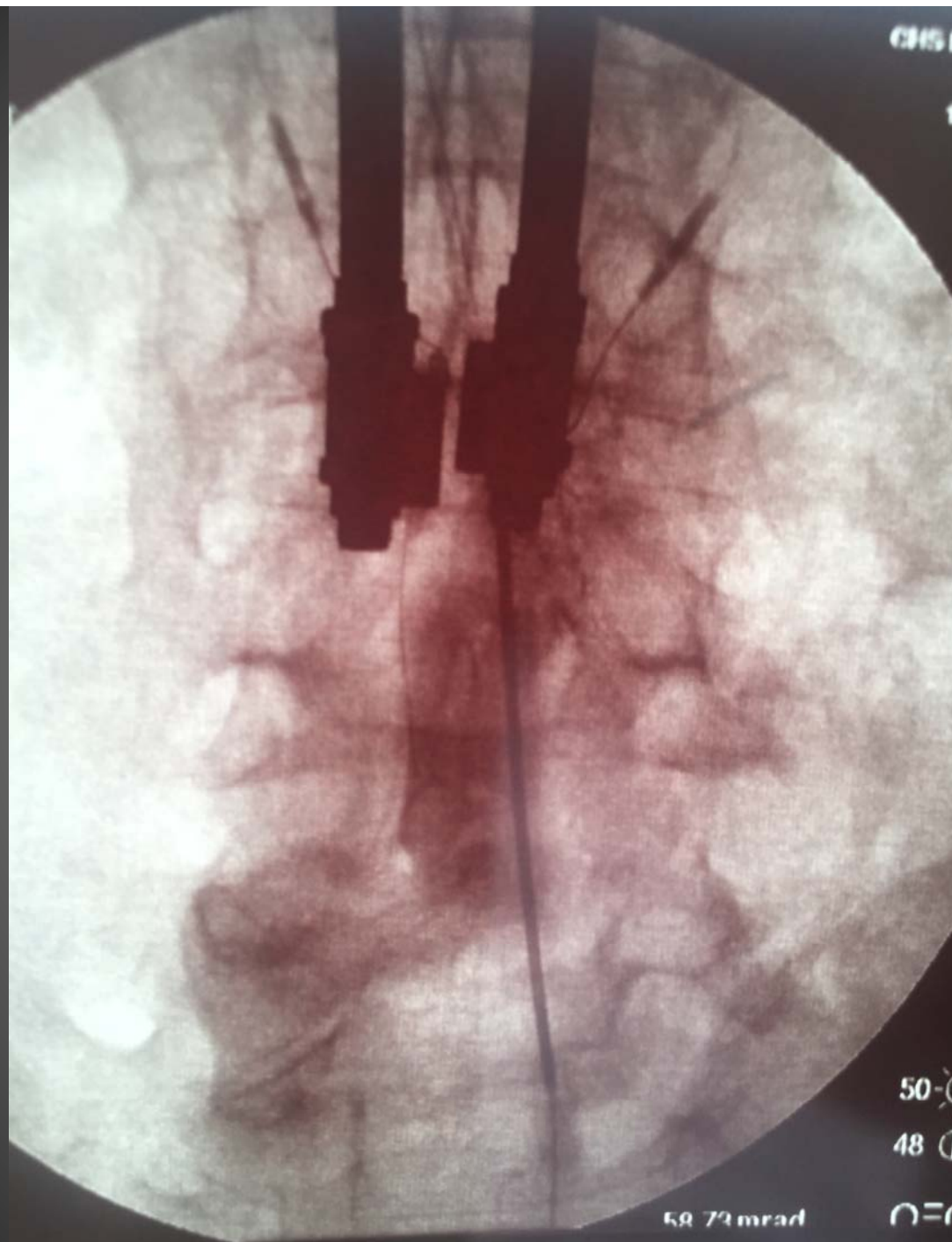
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116 kVp
34.48 mA
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58.73 mrad

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GMT

kVp
mA

58.73 mrad

Advanced Pain Therapies

- Intrathecal Drug Delivery
- Spinal Cord Stimulation

Intrathecal Drug Delivery

- Involves surgical implantation of a catheter into spinal canal and implantation of a pump to deliver medication
- Pumps are programmed with computer
- FDA approved drugs include morphine, baclofen, ziconotide, “off label medications”





Intrathecal vs. Oral Administration

Oral: low blood/brain barrier penetration
lack of preferential spinal cord distribution
severe side effects at high doses

IT meds: delivery directly to receptor sites
better efficacy
1 mg IT morphine = 300 mg oral
less drug related side effects

Patient Selection

- More conservative therapies have failed
- Psychological clearance
- Successful trial
- No contraindications

IDD Adverse Effects & Complications

- Surgical: infection, spinal headache, CSF hygroma, CSF leakage around catheter/insertion site, bleeding, pump pocket seroma/hematoma
- System: catheter kink/obstruction, dislodgement, disconnection, break, programming errors, pump failure
- Drug: pruritis, urinary retention, overdose, loss of effect, edema, withdrawal

IDD Infusion Modes

- Bolus, continuous, flexible mode
- CRPS: flex. mode – continuous w/ periodic bolus
 - Patient is empowered to respond to increased pain
 - Physician programs safeguards

Advantages of IDD

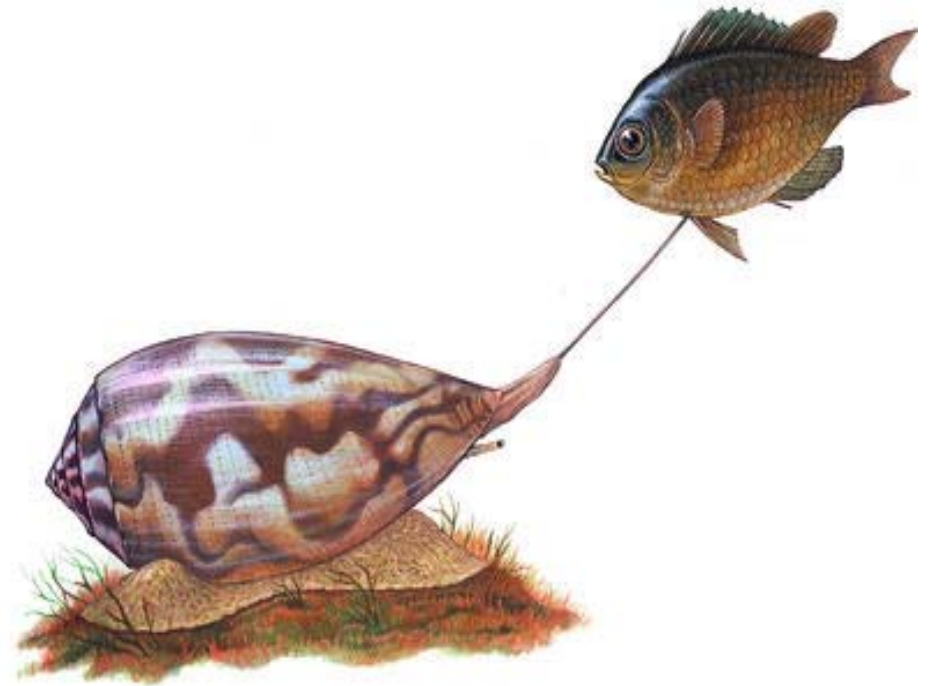
- Delivers medication directly to spinal cord
- Reduces need for systemic medications
- Programmed noninvasively for changing patient needs
- Increased quality of life by reducing pain and improving function

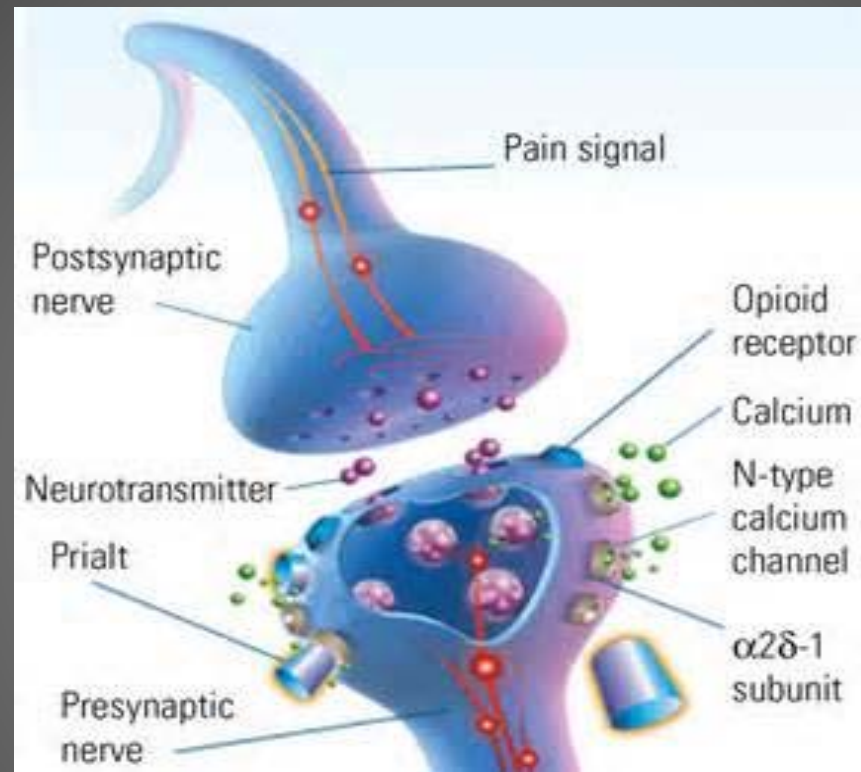
Intrathecal Ziconotide

- Ziconotide binds to N-type calcium channels on primary nociceptive (A-delta & C) afferent nerves in the superficial layers of the dorsal horn in the spinal cord
- Blocks excitatory neurotransmitter release from primary afferent nerve terminals – glutamate, calcitonin gene-related peptide, substance P in brain and spinal cord
- Ziconotide does NOT bind to opioid receptors

Conus magus (cone snail)







Adverse Reactions

- Dizziness, nausea, confusion vertigo, ataxia, hypotension, hallucinations
- Maximum recommended dose is 19.2 mcg/day
- No withdrawal if stopped abruptly

Placebo-controlled Studies

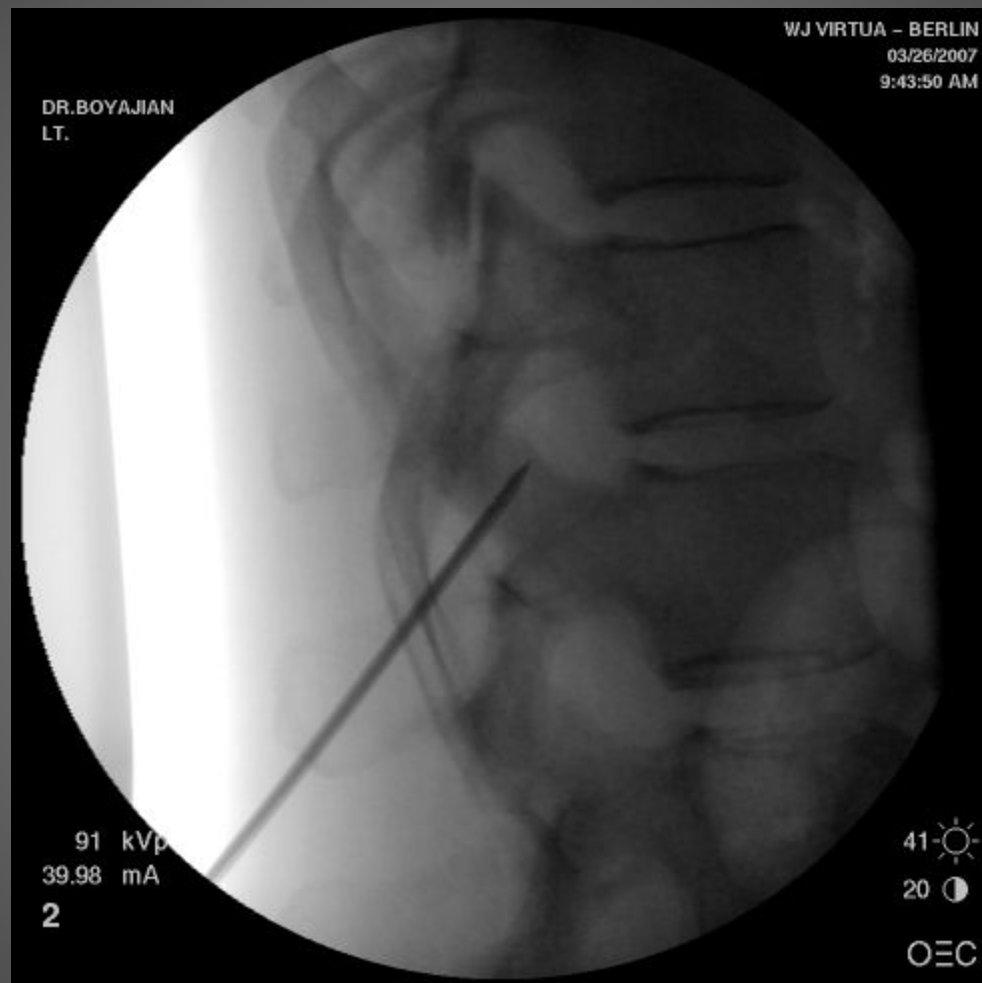
- CRPS and ziconotide – none
- Severe chronic pain – a few
- Kapural et al (2009) 7 patients w/CRPS treated with IT ziconotide alone or in combination w/ other IT meds. Had a mean VAS change of 47.5%

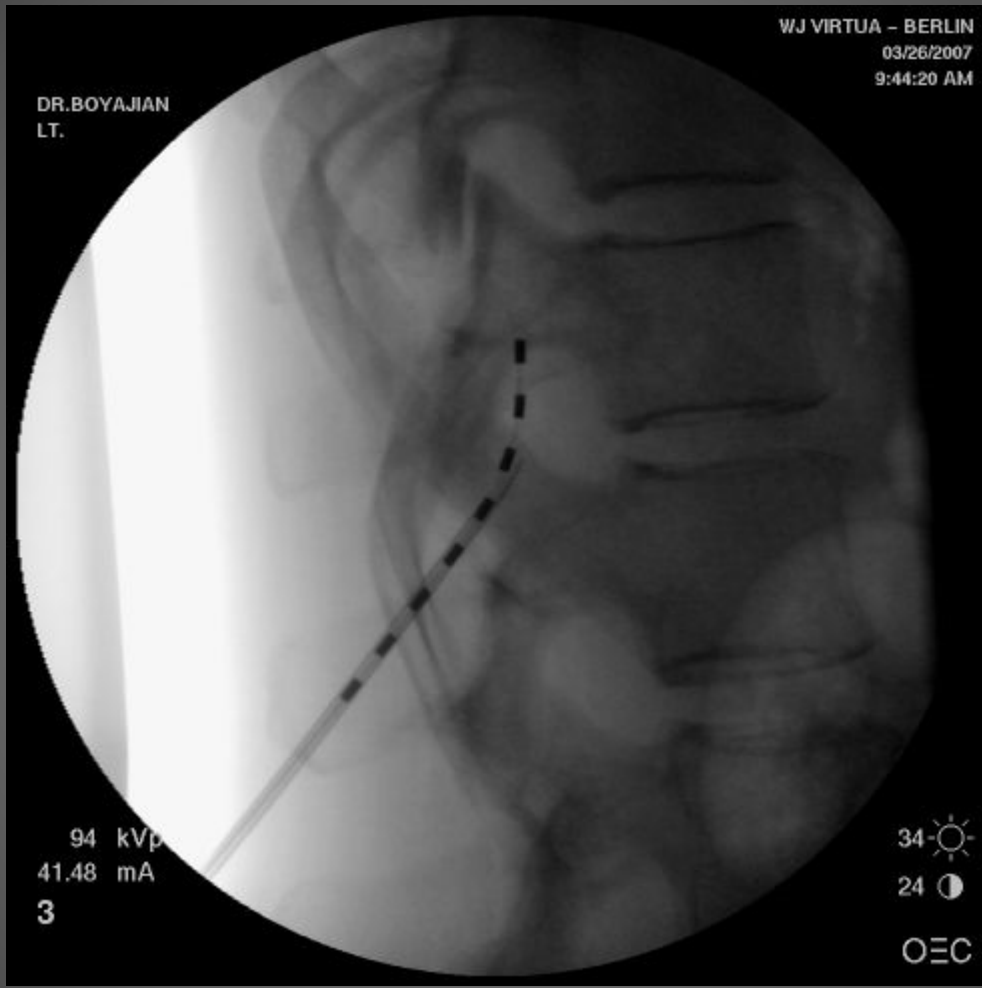
Spinal Cord Stimulation

- Consists of implanted electric wires (leads) connected to a power supply (pulse generator)
- Delivers pulsed electrical signals to spinal cord
- Neurophysiology – may be different for differing pain physiology
- Alteration in the cord neurochemistry in the dorsal horn, suppressing hyperexcitability of neurons by stimulating/suppressing neurotransmitters









WJ VIRTUA - BERLIN
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DR. BOYAJIAN
LT.

94 kVp
41.48 mA
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24 ●
OEC



DR. BOYAJIAN
LT.

WJ VIRTUA - BERLIN
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79 kVp
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WJ VIRTUA - BERLIN

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DR. BOYAJIAN
LT.



93 kVp
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OEC

Three Parameters for SCS

- Pulse Width (microseconds) = breadth of paresthesia, up to 100 microseconds
- Amplitude (volts) = intensity of paresthesia, up to 10.5 volts
- Rate (Hz) = smoothness of paresthesia

Recent Advances in SCS

- There is a subset of CRPS patients who are candidates for SCS but fail due to irritability/noxious paresthesia
- Leads placed for trial, excellent coverage of painful region(s)
- Paresthesia can be irritating and painful regardless of altering rate, amplitude or pulse width

High Frequency (paresthesia free) SCS

- Recently FDA approved for clinical use in the U.S.
- HF10 therapy by Nevro
- Conventional SCS – frequency up to 1,200 Hz
- HF10 SCS – frequency up to 10,000 Hz
- Paresthesia free – there is no feeling of paresthesia, only relief of pain



ANESTHESIOLOGY

The Journal of the American Society of Anesthesiologists, Inc. • anesthesiology.org

Novel 10-kHz High-frequency Therapy (HF10 Therapy) Is Superior to Traditional Low-frequency Spinal Cord Stimulation for the Treatment of Chronic Back and Leg Pain

The SENZA-RCT Randomized Controlled Trial

Leonardo Kapural, M.D., Ph.D., Cong Yu, M.D., Matthew W. Doust, M.D.,
Bradford E. Gliner, M.S., Ricardo Vallejo, M.D., Ph.D., B. Todd Sitzman, M.D., M.P.H.,
Kasra Amirdelfan, M.D., Donna M. Morgan, M.D., Lora L. Brown, M.D.,
Thomas L. Yearwood, M.D., Ph.D., Richard Bundschu, M.D., Allen W. Burton, M.D.,
Thomas Yang, M.D., Ramsin Benyamin, M.D., Abram H. Burgher, M.D.

Senza-RCT

- 198 patients randomized and followed for 12 months
- 101 patients HF10 vs. 97 conventional SCS
- Superior outcomes with HF10
- Back and leg pain

HF10 SCS

- First study to directly compare SCS technologies – each company supporting their respective devices
- Largest randomized, controlled study (for back pain and leg pain)
- First ever SCS study to report on 100% of patients to 12 months (2 year data now available)
- Designed in consultation with and monitored by the FDA

Concluding Remarks

- Very little high quality research regarding interventional therapies for CRPS
- However, we still have a responsibility to treat our patients
- Must develop better evidence, but our patients cannot wait

CRPS/Chronic Pain Support Group

- Meets 4th Tuesday of each month
- Mt. Laurel YMCA Child Care Center, 59 Centerton Road, Mt. Laurel, NJ
- Lisa Vasey lisav1@live.com

Thank you!

