神經外科的疼痛治療

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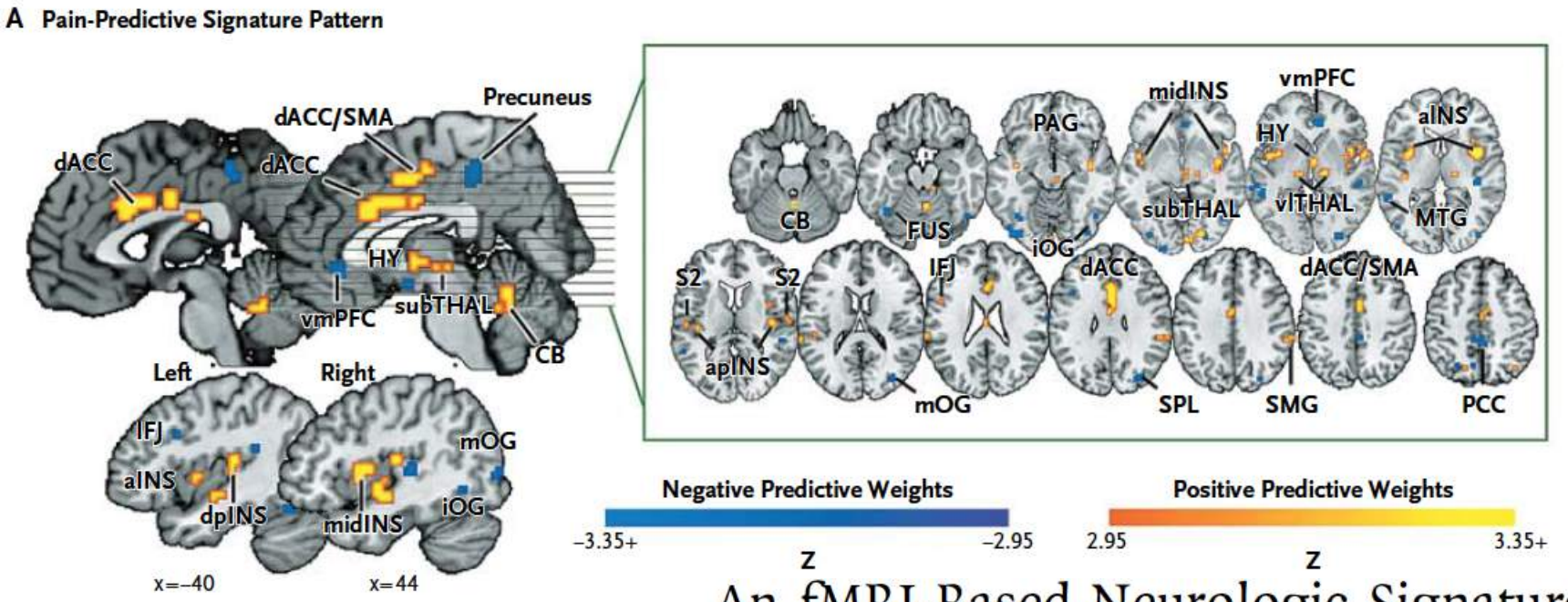
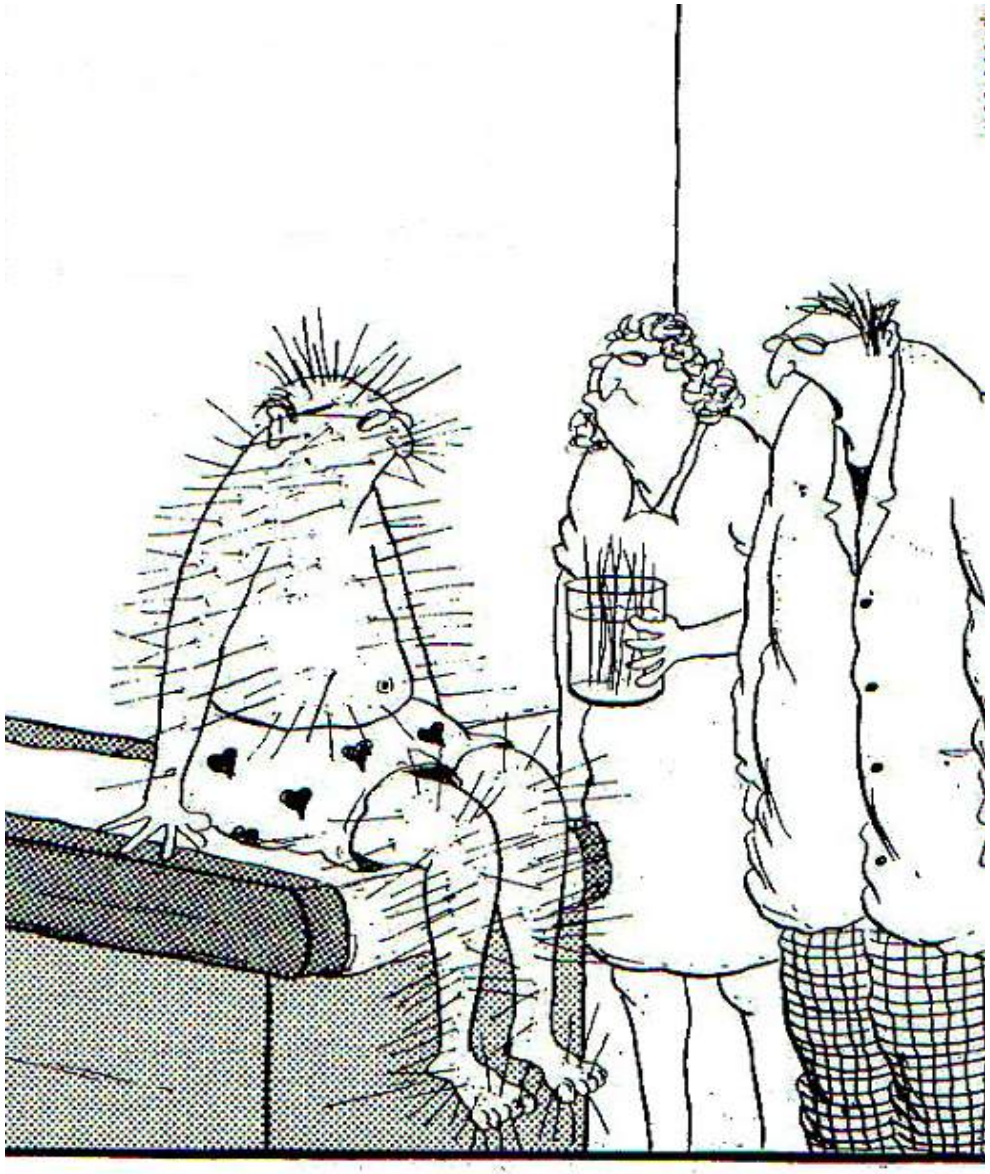


An fMRI-Based Neurologic Signature of Physical Pain

Tor D. Wager, Ph.D., Lauren Y. Atlas, Ph.D., Martin A. Lindquist, Ph.D., Mathieu Roy, Ph.D., Choong-Wan Woo, M.A., and Ethan Kross, Ph.D.

The NEW ENGLAND JOURNAL of MEDICINE



Know When To Quit

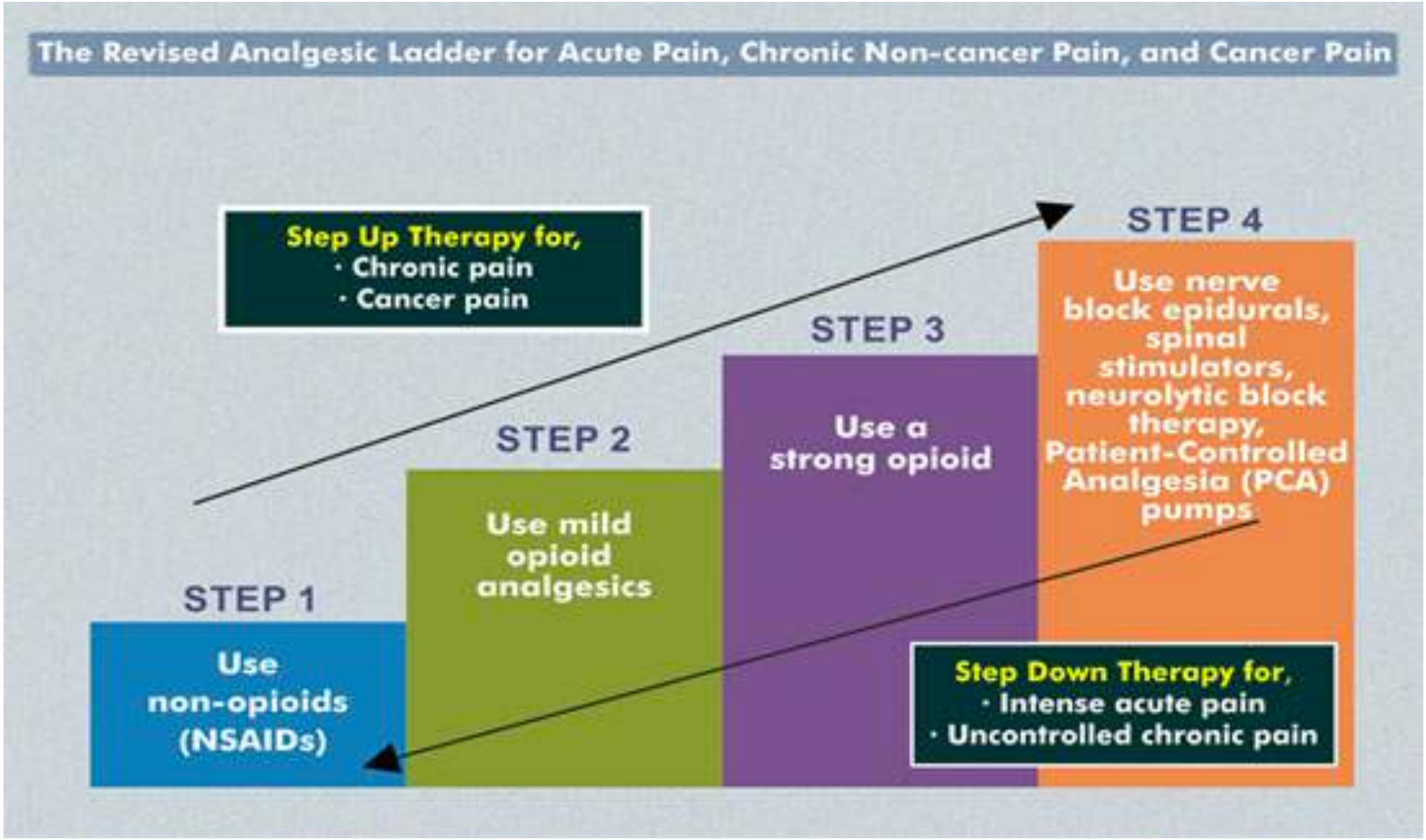
歡樂往往像個訪客，疼痛則殘酷地緊纏著我們不放

Pleasure is oft a visitant; but pain/Clings cruelly to us

英國詩人 濟慈

John Keats

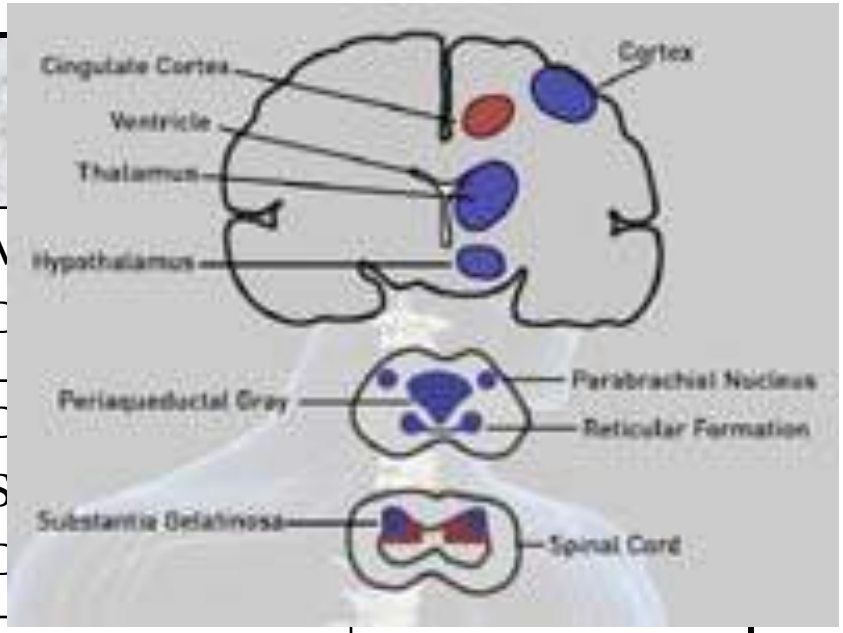
Pain Treatment Ladder



Opioid Receptors and Ligands

Location of Opioid Receptors in the CNS

Opioid Receptor	Endogenous Agonist	
Dorsal horn Lamina I Substantia gelatinosa Brainstem Nucleus caudalis Supraspinal PAG Thalamic nuclei Striatum Hypothalamus Limbic system Cortex	ß-Endorphin Endomorphins Met-Enkephalin Leu-Enkephalin Dynorphine A Dynorphine B	
Mu (70%)		M D
Delta (20-30%)		D S D
Kappa (5-10%)		
hORL1	Nociceptin/OFQ	None

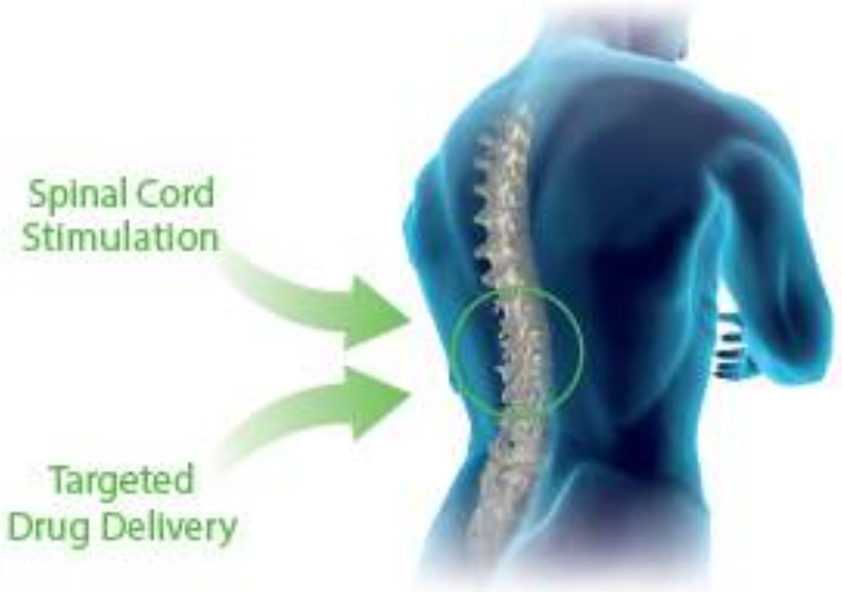


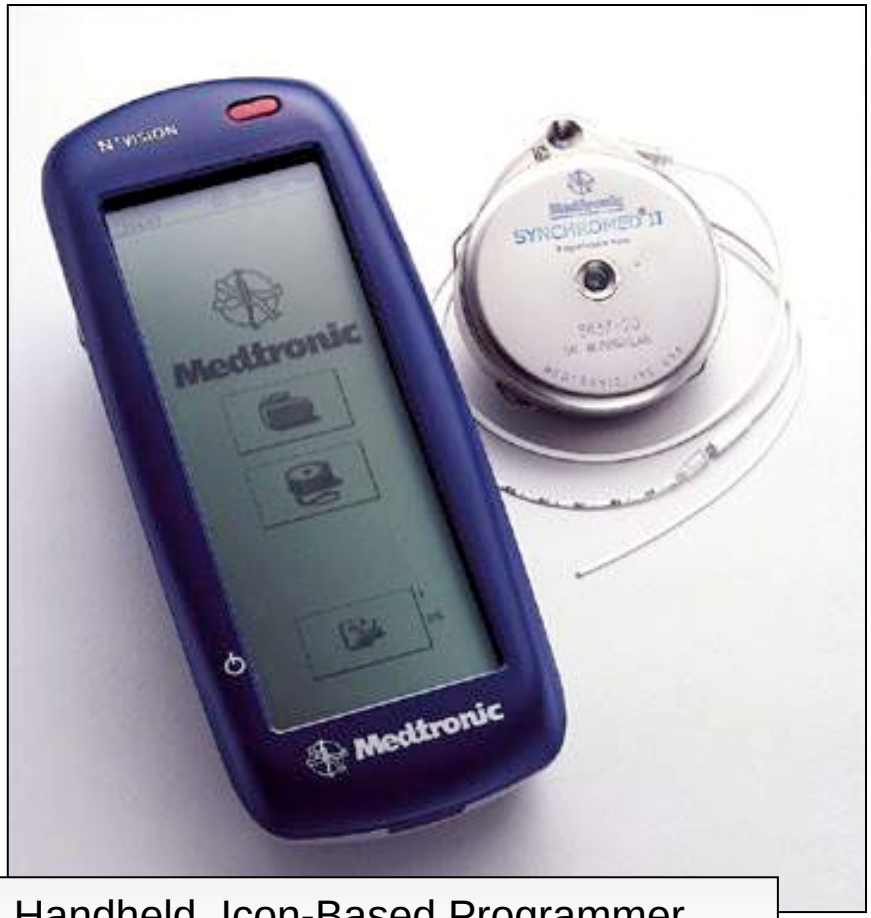
Opioid Actions

- Analgesia
- Pruritis
- Urinary retention
- Autonomic Effects
  - Cough suppression, orthostatic hypotension
    - Nucleus tractus solitarius and ambiguous, locus ceruleus
  - Respiratory depression
    - Nucleus tractus solitarius, parabrachial nucleus
  - Nausea/vomiting
    - Area postrema
  - Constipation
  - Meiosis
    - Superior colliculus, pretectal nuclei
- Endocrine effects
  - Posterior pituitary – inhibition of vasopressin
  - Hormonal effects – hypothalamic infundibulum
- Behavioral effects
  - Amygdala, hippocampus, nucleus accumbuns, basal ganglia
- Motor rigidity
  - Striatum

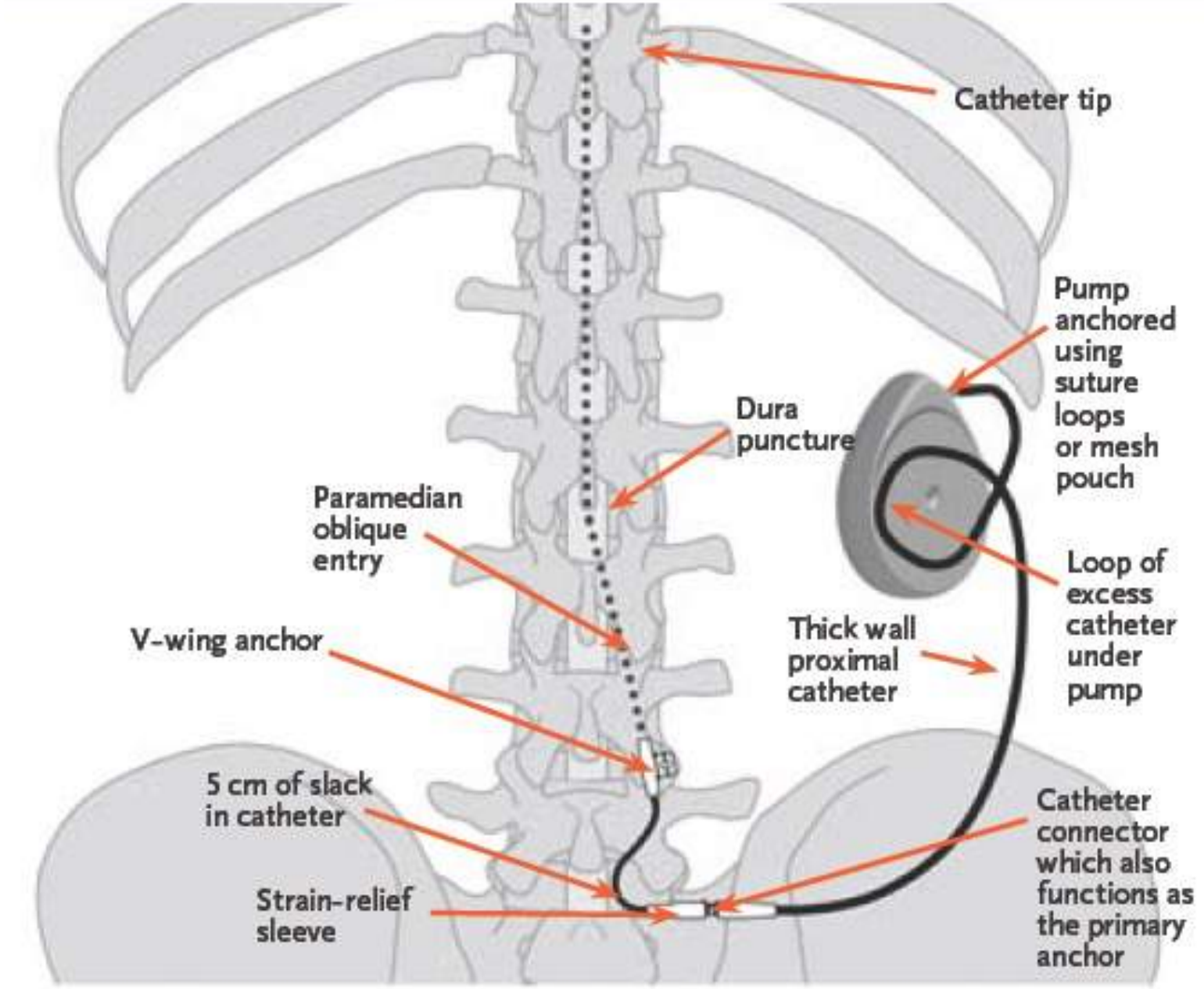
Systemic Delivery of Medications

Targeted Therapy Where It Matters



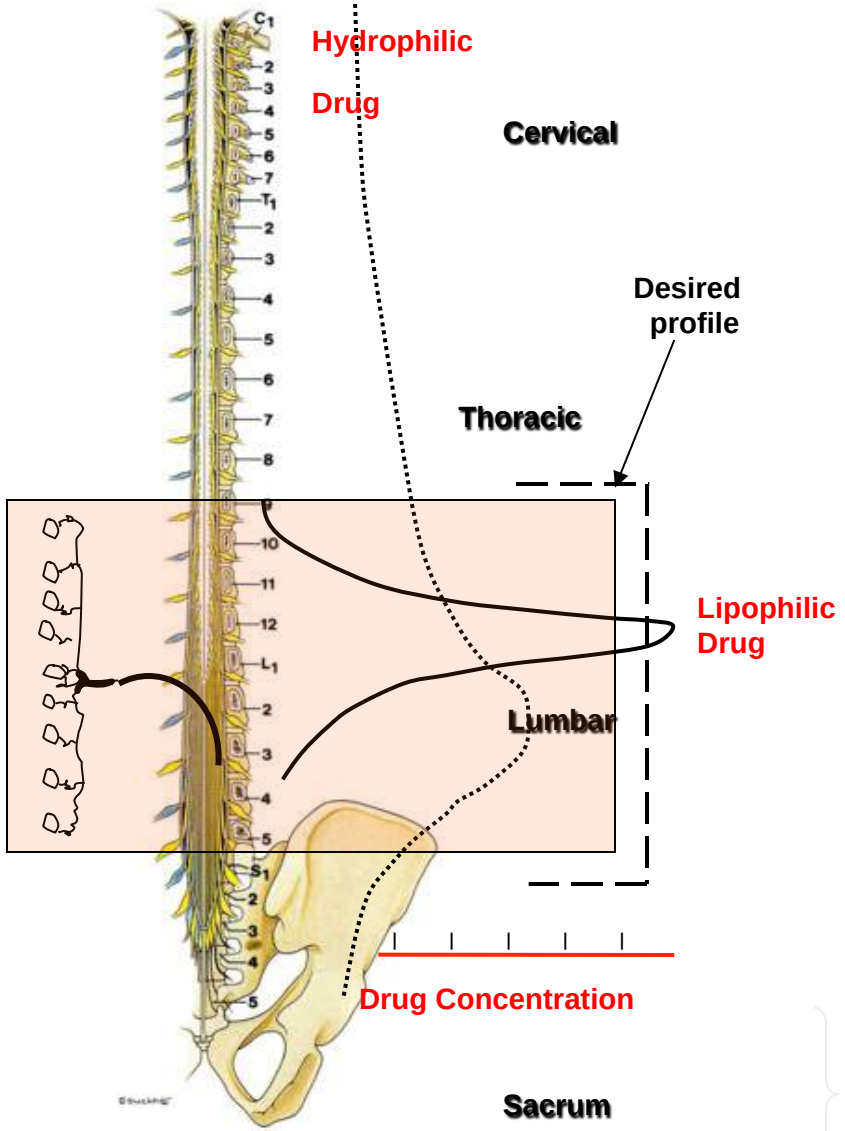


Handheld, Icon-Based Programmer


Catheter tip
Pump anchored using suture loops or mesh pouch
Dura puncture
Paramedian oblique entry
Loop of excess catheter under pump
V-wing anchor
Thick wall proximal catheter
5 cm of slack in catheter
Catheter connector which also functions as the primary anchor
Strain-relief sleeve

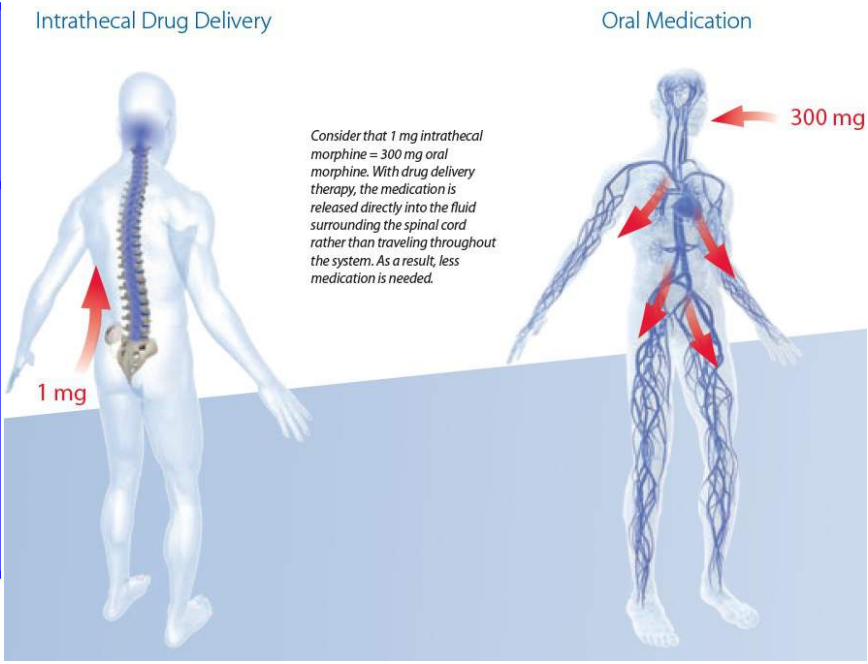
Drug targets: Chronic Pain

- Afferents enter into local dorsal horn and project rostral / caudal 4-6 segments
- Normal - Modest drive on neurons in distal segments
- Sensitization > Recruitment of adjacent afferent neurons and spinal segments
- Result> Often not a single pain or spasticity generator



Approximate Equivalent Daily Doses of Morphine Administered by Various Routes

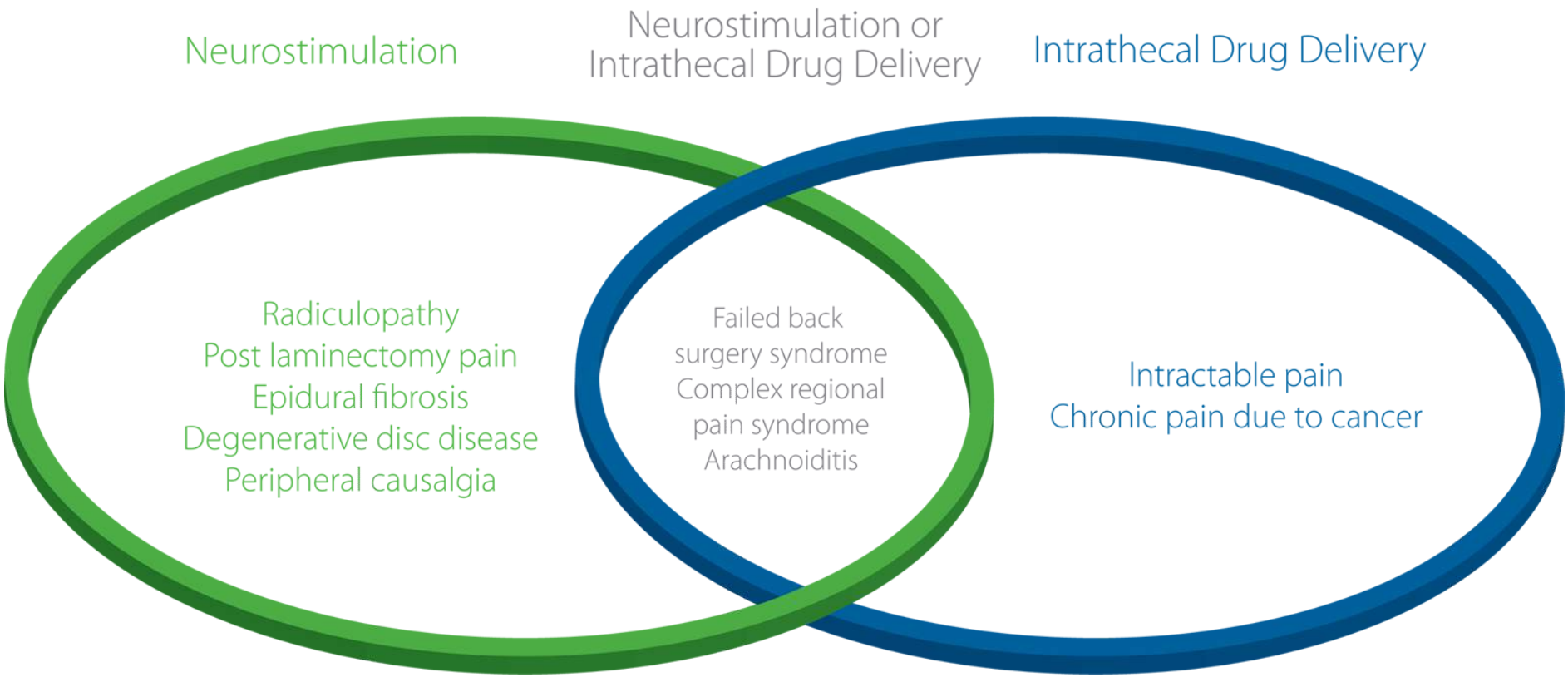
Route of Administration	Relative Potency (mg)*
Oral	300
Intravenous	100
Epidural	20
Intrathecal	1



Reduce Dose → Reduce Side Effects

*Relative approximations based on clinical observations

適應症


Neurostimulation
Neurostimulation or
Intrathecal Drug Delivery
Intrathecal Drug Delivery
Radiculopathy
Post laminectomy pain
Epidural fibrosis
Degenerative disc disease
Peripheral causalgia
Failed back
surgery syndrome
Complex regional
pain syndrome
Arachnoiditis
Intractable pain
Chronic pain due to cancer

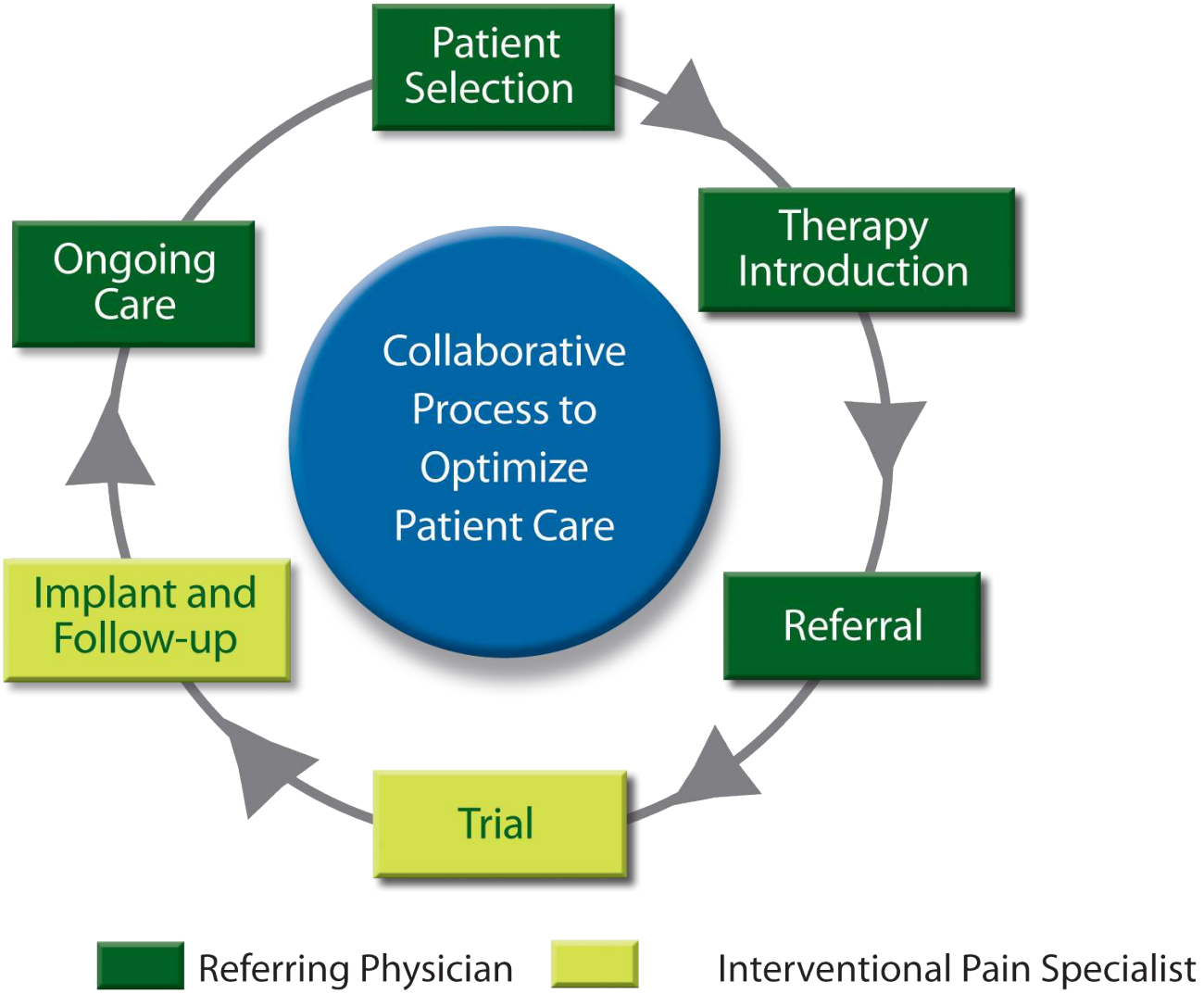
Patient Selection

- Inclusion Criteria
  - Opioid-responsive pain
  - Failure of long-acting oral opioids

- Exclusion Criteria
  - Spinal pathology precluding catheter placement
  - Allergy to opiates
  - Difficulty coming for pump refills

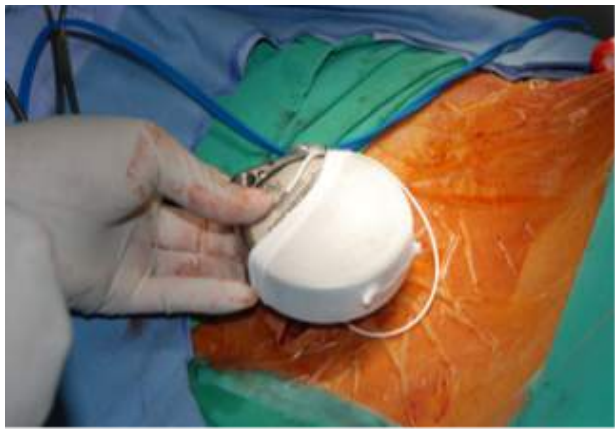
Psychological Evaluation

- Consider recommendations and treat if indicated - *prior to trial*
- Ability to understand appropriate expectations
- Major active psychosis, current drug addiction, some personality disorders, cognitive deficits, progressive organic brain disorders, suicidal, homicidal behavior


Patient Selection
Therapy Introduction
Referral
Trial
Implant and Follow-up
Ongoing Care
Collaborative Process to Optimize Patient Care
Referring Physician
Interventional Pain Specialist

Targeted Drug Delivery

- Trial
  - Patients can trial the therapy
    - Bolus or in-dwelling catheter
    - Assess for improvements in:
      - Pain scores
      - Physical function
      - Adverse events
  - Successful trial can be followed by implant
- Implant
  - Implantation of infusion pump and intrathecal catheter



Spinal Opiates

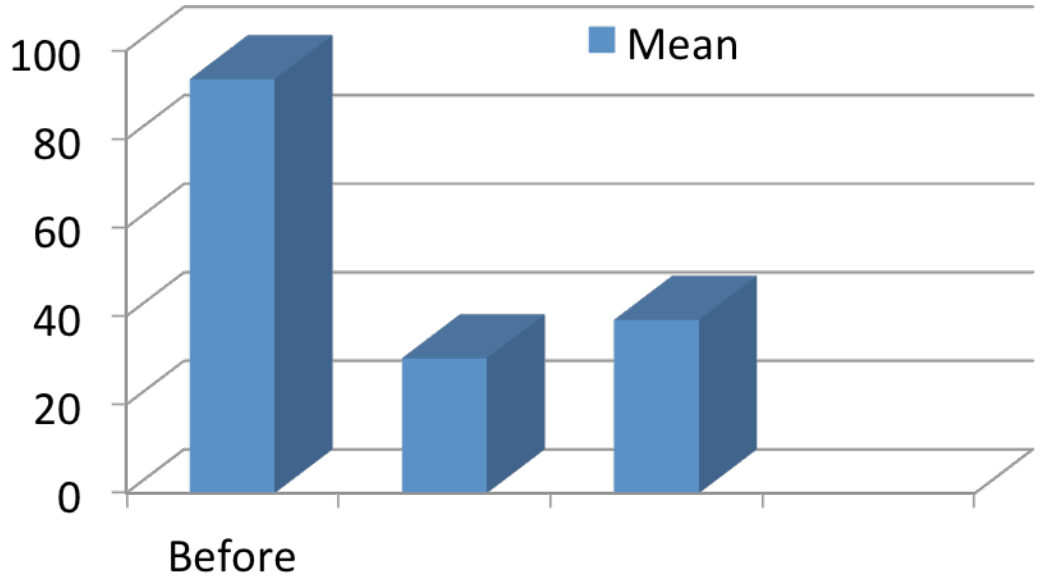
Non-malignant Pain

- Mean morphine dose
  - initial: 2.7 mg/day (0.3-12 mg/day)
  - after 3.4 years: 4.7 mg/day (0.3-12 mg/day)

- 28 patients followed more than 4 years
  - 64% (n=18) constant dosage history
  - 36% (n=10) increase in morphine dose > 6mg/day after 1 year

Winkellmuller et al.: J Neurosurgery 85:458-467, 1996

Mean Pain Scores



- 74% benefit
- Avg. pain reduction
  - 67% at 6 months
  - 58% last follow-up
- 81% improved QOL
- 92% "satisfied"
- Increased employment

Winkellmuller et al.: J Neurosurgery 85:458-467, 1996

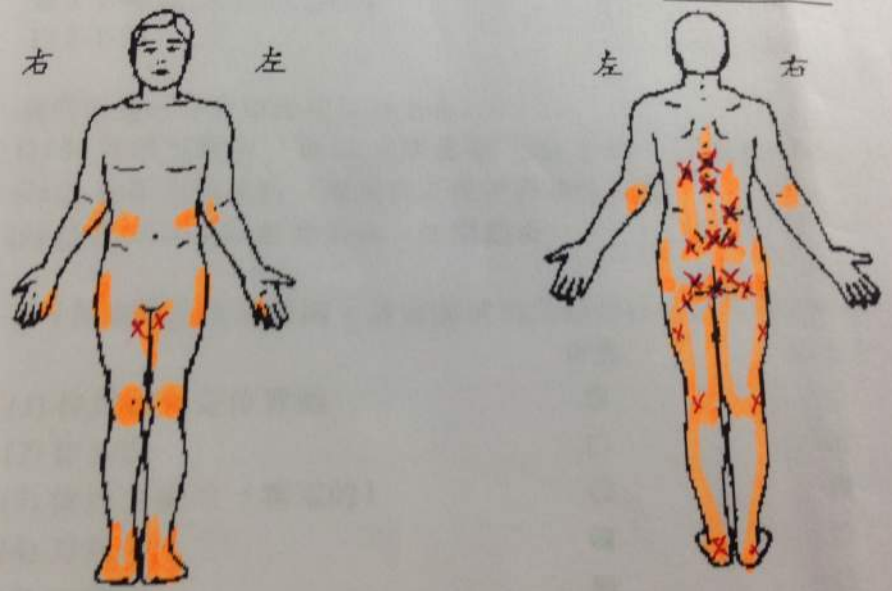
2007/3 ~ 2014/4

	Diagnosis	Duration	Morphine test	VAS (Pre-op)	VAS (Post-op)	Intra-thecal pump (morphine) dose (mg/day)
1	Neuropathic pain, cervical spinal cord injury	10 years	+	9	4	2.557
2	Neuropathic pain, cervical spinal cord injury	14 years	+	10	5	0.57
3	Failed back, neck surgery syndrome	14 years	+ (blinded test)	10	3	0.58
4	Reumatoid arthritis	5 years	+	10	5	0.6365

2 patients morphine free, 2 patients with morphine >50% reduction

(1) ■有　　(2) □沒有

2. 請您在下圖中用筆圈出您感到疼痛的部位，並在最痛的部位打"X"



(2) □ 我原來的疾病（即現在正接受診療的疾病）
(3) □ 與原來疾病無關的病（如關節炎）

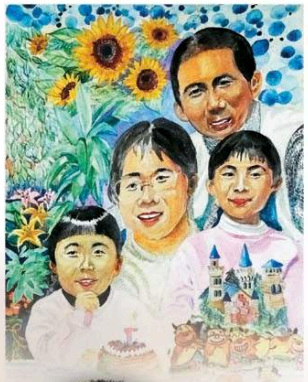
13. 下列各個描述疼痛的詞，請您圈選出最恰當描述您

	合適
(1) 持續而固定位置的	■
(2) 律動的	□
(3) 快速穿過的（觸電的）	□
(4) 刀割的	■
(5) 咬嚙的	■
(6) 尖銳的	■
(7) 觸痛的（一觸即痛的）	■
(8) 灼的	■
(9) 精疲力竭的	■
(10) 累人的	■
(11) 貫穿的	■
(12) 煩人的（纏人的）	■
(13) 麻麻的	□
(14) 可憐的	□
(15) 無法忍受的	■

14. 請圈出一個數字以表示您在最近一週內受疼痛影
1) 一般活動(吃、上廁所、洗澡)

彩繪舞動生命

畫渡人—陳宇昱的故事



傳揚美善於世間

「我最大的目標就是讓更多人善念永恆，
一張張『用心來畫的畫 』，
希望可以勸人向善。」

從細膩的筆鋒，探討生命力的泉源；從陳宇昱生命的故事，感受母親、弟弟、姊姊、姊夫、妻女、外傭安安的愛。從花蓮、桃園到台北慈濟醫院一份醫病情、鼓勵病友、師生緣、法親關懷，綿綿不絕的環扣，呵護生命的接力，正編織一篇人間至情的故事。

透過陳宇昱的樸實藝術畫作、心情日記，見證正在進行式的感人故事，除了給陳宇昱一分肯定與鼓勵外，更要讓有同樣病苦的人一分因緣。

因爲
有愛－就有希望
有希望－就有力量

誠摯邀請您蒞臨觀賞

開展時間/2012年4月22日(日) PM 13:00----PM 14:00

展覽時間/2012年4月22-6月30日(AM09:30----PM 16:00)

展覽地點/慈濟三重園區靜思堂 (福慧廳)

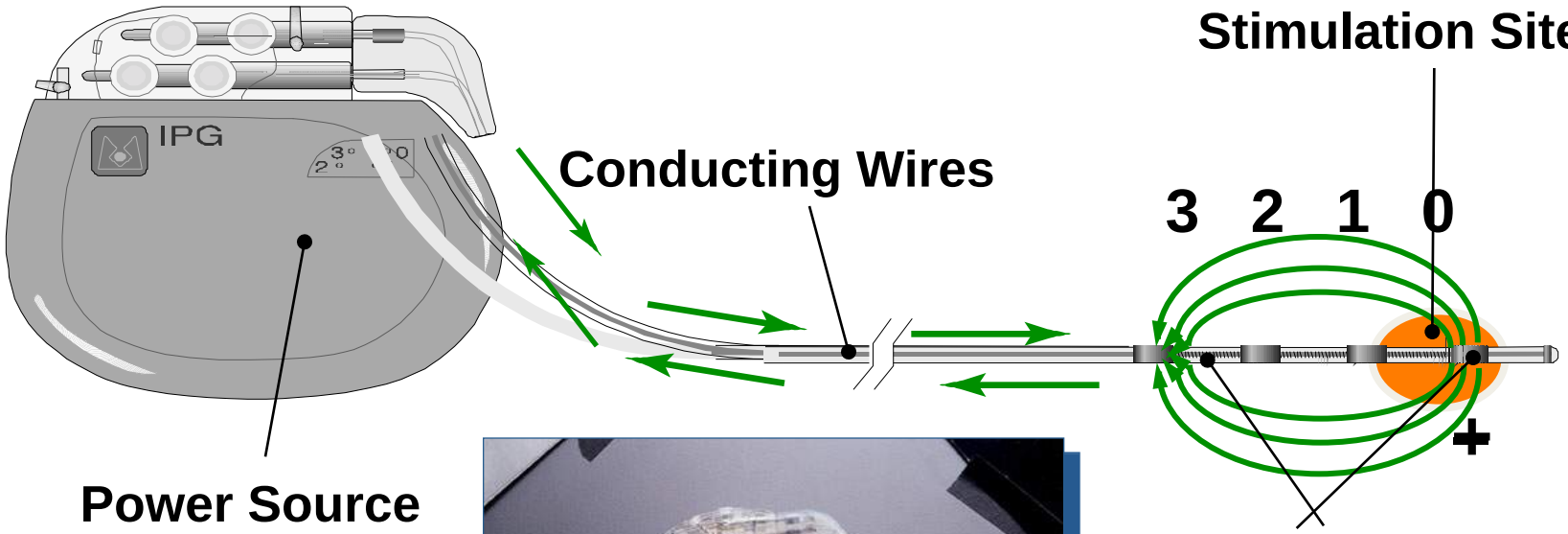
地址:新北市三重區中正北路450號

主辦單位:陳宇昱、慈濟三重靜思堂

WHAT IS SPINAL CORD STIMULATION?

Stimulation System Components

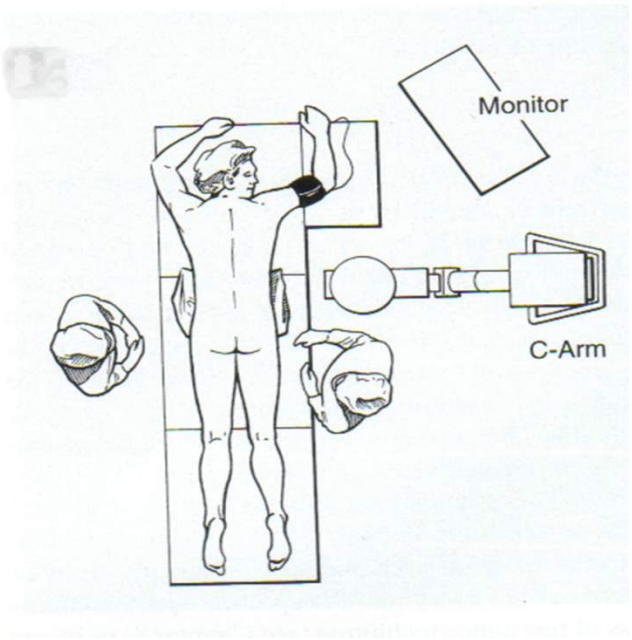
Extension and Leads

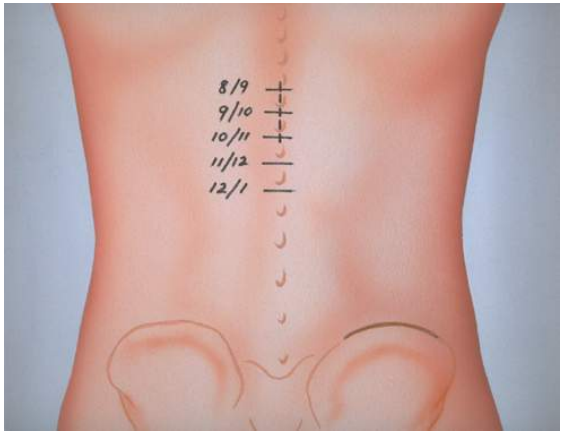


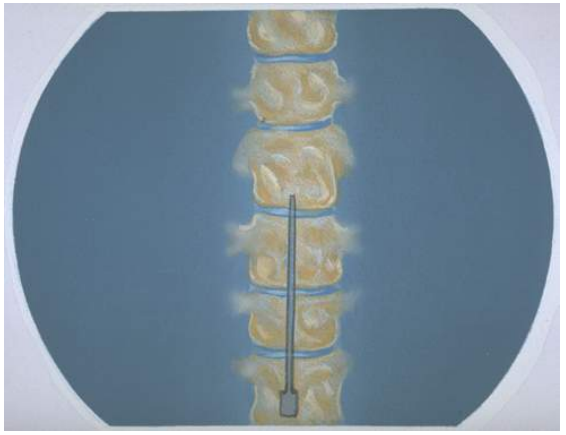
IPG/Battery

Electrodes

Neurostimulation Procedure Overview

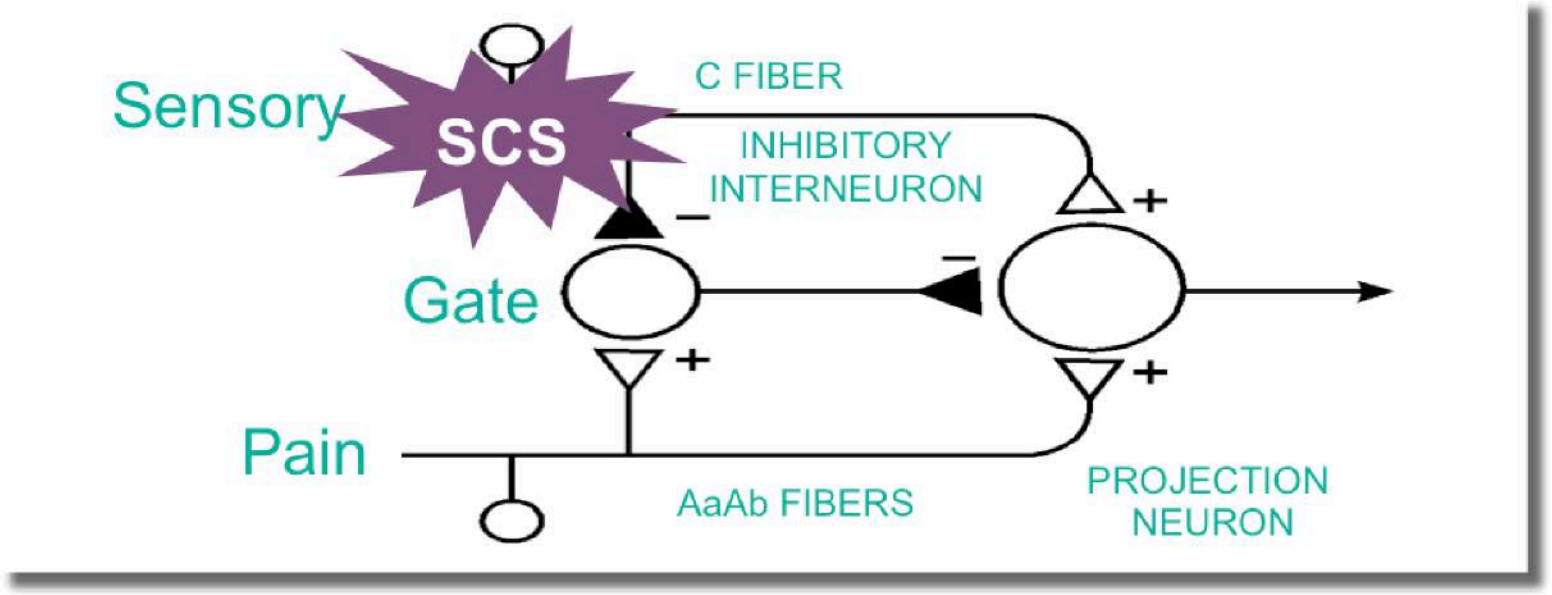






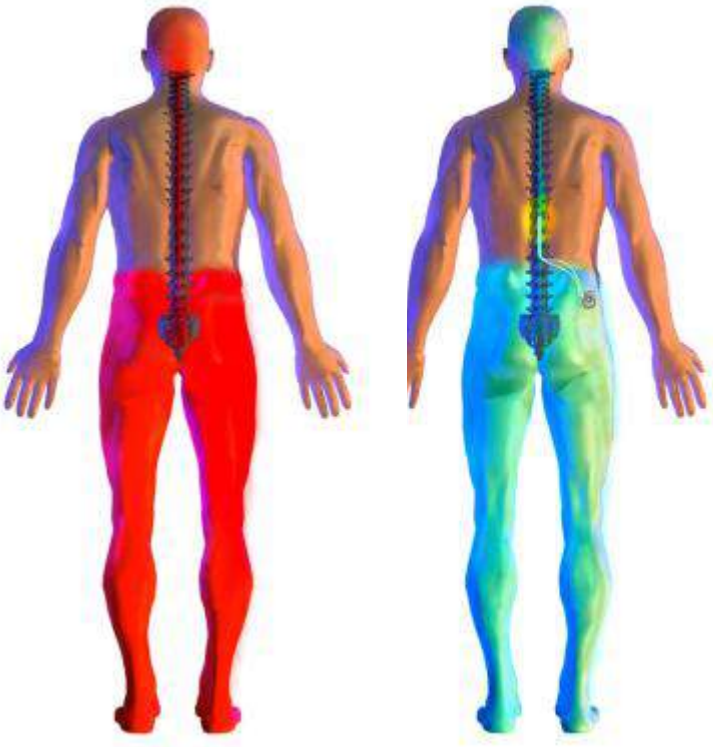
Gate Theory and SCS

SCS system implanted in the epidural space stimulates the pain-inhibiting nerve fibers masking painful sensation with a tingling sensation (paresthesia)



SCS Mechanism of Action - Vasodilatation

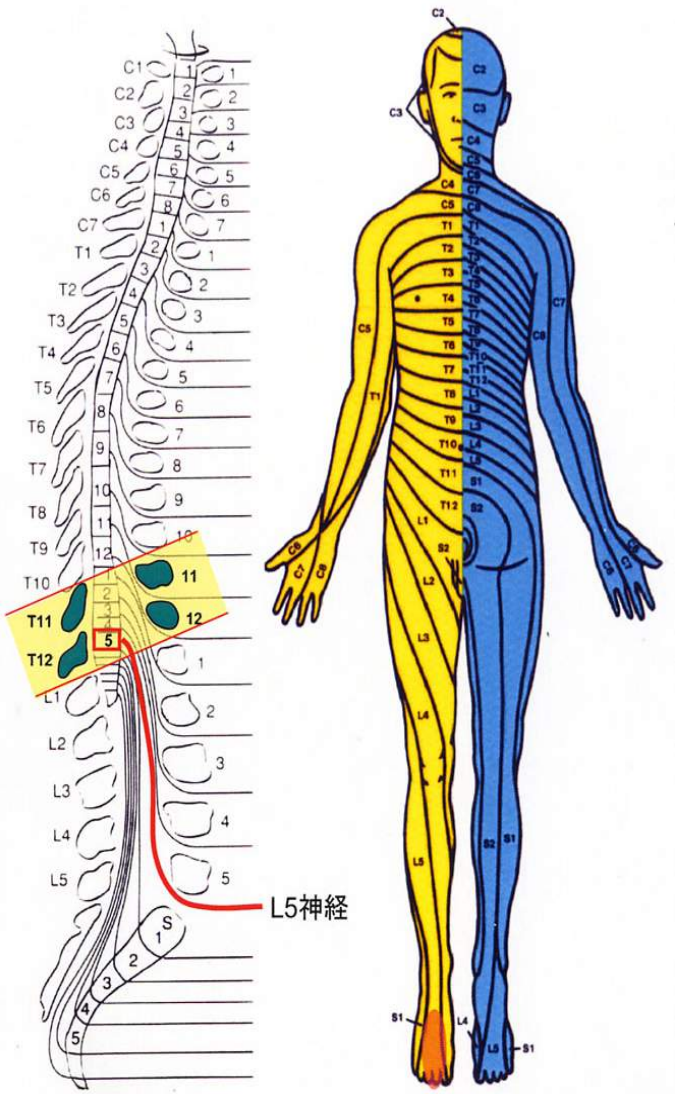
Inhibiting effects on the sympathetic nervous system



Pain **Paresthesia with SCS**

- **Vasodilatation is a frequent post-stimulation finding in both animal models and humans. This might be secondary to the pain-relieving effect of SCS; to antidromic effects on small afferent fibres; or to effects on central mechanisms controlling sympathetic outflow.**
- **SCS at high frequencies, might release vasoactive substances such as the calcitonin gene-related peptide (CGRP), substance P.**

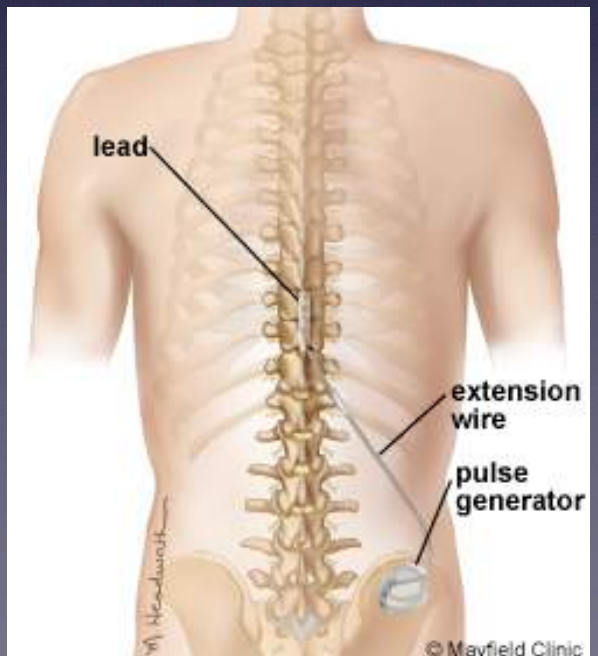
Map for Pain

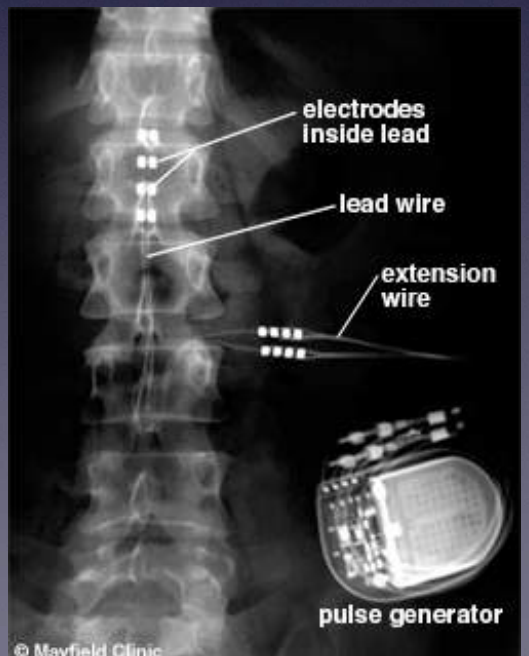


Pain Location (match the dermatome)	Vertebral Level (highest probability for initial placement of center bipole)		Pain Location (match the dermatome)	Vertebral Level (highest probability for initial placement of center bipole)
Anterior shoulder C4–C5 fibers	**C3** Range C3–C5		**Buttock through lower extremity** L2 to S1 fibers	**T9–T10** Range T11–L1
External arm C5 fibers	**C4** Range C2–T3		**Low back** T9–L1 fibers	**T9** Range T8–T11
Radial forearm C6 fibers	**C5** Range C2–T3		**Abdomen** T9–L1 fibers	**T8** Range T6–T11
Median hand C6–C7 fibers	**C6** Range C2–T3		**Anterior thigh** L2–L3 fibers	**T11** Range T11–T12
Ulnar hand C8 fibers	**C7** Range C2–T2		**Anterior leg** L4–L5 fibers	**T12** Range T12–L1
Ulnar forearm T1 fibers	**C7** Range C4–T3		**Posterior leg** S1–S2 fibers	**L1** Range T11–L1
Internal arm T2 fibers	**T1** Range C5–T3		**Posterior thigh** S1–S2 fibers	**L1** Range T11–L1
Chest T2–T6 fibers	**T2** Range T1–T7		**Foot only** L5–S1 fibers	**L1** Range T11–L1

Indication

- Failed back surgery
- Peripheral vascular disease: critical limb ischemia
- Complex regional pain syndrome
- Refractory angina pectoris





PROCESS Study Results – Failed back surgery syndrome

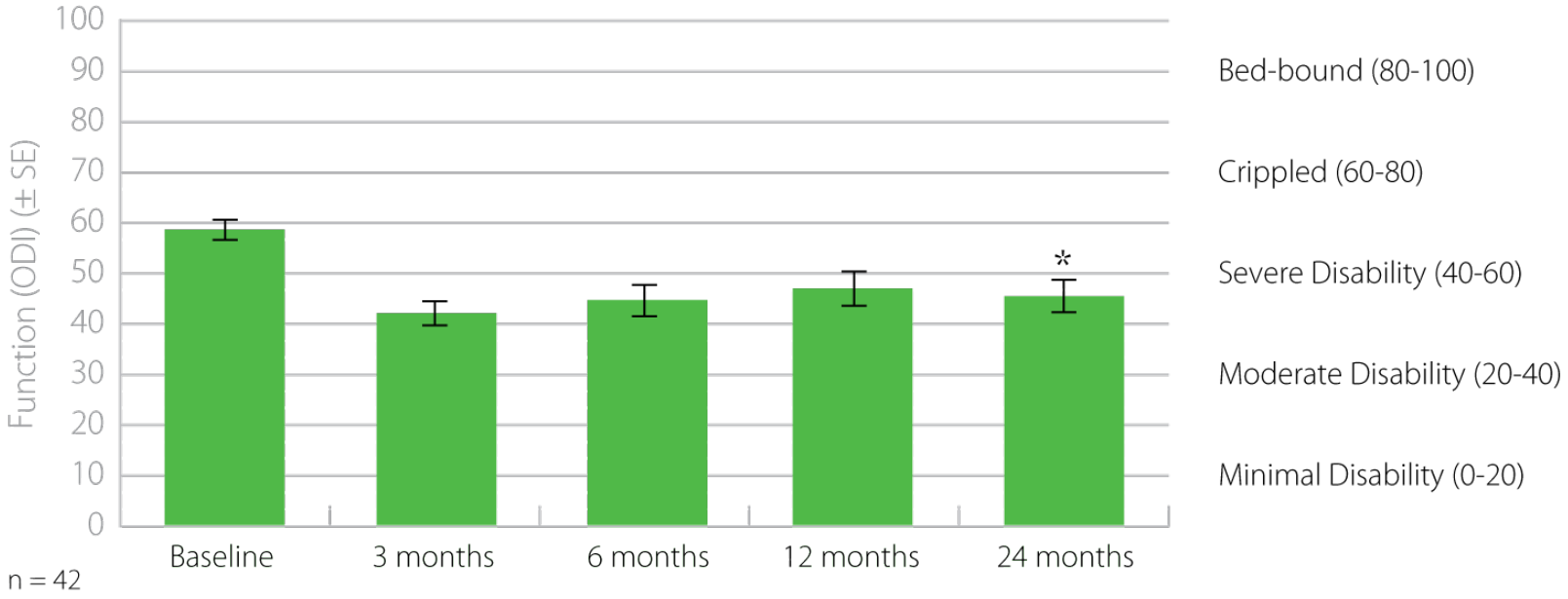
Primary outcome

Number of SCS + CMM patients with ≥ 50% leg pain relief (≥ 50% reduction in leg VAS) is:

- at 6 months, 23 of 42 or 55%
- at 12 months, 16 of 42 or 38%
- at 24 months, 17 of 42 or 40%

Kumar K, Taylor R, Jacques L, et al. *Neurosurgery*. 2008;63:762-770.

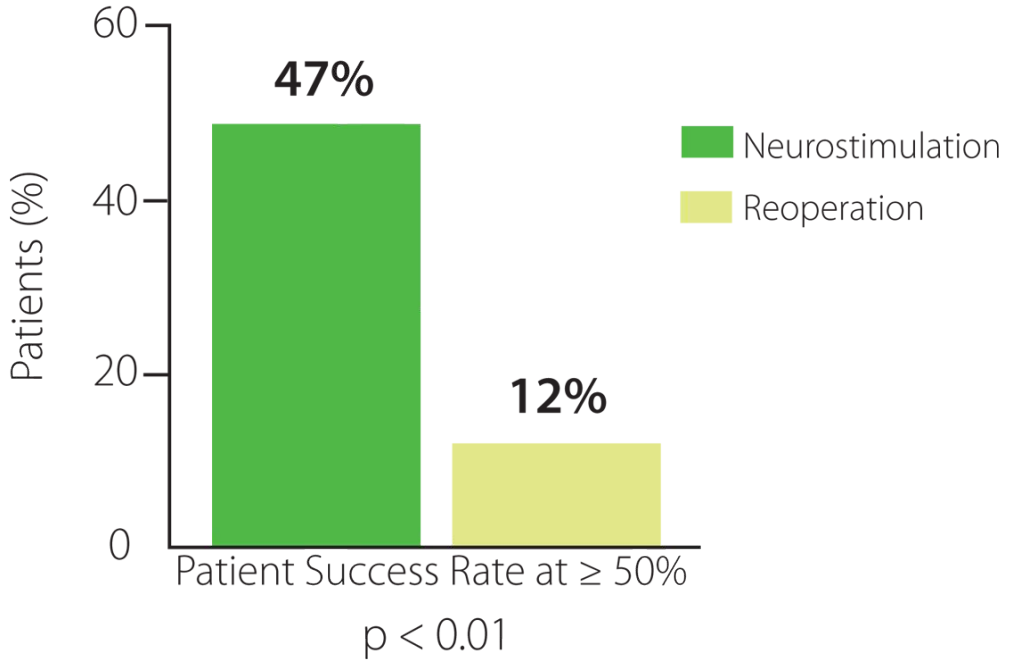
Significant Improvement in Function



Key Findings: Significant improvement in function (Oswestry Disability Index) in SCS +CMM group over 24 months.

Kumar K, Taylor R, Jacques L, et al. *Neurosurgery*. 2008;63:762-770.

More Effective than Repeat Surgery



Key Findings:

Among patients available for long-term follow up, SCS was significantly more successful than reoperation: 9 (47%) of 19 patients randomized to SCS and 3 (12%) of 26 patients randomized to reoperation achieved at least 50% pain relief and were satisfied with treatment.

North RB, Kidd D, Shipley J, et al. Spinal cord stimulation versus reoperation for failed back surgery syndrome: a cost effectiveness and cost utility analysis based on a randomized, controlled trial. Neurosurg. 2007;61:361-369.

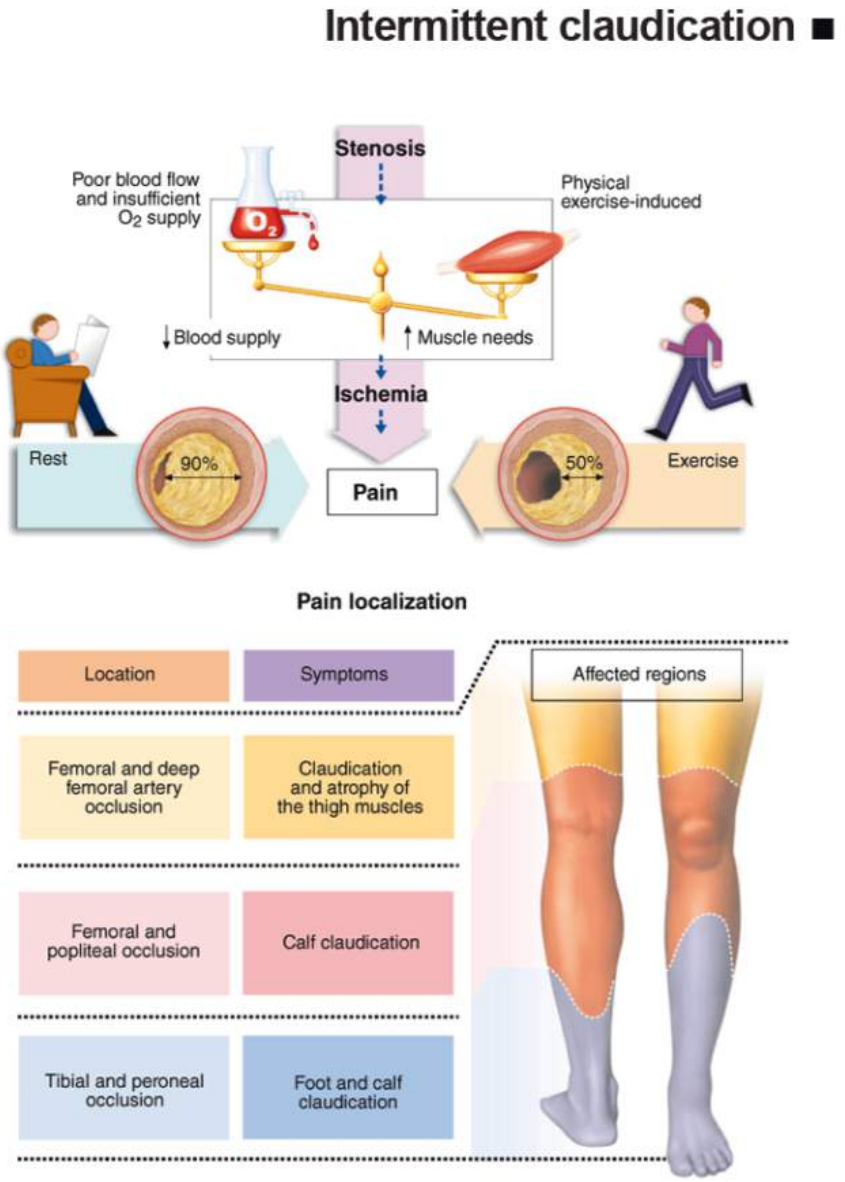
Critical Limb Ischaemia (SCS)

Results “ Clinical Studies”

- >75% pain relief in 80%
- tcPO2 ++
- RBCV ++
- Capillary perfusion ++
- Improved ulcer healing++
- Multipolar electrode (Th10~12)
- Amplitude 0.5~2.0V
- Frequency :70~120Hz
- Pw : 210 us
- One stage procedure

Algorithm

- “Good” microcirculation ~NO SCS
  tcPO2>30mmHg(normal 70 mmHg)
- **“Intermediate” type ~TRIAL SCS**
  number of perfused capillaries :20/mr
  tcPO2 :10~30mmHg
- “Poor” microcirculation ~NO SCS
  tcP02<10mmHg



Spinal cord stimulation in the treatment of non-reconstructable stable critical leg ischaemia: results of the European Peripheral Vascular Disease Outcome Study (SCS-EPOS)

AUTHORS:
Amann W, Berg P, Gersbach P, Gamain J, Raphael JH, Ubbink D

REFERENCE:
Manuscript accepted for publication, Eur J Vasc Endovasc Surg 2003

Parameters used to determine treatment group

Parameter	SCS-Match* (n=41)	SCS-No-Match* (n=32)	No SCS* (n=39)
$TcpO_2$:**			
• Baseline forefoot <30 mmHg	✓	✓/×	✓/×
After test stimulation (≥72 h):			
• If baseline $TcpO_2$ <10 mmHg, should increase to >20 mmHg after test stimulation	✓	✓/×	✓/×
• Sufficient pain relief	✓	✓/×	✓/×
• Paraesthesia coverage >75%	✓	✓/×	✓/×
	Implanted with internal pulse generator (IPG Itrel® or Synergy, Medtronic)		Conservative treatment only

* SCS-Match group meets all criteria; the other two groups may meet some criteria, but not all

** Measured in supine position using TCM3, Radiometer (Copenhagen, Denmark)

Eur J Vasc Endovasc Surg **26**, 280–286 (2003)

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Increase in $TcpO_2$ from baseline during treatment with SCS

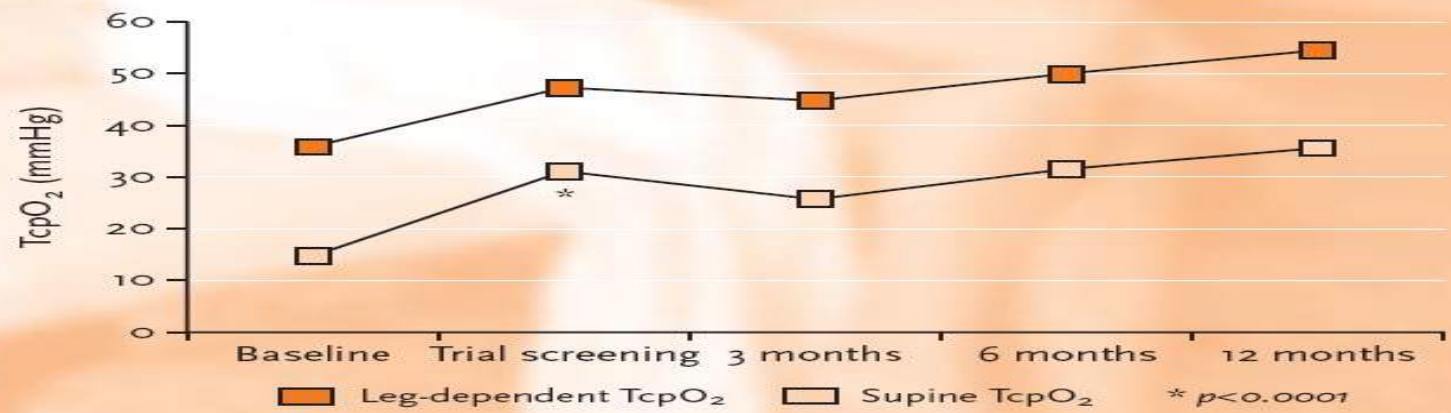

Table 5. Effects of 3 months of SCS treatment on tcpO2 values in 52 atherosclerotic amputations-free survivors

Position	Initial tcpO2 (mmHg)	tcpO2 at 3 months (mmHg)	Mean tcpO2 increase (mmHg)
supine	12.5 ± 11.6*** median 9	33.3 ± 17.1*** median 39	20.8 ± 14.8 median 22
sitting	40.6 ± 15.0*** median 40	56.7 ± 11.8*** median 58	16.1 ± 16 median 15.5

***$p < 0.001$, 2-tailed t-test.

Eur J Vasc Endovasc Surg **26**, 280–286 (2003)

Spinal cord stimulation in the treatment of non-reconstructable stable critical leg ischaemia: results of the European Peripheral Vascular Disease Outcome Study (SCS-EPOS)

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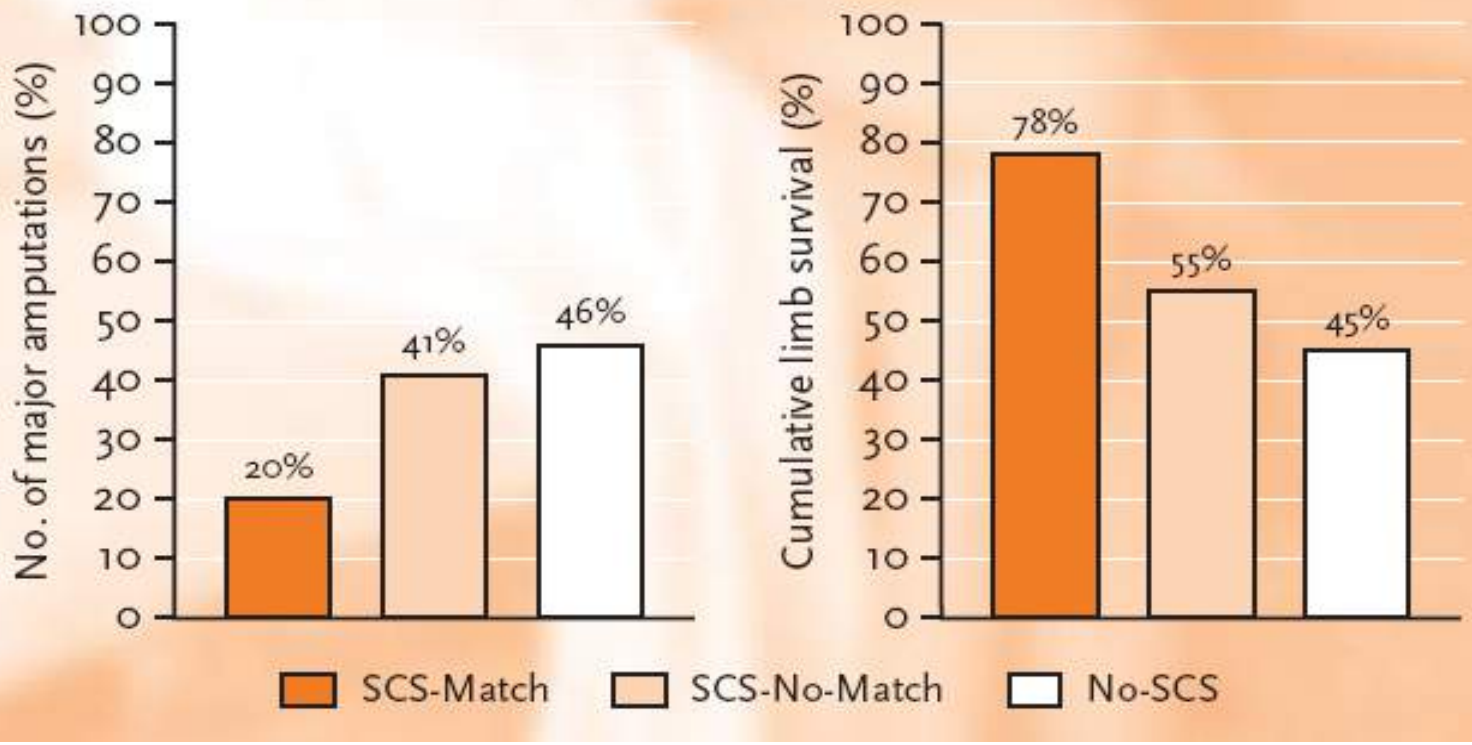
Amann W, Berg P, Gersbach P, Gamain J, Raphael JH, Ubbink D

REFERENCE:
Manuscript accepted for publication, Eur J Vasc Endovasc Surg 2003

Reduced risk of amputation and increased cumulative limb survival with SCS-Match at 12 months



Eur J Vasc Endovasc Surg **26**, 280–286 (2003)

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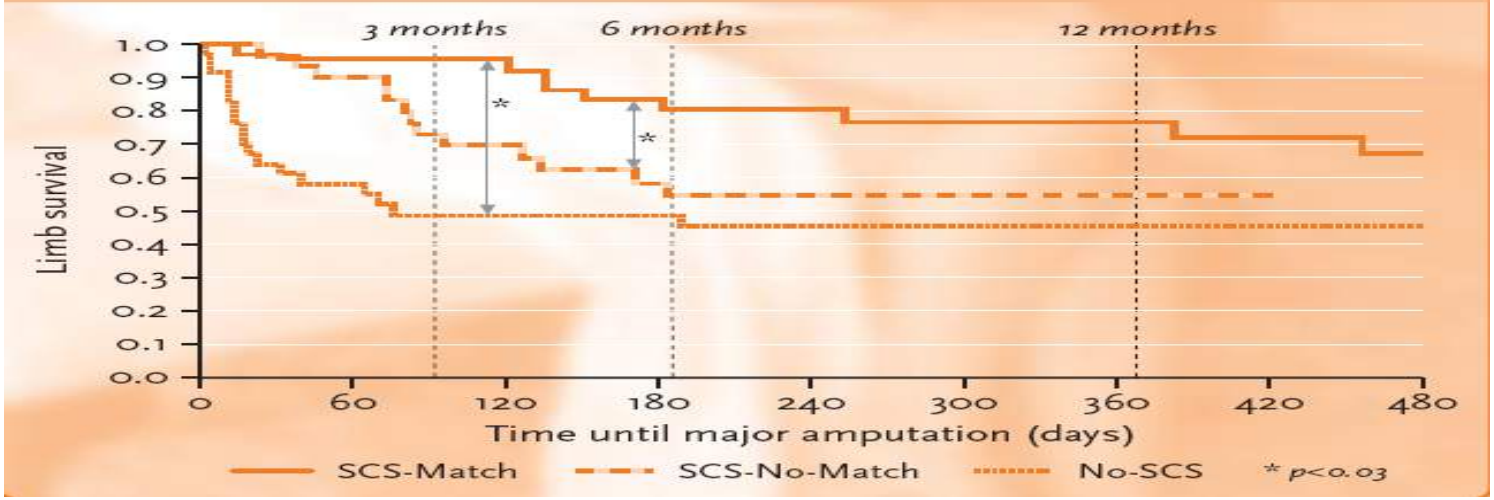
Increased cumulative limb survival with SCS compared with No-SCS



43% SCS-Match patients: from Fontaine stage Ⅲ or Ⅳ

After 12months

Improved to Fontaine stage Ⅰ or Ⅱ

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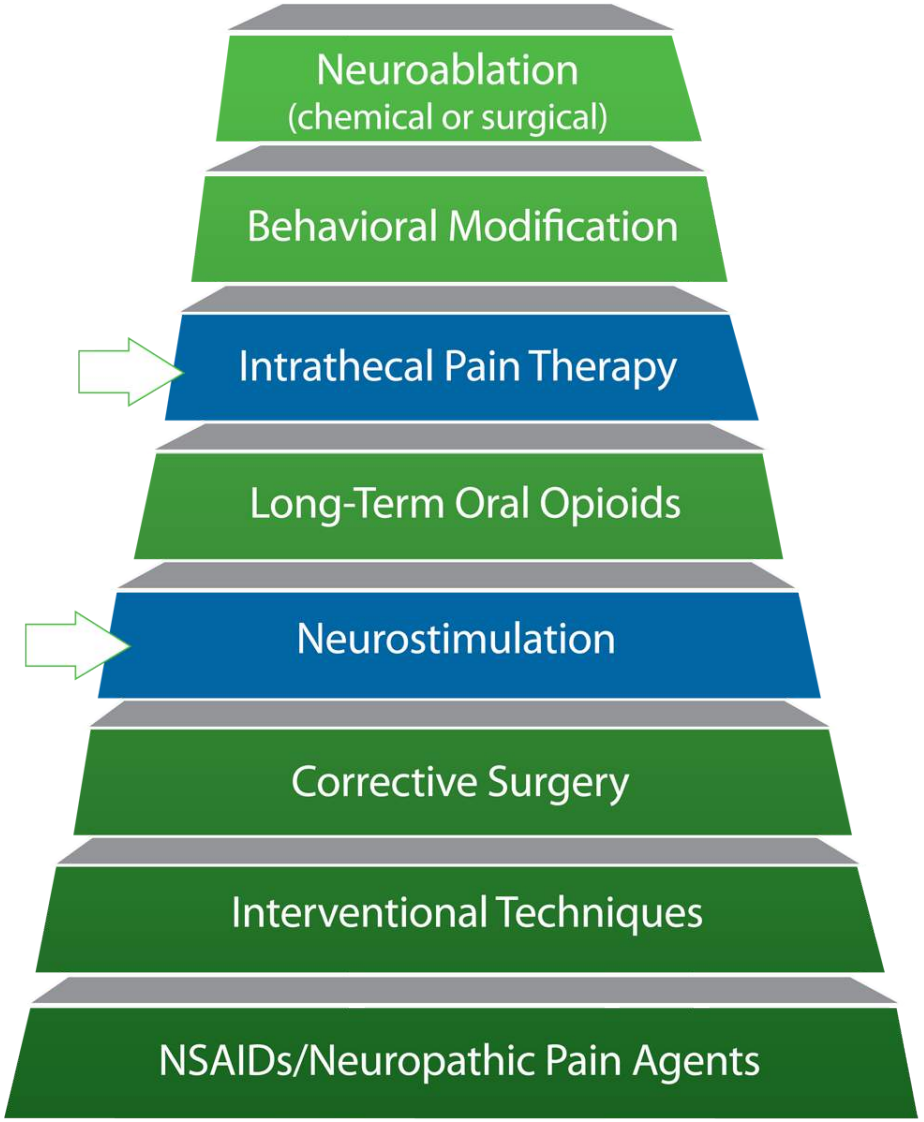
Rethinking the Pain Treatment Ladder

In contrast to earlier thinking on the order of treatments in the pain treatment continuum,[1] it has been proposed that device therapies be considered at an earlier stage.[2]



[1]Krames ES. Intraspinal Opioid Therapy for Nonmalignant Pain: Current Practices and Clinical Guidelines. *J Pain Symptom Manage* 1996;11:333-352.

[2]Stamatos JM, et al. *Live Your Life Pain Free*, October 2005. Based on the interventional pain management experience of Dr. John Stamatos.

感謝大家聆聽