Blocks of the Sympathetic Nervous System: An Update

Mitchell P. Engle, MD, PhD
Texas Pain Society Annual Meeting
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Disclosures

• No relevant financial disclosures

• Equity: Cellarian Health
Talk Overview

• Sympathetic Nervous System anatomy
• Review of sympathetic blocks
• Evidence: classic and new
• Emerging concepts
Sympathetically Mediated Pain

Pain that is enhanced or maintained by a functional abnormality of the sympathetic nervous system.
Pain Syndromes

- CRPS
- Herpes Zoster (and PHN)
- Phantom limb pain
- Trigeminal neuralgia
- Traumatic neuropathies
- Metabolic or drug neuropathies
- Cancer pain
- Visceral pain
SNS Pathophysiology

• Direct
  – Sympatho-afferent coupling: Upregulation of adrenergic receptors on distal terminals of PAN
  – Ephaptic connections
  – DRG coupling “baskets” after nerve injury

• Indirect
  – ↑ systemic NE → altered microcirculation impacting local nutrition and oxygenation
Sympathetic Nervous System Blocks
Sphenopalatine Ganglion Block (Pterygopalatine)

• Mixed ganglia
  – Parasymp, Symp, Sensory

• Sympathetic fibers from superior cerv chain.

• Blocks used for
  – SP neuralgia
  – Cluster HA
  – Atypical facial pain
  – Cancer of tongue and floor of mouth
Sphenopalatine Ganglion Block

A

B

Brian Bruel MD
Sphenopalatine Ganglion Block: Evidence

• No RCTs; Mostly case series
• SP neuralgia (8 pts) → repeat chemical neurolysis → average 90% relief for 9 months (Puig 1998)
• Cluster HA, 2 studies (81 pts) → SPG RFA → decreased attack intensity and frequency (Sanders 1997; Narouze 2009)
Retrospective study; atypical unilateral TN patient; Intranasal SPG significantly reduced VAS for up to a month

Prospective; cluster HA and atypical facial pain; CT guided SPG neurolysis; 67% had 50% reduction for average duration of 10 months
Stellate Ganglion Block

- Anterior to C7 TP/T1 rib
- Sympathetic innervation to the ipsilateral head, neck, and upper extremity.
- Block used for
  - SMP (CRPS, AHZ, PHN)
  - Hyperhydrosis
  - Vascular insufficiency
Stellate Ganglion Block: Evidence

• For CRPS
  – Effectiveness of the SGB is temporally associated with the development of the syndrome (Yucel 2009; Ackerman 2006)

• AHZ/PHN
  – RCT N=64, Saline vs LA/Dex SGB within 2 weeks of rash reduced pain and possibly PHN (Makharita 2012)

• Ideal volume based on cadaveric data 5 ml (Feigl 2007)
Effectiveness of Stellate Ganglion Block Under Fluoroscopy or Ultrasound Guidance in Upper Extremity CRPS

FARNAK IMANI1, KARIM HEMATI2, POUPAK RAHIMZADEH3, MOHAMAD REZA KAZEMI4, KOKAB HEJAZIAN5

Ultrasound-Guided Stellate Ganglion Blocks Combined with Pharmacological and Occupational Therapy in Complex Regional Pain Syndrome (CRPS): A Pilot Case Series Ad Interim

DOI 10.1007/s11916-014-0424-5

ANESTHETIC TECHNIQUES IN PAIN MANAGEMENT (D WANG, SECTION EDITOR)

Ultrasound-Guided Stellate Ganglion Block: Safety and Efficacy

Samer Narouze
Stellate Ganglion Block
Thoracic Sympathetic Block

- Anterolateral to vertebrae
- Provide sympathetic innervation to the upper extremities, chest wall, and upper abdominal wall
- 10-20% of people have significant sympathetic innervation to UE via T2 and T3
Thoracic Sympathetic Block

Courtesy of Miles Day, MD
Thoracic Sympathetic Block: Evidence

• UE neuropathic pain
  – Fluoro guided TSB, 20% reported much improved, better outcomes early in pain condition (Yoo 2011)

• UE PHN, neuropathic pain, or CRPS
  – CT guided TSB or neurolysis (N=293), significant pain reductions, PTX 1% (Agarwal-Kozlowski 2011)
  – TSB and RFA (N=110), significant and prolonged pain relief, PTX 2% (Wilkinson 1996)
Thoracic sympathetic block for the treatment of complex regional pain syndrome type I: A double-blind randomized controlled study

Roberto de Oliveira Rocha a,*, Manoel Jacobsen Teixeira a,b, Lin Tchia Yeng a,c, Mirlene Gardin Cantara a,c, Viviane Gentil Faria a,c, Victor Liggieri a,c, Adrianna Loduca a, Barbara Maria Müller a, Andrea C.M.S. Souza a, Daniel Ciampi de Andrade a,d
Splanchnic Nerve Block

- “Celiac Axis Pain” generally in upper abdomen, frequently refers to the back
- Visceral afferents from the lower esophagus, stomach, pancreas, liver, gall bladder and parts of the intestine up to the splenic flexure
- Block / neurolysis disrupts sympaththetic efferents and afferent nerves
Splanchnic Nerve Block
Celiac plexus block for pancreatic cancer pain in adults (Review)

Arcidiacono PG, Calori G, Carrara S, McNicol ED, Testoni PA

Figure 3. Forest plot of comparison: 'CPB versus analgesic therapy (VAS)' follow up at 4 weeks.

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Experimental Mean</th>
<th>SD</th>
<th>Total</th>
<th>Control Mean</th>
<th>SD</th>
<th>Total</th>
<th>Weight</th>
<th>Mean Difference IV, Fixed, 95% CI</th>
<th>Mean Difference IV, Fixed, 95% CI</th>
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</thead>
<tbody>
<tr>
<td>Kawamata 1996</td>
<td>2.5</td>
<td>0.4</td>
<td>10</td>
<td>3.3</td>
<td>0.8</td>
<td>11</td>
<td>30.9%</td>
<td>-0.80 [-1.33, -0.27]</td>
<td></td>
</tr>
<tr>
<td>Wong 2004</td>
<td>2.2</td>
<td>1.5</td>
<td>40</td>
<td>2.6</td>
<td>1.6</td>
<td>37</td>
<td>18.3%</td>
<td>-0.30 [-0.99, 0.39]</td>
<td></td>
</tr>
<tr>
<td>Zhang 2008</td>
<td>2.7</td>
<td>1.2</td>
<td>29</td>
<td>3.0</td>
<td>0.9</td>
<td>27</td>
<td>28.7%</td>
<td>-0.30 [-0.85, 0.25]</td>
<td></td>
</tr>
<tr>
<td>Mercadante 1993</td>
<td>3.2</td>
<td>0.7</td>
<td>9</td>
<td>3.4</td>
<td>0.7</td>
<td>10</td>
<td>22.1%</td>
<td>-0.20 [-0.83, 0.43]</td>
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</tr>
<tr>
<td>Total</td>
<td>88</td>
<td></td>
<td></td>
<td>85</td>
<td></td>
<td></td>
<td>100.0%</td>
<td>-0.43 [-0.73, -0.14]</td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: Chi² = 2.70, df = 3 (P = 0.44); I² = 0%
Test for overall effect: Z = 2.86 (P = 0.004)

Figure 4. Forest plot of comparison: CPB versus analgesic therapy, outcome: 1.2 Pain VAS at 8 weeks.

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Experimental Mean</th>
<th>SD</th>
<th>Total</th>
<th>Control Mean</th>
<th>SD</th>
<th>Total</th>
<th>Weight</th>
<th>Mean Difference IV, Random, 95% CI</th>
<th>Mean Difference IV, Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kawamata 1996</td>
<td>2.8</td>
<td>0.5</td>
<td>7</td>
<td>3.2</td>
<td>0.4</td>
<td>7</td>
<td>19.4%</td>
<td>-0.40 [-0.87, 0.07]</td>
<td></td>
</tr>
<tr>
<td>Lillermo 1993</td>
<td>2.4</td>
<td>0.3</td>
<td>58</td>
<td>3.4</td>
<td>0.4</td>
<td>58</td>
<td>24.2%</td>
<td>-1.00 [-1.13, -0.87]</td>
<td></td>
</tr>
<tr>
<td>Mercadante 1993</td>
<td>3.0</td>
<td>0.2</td>
<td>4</td>
<td>3.6</td>
<td>0.17</td>
<td>3</td>
<td>22.6%</td>
<td>-0.66 [-0.93, -0.39]</td>
<td></td>
</tr>
<tr>
<td>Wong 2004</td>
<td>1.6</td>
<td>1.5</td>
<td>36</td>
<td>1.8</td>
<td>1.7</td>
<td>32</td>
<td>14.4%</td>
<td>-0.20 [-0.97, 0.57]</td>
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<tr>
<td>Zhang 2008</td>
<td>3.4</td>
<td>0.1</td>
<td>29</td>
<td>3.1</td>
<td>0.8</td>
<td>27</td>
<td>19.4%</td>
<td>0.30 [-0.17, 0.77]</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>134</td>
<td></td>
<td></td>
<td>127</td>
<td></td>
<td></td>
<td>100.0%</td>
<td>-0.44 [-0.89, 0.01]</td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: Tau² = 0.22; Chi² = 35.88, df = 4 (P = 0.00001); I² = 89%
Test for overall effect: Z = 1.90 (P = 0.06)
Six studies (358 participants)  
All RCT’s  
↓ mean pain score at four weeks  
↓ opioid consumption  
↓ constipation  

“CPB appears to be safe and effective for the reduction of pain in patients with pancreatic cancer, with a significant (though limited) advantage over standard analgesic therapy.”
Randomized, Double-Blind, Controlled Trial of Early Endoscopic Ultrasound–Guided Celiac Plexus Neurolysis to Prevent Pain Progression in Patients With Newly Diagnosed, Painful, Inoperable Pancreatic Cancer

Jonathan M. Wyse, Marco Carone, Sarto C. Paquin, Mariana Usatii, and Anand V. Sahai

Pain Physician 2016; 19:281-292 • ISSN 1533-3159

Retrospective Evaluation

The Effectiveness of Alcohol Versus Phenol Based Splanchnic Nerve Neurolysis for the Treatment of Intra-Abdominal Cancer Pain

Dhanalakshmi Koyyalagunta, MD, Mitchell P. Engle, MD, PhD, Jun Yu, Lei Feng, and Diane M. Novy, PhD
Lumbar Sympathetic Block

- Sympathetic ganglia from L2-4
- Majority of the sympathetic innervation to the LE
- Most research has evaluated CRPS
Lumbar Sympathetic Block: Evidence

• LE CRPS
  – LSB for CPRS after TKA (N=29); 45% significant pain relief (Cameron 1994)
  – LSB RFA for LE CRPS (N=20); 14 some response, 5 excellent response (Rocco 1995)

• Botulinum toxin A (OFF LABEL USE)
  – N=10; 75 u BTXa included in LSB prolonged effectiveness from 10 to 71 days (Carroll 2009)
Superior Hypogastric Plexus Block

- Visceral afferents from distal colon, lower ureter, bladder, uterus, proximal vagina, testes or ovaries
- Single small RCT
- Three case series reporting >50% reduction in pelvic pain due to tumor
Superior Hypogastric Plexus Block
PALLIATIVE CARE SECTION

Original Research Article
Efficacy of the Anterior Ultrasound-Guided Superior Hypogastric Plexus Neurolysis in Pelvic Cancer Pain in Advanced Gynecological Cancer Patients

Superior hypogastric plexus block as a new method of pain relief after abdominal hysterectomy: double-blind, randomised clinical trial of efficacy

H Rapp, S Ledin Eriksson, P Smith

* Department of Gynaecology and Obstetrics, Gävle Hospital, Gävle, Sweden. * Department of Anaesthesiology, Gävle Hospital, Gävle, Sweden

Correspondence: H Rapp, Department of Gynaecology and Obstetrics, Gävle Hospital, Lassegatan 5, 803 24 Gävle, Sweden. Email hanna.rapp@regiongaeborg.se

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Impars Ganglion Block

- Most caudal sympathetic ganglion
- Contains sympathetic, parasymp, and visceral afferent fibers
- Used for pain from the distal rectum, anus, perineum, vulva, distal vagina, and distal urethras.
- 3 small case series report pain relief in cancer and noncancer pain.
Impars Ganglion Block
Retrospective study
Coccydynia
N=41
Conventional RFA
Significant pain reduction for 6 months
Novel SNS Techniques

Sympathetic Block with Botulinum Toxin to Treat Complex Regional Pain Syndrome
Ian Carroll, MD, MS, J. David Clark, MD, PhD, and Sean Mackey, MD, PhD

CHRONIC AND INTERVENTIONAL PAIN
ORIGINAL ARTICLE

Stellate Ganglion Block for the Treatment of Posttraumatic Stress Disorder
A Randomized, Double-Blind, Controlled Trial
Steven R. Hanling, MD, Anita Hickey, MD, Ivan Lesnik, MD, Robert Jeremy Hackworth, MD, Eric Stedje-Larsen, MD, Carol Anne Drasdal, RN, MPH, and Robert N. McLay, MD, PhD

Effects of stellate-ganglion block on hot flushes and night awakenings in survivors of breast cancer: a pilot study
Eugene G Lipov, MD, Jaydeep R Joshi, MD, Sarah Sanders, PA-C, Kris Wilcox, EMT, Sergei Lipov, MD, Hui Xie, PhD, Robert Maganini, MD, Konstantin Slavin, MD

Bone Cancer Pain: From Mechanism to Therapy
Patrick W. Mantyh
Conclusions

• Sympathetic blocks have a long history in pain medicine
• Most data is based observational studies
• Paucity of RCT data
• Emerging trends and techniques may increase the utilization of these blocks
Neuropathic pain: mechanisms and their clinical implications

Steven P Cohen,1 2 Jianren Mao3

REVIEW

Mechanism-based treatment in complex regional pain syndromes

Janne Gierthmühlen, Andreas Binder and Ralf Baron

EVIDENCE-BASED MEDICINE

Section Editor: Jan Van Zundert, MD, PhD, FIPP

Sympathetic Blocks: The Evidence

Miles Day, MD, FIPP, DABIPP

Department of Anesthesiology and Pain Management, Texas Tech University Health Sciences Center, Lubbock, Texas, U.S.A.
mitchengle@gmail.com
References