Radiofrequency Ablation
Cervical and Lumbar Facet Joint Pain

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Disclosures

- CVS Caremark
- Cardinal Health
Outline

- Spine pain prevalence
- Anatomy of facet joints
- Presentation of facet joint pain
- Diagnosis
- Historical perspectives in treating facet joint pain
- Evidence of efficacy
Spine Pain Epidemiology

- Spine pain lifetime prevalence ~**54% to 80%**
- “Chronic persistent low back and neck pain is seen in **25% to 60%** of patients, one-year or longer after the initial episode.”
- “Spinal pain is associated with significant economic, societal, and health impact [and] frequent use of opioids in managing chronic non-cancer pain has been a major issue for health care in the United States...”

(Manchikanti, Singh, Datta, Cohen, & Hirsch, 2009)
Facet Joint Pain

- The prevalence of facet joint pain:
  - Pain in the cervical spine ~55%
  - Pain in the thoracic spine ~42%
  - Pain in the lumbar spine ~31% (Manchikanti et al., 2004)

- In 1927 Putti first illustrated zygapophyseal joint osteoarthritis
  - Dissected 75 cadavers over 40 y/o (Putti, 1927)

- In 1933 Ghormley coined the term Facet Syndrome (Ghormley, 1933)
Anatomy of the Facet Joint

(Walsh, 2003)
Anatomy of the Facet Joint

(Binder & Nampiaparampil, 2009)
Cervical Referral Pattern

(Gellhorn, Katz, & Suri, 2013)
Lumbar Referral Pattern

(Gellhorn, Katz, & Suri, 2013)
Associations

- **Cervical**
  - C3-4, C4-5
  - Age
  - Male=Female

- **Lumbar**
  - L4-5>L5-1
  - Age
  - BMI
  - Female>Male
  - Disc height narrowing

(Gellhorn, Katz, & Suri, 2013)
Diagnosis

- History
  - Head turning
  - Standing vs Sitting
  - Stiffness
- Physical Exam
  - Palpation
  - Provocative maneuvers
  - Flexion (Unloading)/Extension (Loading)
- Imaging
- Diagnostic Blocks
Arthritis of the Facet Joint

(Gellhorn, Katz, & Suri, 2013)
Cervical Diagnostic Approach

“Local anesthetic blocks of the cervical medial branches are a specific test for the diagnosis of cervical zygapophyseal joint pain. The local anesthetic always reaches the target nerve and does not affect any other diagnostically important structures.” (Barnsley & Bogduk, 1993)
Lumbar Diagnostic Approach

“When properly performed, lumbar medial branch blocks successfully inhibit pain associated with capsular distention of the lumbar zygapophysial joints at a rate of 89%.” (Kaplan, Dreyfuss, Halbrook, & Bogduk, 1998)
Historical Perspective

Percutaneous radiofrequency denervation of spinal facets

Treatment for chronic back pain and sciatica

C. Norman Shealy, M.D.
The Pain Rehabilitation Center, S.C., La Crosse, Wisconsin

A technique for radiofrequency localization and coagulation of articular nerves supplying the spinal facets is described and results are reported from a series of 207 patients followed 6 to 21 months (mean 13 months). Relief of pain was achieved in 79% of previously unoperated patients, in 41% of those with laminectomy but no fusion, and in 27% of those with an earlier fusion. No neurological complications were encountered.

Key Words • facet nerve • disc syndrome • sciatica • back pain
(Shealy, 1975)
Radiofrequency Ablation: Mechanism of Action

(Hong & Georgiades, 2010)
Technique

- Fluoroscopic guidance
- Impedance
- Sensory Threshold
- Motor Threshold
- Lesion

(Son, Kim, Kim, Lim, & Park, 2010)
Randomized Trial of Radiofrequency Lumbar Facet Denervation for Chronic Low Back Pain

Maarten van Kleef, MD, PhD,* Gerard A. M. Barendse, MD,* Alfons Kessels, MD,† Helma M. Voets,* Wilhelm E. J. Weber, MD, PhD,*‡ and Simon de Lange, MB, BS, PhD, FRCA*
Lumbar Facet RFA Efficacy

- **Trial Design**
  - Prospective, Double Blind, Randomized, Sham Controlled

- **Patient Selection**
  - Between 20-60 y/o, pain>1yr, VAS > 4, 50% relief with LMBB
  - Excluded HNP, Stenosis, listhesis, infection, trauma, malignancy

- **Treatment**
  - L-RFA at L3, L4, L5DR for 60s at 80C
  - Sham

- **Outcome**
  - VAS, ODI
Lumbar Facet RFA Efficacy

(van Kleef et al., 1999)
Lumbar Facet RFA Efficacy

Table 1. Pretreatment Characteristics by Allocated Treatment

<table>
<thead>
<tr>
<th>Pretreatment, mean (SD)</th>
<th>Sham Group (n = 16)</th>
<th>Lesion Group (n = 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>6M, 10F</td>
<td>5M, 10F</td>
</tr>
<tr>
<td>Age, mean (SD) (yr)</td>
<td>41.4 (7.5)</td>
<td>46.6 (7.4)</td>
</tr>
<tr>
<td>Months of pain, median (range)</td>
<td>48 (12–192)</td>
<td>26 (12–120)</td>
</tr>
<tr>
<td>VAS mean</td>
<td>5.2 (1.6)</td>
<td>5.2 (1.7)</td>
</tr>
<tr>
<td>VAS high</td>
<td>7.6 (1.7)</td>
<td>7.7 (1.5)</td>
</tr>
<tr>
<td>VAS low</td>
<td>3.0 (1.7)</td>
<td>2.9 (1.8)</td>
</tr>
<tr>
<td>Impairment according to Waddell</td>
<td>2.8 (1.1)</td>
<td>1.8 (1.5)</td>
</tr>
<tr>
<td>No. of analgesic tablets per 4 days [median (range)]</td>
<td>0 (0–12)</td>
<td>0 (0–15)</td>
</tr>
<tr>
<td>Oswestry Disability Scale [mean (SD)]</td>
<td>38.0 (13.1)</td>
<td>31.0 (14.2)</td>
</tr>
<tr>
<td>Coopwoonca quality of life [mean (SD)]</td>
<td>21.6 (3.6)</td>
<td>20.2 (3.8)</td>
</tr>
</tbody>
</table>

(van Kleef et al., 1999)
Lumbar Facet RFA Efficacy

Table 2. Percentage of Successes of the Sham and Lesion Group After 8 Weeks of Treatment, the Unadjusted and Adjusted Odds Ratio (OR), and Their 90% Confidence Intervals

<table>
<thead>
<tr>
<th>Percentage of Successes</th>
<th>Sham Group</th>
<th>Lesion Group</th>
<th>OR Unadjusted (90% CI)</th>
<th>OR Adjusted (90% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>37.5</td>
<td>66.7</td>
<td>3.33 (0.97 to 11.5)</td>
<td>9.53† (1.50 to 60.5)</td>
</tr>
</tbody>
</table>

(van Kleef et al., 1999)
### Table 3. Effects in Sham and Lesion Group After 8 Weeks of Treatment, the Unadjusted and Adjusted Differences Between Sham and Lesion Group, and Their 90% Confidence Intervals

<table>
<thead>
<tr>
<th></th>
<th>Mean Sham Group</th>
<th>Mean Lesion Group</th>
<th>Difference Unadjusted (90% CI)</th>
<th>Difference Adjusted (90% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in VAS–mean</td>
<td>−0.43</td>
<td>−2.37</td>
<td>1.94* (0.24 to 3.64)</td>
<td>2.46* (0.72 to 4.20)</td>
</tr>
<tr>
<td>Change in VAS–high</td>
<td>−1.02</td>
<td>−3.64</td>
<td>2.62† (0.92 to 4.32)</td>
<td>3.39† (1.55 to 5.22)</td>
</tr>
<tr>
<td>Change in VAS–low</td>
<td>0.48</td>
<td>−1.85</td>
<td>2.33† (0.87 to 3.79)</td>
<td>2.42† (0.91 to 3.92)</td>
</tr>
<tr>
<td>Global perceived effect</td>
<td>0.37</td>
<td>1.33</td>
<td>−0.96* (−1.70 to −0.22)</td>
<td>−1.10* (−1.89 to −0.30)</td>
</tr>
<tr>
<td>Change in impairment according to Waddell</td>
<td>−0.07</td>
<td>−0.33</td>
<td>0.27 (−0.69 to 1.22)</td>
<td>0.31 (−0.74 to 1.35)</td>
</tr>
<tr>
<td>Change in no. of analgesic tablets per 4 days</td>
<td>1.75</td>
<td>−2.13</td>
<td>3.88* (1.19 to 6.57)</td>
<td>3.24 (−0.13 to 6.60)</td>
</tr>
<tr>
<td>Change in Oswestry Disability scale</td>
<td>1.69</td>
<td>−11.07</td>
<td>15.75† (4.16 to 21.39)</td>
<td>10.90† (1.76 to 20.0)</td>
</tr>
<tr>
<td>Change in Coopworsce quality of life</td>
<td>−1.62</td>
<td>−3.13</td>
<td>1.51 (−1.88 to 4.97)</td>
<td>2.27 (−1.77 to 6.30)</td>
</tr>
</tbody>
</table>

* One-tailed \( P < 0.05 \).
† One-tailed \( P < 0.01 \).

(van Kleef et al., 1999)
Cervical RFA Efficacy

PERCUTANEOUS RADIO-FREQUENCY NEUROTOMY FOR CHRONIC CERVICAL ZYGAPOPHYSEAL-JOINT PAIN

PERCUTANEOUS RADIO-FREQUENCY NEUROTOMY FOR CHRONIC CERVICAL ZYGAPOPHYSEAL-JOINT PAIN

SUSAN M. LORD, B.MED., PH.D., LESLIE BARNESLEY, B.MED., PH.D., BARBARA J. WALLIS, B.SC.,
GREGORY J. McDOUGAL, M.B., B.S., AND NIKOLAI BOGDUK, M.D., PH.D.
Cervical RFA Efficacy

- **Trial Design**
  - Prospective, Double Blind, Randomized, Sham Controlled

- **Patient Selection**
  - Painful C3-4 to C6-7 facets by 3 double blind placebo controlled diagnostic blocks

- **Treatment**
  - C-RFA for 90s at 80C 2-3 lesions

- **Outcomes**
  - VAS, McGill Pain Questionnaire
**Table 1. Base-Line Characteristics of the 24 Patients with Chronic Cervical Zygapophyseal-Joint Pain.**

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>ACTIVE-TREATMENT GROUP (N = 12)</th>
<th>CONTROL GROUP (N = 12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age — yr</td>
<td>44±12</td>
<td>43±12</td>
</tr>
<tr>
<td>Sex — M/F</td>
<td>5/7</td>
<td>4/8</td>
</tr>
<tr>
<td>Employed — no. of patients</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Involved in litigation — no. of patients</td>
<td>4</td>
<td>10†</td>
</tr>
<tr>
<td>Months of pain — median (interquartile range)</td>
<td>44 (23–94)</td>
<td>34 (25–92)</td>
</tr>
<tr>
<td>Symptomatic joints — no. of patients</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C3–4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>C4–5</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>C5–6</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>C6–7</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>C2–3 and ipsilateral C4–5†</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>C2-3 and contralateral C5–6†</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>C2–3 and ipsilateral C4–5† and C5–6‡</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Bilateral C2–3 and C5–6 and contralateral C6–7‡</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>C3–4‡</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Visual-analogue scale — score</td>
<td>40±15</td>
<td>47±18</td>
</tr>
<tr>
<td>McGill Pain Questionnaire — score</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total word count</td>
<td>14±5</td>
<td>12±5</td>
</tr>
<tr>
<td>Pain rating</td>
<td>37±19</td>
<td>32±16</td>
</tr>
</tbody>
</table>

(Lord, Barnsley, Wallis, McDonald, & Bogduk, 1996)
Cervical RFA Efficacy

(Lord, Barnsley, Wallis, McDonald, & Bogduk, 1996)
Cervical RFA Efficacy

“The results cannot be generalized to apply to patients whose pain is confirmed by less stringent criteria or who are treated with less exacting variants of the technique.”

(Lord, Barnsley, Wallis, McDonald, & Bogduk, 1996)
Repeat Medial Branch Ablation

The Efficacy of Repeated Radiofrequency Medial Branch Neurotomy for Lumbar Facet Syndrome

Jung Hee Son, M.D., Sang Dae Kim, M.D., Se Hoon Kim, M.D., Dong Jun Lim, M.D., Jung Yul Park, M.D., Ph.D.

Department of Neurosurgery, Korea University Ansan Hospital, Korea University School of Medicine, Ansan, Korea

Table 2. Success rates and pain relief duration of repeated RF medial branch neurotomy

<table>
<thead>
<tr>
<th>The times of RF medial branch neurotomy</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients No.</td>
<td>60</td>
<td>55</td>
<td>5</td>
<td>60</td>
</tr>
<tr>
<td>Success (%)</td>
<td>51 (85)</td>
<td>50 (91)</td>
<td>4 (80)</td>
<td>88%</td>
</tr>
<tr>
<td>Failure (%)</td>
<td>9 (25)</td>
<td>5 (9)</td>
<td>1 (20)</td>
<td>13%</td>
</tr>
<tr>
<td>Duration of pain relief (months)</td>
<td>10.9</td>
<td>10.2</td>
<td>9.8</td>
<td>10.5</td>
</tr>
</tbody>
</table>

RF: radiofrequency

(Son, Kim, Kim, Lim, & Park, 2010)
Complications

- **Common**
  - Pain
  - Neuritis/Cutaneous dysesthesias
  - Hematoma
  - Steroid reaction

- **Rare**
  - Radiculitis

(Boswell, Colson, Sehgal, Dunbar, & Epter, 2007)
Conclusions Future Directions

- C-RFA and L-RFA are effective techniques for reducing facetogenic spine pain and disability
- More studies with stringent investigative criteria that compare RFA to conservative treatments are needed
Citations