The Role of the Facet in Whiplash
Edward Babigumira, MD, FAAPMR

- Interventional Pain Management, Lincoln.B.Pain Clinic, Ltd.
- Diplomate ABPMR.
- Board Certified Pain Medicine

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Our Agenda

- Cervical intra-articular zygapophysial joint injections
- Cervical medial branch blocks
- Cervical medial branch radiofrequency
Clinical Features of Cervical Facet Arthropathy

- Joints are deep to posterior cervical musculature. Can not exam with specificity.
- Joint pain is felt deeply with no identifiable borders
- **Dorsal rami are not accessible to clinical neurological assessment**
  - Non-dermatomal pain
  - Normal neurological exam
  - Normal electrodiagnostic exam
- Neck tenderness and restricted ROM are commonly reported symptoms, but are non-specific
When to consider interventional procedures for suspected Z-joint pain after whiplash

- Consider procedures targeting Z-joint pain for subacute or chronic pain >6 months

- Need to consider conservative management first, but not wait too long, before compounding chronic pain features arise.

- 117 patients; acute whiplash, with conservative care
  - 56% of patients had full recovery at 3 months
  - 70% of patients had full recovery at 6 months
  - 76% of patients had full recovery at 12 months

Is the history and physical helpful in making the diagnosis of Z-joint pain?

- No consistent validated history or physical examination method to diagnose cervical z-joint pain as judged against diagnostic blocks

Innervation of Cervical Zygapophysial Joints

- Innervation is from the medial branch division of the dorsal rami corresponding to the joint level
  - C5-6 joint innervated by the C5 and C6 MB nerves
  - C2-3 joint innervated by the third occipital nerve
Can Zygapophysial Joints Be Painful?

- Dwyer et al.

- Stimulated the cervical zygapophysial joints in normal volunteers by distending the joints with injections of contrast.

- They found the referred pain patterns from individual joints followed a distinctive pattern.

Can patterns of pain be used to predict which cervical joints are the pain generators?

- Aprill et al found that the pain pattern can be used to help predict which cervical joints are painful.

Intra-Articular Cervical Z-joint Injections

- 5 uncontrolled studies suggest isolated z-joint injections are helpful (1983-1990)

- **Barnsley, NEJM 1994 330:1047**
  - 42 patients with cervical z joint pain after whiplash
  - Double blind RCT - Celestone vs. Bupivicaine
  - Time from Tx to 50% return of pain was compared.
    - Steroid group 3 days
    - Anesthetic group 3.5 days (p=0.42 not significant)
  - <50% had relief for >1 week and <20% had relief for >1 month irrespective of what was injected
Intra-articular Cervical Z-Joint Injections

- Prospective
- 30 patients without prior trauma
- VAS pre-treatment was 8
- First had 2% lidocaine injection with excellent relief >80%
- Second had 40mg of methylprednisolone injected in the same joint

RESULTS
- Avg time to return VAS to pre-treatment pain was 13 weeks
- 73% had >90% relief at 3 weeks
- 40% had 90% relief at 3 months
- 20% had 90% relief at 5 months

Folman, Harefauh 2004; 143:339-341
Intra-articular Cervical Z-Joint Injections

- The joint volume is ≤ 1.0 cc with a 17% rate of extra-articular leakage
  - Impairs specificity
Cervical Medial Branch Blocks

- A diagnostic procedure which utilizes a tiny amount of anesthetic in an effort to relieve pain.

- Purpose is to test if a patient’s pain is derived from suspected zygapophysial joint(s), which are innervated by their respective medial branches of the dorsal rami.

ISIS Practice Guidelines for Spinal Diag. and Treatment Proc
Cervical Medial Branch Blocks

- Cervical medial branch blocks are specific for the diagnosis of cervical zygapophysial joint pain

- Of all the structures innervated by the medial branches of the cervical dorsal rami, the zygapophysial joints are the only ones that might harbor a discrete source of chronic pain

- Barnsley L, Bogduk N. Medial branch blocks are specific for the diagnosis of cervical zygapophysial joint pain. Regional Anesthesia 1993; 18:343-350
Why medial branch blocks are favored over intra-articular blocks

- Medial branch blocks are easier to perform
  - Medial branch blocks may always be performed
  - Needle passage with intra-articular blocks may blocked by osteophytes and joint space narrowing

*ISIS Practice Guidelines for Spinal Diag. and Treatment Proc* page 112
Why medial branch blocks are favored over intra-articular blocks

- Medial branch blocks are safer
  - During medial branch blocks, bone prevents over penetration of the needle into the spinal canal
  - During intra-articular injections it is possible to pass through the joint and into the spinal cord

ISIS Practice Guidelines for Spinal Diag. and Treatment Proc page 112
Why medial branch blocks are favored over intra-articular blocks

- Medial branch blocks are more easily subjected to controls
  - Medial branch nerves can be anesthetized with different agents with known variant durations of effect
  - The duration of effect of different agents inside a joint is unknown

*ISIS Practice Guidelines for Spinal Diag. and Treatment Proc page 112*
Why medial branch blocks are favored over intra-articular blocks

- Intra-articular blocks if positive, lack a validated subsequent treatment
- Therefore they lack validated therapeutic utility

*ISIS Practice Guidelines for Spinal Diag. and Treatment Proc* page 112
Why medial branch blocks are favored over intra-articular blocks

- Medial branch blocks, if positive, can be followed by radiofrequency neurotomy

- Therefore medial branch blocks have therapeutic utility and predictive validity
Cervical Medial Branch Anatomy
Anatomic Specificity

- Bogduk was first to support the selective technique of targeting the medial branches of the dorsal rami as they cross the articular pillars, rather than the dorsal rami themselves

*Bogduk N. The clinical anatomy of the cervical dorsal dorsal rami*  
*Spine 1982; 7:319-350*
Early Reports of the Therapeutic Utility of Cervical Medial Branch Blocks

- First report: 1985

- Bogduk and Marsland reported complete relief of headache in 8/12 patients following block of the medial branch of the C3 dorsal ramus: the third occipital nerve

Early Reports of the Therapeutic Utility of Cervical Medial Branch Blocks

- First report of therapeutic benefit from medial branch blocks at all levels: 1988
- Complete relief of neck pain and headache, or neck pain and shoulder pain, in 17/24 patients following diagnostic block of C3 or lower medial branches.

Bogduk N, Marsland A. The cervical zypapophysial joints as a source of neck pain; 1988 Spine; 13:610-617
Bogduk and Aprill investigated 318 consecutive patients with neck pain, and found the prevalence of cervical zygapophysial joint pain to be \textit{at least} 25%.

Cervical medial branch blocks have face validity – target specific

- Barnsley and Bogduk; 1993

- Showed that cervical medial branch blocks had face validity and were target specific

- Injectate consistently bathed the nerve and did not spread to affect any other alternative pain generator.

- Barnsley L, Bogduk N. Medial branch blocks are specific for the diagnosis of cervical zygapophysial joint pain. Regional Anesthesia 1993; 18:343-350
Single Uncontrolled Cervical Medial Branch Block

- False positive rate of at least 27%

Do cervical medial branch blocks have construct validity?

- Can medial branch blocks distinguish true responses from false responses?

- Barnsley et al used comparative local anesthetic blocks and determined that a placebo response could be identified or excluded by repeating the same diagnostic block with anesthetics of different durations of action.


- Double blind study

- Barnsley et al performed two cervical medial branch blocks in patients with neck pain, using both lidocaine and bupivacaine in random order.

- They identified four patterns of response:....
Comparative Anesthetic Control

- **Concordant:**
  - Long lasting relief following bupivacaine
  - Short lasting relief following lidocaine
  - Duration of relief was not longer than the expected duration of action of the anesthetic used

- **Prolonged concordant:**
  - Longer lasting relief with bupivacaine than lidocaine, but the duration of both anesthetics exceeded their expected duration

- **Discordant:**
  - Relief following lidocaine was longer that that of bupivacaine

- **Discrepant:**
  - Patients failed to obtain any relief when the same nerves were blocked on a second occasion by either anesthetic.

- **Barnsley et al. only considered concordant and prolonged concordant to constitute a true positive response**
Use of Comparative anesthetic control for the diagnosis of cervical z-joint pain is tested…


- Compared diagnosis made on the basis of comparative blocks with those based on placebo controlled blocks (two different anesthetics versus anesthetic and saline).

- Concordant and prolonged concordant responses with comparative blocks had a sensitivity of 54% and specificity of 88%
  - Good for research purposes (good specificity), but many patients would not be detected (mediocre sensitivity)

- ISIS advocates “if desired, to include concordant + discordant responses, provided that they obtain complete relief of their pain with MBBx2, regardless of the agent used, and regardless of the duration of relief. This increases the sensitivity to 100%, but the specificity then drops to 65%”

ISIS Practice Guidelines for Spinal Diag. and Treatment Proc page 114
Study: Prevalence of Z-joint Pain Headache in patients with chronic neck pain after whiplash

- Comparative blocks used
- Double blind
- 100 patients

- The prevalence of headache, in patients with chronic neck pain after whiplash, stemming from the C2-3 zygapophysial joint was 27%

- In patients where headache was the dominant symptom, the prevalence of headache stemming from the C2-3 zygapophysial joint was 53%

Study: Prevalence of Z-joint Pain
In patients with chronic neck pain after whiplash

- Comparative blocks used
- Double blind
- 50 consecutive patients

- Prevalence of Z-joint pain was 54%.
- The joints most commonly involved were C2-3 and C5-6

Study: Prevalence Z-Joint Pain
In patients with chronic neck pain after whiplash

- Comparative blocks used
- Double blind

**Drivers of high speed motor vehicle accidents**

- Prevalence of zygapophysial joint pain was found to be 88%!

Not using cervical medial branch blocks, **denies a valid diagnosis for 88%** of **drivers of high speed motor vehicle accidents** presenting for neck pain after whiplash.
Treatment of Cervical Z-joint Pain
Cervical Medial Branch RF

- Randomized
- Double blind
- Placebo controlled study
- Established that cervical medial branch radiofrequency neurotomy was not a placebo
- 70% of patients obtained relief


- This established the therapeutic utility and predictive validity of cervical medial branch blocks.

ISIS Practice Guidelines for Spinal Diag. and Treatment Proc
Recap: Cervical Medial Branch Blocks

- If pain is relieved, the response indicates the targeted nerves are involved with pain generation
  - It is not required to have all the patients pain relieved to justify a positive response, just the pain that correlates with the targeted segments.
  - Secondary pain sources may overlap. Ex ligament, muscle, opposite side effects,

- If there is not relief of pain, then the target nerves and Z-joint are not involved with pain generation

- Establishing a diagnosis protects the patient from unnecessary attempts to find other diagnoses, or from undergoing treatment for other presumptive diagnoses

- ISIS Practice Guidelines for Spinal Diag. and Treatment Proc 117-118
Cervical Medial Branch Block

- **Indications**
  - Chronic or sub-acute neck pain
  - To establish the targeted medial branches innervating their zygapophysial joint as the pain generator
  - Prerequisite to radiofrequency neurotomy

- **Patient selection**
  - Serious causes of neck pain must first be ruled out
    - infection, tumors, vascular disease, fracture/dislocation

*ISIS Practice Guidelines for Spinal Diag. and Treatment Proc*
Cervical Medial Branch Block

- Contraindications
  - Absolute
    - Bacterial infection systemic or localized
    - Bleeding diathesis ie: bleeding disorder, or anticoagulants
    - Possible pregnancy
  - Relative
    - Allergy to contrast media
    - Allergy to local anesthetics
    - Concurrent treatment of NSAIDS, or other medications which may compromise coagulation
    - Neurologic signs suggesting alternative diagnoses

ISIS Practice Guidelines for Spinal Diag. and Treatment Proc
Equipment

- C-arm fluoroscope
- 25 gauge needle
- Betadine or chlorhexidine prep
- Contrast medium
- 3ml Bupivicaine (0.5% or 0.25%)
- or 3ml Lidocaine 2%
- IV, sedation is not required

ISIS Practice Guidelines for Spinal Diag. and Treatment Proc
Target Identification – Lateral View

- True lateral image
- C3-C6
- The medial branch crosses the center of the articular pillar with the same segmental number as the target nerve
  - Ex C4 MB found at the C4 vertebral level
  - Center is found at the intersection of the two diagonals of the diamond shaped pillar
Target Identification – Lateral View

- C7 MB
  - Target is the tip of the C7 superior articular process (SAP)

Credit to Lord, Thesis
The third occipital nerve requires three target points to ensure infiltration:
- It is thicker than medial branches
- Has a more variable course

Highest target –
- Lies opposite the level of the apex of the C3 SAP

The low target
- Lies at the bottom of the C2-3 foramen

The middle target
- Lies midway between the low and high targets

Credit to Lord Dissection
Target Identification – AP View (Lord, Thesis)
We’re half-way through!!
Wake-up!
Radiofrequency

- This is the treatment procedure following successful identification of targeted medial branches using comparative controlled medial branch blocks.

- Aims to destroy the afferent nerve supply (medial branch or dorsal ramus) to the zygapophysial joints by a heat lesion.

- Nerve regeneration is assumed to occur in 9-12 months with possible resumption of pain.

- The period of pain relief provides an opportunity for patients to more effectively participate in spinal stabilization therapy.
Radiofrequency

- Percutaneous procedure
- Teflon coated insulated electrode with an uninsulated exposed tip
- Electrical current is applied to the electrode (AC at 500 kilocycles/second)
- Tissue resistance to current causes charged molecules to oscillate and generate heat
- Tissue surrounding the electrode is heated and coagulated, including the target nerve
- Lesion performed at 80 degrees for 60-90 seconds
Advantages of Radiofrequency

- Controlled lesion size
- Good monitoring of temperature
- Precise placement of electrode with electrical stimulation
- Rapid recovery (2-4 weeks minor post-procedure effects)
- Low incidence of morbidity
- Ability to repeat lesion if neural pathway regenerates
Radiofrequency

- The use of radiofrequency for lumbar spinal pain was first promoted by Shealy in the mid 1970’s.

- Electrodes were placed initially perpendicular to the nerve, but in 1987 it was found that the lesion did not extend from the tip, but rather radially along the axis of the electrode.


- The lesion shape is elliptical with the zone of coagulation 1-1.5 times the diameter of the electrode needle.

- This meant a more appropriate placement of the electrode required it to lie parallel to the nerve.

Parallel vs. Perpendicular needle placement

- Heat spreads sideways with minimal spread ahead of the tip.
- Electrical field projects forward and is weak along the shaft.
Randomized, controlled trial
24 patients
Mean duration of pain
- Control group 34 months
- Active group 44 months
Mean pain score
- Control group 47/100
- Active group 40/100
Selection criteria
- Complete relief from comparative MBB and lack of relief from saline (placebo) injections
Excluded C2-3 joint
Included C3-4, to C6-7 joints
Single joint involvement
- 9/12 in active group
- 8/12 in placebo group
Double blind
Outcome Measure – VAS, McGill, 4 personal ADL’s
Success defined as pain of 0-5/100 and a McGill of <3 and restoration of all 4 ADL’s (essentially >90% improvement)

RESULTS:

Post procedure pain lasted median of 13 days in the treatment group

At 6.5 months 1/12 control (8%) and 7/12 (58%) in the active patients were a success

Patient reporting complete relief required no supplemental treatment

The median time for pain to return to at least 59% pre-tx was 263 days (8.8 months) in the active group and 8 days in the placebo group

P=0.04
Comparative control cervical medial branch blocks were used

Audit of 28 pts with cervical RF over a 5 year period

Complete relief in 71% of patients

Mean duration of relief was 422 days in successful patients

If patients had at least 90 days of relief from the first RF, then the chance of a successful repeat RF was 82%.

If pain relief was <90 days from the first RF, then only 33% of patients having a repeat RF had success of >90 days.
49 patients treated

Comparative blocks used with complete relief of pain with each block

Success defined as 100% pain relief for at least 90 days with full return to ADL’s and no drug treatment for headache

39/44 (88%) had success with a mean duration of 297 days

14 patients had a repeat TON RF with a median duration of relief of 217 days.
RF - Third Occipital Nerve
Govind, J Neurol Neurosurg Psychiatry 2003; 74:88-93

- Side Effects:
  - Suboccipital numbness in 97%
  - Ataxia in 95%
  - Dysethesias in 55%
  - Hypersensitivity in 15%
  - Itching 10%

- Side effects were limited to 2 weeks and up to 4 weeks in one patient
Cervical Medial Branch RF
Litigants vs. Non-Litigants

- Prospective study with one year f/u
- 46 whiplash patients
  - 28 were litigants
  - 18 non litigant patients
- Inclusion: >80% relief after comparative cervical medial branch blocks

Cervical Medial Branch RF
Litigants vs. Non-Litigants

- Pre-treatment VAS was 8.2
- At 2 weeks post RF mean VAS was 2.5
- At 1yr post RF mean VAS was 3.6
- Return to 50% of pretreatment pain level occurred at 8 months +/- 2 months

- 2 weeks Post RF
  - >80% reduction in VAS
    - 39% of litigants and 45% non-litigants
  - >50% reduction in VAS
    - 89% of litigants and 90% of non-litigants

- At 1 yr post RF
  - >80% reduction in VAS
    - 11% of litigants and 38% of non-litigants
  - >50% reduction in VAS
    - 46% of the litigants and 73% of the non-litigants

Cervical MB RF C4-C6

Picture on left from Lord, Thesis

3 lesions at C4
2 lesions at C5
3 lesions at C6
Cervical MB RF C3 (TON)

- The third occipital nerve, requires three target points.
  - Has a more variable course

- Highest target –
  - Lies opposite the level of the apex of the C3 SAP

- The low target
  - Lies at the bottom of the C2-3 foramen

- The middle target
  - Lies midway between the low and high targets
C7 MB technique
4 lesions

Note location of fourth lesion out Lateral on TP
Systematic Reviews

- *Boswell. Pain Physician 2005; 8:101*

- Conclusion:
  
  For RF facet neurolysis there was moderate to strong evidence for short-term and long-term relief of cervical facet joint pain.
The End

Thank you