

Radiofrequency treatment of lumbar spine – the past, the present and the future

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Objectives:

1. Radiofrequency of lumbar facet joints
 - Past lessons
 - Diagnosing zygapophysial joint pain
 - Technique
 - Outcome measures
2. TransDiscal™ RF Annuloplasty of intervertebral disc
 - Analysis of contemporary techniques: IDET and DiscTRODE
 - Operating principle
 - Technique
 - Perspective

Radiofrequency of lumbar facet joints

Past lesions

In 1971, Rees invented the procedure, which he called *rhizolysis*, for treatment of back pain. He claimed that severing the nerves to the zygapophysial joints (ZAPJ's) percutaneously with a scalpel resulted in tremendous success (1). The operation was based on totally mythical anatomy.

Next pivotal step in the destiny of interventional management of low back pain was application of radiofrequency current instead of knife. In 1974, Shealy applied the same principle of gasserian ganglion radiofrequency ablation for facet nerves. He called the procedure "facet denervation" and claimed excellent success rates (2). Unfortunately, the spot he recommended to place the electrode doesn't have a nerve whatsoever to coagulate. Despite this, the procedure rapidly became very popular and many adopted it.

In 1979 the surgical anatomy of ZAPJ's was corrected (3). Few practitioners followed the revised recommendations, but the vast majority still continued to perform the disproven operation. Even two randomized control trials with favorable results were published (4, 5). These trials literally proved that a sham procedure was more effective than placebo.

Subsequently, in 1987 Bogduk showed that in order to be effective, the electrodes have to be placed parallel to the target nerve and not perpendicular, as it was thought. The electrode does not burn distally, but predominantly sideways. Again, this guidance was not heeded. The former technique continued to practice without evidence of efficacy.

Several recurrent features marked this history. Practitioners invent a procedure with no formal exploration of its anatomical basis. They invent that basis. They invent the mechanism by which the procedure is alleged to be effective. They claim great success. This renders the procedure attractive, and other adopt it. They too, report success, yet remain oblivious to the fact that the procedure cannot possibly work for anatomical or physiological reasons. The procedure must work because people want it to work. Evidence is not required when conviction rides high. (6). Even new published anatomical studies do not stop this practice (7).

The only one published trial was done using strict selection criteria, double comparative blocks and proper technique (8). Unfortunately, the sample size was rather small. 15 patients are neither enough to convince medical professionals to follow the particular technique, nor to obtain sufficient statistical power of outcome measurements. Obviously, a larger, at least observational but genuine, study is crucial to back up the Dreyfuss study.

Diagnosing zygapophysial joint pain

Comparative diagnostic blocks remain the most powerful tool for diagnosing facet pain. Even though utilization of clinical criteria, known as Revel's tests can potentially substitute the need of diagnostic block or at least reduce it for only one injection, that practice places a diagnostic confidence in danger for both false-negative and false-positive results (9). Comparative single-blinded blocks should provide 100% diagnostic confidence confirming facet joint pain among non-selected or partially selected group of patients with chronic low back pain. However, considerable proportion of patients failed to obtain more than 50% pain relief following the radiofrequency procedure. Multidimensional aspects of chronic low back pain and/or still insufficient selection criteria, could probably explain it.

Technique

The technique of proper electrode's placement depicted on figures 1 and 2.



Figure 1. Patient position and site of needle placement under the fluoroscopy at the L3, L4 and L5 levels

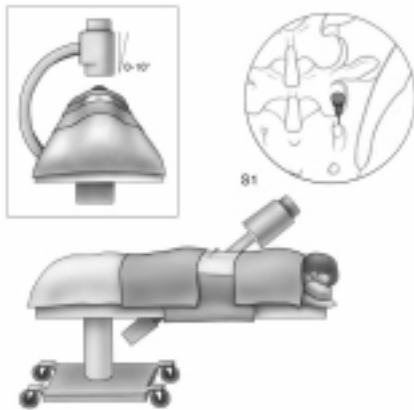


Figure 2. Fluoroscopy position and electrode at the posterior division of the sacral S1 nerve at S1 foramen

Two other recommendations are 1) use large bore curve electrode with 10mm active tip in order to increase lesion size. It seems that 18 gauge electrode is a good compromise between desire to produce sufficient lesion and to keep an electrode size in the limits of “minimally invasive treatment”; 2) use electrical stimulation as a negative rather than a positive predictive factor, i.e. any dermatomal radiation should be considered as unacceptable. There is no other path of medial branch or primary ramus to be expected, rather than in the groove at the base of SAP between intervertebral foramen and mamillo-accessory ligament. Therefore, no time should be wasted to seek 0.3V response. The main principle of lumbar facet denervation is a correct placement of the electrode in parallel to target nerve.

Outcome measures

How the results should be assessed? Is VAS tool good enough to assess chronic pain? What is an acceptable period of pain relief and when to re-intervene?

Probably Global Improvement Score or Likert Score are better and more practical than no frills VAS or bulky MMPI, Oswestry and others.

Most of the studies provide up to 3-months follow up data, which even if beneficial, still lie within placebo response. 6-9 months pain relief seems more acceptable from both medical and fiscal aspects of medical practice.

TransDiscal™ RF Annuloplasty of intervertebral disc

Analysis of contemporary techniques: IDET and DiscTRODE

IDET

Pro

- Extensively studied technology supported by single randomized controlled trial. Although the favorable results reached statistical significance, clinical significance remains uncertain (10).

Cons

- Technically demanding
- No temperature monitor
- No impedance monitor
- Artificial concentric fissure formation
- Risk of detachment of heating element

DiscTrode

Pro

- Easier than IDET
- Reliable temperature and impedance monitoring

Cons

- Yet controlled study done
- Technically demanding
- “Impromptu” set
- Risk of detachment of heating element
- Artificial fissure formation
- The company is disinterested in MOP

TransDiscal™ RF Annuloplasty

Pro

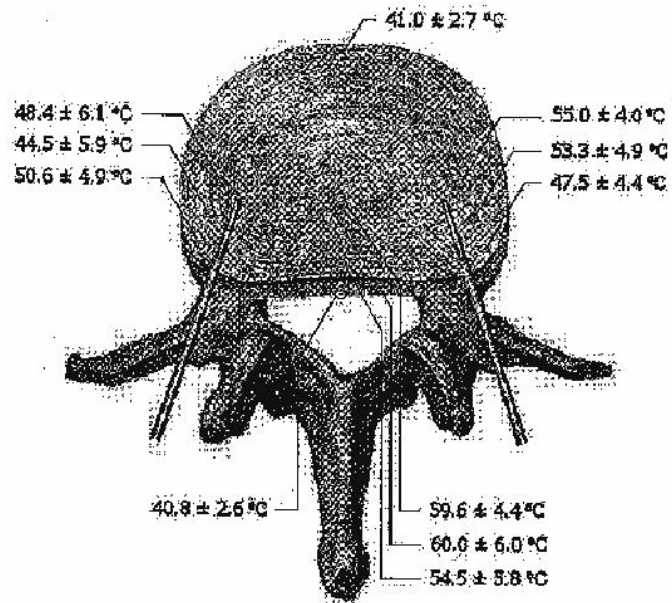
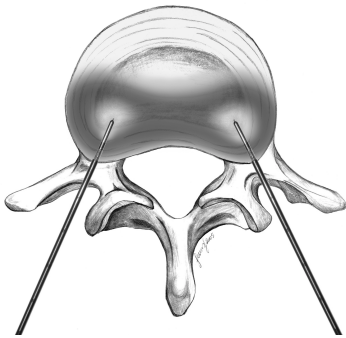
- Straightforward placement.
- Radiofrequency current is concentrated between electrodes on two straight probes.
- Large, reproducible, and controlled lesions are achieved in the posterior annulus.
- The electrodes are internally cooled allowing deep, even heating and eliminating tissue adherence.
- Temperature sensors allow monitoring at the electrode tips.
- Iatrogenic injury is minimized and artificial concentric fissures are not produced.

Cons

- Very limited clinical data (11)

Technique

- Discography-like placement of electrodes into the annulus
- Automatic processing for 15 minutes



Temperatures measured in the intervertebral disc and PLL (Average \pm Standard Deviation) (Pauza)

Perspective

- Heating posterior and lateral annulus targets both sinuvertebral and rami communicants nerve endings. Therefore, the technique seems to be promising
- Randomized control trial with unequivocal results required to accept the procedure
- Basic sciences studies must be done for better understanding discogenic pain and mechanisms of intradiscal therapies