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The role of radiofrequency in the treatment of mechanical pain of spinal origin

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Abstract Radiofrequency (RF) ablation is a method that has been gaining popularity over the past few years among spinal surgeons. It has a role when dealing with pain of spinal origin, either mechanical or neuro-pathic, after conservative treatment has failed. In the present study, 122 patients with a minimal follow up of 1 year were examined at our institution after having undergone RF heat lesion of the medial branch for mechanical spinal pain (low back pain, thoracic pain or cervical pain). They were followed up 1, 3, 6 and 12 months after treatment. Twenty-two of them were additionally followed up at 18 months. After 1 month, 91 patients (75%) were satisfied with the results. After 3 months, 87 pa-

tients (71%) had significant pain relief, while in 35 patients (29%) there was no improvement. After 6 months of follow-up, 80 patients (66%) had pain relief and in 42 patients (34%) there was no effect. At 12-months follow-up, 77 patients (63%) showed good results and 45 patients (37%) had no effect. In the case of the 22 patients who were followed for 18 months, all showed significant pain relief. Minor complications occurred in 27 patients (22%), who had transient discomfort and burning pain. We concluded that RF is a safe and partially effective procedure for mechanical back pain.

Keywords Radiofrequency · Mechanical back pain

Introduction

Radiofrequency (RF) procedures are an important part of complex minimally invasive treatment of chronic pain conditions and are used for reducing noxious transmission in the nervous system. The principle is production of heat in order to damage some or all nerve fibers in the target nervous structure (in the case of “conventional” RF) or application of an electromagnetic field to the nervous structure (in the case of pulsed RF), with the ultimate aim of blocking transmission of pain stimuli from peripheral receptors to the central pain structures. In recent years, some publications have reported contradictory results following RF treatment of back pain [1, 4, 6, 8, 17, 19, 22]. On the one hand, Leclaire et al. reported that the procedure is effective in terms of pain improvement only in the short term (4 weeks after the procedure) and the improve-

ment failed to last even beyond 12 weeks [8]. Other studies supported these data, including one recently published in the *Lancet* [1, 6, 8]. On the other hand, other authors showed long-term improvement in pain even for years after the procedure [4, 17, 19, 22].

The wide spectrum of clinical results led us to prospectively study our large group of patients who underwent the RF procedure for mechanical back pain, using strict criteria for the evaluation of pain improvement.

Materials and methods

Our study comprises 122 patients who underwent the RF procedure for mechanical pain of spinal origin between the years 2000 and 2002 and were followed up for at least 1 year. Patients with mechanical pain at different levels, low back pain (LBP), thoracic pain or cervical pain, were treated with RF heat lesion of the medial branch of the dorsal ramus. There were 77 men (63%)

and 45 women (37%) with ages ranging from 20 to 75 (mean 56) years.

Ninety-eight of them (80%) had symptoms related to the thoraco-lumbar region, and 24 patients (20%) had symptoms related to the cervical spine. Twenty-four patients (20%) had previously been operated (laminectomy, decompression of nervous structures, discectomy, or different kinds of fusions). Criteria for selecting patients for RF treatment were:

- Six months' history of pain prior to the procedure
- Failure of conservative treatment, which included a period of at least 6 months of physiotherapy and non-steroidal anti-inflammatory medications, and
- Absence of indication for surgical treatment such as disc herniation or spinal stenosis

Patients who were suffering LBP and had osteoarthritic changes in their facet joints (facet syndrome) underwent RF ablation of the medial branch of the dorsal ramus [2, 9, 10, 12, 14, 15, 17, 19, 21, 20]. Denervation was performed in an ambulatory outpatients setting under local anesthesia of the superficial tissue layers using 1% lidocaine and with fluoroscopic guidance. SMK-5, SMK-10, or SMK-15 electrodes with a 5- or 10-mm active tip (depending on the level) and an RFG-3C generator was used to localize targets. After sensor stimulation with 50 Hz and motor stimulation with 2 Hz, 0.5 cc of local anesthetic (2% lidocaine) and 80 mg depomedrol were injected. The ablation was done with a core temperature of 80°C around the electrode tip [9, 12, 17, 19]. For ablation of the cervical medial branch we used the postero-lateral approach [18]. The duration of procedures was 60 and 90 s for the cervical and thoraco-lumbar regions, respectively. Between one and three levels were treated after assessing the symptoms reported by the patients, complete physical examination and the imaging data.

All patients were treated with non-steroidal anti-inflammatory drugs for 4–6 weeks after the procedures, and underwent physiotherapy treatment for 1 month after the procedure.

We used the visual analog scale (VAS) for evaluating the pain prior to and post surgery. A pain-free result was considered as a complete resolution of pain; a good result was considered to be at least 50% decrease in pain levels; a moderate result, 30–50% decrease in pain levels; and no effect was defined as less than 30% decrease in pain. We considered the outcomes "pain free", "good result" and "moderate result" as all representing significant reductions in pain.

The patients were followed up four times during the 1st year: after 4 weeks, after 3 and 6 months, and after 1 year. Twenty-two patients were followed for 18 months.

Statistical analysis

Averages were calculated for the different variables. Differences were compared using the one-way analysis of variance (ANOVA) test. Differences of $P < 0.05$ were considered as significant.

Results

Four weeks following the procedure, 91 patients (75%) had significant reduction in pain. At 3 months' follow-up, 87 patients (71%) reported some kind of improvement: 9 patients were pain-free, an additional 51 patients reported good results, 27 were classified as moderate, and 35 patients (29%) showed no effect. At the third evaluation period (6 months after treatment), 7 cases remained pain-free, good results were obtained for 41; moderate results for 32, and for 42 patients (34%) there was no improvement arising from the procedure.

Table 1 Results after radiofrequency (RF) treatment of 122 patients with mechanical back pain

	Pain free	Good	Moderate	Pain relief	No effect
1 month	10	54	27	91 (75%)	31 (25%)
3 month	9	51	27	87 (71%)	35 (29%)
6 month	7	41	32	80 (66%)	42 (34%)
12 month	7	36	34	77 (63%)	45 (37%)

Table 2 Mean visual analog scale score before and after RF treatment of 122 patients with mechanical back pain

	Before	After	Difference
1 month	9.2 (range 7–10)	4.3 (range 0–10)	4.9
3 month	9.2 (range 7–10)	4.4 (range 0–10)	4.8
6 month	9.2 (range 7–10)	4.8 (range 0–10)	4.4
12 month	9.2 (range 7–10)	4.9 (range 0–10)	4.3

At the fourth follow-up (1 year following the procedure), 77 patients (63%) had an improvement in terms of pain (7 patients were pain free, 36 and 34 patients showed good and moderate results, respectively), and for 45 patients (37%) there was no effect. Twenty-two patients were followed for 18 months after the procedure. In all cases a significant pain relief was noted.

The results are summarized in Table 1 and Table 2.

Twenty-seven patients (22%) developed discomfort at the operative site. In all patients this was spontaneously resolved within a 1-month period.

The results were not statistically different for patients who had previously undergone operative treatment and those who had not, and did not statistically differ among the different levels in the spine (cervical, thoracic or lumbar) in terms of pain reduction.

Discussion

We evaluated and treated patients suffering from mechanical pain. We found that, on average, patients experienced a substantial reduction in pain following the conventional procedure of RF ablation of the medial branch. After 1 year follow-up, 63% of patients still showed significant improvement, and the average reduction in VAS was 4.3 points. We did not have any major complications in this series. The only complications (discomfort at the operation site) resolved spontaneously within a 1-month period.

Reduction in VAS score of about 2 points, or more than 30%, has been reported to represent a clinically important difference in pain when comparing treatments [5]. In our study we defined only reductions of more than 30% of the original VAS as representing a significant result. This criterion is even stricter, and if we had counted a 2-point reduction in VAS as significant we could have ended up with even better results.

The issue of prognostic blocks prior to the definitive procedure has been questioned in previous articles [12, 14]. In the past, we used to perform prognostic blocks of the treated region before every RF procedure. With time, we changed this approach, because we realized that we can rely on a combination of accurate history taking, physical examination and imaging studies for doing RF procedures, without confirmation of diagnosis by blocks prior to the procedure. In addition, there are up to 25% false-positive and false-negative results of blocks, and carrying out this diagnostic procedure leads to increased waiting time and additional hospitalizations.

The operations some of our patients had undergone prior to the RF treatment did not alter their results significantly in comparison with the non-operated patients. This finding is supported by other authors [12, 16].

It is assumed that the natural process of healing in the disc region can cause cessation of symptoms without any procedures or operations [13]. Most probably macrophage induction plays a key role in disc resorption and cytokine signaling to promote endothelial cell proliferation and neo-vascularization [3, 7]. Most of the spontaneous resolutions of pain in the acute phases take place in the first 2–4 weeks

[13]. However, some patients develop pain for a longer period of time and, among them, some suffer from acute exacerbations from time to time. In these patients it takes much longer to become asymptomatic. Among our criteria for RF treatment was the requirement that patients had to have suffered at least 6 months of symptoms (mean symptomatic period until the procedure was 20 months). Spontaneous resolution of pain after being symptomatic for so long is almost never detectable.

Our complications rate was quite high in comparison with that of other authors if we include the post-procedural discomfort as a complication [11]. However, these complications were all minor and resolved in a short time period (less than 1 month) after the procedure.

We conclude that the RF procedure has a role in treating patients with mechanical back pain at different levels. This procedure should be performed only as a second line of treatment after conservative treatment has failed. The complication rates and side effects of this procedure are relatively small and the patients benefit from long-term pain relief. This procedure yielded good results both after failure of conservative treatment and for failed surgery patients.

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