

Radiofrequency Ablation; A Palliative Option To Control Pain In Non-Iatrogenic Spondylodiscitis

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Citation

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Abstract

Objective: Spinal infections are a significant clinical problem. Associated axial back pain has a substantial burden and disability on the patient. Management involve conservative and surgical pathways. We here present our experience with the effect of facetal radiofrequency ablation on axial back pain and quality of life for patients with primary spinal infections.

Methods: A retrospective study of patients with primary pyogenic spine infection treated in the period from February 2014 through December 2017. All patients had axial back pain score of 10/10 before any intervention. All patients involved has no other associated neurological morbidity. Patients were treated with pulsed radiofrequency (PRF) of the dorsal root ganglion, conventional radiofrequency (CRF) of facet medial branch, or a combination of both techniques to improve their back pain beside conservative antibiotics management.

Results: Thirty-one patients were included in this study. Mean age was 43 years. Mean follow up period was 8.5 months. Seven patients had an associated epidural abscess. The most commonly involved region was the lumbar region (80%). All patients of the study had immediate improvement of their back pain in the same day of treatment. The mean, median and range Oswestry disability index (ODI) after 6 months was 19.8%, 15% and 4% - 65% respectively. The mean improvement of our study patients' ODI was 48.5% (P value = 0).

Conclusion: Our data suggests that facetal radiofrequency provides palliative control of back pain and improve ODI in patients with primary spinal infection, till the IV antibiotic therapies do its job.

INTRODUCTION:

Primary spinal infections are a significant clinical problem with a substantial financial burden and impact on the quality of life of the patients. Their insidious presentation and slow clinical course make the diagnosis and subsequent treatment difficult. [25] Due to the inconsistent presentation of these entities, delay in diagnosis is not infrequent. [25]

There has been an increase in the reported number of patients presenting with primary pyogenic infection of the spine.[2,4,5] The reasons are multifactorial and have been attributed for the most part to the increase in intravenous drug abuse (IVDA) and the increase in life expectancy of older patients and those with chronic debilitating diseases.[21,24] Other predisposing factors for pyogenic spinal infections include malnutrition, compromise of the immune system, diabetes mellitus, HIV positivity, malignancy, chronic steroid usage, renal failure, septicemia,

and devices (intravascular or intrauterine), which make this pathology more common in developing countries. [21,24]

RF tool has accented its need as a powerful tool in pain management and is established as a widely used procedure, due to its low complication rate (<1%), its ease of application, and the low associated costs. [3] Two most commonly used methods are conventional or thermal radiofrequency (CRF), in which a lesion is induced by heat generated by the vibration of particles and pulsed radiofrequency (PRF), whereby an electromagnetic field generated in the needle tip induces a series of changes at the cellular level that hinder action potential transmission by neurons. [8]

Back pain has been reported as one of the most common presenting symptom of spinal infections. It is believed that the pathology of spondylodiscitis is not only affecting the

end plates but also the nearby facets. [7,18] Hence we aim that facets medial branch nerve target in RF procedure might cause a kind of relief in the incapacitating pain complaint associated in that condition.

METHODS:

A retrospective review for patients diagnosed with primary spondylodiscitis managed at our neurosurgical facility in the period from February 2014 to December 2017. All the patients included in the study had only axial back pain with no other neurological symptoms or sign. None of the patients included in the study had any motor or sphincter symptoms or signs.

Our primary outcome was improvement of axial back pain assessed with visual analogue scale. The secondary outcome was degree of patient disability assessed with Oswestry disability index.

All cases of postsurgical spine infection, so-called secondary spine infection, were excluded. The data extracted included patient age, sex, site of infection, risk factors, preceding medical treatment with concomitant laboratory data rising/remitting, clinical presentation, type and number of lesions performed, and outcomes. The following laboratory data were reviewed: erythrocyte sedimentation rate (ESR), white blood cell (WBC) count, and C-reactive protein (CRP) level. Microbiological results from blood, urine, and spine biopsy cultures as well as any other tissue cultures were reviewed. Radiological studies reviewed included information from plain radiographs, CT, and MRI on admission and follow-up.

Diagnosis was made based on a combination of clinical history, physical examination findings, results of radiological assessment, and positive organism cultures (blood culture or post drainage of paraspinal collection). Diagnosis of spinal infection was additionally given in cases with suggestive clinical features and appropriate radiological changes, in which microbial cultures remained negative, but the patients had elevated inflammatory markers.

All patients included in the study were treated with conservative management for control of the spine infection. The Radiofrequency ablation of the medial branch of the facet was used to control axial back pain. The technique of the radiofrequency ablation involves the use of fluoroscopy to visualize the target point at the tip of the superior articular process (SAP). We used a 22-G SMK C-10 pulsed radiofrequency ablation (PRF) cannula with a 10-mm active

tip to produce wider electric fields from the non-insulated portion. We believe that this position allows better exposure to the electric fields that are generated along the shaft of the cannula. The parameters used were: 40 V; pulse width, 10 ms; frequencies, 2 Hz, or 5 ms and 5 Hz applied for 10 minutes. Correct positioning of the needle within the capsule is usually associated with an impedance < 300 Ω.

We have fixed strategy in radiofrequency ablation procedure of: 70/90 dosing on the medial facet branch and pulsed RF with same dosing DRG (dorsal root ganglia). Followed by injection of Betamethasone sodium phosphate (a long-acting steroid depot preparation) and xylocaine (local anesthetic agent). The local anesthetic and steroid were mixed in equal volumes when injecting the facet and 1:2 for the medial branch the local anesthetic used here should be preservative-free, so as to prevent flocculation of the steroid. Other steroids like methylprednisolone or betamethasone may be employed. 1% Lignocaine is used for skin infiltration.

We used descriptive statistics to present patient demographics and outcomes. Graph pad online software and social science statistics was used for inferential statistical analysis in which, Wilcoxon signed rank test was used to assess the significance of the change in visual analogue scale and Oswestry disability index and Unpaired t test was used to assess difference in outcomes depending on predisposing factors of infection.

RESULTS:

Thirty-one patients were included in this study, 13 men and 18 women. Their mean age at presentation was 43 years, most of the patients was in the age group of 30 - 60 years (range was from 21-69 years). Mean follow up period was 8.5 months (Range 6-15 months).

All patients presented with persistent axial pain, depending on the level of the disease. MRI showed findings consistent with spondylodiscitis with or without epidural abscess, exclusive epidural abscess, or spondylodiscitis expanding into the surrounding paravertebral soft tissue, including the corresponding facet. Nine patients (29%) presented with epidural abscess associated with spondylodiscitis, and 22 patients (71%) presented with spondylodiscitis without epidural abscess (see Table). All patients have radiological evidences of spondylodiscitis. Visual analogue score was plotted as 10/10 in the initial visit for all patients in this study.

Three patients were diagnosed with HIV infection, 12

patients were diagnosed with diabetes mellitus and 5 patients admitted IV drug abuse.

The most commonly affected levels were lumbar (25 patients [80%]), followed by thoracic (5 [16%]) and one case at the cervical level. A single level was involved in 17 patients (55%), in the rest multiple levels were involved.

All patients underwent medical treatment with intravenous antibiotic therapy tailored to their specific organism. Medical treatment was in two pathways: 1] Analgesics antinflammatory, and 2] Intravenous antibiotic therapy tailored to their specific organism, guided by inflammatory markers, worth mentioning here that there was no correlation between the high -but decreasing- markers and the perception of pain.

The most common organism isolated from cultures of the bone and/or blood was Staphylococcus aureus, which was found in 24 (77%) cases. If no organism was identified in cultures, a 6-week course of broad-spectrum empirical antibiotic coverage was prescribed.

Axial back pain:

All patients of the study had immediate improvement of their back pain in the same day of radiofrequency ablation, with a controlled post procedure pain relief on NSAID (non-steroidal antinflammatory drugs). The mean preoperative and postoperative VAS of back pain was 10 and 3.5 respectively. Using the Wilcoxon ranked signed test showed a statistically significant change in VAS of back pain in our cohort with a mean improvement of back pain VAS = 6 (p value= 0).

The mean VAS of back pain was increased to 5.3, 6 months after ablation in 21 patients of this study. This mild increase in back pain score was statistically significant (P= 0.0008).

Table 1

Table 1

Results of VAS for axial back pain and Oswestry disability index (ODI).

	Pre and immediate VAS	Immediate and Post 6 months VAS	Pre and 6 months ODI
W- value	0	0	0
Mean difference	6	-3.62	48.5
Z- value	-4.8559	-4.0145	-4.8599
P- value	0	0.0008	0

Oswestry disability index (ODI):

All of our patients was either severely disabled or crippled

on the ODI before the radiofrequency ablation, mean = 60.5%, median = 64% and range was from 40% to 79%. In 6 months follow up 25 (81%) patients maintained an ODI less than 20% (minimal disability). The mean, median and range ODI after 6 months was 19.8%, 15% and 4% - 65% respectively. The mean improvement of our study patients' ODI was 48.5% (P value = 0). Of note, none of our study patients maintained neurological morbidity or was in need to have surgical decompression in the follow up period. Table 1

Further sub analysis of our results with respect to predisposing factors of infection; diabetes mellites, IV addiction, HIV infection, history of abdominal surgery and intrauterine device usage, showed insignificant difference of 6 months axial back pain VAS and 6 months ODI through our study group (p=0). Also, the sub group of patients with epidural abscess (9 patients) showed improvement of back pain and ODI at 6 months follow up, with mean VAS for back pain and ODI of 4.9 and 17.3 respectively. Table 2.

Table 2

Sub analysis of results according to different predisposing factors.

	Number of patients	Mean 6 months pain VAS	SEM	P-value	Mean ODI (6 months) %	SEM	P-value
Patients with HIV	3	3.7	1.5	0.82	13.7	4.9	0.91
Patients admitted IV Addiction	5	6	0.6	0.85	16.4	2	0.93
Patients with diabetes mellitus	12	6.1	2.06	0.83	29.5	21.7	0.7
Patients with radiological epidural abscess	9	4.9	1.9	0.93	17.3	9.3	0.9
History of abdominal surgery	12	5.8	1.2	0.9	30.4	5.8	0.7
History of IUD	6	4.5	1.9	0.88	10.3	3.9	0.8

	Mean	SEM
VAS for all patients 6 months	5.3	2.14
ODI for all patients 6 months (%)	19.8	16.5

DISCUSSION:

Vertebral infection has remained a challenging problem despite advances in medical knowledge, imaging techniques, and surgical spine instrumentation. [26] There is no consensus regarding its optimal management or the optimal duration of parenteral antibiotic therapy and subsequent oral therapy. [26] Furthermore, questions remain regarding whether and when to interfere, when this candidate will reach the incapacitating line of collapse, it is not a collapse at the sense of neurological morbidity and disability but at

the sense of pain and the consequent painful limitation of movement. The major prognostic factor is early diagnosis, Favoring better prognosis. [9,15] The neurological symptoms is highly variable, ranging from any type of neurological deficit to back pain as the only presentation. [1,4,9,10,12,14,23,28]

In our study we focus on the control of the disabling axial back pain in patients with primary infected spondylodiscitis with pulsed radiofrequency (PRF) ablation of the medial facet branch and dorsal root ganglia. We attributed the immediate relieved cases outcome to the local long acting steroids and local long acting anesthetic. In contrast to conventional RF, the action of PRF is not limited to neural structures. In view of the good results obtained with joint pain, [26] Sluijter et al. [27] have postulated a local or regional effect of the electric fields produced by PRF on immune cells and thus, influencing the nociceptive process itself rather than merely the afferent innervation. The electric fields that are involved in this process might be quite low. Maretto et al. [19] recently demonstrated that applying PRF at a uniform field strength of 200 V/m to monocytes induces biological activity of TNF- α . The technique we used in our study involved 70/90 dosing on the medial facet branch and pulsed RF with same dosing DRG (dorsal root ganglia).

It was reported that blood cultures in cases of spine infection are accurate in identification of the pathogen involved in approximately 85% of cases. However, Tissue cultures from the infected vertebra in cases in which blood cultures are negative is indicated [1,13,16,25] Blood cultures or CT guided biopsy cultures were performed in all of our patients to confirm diagnosis and appropriate antibiotics.

Pyogenic spondylodiscitis affects mostly the lumbar spine followed by the thoracic, cervical and sacral regions [16,20] In our study, the most commonly affected levels were lumbar levels in 85% of cases.

Risk factors for spinal infection may include; intravenous drug use, HIV infection, immunosuppression and underlying co-morbidities such as renal failure, rheumatological disease and hepatic cirrhosis. Urinary tract infections are common (17%) and range from cystitis to pyelonephritis. [11,13,22,24,29] In our Three patients were diagnosed with HIV infection, 12 patients were diagnosed with diabetes mellitus and 5 patients admitted IV drug abuse.

Recently, Staphylococcus aureus has become the most frequent bacterium isolated in cultures of cases of vertebral

infections, accounting for 20% to 84% of all cases. [6,13,20] our results fall in this range in which, the most common organism isolated from cultures of the bone and/or blood in our study population was Staphylococcus aureus (77%).

In the majority of cases of primary spinal infections, conservative management of infection with antibiotic therapy is successful, especially in the absence of absolute indication of surgical management. [3] The main goals of management are; eradication of infection, restoration of spinal stability, recovery of neurological morbidity and pain control. Bed rest and immobilization is a corner stone in conservative management and adequate pain control was proved to decrease the time and complications of bed rest. [3] All patients of our study were candidates for conservative management with no indication for surgical management. Our results showed a statistically significant change in VAS of back pain in our cohort with a mean improvement of back pain VAS = 6 (p value= 0) and mean improvement of our study patients' ODI of 48.5% (P value = 0). Of note, none of our study patients maintained neurological morbidity or was in need to have surgical decompression in the follow up period. These results would be compared to results of a recently published article which showed Mean improvement of VAS for back and leg pain 3.6 and mean improvement of ODI score of 35.8 after one of the radicular surgeries with debridement and the use of anterior lumbar interbody fusion. [17]

Recent reports support that early surgical intervention in spinal infection improve outcome including pain and decrease hospital stay. [30] Hence, Patients with primary vertebral infection must choose between: (1) Long lasting tolerate pain till the conservative antibiotic management option reaches its drop off destination, and/or (2) Heroic invasive surgical option to eradicate and hardware fixation with the added risks and consequences. our study suggests that radiofrequency ablation of medial facet branch would be an option to help the patient tolerate pain till the conservative management achieve its goals without adding significant morbidity.

CONCLUSION:

To the best of our knowledge pain control with radiofrequency ablation in spinal infection has not been reported, our data suggests that facet radiofrequency provides palliative control of back pain and improve ODI in patients with primary spinal infection (especially in developing countries with limited resources), till the IV

antibiotic therapies do its job.

IRB approval:

This is a retrospective chart review study approved from our institutional ethical standards ethical committee (in coherence with the 1964 Helsinki declaration and its later amendments or comparable) with waiver of informed consent.

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