ORIGINAL ARTICLE

Role of Radiofrequency in Management of Chronic Low Back Pain

Waleed Ahmed Qenawy [1]*, Khaled Ismail Abd El-Aziz [1], Ahmed Sayed Abd El-bar [2], Radwan Nouby Mahmoud [3], Mohammad F. Elshirbiny [4]

[1] Neurosurgery Department, Faculty of Medicine, Aswan University

[2] Neurosurgery Department, Faculty of Medicine, Ain shams University

[3] Neurosurgery Department, Faculty of Medicine, Assuit University

[4] Neurosurgery Department, Faculty of Medicine, Mansoura University

ABSTRACT

Keywords: Radiofrequency neurotomy, low back pain, LBP, VAS.

***Corresponding Author:**

Waleed Ahmed Qenawy,
Mobile: 01114871424 .
Email: dr.qenawy151@gmail.com

Background: Chronic low back pain (LBP) affects about 45% of the population, it is treated conservatively, and if failed, we use invasive methods, as radiofrequency neurotomy (RF). **Objective:** to evaluate the efficacy, safety, and outcome of RF in patients with chronic LBP**. Patients and Methods:** This prospective study included patients with chronic LBP lasting ≥3 months. We performed RF to the included participant, moreover, we assessed the chronic LBP by visual analogue score, the improvement of the daily activities, and the safety immediately after the procedure, after one week, after one month and after three months. **Results:** We included 40 patients with chronic LBP not responding to medical treatment. The average age was 58.28 ±7.2, 13 of them were male. The L4-L5-S1 levels were the most affected (67.5%). The pain score reduced from 8 before the operation to 3 after three months follow up p-value < 0.001. Regarding to Daily living activities, after 3 months the number of patients with normal daily activities was 50 %, and the number of supported patients still only 3 patients p-value < 0.001. **Conclusion:** RF showed promising results in the management of chronic LBP, it has advantages regarding the long term follow up.

INTRODUCTION

Low back pain (LBP) is defined as pain, stiffness, or muscle ache localized below the costal margin and above the inferior gluteal sulcus, ± sciatica, and considered chronic if persisted for ≥ 12 weeks (3). About 2–7% of people with acute LBP become chronic. It has been reported that about 15-45% of the population complain from chronic LBP further than 3 months. Also it is one of the major reasons of 45 – 65 years disabilities (4). Muscle tension and spasm are a considerable causes for LBP. In other cases, LBP can be attributed to different pain creators, with specific characteristics, such as radicular, discogenic pain, facet joint, sacroiliac, as well as spinal stenosis and spondylolithesis. (5)

Conservative treatment options for chronic LBP either medical, physiotherapy, muscle strengthening, or psychological therapies. Failure of conservative method may indicate the use of local invasive maneuvers such as steroid injections, nerve blocks, cryoablation, radiofrequency ablation (RFA) or attempt of surgical intervention. (6)

The radiofrequency (RF) beside its use to treat pain by application of electrical signals to neural tissue used also in other diseases such as atrial fibrillation, liver tumors, bony tumors and varicose veins. This technique based on generating sufficient RF heating in the tissue to increase the temperature more than 45-50°C which is called "lethal temperature", because the tissue is destroyed if they were exposed to these temperatures for ≥20 seconds (7)

Application of pulsed RF to nerve tissue used as minimally or nondestructive technique in comparison to heat lesion from the continuous RF with the same voltage. (8)

This study aims to evaluate the efficacy and results of radiofrequency neurotomy as a method for management of chronic LBP patients.

PATIENTS AND METHODS

This prospective study was conducted at Neurosurgery Department, Aswan University Hospital and Ain Shams university hospital from Feb. 2019 till Dec. 2020. The protocol was approved by institutional review board, Faculty of Medicine, Aswan University, and all participants were given informed consent.

Patients:

We included 40 patients with chronic sacroiliac joint pain, chronic lumbosacral radicular pain lasting ≥3 months, chronic back pain due to degenerative spine disease, failed back syndrome, refusing surgery, or not fit for surgery, who was justified for receiving interventional pain management as a conservative treatment.

While chronic back pain patients due to chronic inflammatory joints diseases and malignancy, having an acute or chronic uncontrolled medical illness or mental illness, infectious diseases, bleeding tendency, pregnancy, radicular pain associated with progressive neurological deficit were excluded.

The outcomes of this study were assessed for the low back pain: clinically and by visual analogue score (VAS), the improvement of the daily activities, and the safety of the procedure. Data were collected in a pre-structured questionnaire which includes clinical assessment -neurological examination, VAS score (1), and quality of life (2)- and investigation: lumbosacral X-ray (spine anteroposterior, lateral and dynamic views), lumbosacral spine C.T scan, lumbosacral spine MRI-. The outcomes were assessed immediately after the procedure, after one week, after one month and after three months

Procedures:

We used radiofrequency generator (LG2 NEURO N50, INOMED, GERMANY), fluoroscopy, operating table, and lidocaine as a local anesthesia. Operating room equipped with fluoroscopy and radiofrequency generator, the patient lie in prone position, after that we sterilize the lower back and injected the lidocaine. After conformation of the position under fluoroscopy we Implanted the RF probe. The C-arm is rotated to 10–20° from AP to visualize the junction between base of the transverse process and the superior articular process (where the lumbar medial branch lies against the bone in this region) in the center of the field. With this view, the "Scotty Dog" configuration appears, the ear represent the superior articulating process, the nose represents the transverse process and the eye represents the pedicle. A 22G RF needle , 100.5mm (exposed tip 5mm) inserted along the angle of the X-ray beam so as to hit the 'eye of the Scottie dog' in tunnel vision then lateral view is obtained to rule out that the needle tip is not encroaching on the neural foramen.

The electrodes were placed at the site of the dorsal ramus medial branches of the relevant facet joints. The electrode tip was placed parallel to the nerves at the junction between the transverse process and the superior articular process. The radiofrequency thermal energy applied to 80°C, for 90 s for two or three cycles during the ablation the patient was asked about the pain and the movements of the lower limb muscles. When the lesion has been performed, remove the electrode

and inject 1 ml of a mixture of 0.5% Bupivacaine plus a depot steroid medication in order to reduce post procedure discomfort. There is special consideration to L5/S1 facet joint, the target is L5 dorsal root which located at the junction of the base of the S1 superior articular process and the ala of the sacrum.

In case of sacroiliac joint the electrodes were placed at the site of lateral branches of S1 and S2. Pulsed radiofrequency done at 45V for 3 cycles of 90 sec (temperature not to exceed 45°C). General sedation not used to provide adequate feedback during the procedure and to prevent some complications due to improper needle positioning. The patients were discharged after 3 hours recovery.

Statistical Analysis:

Data were collected, coded, revised and entered to the SPSS 23. The quantitative data were presented as mean, standard deviations if normally distributed, if not we used median, (IQR) while qualitative data were presented as number and percentages. To compare between groups with qualitative data we used Chi-square test, while to compare between independent groups with quantitative data and non-parametric distribution was done by using MannWhitney test.

The comparison between paired groups with quantitative data and non-parametric distribution was done by using Wilcoxon-Rank test.

The confidence interval was set to 95% and 5% was accepted as margin of error. So, the p-value was considered significant if p-value < 0.05: Significant.

RESULTS

We included 40 patients with chronic low back pain not responding to medical treatment. The average age was 58.28 ±7.2, and ranging from 43-71 years, 13 of them were male. The L4L5-S1 levels were the most affected levels (67.5%), moreover the L5-S1 level was 10%. Post-operative adhesions were the most common pathology (60%), while facet arthropathy was the second common pathology (32.5%). Table 1.

The median (IQR) pain score (VAS) before radiofrequency was 8 (7-8), immediately after radiofrequency neurotomy the pain score reduced into 1 (0-3) and remained at 1 (1-3) after one week. After one months, it raised into 3 (2-5), and reached 3 (2-6) after 3 months follow up. These findings were very high statistically significant in comparison to the baseline p-value < 0.001 (Table 2).

Regarding to Daily living activities, only 5 patients were normal before the radiofrequency neurotomy, and about 50% of them were doing their activities without support, and 35% of them were doing their activities with support, while no patient was bed ridden. After one week, 70% of them become normal while doing their daily activities, and only 1 needed support while normal activities, this improvement was very high statistically significant p-value <0.001. after a months the number of normal daily activities reached about 60 % and only 3 of them needed support, this was still statistically significant in comparison to the baseline p-value < 0.01. after 3 months the number of patients with normal daily activities was 50 % and 40% of them was doing their activities unsupported, and the number of supported patients still only 3 patients, and no patients become bed ridden after neurotomy which is still highly statistically significant p-value < 0.01 (Table 3).

DISCUSSION

A major proportion of the adult population has LBP at some stage of life. Although most of them are treated successfully with conservative treatment, a substantial group of patients develop chronic pain symptoms (9). If conservative treatments were unsuccessful, more invasive maneuvers, such as radiofrequency ablation. (6) it has been reported that the improvement rate of RFA reached 60% to 80%. (10)

In the present study, we included 40 patients with chronic LBP. They had radiofrequency neurotomy as a conservative way of management, and they were followed up for three months for patient pain score and functional ability "daily living activity" and the analysis of the retrieved data revealed that 65% of patients had pain score VAS less than 5 and increase in daily activity at the

end of the study while 35% patients had unsatisfactory result with pain score more than five. Pain scores at different times of follow up period were significantly decreased in comparison to before intervention. These finding agrees with the results obtained by Manchikanti et al., (11). Moreover, It has been reported that 80 % of patients with chronic LBP treated with RF neurotomy achieved pain relief lasting at least one years (12). Also, Gofeld et al., reported that about 70% of patients maintained at least 50% pain relief for between 6 and 24 months. (13)

The reviews of Boswell et al, and Manchikanti et al, provide strong evidence for short-term relief and moderate evidence for long-term relief (14,15). Moreover, Manchikanti et al., provided a strong recommendation for lumbar RF neurotomy (16). RF of the medial branch nerves has been shown to improve function, pain, and analgesic use for 6–12 months in patients with lumbar facet syndrome (17).

In a retrospective cohort study, it was concluded that a high percentage of patients treated with RF medial branch neurotomy had a good to excellent pain relief for a prolonged period of time in patients diagnosed as facet syndrome (18).

On the other hand, Juch et al, do not support use of RF to treat chronic LBP because he found no clinically significant improvement when he compares standard exercise program plus RF denervation with standard exercise program alone (19). This can be explained as they used different RF techniques, while we used palisade technique only. Moreover, they included participants from Netherland, who is difference in ethnicity, culture, and habits from Aswan population. Also, the age in our sample were narrower than their study. On the other hand, Klessinger et al., had a result of 60% success rate with a radiofrequency neurotomy applied to patients with this condition. (20)

Our study had some limitations, one of the major limitations of our study was the sample size, so further studies with large sample size with longer follow up period assessment and randomization if could be conducted the results may indicate many clues.

CONCLUSION

The results of radiofrequency neurotomy after three months was promising in the management of chronic LBP. But its costs and equipment wised problem still make it less widely used.

REFERENCES

1. Wewers ME, Lowe NK. A critical review of visual analogue scales in the measurement of clinical phenomena. Res Nurs Health [Internet]. 1990 Aug;13(4):227– 36. Available from: https://onlinelibrary.wiley.com/doi/10.1002/nur.4770130405
2. Balestroni G, Bertolotti G. EuroQol-5D (EQ-5D): an instrument for measuring quality of life. Monaldi Arch Chest Dis [Internet]. 2015 Dec 1;78(3). Available from: http://www.monaldi-archives.org/index.php/macd/article/view/121
3. Uddin MM, Khan AA, Chowdhury AH, Guha RK. Association of Low Back Pain with Common Risk Factors: A Community Based Study. Indian J Phys Med Rehabil [Internet]. 2014 Jun;25(2):50–5. Available from: https://www.ijopmr.com/doi/10.5005/ijopmr-25-2-50
4. Alleva J, Hudgins T, Belous J, Kristin Origenes A. Chronic low back pain. Dis Mon [Internet]. 2016 Sep 1 [cited 2022 Feb 23];62(9):330–3. Available from: https://pubmed.ncbi.nlm.nih.gov/27344193/
5. Braun J, Baraliakos X, Regel A, Kiltz U. Assessment of spinal pain. Best Pract Res Clin Rheumatol [Internet]. 2014 Dec 1 [cited 2022 Feb 23];28(6):875–87. Available from: https://pubmed.ncbi.nlm.nih.gov/26096091/
6. Savigny P, Watson P, Underwood M. Early management of persistent non-specific low back pain: summary of NICE guidance. BMJ [Internet]. 2009 Jun 13 [cited 2022 Feb 23];338(7708):1441–2. Available from: https://pubmed.ncbi.nlm.nih.gov/19502217/
7. Cosman Sr ER, Cosman Jr ER. Radiofrequency lesions. In: Textbook of stereotactic and functional neurosurgery. 2009. p. 1359–82.

8. Atim A, Ergin A, Bilgic S, Deniz S, Kurt E. Pulsed radiofrequency in the treatment of coccygodynia. Agri [Internet]. 2011 Jan [cited 2022 Feb 23];23(1):1–6. Available from: https://pubmed.ncbi.nlm.nih.gov/21341145/
9. Lambeek LC, van Mechelen W, Knol DL, Loisel P, Anema JR. Randomised controlled trial of integrated care to reduce disability from chronic low back pain in working and private life. BMJ [Internet]. 2010 Mar 16;340(mar16 1):c1035–c1035. Available from: https://www.bmj.com/lookup/doi/10.1136/bmj.c1035
10. LORA J, LONG D. So-Called Facet Denervation in the Management of Intractable Back Pain. Spine (Phila Pa 1976) [Internet]. 1976 Jun;1(2):121–6. Available from: http://journals.lww.com/00007632-197606000-00006
11. Manchikanti L, Pampati V, Fellows B, Bakhit CE. The diagnostic validity and therapeutic value of lumbar facet joint nerve blocks with or without adjuvant agents. Curr Rev Pain [Internet]. 2000 Sep 1;4(5):337–44. Available from: http://link.springer.com/10.1007/s11916-000-0016-4
12. Dreyfuss P, Halbrook B, Pauza K, Joshi A, McLarty J, Bogduk N. Efficacy and Validity of Radiofrequency Neurotomy for Chronic Lumbar Zygapophysial Joint Pain. Spine (Phila Pa 1976) [Internet]. 2000 May;25(10):1270–7. Available from: http://journals.lww.com/00007632-200005150-00012
13. Gofeld M, Jitendra J, Faclier G. Radiofrequency denervation of the lumbar zygapophysial joints: 10-year prospective clinical audit. Pain Physician [Internet]. 2007 Mar;10(2):291–300. Available from: http://www.ncbi.nlm.nih.gov/pubmed/17387351
14. Boswell M V, Trescot AM, Datta S, Schultz DM, Hansen HC, Abdi S, et al. Interventional techniques: evidence-based practice guidelines in the management of chronic spinal pain. Pain Physician [Internet]. 2007 Jan;10(1):7–111. Available from: http://www.ncbi.nlm.nih.gov/pubmed/17256025
15. Manchikanti L, Singh V, Vilims BD, Hansen HC, Schultz DM, Kloth DS. Medial branch neurotomy in management of chronic spinal pain: systematic review of the evidence. Pain Physician [Internet]. 2002 Oct;5(4):405–18. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16886020
16. Manchikanti L, Boswell M V, Singh V, Derby R, Fellows B, Falco FJE, et al. Comprehensive review of neurophysiologic basis and diagnostic interventions in managing chronic spinal pain. Pain Physician [Internet]. 2009;12(4):E71-120. Available from: http://www.ncbi.nlm.nih.gov/pubmed/19668292
17. Royal MA, Bhakta B, Gunyea I, Jenson M, Movva V, Taqi D, et al. Radiofrequency Neurolysis for Facet Arthropathy: A Retrospective Case Series and Review of the Literature. Pain Pract [Internet]. 2002 Mar;2(1):47–52. Available from: http://doi.wiley.com/10.1046/j.1533-2500.2002.02004.x
18. Son JH, Kim SD, Kim SH, Lim DJ, Park JY. The Efficacy of Repeated Radiofrequency Medial Branch Neurotomy for Lumbar Facet Syndrome. J Korean Neurosurg Soc [Internet]. 2010;48(3):240. Available from: http://jkns.or.kr/journal/view.php?doi=10.3340/jkns.2010.48.3.240
19. Juch JNS, Maas ET, Ostelo RWJG, Groeneweg JG, Kallewaard J-W, Koes BW, et al. Effect of Radiofrequency Denervation on Pain Intensity Among Patients With Chronic Low Back Pain. JAMA [Internet]. 2017 Jul 4;318(1):68. Available from: http://jama.jamanetwork.com/article.aspx?doi=10.1001/jama.2017.7918
20. Klessinger S. Zygapophysial Joint Pain in Post Lumbar Surgery Syndrome. The Efficacy of Medial Branch Blocks and Radiofrequency Neurotomy. Pain Med [Internet]. 2013 Mar;14(3):374–7. Available from: https://academic.oup.com/painmedicine/article-lookup/doi/10.1111/pme.12012

Table 1: Demographic data of the included participants

		No.= 40
Age	Mean ± SD	58.28 ± 7.20
	Range	43 – 71years
Sex	Female	27 (68.0%)
	Male	13 (32.0%)
Diagnosis according to the affected level	**No.**	**%**
L3-L4	2	5.0%
L3-L4-L5	2	5.0%
L4-L5	2	5.0%
L4-L5-S1	27	67.5%
L5-S1	4	10%
Sacroiliac joint	3	7.5%
Pathology		
Adhesion post operation (failed back syndrome)	24	60.0%
Facet arthropathy	13	32.5%
Spondylolisthesis	2	5.0%
Stenosis	1	2.5.0%

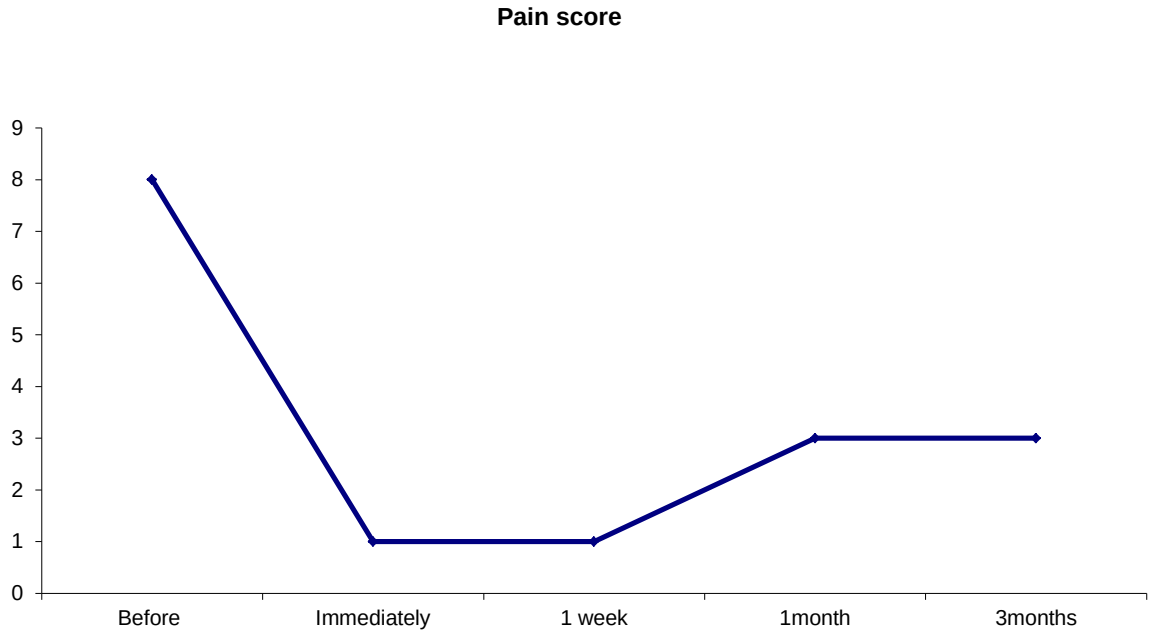
Table 2: Comparison between pain score before and pain score at different time of measurement after radiofrequency neurotomy

Pain score		**No.= 40**	**Wilcoxon Rank test**	
			Z	**P-value***
Before RF	Median (IQR)	8 (7 – 8)	-	-
	Range	6 – 10		
Immediately	Median (IQR)	1 (0 – 3)	4.386	0.000
	Range	0 – 7		
1 week	Median (IQR)	1 (1 – 3)	4.310	0.000
	Range	0 – 8		
1 month	Median (IQR)	3 (2 – 5)	4.136	0.000
	Range	1 – 8		
3 months	Median (IQR)	3 (2 – 6)	4.030	0.000
	Range	0 – 9		

Table 3: Comparison of daily living activities before with daily living activities at different time of measurement after radiofrequency neurotomy:

Daily living activities before	Normal	Unsupported	Supported	Bed ridden	X^2	P-value
Before	5 (12.5%)	21 (52.5%)	14 (35 %)	0 (0.0%)	-	-
1 week	29 (72.5%)	10 (25%)	1 (2.5%)	0 (0.0%)	19.693	0
1 month	23 (57.5%)	14 (35. %)	3 (7.5%)	0 (0.0%)	12.299	0.002
3 months	21 (52.5%)	16 (40.0%)	3 (7.5%)	0 (0.0%)	11.096	0.004

Figure 1: Line chart shows that pain score decreases significantly immediately after RF



neurotomy, but it increases again after 1month.

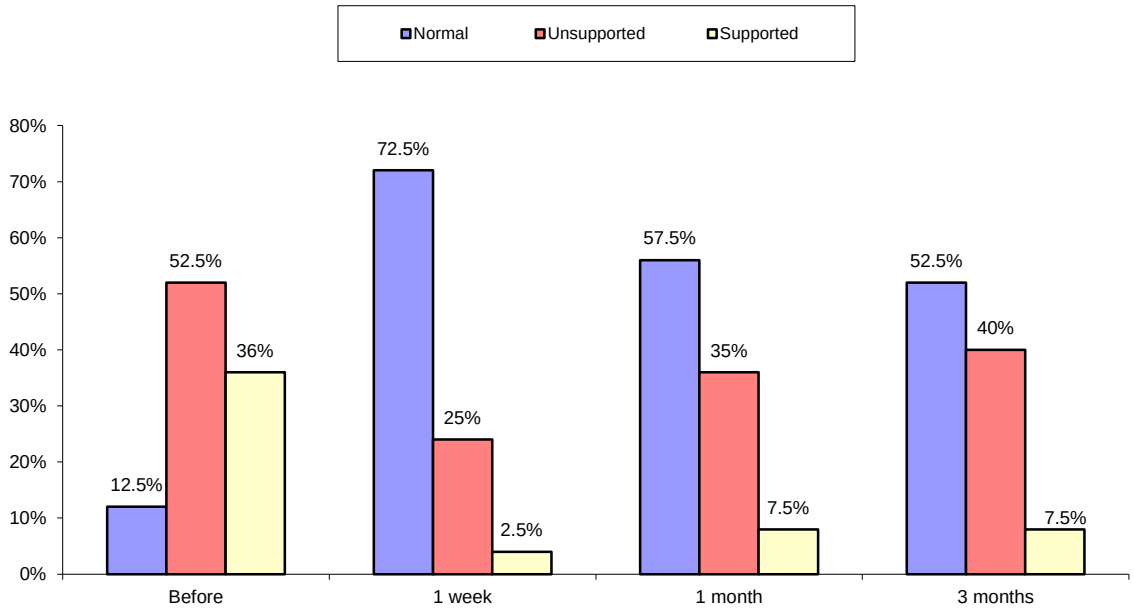


Figure 2: Column chart shows the differences between daily living activities before and after RF neurotomy.