

Effect of ultrasound guided pulsed radio frequency treatment on pain intensity, functional limitation and indication of surgery in patients with cervical disc prolapse

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Abstract

The Cervical Disc Prolapse (CDP) considered one of the most common cases presenting to pain clinics and can cause a great deal of pain and limitations to patients' daily activity and may require surgical treatment if not responded to conventional treatment modality. The Pulsed Radiofrequency (PRF) represents one of the treatment modalities that may reduce patient's pain and improve lifestyle, its effect not fully studied yet. Objectives: This study tries to clarify the pain reduction effect of PRF when applied under ultra-sound guidance to patients with CDP and predict the percentage of the patients that can avoid surgery by getting benefit from PRF treatment. Patient And Method: the study designed as a comparative observational pre-post study, 40 patients was selected to enroll in the study, all complaining from CDP at one or more level that not responding to conventional therapy, the patients received PRF and assessed before and after application of PRF for 3- and 6-months period. Their assessment includes the pain intensity, functional limitation of their activity and whether they prefer surgical solution after PRF treatment according to their clinical improvement. Results: there were extremely statistically significant reduction in pain score and functional limitation after PRF, most patients prefer PRF modality over surgical solution. Conclusion: PRF can have satisfactory results in reducing pain for patients with CPD and it may reduce the need for surgery.

Keywords: cervical disc, PRF, pain management

1. Introduction

One of the most common problems attending pain clinics is Cervical Radiculopathy (CR), which refer to dysfunction of cervical spinal nerves or their roots. The main etiology is either mechanical compression of nerve by herniated disc or chemical irritation leading to inflammation of the nerve root, degenerative disc changes that develop naturally with age may have a contributing role as well [1]. CR may cause variety of symptoms including neck pain which may radiate to upper limb in dermatomal pattern, shoulder pain, headache, parasthesia, muscle weakness, and it can lead to motor and sensory dysfunction of the upper limbs [2]. Different modalities for treatment can be used to manage CR including analgesic drugs and epidural steroid injection but still there is poor response of some patient to these modalities and that interfere with their daily life and activities and make them look for another solution like surgery [3].

One of minimally invasive modalities of management is application of Pulsed Radio Frequency (PRF) which differs from conventional radiofrequency in being less destructive to neural tissue. It proposed for the first time in middle of 1990s. The PRF utilizes high voltage shoots of brief phase or "pulses" of radiofrequency current ranging about 300 kHz, each pulse lasts for 20ms and followed by a silent phase (480 ms) and thus, allows maintaining the target tissue temperature below 42° C [4]. These oscillating pulses of energy can modify the nerve tissue function affecting pain signal transmission via pain perception pathway leading to reduce pain sensation (neuro modulation) [3]. The PRF applied through RF cannula which was firstly introduced in 1981 to the accurate anatomical target location [5]. Applying PRF under Ultrasound Guidance (USG) has an advantage of identifying nerves and vessels structures and reducing the risk of radiation [3].

In this study 40 patients visiting pain clinic at Al-Arabi and Nursing home hospitals complaining from CR due to Cervical Disc Prolapse (CDP), were selected

to be managed with USG-PRF since they not responded well to conservative management and advised to consider the surgical solution by neurosurgery department.

The study is aiming to determine the effect of USG-PRF in reducing pain intensity and enhancing quality of patient's life in addition to determine percentage of the patients that can avoid surgical intervention by getting benefit from USG-PRF.

The patients followed up carefully for pain intensity and functional limitation in pre PRF visit, 3 and 6 months after applying PRF. The Numeric Rating Scale (NRS), Neck Disability Index (NDI) were used to assess pain intensity and functional limitation of daily activity of the patients respectively. In addition, satisfaction scale and analgesic consumption of the patients were also considered and their preference to either therapeutic option (surgery or PRF).

2. Patients and Method

Study design

The study was designed as a comparative observational pre-post study pattern and includes 40 patients (16 males and 24 females) in various age groups (33-73) years suffering from CDP on multiple levels mostly.

Patient selection criteria

- CDP at one or more level
- No red flag
- Pain not responding to conventional treatment
- Candidate for elective surgery as recommended by neurosurgical department.
- No history of previous back surgery

Patient Exclusion criteria

- Sever spinal canal stenosis
- Previous back or cervical surgery
- Spinal cord injury, tumors

Procedure description

All the interventions done at the OR in Al-Arabi and Nursing Home hospital, The USG-PRF procedure was fully explained to the patients. After signing a written consent, the patient lie supine with standard monitoring and aseptic technique, the optimal localization of cervical nerve root was done using US and Extra Foraminal Selective Cervical Nerve Root stimulation was done at the target level. Motor stimulation with frequency of 5 Hz and voltage 0.2-1 volt (according to response) was applied for 5- 10 minutes while PRF was applied for 2-3 minutes for each level in addition to 5-10 short rapid bursts of sensory stimulations. Moreover, steroid injection was also given as 40 mg kenacort + 20 mg lidocain diluted with normal saline, 2 ml of the inject ate is given 1 ml around the nerve root and the other at facet joint for each intended level, the intervention lasted for 10-20 min.

Assessment

The patients assessed before applying PRF and 3, 6

months later on. The variables evaluated during these assessment visits were including:

- NRS for pain intensity: The patients asked to rate the pain they feel on a scale from 0 to 10. The 0 value indicates no pain, the 10 value indicates worst pain, in between the pain can be categorized into mild (1-4), moderate (5-6) or sever pain (7-10).

- NDI which is a modification of Oswestry low back pain Disability index, it includes ten items to be assessed including: (pain intensity, personal care, lifting, reading, headache, concentration, work, driving, sleeping, and recreation) each one scored from 0(minimum) to 5 (maximum) disability. The total score of all the 10 items represents the result of the test and can be expressed as a row score or percentage, the higher score means more functional limitation and more interference of pain with the daily activity of the patients. In this study all NDI results represented as a percentage. This variable were used in many treatments and scientific literatures and adopted by many guidelines [6 and 7].

Satisfaction rate: In the last visit the patients asked to rate their satisfaction according to their clinical improvement. The satisfaction scale include (0-4) score with minimum 0 for very dissatisfied, 1 for dissatisfied, 2 for neutral, 3 for satisfied, and 4 for very satisfied about the experience of USG-PRF.

Analgesic consumption: Also, the patients were assessed for their analgesic consumption pre and post application of PRF, any adverse effect that might happened.

Decision of surgery: lastly the patients asked if they prefer to proceed with surgical intervention or reject it according to their clinical improvement.

3. Statistical Analysis

A descriptive data analysis was performed to interpretate data in form of means, Standard Deviations (SD), frequencies and percentages. Unpaired student's t test was used to compare means of NRS and NDI scores in pre and post PRF groups and calculation and interpretation of P value. P value = 0.05 or less considered significant.

4. Results

The study included 40 patients, 40% of the participants were males. The mean age for the patients included was 54.1 year with SD of 10.6. Each patient had CDP in one or more levels. The prolapsed disc at C5-6 was mostly presented. In addition, 50% of patients had a Lt sided CDP, 35% had a Rt. Sided and 15% had a CDP with bilateral compression on a nerve root. General the characteristics for patients are shown in table (1).

NRS

Before initiating PRF stimulation 85% of the patients reported sever pain while the rest of the patients categorized the pain as moderate. The percentages of the patients suffered from sever pain dropped to

10% and 15% after 3 and 6 months from applying PRF respectively. Moreover, the mean NRS score before PRF was extremely statistically significant decrease after PRF treatment for 3 and 6 months (P value < 0.0001). NRS mean score showed in table (2).
NDI

The included patients have an average NDI equal to 43.1 % reflecting moderate functional limitation due to pain and this percentage statistically decrease significantly to 28.65% in the subsequent 3months (P value < 0.0001), this decrement maintained at 6 months visits when the average NDI score reached 24.4%. NDI mean scores showed in table (3)

Patient's satisfaction rate

After 6 months visits the patients asked about their satisfaction to PRF treatment according to their clinical improvement the results showed in table (4).

Analgesic consumption

The patients included in the study pre PRF treatment were on various types of analgesic drugs including NSAIDs, opioids and neuromodulators. After application of PRF the analgesic requirements decreased in 20% of patients while 45% of patients reported complete cessation of analgesia and they only count on simple analgesics on need. However, 35% of patients reported no change in their analgesic consumption. Analgesic consumption of the patients with corresponding frequencies and percentage shown in table (5)

Decision of surgery

All the patients included in the study had an elective indication of surgery because of pain that not responding to treatment and interfere with their daily life. After the application of PRF 65% of the patients reported that they prefer PRF over surgery because of their clinical improvement, ease of application, almost no complication and relatively less cost. On the other hand, 15% of patients reported they prefer surgery because they didn't get the desired effect from PRF therapy, but they delay their decision about the surgery due to personal cause, cost, and fear of surgical complications. It's worthy to mention that out of the 40 patients included in the study only 2 patients proceed to surgery since they get no benefit from PRF application and maintain same NRS and NDI scores over the 6 months of the study. In addition, 20% of the patients choose neither of both treatments (surgery or PRF) and they prefer other modalities of treatment like physiotherapy or analgesic drugs. Patient's preference to either choice of treatment modality shown in table (6).

Table (1) General characteristics of the selected patients.

variable	frequency	%	
age	30-	6	15
	40-	2	5
	50-	18	45
	60-	12	30
	70-80	2	5
sex	male	16	40
	female	24	60
Target nerve root			
C3	2	2.5	
C4	8	10	
C5	20	25	
C6	32	40	
C7	18	22.5	
CDP compression side			
Rt.	14	35	
Lt.	20	50	
Bilateral	6	15	

Table (2) NRS mean scores with pain categorization

NRS Score	Pre PRF		3 M after		6 months after	
	frequency	%	frequency	%	frequency	%
Mild	0	0	30	75	32	80
Moderate	6	15	6	15	2	5
Sever	34	85	4	10	6	15
Total	40	100	40	100	40	100
Mean	7.15		4.1		3.6	
SD	0.802		1.355		1.905	
P value	<0.0001					

Table (3) NDI mean score

NDI Score	Pre PRF		3 M after		6 M after	
	frequency	%	frequency	%	frequency	%
no	0	0	0	0	8	20
Mild	4	10	28	70	20	50
Moderate	28	70	10	25	10	25
Sever	8	20	2	5	2	5
complete	0	0	0	0	0	0
Total	40	100	40	100	40	100
Mean	43.1		28.65		24.4	
SD	10.071		11.468		11.653	
P value	<0.0001					

Table (4) satisfaction rate

Satisfaction rate	frequency	Percentage %
Very dissatisfied	0	0
dissatisfied	8	20
neutral	8	20
satisfied	14	35
Very satisfied	10	25

Table (5) analgesic consumption

Analgesic consumption	frequency	Percentage %
decreased	18	45
stopped	8	20
unchanged	14	35

Table (6) patient preference to each therapy.

Patient preference	frequency	Percentage %
PRF	26	65
Surgery Already did	6	15
surgery Waiting for surgery	2	5
	4	10
Neither of both	8	20

5. Discussion

Using PRF for treatment of radicular pain had been a subject of many clinical trials. [8-10] three randomized controlled trials showed a pain reducing effect after application of PRF to CR patients for 3 months follow up period and [10] found to have that pain reducing effect of PRF will be enhanced with the

addition of Trans Foraminal Epidural Steroid Injections TFESIs better than using each one alone. A meta-analysis carried out by [11] which studied the effectiveness of PRF on CR and the results showed that using PRF on dorsal root ganglia (DRG) is effective in reducing pain nonresponding to other conventional treatments include oral analgesia and epidural steroid injections. [12] Another study contributing to the same subject and considered PRF a safe treatment modality in CR patients. [11] And [12] had a 6-month assessment period.

Other studies [13-15] results showed a significant pain scores decrement after application of PRF and [13] found 50% reduction in pain scores for 1 year follow up period. Nevertheless, some studies showed no significant improvement with application of PRF [16].

All the previously mentioned studies depend on application of PRF on DRG and since the foramina difficult to visualize by US the PRF was applied on extra foraminal selective cervical nerve root which means the PRF application was some distance away from DRG in this study. However, as the results of this study showed there is a significant decrease in pain intensity and, this is concurring with the results of [3] in which the researchers adapt a USG-PRF and they believed that the electrical field that applied on extra foraminal selective cervical nerve root due to PRF still can affect DRG and thus reducing pain intensity.

In addition, a few studies emphasized on the effect on PRF stimulation on surgical indication, in [17] twelve patients were scheduled for lumbar spinal surgery followed up for 11 months after application of PRF and the result was rejection of surgery by all patients except one. Similarly, in [18] 80% and 76% of the participants rejected surgery after receiving PRF treatment for 1 month and 1 year respectively.

6. Conclusion

The USG-PRF can be considered a good therapeutic strategy in treatment of cervical radicular pain not responding to other modalities of treatment and it may reduce the need for surgical intervention.

However, this study had a limitation of lacking a control group to compare with and relatively small sample size so the results difficult to be generalized.

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