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Management of Discogenic Back Pain Using Intradiscal Radiofrequency

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ABSTRACT

Background: Degenerated discs producing discogenic back pain had nerves reportedly to be present in the inner third of the annulus fibrosis and nucleus pulposus. The electromagnetic field of the intradiscal radiofrequency (PRF) method was focused at the center of the target disc.

Objective: This study aimed to evaluate the better management and reducing chronic discogenic low back pain (LBP) and disability.

Patients and methods: This study included 26 patients who were diagnosed with chronic LBP without radiculopathy or neural compromise in MRI and carried out at Neurosurgery Department, Faculty of Medicine, Zagazig University. Complete history taking, clinical examination radiological examination were done preoperatively and postoperatively.

Results: The present study included 26 patients with age ranged from 16 to 58 years. The majority of our patients were classified to be overweight by 38.4%**.** Level of physical activity was reported by patients; 38.5%, 30.8%, 19.2% and 11.5% had moderate, vigorous, light and sedentary physical activity respectively. MRI imaging was done for all patients pre and postoperatively with no change reported as larger percentage had disc bulge (65.4%), followed by black disc (34.6%)**.** Among the studied patients, 73.1% had decrease in mean CPK postoperatively. Regarding final outcome (improvement in both OSI and VAS), 17 patients had successful outcome. There was statistically non-significant association between outcome and either age, sex, BMI, occupation, exercise level, preoperative MRI findings, CPK, OSI, VAS or sitting intolerance. Age, BMI, CPK, OSI and sitting intolerance were non-significantly higher among those with failed outcome.

Conclusion: Intradiscal radiofrequency appears to be an effective method for selected patients with chronic discogenic low back pain.

Keywords: Degenerated discs, Intradiscal radiofrequency, Low back pain

INTRODUCTION

Types of back pain include discogenic low back pain (LBP), radicular back pain, facet joint osteoarthritis back pain, muscle and fascia-induced back pain, and spontaneous LBP. Although the specific causes of discogenic back pain are usually convoluted and difficult to detect and treat, it may be characterised as a distinct form of back pain comprised mostly of nociceptive and neuropathic pain [(1)].

The International Spine Intervention Society, International Association for the Study of Pain, North American Spine Society, and American Society of Interventional Pain Physicians have all released consensus statements on discogenic criteria for discogenic pain diagnosis [(2)].

The advantage of having a provocative discography is that it has a very high specificity and sensitivity. Since clinical evidence indicates that there is a significant danger of accelerated disc degeneration and disc herniation in patients after surgery, discography may be too invasive to be employed as a diagnostic tool. Provocative discography also carries a significant chance of false positives [(3)].

Intradiscal electrothermal therapy (IDET), a minimally invasive surgery that uses flexible catheters to coagulate the annulus, has been utilised to treat persistent discogenic LBP in individuals who have not responded to conventional therapies [(4)]. Nonetheless, meta-analyses of the available published evidence of IDET's effectiveness produce debatable results [(5)].

Although the precise method by which intradiscal RF lessens discogenic pain is unknown, it is believed that there are two separate processes at play. The nerve terminals that have been sprouting into the disc's nucleus may experience very strong electric fields as a result of high voltage PRF current being administered intradiscally using Diskit needles [(6)].

This study aimed to evaluate the better management and reducing of chronic discogenic LBP and disability.

PATIENTS AND METHODS

This prospective Cohort study was carried out at Neurosurgery Department, Faculty of Medicine, Zagazig University and included patients with chronic LBP without radiculopathy or neural compromise in MRI.

Ethical consent:

An informed verbal consent from all participants was taken and confidentiality of information was assured. The title and objectives of the study were explained to them to ensure their cooperation. The study was approved by the Ethics Board of Faculty of Medicine, Zagazig University. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Inclusion and exclusion criteria:

Chronic low back pain of at least 6 months continuous duration. Clinically the patients complain of

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chronic LBP often radiating into the buttock and the leg, bilaterally but without significant radicular pain. Lack of satisfactory improvement with a comprehensively applied non-operative care program. Intradiscal administration of 1 mL of lidocaine 2% diminished pain more than 70%. While, disc extrusion; degenerative spinal canal narrowing; segmental instability or psychological issues and previous lumbar surgery were excluded from this study.

Clinical evaluation:

All patients were enrolled for history taking, clinical examination, radiological tests such as X-ray and CT scan. The Oswestry Disability Index (aka the Oswestry Low Back Pain Disability Questionnaire) and VAS score were performed preoperatively and postoperatively. MRI was used to image external and internal morphology of intervertebral disc in identifying such structural failure. However, radiology alone is not recommended for the diagnosis of LBD.

Surgical Technique:

Intradiscal radiofrequency was performed on an outpatient basis. All patients received intravenous injections of antibiotics before the procedure and sedated with alfentanil and midazolam. The discs treated were selected on clinical grounds according to the level of provocative discography. Under fluoroscopic guidance and via a posterior oblique approach, the Diskit II® needle was advanced to place centrally the disc which was responsible for the symptoms. We applied intradiscal RF at a frequency of 5 Hz, pulse width of 5 ms, amplitude of 60 V, and a maximum temperature of 60ºC, for a duration of 2 minutes, with the NT1100 generator then needle was withdrawn without removing it from the disc, another electro-stimulation was done at 2 V at 2 and 50 Hz to confirm that the needle position far away from the nerve.

Postoperative care and Follow up:

After an hour of bed rest, patients were allowed to leave the outpatient clinic. All patients were followed clinically 1 and 4 weeks then radiologically 3, 6 months postoperatively.

Statistical analysis

Data were analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) software for analysis. According to the type of data qualitative were represented as number and percentage, while quantitative continues data were represented by mean±SD, median and range. Wilcoxon signed-rank test was applied to evaluate the improvement in NRS and RMDQ scores before and after the procedure. P value was set at <0.05 for significant results and <0.001 for high significant result.

RESULTS

The present study included 26 patients with age ranged from 16 to 58 years. The majority of our patients were classified to be overweight **(Table 1).**

(1) Distribution of the studied patients according to BMI

	N=26	%
BMI		
Normal weight	8	30.8%
Overweight	10	38.4%
Class I obesity	4	15.4%
Class II obesity	4	15.4%

Level of physical activity reported by patients is shown in **(Figure 1)**. MRI imaging was done for all patients pre and postoperatively with no change reported as larger percentage had disc bulge, followed by black disc **(Table 2).**

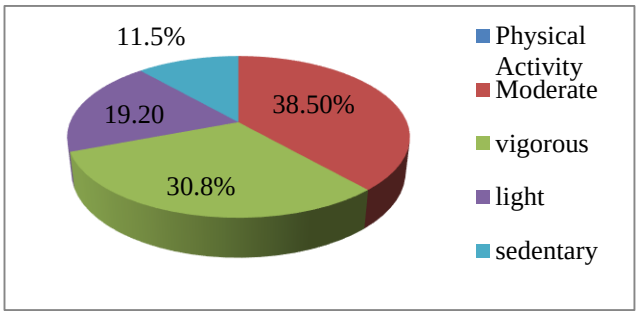

Figure (1) Pie chart showing distribution of the studied patients according to level of physical activity

Table (2) Change in MRI findings pre and postoperatively among the studied patients

MRI	MRI	
	Preoperatively	Postoperatively
	N=26 (%)	N=26 (%)
Black disc	9 (34.6%)	9 (34.6%)
Disc bulge	17 (65.4%)	17 (65.4%)

Among the studied patients, 73.1% had decrease in mean CPK postoperatively **(Figure 2)**. There was statistically significant decrease in OSI postoperatively. Median decreased from 35 to 20 postoperatively. According to disability assessed by OSI, 26.9% of patients with mild disability increased to 53.8% postoperatively **(Table 3).**

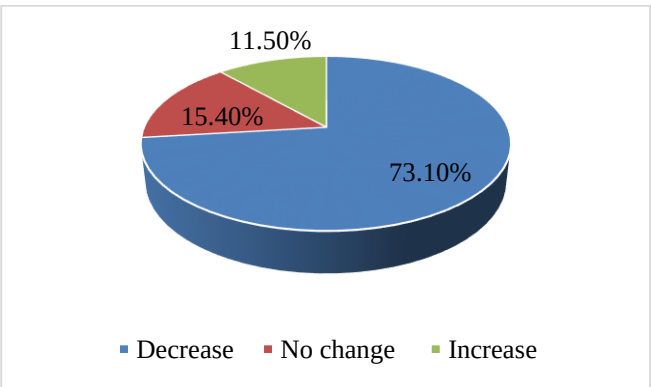

Figure (2) Pie chart showing distribution of the studied patients according to postoperative change in CPK

Table (3) Change in OSI findings pre and postoperatively among the studied patients

OSI	Time		p
	Preoperatively	Postoperatively	
	N=26 (%)	N=26 (%)	
Mean ± SD Median (Range)	33.85 ±14.09 35 (10 – 60)	25.96 ± 12.33 20 (10 – 65)	0.003*
Change OSI: Decrease No change increase	 - - -	 14 (53.8%) 10 (38.5%) 2 (7.7%)	
Disability Minimal Moderate Severe Crippled	 7 (26.9%) 11 (42.3%) 8 (30.8%) 0 (0%)	 14 (53.8%) 9 (34.6%) 2 (7.7%) 1 (3.8%)	0.012*

*: statistically significant

There was statistically significant decrease in mean VAS from 6.31 to 4.8 postoperatively. Among the studied patients, 69.2% had decrease in mean VAS postoperatively while 23.1% had no change and 7.7% had VAS increased postoperatively **(Figure 3)**.

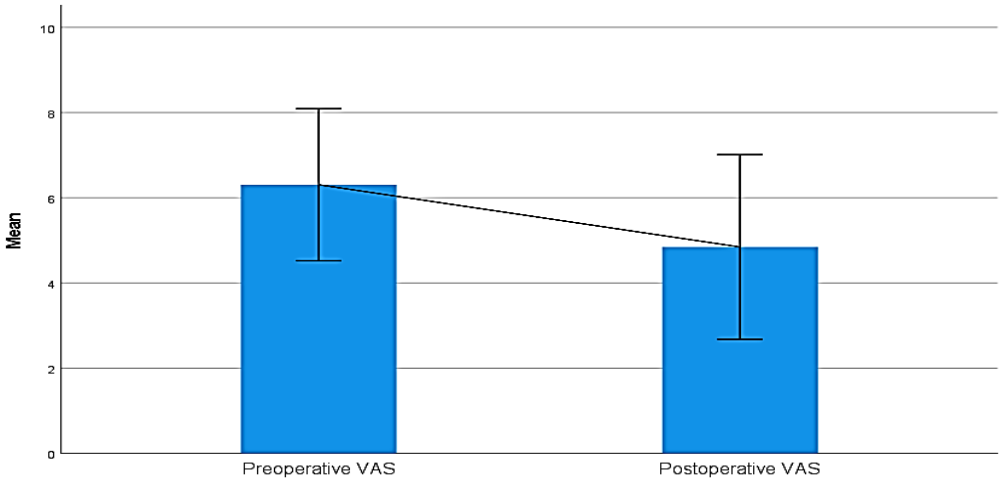

Figure (3) Simple bar chart with error bar and trendline showing VAS pre and postoperatively

There was statistically significant increase in time till sitting intolerance as median increased from 30 minutes to 60 minutes postoperatively. Among the studied patients, 61.5% had increase time postoperatively **(Table 4)**.

Table (4) Change in sitting intolerance pre and postoperatively among the studied patients

Sitting intolerance (minute)	Time		p
	Preoperatively	Postoperatively	
	N=26 (%)	N=26 (%)	
Mean ± SD Median (Range)	26.35 ±13.08 30 (10 – 60)	97.12 ± 87.4 60 (10 – 300)	<0.001**
Increase No change Decrease	16 8 2	61.5% 30.8% 7.7%	

**: statistically highly significant

Regarding final outcome (improvement in both OSI and VAS), 17 patients had successful surgery **(Table 5)**.

Table (5) Distribution of the studied patients according to surgical outcome after 4 weeks

	N=26	%
Outcome Success Failure	 17 9	 65.4% 34.6%

Age, BMI, CPK, OSI and sitting intolerance were non-significantly higher among those with failed outcome **(Table 6)**.

Table (6) Relation between outcome and baseline data

Parameter	Outcome		p
	Success	Failure	
	N=10 (%)	N=16 (%)	
Age Mean ± SD	32.9 ± 8.65	38.56 ± 10.77	0.147
Gender Female Male	5 (50) 5 (50)	7 (43.8%) 9 (56.3%)	0.756
BMI: Mean ± SD	22.4 ± 3.63	25.31 ± 5.35	0.144
Physical activity Moderate Vigorous Light Sedentary	4 (40%) 3 (30%) 2 (20%) 1 (10%)	6 (37.5%) 5 (31.3%) 3 (18.8%) 2 (12.4%)	0.849
MRI Black disc Disc bulge	5 (50%) 5 (50%)	4 (25%) 12 (75%)	0.115
CPK: Mean ± SD	92.5 ± 17.99	95.31 ± 19.79	0.719
OSI: Mean ± SD	39.5± 9.53	30.31 ± 7.34	0.107
VAS: Mean ± SD	6.9 ± 0.99	5.94 ± 1.08	0.063
Sitting intolerance Mean ± SD	27.5 ±6.62	30 ± 6.52	0.72

DISCUSSION

Perhaps the easiest ways to identify disc degeneration are tissue loss and structural abnormalities. Although disc degeneration is age-related, it is not the same as disc ageing and instead involves pathological structural flaws that are different from changes brought on by ageing [(7)]. Such localised flaws may raise proinflammatory conditions, apoptosis, strain concentrations, and deformities, all of which may lead to unpleasant situations [(8)].

The aim of the present study is to evaluate the better management and reducing chronic discogenic low back pain (LBP) and disability.

In this study, level of physical activity was reported by patients; 38.5%, 30.8%, 19.2% and 11.5% had moderate, vigorous, light and sedentary physical activity respectively, which is consistent with what **Asadi *et al.*** [(9)] found, but was the complete opposite of what **Alzahrani *et al.*** [(10)] reported that there was inverse relationship between physical activity and low back pain.

Our study showed that MRI imaging was done for all patients pre and postoperatively with no change reported as larger percentage had disc bulge (65.4%), followed by black disc (34.6%) and this is consistent with what **Park *et al.*** [(11)] proved that there was no change in MRI postoperatively and MRI postoperatively was done only to assess the potential of intradiscal radiofrequency to prevent or to aggravate disc degeneration.

The present study revealed 73.1% had decrease in mean CPK postoperatively. On the other hand, **Hirachan *et al.*** [(12)] agreed with us that there was significant decrease in CPK levels.

One week after our procedure, 53.8% had decrease in OSI postoperatively while 38.5% had no change and 7.7% had OSI increased postoperatively. Our study showed that there was statistically significant decrease in OSI postoperatively. Median decreased from 35 to 20 postoperatively. According to disability assessed by OSI, 26.9% of patients with mild disability increased to 53.8% postoperatively. While 42.3% and 30.8% had moderate and severe disability preoperatively, 34.6% and 7.7% reported moderate and severe disability postoperatively. However, after 4 weeks, there was highly statistically significant decrease in OSI. Median decreased from 35 to 15, 76.9 % had decrease in OSI while 15.4 % had no change and 7.7% had OSI increase. On the other hand, there was highly statistically significant decrease in mean VAS from 6.31 to 4.38 four weeks postoperatively. 76.9 % had decrease in mean VAS while 15.4 % had no change and 7.7% had VAS increased postoperatively.

Our study showed that after one week, there was statistically significant increase in time till sitting intolerance as median increased from 30 minutes to 60 minutes. 61.5% had increase time while 30.8% had no change and 7.7% had time decreased postoperatively.

Our results are consistent with what **Fukui *et al.*** [(13)] proved that intradiscal PRF method appears to be a

safe, minimally invasive treatment option for patients with chronic discogenic LBP but outcome was assessed with pain intensity score on a 0-10 numeric rating scale (NRS) and the Roland-Morris Disability Questionnaire (RMDQ). On the other hand, our results are different with what **Barendse *et al.* [14]** proved that percutaneous intradiscal radiofrequency thermocoagulation (90 seconds, 70°C) is not effective in reducing chronic discogenic low back pain. This could be explained by the difference in our technique where they did not use radiofrequency current and time of application was only 90 seconds. **Beresford *et al.* [15]** reported that available evidence does not support the efficacy or effectiveness of percutaneous thermocoagulation intradiscal techniques for the treatment of discogenic low back pain. **Freeman *et al.* [16]** demonstrated that there was no significant benefit from IDET over placebo.

Our study showed that there was statistically non-significant association between outcome and either age, sex, BMI, occupation, physical activity, preoperative MRI findings, CPK, OSI, VAS or sitting intolerance. Age, BMI, CPK, OSI and sitting intolerance were non-significantly higher among those with failed outcome either after one week or 4 weeks. Thus, our results agree with several studies that concluded that intradiscal RF appears to be a good alternative minimally invasive treatment to IDET for discogenic pain, which was resistant to other conservative therapies [13, 17-19].

The clinical outcome of our study was apparently better than that of previous studies due to carefully selected patients with discogenic LBP, nonresponsive to conservative care, with definitive imaging and provocative discography and discoblock seem to benefit clinically from intradiscal RF in terms of pain reduction, functional, and quality-of life improvement. This apparently may have led to the reliability of our diagnostic method and the improvement in the quality of the data.

CONCLUSION

Intradiscal radiofrequency appears to be an effective method for selected patients with chronic discogenic low back pain.

Conflict of interest: The authors declare no conflict of interest.

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Author contribution: Authors contributed equally in the study.

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