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Research Paper

Intradiscal injection of autologous platelet-rich fibrin versus platelet-rich plasma in discogenic lumbar pain: An applied comparative study

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Abstract

Objective: Discogenic lumbar pain is a very common cause of back pain. Injection of autologous Platelet-Rich Fibrin (PRF) and Platelet-Rich Plasma (PRP) in affected intervertebral disc is a novel therapeutic modality for discogenic lumbar pain. The current comparative prospective randomized study aimed to clarify the efficacy and safety of intradiscal injection of PRF and PRP as a novel minimally invasive therapeutic modality for chronic discogenic lumbar pain in a cohort of Egyptians.

Methods: The current study was conducted on 132 patients with chronic lumbar discogenic pain. Patients were treated with intradiscal injection PRP or PRF; 88 patients with PRF and 44 patients with PRP.

Results: All participants were followed up and their response to therapy was analyzed by independent observers. Over 6 months of follow-up, there were statistically significant improvements in participants who received intradiscal PRF as regards to pain Visual Analog Scale (VAS) compared to PRP. No adverse events of disc space infection, neurologic injury, or progressive herniation were reported following the injection.

Conclusion: Intradiscal injection of PRF and PRP are a safe and effective treatment for discogenic low back pain. Participants treated with intradiscal PRF injection experienced significantly greater clinical improvements compared to those who received intradiscal PRP. There were no reported complications after injection among enrolled participants. Although these results are encouraging, further wide-scale studies with larger sample size and longer follow up periods are needed to validate our results and determine the best candidates are for this treatment modality.

Keywords: PRP, PRF, discogenic pain, intradiscal injection

BACKGROUND

Low Back Pain (LBP) is a major cause of pain and disability worldwide, and subsequently, a significant economic and public health burden. Although most cases of LBP are self-limited, approximately 20% recur within six months and a subset of patients will develop chronic pain [1]. In approximately 40% of LBP complaints in adults, the etiology of pain can be attributed to a discogenic origin [2,3]. A significant cause of LBP is degeneration of lumbar intervertebral discs [4]. Intervertebral Disc (IVD) degeneration usually accompanies normal aging and is characterized by a loss of IVD homeostasis. This result in degradation and dehydration of the Nucleus Pulposus (NP) followed by breakdown of the collagenous fiber bundles in the Annulus Fibrosus (AF), with the result of discogenic back pain. Currently, there is no definite therapeutic modality to stop the progression of disc degeneration; instead, treatments focus on alleviating symptoms. Such conservative measures include pain medications that are not intended for long-term use, physical therapy or steroid injections. Unfortunately, symptom alleviation is not always achieved as the disc degeneration often continues to progress and the final solution is surgical intervention [5]. Cell loss plus anabolism and catabolism imbalance play a pivotal role in this process. This leads to the development of new treatment strategies targeting the regeneration of the Intervertebral Disc (IVD). Recombinant human growth factors are now very popular in the management of musculoskeletal disorders. More recently, platelet concentrates are frequently used for treating cartilage and tendon abnormalities. The results are promising but still under evaluation [6].

Platelets are the reservoirs of biologically active proteins; growth factors and cytokines which are the key mediators of tissue regeneration. They form an intracellular storage pool of proteins vital to wound healing, including Platelet-Derived Growth Factor (PDGF), Transforming Growth Factor (TGF-β) and Insulin-like Growth Factor (IGF-I). The interplay between these proteins enhances the rate and quality of wound healing [7]. Binding of these proteins within a developing fibrin mesh or to the extracellular matrix can create chemotactic gradients inviting stem cells aggregation, stimulating cell migration, differentiation, and promoting repair. Thus, use of autologous platelet concentrates is a promising application in the field of tissue regeneration and can be used in clinical situations requiring rapid healing [8].

Platelet Rich Plasma (PRP) is a first-generation platelet concentrate. However, the short duration of cytokine release and its poor mechanical properties have resulted in search of novel biological platelet substitutes. Platelet Rich Fibrin (PRF) is a second-generation platelet concentrate. It is an autologous leukocyte and platelet-rich fibrin biomaterial with a specific composition and three-dimensional architecture. PRF is a natural concentrate prepared from venous blood without the addition of any anticoagulants [6]. The slow polymerization during centrifugation, fibrin-based structure, ease of preparation and minimal expense makes PRF somewhat superior in some aspects to PRP [9].

Many *in vitro* studies investigated the effect of PRP on cultured discogenic cells. The study of Chen and colleagues [10] on PRP-added culture medium for human NP cells showed that NP cells proliferation increased 7-11 times along with upregulated proteoglycan content. Moreover, Akeda et al. [11] reported up-regulated of proteoglycan and collagen synthesis in porcine IVD tissues cultured in PRP. Additionally, Kim and co-workers [12] found that PRP down-regulated the proinflammatory cytokines and up-regulated Extracellular Matrix (ECM) synthesis. More recently, Pirvu et al. [13] investigated the regenerative potential of PRP and Platelet Lysate (PL) on bovine Annulus Fibrosis (AF) cells and concluded that both induced proliferative effects on AF cells and up-regulation of ECM synthesis.

The clinical use of platelet aggregates in an injectable form is worldwide, in orthopedics and plastic surgery, with favorable results [14]. *In vivo* studies of PRP injection for disc regeneration was recently demonstrated in the clinical setting and showed promising results [9,15,16]. Injectable PRF (i-PRF) is a new alternative to PRP and the clot form of platelet aggregate. Its uses in spine practice are a new, innovator and promising tool. Despite the vast potentials, safety and encouraging results of clinical applications of PRP and PRF, a limited number of studies are available on the clinical utility of PRP and PRF in lumbar discogenic pain.

Platelet-Rich Plasma (PRP) and Platelet-Rich Fibrin (PRF) have been widely and safely used clinical repair, regenerative medicine, tissue engineering and pain management [17]. Intradiscal injection of autologous platelet-rich plasma/Platelet-rich fibrin for treating discogenic pain has been previously experienced with published promising results [18-20]. It was also applied for neck and lower back pain secondary to spinal disc herniation [21].

The current study aimed to assess the possible role of PRP and PRF for treating chronic discogenic lumbar pain in a cohort of Egyptians.

DATA AND METHODOLOGY

STUDY DESIGN

This was a comparative prospective randomized study of participants with chronic discogenic lumbar pain treated with intradiscal PRP or PRF injection (Fig. 1 and 2). The study was approved by the Research Ethics Committee of Neurosurgery, Faculty of Medicine, Cairo University. Informed written consent was obtained from all participants before enrollment in the study. All procedures performed were per the recommendation of the Declaration of Helsinki 1964 and its later amendments or comparable ethical standards.

STUDY POPULATION

Patients were assessed for eligibility at our one-day Spine Outpatient Clinic between May 2016 and May 2018 based on the general inclusion and exclusion criteria set (Table 1). 132 patients met the inclusion criteria and were included in the study (88 patients in PRF group and 44 patients in PRP group).

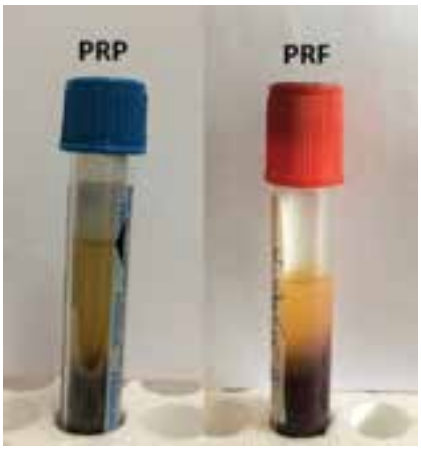

Fig. 1. Prepared PRP and PRF in liquid form

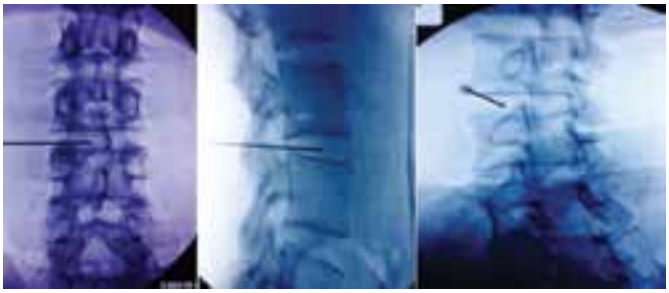

Fig. 2. Procedure fluoroscopy, with the needle in the middle of the disc space

Table 1. Patients' selection criteria

Inclusion criteria	Exclusion criteria
Low back pain>6 months	Bleeding disorders
Failure of conservative treatment	Undergoing anticoagulation therapy
50% of IVD height is maintained	Pregnancy
Magnetic resonance imaging confirming disc protrusion less than 5 mm	Presence of infection
Absent contraindications	Any psychiatric condition
Positive discography	Disc Fragments
Age between 18-60 years	Previous spinal surgery
	Spondylolithesis
	Spondylolysis
	Bone Fusion
	Age below 18 years or above 60 years
	Morbid obesity with BMI above 40 or more and experiencing obesity-related health conditions, such as high blood pressure or diabetes
	Uncontrolled medical conditions example diabetes mellitus

As most of the previously published work focused on the clinical utility and promising results of PRP in treating discogenic pain, our target was to clarify the clinical applicability and advantage of PRF as a second-generation platelet substitute and to compare between the two platelets preparations from the clinical point of view (Patients response, VAS score as well as MRI findings). According to the calculated sample size, our initial working plan was to enroll an equal number of patients in each group. However, we increased the number of patients treated with injectable PRF to validate our results, we talked to our statistician then we decided to make the ratio 2:1 to have the maximum benefit for our patients with no significant statistical bias.

All participants were evaluated by 2 different spine surgeons. General demographic information, including age and gender, as well as baseline outcome scores, were obtained from participant charts and questionnaires. The patient's assessment before injection included history taking, thorough clinical examination, routine laboratory investigations, radiological assessment and scoring system for pain or limitation of movement if present. Baseline Visual Analogue Scale (VAS) score and neurological examination of the lower limb before the procedure was recorded. Baseline information was obtained from each participant. At enrollment, typically two weeks before treatment, participants provided informed consent, a baseline assessment, and blood samples via venipuncture to assess white blood cell count, erythrocyte sedimentation rate, prothrombin time, and International Normalized Ratio (INR) to ensure all values were within normal limits. Patients were subdivided into two groups, Group (I) to be injected with PRP (44 patients) and Group (II) to be injected with PRF (88 patients).

This study is single-blinded as the patients didn't know the injected material. We use the Unequal Randomization technique in our study in this order every 3 patients who met the inclusion criteria (PRF, PRP, PRF). So, for every 3 patients: 2 were randomized to PRF & 1 were randomized to PRP with a 2:1 randomization ratio.

Using PRF for discogenic pain management could be considered as a pilot study as we are one of the early investigators of this type of treatment.

Patients were diagnosed with discogenic LBP by clinical means, imaging, and exclusion of other causes. Discography was done guided by real-time x-ray images (fluoroscopy), by inserting a needle into the center of the disc being examined. Then, 1 ml (maximum 2.0 mL) of contrast material (Ominipaque 240) is injected.

During the procedure the patient is asked to describe the pain in terms of location, distribution, and severity. The process usually repeated for other discs including one that is a negative control. To consider the discography an objective test, the operator cannot disclose which level is being injected and the time of the injection. The injection was terminated if very firm resistance is felt or if severe pain is produced. When discography results in the same symptoms, it is defined as a positive discogram. If no or different symptoms, it is a negative discogram. All cases included in this study had a positive discogram. Patients underwent a single treatment of intradiscal injection of PRP or PRF (Fig. 3 and 4) at one or multiple levels.

PREPARATION OF LIQUID (INJECTABLE) PLATELET-RICH FIBRIN (I-PRF)

For each participant, ten milliliters peripheral blood was collected under complete aseptic conditions in three plain (additive-free) sterile vacutainers. Immediate centrifugation for two minutes at 3300 rpm results in the separation of PRF on top of the remaining blood cells (i-PRF) and the remaining blood materials below [14]. For a collection of the PRF, the tubes were opened carefully, to avoid homogenization of the material, and PRF was aspirated using a 20 ml syringe, with an 18 G hypodermic needle.

PREPARATION OF PLATELET-RICH PLASMA (PRP)

Twelve milliliters peripheral blood was collected under complete aseptic conditions in six citrated sterile vacutainers (the addition of anticoagulant). Centrifugation of blood for six minutes at low speed (1000 rpm) is mandatory to obtain PRP. Aspiration of the PRP was done and (0.5 ml) Calcium gluconate was added as a platelet activator to stimulate platelet release reaction [11].

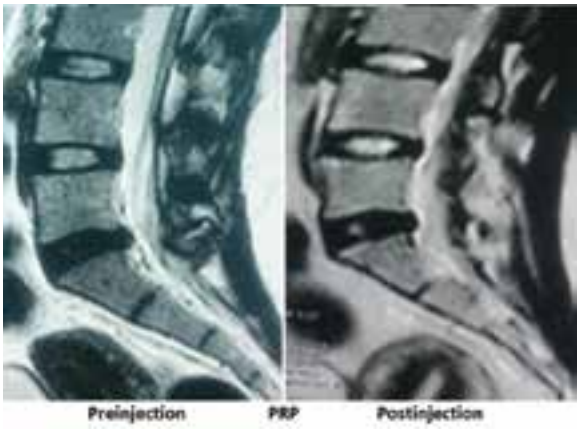

Fig. 3. Pre-injection and post-PRP injection MRI showing improved disc hydration and mild diminution of the disc bulge

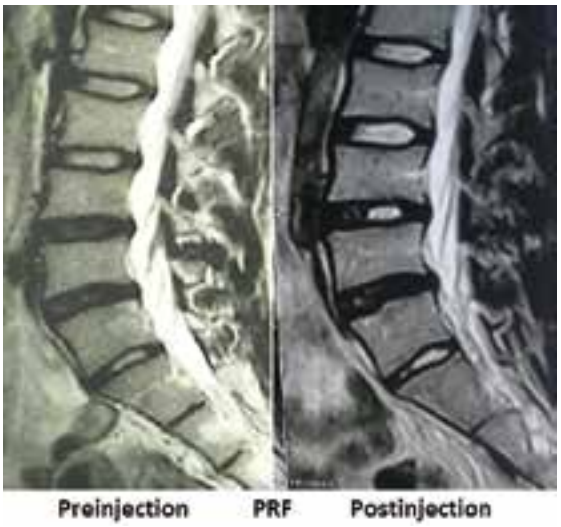

Fig. 4. Pre-injection and post-PRF injection MRI showing apparent improvement of disc hydration

QUALITATIVE ASSESSMENT OF PRP AND PRF

Initial platelet count ranged between 153-355 × 10^3/cm³ with a mean value of 217 ± 55.6 × 10^3/cm³. Platelet count was re-estimated after PRP preparation and it was found to be almost double to triple than the initial platelet count. It ranged between 299-599 × 10^3/cm³ with a mean value of 427 ± 90 × 10^3/cm³. Initial platelet count in Group II (PRF-patients) ranged between 155-382 × 10^3/cm³ with a mean value of 229 ± 55.6 × 10^3/cm³. It could not be estimated after PRF preparation.

PROCEDURE

The participant was taken to the interventional procedure theatre and placed prone on the fluoroscopy table. Strictly aseptic condition is mandatory. After a standardized sterile preparation, local anesthesia is administered. With a standard double-needle, intraneural technique, a 25-gauge spinal needle is advanced through a 20-gauge introducer needle into the mid-portion of the suspected disc levels. Anteroposterior and lateral fluoroscopic imaging confirmed the proper needle position. A single injection of 3 ml autologous PRF or PRP was administered. In the case of PRF injection, the time factor is very important, as delay in injecting its fluid form may result in a transformation of the prepared PRF fluid into a gel form. So, rapid injection is mandatory.

Follow-up questionnaires were then administered postoperatively.

MRI ANALYSIS

MRI LSS analysis was routinely performed before management and at three to six months post-injection. the pre-injection and post-injection MRI findings were evaluated in terms of changes in disc height; the lumbar lordosis angle through the MRI T2 sagittal images. But the most important was the classification of lumbar discs into five grades of degeneration using the Pfirrmann disc degeneration grading scheme with the improvement of the grade of the disc injected especially after a relatively long follow up period (example 6 months). Also, a vertical line was used to measure the perpendicular distance between the most posterior edge of the corresponding vertebral bodies to the most posterior point of the posterior disc then comparing posterior disc projection reduction post-injection.

STATISTICAL ANALYSIS

Data analysis was performed using Statistical Package for Social Science (SPSS) version 24 (SPSS IBM., Chicago, IL).

The sample size was calculated via Epicalc 2000. In our study, we enrolled 132 patients. Based on an expected mean (SD) VAS of 7.5 (1.3) in the control group and 3.1 (2.5) in the treatment group [20,21], 100 participants (80 patients and 20 control) were found to yield a power of 80% at a p-value of 0.05. The sample size calculation showed that 100 participants (80 patients and 20 controls) were found to yield a power of 80% at a p-value of 0.05. (Q. 3)

The Odds ratio and 95% confidence interval were not added to the tables as our aim was not to clarify the relative risk estimation of using PRP or PRF as a comparable therapeutic modality. T-test was used to compare between the two groups and the p values were presented in the tables.

Normally distributed numerical variables were presented as mean ± SD, while non-parametric variables were summarized as median with 25 and 75 percentiles. Categorical data were presented as frequencies and percentages. For comparison between groups, numerical parameters were compared using the non-parametric Wilcoxon-Mann-Whitney U-test, whereas the parametric parameters were compared using the paired samples (t) test. Chi-square (χ^2) test with Contingency Coefficient was used for comparing categorical data. Correlation between different parameters was tested by Spearman's rank correlation coefficient (r). A p value<0.05 was considered statistically significant.

OUTCOME MEASURES

Patients were followed throughout the study duration (6 months). Patients were considered a categorical success if they achieved improvement in the visual analogue scale at 3 (post 1 VAS) and 6 months (post 2 VAS) after the procedure.

RESULTS

Comparing PRF and PRP groups regarding their pre-VAS, post 1 VAS and post 2 VAS revealed that the VAS before injection did not differ significantly between the two patients' groups (p=0.39). In the follow-up period, VAS was evaluated at 3 and 6 months (post 1 and 2). VAS was statistically significantly lower in the PRF group compared to PRP group for both post 1 VAS (P=0.002) and post 2 VAS (P=0.001) (Table 2).

Comparison between PRF and PRP groups concerning their post 1 and post 2 VAS in the age group (40 years or more), there was a significant difference in post 2 VAS being lower in the PRF group compared to PRP group (p=0.013), but there was no significant difference between both groups at post 1 VAS (p=0.72). For patients between 20 to 40 years, post 1 and post 2 VAS was significantly lower in the PRF group compared to PRP group (p=0.011 and 0.025 respectively) (Table 3).

Patients were divided into two groups according to the levels of injections received. In a single level in injection, post 1 and post 2 VAS were significantly lower in the PRF group (p=0.011 and 0.002 respectively). There was a significant difference in the post 1 VAS between the two patients' groups (p=0.012), while the difference in post 2 VAS was statistically insignificant (p=0.242) (Table 4).

Comparison between PRF and PRP groups regarding assessing the clinical outcome and regaining the activity of daily life at 3-months and 6-months intervals using the 4-point rating scale (Odom's Criteria). PRP group had an excellent or good outcome at 3 months interval was 56.8% (25/44) decreased to 40.9% (18/44) at 6 months interval while the PRF group had an excellent or good outcome at 3 months interval was 65.9% (58/88) decreased to 52.2% (46/88) at 6 months interval but it is non-significant better outcome (Table 5).

Disc hydration improved slightly in T2-weighted MRI images in 22 patients (25%) of the PRF injected patients at 6 months after therapy versus only 3 patients (about 7%) of the PRP injected patients.

Regarding disc height in T2-weighted MRI images, only 2 patients (about 2%) of the PRF group showed a decrease by 1mm and 2 patients (about 5%) of the PRP group showed a decrease by 1 and 2 mm respectively. While there were also 2 patients (about 2%) of the PRF group showed an increase of the disc height by 1mm but no patients (0%) of the PRP group showed an increase of the disc height. But most of the cases didn't show a significant change of the disc height being 84

Table 2. Comparison between PRF and PRP groups regarding their pre, post 1 and post 2 Pain Visual Analog Scales (VAS)

	PRP patients (n=44)			PRF (n=88)			p-value
	Pre VAS	Post 1 VAS	Post 2 VAS	Pre VAS	Post 1 VAS	Post 2 VAS	
Range	7-9	4-9	4-9	7-10	1-9	1-9	0.002*
Mean ± SD	8.45 ± 0.59	6.73 ± 1.65	6.84 ± 1.58	8.34 ± 0.77	5.58 ± 2.17	4.95 ± 2.07	0.001**
Median	8.50	7.00	7.00	8.00	5.00	5.00	0.39***

Pre VAS: VAS before injection; Post 1 VAS: VAS after 3 months; Post 2 VAS: VAS after 6 months; P value*: Post 1 VAS PRP *vs* PRF; ** for Post 2 VAS PRP *vs* PRF; *** for Pre VAS PRP *vs* PRF

Table 3. Comparison between PRF and PRP groups regarding their post 1 VAS and post 2 VAS according to their age

Patients' groups		PRF group (n=88)		PRP group (n=44)		p-value
		Post1 VAS	Post 2 VAS	Post1 VAS	Post 2 VAS	
Age 20-40 years	Range	1-9	1-9	5-9	5-9	
	Mean ± SD	5.1 ± 2.1	4.53 ± 1.9	7.5 ± 1.5	7.17 ± 1.6	
	Median	5	5	7.5	7	*0.011
	Number	51	51	12	12	**0.025
Age 40 years or more	Range	1-9	1-9	4-9	4-9	
	Mean ± SD	6.27 ± 2.2	5.6 ± 2.1	6.44 ± 1.7	6.72 ± 1.6	
	Median	6	5	6.5	7	*0.72
	Number	37	37	32	32	**0.013
Pre VAS: VAS before injection; Post 1 VAS: VAS after 3 months; Post 2 VAS: VAS after 6 months; P value *: Post 1 VAS for patients in PRP *vs* PRF groups; ** for Post 2 VAS for patients in PRP *vs* PRF groups						

Table 4. Comparison between single and multiple levels concerning Post 1 VAS and Post 2 VAS in the PRF group and PRP groups

Patients' groups		PRF group (n=88)		PRP group (n=44)		p-value
		Post1 VAS	Post 2 VAS	Post1 VAS	Post 2 VAS	
Single level	Range	1-9	1-9	4-9	4-9	*0.011 **0.002
	Mean ± SD	5.23 ± 2.2	4.53 ± 2	7.4 ± 1.5	7.15 ± 1.8	
	Median	5	5	8	8	
	Number	62	62	20	20	
Multiple levels	Range	3-9	3-9	4-9	4-9	*0.012 **0.24
	Mean ± SD	6.42 ± 1.8	6 ± 1.9	6.17 ± 1.6	6.58 ± 1.3	
	Median	6	6	6	6.5	
	Number	26	25	24	24	
P value*: Post 1 VAS for patients in PRP *vs* PRF groups; ** for Post 2 VAS for patients in PRP *vs* PRF groups						

Table 5. Comparison between PRF and PRP groups regarding assessing the clinical outcome and regaining the activity of daily life at 3-months and 6-months interval using the 4-point rating scale (Odom's Criteria)

Odom's Criteria	3-month			6-month		
	PRF-group	PRP-group	p-value	PRF-group	PRP-group	p-value
Excellent	18	6	0.34	12	4	0.45
Good	40	19	0.8	34	14	0.44
Fair	25	15	0.5	35	18	0.9
Poor	5	4	0.46	7	8	0.08

patients (about 96%) of the PRF group and 42 patients (about 96%) of the PRP group.

There were no reported adverse events in both groups in the form of superficial or deep wound infection, hematoma formation, temporary or permanent neurological deficit.

DISCUSSION

About 90% of people experience significant lower back pain in their lifetime. Pain from lumbar discs can be attributed to disk infection, torsion injury or Internal Disk Disruption (IDD). Torsion injury is believed to result from forcible rotation of the intervertebral joint which can lead to circumferential tear [22], while IDD results from lumbar disk degradation and development of radial fissures that extend from the nucleus to the annulus. IDD is believed to be the most common type of discogenic pain [23].

Although low back pain was traditionally believed to be self-limited in most cases, many low back pain sufferers have recurrences or proceed to a more chronic course [24]. Previous studies reported that 39% of cases can be attributed to the intervertebral disk [25]. This group of patients faces the difficult decision of living with pain, undergoing major spinal surgery or seeking alternate therapeutic modalities [9].

Many studies reported the results of intradiscal injection of different materials aiming to study their effects on discogenic pain and function. The use of autologous platelet concentrates; represent promising and innovative tools. This evolution starts from the late 1990s, with the release of Platelet Rich Plasma (PRP), followed by the second generation of platelet aggregates; Platelet Rich Fibrin (PRF). These injectable forms of platelet concentrates are often used in regenerative procedures and demonstrate promising results [9,26].

Platelet concentrates are developed as bioactive surgical additives that are applied locally to promote wound healing as it contains a higher concentration of growth factors that enhance tissue regeneration [14]. PRP is clinically used to deliver growth factors in high concentrations to the sites requiring tissue healing and regeneration [6]. The preparation of PRP produced by various apparatuses for "point of care" separation of a patient's blood in the operating room is regulated as an FDA 510(k) cleared device [18]. Based on the biological property of PRP, there is an immediate release of growth factors.

Platelet Rich Fibrin (PRF) is prepared as a natural concentrate without the addition of any anticoagulants to eliminate the risk associated with the use of bovine thrombin [6]. It affects cellular activities at genetic and cellular levels. The slow natural polymerization of PRF during its preparation allows the establishment of a fine and flexible fibrin network able to support cytokines enmeshment and cellular migration. This 3-dimensional organization gives great elasticity to the fibrin matrix, which is observed in a flexible, elastic and very strong PRF membrane [14,18]. Based on the biological property, growth factors are released from PRF slowly over 7 days or more [27]. The biologic mechanisms of PRF need more research to correlate them with clinical results [28]. The rationale behind treating chronic discogenic pain is to minimize the pain and to improve the function by reducing the dependence on caregivers and returning to work and/or activities [29]. The clinical utility of intradiscal PRP for disc regeneration was

recently demonstrated in the clinical setting showed promising results [15,16]. To the best of our knowledge, the role of injectable PRF for chronic lumbar discogenic pain was not yet investigated.

The current study aimed to assess the possible role of intradiscal injection of PRP and PRF in treating chronic discogenic lumbar pain in a cohort of Egyptians. To achieve our aim, 132 adult Egyptian patients fulfilling the inclusion criteria were subjected to intradiscal PRP and PRF injection. The PRF group included 88 patients, while 44 patients were injected with PRP. Patients were followed up for 6 months. Data analysis revealed that there was a marked improvement in the Visual Analogue Scale (VAS) in patients treated with either PRP or PRF injections. Similarly, Levi et al. [30] studied the efficacy of PRP intradiscal injection in discogenic low back pain for 22 patients and categorical success was considered if the patient achieved a 50% improvement in the VAS at one, two, and six months post-treatment. Their study showed that PRP is an efficient therapeutic modality for discogenic low back pain. Furthermore, following our results, Monfett et al. [9] and Tuakli-Wosornu et al. [15] reported that there was a significant improvement in patients receiving an intradiscal injection of PRP compared to control subjects regarding pain improvement (numerical rating scale), patient satisfaction (patients' questionnaire) through years of follow up.

Statistical comparison between the clinical efficiency of PRP and PRF injections showed that participants treated with intradiscal PRF injection experienced significantly greater clinical improvement evaluated by the Visual Analogue Scale (VAS) compared to those who received intradiscal PRP. Furthermore, the VAS after 3 and 6 months of follow up (Post 1 and 2) was significantly lower in the PRF group. Accordingly, our study showed that PRF injection was superior to PRP in treating discogenic lumbar pain.

Moreover, patients were stratified according to their age into two age groups: patients between 20 to 40 years old and patients above 40 years. VAS after 3 and 6 months of follow up (Post 1 and 2) was significantly lower in PRF group compared to PRP group in patients younger than 40 years old. As for patients older than 40 years, post 1 VAS did not differ significantly between the two patients' groups; however, post 2 VAS was significantly lower in the PRF patients' group. From our results, we might conclude that PRF injection is superior to PRP in treating discogenic lumber pain in patients regardless of their age.

Patients were further divided into two groups according to the levels of injections received. The single-level injection was performed for sixty-two patients with PRF (62/88) and twenty patients with PRP (20/44). Pain improvement was significantly detected in patients treated with injectable PRF as shown by their VAS after 3 and 6 months of follow up. As for those with multiple levels of injection, there was no statistical difference between the PRP and PRF groups regarding their post 1 and 2 VAS. Accordingly, PRF is more efficient in cases requiring single level of injection comported to PRP. For cases requiring multiple levels of injections, either PRP or PRF could be used efficiently.

The study of Levi et al. [30], a single-level injection of PRP was done for nine patients, two levels for ten patients, three levels for two patients, five levels for one patient. Categorical success rates were recorded: 1 month: 3/22=14%, 2 months: 7/22=32%, 6 months: 9/19=47%. This trial shows encouraging preliminary six-month findings for intradiscal PRP.

Radiographically, no definite increase of disc height narrowing was observed in both groups. Although a definite reparative effect on disc height was not observed, our noting suggested that injections did not negatively affect disc height. Furthermore, some of the PRF injected patients showed slight improvement of the disc hydration and enhanced integrity especially with follow up images after 6 months. But this note needs to be evaluated accurately with longer follow up periods and by using T2-mapping techniques including T2 value statistical analysis.

However, some limitations of this study should be noted. First, larger sample size and longer follow up period are needed. Also, Quantitative analysis of MRI results should be included after longer follow up. Finally, the Minimal Clinically Important Difference (MCID) of VAS should have been accounted for.

CONCLUSION

Intradiscal injection of autologous PRP and PRF can be considered as a good alternative to the medical and surgical management of patients with chronic discogenic lumbar pain. Additionally, our study supports the idea of the safety of intradiscal injection of PRP and PRF and compares in the outcome achieved by both methods. These procedures can be done as a day procedure in about 30 minutes and are about one-tenth of the cost of a spinal fusion. A large economic burden may be lifted from the healthcare system in general if we achieved an algorithm that predicts whether a surgical or nonsurgical route would best suit each patient and which material will be better for the patient. There are possible predictive factors for determining surgical outcome measures and optimal surgical. Biologic therapies such as PRP and PRF not only offer hope for a cure to the most common, most costly and most disabling musculoskeletal condition faced by clinicians and patients, namely back pain but may also offer national healthcare systems a cost-effective, sustainable solution to the management of low back pain.

CONFLICT OF INTEREST

All authors declare that there is no conflict of interest.

FUNDING

Self-funding.

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