Results of Platelets rich plasma injection in the management of chronic planter fasciitis

Kamal A Hafez, Mohammed I. Abulsoud and Mohammed M. Mahdy

Departments of Orthopedic Surgery, Faculty of Medicine, Al-Azhar University, Cairo, Egypt
Email: dr.m.m.mahdy@gmail.com

Abstract: Background: Chronic plantar fasciitis (PF) is the most common cause of foot complaints and, making up 11–15% of the foot symptoms requiring professional care among adults As well, it is a common problem that affects sport participants as well as inactive middle-aged individuals. The diagnosis is based on the typical history and the finding of localized tenderness in the medial calcaneal tubercle. The planter fascia in anatomy is divided into three slip medial central and lateral. The central portion is the thickest and originates at the medial process of the calcaneal tuberosity. It then divides into five slips. These blend into the distal planter aspect of the digits. The medial and lateral portion blend with the central portion as the course becomes more distal. **Aim of the work:** to assess the safety and clinical results of platelet-rich plasma (PRP) injections for treating chronic plantar fasciitis. **Patients & Methods:** The study was conducted on 80 patients from December 2017 till October 2018 including chronic plantar fasciitis not responding to conservative treatment presenting to outpatient clinics in Sayed Galal, Alazhar Universitiy Hospital and Maadi Military Hospital (40 patients were injected with PRP while other 40 were injected with normal saline) The mean age of study group was (36 ± 8.43) years old and the average follow-up duration was 6 months. **Results**: The results of this study using visual analog pain (VAS) scale showed that, the average pre-injection pain in patients **(PRP group)** was 8(7–9). Prior to injection, after 6 months it decreased to 2 (2 – 3) degrees while **(saline group)** was 8(7–9). Prior to injection, after 6 months it decreased to 6 (3 – 7) degrees. By using Roles and Mudsley scale it showed that the score in **(PRP group)** prior to injectionwas1 (1– 1.5), 6 months after injection it increase to 4(3– 4) degrees while in **(saline group)** it was 1 (1 – 1.5) prior to injection, it increase to 2 (2 – 3) degrees after 6 months of injection **Conclusion:** There was a significant improvement in pain by using PRP according VAS and Roles and Madusley score. There was no complication reported during follow up of the cases.
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Keywords: Result; Platelet rich plasma; injection; management; chronic; planter; fasciitis

1. Introduction

Chronic plantar fasciitis (PF) is the most common cause of foot complaints and, making up 11–15% of the foot symptoms requiring professional care among adults [1].

As well, it is a common problem that affects sport participants as well as inactive middle-aged individuals. [2] The diagnosis is based on the typical history and the finding of localized tenderness in the medial calcaneal tubercle [3].

Increasing knowledge of the pathology has led to the widespread application of a large number of conservative treatment for recalcitrant plantar fasciitis, including physiotherapy, plantar-fascia-stretching exercises, icepacks, night splints, prefabricated and custom-made insert, shoe modification and non-steroidal anti-inflammatory drugs (NSAIDs) [2].

Local injection modalities are commonly used secondary to conservative therapies in the treatment of patients who have resistant plantar fasciitis as corticosteroid. Platelet-rich plasma (PRP), which is a natural concentrate of autologous growth factors, is now being widely tested in different fields of medicine for its possibilities in aiding the regeneration of tissue with low healing potential. Local injection of PRP is a new modality which has recently been discussed for the treatment of plantar fasciitis [3].

Recently, promising results were reported with the use of platelet-rich plasma (PRP) injections for treating muscle and tendon injuries and degeneration. The rationale for using PRP in orthopedics is to increase tendon regenerative abilities with a high content of cytokines and cells, in hyper physiologic doses, which should promote cellular chemo-taxis, matrix synthesis, and proliferation [2].

In Europe and the United States, there is an increasing prevalence of the use of autologous blood products to facilitate healing in a variety of applications. New data exist about specific growth factors, which play a crucial role in the healing process. With that knowledge there is abundant enthusiasm in the application of concentrated platelets, which release a supra-maximal quantity of these growth factors to stimulate recovery in non-healing injuries. For 20 years, the application of autologous PRP has been safely used and documented in many fields including; orthopedics, sports medicine,

dentistry, ENT, neurosurgery, ophthalmology, urology, wound healing,. etc [4.]

Platelet-rich plasma (PRP) as a clinical treatment for bone, muscle, tendon, and cartilage injury has gained popularity in the field of orthopedic sports medicine. [5]

Platelets are small, non-nucleated bodies in peripheral blood that are known primarily for their role in hemostasis. Platelets contain a number of proteins, cytokines, and other bioactive factors that initiate and regulate basic aspects of wound healing **(Table 1-1)**. Normal platelet counts in blood range from 150 000/mcL to 350 000/mcL. Plasma is the fluid portion of blood and contains clotting factors and other proteins and ions. Platelet-rich plasma, with a platelet concentration of at least 1 000 000 platelets/mcL in 5mL of plasma is associated with the enhancement of healing. Platelet-rich plasma contains a 3- to 5-fold increase in growth factor concentrations. [6]

2. Patients and Methods

The study was conducted on 80 patients from December 2017 till October 2018 including chronic plantar fasciitis not responding to conservative treatment presenting to outpatient clinics (40 patients were injected with PRP while other 40 were injected with normal saline).

Inclusion criteria:

Patients were included if they are ≥18 years, experienced heel pain felt maximally over the plantar aspect for at least six months continuously. Patients were treated in the prior three months with conservative therapies, such as icepacks, stretching of the Achilles tendon and NSAID medication, which provided inadequate improvement of pain and functionality.

Exclusion criteria:

Exclusion criteria included known generalized inflammatory arthritis, any wound or skin lesion at the plantar aspect of the foot; pregnancy; severe infection; known malignancy; bleeding disorders, Antiplatelet medication; previous surgery, or nerve-related symptoms such as radiculopathy .

Interventions

40 patients were injected with PRP while other 40 were injected with normal salineat the plantar fascia.

All injections were performed by on an outpatient basis.

The injection point was at the origin of the plantar fascia on the medial tubercle of the calcaneus, as described by Cyriax and Cyriax [9]. The origin of the plantar fascia was approached from the medial side of thefoot but near the plantar surface.

Patients' evaluation:

Clinical evaluation:

All patients were subjected to through history taking. The patients' inferior heel pain that is usually worse with their first steps in the morning or after a period of inactivity, with maximal tenderness over the anteromedial aspect of the inferior heel.

Preparation of Platelets rich plasma:

A 20 cm volume of autologous blood is drawn from each patient into vacuum tubes containing 5 cm of 10% sodium citrate. The PRP will be prepared according to a double-centrifugation protocol.

First centrifugation: The separation of the blood cell elements will be performed using a laboratory centrifuge (Beckman Centrifuge, CA, USA). The tubes were centrifuged at 160 G for 20 minutes at room temperature resulting in two basic components: blood cell component (BCC) in the lower fraction and serum component (SEC) in the upper fraction.

Second centrifugation: A mark is made 6 mm below the line that separated the BCC from the SEC. To increase the total amount of platelets collected for the second centrifugation, all content above this point are pipetted and transferred to another 5 ml vacuum tube without anticoagulant. The sample is then centrifuged again at 400 G for 15 minutes resulting in two components: SEC and PRP. The PRP (approximately 3 cm) is separated from the SEC. [7]

Fig. 2-2: PRP sample

Injection technique:

The procedure is done on out-patient basis under complete aseptic condition.

1) Position: the patient lies supine with lower limb external rotated.

2) Disinfection: Skin dis-infection with betadine**.**

3) Injection technique:

a) 3 ml of PRP are injected at sites of maximum tenderness **(Fig 2-3).**

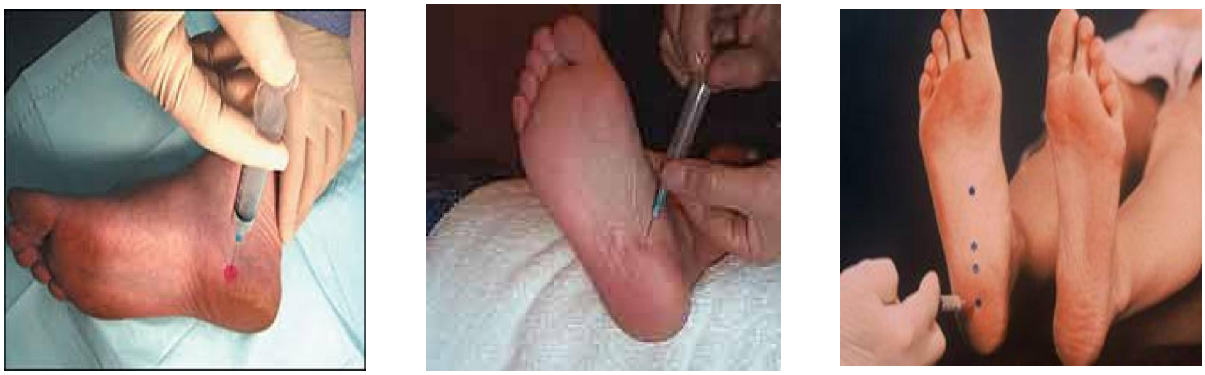


Fig. 2-3: Procedure of PRP injection

Post –injection precautions:

1) The plan of postoperative care:

- Acetaminophen (paracetamol) is only allowed as analgesic after procedure.
- Ice packs, rest and leg elevation for 72 hours.
- Avoid full weight bearing for 48 hours.
- Gradual return to activity.
- Plantar fascia specific stretch exercises after 4 days and for 4 weeks.

2) Assessment of the patients in the postoperative care:

All the patients were followed up in outpatient clinic **clinically.**

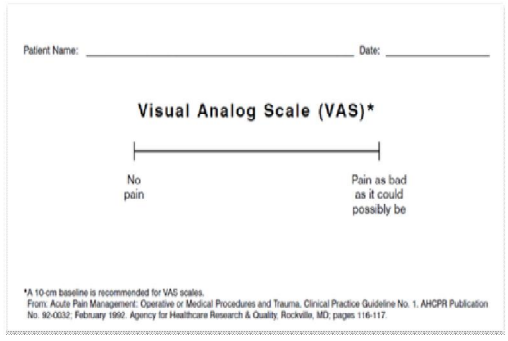
a) Clinical evaluation:

The patients were evaluated by visual analogue scale (VAS) and Roles and Maudsley score Fig. 2-4: Roles and Maudsley scor[e8]

visual analogue scale[9]

Satisfaction According to the Roles and Maudsley Score

Level	Roles and Maudsley Score
Excellent	No pain, full movement, full activity
Good	Occasional discomfort, full movement, full activity
Acceptable	Some discomfort after prolonged activities
Poor	Pain limiting activity



3. Results

This Comparative study was conducted on80 CPF patients. They were classified according to interventional injection material into 2independent groups: **PRP group (40 patients) and Saline group (40 patients).**

Basic clinical data:

Table 1: Comparison between the 2 groups as regards basic clinical data using Mann-Whitney's U and Chi square tests:

Variable		PRP group (40)	Saline group (40)	Mann-Whitney's U test
		Median (IQR)	Median (IQR)	P value
Age (years)		38.5 (33 – 46)	41.5 (36 – 45)	= 0.412
Variable		PRP group (40)	Saline group (40)	Chi square test
				P value
Gender	Female Male	31 (77.5%) 9 (22.5%)	31 (77.5%) 9 (22.5%)	= 1.000
Side of injection	Lt Rt	17 (42.5%) 23 (57.5%)	15 (37.5%) 25 (62.5%)	= 0.819

IQR: inter-quartile ratio. *Percentage of Column Total.

Comparative study between the 2 groups revealed non-significant difference as regards age, sex and side of injection ($p > 0.05$).

Baseline (pre-injection) data:

Table 2: Comparison between the 2 groups as regards baseline (pre-injection) using Mann-Whitney's U and Chi square tests:

Variable		PRP group (40)	Saline group (40)	Mann-Whitney's U test
		Median (IQR)	Median (IQR)	P value
VAS score (pre-injection)		8 (7 – 9)	8 (8 – 9)	= 0.243
Variable		PRP group (40)	Saline group (40)	Chi square test
				P value
R & M categories (pre-injection)	Poor	22 (55%)	30 (75%)	= 0.1008
	Acceptable	18 (45%)	10 (25%)	
	Good	0 (0%)	0 (0%)	
	Excellent	0 (0%)	0 (0%)	

*Percentage of Column Total.

Comparative study between the 2 groups revealed non-significant difference as regards baseline (pre-injection) VAS score and R & M score ($p > 0.05$).

Follow up (post-injection) data:

Paired comparative studies regarding (PRP group):

We further analyzed and compared 40 (paired) PRP group of patients according to the serial measurements (pre and post-injection); data are shown in the following tables and figures:

- **Serial clinical assessments:**

Table 3: Comparison between PRPpatients as regards serial clinicalassessments:

Variable		Baseline	2-month	4-month	6-month	Friedman's test ^^
		Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	P value
VAS score		8 (7 – 9)	5 (4 – 5.5)	3 (2.5 – 4.5)	2 (2 – 3)	<0.0001**
Variable		Baseline	2-month	4-month	6-month	Chi square test ^^
		(%)	(%)	(%)	(%)	P value
R & M score	Poor	22 (55%)	3 (7.5%)	2 (5%)	2 (5%)	<0.0001**
	Acceptable	18 (45%)	9 (22.5%)	8 (20%)	4 (10%)	
	Good	0 (0%)	28 (70%)	24 (60%)	8 (20%)	
	Excellent	0 (0%)	0 (0%)	6 (15%)	26 (65%)	

Comparative study between pre and post-injection assessments revealed; highly significant decrease in VAS score assessments in PRP group; with highly significant difference ($p < 0.01$) and highly significant increase in R & M assessments in PRP group; with highly significant difference ($p < 0.01$).

Paired comparative studies regarding (saline group):

We further analyzed and compared 40 (paired) saline group of patients according to the serial measurements (pre and post-injection); data are shown in the following tables and figures:

- **Serial clinical assessments:**

Table 4: Comparison between salinepatients as regards serial clinicalassessments:

Variable		Baseline	2-month	4-month	6-month	Friedman's test ^^
		Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	P value
VAS score		8 (8 – 9)	7 (6 – 8)	6 (5 – 7)	6 (3 – 7)	<0.0001**
Variable		Baseline	2-month	4-month	6-month	Chi square test ^^
		(%)	(%)	(%)	(%)	P value
R & M score	Poor	30 (75%)	15 (37.5%)	7 (17.5%)	3 (7.5%)	<0.0001**
	Acceptable	10 (25%)	18 (45%)	21 (52.5%)	19 (47.5%)	
	Good	0 (0%)	7 (17.5%)	11 (27.5%)	11 (27.5%)	
	Excellent	0 (0%)	0 (0%)	1 (2.5%)	7 (17.5%)	

Comparative study between pre and post-injection assessments revealed; highly significant decrease in VAS score assessments in saline group; with highly significant difference ($p < 0.01$) and highly significant increase in R & M assessments in saline group; with highly significant difference ($p < 0.01$).

Combined paired and un-paired comparative studies:

We further analyzed and compared all 80 (paired) patientsaccording to the serial (clinical assessments) (pre and post-injection); with entering a grouping factor **(PRP or saline)**; data are shown in the following tables & figures:

Table 5: Comparison between the 2 groups of patients as regards serial clinical measurements using repeated measures ANOVA test (2-Factor study):

Variables	Repeated 2 measures ANOVA (2-F: between the 2 groups)	
	F ratio	P value
VAS score	40.85	<0.001**
R & M score	25.66	<0.001**

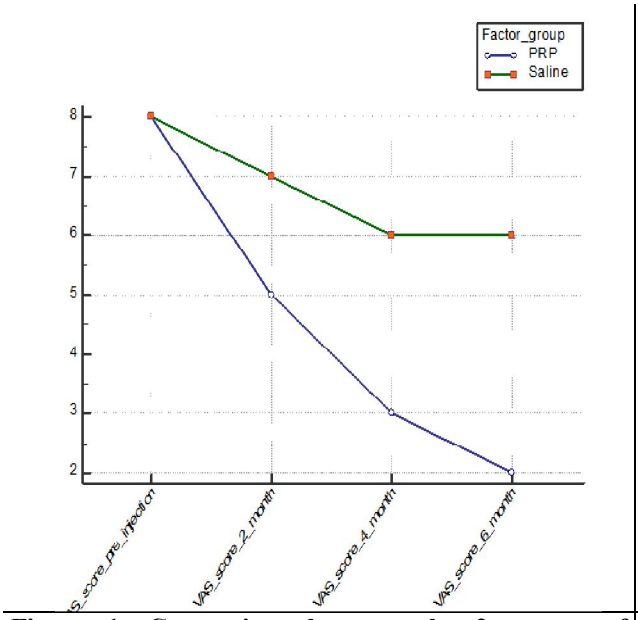


Figure 1: Comparison between the 2 groups of patients regarding serial VAS score assessments.

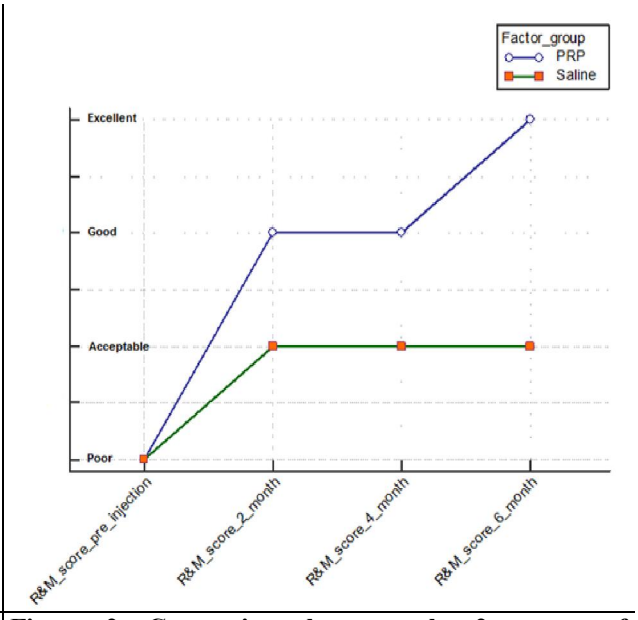


Figure 2: Comparison between the 2 groups of patients regarding serial R & M score assessments.

ANOVA: analysis of variance, 2-F: 2-factor study. #logarithmic transformation was done to non-parametric data.

The 2 groups showed marked decrease in VAS score ($p < 0.01$) and marked increase in R & M score ($p < 0.01$) in PRP group; compared to saline group; during the serial measurements.

4. Discussion

Although the most common cause of heel pain is plantar fasciitis, the etiology and treatment are still not fully understood. The diagnosis of plantar fasciitis is based on the patient's history and physical findings for at least 6 months. This is in accordance with most studies which included only Patients who had symptoms for 6 months or longer, and who had failed conservative treatment. [10]

There is a debate in the literature that will probably modify the treatment modalities is the research concerning the pathophysiology of plantar fasciitis. It is widely believed that plantar fasciitis results from repeated micro-trauma due to overuse, which results in micro-tears of the tissue substance until a macro injury occurs.[3]**Lemont et al**. [11] concluded that plantar fasciitis isn't an inflammatory process but a degenerative process characterized by micro-tears and necrosis of the plantar fascial ligament and intrinsic flexor muscles of the foot at their attachments on the calcaneus. Hence, this disorder is better termed plantar fasciosis. Regarding specimens of resected plantar fascia [12], it was proposed that the condition commonly referred to as plantar fasciitis be called "plantar fasciosis", which more accurately describes the condition. These findings are further supported by the histological analysis of surgical

biopsies of tendons which were affected by "tendonitis," but had no markers of inflammation [13]. Similarly, a study by **Snider et al**. showed that the histologic examination of surgical biopsy specimens showed collagen necrosis, angiofibroblastic hyperplasia, chondroid metaplasia, and matrix calcification. Again, no cellular proof of anti-inflammatory response was cited [14]

The population shared in this study comprised of44 patients 24 males (54.5%) and 20 females (45.5%) with a mean age 46.5.

The aim of the study was to evaluate this novel biological approach of treating chronic plantar fasciitis using PRP the results of this study showed that PRP injections provided improvement in VAS and Roles and Madusly score, with an excellent and good results in 91% of cases.

This confirms reports by other authors that suggest an improved healing process of tendons following local administration of growth factors through PRP injections [2]

Although there are many studies in the literature that examine PRP administration for treating chronic tendinopathy, evidence to date showing the benefit of PRP injections is controversial [2].

De Vos et al. performed a randomized placebo-controlled trial of 54 patients with Achilles tendinopathy treated at a single centre with exercise (usual care and injection of either PRP or saline solution (placebo group)) [2]. The authors concluded that PRP injection did not provide greater pain relief or improvement of nonfunctional activities compared with placebo [11]. In a prospective study of 15 patients with chronic elbow tendinosis, **Mishra et al**. found significant pain decrease two years after PRP injection [15].

Extracorporeal shock wave therapy (ESWT) has been used for treatment of chronic plantar fasciitis. Results have been mixed and depending on the cited study, success rates have ranged from 48 to 77%. This could be an alternative conservative method that may represent a short term prudent and cost-effective alternative for the treatment of resistant plantar fasciopathy that reduces the necessity for surgical procedures. [16].

An injection of autologous blood for managing chronic plantar fasciitis has been reported. A prospective randomized study by **Lee et al**. compared autologous blood injection with corticosteroid injection. Although intra-lesional autologous blood significantly decreased pain levels and increased tenderness thresholds over the six month follow-up period, corticosteroid was considered superior in terms of speed and, probably, extent of improvement. The authors suggest that administration of intralesional autologous blood injection could be used for patients in whom first-line noninvasive treatment failed to decrease pain levels and when corticosteroid injection fails or is contraindicated [17]

PRP is the more potent form of autologous blood in terms of the number of growth factors and concentration of platelets since it is derived from the plasma portion of autologous blood by centrifugation or filtration. The authors expected a more potent effect with PRP in the treatment of plantar fasciitis, with respect to autologous blood [3]

Barrett et al. applied a single injection of PRP in a pilot study of nine patients and reported 78 % symptom resolution at short-term follow-up of two months [3]. The hypothesis was to inject PRP into recalcitrant, symptomatic plantar fascia in an attempt to cause a reparative effect leading to a resolution of symptoms, and this technique was termed plantar fasciorraphy. They found that six out of nine subjects achieved complete resolution of symptoms after 2 months. One subject had resolution after a second injection. After 1year, 77.9% of the subjects had no symptoms. They showed that ultrasound measurements of the thickness of the plantar fascia were reduced between pre- and post-injection [18]**.**

Akşahin, E., et al. showed that there is no significant difference between the steroid and PRP groups in the visual analog scale scores and the modified criteria of the Roles and Maudsley scores measured at 3 weeks and 6 months ($P > 0.05$). No complications attributable to PRP and corticosteroid injections were observed.

Both methods were effective and successful in treating plantar fasciitis. Although there is no complication related to steroids are observed, when the potential risks of corticosteroid such as fat pad atrophy, osteomyelitis of the calcaneus, and iatrogenic rupture of the plantar fascia are taken into consideration, PRP injection seems to be safer while being just as effective in the treatment of plantar fasciitis.

Taking the possible regenerative effect of PRP into consideration, the results of the PRP injection group were expected to be more satisfactory in cases of plantar fasciitis, since it is believed to be a degenerative process rather than an inflammatory reaction.[3]

The other issue in corticosteroid and PRP injection treatment is the method of injection wither ultrasound guided or palpation guided. Although in some studies ultrasound-guided injection was suggested [19], [20]

It is worth mentioning that Kane et al. reported no significant difference in the outcome of ultrasound- and palpation-guided injection methods [21]

Ragab et al., performed an ultrasound guided injection of PRP in the planter fasciitis. All patients

were assessed for the pain on Visual Analogue Scale (VAS) pre-injection and post-injection. Using ultrasound, the thickness of the plantar fascia was measured prior to the injection of PRP and at each visit of follow-up after injection. The mean follow-up was 10.3 months. The results of this study using visual analog pain scale showed that, the average pre-injection pain in patients of was 9.1 (range 8–10). Prior to injection, 72 % of patients had severe limitation of activities, and 28 % of patients had moderate limitation of activities. Average post-injection pain decreased to 2.1. Twenty-two patients (88 %) were completely satisfied, two patients (8 %) were satisfied with reservations, and one patient (4 %) was unsatisfied with using the visual analog scale. Fifteen patients (60 %) had no functional limitations post-injection and eight patients (32 %) had minimal functional limitations. Two patients (8 %) had moderate functional limitations post-injection. Twenty PRP injections, Ultrasonography, we noted significant changes not only in thickness but also in the signal intensity of the plantar fascia after PRP injection. None of our patients experienced any complications from PRP injection at the end of follow-up period. [22]

Conclusion:

There was a significant improvement in pain according VAS and Roles and Madusley score. There was no complication reported during follow up of the cases.

Recommendations:

PRP injection is recommended in patient with chronic planter fasciitis after failure of conservative treatment.

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