Original Article

Effective pain relief by autologous platelet rich plasma injection in patients suffering from plantar fasciitis - a new thought to culture

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Abstract

Background *To date the response of plantar fasciitis (PF) to any treatment is unpredictable. Autologous blood might provide cellular and humoral mediators to induce healing in areas of degeneration at the site of the underlying pathology of plantar fasciitis.*

Objective This randomized controlled study was designed to compare the effectiveness of local injection of autologous platelet rich plasma (PRP) and local steroid in reducing pain and improving function in patients with plantar fasciitis (PF).

Methods *The study population comprised two groups; patients of PF treated with steroid injection (n = 15) and patients of PF treated with PRP injection (n = 15). Patients were allocated randomly to receive either a steroid or PRP injections. All patients filled in visual analog scale (VAS) and foot health status questionnaire (FHSQ) for PF at base line and after 6 weeks at follow up.*

Results *PF patients comparison of VAS and FHSQ at base line and 6 weeks after treatment between control group and PRP group showed significant differences for VAS ($p = 0.005$ and $p < 0.001$, respectively), and for FHSQ ($p = 0.03$ and $p < 0.001$, respectively). While highly significant difference were observed between both groups regarding VAS and FHSQ changes ($p = 0.001$).*

Conclusion *Local injection of autologous PRP proved to be a promising form of therapy for PF. It is both safe and effective in relieving pain and improving function and superior to local steroids.*

Keywords *Autologous platelet rich plasma; plantar fasciitis; Foot health status questionnaire (FHSQ);*

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Introduction

The most common cause of foot pain in the world may be due to plantar fasciitis (PF), a degenerative tissue condition near the origin of plantar fascia making up to approximately 11 to 15% of the foot symptoms requiring professional care among adults[1,2]. The incidence peaks in people between the ages of 40 to 60 years with no bias towards either sex [3].

Near the site of origin of the plantar fascia, at the medial tuberosity of the calcaneous there is degenerative changes that can be characterized in acute condition by classical signs of inflammation including pain, swelling and loss of function[4]. But surprisingly in more chronic conditions histology has shown infiltration with macrophages, lymphocytes, and plasma cells; tissue destruction; and repair involving immature vascularization and fibrosis into the affected area , resulting the usual fascia to be replaced by an angiofibroblastic hyperplastic tissue which spreads itself throughout the surrounding tissue creating a self-perpetuating cycle of degeneration [5].

To date various methods for treatment of this notorious condition including rest, nonsteroidal anti-inflammatory medication, night splints, foot orthosis, stretching protocols and extracorporeal shock wave therapy, steroid injection have been

tried but only seem to be useful in the short term and only to a small degree [6]. Other various types of surgical procedures have also been recommended [2,7-11]. The use of corticosteroids is particularly troubling as several studies have linked plantar fascia rupture to repeated local injections of a corticosteroid [2,11-13] .

Platelet Rich Plasma (PRP) uses the natural healing properties of patient's own blood. At the time of treatment venous blood is collected into a special tube similar to a simple blood test. The platelets and growth factors are separated. PRP is injected into the area of injury or degeneration under imaging control. Platelets in PRP contain alpha granules that release certain growth factors. These growth factors are natural chemical substances that stimulate the healing cascade involving naturally occurring Stem Cells that are required for repair of damaged tissue. PRP 'directs' stem cells in our body to generate a healing response by regenerating the damaged part. Thus PRP enhance wound healing, bone healing and also tendon healing [14, 15]. PRP injection is a safe procedure with very minimal risks. In addition PRP possesses antimicrobial properties that may contribute to the prevention of infections [16]. In humans it has been shown that the injection of whole blood into the tendon decreases pain [17]. The introduction of platelet rich plasma (PRP) as a possible adjunct to conservative and operative treatment has motivated significant research in the topic [18].

In PF the injection of PRP into the affected tissue addresses the healing stages necessary to reverse the degenerative process which are going on in the base of the plantar fascia. Moreover the treatment of tendinosis with an injection of PRP may be a nonoperative alternative. This treatment concept directly addresses the existing condition and should prove to be a superior alternative to current conservative treatments for chronic PF[19].

All these new lines of evidences inspired us to evaluate the effectiveness of local injection of autologous PRP in reducing pain and improving function in patients with plantar fasciitis (PF) compared with local injection of corticosteroid.

Methods

This randomized clinical study was carried out in the Mahalatye District Hospital, Botswana from July, 2010 to December, 2012. A total of 30 patients recruited for the studies were divided into control group received steroid injection; (n=15) and PRP group (n-15) received pRP injection each.

Thirty patients diagnosed as Plantar Fasciitis (PF) of both genders, aged above 18 years were included: they had inferior heel pain that was 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. None of our patients received local steroid injections, non-steroidal anti-inflammatory at least 4 weeks prior to the study.

Patients with previous surgery for PF, vascular insufficiency or neuropathy related to heel pain, hypothyroidism and diabetics were excluded. History of anemia (hemoglobin <7.0 g/dl), thrombocytopenia (platelets <150 × 103 ìL) or bleeding dyscrasias, significant cardiovascular, renal or hepatic disease, local malignancy were also excluded.

All included patients on the 1st visit were evaluated by a full medical history and physical examination and then each patient marked the level of pain on the visual analog scale (VAS) (0–10). The score records the patient's reported pain where 0 is pain-free and 10 is the worst pain imaginable.

All affected patients in both groups were screened with standard X-ray projections to exclude bony abnormalities of the calcaneus. The functional assessment and satisfaction was measured using the foot health status questionnaire (FHSQ).

Preparation of Platelet Rich Plasma

Various blood separation devices have differing preparation steps essentially accomplishing similar goals. We used the Biomet Biologics GPS III system for simplicity. About 30–60 ml of venous blood is drawn with aseptic technique from the antecubital vein. An 18 or 19 g butterfly needle is advised, in efforts of avoiding irritation and trauma to the platelets which are in a resting state. The blood is then placed in an FDA approved device and centrifuged for 15 min at 3,200 rpm. Afterward, the blood is separated into platelet poor plasma

(PPP), RBC, and PRP. Next the PPP is extracted through a special port and discarded from the device. While the PRP is in a vacummed space, the device is shaken for 30 s to re-suspend the platelets. Afterwards the PRP is withdrawn. Depending on the initial blood draw, there is approximately 3 or 6 cc of PRP available.

Injection procedure

All patients gave an informed written consent, which was approved by local ethical committee in the Hospital. The patients were informed of the rare possibility of temporary worsening symptoms after the injection. This is likely due to the stimulation of the body's natural response to inflammatory mediators. Although adverse effects are uncommon, as with any injection there is a possibility of infection, no relief of symptoms, and neurovascular injury. Scar tissue formation and calcification at the injection site are also remote risks. All these issues were discussed with the patient prior having consent.

The area of injury was marked while taking into account the clinical examination and data from imaging studies such as MRI and radiographs. We used a dynamic musculoskeletal ultrasound with a transducer of 6–13 Hz in an effort to more accurately localize the PRP injection. Under sterile conditions, the patient received a PRP injection with approximately 1 cc of 1% Lignocaine and 1 cc of 0.25% Bupivacaine directly into the area of injury. Recommendation according to NICE guideline of using a peppering technique spreading in a clock-like manner to achieve a more expansive zone of delivery was followed.

The patient was observed in a supine position for 15–20 min afterwards, and was then discharged home. Patients typically experienced minimal to moderate discomfort following the injection which lasted for up to 1 week in 3 cases. They were instructed to ice the injected area if needed for pain control in addition to elevation of the limb and modification of activity as tolerated. They were instructed to rest and to avoid weight bearing for 48 hours after injection with a subsequent increase in ambulation over the next days. If needed they were only allowed acetaminophen for pain and use of any non-steroidal anti-inflammatory medication were strictly prohibited. Patients were allowed to return to a comfortable shoe after two days. Six weeks later, all patients were re-evaluated and refilled VAS and FHSQ during follow-up.

Quantitative variables were described using mean ± standard deviation (SD) and categorical data by frequency and percentage. Student's t-test was used to compare quantitative variables between groups of patients. Levene's test for equality of variances and t-test for equality of means were used to examine the changes of VAS and FHSQ at base line and at follow-up after treatment. In all tests, p value <0.05 was considered to be statistically significant.

Results

The mean age of the control group in PF patients was 44.5 ± 15.5 years, and among PRP group were 42.5 ± 17.5 years. The control group includes 5 males and 10 females, while the PRP group includes 6 males and 9 females. In the control group, 7 patients had right heel affection, and 8 had affection of the left heel. In the PRP group, 11 patients had right heel affection and 4 had affection of the left heel.

Table I *Comparison of patients' outcome regarding VAS and FHSQ Scores in both groups.*

Parameter	Control Group (mean ± SD)		*P Value*	PRP Group (mean ± SD)		*PValue*
	1st Visit	2nd Visit		1st Visit	2nd Visit	
VAS (0-10)	8.26 ± 8.33	5.67 ± 5.6	<0.005*	8.26 ± 1.22	2.2 ± 0.9	<0.000**
FHSQ Score	57.6 ± 8.64	40.06 ± 9.89	<0.030*	58.87 ± 6.32	23.6 ± 7.19	<0.000**

VAS, visual analog scale; PF, plantar fasciitis; PRP, platelet rich plasma; FHSQ, foot health status questionnaire.

* Significant ($p < 0.05$).

** Highly significant ($p < 0.001$)

Significant differences were observed between both groups relative to VAS assessment (1st visit versus 2nd visit) in both control group ($p = 0.005$) and PRP group of patients ($p = 0.03$). Relative to FHSQ score highly significant differences were observed between control group and PRP group of patients ($p < 0.001$).

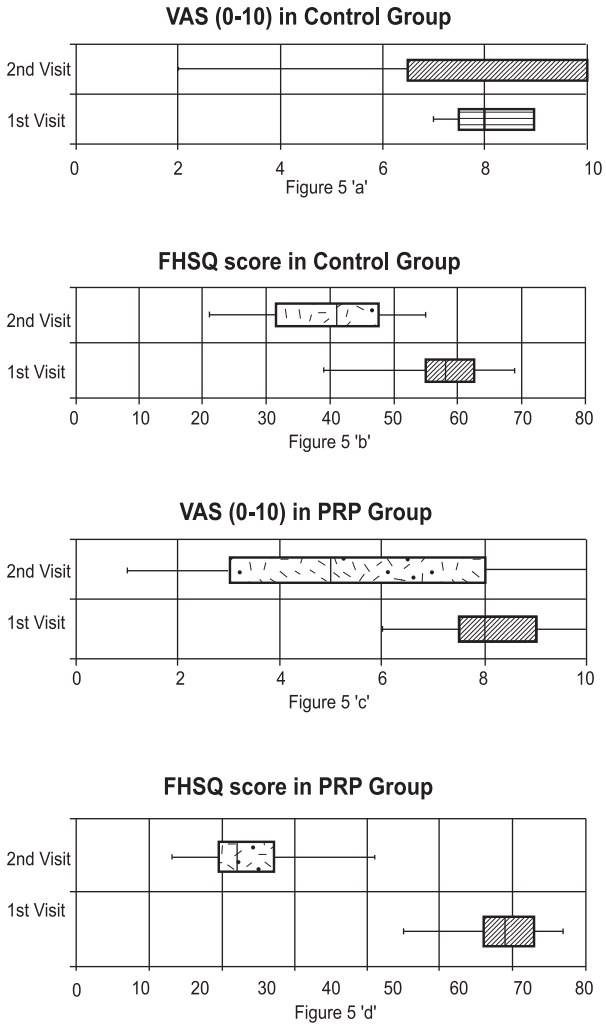

Fig 5(a-d) *Box plot showing the significant difference between VAS and foot health status questionnaire (FHSQ) scores (1st visit) versus (2nd visit) in both control group and PRP group of patients.*

VAS and FHSQ score changes among control and PRP groups of patients with PF showed no significant difference between both groups regarding base line VAS ($p = 0.147$) and baseline FHSQ ($p = 0.741$). While highly significant difference were observed between both groups regarding VAS 2nd visit ($p < 0.001$) and FHSQ 2nd visit ($p = 0.001$) and another highly significant difference between both groups regarding VAS and FHSQ changes ($p = 0.001$). However PRP treated group of patients showed much significant improvement compared to control group reflecting better efficacy.

Discussion

The current study revealed that local injection of PRP, which is a novel form of treatment, provides significant relief of pain and improvement in function that is superior to local steroid injection. Moreover, it provides a safer option for patients who have contraindications to steroid therapy (e.g. diabetics), and an option for patients who are considered for surgical intervention.

Although refractory chronic tendinopathy may be responsive to PRP injection, yet the data available to date are limited by quality and size of study, as well as length of follow-up, and are currently insufficient to recommend this modality for routine clinical use [16]. However autologous PRP was proved to improve the early neotendon properties [17] and improve tissue healing by enhancing cellular chemotaxis, proliferation and differentiation, removal of tissue debris, angiogenesis, and the laying down of extracellular matrix [18,19].

However treatment with corticosteroids has a high frequency of relapse and recurrence, probably because intra fascial injection may lead to permanent adverse changes within the structure of the fascia and because patients tend to overuse the foot after injection as a result of direct pain relief [20]. Additionally and more seriously repeated corticosteroids injections could predispose to rupture of the plantar fascia and consequently amend for surgical intervention. The later complication was critically addressed in the study by Acevedo and Beskin [21] . In their study a total of 765 patients with PF were evaluated. Fifty-one patients were diagnosed with plantar fascia rupture, and 44 of these ruptures were associated with corticosteroid injection. Most important to conclude from their study is that thirty-nine of these patients were evaluated at an average 27-month follow-up. Thirty patients (68%) reported a sudden onset of tearing at the heel, and 14 (32%) had a gradual onset of symptoms. In most cases the original heel pain was relieved by rupture. However, these patients subsequently developed new problems including longitudinal arch strain, lateral and dorsal midfoot strain, lateral plantar nerve dysfunction, stress fracture, hammertoe deformity, swelling, and/or antalgia.

In our study we observed significant difference between control and PRP group regarding VAS and FHSQ scores (1st visit versus 2nd visit) and highly significant difference regarding VAS ($p < 0.001$) and FHSQ scores changes ($p < 0.001$) between both groups. Importantly the PRP treated group showed much significant improvement compared to control group reflecting better efficacy. However sustained efficacy should be further evaluated in longitudinal follow-up studies.

In previous work Lee et al. [22] conducted prospective, randomized, controlled, observer-blinded study over a period of 6 months. In their study Sixty-four patients were randomly allocated to either the autologous blood or corticosteroid treatment group. The authors reported that the reduction in VAS for both groups was significant over time ($p < 0.0001$). At 6 weeks and 3 months, the corticosteroid group had significantly lower VAS than the PRP group ($p < 0.011$ and $p < 0.005$, respectively), but the difference was not significant at 6 months. The authors concluded that intralesional autologous blood injection is efficacious in lowering pain and tenderness in chronic PF, but corticosteroid is more superior in terms of speed and probably extent of improvement. A forthcoming randomized controlled multi center trial will be performed by Peerbooms et al. [19]. The study population will consists of 120 patients of 18 years and older. Patients with chronic PF will be allocated randomly to have a steroid injection or PRP injections. Data will be collected before the procedure, 4, 8, 12, 26 weeks and 1 year after the procedure. The authors postulate that the concentrated growth factors work in a synergetic manner to initiate a tendon healing response. Their authors suggested that transforming growth factor â1 is shown to significantly increase type I collagen production by tendon sheath fibroblasts. This same mechanism is likely to be active in chronic PF [23].

In our study PRP treated group of patients with PF showed much significant improvement compared to steroid treated group reflecting better efficacy.

Conclusion

Local injection of autologous PRP proved to be a promising form of therapy for Plantar Fasciitis. It is both safe and effective in relieving pain and improving function. The current available data support that repeated steroid injections is deleterious and may lead to serious consequences. However sustained efficacy of this promising and safer therapeutic option should be further evaluated in longitudinal follow-up studies that include larger number of patients.

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