The Egyptian Journal of Radiology and Nuclear Medicine xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

The Egyptian Journal of Radiology and Nuclear Medicine

journal homepage: www.sciencedirect.com/locate/ejrnm

Original Article

Ultrasound guided injection of platelet rich plasma in cases of chronic plantar fasciitis

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ARTICLE INFO

Article history:
Received 3 September 2016
Accepted 10 December 2016
Available online xxxx

Keywords:
Platelet rich plasma PRP
Plantar fasciitis
Ultrasound guided injection

ABSTRACT

Chronic plantar fasciitis (PF) is, by far, considered one of the commonest causes of foot complaints; constituting up to 15% of the foot symptoms that needs medical care in adult and active subjects.
Purpose: Is to confirm the clinical diagnosis of plantar fasciitis by ultrasound and to depict the effect of ultrasound guided injection of PRP in such cases.
Methods: The study was conducted on 44 patients with chronic plantar fasciitis not responding to conservative treatment, they were diagnosed and were treated by ultrasound guided PRP injection then followed-up after 4 months by both clinical and ultrasound examinations.
Results: By ultrasound mild improvement in plantar fascia thickness from 6.04 mm (mean of pre injection) to 4.93 mm (mean of 4 months post last injection). By VAS, significant improvement from 8.14 (mean of pre injection) to 2.59 (mean of 4 months post injection). By Roles and Maudsley score, significant improvement from 81.8% of patients who were acceptable and 18.2% were poor (pre injection) to 59.1% became excellent, 31.8% good, 4.5% acceptable and 4.5%poor (4 months post injection).
Conclusion: Ultrasound is a confirmatory diagnostic tool of PF and PRP ultrasound guided injection is recommended after failure of conservative treatment.

1. Introduction

The plantar fascia is a thick sheet-like tendinous expansion originating from the medial aspect of the calcaneus bone and made of densely superimposed collagen and intermingled elastin fibers arranged into two orthogonal planes. It consists of a thick central portion that almost covers the digital flexor muscles as a whole and of thinner peripheral portions, the medial and lateral ones, that cover individually the intrinsic foot muscles of the big and little toes respectively [1,2].

Plantar fascia is constructed in a configuration that maintains the stability of the inner longitudinal foot arch and it helps in reformation of the foot facilitating for occurrence of an efficient toe-off mechanism, thus, it has both static and dynamic roles [3].

Plantar fasciitis (PF) is by far considered the commonest cause of foot complaints and it constitutes 11–15% of the adult foot symptoms that need medical care [4] as well, it is a commonly encountered problem in athletes and active subjects, especially those of the middle age group [5]. Its diagnosis is based on clinical findings like typical morning (or after prolonged period of inactivity) heel pain as a symptom and localized tenderness over the medial aspect of the heel by examination as a physical sign [6].

Increased studies concerned with the pathology of this condition had led to increased popularity of conservative measures taken for treatment of plantar fasciitis resistant cases including: **medications** like non-steroidal anti-inflammatory drugs and **non medications** (e.g. physiotherapy exercises, local ice packs, night splints wears, and modified shoes wearing) [5].

The next step following non satisfactory conservative measures is the local injection therapy for treatment of patients with medication resistant plantar fasciitis. A natural autologously prepared concentrate of growth factors is the **platelet-rich plasma** (PRP) that is now being widely implemented in different medical fields as it aids in the regeneration of the diseased and degenerated tissues that exhibit low healing potential. Locally injected autologous PRP material has been currently introduced as a new treatment modality in cases of resistant plantar fasciitis [6].

The PRP local injections had gained acceptance and promising results were reported recently in the treatment of musculoskeletal

Peer review under responsibility of The Egyptian Society of Radiology and Nuclear Medicine.
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http://dx.doi.org/10.1016/j.ejrnm.2016.12.004
0378-603X/

soft tissue injuries and degenerative processes [5], an explanation for this, is to increase tendon regenerative capacity through administration of hyperphysiologic doses of growth factors, cytokines and cellular contents which, in turn, promote the processes of chemo-taxis, then matrix synthesis, and finally cellular proliferation [5].

In Europe and the United States, there was an era of increased usage of autologous blood products in various applications aiming to promote tissue healing process through utilizing the growth factors within these blood products [7]. For the past two decades, the use of autologous PRP has been safely reported in different medical fields [7].

Diagnostic ultrasonography is a valuable noninvasive technique for assessment of the plantar fascia; hence the diagnosis of chronic plantar fasciitis and detection of plantar fascia tears if present.

When the plantar fascia is imaged with the ultrasound beam at 90 degrees, the normal plantar fascia is almost homogenously iso to hyperechoic as compared to the adjacent heel pad fat [8].

In the sagittal (longitudinal) plane, the fascia is recognizable by its striated fibrillar appearance which results from the longitudinal orientation of its fibers with no hypoechoic defects. If the ultrasound beam is not perpendicular to the fascia, this will result in hypoechoic artifacts of the normal fascia and a pitfall known as **anisotropy** will be seen [9]. The anisotropic effect is dependent on the angle of the incident beam. The maximum return of echoes occurs when the ultrasound beam is perpendicular to the longitudinally oriented tendon fibers. Decreasing the insonation angle on a normal tendon will consequently decrease the echogenicity. If the angle is then re-increased, the tendon will gradually regain its hyperechoic appearance [10]. Hypoechoic fasciitis is analogous to that is seen in tendinosis and is etiologically related to an underlying repetitive micro-tears that lead to fiber degeneration, fraying and edema [11]. Thus, an increased thickness of the plantar fascia either in absence or presence of hypoechoic fascia should be considered as sonographic findings of **PF** [12] (Fig. 1).

In power Doppler mode, mild hyperemia can occur with plantar fasciitis but practical speaking, most individuals will not exhibit greater soft tissue vascularity when assessed with routine power Doppler ultrasound and therefore clinicians dealing with plantar fasciitis should not consider positive power Doppler signals as an essential finding for diagnosis of the condition but rather as a feature-if present-that may help to monitor the treatment plan for the same patient or as a follow up criterion [13].

Ultrasonography is used as an image guiding modality that is available, inexpensive and portable, in addition it allows real time imaging by completely safe modality, free of the hazardous ionizing radiation, that could be met with the use of computed tomography (CT), importantly, the use of ultrasound as a procedure guiding technique provides real time monitoring of the needle tip allowing for precise needle placement in the target, instantly saving the nearby important structures form unnecessary puncture or injury. The color flow Doppler, helps in identification of the adjacent vascular structures that to be avoided from the path of the needle. Moreover, watching the needle tip ensures that the needle tip does not extend outside the lesion [14,15].

Magnetic resonance imaging (MRI) is a valuable diagnostic tool for plantar fasciitis with perfect tissue characterization and being a multiplanar modality. Plantar fasciitis MRI features include fusiform fascial thickening extending from the calcaneal insertion to the proximal portion, peritendinous soft tissue edema of the subjacent fat pad and surrounding soft tissues and focal bone marrow edema within the relevant calcaneus insertion. Specifically, T2 and STIR sequences are very sensitive in the detection of such findings (Fig. 2) [16].

Aim of the work: The purpose of this study is to confirm the clinical diagnosis of chronic plantar fasciitis by the use of ultrasound and to depict the value of platelet rich plasma ultrasound guided injection in such cases.

2. Patients and methods

The study was conducted on 44 patients from May 2014 till December 2014 including chronic plantar fasciitis not responding to conservative treatment presenting to our institute. Patients were treated by ultrasound guided PRP injection. The follow-up duration was 4 months by clinical and ultrasound examinations.

Preparation of Platelets rich plasma:

A 20 cm of blood was withdrawn from the patient into citrated vacuum tubes (containing 5 cm of 10% sodium citrate). The PRP sample was prepared by double-centrifugation protocol.

1st centrifugation: The separation of the blood cellular elements by the laboratory centrifuge (Beckman Centrifuge, CA, USA). The tubes were centrifuged at 160*G* for 20 min at normal room temperature with resultant two components: (a) **cellular**: blood cell component (BCC) and (b) **fluid:**serum component

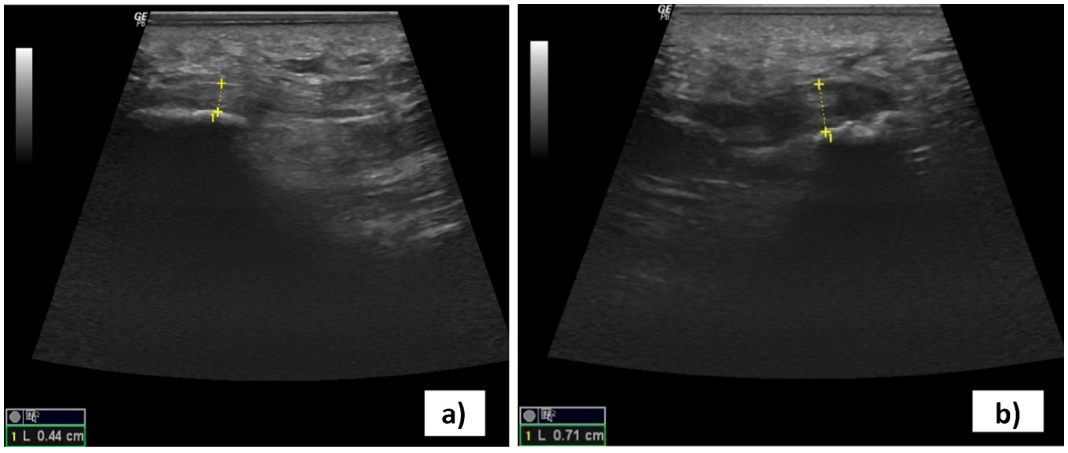

Fig. 1. a & b ultrasound images in B-mode demonstrating mild (a) and marked (b) degrees of plantar fascia thickening (measuring 4.4 & 7.1 mm in thickness respectively) in two different patients in this study. Note the inhomogenicity of the thickened fascia with scattered hypoechoic areas within its substance (more manifest in b).

Please cite this article in press as: Baz AA et al. . Egypt J Radiol Nucl Med (2016), http://dx.doi.org/10.1016/j.ejrnm.2016.12.004