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Low dose radiotherapy for plantar fasciitis. Treatment outcome of 171 patients

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ABSTRACT

Background: Although the effectiveness of low-dose radiotherapy for chronic degenerative and inflammatory diseases has been documented in previous studies, patient-reported clinical outcomes are rarely available.
Objective: This study aimed to determine the effect of low-dose radiotherapy on patients with painful plantar fasciitis.
Method: From 2002 to 2008, 200 patients older than 65 years of age with painful plantar fasciitis were treated in our hospital. Records from 171 of these patients were available for analysis. All patients were treated with an identical dose of 3 Gy using identical equipment and techniques. Response was evaluated with patient-reported questionnaires and clinical visits.
Results: Minimum-term follow-up was 18 months, with mean follow-up at 54 months. Three months after receiving low-dose radiotherapy, 67.3% of patients had no or mild pain, and 57.9% had no or discrete mobility restriction. At a mean of 54 months, 61.4% of patients had no or mild pain and 64.9% of patients had no or discrete mobility restriction; 60.8% of patients reported improved quality of life.
Conclusion: Low-dose radiotherapy is effective in most patients with painful plantar fasciitis. Due to minimal side effects and low costs, it represents an excellent treatment option compared to conventional therapies or surgery.

1. Introduction

Plantar fasciitis (PF) is a chronic pain syndrome that significantly affects the quality of life of patients. Approximately 10–16% of the population worldwide suffers from chronic, painful PF [1]. The underlying cause of PF is thought to be multifactorial. Degenerative changes of the heel fat pad, mechanical arch abnormalities that increase tension on the plantar fascia, and patient demographics, notably increasing age, obesity, and work-related weight-bearing are commonly implicated [2]. The present study included only patients above 65 years of age. Chronic pain clearly has an adverse impact on patient quality of life and influences activities of daily life with respect to professional work. This leads to a chronic disease requiring medication and frequent visits to a general practitioner, orthopedic foot and ankle surgeon, podiatrist, or physical therapist. Chronic disease can also be a severe psychological issue, which is also a burden on the health care system in terms of cost and resources.

The main goal of any therapy for PF is patient-reported pain relief. A large arsenal of non-surgical strategies have been investigated including immobilization of the foot using special splints and adjustable shoes, and physiotherapy [3]. Currently, data are available for the following non-surgical modalities: high-energy extracorporeal shock wave therapy [4], injections of micronized dehydrated human amniotic/chorionic membrane [5], use of silicone insoles [6], ultrasound guided corticosteroid injection [7], botulinum toxin A injection [8], iontophoresis using dexamethasone [9], and the application of different orthotic concepts [10].

Surgery is recommended and may be effective in some patients when standard non-surgical therapies fail [11–13].

The use of low-dose radiotherapy (LDRT) as an anti-inflammatory and analgesic agent has been reported in the literature. Numerous studies have described the effectiveness of orthovolt as well as megavolt RT. More recent data have shown that LDRT can affect inflammation, endothelial cell function, and mononuclear and polymorph nuclear leucocytes, as well as macrophages. The adhesion of leukocytes to the endothelium is impaired, apoptosis in endothelial cells and leukocytes is enhanced,

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and the activity of nitric oxide synthetase is diminished. Furthermore, the induction of cytokines inhibiting inflammation is stimulated [14,15]. Clinical data demonstrating the feasibility and efficacy of LDRT for PF are available [16–19]. To date, two randomized trials have been performed [20,21]. The largest randomized multicenter, phase III trial showed the effectiveness of different doses and stated that "radiation therapy yields important pain relief in patients with painful heel spur (plantar fasciitis) compared with very low doses, and this could be proven at a high level of evidence for the first time" [21].

Based on the clinical outcome data and scientific laboratory information, the present study initiated a program for elderly patients (>65 years of age) with refractory and chronic, painful PF. A vast majority of patients volunteered to participate by asking for treatment. A non-randomized trial was designed to assess the efficacy of low-dose orthovoltage RT. A moderate dose was used and treated under uniform technical and logistical conditions in order to assess patient-reported pain relief and improvement in quality of life in patients.

2. Methods

Between 2002 and 2008, 200 patients with diagnosed PF were referred to our clinic. All patients had a long history of pain and analgesic use, and, at minimum, a two-dimensional X-ray of the foot. In 35 cases an MRI was performed prior to other treatment in order to exclude other pathological conditions. All patients presented with symptoms such as pain and/or mobility restrictions. Almost all patients had received various treatments prior to LDRT including local analgesic injections (60%), arch supports and footwear (70–75%), nonsteroidal anti-inflammatory drugs (NSAIDs) (80%), steroid injections (22%), shock wave therapy (15%), and physiotherapy sessions (40–50%). The median age of patients was 70 years. Younger patients were excluded due to any potential risk of radiotherapy (RT)-induced malignancies. The median duration of pain for all patients, independent of pain intensity, was 12.2 months (range: 1–30 months). The median duration of mild and severe pain before LDRT was five months (range: 2–36 months) and eight months (range: 1–95 months), respectively.

LDRT was performed on all patients. The prescribed dose of 0.5 Gy per fraction was applied six times, twice weekly, up to a total dose of 3 Gy. All patients were treated at the same institution and with the same X-ray orthovoltage unit (Philips RT 250) and identical radiation parameters (250 kV, 15 mA, and 1 mm copper filtration). Two different types of tubes were used for patients (6×8 cm or 8×10 cm, both with 40 cm source–surface–distance). Patients were treated in the prone position with one portal centered on the anterior part of the calcaneus bone. The maximum dose was prescribed for 1–2 cm tissue depth. An experienced radiation technologist team performed all treatment sessions. Seventeen percent of all patients were treated with a second series using the same dose prescription because they experienced no pain relief and explicitly asked for a second course of treatment.

Clinical functions were assessed before LDRT, and the outcome was measured at the end of treatment, three months, and once each year after radiotherapy. Each assessment included a physical examination and changes in pain history and mobility. Treatment response and clinical outcome were evaluated using a standardized questionnaire with eight simple questions (Table 1). Patients assessed their symptoms by scoring them using four different grades (none, mild, moderate, severe).

The primary endpoint of the present study was patient-reported pain relief. The secondary endpoint was patient-reported improvement in mobility in terms of walking and standing. The mean follow-up time was 42 months (range: 12–73 months). Follow-up data concerning pain history were available for the 171 patients who comprised the study population, which represents an acceptable 86% follow-up rate.

Table 1
Questionnaire.

1For how long did you suffer from heel pain before radiotherapy?
2Please score the intensity of your pain before radiotherapy?
3Please score the intensity of your pain at the end of radiotherapy?
4Do you suffer from heel pain at the moment; if yes please score the intensity?
5Please score the extent of mobility restriction before radiotherapy?
6Please score the extent of mobility restriction at the end of radiotherapy?
7Please score the extent of mobility restriction as of today?
8Did you undergo further treatments of your heel pain after radiotherapy?
9Did your quality of life improve due to our treatment?

Table 2
Clinical symptom prior to radiotherapy.

Pain intensity	Number of patients	Percentage
Mild	2	1.2
Moderate	35	20.5
Severe	134	78.4

Table 3
Mobility restriction prior to radiotherapy.

Mobility restriction	Number of patients	Percentage
No MR	2	1.2
Mild MR	15	8.8
Moderate	41	24.0
Severe	93	54.4

3. Results

Tables 2 and 3 show the patient data concerning pain intensity and mobility restriction before RT. The questionnaire was not correctly completed with regard to information on mobility in 20 cases and as such were not included in the results.

Patients were divided into three groups based on treatment response and clinical outcome with regard to pain symptoms and mobility restriction. Group 1 had 'no' or 'mild' pain, Group 2 had 'moderate' pain, and Group 3 had 'severe' pain. Table 4 summarizes the results with regard to pain history. Pain relief was defined as marked clinical improvement with only 'mild' or 'no' residual pain.

Three months after LDRT, 67.3% of patients had 'no' or 'mild' pain, which was maintained in most instances until the questionnaire was answered (61.4%).

Table 5 summarizes the changes in mobility restriction. Three months after LDRT, 57.9% of patients had 'no' or 'discrete' mobility restriction compared with 64.9% of all patients at medium-term follow-up.

4. Discussion

The main finding of this study is the significant patient-reported pain relief associated with LDRT, which was the primary endpoint. The main reason RT was administered was the failure of all

Table 4
Results of pain relief three months after LDRT and at time of the questionnaire.

Pain	Three months after LDRT	At time of questionnaire
Relief	67.3%	61.4%
Improvement	17.5%	7.6%
No change	9.4%	5.8%