



بسم الله الرحمن الرحيم

∞∞∞∞

تم رفع هذه الرسالة بواسطة / حسام الدين محمد مغربي

بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى

مسئولية عن محتوى هذه الرسالة.

ملاحظات : لا يوجد





Comparison between the effect of steroid injection, prolotherapy local injection and extracorporeal shock wave therapy in treatment of symptomatic calcaneal spur

Thesis

Submitted for Partial Fulfillment of master degree in Physical Medicine, Rheumatology and Rehabilitation

By

Nourhan Hussien Mostafa

M.B., B.Ch.

Faculty of Medicine- Ain Shams University

Under supervision of

Prof. Dr. Mohamed Ragaei El-helw

Professor of Physical Medicine, Rheumatology & Rehabilitation

Faculty of Medicine - Ain Shams University

Prof. Dr. Mahmoud Mohammed Fathallah

Professor of Physical Medicine, Rheumatology & Rehabilitation

Faculty of Medicine - Ain Shams University

Prof. Dr. Abeer Kadry El Zohiery

Professor of Physical Medicine, Rheumatology & Rehabilitation

Faculty of Medicine - Ain Shams University

*Faculty of Medicine
Ain Shams University*

2022

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قَالَ

سَبِّحْ اِنَّكَ لَا تَعْلَمُ لَنَا
اِلَّا مَا عَلَّمْتَنَا اِنَّكَ اَنْتَ
الْعَلِيمُ الْعَظِيمُ

صدق الله العظيم

سورة البقرة الآية: ٣٢

Acknowledgment

*First and foremost, I feel always indebted to **ALLAH**,
the Most Kind and Most Merciful.*

*I'd like to express my respectful thanks and profound gratitude to **Prof. Dr. Mohamed Ragaei El-helw**, Professor of Physical Medicine, Rheumatology & Rehabilitation, Faculty of Medicine - Ain Shams University for his keen guidance, kind supervision, valuable advice and continuous encouragement, which made possible the completion of this work.*

*I am also delighted to express my deepest gratitude and thanks to **Prof. Dr. Mahmoud Mohammed Fathallah**, Professor of Physical Medicine, Rheumatology & Rehabilitation, Faculty of Medicine - Ain Shams University, for his kind care, continuous supervision, valuable instructions, constant help and great assistance throughout this work.*

*I am deeply thankful to **Prof. Dr. Abeer Kadry El Zohiery**, Professor of Physical Medicine, Rheumatology & Rehabilitation, Faculty of Medicine - Ain Shams University, for her great help, active participation and guidance.*

Nourhan Hussien

List of Contents

Title	Page No.
List of Abbreviations.....	i
List of Tables	ii
List of Figures	iv
Introduction	1
Aim of the Work.....	4
Review of Literature	
Anatomy of the Foot.....	5
Calcaneal Spur and Plantar Fasciitis.....	16
Treatment of Calcaneal Spur and Plantar Fasciitis	34
Patients and Methods.....	84
Results	95
Discussion	119
Summary	129
Conclusion	132
Recommendations	133
References	134
Appendix.....	164
Arabic Summary	—

List of Abbreviations

Abb.	Full term
ATP.....	Adenosine triphosphate
BMP.....	Bone morphogenetic protein
DP.....	Dextrose prolotherapy
EBRT.....	External beam radiotherapy
EFD.....	Energy flux density
eNOS.....	Endothelial nitric oxide synthase
ESWT.....	Extracorporeal Shock wave therapy
FDA.....	Food and Drug Association
IGF.....	Insulin-like growth factor
IQR.....	Inter-quartile range
LCI.....	Local corticosteroid injections
LD-EBRT.....	Low dose EBRT
LLLT.....	Low Level Laser therapy
MRI.....	Magnetic resonance imaging
NICE.....	National institute of health and care excellence
NSAIDs.....	Nonsteroidal anti-inflammatory drugs
PCS.....	Plantar calcaneal spur
PRP.....	Platelet-rich plasma
RIT.....	regenerative injection therapy
sICAM.....	Soluble intercellular adhesion molecule 1
sVCAM.....	Soluble vascular cell adhesion molecule 1
TENS.....	Transcutaneous electrical nerve stimulation
VAS.....	Visual analog scale
VEGF.....	Vascular endothelial growth factor

List of Tables

Table No.	Title	Page No.
Table (1):	Muscles attached to calcaneus bone.....	15
Table (2):	Classification of shock-wave therapy according to energy flux density (EFD) ranges according to Rompe.....	46
Table (3):	The solubility of commonly used locally-acting corticosteroids:	61
Table (4):	Demographic data and characteristics of the total studied patients of three groups:.....	95
Table (5):	Comparison between the three studied groups regarding demographic data and characteristics of the studied patients.....	98
Table (6):	Comparison between the three studied groups regarding VAS score before and after 2 months	101
Table (7):	Comparison between the three studied groups regarding pain subscale before and after 2 months	104
Table (8):	Comparison between the three studied groups regarding disability subscale before and after 2 months	107
Table (9):	Comparison between the three studied groups regarding activity limitation subscale before and after 2 months.....	109
Table (10):	Comparison between the three studied groups regarding total score of FFI before and after 2 months	111
Table (11):	Correlation between the three studied groups improvement and age of all studied patients	113

List of Tables Cont...

Table No.	Title	Page No.
Table (12):	Correlation between the three studied groups and duration of symptoms	114
Table (13):	Relation between gender of all studied patients and improvement in Dp group:	115
Table (14):	Relation between gender of all studied patients and improvement in corticosteroid group:.....	117
Table (15):	Relation between gender of all studied patients and improvement in ESWT group:.....	118

List of Figures

Fig. No.	Title	Page No.
Figure (1):	Anatomy of ankle joint	5
Figure (2):	Ligaments of the ankle joint	8
Figure (3):	The bones of the tarsus.....	11
Figure (4):	Calcaneal anatomy	12
Figure (5):	Calcaneus: A. Superior view B. Inferior view C. Lateral view D. Medial view	14
Figure (6):	Radiographically evident heel spur	31
Figure (7):	Heel spur in musculoskeletal Ultrasonography	32
Figure (8):	Thickening of the plantar fascia (>4 mm) is often associated with a local reaction, but is also found (in >21% of cases) in asymptomatic patients	33
Figure (9):	Foot insoles.....	36
Figure (10):	Ultrasound therapy	40
Figure (11):	Calf stretch	52
Figure (12):	Plantar fascia stretching exercise for plantar fasciitis	53
Figure (13):	Foot ankle circles exercise	54
Figure (14):	Toe curls exercise.....	55
Figure (15):	Toe towel curls exercise.....	56
Figure (16):	Visual analogue scale.....	86
Figure (17):	Position of the patient during injection.	90
Figure (18):	Shock wave therapy apparatus.	92
Figure (19):	Sex distribution among the studied patients.	96
Figure (20):	Affected side among the studied patients	96

List of Figures Cont...

Fig. No.	Title	Page No.
Figure (21):	Comparison between the three studied groups regarding age	99
Figure (22):	Comparison between the three studied groups regarding sex.....	99
Figure (23):	Disease duration in the three groups.....	100
Figure (24):	Affected side in the three groups.	100
Figure (25):	Comparison between the three studied groups regarding VAS score before and after 2 months.	103
Figure (26):	Comparison between the three studied groups regarding VAS score difference.....	103
Figure (27):	Comparison between the three studied groups regarding pain subscale difference.	106
Figure (28):	Comparison between the three studied groups regarding disability subscale before and after 2 months.	108
Figure (29):	Comparison between the three studied groups regarding disability subscale difference.	108
Figure (30):	Comparison between the three studied groups regarding disability subscale before and after 2 months.	110
Figure (31):	Comparison between the three studied groups regarding activity limitation subscale difference	110
Figure (32):	Comparison between the three studied groups regarding total score of FFI before and after 2 months	112

List of Figures Cont...

Fig. No.	Title	Page No.
Figure (33):	Comparison between the three studied groups regarding total score of FFI difference.	112
Figure (34):	Correlation between the improvement of activity limitation subscale and duration of symptoms in corticosteroid group	114
Figure (35):	Relation between gender of studied patients and improvement in Dp group.....	116
Figure (36):	Relation between gender of studied patients and improvement in activity limitation subscale in corticosteroid group.	117

ABSTRACT

Background: Calcaneal spurs are common cause of heel pain occurring anywhere along the calcaneal tuberosity and most frequently found at the insertion of the plantar fascia. They are usually asymptomatic, but when they are painful, the condition is generally the result of inflammation of the insertional fibers of the plantar fascia at the medial tuberosity. Symptomatic calcaneal spurs are often found in association with plantar fasciitis. Like plantar fasciitis, calcaneal spurs can occur alone or may be part of a systemic inflammatory condition such as rheumatoid arthritis or gout. In some patients, the cause seems to be entirely mechanical, and such patients often exhibit an abnormal gait with excessive heel strike.

Objective: To compare the effectiveness of dextrose prolotherapy injection, corticosteroid injection and extracorporeal shockwave in symptomatic calcaneal spur, based on clinical and functional outcome measures.

Patients and Methods: This study was conducted on forty-five patients diagnosed with symptomatic calcaneal spur (plantar fasciitis) for more than 6 months. The patients were recruited from Physical Medicine, Rheumatology and Rehabilitation department at Ain Shams University Hospitals. Diagnosis was based on detailed history taking, full clinical examination, pain and functional assessments of the foot using visual analogue scale (VAS score) and foot function index (FFI).

Results: Eight weeks after treatment, the pain score by VAS was significantly improved at ESWT group mostly, less extent at prolotherapy group and least at corticosteroid group. Also the percentage of improvement in ESWT group was found higher than the other groups indicating the long term analgesic effect of ESWT. Eight weeks after treatment, the FFI subscales (pain, disability and activity limitation) and total FFI score significantly improved mostly at ESWT group, less extent at prolotherapy group and least at corticosteroid group indicating the long term beneficial effect of ESWT on the function in patients with chronic PF.

Conclusion: Although ESWT, dextrose prolotherapy injection, and local corticosteroid injection were all effective in the treatment of symptomatic calcaneal spur during 8 weeks of follow-up but, ESWT was superior to all other modalities in its effect on pain intensity and function during daily life activities at long term follow up.

Keywords: Plantar fasciitis, foot function index, dextrose prolotherapy

INTRODUCTION

A calcaneal spur (or heel spur) is a bony outgrowth from the calcaneal tuberosity (heel bone) (*Abreu et al., 2003*). Calcaneal spurs are typically detected by a radiographic examination (commonly referred to as an “x-ray”).

When a foot is exposed to constant stress, calcium deposits build up on the bottom of the heel bone. Generally, this has no effect on a person's daily life. However, repeated damage can cause these deposits to pile up on each other, causing a spur-shaped deformity, called a calcaneal (or heel) spur. People who are obese, have flat feet, or who often wear high-heeled shoes are most susceptible to heel spurs (*Johal and Milner, 2012*).

Calcaneal spurs and plantar fasciitis can occur alone, or they can be related to underlying diseases that cause arthritis, such as reactive arthritis and ankylosing spondylitis (*Kasper et al., 2015*).

Major symptoms consist of pain in the region surrounding the spur, which typically increases in intensity after prolonged periods of rest. Patients may report heel pain to be more severe when waking up in the morning. Patients may not be able to bear weight on the afflicted heel comfortably. Running, walking, or lifting heavy weight may exacerbate the issue.

Plantar fasciitis is a location oriented term that refers to the bottom of the foot(i.e. plantar warts). Fascia is a tough, inelastic band (**Hossain and Makwana, 2011**). It is the most common cause of heel pain (**Peerbooms et al., 2010**). The diagnosis is usually clinical and rarely needs to be investigated further (**Puttaswamaiah and Chandran, 2007**).

Plantar fasciitis is used to describe heel pain caused by an inflammation of the plantar fascia. This could result from a one-off tear in the plantar fascia or damage from repetitive microtraumas. It is an enthesopathy that arises from degenerative processes affecting the junction between the periosteal (calcaneus) and the ligament attachment (plantar fascia) (**Puttaswamaiah and Chandran, 2007**).

Conservative treatment of plantar fasciitis such as rest, weight loss, deep massage, stretching techniques, and heel cups, nonsteroidal anti-inflammatory drugs, physical therapy, iontophoresis, night splint, and custom full-length arch supports (**Crawford, 2011**).

Corticosteroid injections have been used to treat plantar heel pain since the 1950s (**Orchard, 2012**). Both orthopaedic surgeons and rheumatologists have been known to use them frequently (**Lapidus and Guidotti, 1957**). The advantages of corticosteroid injections include low cost, low complexity and rapid pain relief.

Disadvantages of corticosteroid injections include planter fascial rupture, planter fat pad atrophy, lateral planter nerve injury secondary to injection, and calcaneal osteomyelitis (**Tatli and Kapasi, 2009**).

Prolotherapy with dextrose (DP) has been reported to decrease pain and to improve function (**Fadale et al., 1994**).

Hyperosmolar dextrose has been shown to increase platelet derived growth factor expression and to up-regulate multiple mitogenic factors that may act as signaling mechanisms in tendon repair (**Rabago et al., 2005**).

Extracorporeal shock wave therapy (ESWT) for orthopaedic diseases is thought to provide long lasting analgesia and stimulate the healing process. It has been recommended as treatment for chronic plantar fasciitis in patients unresponsive to conservative treatment (**Rompe et al., 1996**).

In ESWT, extracorporeal shockwaves are applied to lesions to help revascularization and stimulate or reactivate the process of connective tissue and bone healing, thereby relieving pain and improving function (**Lee et al., 2014**).

Extracorporeal shock wave therapy is a safe and effective treatment for patients who have failed previous conservative nonsurgical treatments for chronic plantar fasciitis (**Hammer et al., 2002**).