شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

# بسم الله الرحمن الرحيم


HANAA ALY

# شبكة المعلومات الجامعية

# التوثيق الالكتروني والميكروفيلم

HANAA ALY

شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

# جامعة عين شمس

# التوثيق الإلكتروني والميكروفيلم

# قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

# يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

HANAA ALY

# A Histological Study on the Effect of Dextrose Prolotherapy on Skeletal Muscle Injury In Adult Male Albino Rats

**Thesis**

*Submitted for Partial Fulfillment of M.D Degree*

***In Anatomy and Embryology***


**Presented By**

**Eman Diaa EL Deen Salama**

*Assistant Lecturer of Anatomy and Embryology*

*Faculty of Medicine- Ain Shams University*

**Under Supervision of**

**Prof. Dr. Azza Salah El Din Soliman**

*Professor of Anatomy and Embryology*

*Faculty of Medicine- Ain Shams University*

**Prof. Dr. Rania Ahmed Salah El Din**

*Professor of Anatomy and Embryology*

*Faculty of Medicine - Ain Shams University*

**Ass. Prof. Dr. George Fayek Barsoum Hanna**

*Assistant Professor of Anatomy and Embryology*

*Faculty of Medicine - Ain Shams University*

**Ass. Prof. Dr. Shereen Adel Saad**

*Assistant Professor of Anatomy and Embryology*

*Faculty of Medicine - Ain Shams University*



**Faculty of Medicine**

**Ain Shams University**

**2020**

# Acknowledgement

*First of all, I thank **ALLAH** for blessing this work as a part of his generous help throughout my life.*

*I would like to express my profund appreciation to **Prof. Dr. Shahira Youssef,** the head of Anatomy and Embryology department, Faculty of Medicine, Ain Shams University for her help and support.*

*I would like to acknowledge my sincere gratitude, and appreciation to **Prof. Dr. Azza Salah El Din,** Professor of Anatomy and Embryology, Faculty of Medicine, Ain Shams University, for her supervision and scientific support throughout this study. It was an honor to work under her supervision.*

*I would like to thank **Prof. Dr. Rania Ahmed Salah,** Professor of Anatomy and Embryology, Faculty of Medicine, Ain Shams University, for her kind support and encouragement.*

*I am also grateful to **Ass. Prof. Dr. George Fayek,** Assistant Professor of Anatomy and Embryology, Faculty of Medicine, Ain Shams University, for his kind support and encouragement.*

*I would like to thank **Ass. Prof. Dr. Shereen Adel Saad,** Assistant Professor of Anatomy and Embryology, Faculty of Medicine, Ain Shams University, for her unique effort, assistance and knowledge.*

*I would like to display my indebtedness to **Prof Dr. Salwa Lasheen,** Professor of Anatomy and Embryology, Faculty of Medicine, Ain Shams University, for her help and meticulous revise.*

*I would like to thank **Dr. Ahmed Farid** and **Dr. Maha Abbass** for their effort and assistance.*

*Finally, I would like to offer my thanks to **my Family** and **my Finance**, without their help and support, this work could not come to birth.*

✍ Eman Diaa El Deen

# List of Contents

# List of Abbreviations

| Abb. | Full term |
|---|---|
| **ANOVA** | One-way analysis of variance |
| **BMD** | Becker muscular dystrophy |
| **CARE** | Committee of animal research ethics |
| **CT** | Computed tomography |
| **CTGF** | Connective tissue growth factor |
| **DMD** | Duchenne muscular dystrophy |
| **ECM** | Extracellular matrix |
| **EGF** | Epidermal growth factor |
| **FGF** | Fibroblast growth factor |
| **HGF** | Hepatocyte growth factor |
| **IGF** | Insulin growth factor |
| **IL-1 beta** | Interleukin-1 beta |
| **IL-10** | Interleukin-10 |
| **IL-12** | Interleukin-12 |
| **MGF** | Mechano growth factor |
| **MHC** | Myosin heavy chain |
| **MRI** | Magnetic resonance imaging |
| **NSAIDs** | Non steroidal anti-inflammatory drugs |
| **PDGF** | Platelet derived growth factor |
| **PG** | Prostaglandins |
| **SC** | Satellite cells |
| **SPSS** | Statistical Package for Social Studies |
| **TGF-beta 1** | Transforming growth factor-beta 1 |
| **TNF-beta** | Tumor necrotic factor-beta |
| **U/S** | Ultrasonography |
| **VEGF** | Vascular endothelial growth factor |

# List of Tables

# List of Histograms

# A Histological Study on the Effect of Dextrose Prolotherapy on Skeletal Muscle Injury In Adult Male Albino Rats

# Abstract

***Background***: Skeletal muscle injuries are one of the most common injuries occurring in sport medicine varies from 10% to 55% of all injuries. Phases of muscle injuries includes a series of complex stages including inflammation, regeneration and remodeling. Treatment of the injuries is based on conservative measures as rest, elevation, physical therapy and non steroidal anti-inflammatory medications**.** Many injection protocols have been proposed for the treatment of muscle lesions as corticosteroid injection**.** Recently prolotherapy appears to have a safety profile comparable with other injection procedures.

***Aim of the work***: The aim of the present work is to determine the efficacy of dextrose prolotherapy in treatment of skeletal muscle injury in adult male albino rats.

***Material and methods:*** Sixty six adult male albino rats were used in the study. They were divided into control (group I) and experimental groups. Control group: rats were left without any intervention. The experimental group was group II that was divided into sham operated group in which skin incision was done in the left hindlimb without injury to gastrocnemius (group II`) and muscle injury group in which transverse cut injury across the midbelly of the gastrocnemius muscle of right hindlimb was done (group II``) and group III that was divided into lidocaine injected group in which skin incision in lefthindlimb was done without injury to gastrocnemius followed by injection of 0.3 ml 1% lidocaine was injected across the muscle (group III` ) and muscle injury treated with dextrose prolotherapy group in which a transverse cut injury across the midbelly of gastrocnemius of right hindlimb was done followed by injection of 0.1 ml of dextrose prolotherapy of mixture of 0.1ml of 12.5% dextrose and 0.3 ml of 1% lidocaine (group III``). The animals were received 6 injections of lidocaine and dextrose prolotherapy at 5 days interval (starting from day 0 to day 25). In group II and III, muscle specimens were taken at 5,12 and 28 days and processed for light microscope

***Results:*** Examination of Group II``A ( 5 days untreated group) showed intense infiltration of mononucleated inflammatory cells intermingling with dispersed myoblasts and macrophages. Group II`` B ( 12 days untreated group ) showed regenerating myotubes intermingling with mononuclear inflammatory infiltrate and macrophages. Group II``C ( 28 days untreated group) showed some muscle fibers with peripherally elongated nuclei while others showed centrally vesicular ones. Examination of group III``A (5 day treated group with prolotherapy ) showed longitudinal regenerating myofibers with multiple rows of internal vesiculated nuclei. Group III``B ( 12 days treated group) showed newly formed myofibers with incomplete striations together with well developed newly formed striated longitudinal muscle bundles with peripheral flattened nuclei , group III``C ( 28 days treated group) showed cross striated muscle fibers with the appearance of elongated vesicular nuclei.

***Conclusions:*** dextrose prolotherapy was effective in soft tissue healing as it accelerated myoblast proliferation and differentiation

***Key words:*** Skeletal muscle injury, Dextrose prolotherapy,

# Introduction

Skeletal muscle is an amazing tissue in many regards, it is specialized to generate force and has an impressive ability to adapt to changing functional demands and provide a major site for energy storage in the body. Muscle can serve an endocrine function in which it releases factors and small molecules that can influence the growth, function and development of other tissues **(Tidball, 2011).**

Skeletal muscle injuries are one of the most common injuries occurring in sport medicine, their frequency varies from 10% to 55% of all injuries. The pathophysiology of muscle injuries includes a series of complex stages which may occur simultaneously including degeneration, inflammation, regeneration and the formation of fibrotic scar tissue **(Baoge et al., 2012 and Tsai et al., 2018).**

Treatment of muscle injuries is based on conservative treatments as rest, icing and elevation together with non steroidal anti-inflammatory medication **(Baoge et al., 2012).**

Recently, many injection protocols have been proposed for the treatment of muscle lesions as

prolotherapy or proliferative therapy **(Orchard et al., 2008).**

Proliferative therapy (prolotherapy or regenerative injection therapy) is a non-surgical technique that introduce locally irritant substances (proliferant) to the site of painful and degenerated tendons, joints, ligaments and muscles. Prolotherapy accelerates the natural healing process of the body by initiating a local inflammatory cascade that trigger the release of inflammatory cells as granulocytes and macrophages that induce the release of multiple growth factors **(Campbell and Dunn, 2012; Hauser et al., 2016).**

Growth factors released by prolotherapy include platelet derived growth factors (PDGF), fibroblast growth factor (FGF) at early stages of healing to induce proliferation of myoblasts together with connective tissue growth factor (CTGF) and insulin growth factor (IGF ) at late stages of healing to induce fusion and differentiation of myoblasts **(Karalaki et al., 2009).**

The most common used agent is hyperosmolar dextrose usually in a concentration of 25% mixed with saline. Dextrose (d-glucose) is a natural form of glucose normally found in the body. It is considered to be an ideal

proliferant as it is water soluble and can be injected safely into multiple areas and in large quantity **(Hauser et al., 2016).**

# Aim of the Work

The aim of the present study is to determine the efficacy of dextrose prolotherapy in treatment of skeletal muscle injury in adult male albino rats.

## Specific objectives

To study the skeletal muscle histology and to investigate the possible therapeutic 1effects of dextrose prolotherapy on skeletal muscle injury and regeneration in adult male albino rats by light microscopy using paraffin and semithin sections together with morphometric analysis.