ULTRASOUND BIOMICROSCOPY IMAGES OF TRICEPS SURAE MUSCLES OF HEALTHY AND INJURED RATS - PRELIMINARY STUDY

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INTRODUCTION

Ultrasound biomicroscopy (UBM) is a high-resolution image technique used in many areas of medicine and biology, mainly for detection, accompaniment and qualification of diseases and injuries, and also of regeneration processes associated with different types of treatment [1,2]. Frequencies used in most applications vary from 40 to 60 MHz, what corresponds to a resolution in the order of micrometers, overcoming obstacles commonly seen because of low resolution of ultrasound equipments used for diagnosing muscle injuries in humans. Some studies indicate the possibility of obtaining real-time in vivo images of rats' skeletal muscle with high resolution ultrasound. As an example, UBM has been used to study the embrionary development through *in utero* images of small animals [1,2]. This study aims to generate high resolution images of healthy and injured rats' triceps surae muscles, and also of its architectural parameters, assessing the extension of the damage at different times after muscle injury.

METHODS

Animals – Five wistar female rats (5-6 months, 0.44 to 0.66 pounds) were used. Four of them were assessed for obtaining images of healthy Triceps Surae muscles and one was submitted to a laceration injury protocol [3] for further image acquisition.

Image acquisition –It was used an UBM system with central frequency of 50 MHZ that produced rectangular sectional images. There were obtained transversal and longitudinal images relative to the segment's longitudinal axis. The injured rat was monitored 9, 16, 23, 30 e 36 days after injury.

Injury Protocol – Soleus muscles were cut at 60% of the length from their distal insertion, through 75% of their width and 50% of their thickness, according to Menetrey et al. [3].

RESULTS AND DISCUSSION

There were obtained *in vivo* transversal and longitudinal images relative to the segment's longitudinal axis that allowed the visualization of architectural parameters (fiber length and pennation angle) of gastrocnemius, soleus and fibular muscles (Figure 1). Images from injured leg showed different patterns (Figure 2). Images from injured rat showed that the muscle is hypoechoic in the beginning of injury and that echogenicity gradually increases during regeneration process, what is well described in other studies done in humans and rabbits with conventional ultrasound [4, 5, 6]. However, these studies don't show a well-controlled injury protocol methodology and neither a previous and quantitative analysis of architectural characteristics of muscles prior to injury. There were not found in the literature descriptions of *in vivo* real-time high resolution images of skeletal muscular tissue. The possibility of following morphological changes induced by injuries and by different types of treatment constitutes a significant step in clarifying mechanisms inherent to muscular degeneration-regeneration processes.

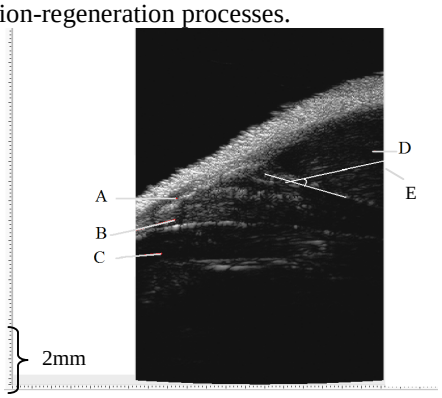

Figure 1: Right leg longitudinal image of a healthy rat. A: Calcanear tendon. B: Soleus. C: Fibular. D: Lateral Gastrocnemius. Note the indication of pennation angle and fascicle length (E).

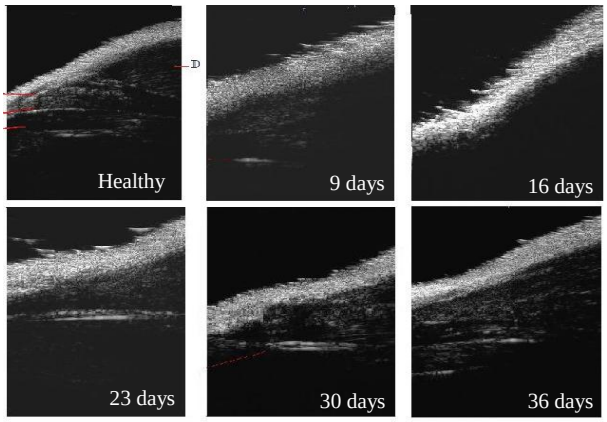

Figure 2: Images of injured rat at different days after injury.

The methodology used in this work may elicit future UBM utilization for following muscle degeneration-regeneration processes associated with different types of treatment, such as stem cells, for further use in humans.

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