

FES OF DENERVATED TIBIALIS ANTERIOR IN THE PIG MODEL

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Introduction

Currently experiments are carried out in Liverpool to evaluate stimulation parameters and protocol for effective and safe stimulation of long-term denervated muscles. These basic experiments are carried out in rabbits using implanted stimulation electrodes. Obviously experiments from rabbits cannot be transferred directly to human application. Therefore a small series of animal experiments in pigs is scheduled to “bridge” results from rabbit to human.

Material and Methods

Animals:

12 "Göttinger minipigs" of the same sex will be used for investigation.

Denervation:

In a first surgical procedure the left common peroneal nerve will be dissected to denervate the left Tibialis anterior (TA) and Extensor digitorum longus (EDL) muscle. A period of minimum 6 months will be kept to achieve long term denervation. After that time periode neurophysiological investigations and muscle biopsies will be performed monthly in order to detect the desired denervation state which means more than 50% reduction of muscle mass and loss of mitochondrial function.

Prior to stimulation the left leg has to be denervated partly or totally in a second surgical procedure performing either local denervation of peripheral sensible nerves or rhizotomy of dorsal rootlets via hemilaminectomy.

Stimulation:

Chronical stimulation will be performed over a time period of 6 months:

Surface electrodes will be fixed to the anterior surface of the left lower leg for 30 to 60 minutes, once daily for five days per week. Stimulation will be started when the animals are trained to accept the electrodes. Stimulation parameters will be set according to the findings from rabbit experiments.

Investigation:

Under general anesthesia the denervated and stimulated TA muscles will be connected to force transducers for physiological examination. After sacrifice of the animals the entire TA and EDL muscles will be excised for investigation according to the rabbit experiments.

Discussion

The scheduled pig experiment should be appropriate to “bridge” results from rabbit experiments to human application: Pig skin is comparable to human skin. “Göttinger minipigs” grow up to about 80kg which is comparable to human bodyweight. Stimulation once a day for half an hour is an accepted protocol for human application. Moreover the experiment should not only allow to answer the scientific questions about efficacy and safety of stimulation of long-term denervated muscles but also to test the technical equipment for human use.

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