PERCUTANEOUS ELECTRICAL NERVE BLOCK OF ACUTE PAIN IN HUMANS

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INTRODUCTION

High-frequency (HF) electrical stimulation delivered to a peripheral nerve through implanted electrodes has been reported to reduce chronic post-amputation pain¹. However, surgical placement of stimulating electrodes significantly burdens the use of HF electrical stimulation for treating acute pain.

The present study investigates the effects of HF electrical stimulation delivered percutaneously to the saphenous nerve in the adductor canal (AC) on electrically elicited pain in able-bodied subjects, and on post-surgical pain in subjects following total knee arthroplasty (TKA).

Anatomically, the adductor canal is a musculoaponeurotic tunnel that originates at the apex of the femoral triangle in the mid-thigh and is formed by the vastus medialis, adductor longus and adductor magnus muscles and is roofed by the sartorius muscle². The sensory saphenous nerve, most consistently found within the adductor canal, is routinely used for blocking post-surgical pain in TKA patients³.

RESULTS

The effects of HF electrical nerve stimulation on acute pain in AB and TKA subjects

- All subjects reported reduced pain scores in response to HF electrical stimulation.
- Painful sensations were either completely abolished (4 AB; 1 TKA) or reduced (1 AB; 2 TKA).
- Pain scores returned to baseline values within sec-to-min after HF stimulation was terminated.
- HF electrical stimulation did not elicit EMG activity or visible contractions of nearby muscles.
- No serious adverse effects were reported.

CONCLUSIONS

Percutaneous high-frequency electrical stimulation of the saphenous nerve in the adductor canal can reversibly block electrically elicited or naturally occurring acute pain in humans, without causing co-excitation of nearby muscles.

METHODS

Subjects:

- 5 able-bodied (AB),
- 3 TKA (24-48 hours post surgery);

Target nerve: Saphenous;

HF E-Stim: 10 kHz, sinewave, < 25 mA, various durations, stim electrode (Octrode) percutaneously placed under ultrasound guidance at the adductor canal;

E-stim to elicit acute pain in AB subjects: monophasic, 1 ms pulse width, 9-pulse train at 500 Hz, surface stimulating electrode placed at the medial malleolus;

EMG recordings: vastus medialis, vastus lateralis, sartorius muscles, biceps femoris muscles via surface electrodes;

Outcome measures:

- subject's sensation scores (0-10 scale, with 3 defined as pain threshold) in AB subjects;
- pain NRS scores (0-10 scale, with 1 defined as no pain) in TKA subjects;
- muscle EMG activity.

REFERENCES

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