Are burstDR and HF10 fundamentally the same? A prospective, randomised, single blind, cross over EEG-study

Dr Ganesan Baranidharan[1,2], Dr Richard Feltbower[2], Dr Beatrice Brotherton[1,2], Mrs Tracey Crowther[1]

[1]**Leeds Teaching Hospitals NHS Trust, UK;** [2]**University of Leeds, UK**

Source(s) of financial support: Educational Grant from Nevro Corp.

Introduction

Spinal Cord Stimulation(SCS) has seen an expansion in the waveforms in recent years. There is some evidence in use of Electro Encephalogram (EEG) in analysing the brain activation. Studies by De Ridder et al (1, 2) demonstrated that burst stimulation activates the dorsal anterior cingulate and right dorsolateral prefrontal cortex more than tonic and placebo stimulation. It has been proposed that burstDR and HF10 might both modulate the medial, lateral and descending pain pathways(3). In order to refute or prove this hypothesis we have completed a study to analyse commonalities and differences in the EEGs of patients undergoing both BurstDR (5 spikes of 500Hz delivered at 40Hz) and HF10 (10KHz) spinal cord stimulation in patients with failed back surgery syndrome (FBSS)

Methods

Patients with FBSS who meet the inclusion criteria were randomised to receive either BurstDr or 10KHz stimulation by a computer-generated randomisation. A baseline EEG is performed followed by 7-10 days' trial of BurstDR followed by HF10 and vice versa. Two electrodes were placed using paraesthesia mapping for BurstDR and anatomical midline to T9/10 for HF10. EEG data was collected with and without active stimulation at the end of the trial period for both treatment paradigms. We also collected data on numerical rating scale (NRS), patient attention vigilance score (PVAQ) and Patient Catastrophising scale (PCS) for the two groups

Results

Seventeen patients with FBSS were recruited, fifteen underwent their trial phase with implantation of 2 electrodes. Two patients failed both HF10 and BurstDR. During the weeks of hot weather, we had electrode migration in three patients and EEG data was not usable on 1 patient. We have full set of baseline, BurstDR and HF10 EEG data on ten patients. Initial analysis does not show any difference between the groups

Discussion

This is the first study looking at EEG changes with BurstDR and HF10 in the same patients, and will demonstrates the commonalities and differences between the two treatments. Patients clearly select one therapy over the other uncorrelated to the randomised order. There was not a huge difference in the waveform preference.

References

1. De Ridder D, Plazier M, Kamerling N, Menovsky T, & Vanneste S (2013) Burst spinal cord stimulation for limb and back pain. *World Neurosurg* 80(5):642-649 e641.
2. De Ridder D & Vanneste S (2016) Burst and Tonic Spinal Cord Stimulation: Different and Common Brain Mechanisms. *Neuromodulation* 19(1):47-59.
3. De Ridder D, Perera S, & Vanneste S (2017) Are 10 kHz Stimulation and Burst Stimulation Fundamentally the Same? *Neuromodulation*.

The Leeds Teaching Hospitals NHS Trust

UNIVERSITY OF LEEDS