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Use of a spinal cord stimulation lead for electromagnetic spectral analysis in 6 radiculopathy suffering patients versus control

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Statement of the Problem: The Spinal Cord (SC) electromagnetic physics remains partially unknown despite extensive studies [1]. Especially during chronic pain involving radiculopathy(R). The spectral pattern of the EM activity of the SC could be explored to be more precise for Spinal Cord Stimulation (SCS) processing and to developing close loop device with machine learning. Also, this study is based on the theoretical EM Thomson's theorem [2-3] which said: an electrically charged EM domain creates an EM equilibrium with electroneutral domain. Also, was postulate that a SCS electrode (SCSe, Octrode, ABBOTT SJM) could be used as diagnostic device for SC EM [3] spectral analysis. The electro neutrality (EN) of SCS(e) was preserved by plastic introducer.

Methodology: After Ethic Committee and written patient's consents, were included 6 patients who underwent SCS for L4-L5 R relief. Was defined as control the study of the signal issuing of 2 level up of SC (i.e. L2-L3). SCSe was connected to computer (Apple, USA) for oscilloscopic high sensibility recording (MATLAB Signal Processing®) [3]. After obtaining SCSe EN, SCSe was implanted with the classical percutaneously technic (PCT). Patients were under general anesthesia to avoid muscular interferences during PCT. When the plastic introducer was implanted in epidural space, SCSe was also introduced to set the first metallic contact in epidural space to record SC signal. Noise was subsequently susbtraced. Were first recorded the signals at control level. Secondarily the was studied the L5-S1level.

Results: The results show the different spectral signals in function of the level of SC studied (figure). Statistical Analysis [5] were performed with JMP®software (SAS, USA). No significant difference between control signal in R suffering patients was observed (Kolmogorov-Smirnov test) $p>0,5$. A statistical difference was observed between L4-L5 signals and control level (ANOVA, $p<0,0001$). L4-L5 levels demonstrated a large spike amplitude of SC signal. It could be discussed that SCSe could serve as diagnostic tool in chronic pain. Several clinical trials must be performed to confirm these results.

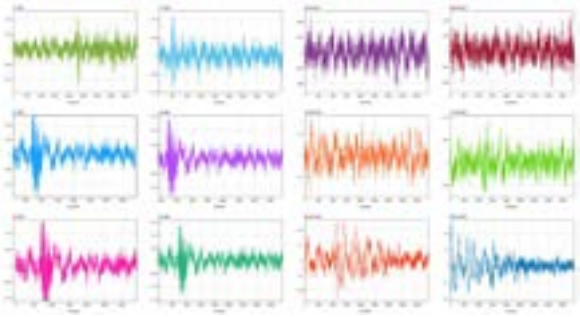

Figure: Left rows: L4-L5 radiculopathy (R) signals, Right rows: L2-L3 Control signal (C): The R signal demonstrated different spike amplitude (R) in contrast with C signal showed no significant spike.

Recent Publications:

1. György Buzrzaâki, Costas Anastssou, Cristoph KochThe origin of extracellular fields and currents-EEG,ECoG,LFP ans spikes, Nature Rev Neuroscience, 13, 407-420(2012).

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3. Semmlow J, L: Biosignal and biomedical image processing Matlab Based Application. Dekker, New York (2004)
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5. Grimm L, G, Yarnold P, R: Reading and Understanding Multivariate Statistics. Washington DC. American psychological Association (2002).

Biography

Damien Haton-Pietrin is interventional pain specialist, Postgraduate in Mathematics and Physics. He works partial time at Neuromodulation Fundamental Physics for the passion of research in biophysics and especially Central Nervous System Physics in chronic pain to SCS close loop devices.

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