Advanced techniques for treating deep-seated tumor using Electrochemotherapy (ECT) and Irreversible Electroporation (IRE)

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It is our pleasure to announce a special issue featured in the journal Biomedical Engineering Online.

This special issue captures the latest research on treating deep-seated tumors either by Electrochemotherapy (ECT) or Irreversible Electroporation (IRE). In the special issue, several of the papers highlight recent efforts to address some of the current challenges associated with treating deep-seated tumors using electroporation-based therapies.

This issue is a result of a special session, which was organized by COST TD1104 Action EP4Bio2Med (http://www.electroporation.net) at the MBEC2014 6th European Conference of the International Federation for Medical and Biological Engineering held in Dubrovnik, Croatia from September 7-11, 2014 (http://www.mbec2014-ifmbe.org). It hosted a number of distinguished speakers from around the world. The presentations were grouped into three topics: i) clinical experience using electroporation based treatment of deep-seated tumors; ii) modeling and treatment planning for deep-seated tumors using electroporation; and iii) prognostic imaging in deep-seated tumors using electroporation.

Current challenges that have been identified during the special session when discussing either IRE or ECT of deep-seated tumors were: tissue conductivity determination (necrotic regions, vasculature, micro-heterogeneities); conductivity changes due to electroporation (amount and dynamics); threshold determination for electroporation (reversible, irreversible) also as a function of pulse parameters (duration and number of pulses); and the accuracy needed for treatment planning, positioning of electrodes, which consequently dictates both accuracy as well as the robustness of a treatment plan.
Many of these challenges have been further addressed in papers presented in this special issue, and although they do not offer immediate and ultimate responses to all of the challenges identified, they do show possible directions on how to approach many of them. However, it is becoming clear that we will only be able to make this technology platform available for widespread use by clinicians and provide the best outcome and benefit for the patient through a holistic analysis of: imaging, treatment planning, and clinical feedback.

From the point of view of the clinician, the challenge is that currently it takes too long when compared to other minimally-invasive procedures such as microwave or RFA due to the requirement of multiple needles for IRE whereas in RFA and microwave, only one probe is inserted.

Electroporation based therapies currently require accurate placement of two or more electrodes within the region of interest. At the present time IRE procedures tend to extend for significantly longer time compared to other ablation technologies. Despite the use of ultrasound (US) during the electrode placement process, it is challenging and time-consuming; this is mainly due to the inherent nature of tumors treated with IRE which are surrounded by critical structures. More extensive use and availability of treatment planning will aide physicians with the electrode placement process given that it illustrates, on a physics-based model, what the most optimal and feasible electrode placement procedure may be.*

The six papers and the editorial published in the special issue are all open access and thus accessible to everybody.

Professors Miklavcic and Davalos served as guest editors and the journal is available at: http://www.biomedical-engineering-online.com/supplements/14/S3

* This text was in part taken from:

Electrochemotherapy (ECT) and irreversible electroporation (IRE) - advanced techniques for treating deep-seated tumors based on electroporation Damijan Miklavcic, Rafael V Davalos