Guest Editorial: Developments in Electromagnetic-Based Medical Technologies

IN THE recent years, the research community has dedicated research endeavors in the development and optimization of electromagnetic-based medical technologies (EMTs). These have the potentialities to offer innovative solutions for the diagnosis and/or treatment of unsolved urgent clinical needs: cancer, cardiovascular and aging-related diseases. Novel, affordable and clinically viable strategies and devices, ranging from adjuvant oncologic treatments and diagnosis up to monitoring and treatment of other very spread diseases such as the one affecting the cardiovascular area, are clearly needed to improve both prevention and cure in these fields.

In this framework, the scientific community gathered to better the chances of success through collaborative schemes such as the MyWave CA17115 COST action, involving clinicians and market inputs. MyWave, with its dedicated Working Groups, supports the great potential that EMTs hold in offering an alternative to or an optimization of traditional medical solutions. The Working Groups are focused on the following.

- Gathering accurate knowledge of the human tissues properties to provide foundations for future EMTs development as well as de-risk existing technologies and foster commercial acceptance;
- Optimizing numerical and experimental modelling techniques to fasten and optimize the EMTs' design and implementation to pave the way for a wider and safer clinical acceptance;
- Optimizing current treatment planning and quality assurance protocols to improve EMTs' safety and effectiveness.

This Special Issue gathers outstanding progresses of international research groups dedicated to EMTs development. This Special Issue wants to provide an in-depth overview of the field yet keeping in mind the medical devices acceptance end-goal. Specifically, this Special Issue focuses on the folowing two main pillars.

- EMTs design optimization including antennas and applicators ranging from microwave imaging to thermal and nonthermal electromagnetic-based therapies.
- Treatment planning (e.g., computational models), quality assurance protocols and monitoring/imaging tools aimed at encouraging clinical acceptance.

Numerical, experimental as well empirical approaches have been considered in the nine manuscripts collected by this Special Issue. The manuscripts tackle cancer (Lodi *et al.*, Bellizzi *et al.*, Gaffoglio *et al.*, Kok *et al.*, Bevacqua *et al.*, Wang *et al.*) and hypertension (Bottiglieri *et al.*), leading causes of mortality and morbidity worldwide, shortly followed by injuries linked with an aging society (Amin *et al.* and Rodriguez-Duarte *et al.*).

Four contributions focus on the thermal effect of the electromagnetic field in both superficial and deep hyperthermia, on novel solutions to improve treatment planning and clinical success. Lodi *et al.*, Bellizzi *et al.*, and Gaffoglio *et al.* deal with numerical models exploring applicators and device design optimization, and strategies for treatment refinement. Kok *et al.* give an overview on the ongoing developments in the clinical applications.

Bottiglieri *et al.* target the use of microwave ablation for a critical target and paves the way for future validation of its clinical feasibility.

Other four contributions present microwave or millimeter-wave imaging solutions for different anatomical targets. These works range from phantom design, as in Amin *et al.* to image reconstruction techniques, as in Bevacqua *et al.* and Rodriguez-Duarte *et al.* Finally, Wang *et al.* propose a novel modality for microwave ablation monitoring.

In conclusion, we wish to thank all the colleagues for their valuable work, for their contributions and the endless interest in collaborating: key factors of the success of this community driven by the ambition to bring EMTs from the bench to the bedside for the benefit of patients.

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