



Newsletter No. 114

Non-thermal Ablation and Drug Delivery by Electroporation: Expanding Current Indications

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During 90's and into 2000's the development of electrochemotherapy, i.e. combination of reversible electroporation and (specific) chemotherapeutic drugs, for cancer patients filled us with enthusiasm. We were expecting rapid and widespread adoption of the treatment for various solid tumours. The lack of it was first ascribed to the 2008-10 economic crisis, but even after the crisis electrochemotherapy was mainly limited to Europe and the numbers of patients benefiting from this very effective treatment was continued to be low in spite of efforts by the actors involved.

In 2005 irreversible electroporation as a nonthermal ablation method was proposed and demonstrated in preclinical models of malignant and non-malignant diseases. In my opinion the combination of the electroporation with a cytotoxic drug like bleomycin clearly offers the specific and beneficial effect by mainly affecting fast dividing cells as opposed to irreversible electroporation which indiscriminately kills all the cells within the perimeter of irreversible electroporation.

Interestingly enough (and unfortunate) the two treatments, i.e. irreversible electroporation and electrochemotherapy, were kept separate and the dominating companies each was pursuing its plans and develop their own target diseases/tumours/approaches and markets. Even occasional coalescence of interventional radiologists and surgeons using either of them did not bring the two together. In a very similar way scientific literature remained separated and even though irreversible electroporation and reversible electroporation in vivo using e.g. needle electrodes will inevitably cause both (Figure on the 2nd page). Irreversible in the vicinity and reversible on periphery which could effectively treat the "safety" margin of the tumour, the use of combination therapy seems to be not attractive enough to be further explored and developed. Needless to say, but to state it explicitly — reversible electroporation (in electrochemotherapy) is accompanied by irreversible electroporation around the electrodes and therefore cannot be avoided.

Same pulse parameters can cause both – depending on the amplitude of electric field; numerical modelling of electric field distribution developed as the underlying tools and knowledge to develop treatment planning are the same; and the devices that are used for ECT and IRE are and can be the same. So why not combining the two approaches and benefit from extending the ablation volume by irreversible electroporation and simultaneously treating the rim of the tumour containing locally invading tumours cells selectively by adding the chemotherapeutic drug thus harnessing electrochemotherapy principle - reversible electroporation + chemotherapeutic drug (see Figure).

On the contrary, irreversible electroporation as an ablation method in cardiac electrophysiology has been recognized as a valuable tool that has shown tissue selectivity and efficiency in eliminating and isolating arrhythmogenic tissue in treatment of atrial fibrillation.

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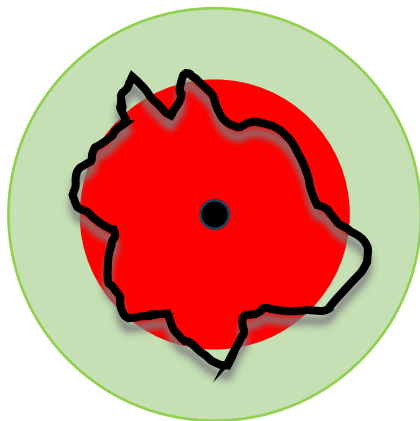
The speed of adoption is beyond any expectation, with the first device being approved by FDA in November 2023, and further in 2024. The number of patients being treated around the world is approaching a million without a single atrioesophageal fistula - the most dreaded adverse event in treatment of atrial fibrillation being reported.

Following the enormous success of Pulsed Field Ablation (PFA/IRE) in cardiac electrophysiology a number of companies are looking into possible other applications/treatments in addition to cardiac and cancer treatment: vascular malformation treatments [1], duodenum resurfacing for treatment of diabetes [2], chronic bronchitis and COPD [3], benign thyroid nodules treatment [4], and gene therapies.

Following the round tables on cardiac ablation (<https://2023.ebtt.org/round-table-recording>) and gene therapies (<https://2024.ebtt.org/round-table-recording>) this year we organize the round table to address above: The use of PFA beyond cardiac ablation with the distinguished panel of experts, medical doctors and company representatives (<https://2025.ebtt.org/round-table>) on Thursday, 13th November, 2025 at 15:15 Central European Time (CET). Join us by registering free of charge at: <https://2025.ebtt.org/round-table-registration-form>. Listen, put questions and see what the future holds.

We also invite you to join the EBTT (<https://www.ebtt.org>) online. Although the school is full you still can enjoy online participation with possibility to be part of discussions, benefiting the exercise/practical works and view of lectures on demand after the school for entire year to come.

References cited above can be found here



- Electrode
- Reversible electroporation
- Irreversible electroporation
- ~ Tumor outline

Tumour with rough edges infiltrating into surrounding tissue treated by a combination of irreversible and electrochemotherapy, i.e. reversible electroporation and specific chemotherapeutic drugs.

Forthcoming events

19th interdisciplinary postgraduate course and international workshop Electroporation Based Technologies and Treatments (EBTT)

Ljubljana, November 10 – 15, 2025 (*on-site* and *on-line* event)

<https://2025.ebtt.org/>

6th World Congress on Electroporation and Pulsed Electric Fields in Biology, Medicine, & Food and Environmental Technologies

Daytona Beach, September 27 – October 1, 2026

<https://wc2026.electroporation.net/>

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References:

[1] Busch CBE et al, 2025
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