

Electro Chemotherapy in Cancer

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Commentary

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DESCRIPTION

Electro chemotherapy is a method of chemotherapy that permits non-permeable chemicals to be delivered to the cell's interior. It is based on the local application of short and powerful electric pulses that transiently permeabilize the cell membrane, allowing molecules to pass through that would otherwise be blocked by the membrane. Clinical trials for the treatment of cutaneous and subcutaneous cancers have begun using medicines such as bleomycin or cisplatin. The first patient was treated with electro chemotherapy with bleomycin in 1991 at the Institute Gustave Roussy in France, and the first patient was treated with electro chemotherapy with cisplatin in 1995 at the Institute of Oncology in Ljubljana, Slovenia. Since then, electro chemotherapy has been used to treat over 4000 patients worldwide (Argentina, Australia, Austria, Belgium, Bulgaria, Denmark, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Mexico, Nicaragua, Poland, Portugal, Slovenia, Spain, Sweden, UK, and USA). Recently, new electro chemotherapeutic techniques for treating internal cancers using surgical procedures, endoscopic channels, or percutaneous approaches to get access to the treatment area have been established.

When a biological cell is exposed to a strong enough electric field, it produces an increase in trans-membrane voltage, which causes the cell membrane structure to rearrange. These modifications improve the permeability of the cell membrane, allowing non-permeable substances to enter the cell. This effect is known as electroporation (or electro-permeabilization) and is increasingly being employed to increase anticancer medication delivery into cells. Direct currents (all unipolar) with brief and strong pulses are used in all biological applications of cell electro-permeabilization (even though *in vitro*, time-decayed pulses can be used).

Research & Reviews: Reports in Cancer and Treatment

The amplitude of the pulses is determined by the tissues as well as the shape and position of the electrodes, but in the case of tumors, the amplitude of the electric pulses must be high enough to create an electrical field of 400 V/cm in the tumor area (8 pulses with duration of 100 microseconds). Pulses are typically one hundred microseconds long. Earlier tests used pulses with a period of 1 second (i.e. at a repetition frequency of 1 Hz); today, pulses are administered in a much shorter time period, with a repetition frequency of 5000 Hz, resulting in much less discomfort for the patient and a shorter length of therapy. To limit the possibility of pulse interaction with heart function when treating deep-seated malignancies in close proximity to the heart, pulses are synced with the absolute refractory period of each heartbeat. The electro chemotherapeutic treatment consists of providing non-permeate cytotoxic medications (e.g., bleomycin) or low-permeate pharmaceuticals (e.g., cisplatin) systemically or locally and applying electric pulses to the area to be treated when the drug concentration in the tumor is at its peak. Cells are subjected to an electric field during the delivery of the electric pulses, which causes the creation of Nano size defects on the cell membrane, altering the permeability of the membrane. Cytotoxic chemicals can freely diffuse into the cytoplasm and exert their cytotoxic impact at this period and for some time after the pulses are given. Multiple electrode placements and subsequent pulse delivery can be performed during a session to treat the entire lesion if the drug concentration is sufficient. To achieve regression of big lesions, treatment might be repeated over the course of weeks or months.