# IRE exploits programmed cell death to target cancer cells

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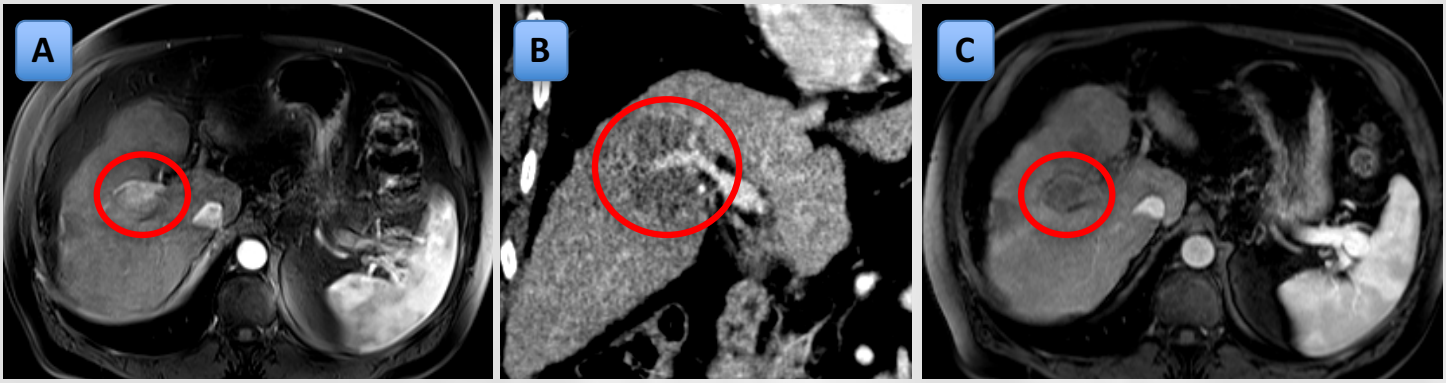
Irreversible electroporation (IRE) is an ablative cancer treatment in which needle electrodes apply electrical impulses to a well-defined treatment area. The electricity stimulates cells to open their pores — as they normally would to take in nutrients — but opens them permanently and induces apoptosis, a process of programmed cell death in which the intact cell simply shuts down and dies. Multicellular organisms rely on apoptosis to eliminate unnecessary or unwanted cells.




*(A) Pre-IRE ablation MRI showing tumor in the liver with enhancement; (B) Immediately post-IRE ablation demonstrating complete eradication of liver tumor sparing large portal vein, which is very unique and advantageous for IRE ablation; (C) Post-IRE ablation MRI showing complete eradication of liver tumor without residual.*

IRE is a fast, painless and effective cancer treatment. Its principle strength lies in its ability to kill cancer cells that are in close proximity to vital structures that must be left intact. Unlike other ablation techniques — including microwave, radiofrequency ablation and cryoablation — IRE does not destroy cells by means of coagulation necrosis (heating or freezing), which changes the nature of cell proteins and damages cell membranes. IRE's ability to induce apoptotic cell death is the key to its ability to spare important nearby structures, such as blood vessels and bile ducts in the liver.

"The trouble with coagulation necrosis is that the cells adjacent to the ones being treated are also at least partially destroyed by heat or freezing temperatures that emanate from the treatment zone," explains Stephen Kee, MD, professor of Radiology and chief of Interventional Radiology at UCLA. "Irreversible electroporation works in a different way. It causes them to open their pores and tells them, 'your time is done; you need to die.'"

UCLA played an active role in IRE basic scientific research, conducting pre-clinical studies of the technology. UCLA physicians are now using IRE to treat select liver, pancreatic and kidney cancer patients. At present, the procedure is reserved for cases where more standard ablation techniques would be problematic — principally due to adjacent vital structures that must be preserved.

The irreversible electroporation procedure is performed under general anesthesia because the electrical pulses cause local muscles to spasm during the treatment. The interventional radiologist places needle probes in parallel pairs across the treatment area. The electrical energy flows between the paired needles, which define the treatment area, so accurate placement is critical to treatment success. Mapping software helps determine the number of needle pairs required and how they should be positioned. Needle placement is done with CT or ultrasound guidance, or both.

"With IRE, the delivery of energy to the right place is technically very demanding," states Dr. Kee. "Getting the needles around the tumor accurately can be very cumbersome. In treating liver tumors, for example, the ribs can get in the way of placing needles in their ideal locations — you sometimes have to angle them in from less ideal insertion points."

With the needles in place, delivery of energy to treat the tumor takes only minutes. Follow-up treatment may be required after about two months to treat edges of the tumor that continue to grow.

IRE is just one of the latest cancer treatment modalities offered by UCLA interventional radiologists, who perform both vascular and percutaneous procedures. Each case is evaluated independently and patients are offered the treatments that are most appropriate for their health needs.