Using a toroid transducer for thermal ablation by high-intensity-focused ultrasound increases the coagulated volume.

David Melodelima, William Apoutou N’Djin, Hubert Parmentier, Michel Rivoire, Jean-Yves Chapelon

To cite this version:

Using a toroid transducer for thermal ablation by high-intensity-focused ultrasound increases the coagulated volume

David Melodelima PhD, William A. N'Djin, Hubert Parmentier MD, Michel Rivoire MD, PhD and Jean-Yves Chapelon PhD

Here, we report that a new design of High Intensity Focused Ultrasound transducer can significantly enlarge the coagulated volume over short periods of time, and that treatment in the liver can be guided in real-time using an integrated ultrasound imaging probe. Eight ultrasound emitters, divided into 256 elements, were created by sectioning a single toroid piezocomposite transducer. The focal zone was conical in shape and located 70 mm from the transducer, enabling the treatment of deep-seated tumors. A single thermal lesion was created when the eight emitters performed alternative and consecutive 5s ultrasound exposures. This paper presents in vivo evidence that the coagulated volume obtained from a 40 s total exposure in the liver was 7.0 ± 2.5 cm$^3$ (min 1.5 – max 20.0 cm$^3$). All lesions were visible with high contrast on sonograms. The correlation between the diameter of lesions observed on sonograms and during gross examination was 92%. This method also allowed the user to easily enlarge the coagulated volume by juxtaposing single lesions. This approach may have a role in treating unresectable colorectal liver metastases and may also be used in conjunction with resection to extend its limits.