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Histotripsy and the developing role of microbubbles in ultrasound therapy

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Microbubbles in therapeutic ultrasound has seen increasing interest in recent years. Once thought to be problematic, bubble production and interactions with ultrasound fields are yielding promising new methods and this presentation will review two areas of collaborative research at the University of Michigan investigating therapeutic applications utilizing microbubbles.
Histotripsy uses short pulses of high intensity ultrasound produce cavitation in vivo and subdivide tissue at a subcellular level. The highly localized bubble activity homogenizes tissue to the point of reducing acoustic backscatter enabling lesion detection. Lesion margins are remarkably fine, even yielding fractional disruption of cells. The homogenized material is readily absorbed thus debulking tissue with little residual scar.
At the other end of the acoustic intensity scale, microbubbles can be produced by triggering vaporization of superheated liquid droplets, termed acoustic droplet vaporization (ADV). ADV requires diagnostic levels of ultrasound to yield localized microbubbles production. The method is being investigated for direct occlusion therapy and perfusion control to augment other therapeutic methods including drug delivery among other potential applications.
These methods highlight the growing field of microbubble-based therapies, which will expand with our increasing understanding of microbubbles and their interactions with surrounding environments. Supported in part by NIH EB00281, HL077629 and EB006476.