

ACOUSTICS2008/3358
High intensity ultrasound activation of coagulation factors

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Although it has been demonstrated that High Intensity Focused Ultrasound (HIFU) can induce vascular cauterization, acoustic hemostasis technology has not been successful in making the transition from proof-of-concept to clinical settings. One reason for this lack of acceptance is the limited understanding of the fundamental mechanisms involved in ultrasound-vessel and ultrasound-blood interactions. The aim of this research was to investigate the hematological and biochemical mechanisms which are influenced by HIFU induced coagulation.

HIFU was used to induce coagulation in an in vitro hematological flow system and in animal models. The flow circuit and in vivo arteries were instrumented with flow probes and thermocouples in the treatment region. Physiological parameters were recorded throughout the in vivo experiments. Blood samples were drawn for analysis prior to, during, and immediately following each HIFU treatment. Clotting time, complete blood count, and biochemical analysis were performed immediately and citrated samples were immediately centrifuged and frozen for future analysis.

Results indicate that HIFU can change local and systemic levels of thrombin/anti-thrombin complex (TAT) and tissue plasminogen activator (tPA), as well as induce changes in activated clotting time (ACT). These results indicate that HIFU can induce coagulation via the coagulation cascades (TAT) and that normal hematological response to thrombus formation is unaffected.