Detection of Primary Stages of Intravascular Blood Coagulation by Acoustic Methods

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Abnormalities of blood coagulation cause serious pathological complications. Nowadays accessible laboratory analyses of blood coagulation status have a number of severe shortcomings. First of all invasiveness of existing method does not allow to conduct tests very often. However in a number of pathologies parameters of blood coagulation system (BCS) can change significantly within an hour or even faster. In the second place blood probe can characterise only general BCS abnormalities. As a result local coagulation associated with inflammation, oncology or vascular disease can remain unnoticed. And last but not least analyses processing lasts for about an hour, what can be crucial when immediate medical help is needed.

As a result there is a desperate need for a continuous noninvasive method for BCS observation. It is understood that registration of yet reversible early stages of coagulation processes is considered as the most important.

In the present work we describe our attempts to apply ultrasonic methods for detection of primary stages of intravascular coagulation. We discovered that processes of formation of microagregates at early stages of blood coagulation are accompanied by acoustic contrast. Significant and rapid rise of intensity of reflected ultrasonic signal was found to occur simultaneously with appearance of optically detectible microclots. Beside these in vitro experiments we conducted clinical observation over patients in our Centre. As a result we recorded echo-contrast effects in vessels. Generally, echo-contrast localization was near the centre of a pathological inflammation. At the same time these patients' blood tests showed noticeable increase of blood coagulability.

In our opinion the results of experiments show a principal opportunity to use acoustic methods for nonivasive coagulography. Comparison of experimental and clinical data allows us to conclude that the increased echogenesity of blood can be used as a risk index for intravascular coagulation. Further experimental and clinical research will allow us to determine fields of application, to investigate stages in formation of intravascular blood clots and to estimate efficiency and features of action of different coagulologic drugs in intensive flows.

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