Researchers develop novel technology to quantify protein critical to blood clot formation through breath gas analysis

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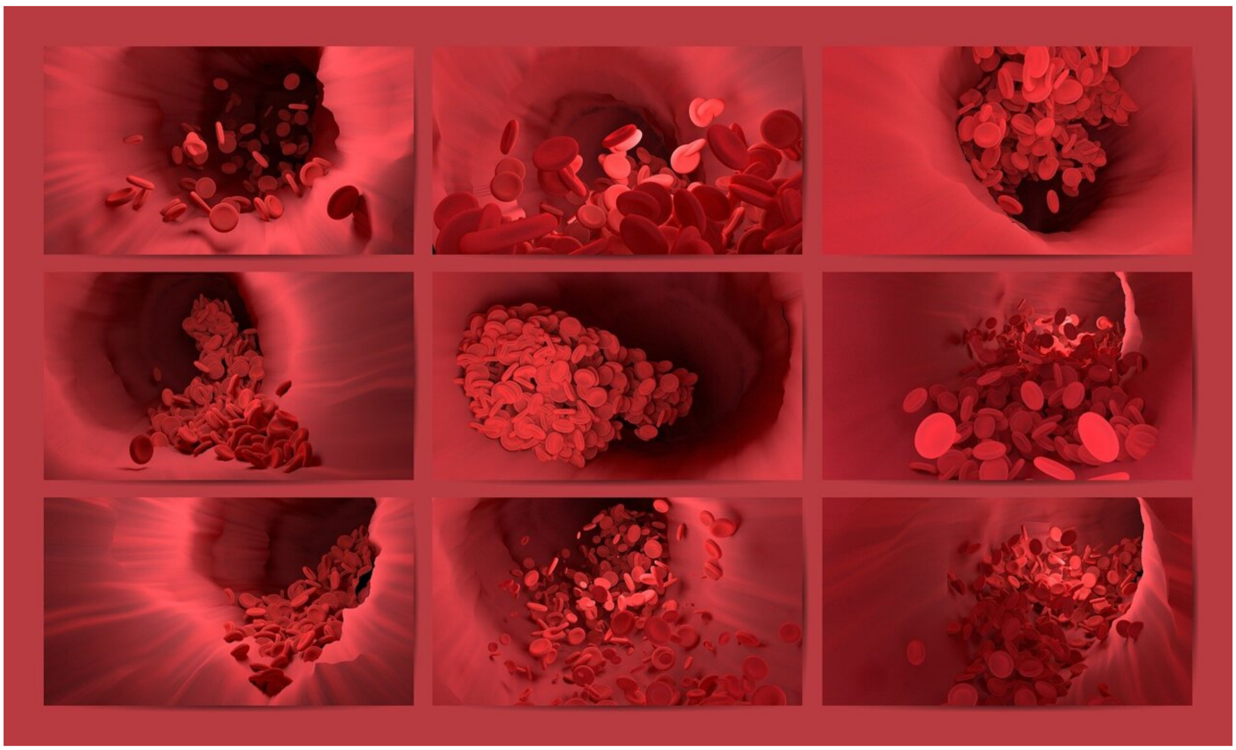

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Immunothrombosis, or the formation of microscopic blood clots during inflammation, is a major cause of morbidity among patients with sepsis or severe COVID-19. A key enzyme in this process is thrombin. To date, no method exists for early detection of immunothrombosis in a living organism.

A team of investigators led by Ali Hafezi-Moghadam, MD, Ph.D., director of the Molecular Biomarkers Nano-Imaging Laboratory (MBNI) at Brigham and Women's Hospital, a founding member of Mass General Brigham health care system, and an associate professor of Radiology at Harvard Medical School, developed a novel technology to diagnose immunothrombosis by measuring thrombin activity through breath gas. The findings are published in the journal *Advanced Materials*.

The researchers generated hyperbranched polymeric nanoprobes, containing thrombin-sensitive regions bound to reporter molecules that would become gaseous upon liberation. Thrombin in microvessels of animals with immunothrombosis liberated the volatile reporter that was then exhaled through the lungs.

Gas biopsies, or samples from the exhaled breath, were analyzed in gas chromatography mass spectrometry to deduce the intravascular thrombin activity. These results lay groundwork for clinical translation.

"Early diagnosis of immunothrombosis and intervention could prevent organ failure in patients with sepsis or severe COVID-19," said Hafezi-Moghadam. "Our technology provides unprecedented knowledge of key enzymatic activity anywhere in the body. Such real-time measurement has the potential to improve personalized and precision treatments and save lives."

More information: Yuanlin Zhang et al, Breath Biopsy Reveals Systemic Immunothrombosis and Its Resolution Through Bioorthogonal Dendritic Nanoprobes, *Advanced Materials* (2023). DOI: 10.1002/adma.202304903

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