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# Magnetic Nanoparticles Promise to Prevent Strokes and Heart Attacks

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Magnetic nanoparticles have served as the foundation for a number of medical technologies, including drug delivery, medical imaging contrast agents and cancer diagnosis and treatment.

Now researchers at Houston Methodist are loading up magnetic nanoparticles with drugs and camouflaging them from the immune systems so that they can destroy blood clots at a rate about 100 to 1000 times faster than a commonly used clot-busting technique.

The albumin, which creates the outer cover, provides a sort of camouflage, giving the loaded nanoparticles time to reach their blood clot target before the body's immune system recognizes the nanoparticles as invaders and attacks them. Iron oxide was chosen for the core because the researchers plan to use them for magnetic resonance imaging, remote guidance with external magnetic fields, and for further accelerating clot dissolution with localized magnetic heating. The clot-busting drug loaded into the nanoparticles is tPA, (tissue plasminogen activator), an enzyme that is also found naturally in blood at low concentrations. Typically, a small volume of concentrated tPA is injected into a stroke patient's blood upstream of a confirmed or suspected clot. From there, some of the tPA reaches the clot, but much of it may cruise past or around the clot, potentially ending up anywhere in the circulatory system. tPA is typically used in emergency scenarios by health care staff, but it can be dangerous to patients who are prone to hemorrhage.

Overall, these nanoparticles may represent an advance in preventing heart attacks, strokes and pulmonary embolisms. Further safety and effectiveness studies are still required to achieve human clinical trials. “We are optimistic because the FDA has already approved the use of iron oxide as a contrast agent in MRIs,” Paolo Decuzzi the study's co-principal investigator said. “And we do not anticipate needing to use as much of the iron oxide at concentrations higher than what's already been approved. The other chemical aspects of the nanoparticles are natural substances you already find in the bloodstream.” Decuzzi said that his group will continue to examine the feasibility of using magnetic fields to guide and heat the nanoparticles.

**Key words:** magnetic nanoparticles, stroke, heart attack