Microparticles may have a key role in diabetes-induced vascular dysfunction

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Video Abstract

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Abstract

For people with diabetes, the dangers of high blood sugar are long established. Now, scientists have uncovered additional components in the blood that can worsen the disease. In a new article in the *Journal of Physiology*, researchers report that microparticles shed from cells under diabetic conditions have unique inflammatory properties that may help explain the multiple organ vascular dysfunction that's common to the disease. Microparticles have been increasingly recognized as important biomarkers in various health conditions. But most prior reports have relied on in vitro studies to evaluate particle function. Because in vitro experiments can't fully replicate physiological conditions, defining exactly how microparticles affect disease progression has been tricky. This prompted researchers to look at the link between microparticles and diabetes-induced vascular dysfunction in vivo, in the microvessels of streptozotocin-induced diabetic rats. The team found an over 100-fold increase in circulating microparticles in diabetic rats compared to control animals. Most of these microparticles displayed multiple cell markers, indicating they were derived from different cell types, and formed aggregates in circulation. They also showed greater externalized phosphatidylserine than microparticles from normal rats. To examine how these microparticles affect vascular health, the researchers used single vessel perfusion and systemic cross-animal-transfusion techniques. Single vessel perfusion involves cannulating an intact microvessel in the mesentery with a perfusion pipette, without interrupting the surrounding circulation. These approaches allow a normal microvessel to be locally or systemically exposed to either normal or diabetic plasma. Any resulting pathological processes can be directly visualized and quantitatively assessed. The results showed that exposing normal microvessels to plasma collected from diabetic animals caused a buildup of microparticles along the vessel walls, which was similar to the accumulation naturally present in diabetic animals. The accumulated microparticles boosted white blood cell adhesion, increased vessel permeability and elevated vessel susceptibility to additional stimulation. Intriguingly, these effects weren't seen when phosphatidylserine exposure was blocked on the microparticles prior to infusion, suggesting that the unique composition of the microparticle surface was key to the results. The work supports that microparticles are not merely cellular byproducts when it comes to diabetes. Rather, they appear to actively disseminate inflammation throughout the vascular system.