New material with built-in vitamin A may reduce scarring

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While scarring is a natural part of any healing process, scar formation within our blood vessels can be deadly.

"When injury occurs, cells proliferate and migrate into the blood vessel, creating scar-like tissue," said Northwestern University's Guillermo Ameer. "It can create blockages that impair blood flow."

To prevent scarring and the dangerous damage that follows, Ameer and his team have developed a new biodegradable material with built-in vitamin A, which has been shown to reduce scarring in blood vessels. This soft elastic material can be used to treat injured vessels or be used to make medical devices, such as stents and prosthetic vascular grafts, to give them intrinsic healing properties. Early tests have shown that the material can reduce cell migration—a major contributor to the scarring process—by 57 percent.

Supported by the National Institutes of Health, the research is described online in *ACS Biomaterials Science and Engineering*. Robert van Lith, a postdoctoral fellow in Ameer's lab, is the paper's first author. Ameer is a professor of biomedical engineering in Northwestern's McCormick School of Engineering and of surgery in the Feinberg School of Medicine.

This research builds on Ameer's earlier work, in which he integrated vitamin C into the structure of a material used to grow tissues and improve the function of vascular grafts. He and his colleagues previously

demonstrated that locally applied vitamin A can significantly inhibit scarring in blood vessels. In his new work, vitamin A is integrated into the material, harnessing the beneficial properties of vitamin A and allowing for its broader application in medical devices.

"The original antioxidant material is based on citric-acid and has antioxidant properties," van Lith explained. "It has groups that react with other acids. By using an acid form of vitamin A, we linked it directly to the material."

This new advanced material brings together two major advantages. Its antioxidant component can reduce the oxidative stress that leads to chronic inflammation. And the vitamin A, which is released as the material degrades, can prevent or reduce scarring.

While the previous material could be used in open-heart surgery, the new version can be used for all endovascular procedures. It can potentially also be used outside the body, such as for wound-healing bandages for diabetic patients. Because the new material releases vitamin A as it degrades, the potential for toxic build up is much lower. Ameer's team can also control how quickly the material degrades—and thus releases the vitamin A—depending on how the material is produced in the laboratory.

Next, the team plans to explore the material's potential for additional applications. Vitamin A is already widely known for its anti-aging properties, and topical antioxidants can be used to combat cell damage or improve wound healing.

"Combining these two elements has great potential," van Lith said.

More information: Robert van Lith et al. Biodegradable Elastomers with Antioxidant and Retinoid-like Properties, *ACS Biomaterials Science*

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