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Vascular medicine

Shaping tomorrow's vascular landscape with extracellular matrix stents

Michael James * and Viren S. Sehgal

CUNY School of Medicine, Townsend Harris Hall, 160 Convent Avenue, New York, NY 10031, USA

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We read the paper by Pelliccia *et al*. with great interest. The authors discuss their study of emerging biological mechanisms underlying in-stent restenosis (ISR).[1] We wish to highlight the extracellular matrix (ECM)-coated stent as a promising novel stent that warrants further study.

The extracellular matrix comprises many components: collagen, elastin, proteoglycans, and glycoproteins. These components provide an interactive microenvironment, allowing for the physical support of cells and their response to disease.[2]

Different diseases result in different ECM morphologies; abdominal aortic aneurysms (AAA) are a great example. At the site of insult in AAA, there is an increase in serine elastases, matrix metalloproteinases, plasminogen activators (PAs), and endothelial cells (angiogenesis).[2] Thus, the AAA's microenvironmental niche appears destructive, and as inflammatory cells further release these components, the matrix is degraded. Research indicates that degraded matrix entities, such as matricryptins, promote specific cellular signaling, which may lead to the chemotaxis of neutrophils or endothelial cells and collagen fibrosis.[2]

Interestingly, a healthy vascular ECM promotes normal cellular differentiation and quiescence.[2] Proteins such as laminin, collagen IV, nidogens, perlecans, growth factors, fibronectin, matrix metalloproteinases (MMPs), and integrins promote adhesion and normal vessel morphogenesis.[2] Therefore, coating a stent with healthy ECM components may allow better integration of the stent into the vessel. It also has other benefits: anti-inflammatory effects, antiproliferative effects, and finally, anti-thrombogenic effects.[3]

A review by Yao *et al*.[3] discussed the different kinds of ECM coatings studied. There is the Bionic EC-ECM coating, Nature-inspired ECM coating, Wharton's Jelly ECM coating, a tailored ECM-mimetic coating, and the ECM-mimetic peptide coating. The tailored ECM-mimetic peptide coating within the review is an excellent example of a study that looked at ISR. An anti-thrombogenic human recombinant collagen that limits affinity for platelet adhesion but strengthens affinity for cells was developed. They ultimately tested a stent with collagen combined with hyaluronic acid; the results indicated an ISR percentage of 15.2% in one month, comparable to the rapamycin-eluted stent of 14.6% in one month. The ECM-coated stent also had significant anti-inflammatory effects, with an inflammation score lower than the rapamycin-eluted stent at one month.

Pelliccia and colleagues find that MMPs and high inflammation are associated with ISR. Given the potential of natural, biocompatible ECM-coated stents to reduce inflammation and ISR, we propose considering their use to optimize ISR. It could be a promising new direction for the future of vascular stents.

Data availability

No new data were generated or analysed in support of this research.

Authors' contribution

M.J. had the idea for this letter. V.S.S. and M.J. contributed equally to the writing of this manuscript.

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References

1. Pelliccia F, Zimarino M, Niccoli G, Morrone D, De Luca G, Miraldi F, De Caterina R. In-stent restenosis after percutaneous coronary intervention: emerging knowledge on biological pathways. *Eur Heart J Open* 2023;**3**. https://doi.org/10.1093/ehjopen/oead083.
2. Lin PK, Davis GE. Extracellular matrix remodeling in vascular disease: defining its regulators and pathological influence. *Arterioscler Thromb Vasc Biol* 2023;**43**:1599–616.
3. Yao S, Cui J, Chen S, Zhou X, Li J, Zhang K. Extracellular matrix coatings on cardiovascular materials—a review. *Coatings* 2022;**12**:1039.

* Corresponding author. Tel: +1 (845) 372 8587, Email: mjames004@citymail.cuny.edu