

INTERVENTIONAL CARDIOLOGY

3D printing of personalized implants for left atrial appendage occlusion

Approximately 90% of stroke-causing clots in patients with atrial fibrillation originate from the left atrial appendage (LAA), a trabeculated structure in the muscular wall of the atrium. Stroke-prevention strategies include surgical occlusion of the LAA with commercially available implants that come in limited sizes and shapes. A new study published in *Nature Biomedical Engineering* describes CT-guided 3D printing of personalized occluders to reduce the risk of incomplete closure of the LAA.

“This work provides the first proof of concept ... of using 3D-printed, personalized endocardial implants”

“We chose this project because the current solutions for LAA closure were not sufficient, often leading to leaks,” explains Bobak Mosadegh, one of the lead investigators. “We believe that medical imaging could help to solve this issue since we can easily acquire the geometry of each person’s LAA using a CT scan.”

In this study, 3D-printed custom moulds designed from CT images of patients’ LAAs were filled with a composite elastomeric material to generate soft, inflatable, balloon-like devices that could adopt the morphology of the LAA after cardiac implantation.

The investigators first validated the occlusion performance of patient-specific implants using an *in vitro* system replicating the communication between the left atrial and LAA chambers under pulsatile fluid flow. Next, a personalized device was

surgically delivered and inflated in a canine model and, 24 h after surgery, correct orientation of the implant in the LAA was confirmed at necropsy.

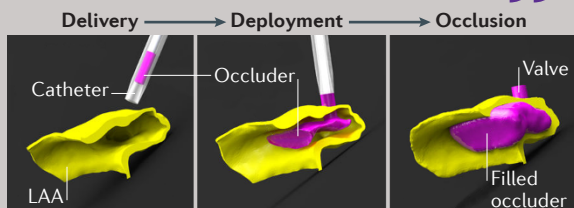
This study provides the first proof of concept of the feasibility and efficacy of using 3D-printed, personalized endocardial implants as an alternative approach for LAA occlusion to prevent the occurrence of stroke.

“This approach allowed us to settle on a very robust solution that met the clinical needs and leveraged some of the soft materials, 3D printing, and soft robotic solutions with which our engineering lab likes to work,” concludes Simon Dunham, another of the investigators. Future studies will involve long-term assessment of the devices, research into alternative delivery techniques, and further exploration of the possibilities that 3D printing can offer to the field of interventional cardiology.

Alexandra Le Bras

ORIGINAL ARTICLE Robinson, S. S. *et al.* Patient-specific design of a soft occluder for the left atrial appendage. *Nat. Biomed. Eng.* **2**, 8–16 (2018)

FURTHER READING Giannopoulos, A. A. *et al.* Applications of 3D printing in cardiovascular diseases. *Nat. Rev. Cardiol.* **13**, 701–718 (2016)



Reprinted from Robinson, S. S. *et al.* Patient-specific design of a soft occluder for the left atrial appendage. *Nat. Biomed. Eng.* **2**, 8–16 (2018) © Macmillan Publishers Limited.