Varicose vein three-dimensional printing model from duplex scan analysis images

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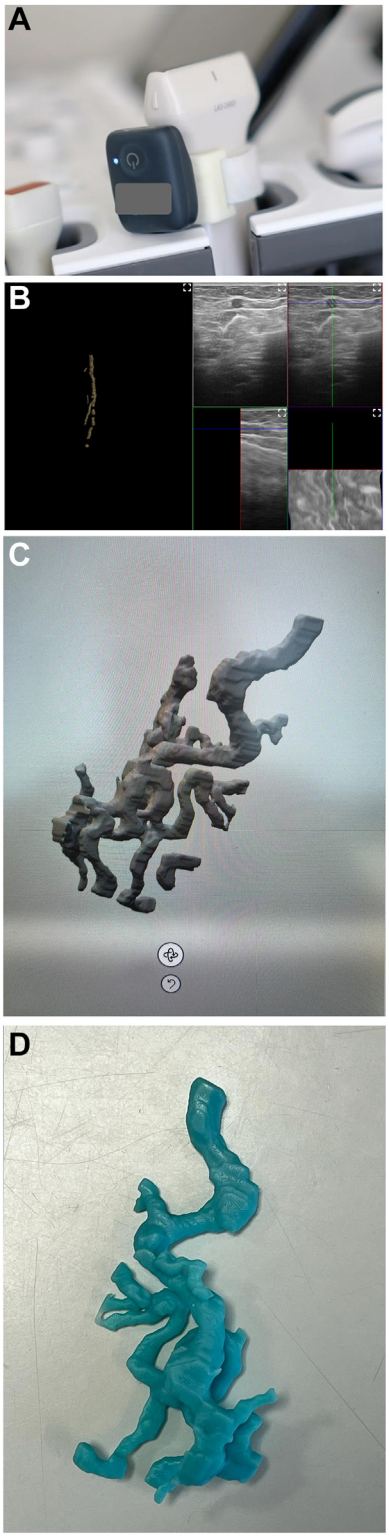
In medicine, three-dimensional (3D) printing is a technology widely used for the creation of complex anatomic geometries and internal structures with high accuracy and resolution.[1] These models are especially useful in biomedical applications, enabling accurate and detailed models of patient-specific anatomic structures. They have various clinical applications, including, but not limited to, preoperative planning, surgical simulation, and medical education.[2]

Until today, multiplanar reconstruction with 3D volume-rendered imaging has been derived from computed tomography or magnetic resonance angiography images. In the present pivotal study, a 3D printed model of a varicose vein was obtained from 3D color duplex ultrasound scan (CDUS) images.

A varicose leg tributary of the great saphenous vein from a 50-year-old woman with chronic venous disease (CEAP [Clinical, Etiologic, Anatomic, Pathophysiologic] class C2, Ep, As, Pr) was evaluated using a 3D-CDUS tool (PIUR t-US; Piur Imaging GmbH). The patient provided written informed consent for the report of her case details and imaging studies. A sensor positioned on the CDUS probe (*A*; Supplementary Video 1, online only) provided multiplanar varicose vein images, which were combined in a 3D output model through dedicated software (*B*; Supplementary Video 1, online only). Once the 3D model was obtained (*C*/Cover), it was printed (*D*/Cover; Supplementary Video 2, online only) using a stereolithography technique.

The use of 3D printing has been revolutionizing the field of medical modeling, providing specialists with more precise and realistic models for surgical planning and training. This technology has the potential to greatly improve patient outcomes by enhancing surgical accuracy and theoretically reducing the surgical time and costs. In the venous field, in which computed tomography and magnetic resonance imaging are not routinely used, 3D-CDUS models could easily increase and facilitate the knowledge of both thrombotic and varicose veins disease, providing interesting insights using a different "3D" perspective. In particular, 3D investigation might enable volume quantification in thrombotic disease, allowing for the analysis of thrombus modifications during the follow-up period.[3] Additionally, it could be useful in planning saphenous cannulation during thermal and nonthermal techniques and optimizing the release of sclerosing agents during tributary sclerotherapy. Finally, venous malformations could benefit from this 3D overview by highlighting afferent and efferent vessels and optimizing the treatment outcomes.



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