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IMAGES IN INTERVENTION

Facilitated Transfemoral Access by Shockwave Lithoplasty for Transcatheter Aortic Valve Replacement

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We present the case of an 80-year-old man who presented with symptomatic severe aortic stenosis and coronary artery disease (proximal left anterior descending artery, proximal circumflex artery, and first marginal branch). Surgical risk was considered high (Society of Thoracic Surgeons score 8.3%), so the decision was made to perform percutaneous revascularization and transcatheter aortic valve replacement (TAVR). A pre-procedural computed tomographic scan showed severe calcified peripheral artery disease that involved the iliofemoral arteries, with a minimum diameter of 4.8 mm at the level of the left common femoral artery and 5 mm at the level of the right external iliac artery (**Figure 1**, Online Video 1). Peripheral arterial disease also affected the subclavian and carotid arteries, which had severe atheromatosis and did not have the minimum diameter required for TAVR. The patient refused transapical and transcaval approaches because these procedures require general anesthesia, so we evaluated the possibility of transfemoral access facilitated by the Shockwave Lithoplasty balloon (Shockwave Medical).

The Shockwave Lithoplasty balloon (**Figure 2**) is a system that enables treatment of calcified stenoses of the peripheral arteries by lithotripsy (sonic pressure waves). The objective of this system is calcified plaque modification to improve vessel compliance, by the administration of lithotripsy waves that disrupt superficial and deep calcium with a minimal impact on healthy tissue.

The optimal right common femoral artery puncture site was identified by ultrasound guidance. A 6 × 60 mm Shockwave Lithoplasty balloon catheter was advanced to the right external iliac artery over a 0.014-inch wire. The balloon was inflated up to 4 atm (lithotripsy delivery pressure), and the connector was activated to initiate the lithotripsy pulses. A cycle (30 pulses) was delivered at the level of the iliac stenosis, and the procedure was repeated 4 times from the iliac artery to the common femoral artery, maintaining a minimum of 1 cm catheter overlap. After each cycle, the balloon was inflated at nominal pressure (6 atm) (**Figure 3**, Online Videos 2, 3, and 4). Once Shockwave Lithoplasty balloon dilatation was performed, a large sheath (20 F) was inserted through the iliofemoral vessels without complications. TAVR was performed successfully using a 34-mm CoreValve® Evolut R (Medtronic). Vascular access was sutured using a Prostar XL (Abbott Vascular). Finally, contralateral angiography ruled out vascular complications after the procedure (**Figure 4**, Online Videos 5, 6, and 7).

To the best of our knowledge, use of the Shockwave balloon to facilitate transfemoral TAVR has not been described before. This system treats specifically superficial and deep calcium with minimal impact on healthy tissue; therefore, it reduces the chances

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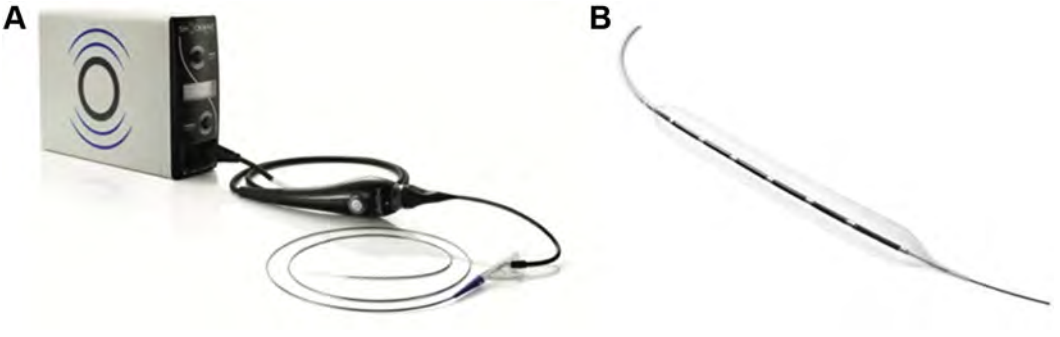
FIGURE 1 Angiography, 3-Dimensional Computed Tomographic Reconstruction of Iliofemoral Arteries, and Computed Tomographic Analysis of the Right Iliofemoral Arteries

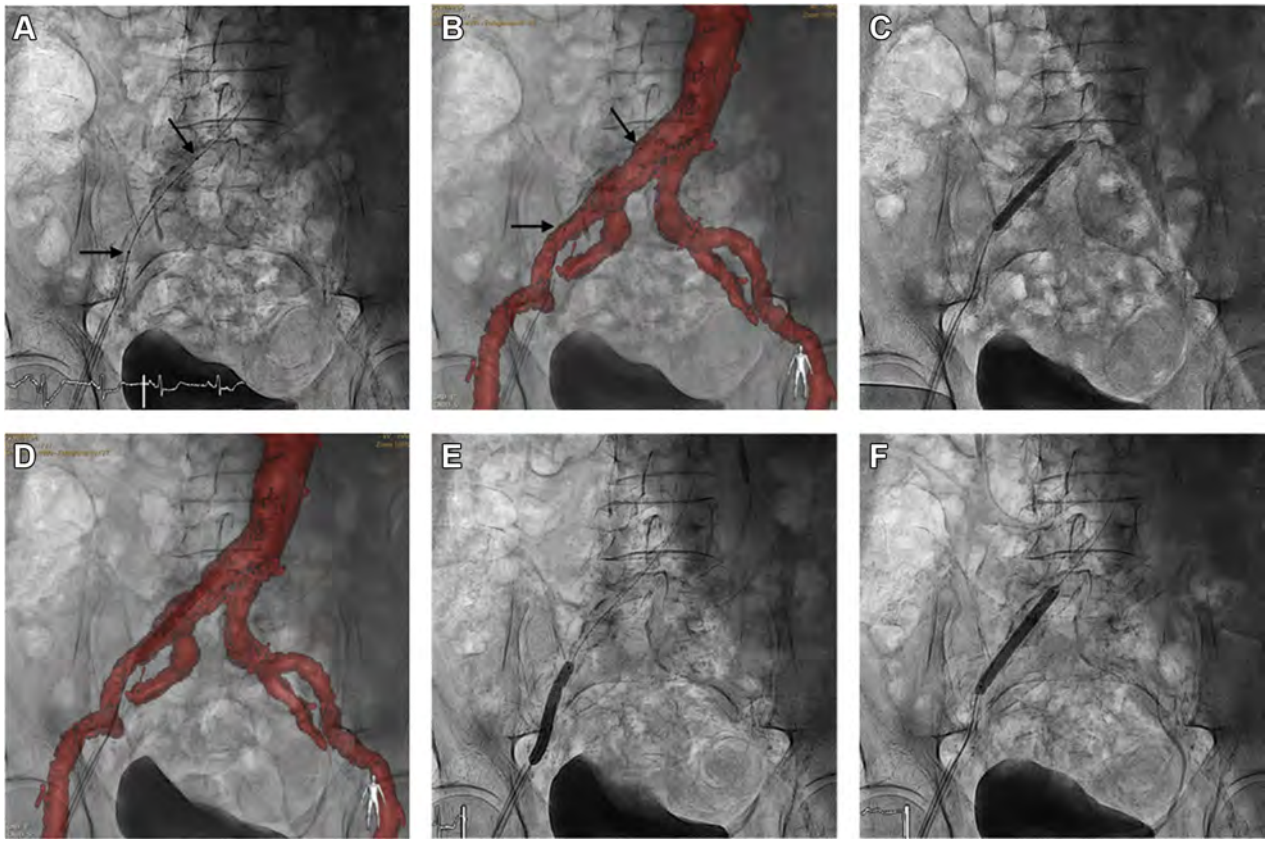
(A) On angiography, the **arrow** shows the minimum diameter measured at the level of the right external iliac artery. **(B)** Three-dimensional computed tomography showed severe calcified iliofemoral arteries with the minimum diameter at the level of the left common femoral artery and the right external iliac artery **(arrows)**. **(C)** Computed tomographic analysis of the right iliofemoral system revealed a narrower luminal diameter at the level of the external iliac artery (4.8 mm). See Online Video 1.

FIGURE 2 Shockwave Lithoplasty Balloon



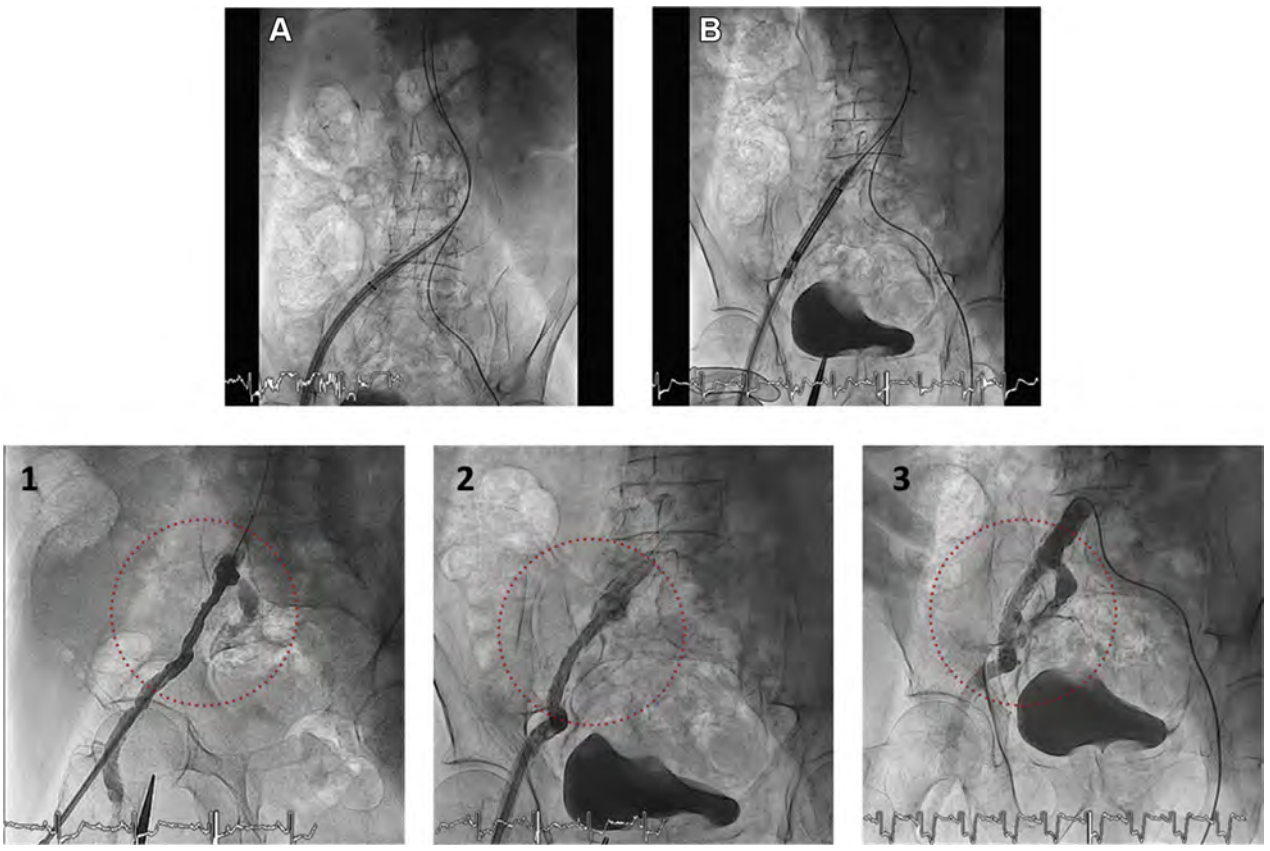
The system consists of the generator, the connector cable, and the lithoplasty catheter **(A)**. Semicompliant balloon catheter with integrated lithotripsy emitters along the length of the balloon and 2 radiopaque markers **(B)**.

FIGURE 3 Shockwave Lithoplasty Balloon Dilatation



(A,B) Arrows show the distal and proximal markers of the balloon. Computed tomographic angiography-fluoroscopy fusion imaging provided additional value in the assessment of tortuosity and calcification during the procedure. **(C to F)** Treatment from the iliac artery to the common femoral artery. See Online Videos 2, 3, and 4.

FIGURE 4 Transfemoral Transcatheter Aortic Valve Replacement and Final Iliac Angiography



A 20-F sheath was inserted **(A)**. The EnVeo PRO delivery system was advanced through the sheath without complications **(B)**. Pre-procedural femoral-iliac angiography **(1)** and after Shockwave Lithoplasty balloon dilatation **(2)**. Final contralateral angiography **(3)**. The **dashed red circles** indicate the narrowest diameter of the artery and highlight the difference in diameter at that point between the initial and final angiography. See Online Videos 5, 6, and 7.

of vessel dissection or rupture. Lithoplasty has been shown to be an effective and safe system for the treatment of moderate and severely calcified femoropopliteal arteries, even in chronic total occlusions (1). The results showed a significant reduction in stenosis severity with high acute gain, no major adverse events, and low rates of stent implantation and target injury revascularization at follow-up. Hence, transfemoral access facilitated by the Shockwave Lithoplasty balloon can be considered in patients with severe calcified peripheral artery disease, after an individual and careful assessment.

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KEY WORDS facilitated transfemoral access, shockwave lithoplasty, TAVR

APPENDIX For supplemental videos, please see the online version of this paper.