

Case Report 

# To Turn Over Rocks for Transcatheter Aortic Valve Replacement: Closure Time With Adenosine Diphosphate to Support Decisions in a Complex Transcatheter Aortic Valve-in-Valve Procedure

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## ABSTRACT

We report a patient with severe aortic stenosis with an extremely high calcium score who underwent a transfemoral transcatheter aortic valve replacement with an Evolut R (Medtronic, Minneapolis, MN) and needed a valve-in-valve approach with a SAPIEN 3 (Edwards Lifesciences, Irvine, CA) to treat significant paravalvular leak. Interestingly, the closure time with adenosine diphosphate, assessed using the Platelet Function Analyzer 100 (Siemens Healthcare Diagnostics, Los Angeles, CA), measured after each important step of this complex procedure, correlated very well with the severity of the paravalvular leak.

## RÉSUMÉ

Nous rapportons le cas d'un patient présentant une sténose aortique grave et un taux extrêmement élevé de calcium, qui a subi un remplacement valvulaire aortique par cathéter par voie transfémorale au moyen du système Evolut R (Medtronic, Minneapolis, Minnesota) et qui a nécessité l'installation d'une valve SAPIEN 3 (Edwards Lifesciences, Irvine, Californie) dans la valve déjà en place pour traiter une importante fuite paravalvulaire. Fait intéressant, une étroite corrélation a été observée entre la gravité de la fuite paravalvulaire et le temps de fermeture avec l'adénosine-diphosphate, évaluée à l'aide du dispositif Platelet Function Analyzer 100 (Siemens Healthcare Diagnostics, Los Angeles, Californie) et mesurée après chaque étape importante de cette intervention complexe.

Valvular calcium burden and distribution must be assessed before transcatheter aortic valve implantation for a better device selection (Fig. 1 A and B) and prevention of complications. Furthermore, we now know that aortic regurgitation after transcatheter aortic valve replacement can be assessed using a fast screening method at the time of the procedure.<sup>1</sup> In fact, the Platelet Function Analyzer 100 (Siemens Healthcare Diagnostics, Los Angeles, CA) can be used to evaluate the hemostasis status and reflects the loss of high molecular-weight multimers of von Willebrand factor. It has been shown that an elevated closure time (> 180 seconds) with adenosine diphosphate (CT-ADP) was strongly associated with more than mild aortic regurgitation and higher mortality rate at 1-year.<sup>1</sup>

## Case

Our patient was a 85 year-old woman, with a medical history significant for hypertension and a non-Hodgkin lymphoma treated with radiation therapy targeting the chest in 1990. She was admitted in the setting of an acute stroke and de novo atrial fibrillation. The transthoracic echocardiography showed a severely calcified aortic valve stenosis with peak and mean gradients of 109 mm Hg and 67 mm Hg, respectively. Because of her high surgical risk and frailty status, the heart team elected to favour a transcatheter approach. The electrocardiogram-gated multislice computed tomography imaging showed an aortic valve area of 485 mm<sup>2</sup>, an aortic perimeter of 79.7 mm, a diameter of the sinus of Valsalva of 43 mm, and an Agatston calcium score of 8215 Hounsfield units (Fig. 1 D-F). The severe calcification was protruding in the left ventricular outflow tract. To minimize the risk of annular rupture, a self-expandable Evolut R (Medtronic, Minneapolis, MN; Fig. 1A) was selected. The baseline CT-ADP value was elevated at 314 seconds.

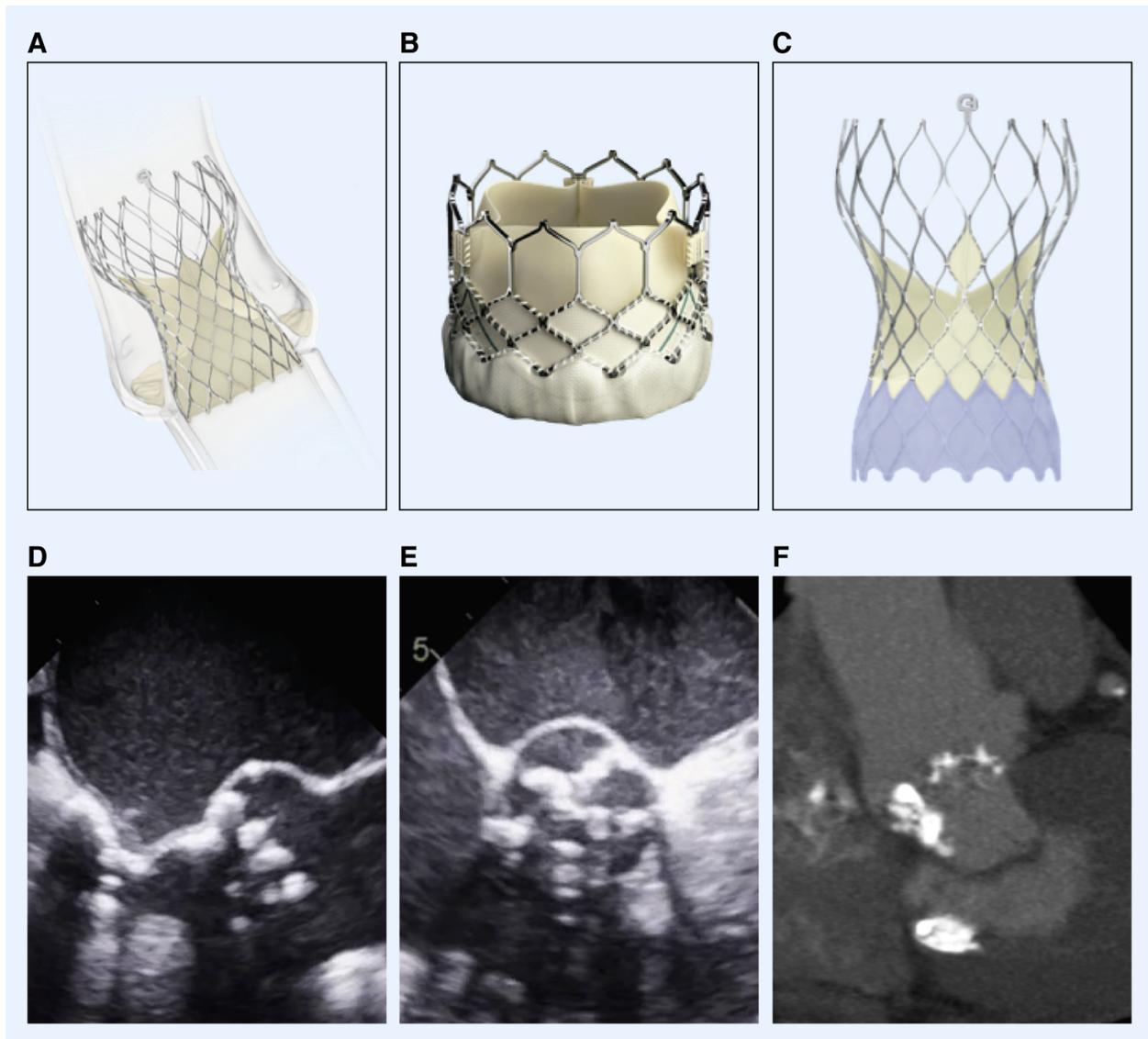
In the cardiac catheterization laboratory, a predilation was performed with a 16-mm Z-MED balloon (B. Braun Interventional Systems, Bethlehem, PA) (Video 1 ); view video online). Then, a 29-mm Evolut R was partially deployed

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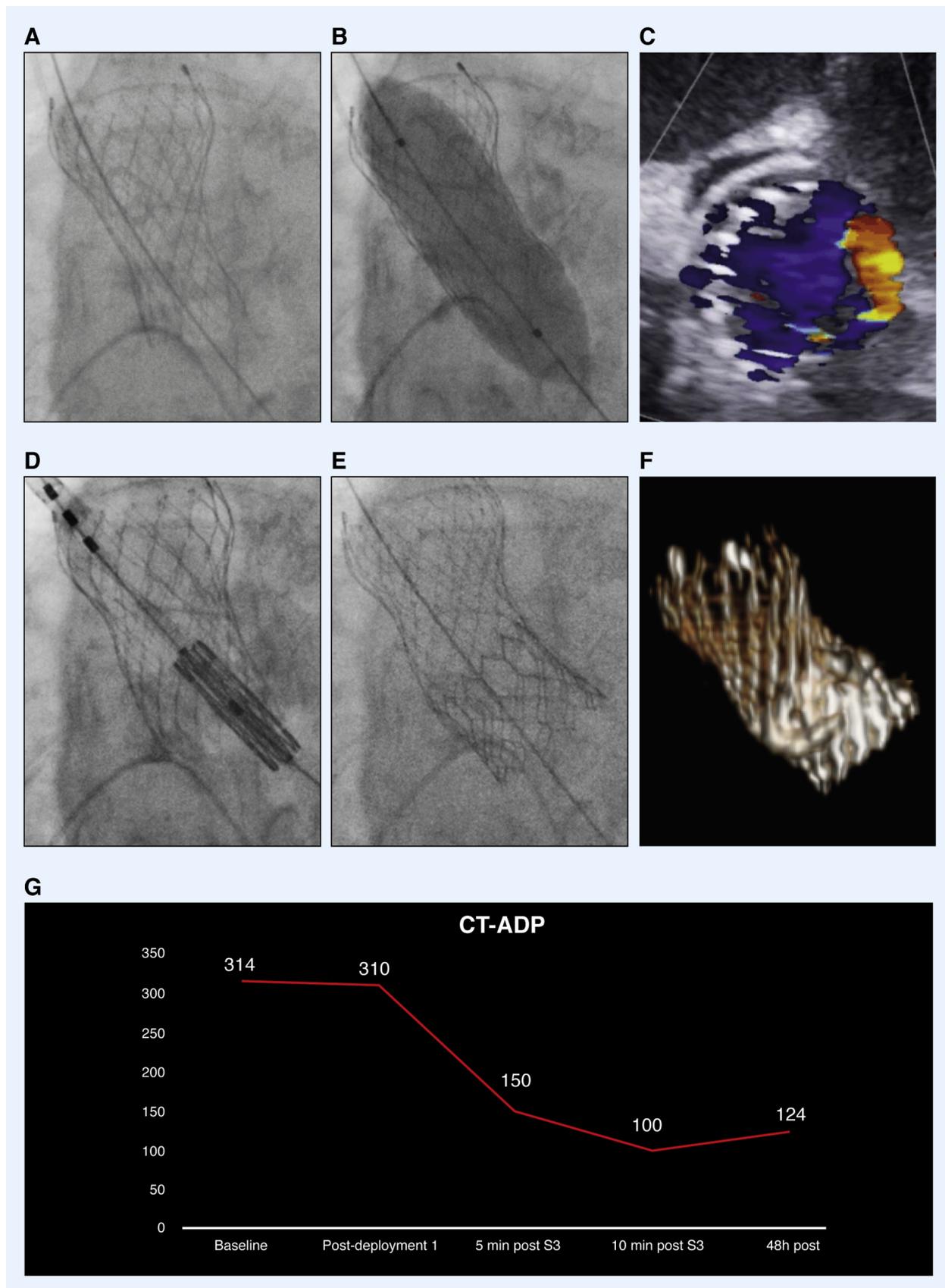
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**Figure 1.** (A) Evolut R valve (Medtronic, Minneapolis, MN). (B) SAPIEN 3 valve (Edwards Lifesciences, Irvine, CA). (C) New Evolut PRO (Medtronic) with external pericardial wrap. (D) Transesophageal echocardiogram: 3-chamber view showing a very calcified aortic valve and aortic-mitral continuity. (E) Transesophageal echocardiogram: short-axis view of the aortic valve in midsystole. (F) Multislice computed tomography image showing significant aortic annular calcification extending in the left ventricular outflow tract. (A, C) Reproduced with permission of Medtronic. © Medtronic 2019. (B) Reproduced with permission from Edwards Lifesciences.

([Video 2](#); view video online) but a large paravalvular leak (PVL) was noted because of underexpansion of the valve caused by the severe calcification ([Video 3](#); view video online). The heart team elected to recapture and reposition the transcatheter heart valve (THV) 2 more times in slightly different positions ([Videos 4](#), [5](#), and [6](#); view videos online) with the same ensuing large PVL. Then, the heart team decided to completely release the Evolut R ([Fig. 2A](#)) and to proceed with postdilation. A 22-mm balloon dilation was tried first ([Fig. 2B](#) and [Video 7](#); view video online) and resulted in a minor improvement in valve expansion with a persistent significant PVL. The CT-ADP value at that time was still high at 310 seconds. A second postdilation with a 25-mm balloon resulted in an obvious recoil of the THV ([Video 8](#); view

video online) after balloon deflation ([Fig. 2C](#)). In that setting, the heart team decided to implant a 26-mm SAPIEN 3 THV (Edwards Lifesciences, Irvine, CA; [Fig. 1B](#)) just below the Evolut R already in place ([Video 9](#); view video online). Our goals were: (1) to increase the radial strength of the Evolut R; and (2) use the sealing skirt of the SAPIEN 3 device to reduce the PVL ([Fig. 2D](#) and [E](#); [Video 10](#); view video online). On postprocedural transesophageal echocardiogram ([Videos 11](#) and [12](#); view videos online), only trace aortic PVL was noted without any evidence of aortic rupture. Remarkably, the CT-ADP went down to 100 seconds at 10 minutes after the deployment of the second valve. On trans-thoracic echocardiography performed on day 2, the peak and mean aortic gradients were 25 and 14 mm Hg, respectively.



**Figure 2.** (A) Initial underexpansion of the Evolut R valve (Medtronic, Minneapolis, MN). (B) Postdilatation of the Evolut R valve. (C) Transesophageal echocardiogram showing significant paravalvular leak. (D) and (E) Balloon-expandable SAPIEN 3 valve (Edwards Lifesciences, Irvine, CA) deployed at the base of the Evolut R valve. (F) 3-D multislice computed tomography image showing the SAPIEN 3 valve inside the Evolut R valve. (G) Evolution of the closure time with adenosine diphosphate (CT-ADP) in seconds at each important step of the procedure.

Strictly no PVL was seen. At that time point, the CT-ADP value was 124 seconds.

### Discussion

In the context of transcatheter therapies, the aortic valve calcification distribution needs to be well characterized beforehand because it can help to anticipate complications like PVL,<sup>2</sup> coronary obstruction, conduction defect, and annular rupture.

Our case represents a unique case of severe valvular and subannular calcification resulting in a significant under-expansion of the Evolut R. More than mild PVL is associated with increased mortality and worst prognosis,<sup>3</sup> and can be addressed at the time of the procedure by further balloon dilation, plug closure, or valve-in-valve procedures. In this case, the latter option was selected. The SAPIEN 3 valve was positioned much lower than usually recommended for native aortic valve replacement, fortunately without serious conduction disturbance. Moreover, the Evolut R already in place was creating an anchoring structure and was covering the open upper struts of the SAPIEN 3, which was probably preventing PVL. Nowadays, the Evolut Pro (Medtronic; Fig. 1C) is available and could have been implanted. The sealing skirt at the base of this new-generation THV could have partially reduced the amount of PVL.

### Conclusion

Our patient's CT-ADP times correlated well with the severity of the PVL with a hemostasis time that remained higher than 300 seconds until the deployment of a second THV, where it decreased to 100 seconds, suggesting a significant improvement of the PVL.

In the presence of significant aortic valve calcification, device selection for transcatheter aortic valve replacement can be very challenging and remains controversial. This case represents a very unusual situation in which the different features of the Evolut R and of the SAPIEN 3 were used together to

obtain a good final hemodynamic and clinical result. In addition, the correlation between the CT-ADP and the severity of the PVL can guide the heart team in the procedural decision-making process.

For an expanded version of this case report, please see the [Supplementary Material](#).

### Disclosures

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### Supplementary Material

To access the supplementary material accompanying this article, visit the online version of the *Canadian Journal of Cardiology* at [www.onlinecjc.ca](http://www.onlinecjc.ca) and at <http://dx.doi.org/10.1016/j.cjca.2019.05.030>.