



Robert Gerber

# Cardiovascular dilemmas: revascularization in patients with critical aortic stenosis and left main stem disease

This case study includes references to some videos, which can be viewed online at [www.confluencejournal.com](http://www.confluencejournal.com)

## Background

With the development of innovative percutaneous solutions to structural heart disease, we have entered a new era of percutaneous cardiac intervention. Transcatheter aortic valve replacement (TAVR) is associated with favourable outcomes when compared with medical treatment.<sup>1</sup> Additionally, we have seen equivalent outcomes to surgery from complex percutaneous multivessel revascularization of coronary artery disease (CAD) in randomized studies and registries.<sup>2-4</sup> However, due to a paucity of evidence a dilemma exists as how best to manage patients with both co-existing CAD and aortic stenosis (AS) who are deemed too high risk for conventional valve and graft surgery. Such uncertainty means that this complex scenario is now dealt with in cardiac multidisciplinary teams, which face greater challenges as to the best course of action in an evidence-free zone. We present here an example of such a case; your treatment and management may differ or agree with ours, but eventually the best result comes down to good clinical acumen.

## Case presentation

In the early hours of 26th September, 2003, a 60-year-old gentleman presented with a large antero-lateral myocardial infarction. He received timely thrombolysis, the reperfusion treatment of choice at that time. Despite rapid thrombolysis, he developed pulmonary oedema and pulmonary sepsis. Seven days later he recovered with medical treatment and underwent in-patient angiography, which demonstrated distal left main stem (LMS) disease and sub-totally occluded left anterior descending (LAD). The circumflex and right coronary artery were free of disease. The transthoracic echo (TTE) demonstrated akinesia

of the anterior wall and so the decision was made to pursue medical treatment. His other co-morbidities were pulmonary emboli, which led to his diagnosis as a heterozygous Factor V Leiden carrier, paroxysmal atrial fibrillation (PAF), gastro-oesophageal reflux disease, hyperlipidaemia and hypertension. Two years later he was leading an active lifestyle playing 18 holes of golf 3 times per week, and although he had moderate left ventricular impairment (with an ejection fraction of 35%) he was New York Heart Association (NYHA) class I.

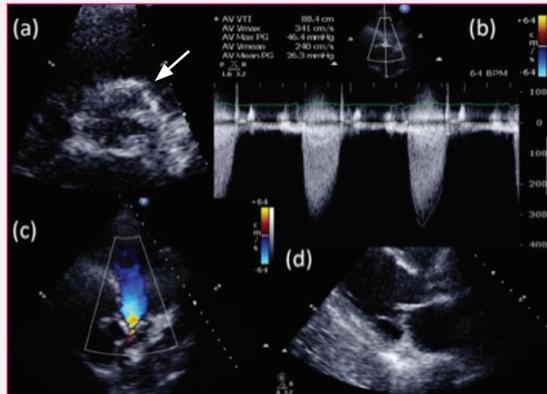
Ten years later, symptoms of dyspnoea developed and a TTE was suggestive of moderate AS with an aortic valve area (AVA) of 1.1 cm<sup>2</sup> and a peak gradient of 30 mmHg. At the start of 2014, he had an episode of syncope, which led to further detailed evaluation.

## Investigations

The repeat TTE demonstrated fixed right coronary cusp fused to the non-coronary cusp with a functionally bicuspid aortic valve and an associated peak gradient of 46 mmHg with an AVA of 0.4 cm<sup>2</sup> by continuity (TTE figure A, videos 1 and 2 [available online at [www.confluencejournal.com](http://www.confluencejournal.com)]). It is important to bear in mind that all patients with syncope and associated AS must have extended monitoring as bradyarrhythmia (requiring pacing) is a feature of AS independently of haemodynamic compromise.<sup>5</sup> His R-test monitor worn for 6.5 days demonstrated 7 beat run of PAF but no dropped beats or pauses. Repeat angiography demonstrated significant distal left main stem (LMS) disease, with an occluded LAD and proximal circumflex stenosis (LCx). The right coronary artery also has a significant stenosis in mid course (Angiography, videos 3–6).

fig. A

(a) short axis view of calcific aortic valve demonstrating fusion of the right and non-coronary cusps, resulting in a functionally bicuspid valve, (b) continuous wave Doppler demonstrating a peak gradient through the valve of 43 mmHg, (c) five chamber colour Doppler image demonstrating high aliasing velocities around the stenotic aortic valve, (d) parasternal short axis view demonstrating a dilated left ventricle with a thinned and akinetic septum. A measured ejection fraction of 30–35% was calculated.



## Diagnosis

These findings are suggestive of a low-flow, low gradient critical AS. The dimensionless index (the ratio of the aortic valve velocity time integral [AOV VTI]: left ventricular outflow tract velocity time integral [LVOT VTI]; whereby a ratio  $>3.5:1$  is regarded as significant) was 5:1 and co-existing significant 3-vessel disease was identified.

## Quiz Questions

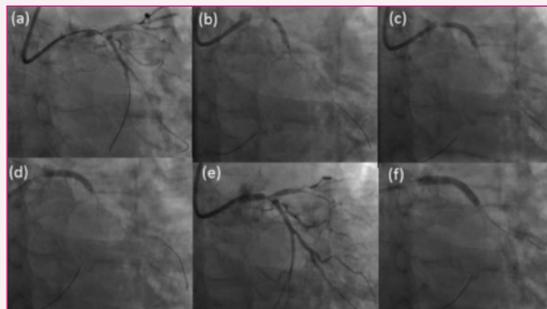
1. Does complete revascularization prior to TAVI confer any prognostic benefit?
2. Is intravascular ultrasound (IVUS) mandatory in unprotected left main stem PCI?
3. What anticoagulant and antiplatelet strategy is best for this particular patient?
4. Is there a role for balloon aortic valvuloplasty (BAV) prior to TAVI?

## Management

The patient's Logistic Euroscore I was 14.4%, Euroscore II was 6.93% (points for NYHA III, CCS angina 4 and other than isolated CABG), and an STS score of 13%. He was considered for TAVI and while waiting assessment developed unstable angina symptoms, and it was decided to proceed to semi-urgent unprotected LMS PCI. The Heart Team's strategy was to intervene and stent from the LMS into the circumflex and not to revascularize the LAD as this supplies infarcted territory.

fig. B

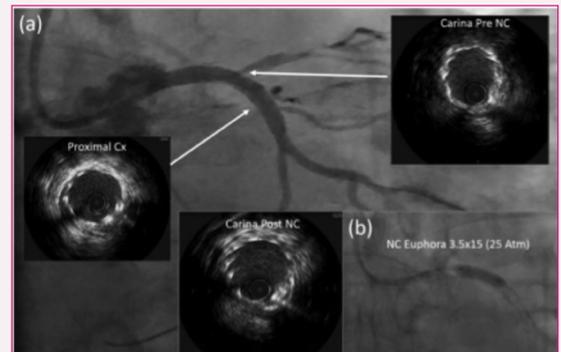
(a) wiring the vessel resulted in TIMI 1 flow so rapid pre-dilatation was performed (b) pre-dilatation with 2.0x20 semi-compliant (SC) balloon (c) pre-dilatation with 2.5x20 SC balloon (d) pre-dilatation with 3.0x15 SC (SC balloon was Emerge) (e) angiogram after pre-dilatation (f) Resolute Integrity Drug Eluting Stent 3.5x30 deployment.



Procedure: with the use of the right radial artery approach and EBU3.5 guide and the anchor wire technique, a Sion blue wire was inserted into the marginal branch and a Whisper Extra Support (Abbott Vascular) wire was placed into the circumflex artery (figure B). After several pre-dilatations with balloons of increasing size 2.0x15, 2.5x20, 3.0x15, a Resolute Integrity Drug Eluting Stent 3.5x30 was implanted at 17Atm (figure C).

fig. C

(a) stenting the LMS into the circumflex with a Resolute Integrity Drug Eluting Stent 3.5x30 with IVUS interrogation of stented segment (b) Post-dilatation with noncompliant Euphora balloon.

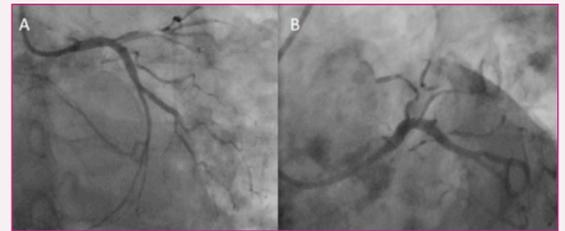


IVUS interrogation of the stented segment post-insertion demonstrated under-expansion at the carina and ostium of the circumflex. The patient did not tolerate well pre-dilatation and stenting as the occlusion of the LMS resulted in transient drop in blood pressure. This is potentially life-threatening in the context of critical AS and so the choice of post-dilatation NC balloon was important to be able to traverse the sharp angulation into the circumflex. The NC balloon not only needs to be deliverable but have a predictable pressure profile and inflate and deflate quickly without the requirement for multiple passes. A Euphora NC 3.5x15 was used and inflated at

25 Atm on 2 occasions (video 7) resulting in adequate expansion and optimization of the stented LMS (figure D, video 8).

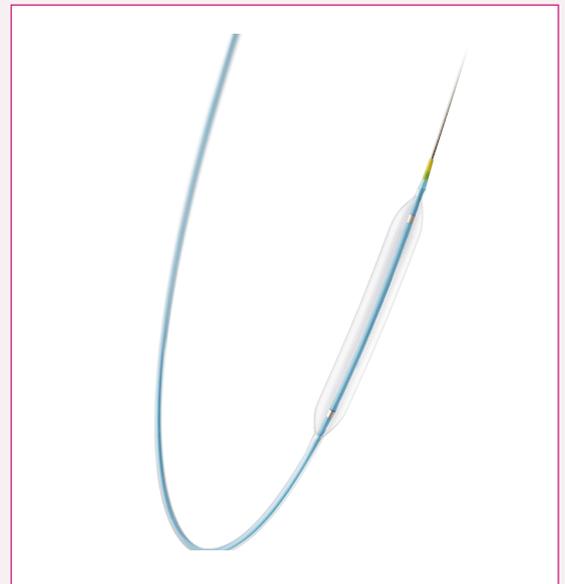
fig. D

Final angiographic result in left main stem and circumflex (a) RAO caudal projection (b) LAO caudal projection (Spider view).



The RCA was left to a further staged procedure and the patient was discharged on triple therapy (aspirin, Clopidogrel and Warfarin), although recent evidence suggests anticoagulation with one antiplatelet agent may be sufficient.<sup>6</sup> The controversial decision to revascularize or not prior to TAVI was not necessary in this case as the patients symptoms deteriorated.<sup>7-9</sup> However, the correct strategy is still under evaluation in ongoing studies and if the patient were to develop cardiogenic shock is *ad hoc* BAV at the time of PCI indicated.<sup>10</sup> At present, the patient is doing very well and is awaiting TAVI.

In summary, this case highlights the importance of selecting newer devices, which facilitate complex PCI in the context of critical aortic stenosis when haemodynamic compromise is best avoided.



### Take-home messages

- The multidisciplinary cardiac Heart Team is essential in the management of these patients
- Newer lower profile NC balloons Euphora™ with better deliverability are invaluable in aiding stent optimization in tortuous anatomy in patients that can't tolerate haemodynamic instability

#### Address for correspondence

Dr RT Gerber, FRCP, PhD  
East Sussex Healthcare  
NHS Trust Department  
of Cardiology  
Conquest Hospital Hastings  
& Eastbourne District  
General Hospital  
127 The Ridge  
St Leonards-on-Sea  
East Sussex  
United Kingdom  
TN37 7RD

Tel.: 01424 755255, ext 6319  
Fax.: 01424 758132

r.gerber@nhs.net

#### REFERENCES:

1. Herrmann HC, et al. *Circulation* 2013;127(23):2316-26.
2. Mohr FW, et al. *Lancet* 2013;381(9867):629-38.
3. Ielasi A, et al. *Rev Esp Cardiol* 2013;66(1):24-33.
4. Gerber RT, et al. *Cardiovasc Revasc Med* 2011;12(4):220-7.
5. Schurr UP, et al. *Interact Cardiovasc Thorac Surg* 2010;11(5):556-60.
6. Figini F, et al. *Am J Cardiol* 2013;111(2):237-42.
7. Ussia GP, et al. *Int J Cardiol* 2013;167(3):943-50.
8. Masson J-B, et al. *Catheter Cardiovasc Interv* 2010;76(2):165-73.
9. Gasparetto V, et al. *Catheter Cardiovasc Interv* 2013;81(2):376-83.
10. Vahanian A. *Heart* 2001;85(2):223-8.

DISCLOSURES: RG has a Consultancy Agreement with Medtronic, Inc., and has sat on Advisory Boards for AstraZeneca.