In 1910, Theodore Roosevelt delivered a speech at the Sorbonne entitled ‘Citizenship in a Republic’ in which he stated ‘It is not the critic who counts; not the man who points out how...the doer of deeds could have done them better. The credit belongs to the man who is actually in the arena ... who does actually strive to do the deeds...’. This issue of the European Journal of Cardio-Thoracic Surgery includes two important reports of the Ross procedure by individuals who are, indeed, actually in the arena. I am aware that it is far safer to criticize someone else than to take the risk and do the deed oneself. Still I hope that what I have to say will count, because it is of course incumbent upon us not only to explore new therapies, but also to be reflective of those practices. Enter the Ross procedure.

I think we can all agree that there is no perfect aortic valve substitute for the young adult. The shortcomings of mechanical valves, xenoprostheses and human allografts (homografts) need not be recounted. We can also agree that Donald Ross’ creative solution is both bold and brilliant. The authors of these series, one from Leuven [1] and the other from Frankfurt [2], are surely technical virtuosos as their results are exemplary. Finally, it is also clear that the procedure itself is still in evolution with modifications expected to improve long-term performance. Still, it is reasonable to ask if the performance has been up to the promise.

When introduced, the pulmonary autograft was argued to offer ideal haemodynamics, freedom from anticoagulation/valve-related thromboembolism and the potential to grow (or dilate) thus solving what seemed an otherwise insurmountable problem. Hopes were embraced [4]. It is also notable that similar arguments applied in favour of mechanical valves failed to demonstrate superiority of the former [5]. While one may argue over the appropriate comparison group—the general population or those receiving other prosthesis post–retro–spective surgical series are imperfect with some element of entry bias. Sufﬁce it to say that the survival beneﬁt is far from proven. It is also notable that similar arguments applied in favour of mechanical prostheses over bioprosthetic valves have not been embraced [4].

With regard to bleeding and thromboembolism, the rates reported in these series (0.7%/patient year by Mastrobuoni and 0.54%/patient year by Miskovic) fall below those of mechanical valves (thromboembolism 1.6%/patient year and bleeding 1.6%/patient year) [6] but remain quite real. Similarly, rates of infection, while low, are non-zero. One cannot know if the observed rates of 0.1%/patient year (i) and 0.36%/patient year (ii) would have been the same with conventional prostheses, but the rates are not far from the expected 0.5%/patient year with conventional prostheses [7].

Of all the hopes for the autograft, however, the most disappointing shortcoming has been reoperation. It stands to reason that the incidence of reoperation in young adults for the Ross will calculated from the Society of Thoracic Surgeons (STS) database Risk Calculator (http://www.sts.org/quality-research-patient-safety/quality/risk-calculator-and-models/risk-calculator accessed 15 February 2015). For example, the predicted mortality for isolated aortic valve replacement in a patient with the mean characteristics of those in these series (age: 42, ejection fraction: 50%, NYHA Class II, predominantly functional stenosis, no lung disease or diabetes) is 0.5%. More at the extreme, a 55-year old woman, with an ejection fraction of 35%, mixed stenosis and regurgitation and NYHA Class IV congestive heart failure, has a predicted operative mortality of 1.5%, well below that observed in either series. More subtle yet, the cross-clamp time reported by Mastrobuoni was 113 min, and that by Miskovic 130 min. While myocardial protection is improving, it is unlikely that this comes at no cost to the patient’s ventricle, and may contribute to late death from congestive failure. Clearly there is an increased early risk.

What of the benefits? The ideal haemodynamics of the autograft have been suggested to confer superior late survival to that of conventional prostheses. In both of these series, however, we begin to see a fall-off of predicted survival at 15 years, and at least one study comparing late outcome between Ross and mechanical valves failed to demonstrate superiority of the former [5]. While one may argue over the appropriate comparison group—the general population or those receiving other prosthesis—our retrospective surgical series are imperfect with some element of entry bias. Sufﬁce it to say that the survival beneﬁt is far from proven. It is also notable that similar arguments applied in favour of mechanical prostheses over bioprosthetic valves have not been embraced [4].

It would appear that the risk of perioperative mortality with this operation has settled around 2−3%. The operative mortality in the series from St Luc’s Hospital was 2.3%, and that from Johann Wolfgang-Goethe University Hospital in Frankfurt 2.4%. This compares favourably with the 3% reported for the Ross procedure in adults from a recent meta-analysis [3]. It is, however, well above the anticipated perioperative mortality for a young adult as pointed out by those reporting late results from both centers [2].

The price of these late results was a technically demanding operation. Thanks to these modified series, the mean cross-clamp time was 120 min, and the expected 0.5%/patient year with conventional prostheses [7].

In summary, our experience of the Ross procedure from the anticipated perioperative mortality for a young adult as pointed out by those reporting late results from both centers [2].
lie somewhere between the very low rate for mechanical valves and what must be a near 100% rate for xenografts implanted in a 42-year-old. Accordingly, whatever the reoperation rate for the Ross, it will be less than that for its biological competition, the xenograft. For those who escape reoperation, the gamble was worthwhile. The critical questions are how many are less lucky, and how dear a price is paid by those unfortunates that require reoperation.

In the series from St Luc’s Hospital, 1 in 4 required reoperation. At 15 years, 1 in 5 of the University Hospital in Frankfurt patients had been reoperated for autograft failure with another 5% having revision of their pulmonary outflow. Among the former the operative mortality was 2.6%, which is low, but still exceeds the <1% expected for a reoperative isolated aortic valve replacement in an otherwise healthy 52-year old per the STS risk calculator. Low operative mortality has been reported by others, but with prolonged cross-clamp times reflecting the complexity of the reoperations themselves, regardless of incidence [8, 9]. Furthermore, these reoperations are frequently not definitive [9].

In the end, these are questions of probability and risk—the answers to which must incorporate patient preferences as well as social circumstances. Young patients have a lot to gain from a permanent, anticoagulation-free solution. They also have a lot to lose if they find themselves among those requiring one or more reoperations. Would it be better to implant a stented tissue valve and accept reoperation [10] or employ anticoagulant self-testing and management [5]? The Ross remains an option, but it is not the ‘ideal’ option we had hoped. There is clearly an up-front risk and a late benefit. For any individual it is a matter of playing the odds and asking if, for them, the early risk is worth the late reward.

REFERENCES