

Measuring risk in valvular interventions: from low risk to futility

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KEYWORDS

- futility
- risk score
- transcatheter heart valve implantation

Abstract

Current risk scores are based on cardiac surgical procedures and therefore have limited application in transcatheter aortic or mitral interventions. Their ability to predict outcome in high-risk patients remains poor and the question of utility or futility of an intervention can only be decided by a team of physicians with diverse expertise.

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Risk scores in cardiac surgery

Surgery or medical management were the two treatment options for valvular heart disease before the introduction of transcatheter valve interventions. Medical management, however, has poor prognosis¹, and there is no question that surgical aortic valve replacement relieves symptoms, improves quality of life and exercise capacity and prolongs life expectancy in patients with symptomatic severe aortic stenosis. Algorithms for clinical decision making attempt to assess the risk of surgical intervention whilst taking into account the risk profile of the patient. In order to help the physician to estimate the risk of surgery, different scores have been developed: the two most widely used are the EuroSCORE and STS-PROM, which predict the hospital mortality of patients undergoing different surgical procedures. Discrimination of these models, as measured by the average area under the receiver-operating characteristic curve, is acceptable but calibration is poor².

Risk scores in transcatheter intervention

Decision making became more complex with the introduction of transcatheter therapies for valvular heart disease. A third factor, the type of intervention, was added to the decision-making process. When different treatments are possible, is a score a useful tool that will help physicians and patients decide which treatment is best?

Evaluation of procedural risk in patients with valvular heart disease being considered for either a transcatheter or a surgical approach is challenging because the current risk scores are based on different cardiac surgical procedures and not just valvular interventions. They provide quite accurate estimation of the operative mortality in low-risk patients, but their ability to predict outcome in high-risk patients remains poor. The reasons for underperformance include inadequate statistical techniques, under-representation of certain subgroups and variables that are not captured in the score³. A risk model that performs accurately across the spectrum of low-, intermediate- and high-risk patients evaluated for cardiac surgery remains challenging. There will always be limitations to the number of variables included in a risk score since a higher number of variables makes the score less user-friendly. Furthermore, selection of the correct variables is crucial, as demonstrated by the fact that even the use of fewer variables proved to a better predictor of outcome in some instances⁴.

As some risk factors only play a role in specific procedures, the variables that predict outcome after transcatheter procedures and surgical valve replacement will vary. For example, severe calcification of the ascending aorta is a risk factor in cardiac surgery but not in transcatheter interventions. Separate risk algorithms are therefore needed to estimate mortality associated with different procedures. Estimation of procedural risk and long-term benefit requires multiple factors to take account of frailty, associated coronary artery disease, other valve lesions, non-cardiac comorbidities and overall life expectancy. A single physician cannot assess all of these different risk factors and a multidisciplinary group is needed

to weigh and assess their overall contribution for an individual patient⁵. This group, the “Heart Team”, can thereby individualise the risk-benefit ratio for each patient.

Use of risk scores in elderly patients: utility versus futility

The risk of surgical procedures increases with advanced age and age is one of the variables common to all risk scores. Transcatheter valve interventions are less invasive, and elderly patients, particularly those with comorbidities, benefit from a less invasive procedure. Transcatheter aortic valve implantation has been shown to reduce all-cause mortality in patients with prohibitive surgical risk and to be a reasonable alternative to surgical aortic valve replacement in high-risk patients. The risk of intervention in these groups of patients is lower with less invasive treatments but the questions of long-term benefit and futility versus utility are not addressed by any of the current risk models. While it is quite hard to estimate treatment risk, it is even more difficult to estimate one-year or even longer-term outcome since the average age-adjusted life expectancy of patients with valvular heart disease will be shorter than the normal population.

Aortic stenosis causes progressive pressure overload and myocardial fibrosis - regression of left ventricular hypertrophy is frequently incomplete after aortic valve replacement and associated with adverse short- and long-term outcomes⁶. Postoperative left ventricular dysfunction can persist after surgical correction of mitral regurgitation and is associated with reduced long-term survival⁷. These scenarios raise the difficult question of how much any intervention can add to life expectancy and overall quality of life in elderly patients. The introduction of less invasive treatments for valvular heart disease has made both cardiologists and cardiac surgeons more aware of the influence of frailty on the operative risk and long-term survival of elderly patients. Furthermore, whilst age-related changes such as reduced muscle strength and hearing loss are universal, not everybody accumulates these problems at the same rate. Patients of the same chronological age may therefore exhibit the effects of ageing, or frailty, to a greater or lesser extent. The more extensive the comorbidity, the higher the frailty index and the shorter the long-term survival⁸. Gait speed is a marker of frailty and improves the prediction of mortality and major morbidity in elderly patients undergoing valve repair or replacement. If comprehensive assessment of a patient's health status (including frailty assessment) suggests that survival beyond one year is unlikely, then the intervention is of questionable value and may be deemed futile. Economic aspects should also be taken into account in the context of “utility versus futility”. The major objectives in elderly patients are improvement in the quality of life and independence after the intervention⁹.

Even with adequate prediction of a difference in long-term outcome between a surgical and a transcatheter intervention, the question remains how this will influence decision making for an individual patient. Surgery is associated with postoperative pain,

morbidity and mortality, and, even when it offers an advantage for the long-term elderly, frail patients are more likely to opt for a less invasive approach¹⁰.

The future of risk scores

Current risk scores should not be used as isolated tools to decide whether an individual patient should undergo treatment, nor which kind of treatment is best. While current prediction models have limited application in decision making for the individual patient, they can still be used for benchmarking and outcome evaluation at institutional and individual surgeon level. Dedicated risk scores should be developed for valvular heart disease interventions – these should be updated regularly and need to be specifically predictive in high-risk and elderly patients. However, it is very unlikely that they will ever be able to replace the judgement of a team of physicians – the “Heart Team”.

Conflict of interest statement

The author has no conflicts of interest to declare.

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