

Risk assessment scores in cardiac surgery

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Risk models are extremely useful in preoperative discussions with patients and their families, assisting the surgeon in providing a realistic estimate of the potential risk of surgery and also acts as a quality control measurement of individual surgeon's and institutional performance. Risk stratification models in cardiac surgery came into existence in 1980's because of increasing awareness among cardiac surgeons about the rise in operative mortality of procedures due to the increasing risk profile of patients. The operative mortality for coronary artery bypass graft increased from 2% to close to 6%, and the surgeons were challenged to explain this increasing trend in mortality. To show that they are operating on a sicker subset, they needed a risk assessment score. In 1989, Victor Parsonnet, *et al.* from Newark, New Jersey proposed a simple additive scoring system to calculate the 30-day mortality. The risk model was developed from 3500 patients operated from 1982 to 1987 and was prospectively validated on a dataset of 1382 patients.^[1] The accuracy of this model was further validated by subsequent studies, and it emerged as a powerful tool for risk assessment in 1990's. The advantage of the Parsonnet score is that the parameters representing risk factors are easily and objectively measurable and have high content validity that is recognized and accepted by the majority of clinicians. As opposed to other scoring methods, variables that are based completely or even partly on subjective assessment, such as unstable angina, operative priority or diffuseness of disease, are not included in this model. Two risk factors of this initial Parsonnet's score were, however, imprecise, and their weights were arbitrarily

chosen by the surgeon (catastrophic states, other rare circumstances). Thus, the reliability of the score decreased when these two risk factors were present. However with decreasing trends in mortality despite increased risk profile and emergence of other risk assessment models like Cleveland score, Euro score, Society of Thoracic Surgeons score etc., lead to development of modified Parsonnet score, including thirty new risk factors.^[2] Subsequent studies showed that the predictive ability is only modest especially in high-risk group. Modified Parsonnet score is very complex to use, and many of the risk factors are subjective or ill-defined. During the last few decades, at least 15 different cardiac surgery risk score algorithms have been published, but it still remains difficult to predict risk for individual patients especially in the high risk group; the observed mortality diverges from the prediction line.^[3]

In this article, the authors used Parsonnet score as a risk stratification model for adult cardiac surgery and evaluated the performance of the model in over 800 patients and found only moderate discrimination power (area under receiver operating characteristic curve of 0.69-predictive value is generally considered insufficient for area between 0.5 and 0.7 and good between 0.7 and 0.9). They also found very poor discrimination in high-risk group (combined procedures). Many diagnostic tests require an area of ROC curve of more than 0.9 to be specific; however none of the scoring systems in cardiac surgery reach that level of significance. The reasons are multifold: Different population subset, inclusion of subjective variables and noninclusion of

Access this article online

Website: www.annals.in

DOI:

10.4103/0971-9784.154469

Quick Response Code:



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important variables, small sample size, changes in the standard of care between institutions and improvement in the quality of care overtime etc. So which model should be used as a benchmark to assess the quality of care? The answer is not clear.

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Cite this article as: Varma PK. Risk assessment scores in cardiac surgery. *Ann Card Anaesth* 2015;18:170-1.

Source of Support: Nil, **Conflict of Interest:** None declared.