



ORIGINAL ARTICLE

## Comparison of multiparametric risk scores for predicting early mortality after transcatheter aortic valve implantation



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### KEYWORDS

Aortic stenosis;  
Transcatheter aortic valve implantation;  
Risk scores;  
Early mortality

### Abstract

**Introduction:** Surgical risk scores are widely used to identify patients at high surgical risk who may benefit from transcatheter aortic valve implantation (TAVI). A multiparametric TAVI mortality risk score based on a French registry (FRANCE-2) has recently been developed. The aim of our study was to compare the 30-day mortality prediction performance of the FRANCE-2, EuroSCORE II and STS scores.

**Methods:** We retrospectively studied 240 patients from a single-center prospective registry who underwent TAVI between January 2008 and December 2015. All scores were assessed for calibration and discrimination using calibration-in-the-large and ROC curve analysis, respectively.

**Results:** The observed mortality was 5.8% (n=14). The median EuroSCORE II, STS and FRANCE-2 scores were 5.0 (IQR 3.2-8.3), 5.1 (IQR 3.6-7.1) and 2.0 (IQR 1.0-3.0), respectively. Discriminative power was greater for EuroSCORE II (C-statistic 0.67) and STS (C-statistic 0.67) than for FRANCE-2 (C-statistic 0.53), but this was not statistically significant (p=0.26). All scores showed adequate calibration.

**Conclusions:** All scores showed modest performance in early mortality prediction after TAVI. Despite being derived from a TAVI population, FRANCE-2 was no better than surgical risk scores in our population.

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**PALAVRAS-CHAVE**

Estenose aórtica;  
TAVI;  
Scores de risco;  
Mortalidade precoce

**Comparação do desempenho de scores de risco multiparamétricos na predição de mortalidade precoce em doentes submetidos a TAVI****Resumo**

**Introdução:** Os scores de risco cirúrgico têm sido amplamente usados para identificar doentes com alto risco cirúrgico que podem beneficiar da implantação de válvula aórtica por via percutânea (TAVI). Foi recentemente apresentado um «score de risco» multiparamétrico de mortalidade por TAVI com base num registo francês – FRANCE 2. O objetivo do nosso estudo foi comparar o desempenho do FRANCE 2, EuroSCORE II (ES II) e STS-Prom (STS) em prever a mortalidade a 30 dias nos doentes submetidos a TAVI.

**Métodos:** Foram estudados retrospectivamente 240 doentes de um registo prospetivo de centro único que foram submetidos a TAVI entre janeiro de 2008 e dezembro de 2015. Todos os scores foram avaliados para discriminação e calibração, com o uso da análise de curvas ROC e da análise de *calibration-in-the-large*, respetivamente.

**Resultados:** A mortalidade observada foi de 5,8% (n = 14). A mediana do ES II, STS II e FRANCE II foi de 5,0 (IQR 3,2-8,3), 5,1 (IQR 3,6-7,1) e 2,0 (IQR 1,0-3,0), respetivamente. O poder discriminatório foi maior para ES II (C-statistic 0,67) e STS (C-statistic 0,67) quando comparado com o FRANCE 2 (C-statistic 0,53), embora não fosse estatisticamente significativo (p = 0,26). Todos os scores apresentaram calibração adequada.

**Conclusões:** Todos os scores apresentaram um desempenho modesto em prever a mortalidade precoce após TAVI. Apesar de ser derivado de uma população de doentes submetidos a TAVI, o FRANCE-2 não mostrou ser melhor do que os scores de risco cirúrgicos na nossa população.

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**Introduction**

Transcatheter aortic valve implantation (TAVI) has emerged as a less invasive treatment alternative for patients with severe symptomatic aortic stenosis at high or very high surgical risk.<sup>1,2</sup> Surgical risk scores are established tools for assisting in the decision-making process for these patients. The Society of Thoracic Surgeons Predicted Risk of Mortality<sup>3</sup> (STS) score and the European System for Cardiac Operative Risk Evaluation<sup>4</sup> (EuroSCORE II) are the most commonly used.

A multiparametric risk score for early mortality prediction has recently been derived based on a TAVI population from a French registry (FRANCE-2).<sup>5</sup> In this registry, early mortality after TAVI was mainly related to age, severity of symptoms, comorbidities and access (transapical or other). The FRANCE-2 score is a simple additive score (ranging from 0 to 21) that can be used to predict early mortality after TAVI. In the internal validation, it showed only moderate discriminative ability,<sup>5</sup> reflecting limited accuracy in the identification of high-risk patients.

In this study, we sought to externally validate the STS, EuroSCORE II and FRANCE II scores and to compare their performance in a TAVI population.

**Methods****Patient population and data collection**

The Valve Catheter Restorative Operation on Santa cruz hospital (VCROSS) was a single-center, prospective, observational study that included 240 consecutive patients

who underwent TAVI between January 2008 and December 2015. The interventional strategy was decided after multidisciplinary discussion. Acceptance of a patient for TAVI required consensus of the heart team. All data on demographic, clinical, and procedural characteristics were prospectively entered in our institutional cathlab-based dedicated database. Outcome data during hospital admission and during the first 30 days were entered in the same database. The EuroSCORE II and STS scores were calculated using the online calculators. The FRANCE-2 score was calculated manually in each patient by matching the sum of points of the variables with the corresponding prediction, using the published nomogram.<sup>5</sup> The study was approved by the local ethics committee and informed consent was obtained from all patients.

**Statistical analysis**

Data were tested for normal distribution using the Kolmogorov-Smirnov test and/or visual assessment of Q-Q plots. Continuous variables were expressed as median and interquartile range (IQR) and categorical variables were expressed as percentages. Statistical analyses of categorical and continuous variables were performed using chi-square statistics and Fisher's exact test and the Mann-Whitney test, respectively.

The performance of the three models was analyzed focusing on discriminative power and calibration. Discrimination indicates the extent to which the model distinguishes between patients who will or will not die within the first 30 days. It was assessed by constructing receiver operating characteristic (ROC) curves for each model. Comparison

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