



Usage of Cardiac Risk Scores During Anesthetic Assessment Before Cardiovascular Surgery: A Survey Study

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ABSTRACT

Objectives: There are different risk scoring systems (RSSs) for preoperatively determining the risk of cardiovascular surgery. Herein, we aimed to determine which of the current RSSs are used at the national level to assess patients who are planned for cardiovascular surgery.

Methods: A survey was conducted electronically or via face-to-face interviews. The number and rate of physicians using RSSs in combination with the American Society of Anesthesiologists (ASA) Physical Status Classification (ASA PSC) were determined. Additionally, the extent to which patients and their relatives were informed about the preoperatively predicted cardiac risk was determined.

Results: Of the 139 participating physicians, only 125 were analyzed. The ASA PSC (n=123, 98.4%), EuroSCORE II (n=48, 38.4%), and CARE score (n=23, 18.4%) were the most commonly used scoring systems for determining the risk level. Among the physicians who used the ASA PSC, 67 (53.6%) only used the ASA PSC. The other 56 (44.8%) physicians used one or more RSSs in combination with the ASA PSC. EuroSCORE II (n=48, 38.4%) was commonly used to determine the risk. Only 16 physicians (12.8%) reported using the ASA PSC, EuroSCORE II, and CARE score in combination, (the most frequent triplet combination). Furthermore, 74 physicians (59.2%) informed the patients and their relatives about the preoperative risk.

Conclusion: In our study, the ASA PSC was used by almost all the participants. However, current cardiac RSSs were not frequently used in clinical practice at the national level. Thus, we believe that current RSSs should be more widely used to determine the risk level in patients awaiting cardiovascular surgery.

Keywords: Cardiovascular surgery, preoperative evaluation, risk score

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Introduction

Risk assessment is critical in the management of patients undergoing surgery or invasive procedures under anesthesia. Risk assessment allows the classification of patients according to the severity of their condition, and it statistically predicts the outcome of the surgical procedure. For high-risk patients, perioperative care can be organized and/or planned surgical procedures can be modified to reduce the risk of morbidity and mortality. The use of risk scoring systems (RSSs) also plays an effective role in reducing treatment costs and shortening hospital stay.^[1]

The increase in the number of open-heart surgeries has made perioperative anesthetic management, and consequently procedural risk assessment, important. Several RSSs have been developed to predict risk in cardiovascular surgery. The most important and/or current RSSs are the Paiement RSS,^[2] modified Parsonnet risk index,^[3] Cleveland Clinic severity score,^[4] Ontario Province RSS,^[5] Society of Thoracic Surgeons (STS) score,^[6] European system for cardiac operative risk evaluation (EuroSCORE) II,^[7] cardiac anesthesia risk evaluation (CARE) score,^[8] American College of Cardiology Foundation–Society of Thoracic Surgeons Collaboration on the comparative effectiveness

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of revascularization strategy (ASCERT) score,^[9] synergy between percutaneous coronary intervention (PCI) with taxus and cardiac surgery (SYNTAX) II score,^[10] and age–creatinine clearance–ejection fraction (ACEF) II risk score.^[11]

In our literature search, as of 09/01/2020, we did not find any national survey study on the use of RSSs in the preoperative anesthetic assessment for cardiac surgery.

In this study, we performed a national survey aimed to determine which cardiac RSSs are used during the preoperative anesthetic assessment for cardiac surgery. The results of this study will contribute significantly to the more frequent inclusion of current RSSs developed for cardiac surgery into clinical practice and thus to more accurate preoperative risk assessment.

Methods

The study was approved by the Dokuz Eylül University's non-interventional Research Ethics Board (No. 2020/24-21; Date: 10.05.2020). Before the main study was conducted, the comprehensibility of the survey was assessed via a preliminary study with 15 physicians that were not included in the main study. Data was collected via an electronic form on the website of the Thoracic, Cardiovascular Anesthesia and Intensive Care Association, filled out by physicians working in the field of anesthesia and reanimation, and via face-to-face interviews with the anesthesiologists attending the 27th National Congress of the same association. Informed consent was obtained from all participants before filling out the survey form.

The first stage of the form collected data regarding the age, academic titles, and institutions of the participants. The first two questions in the survey focused on whether open-heart surgery is performed at their institution, and if so, whether the risk is assessed during the preoperative anesthetic assessment.

The subsequent questions aimed to determine which of the listed RSSs are being used in clinical practice. Additionally, the participants were asked about the use of any other scoring system not included in the survey, and if used, to specify the system. Finally, the survey included questions to determine the extent to which patients and their families are informed of the risks identified during the preoperative period when obtaining patient consent (Table 1).

Statistical analysis was performed to determine the demographic characteristics of the participants and the rates of use of the American Society of Anesthesiologists (ASA) Physical Status Classification (PSC) and RSSs individually as well as in combination. Furthermore, the rates of informing patients and their relatives about identified risks during the preoperative period was also determined. SPSS (version 15.0) was used for all statistical analyses, and data are presented as means±standard deviations or numbers and percentages.

Results

Our survey was conducted either electronically or via face-to-face interviews from 10/15/2020 to 10/15/2021. A total of 139 physicians working in the field of anesthesia and resuscitation participated in our study. Of the 139 physicians, 106 had completed the electronic data form online and 33 had completed the form in person at the 27th National Congress of the Thoracic, Cardiovascular Anesthesia and Intensive Care Association. Two surveys were excluded from the study due to insufficient data. The forms of 12 physicians were excluded from the study because they either reported working in government hospitals where open-heart surgery was not performed (n=7) or reported that they did not determine risk during preoperative anesthesia assessment for open-heart surgeries (n=5). Finally, data obtained from the completed survey forms of 125 physicians were statistically analyzed (Fig. 1).

The mean age of the participating physicians was 33.85±8.76 years. The participating physicians worked in university hospitals (n=89, 71.2%), state hospitals (n=33, 26.4%), or private hospitals (n=3, 2.4%). Nine of the 125 participants (7.2%) were assistant professors, 38 (30.4%) were specialists, and 78 (62.4%) were research associates.

ASA PSC (98.4%) was the most commonly used assessment tool, followed by EuroSCORE II (38.4%) and CARE score (18.4%). The use of other cardiac RSSs ranged from 0.8% to 7.2% (Table 2).

ASA PSC was used by 123 physicians in the preoperative period. Of the 123 physicians, 67 (53.6%) reported using ASA PSC alone and 56 (44.8%) reported using ASA PSC with one or more cardiac RSSs. Forty-four physicians (44%) reported using one of the cardiac RSSs listed in the survey in addition to the ASA PSC. The most commonly used RSS was EuroSCORE II (n=48, 38.4%). One physician (0.8%) reported using an RSS not included in the survey with ASA PSC (Revised Cardiac Risk Index).

Of the physicians using cardiac RSSs listed in the survey, two reported using EuroSCORE I and Goldman's Cardiac Risk Index in addition to ASA PSC. Two physicians (1.6%) reported not using ASA PSC. Of these two physicians, one reported using EuroSCORE II alone, and the other reported using EuroSCORE II, CARE score and ASCERT score together.

The number of physicians who reported using ASA PSC, EuroSCORE and CARE score together was 16 (12.8%). No physician used any other RSS alone in the survey.

Of the physicians whose data were analyzed, 74 (59.2%) reported that they informed patients and their relatives about the risks identified during the preoperative period when obtaining informed consent for planned open-heart surgery. Furthermore, 52 (58.4%), 20 (60.6%), and two (66.6%) of the physicians working in universities, education

Table 1. Questions related to risk scoring systems (RSSs) that were included in the form

- Is open-heart surgery performed at your hospital?
- Is the risk determined during preoperative anesthetic assessment in patients undergoing open-heart surgery?
- Is the ASA PSC system used for determining the risk?
- Is the Paiement risk scoring system used for determining the risk?
- Is the modified Parsonnet risk index used for determining the risk?
- Is the Cleveland Clinic severity scoring system used for determining the risk?
- Is the Ontario Province risk scoring system used for determining the risk?
- Is the STS score system used for determining the risk?
- Is the *EuroSCORE* II used for determining the risk?
- Is the *CARE* score used for determining the risk?
- Is the *ASCERT* score used for determining the risk?
- Is the *SYNTAX* II score used for determining the risk?
- Is the *ACEF* II score used for determining the risk?
- Is a different scoring system used for determining the risk?
- When obtaining patient consent, was the patient informed about the risk score determined during the preoperative period?

ASA: American Society of Anesthesiologists; PSC: Physical Status Classification; STS: the Society of Thoracic Surgeons; EuroSCORE: European system for cardiac operative risk evaluation; CARE: Cardiac anesthesia risk evaluation; ASCERT: American College of Cardiology Foundation–Society of Thoracic Surgeons Collaboration on the comparative effectiveness of revascularization strategy; SYNTAX: Synergy between percutaneous coronary intervention (PCI) with taxus and cardiac surgery; ACEF: Age–creatinine clearance–ejection fraction.

and research hospitals, and private hospitals, respectively, reported preoperatively informing patients and their relatives about risks.

Discussion

The aim of this survey study was to investigate which RSSs for cardiac surgery are used at a national level and identify the most commonly used cardiac RSSs in preoperative anesthetic risk assessment.

Several RSSs for open-heart surgery have been developed. These RSSs were primarily designed to estimate mortality after cardiac surgery in high-risk patients. Although coronary artery bypass graft (CABG) surgery was the gold standard in the 1970s, PCIs gained importance in clinical practice in the 1980s, leading to a significant change in the treatment of coronary artery disease. At that time, patients undergoing CABG surgery were high-risk patients. RSSs containing a large number of parameters and variables have also been used since the 1980s.^[1]

The ASA PSC, which was developed in 1941 to identify patients requiring advanced preoperative evaluation, is still widely used for this purpose.^[12] The vast majority of physicians who responded to our survey (98.4%) also reported using the ASA PSC for preoperative risk assessment of patients undergoing open-heart surgery. Of these physicians, 53.6% stated that they used this classification alone and did not combine it with any other RSS.

In 1983, Paiement et al.^[2] emphasized the positive contribution of an objective and well-defined criteria for clinical decision making and reported the Paiement RSS. The Paiement RSS was the first cardiac surgery RSS consisting of eight criteria aimed at predicting early

Table 2. Number of physicians using the different RSSs listed in the survey (total number of physicians=125)

	n	%
ASA PSC	123	98.4
Paiement Risk Scoring	6	4.8
Modified Parsonnet Risk Index	9	7.2
Cleveland Clinic Severity Scoring System	8	6.4
Ontario Province Risk Scoring System	1	0.8
The STS Score	9	7.2
<i>EuroSCORE</i> II	48	38.4
<i>CARE</i> Score	23	18.4
<i>ASCERT</i> Score	2	1.6
<i>SYNTAX</i> II Score	4	3.2
<i>ACEF</i> II Score	3	2.4

intraoperative and postoperative in-hospital mortality in patients undergoing open-heart surgery. In 1992, Tremblay et al.^[13] emphasized the applicability of the Paiement RSS in their prospective study conducted at the Montreal Heart Institute. In our study, only 4.8% of the analyzed physicians used the Paiement RSS.

Parsonnet and Bernstein^[3] examined 47 different risk factors in their risk model for predicting 30-day postoperative mortality. They published their results in 1990, which were subsequently updated in 2000. Berman et al.^[14] studied 1,639 patients undergoing open-heart surgery and emphasized that the modified Parsonnet risk index is a simple and objective system for predicting in-hospital mortality. However, Pittams et al.,^[15] in their review of RSSs in cardiac surgery, criticized the modified Parsonnet risk index for overestimating mortality. According to our survey, 7.2% of the respondents reported using the modified Parsonnet risk index.

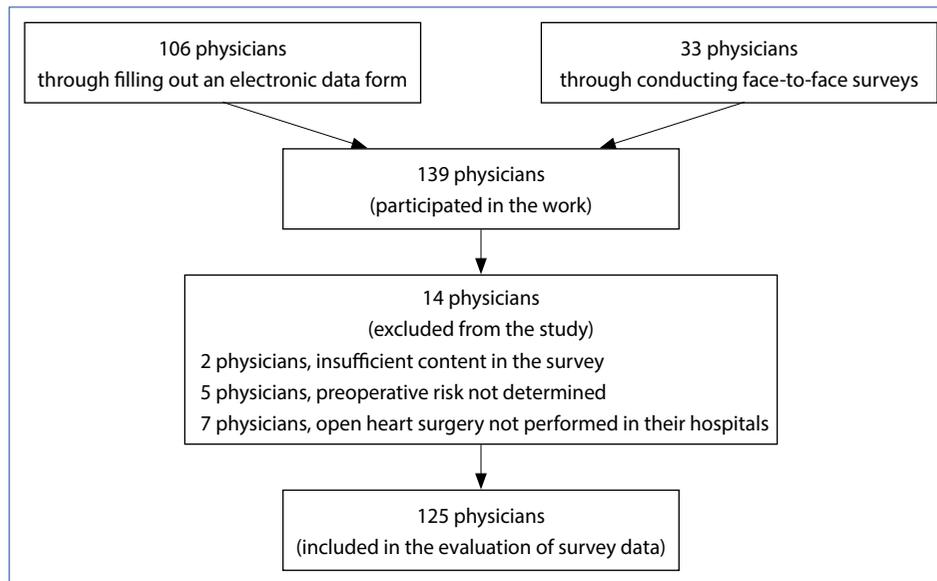


Figure 1. Physicians who participated in the study, were excluded for different reasons, and whose survey answers were evaluated.

In a single-center prospective study conducted in 1992, which included 6,222 patients who underwent cardiac surgical procedures, the Cleveland Clinic severity scoring system, which assesses 13 risk factors, demonstrated a good performance in determining 30-day and 1-year mortality.^[16] In another review by Krishna et al.,^[17] 21 different cardiac RSSs developed for open-heart surgery were examined. They determined that the Cleveland Clinic severity score had the second highest discriminative power for CABG surgery. However, as this RSS was developed only for patients requiring CABG surgery, it cannot be used in all cardiac patients.^[15] In our study, approximately 6.4% of the physicians reported using the Cleveland Clinic severity scoring system.

The Ontario Province RSS was developed in 1995, consists of six risk factors, and is used to predict the ICU/hospital length of stay and mortality after open-heart surgery.^[5] In their prospective study, Geissler et al.^[18] compared six cardiac RSSs with respect to their ability to predict the 30-day in-hospital morbidity and mortality. They found that the Ontario Province RSS was the best predictor of mortality, after the additive EuroSCORE. Additionally, the Cleveland Clinic severity scoring system was the best predictor of morbidity. In our study, the use of the Ontario Province RSS was low (0.8%).

The STS score, which is based on the largest database and includes 65 risk factors, was developed in 1997 for patients undergoing CABG, valve and CABG surgery, and valve surgery alone. It has been revised twice since its introduction. The STS score was designed to predict parameters such as 30-day postoperative mortality, stroke, renal failure, and length of hospital stay,^[6] Kunt et al.^[19]

studied patients undergoing isolated CABG between 2004 and 2012, and they found that the STS score was the most predictive of 30-day mortality. In our study, 7.2% of the analyzed physicians reported using the STS score.

EuroSCORE (additive EuroSCORE) was first developed in 1999, and it has been revised twice since then (Logistics EuroSCORE in 2003 and EuroSCORE II in 2012). EuroSCORE II is based on a large European database of 22,381 patients from 154 centers in 43 countries. The scoring system consists of 17 risk factors aimed at predicting in-hospital mortality in patients scheduled for open-heart surgery.^[7] Both EuroSCORE II and the STS score predict in-hospital mortality extremely well. However, EuroSCORE II is a better predictor of the 2-year postoperative mortality than the STS score.^[20]

EuroSCORE II, which has been compared with other RSSs for risk measurement and assessment at a universal level, is an indicator of the quality of cardiac surgery and is widely used before open-heart surgery.^[21] However, EuroSCORE II has been criticized for not performing as well as elective procedures in emergency situations.^[15] In our study, the EuroSCORE II was the most widely used RSS before cardiac surgery (38.4%).

The CARE score contains only a few parameters and is a simple risk classification that can be easily integrated into clinical practice. Additionally, it includes risk factors such as comorbid conditions, complex surgical procedures and urgency. Moreover, it is similar to the ASA PSC, a model that is familiar to surgeons.^[8] Two separate studies have reported that mortality risk analysis can be reliably performed using the CARE score,^[22] which has a predictive ability almost as good as the EuroSCORE II.^[23] In our study, 18.4% of the analyzed physicians reported using the CARE score.

Most risk scores for CABG surgery are limited to predicting the inhospital mortality or 30-day mortality. The ASCERT score was developed in 2012 as a model to predict long-term mortality risk after CABG surgery based on preoperative patient factors. This score attempts to predict the likelihood of long-term survival after isolated CABG surgery in geriatric patients.^[9] The goal of cardiac surgery should not only be to minimize the risk of short-term morbidity and mortality, but also to maximize long-term survival. Thus, the ASCERT long-term survival probability calculator is a valuable addition to the existing short-term RSSs.^[24] Only 1.6% of the analyzed physicians in our survey study reported using this score.

The SYNTAX score was first published in 2010 as an anatomical classification based on the presence or absence of disease in the left main coronary artery. It was revised in 2013 as the SYNTAX II score by adding six clinical factors to facilitate the choice between CABG surgery and PCI and to predict long-term mortality.^[10] A study by Gonzales-Tamayo et al.^[25] evaluated 2,961 patients undergoing isolated CABG for complex coronary artery disease and compared the predictive performance of the STS score, EuroSCORE II and SYNTAX II score for short-term (30-day) and long-term (4-year) mortality rates. All three risk scores demonstrated good performance for short-term mortality. Additionally, they found that the SYNTAX II score was the best predictor of long-term mortality. In our study, 3.2% of the analyzed physicians reported using the SYNTAX II score.

The ACEF score is an RSS developed to predict the 30-day postoperative mortality in adults undergoing elective open-heart surgery based on three clinical variables (age, creatinine, and ejection fraction).^[26] Emergency surgery and anemia were later added to the score, and it was revised as the ACEF II score, which consists of five risk factors.^[11] In a meta-analysis, preoperative anemia was associated with adverse outcomes following cardiac surgery.^[27] Santarpino et al.^[28] compared the EuroSCORE II and ACEF II score in terms of 30-day mortality. They determined that the ACEF II score is a userfriendly, simple, cardiac risk score that could be a good alternative to the EuroSCORE II in patients undergoing isolated CABG surgery.^[28] In our survey, 2.4% of the analyzed physicians reported using the ACEF II score.

In conclusion, our survey study demonstrated that cardiac RSSs are not widely used in clinical practice at a national level for preoperatively assessing the risk of anesthesia in patients undergoing open-heart surgery. We believe that it is appropriate to incorporate current RSSs developed for cardiovascular surgery during preoperative assessment to improve risk stratification.

Many centres from different regions of the country participated in our survey. The limitation of our study is that not all centres performing open heart surgery participated. Ensuring that more centres participate in the survey may increase awareness of the use and importance of RSSs.

Disclosures

Ethics Committee Approval: The study was approved by The Dokuz Eylül University Non-Interventional Research Ethics Committee (no: 2020/24-21, date: 10.05.2020).

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Informed Consent: Written informed consent was obtained from all patients.

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