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ORIGINAL ARTICLE

# Success Rate of Coronary Artery Bypass Grafting on Elderly Patients in Dr. Soetomo General Academic Hospital, Surabaya

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## ABSTRACT

**Introduction:** Coronary artery disease (CAD) has caused more than a quarter of deaths in Indonesia and is found to be more prevalent in elderlies (≥60 years old). Treatment options include coronary artery bypass grafting (CABG), the most-performed cardiac surgery in Indonesia. This study aimed to determine the short-term and one-year postoperative success, morbidity, and mortality rates with their causes in Dr. Soetomo General Academic Hospital, Surabaya.
**Methods:** This was a cross-sectional retrospective study using secondary data obtained from 85 medical records of CABG patients aged ≥60 years old in the Department of Thoracic, Cardiac, and Vascular Surgery Dr. Soetomo General Academic Hospital, Surabaya, from January 2018 to December 2020. Aside from descriptive statistics, logistic regression was conducted to assess the relationship between EuroSCORE II and the success of CABG in elderly patients. A probability (p) value < 0.05 was considered significant.
**Results:** Patients were mostly male in their sixties with a mean of 65.5 ± 4.9 years old, had three-vessel disease, and predicted mortality of 1.6%. The average number of grafts used was 3.3 ± 0.7, and the average length of hospital stay was 7.4 ± 2.4 days. The morbidity rate was 71.8%, with bleeding as the most common complication, a 17.6% mortality rate, and a success rate of 82.4% (short-term) and 80% (one-year postoperative). Higher EuroSCORE II was found to significantly decrease the probability of both short-term (prevalence ratio [PR], 0.766; 95% CI, 0.604-0.971; p = .028) and one-year postoperative success (PR, 0.787; 95% CI, 0.624-0.993; p = .044).
**Conclusion:** Surgical success in elderly patients is influenced by many factors, and old age should not deter physicians from referring patients for CABG. Despite the ability of EuroSCORE II to predict surgical success, both short-term and one-year survival, on elderly patients, there is a need for holistic and locally validated scoring systems to both evaluate and predict surgical success due to the unique healthcare context of Indonesia.

**Highlights:**
1. CABG is the most performed cardiac surgery in Indonesia, and most patients undergoing this surgery are above 60 years old.
2. CABG success rate is not significantly influenced solely by the patient's age but also by several perioperative characteristics such as gender, comorbidities, and other variables included in the calculation of EuroSCORE II.

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## Introduction

Coronary artery disease (CAD) is a condition where the blood supply to the myocardium is not optimal due to the hardening and narrowing of the coronary arteries and is responsible for 26.4% of deaths in Indonesia.[1,2] This triggers the death of myocardium, causing its most feared complication, acute coronary syndrome.[3] The epidemiology of CAD shows that the prevalence of this disease increases with aging. The incidence of CAD at 60 years old and over increases two to three times compared to the younger age group.[4] Therefore, old age is known as one of the risk factors in diagnosing CAD.[5]

When there is little to no clinical improvement after lifestyle changes and medicine-based therapy, one of the options for treating CAD is coronary artery bypass grafting (CABG), also commonly referred to as heart bypass surgery. CABG is the most widely performed cardiac surgery in Indonesia.[6] Not only in Indonesia, this procedure is also one of the most frequently performed heart surgeries in the world, with around 200,000 cases per year in the United States (US) and Western European countries.[7]

A study by Acinapura, *et al*. (1990) involving 5,563 patients in the US showed that the mean age of patients undergoing CABG was 68.5 years old, with 38% of patients over 70 years old.[8] The study also found that the mortality rate in patients aged over 70 years old was significantly higher than in patients under 70 years old.[8] This is quite concerning because this study implies that with increasing age, the risk of death during and after CABG also increases. Most CAD patients who undergo CABG surgery are aged ≥60 years old. However, Gimbel, *et al*. (2020) found that the long-term outcome of CABG patients aged ≥75 years old was better than those who underwent percutaneous coronary intervention (PCI).[9] In addition to the significantly lower long-term mortality rate (14.5%), recurrence of angina was also less common in CABG patients (9.2%) than PCI patients (24.4%).[9]

As the largest hospital in East Java, Dr. Soetomo General Academic Hospital, Surabaya, performs 260 heart surgeries annually, with CABG and congenital surgeries being the two most commonly performed.[6] Therefore, this study aimed to examine the success and outcome of CABG on elderly patients in Dr. Soetomo General Academic Hospital, Surabaya, because the data is still unavailable. This study could be used to provide data on the success rate of CABG on elderly patients in Dr. Soetomo General Academic Hospital, Surabaya, and the factors that influence it. This study is expected to provide clinicians with information to help consider CABG indications in elderly patients. In addition, this study will contribute to providing consideration to the public in making an informed decision to undergo CABG.

## Methods

This was a cross-sectional retrospective study using secondary data collected from medical records. This study used total population sampling from CABG patients who were ≥60 years old (the age group that is considered geriatric/elderly based on the Regulation of the Minister of Health of the Republic of Indonesia no. 79/2014 regarding Management of Geriatric Care in Hospitals)[10] and operated by the Department of Thoracic, Cardiac, and Vascular Surgery, Dr. Soetomo General Academic Hospital, Surabaya, from January 2018 - December 2020.

Variables in this study were grouped into perioperative and outcome data. Age, gender, vessel disease, number of grafts, length of hospital stays, and the European System for Cardiac Operative Risk Evaluation (EuroSCORE) II were classified as perioperative characteristics.[11] Meanwhile, short-term success rate (STSR), one-year postoperative success rate (OYSR), and morbidity and mortality rates with their causes were classified as surgical outcomes. All variables were analyzed using Jeffrey's Amazing Statistics Program (JASP) software version 0.16.1 with descriptive statistics and frequency distribution.[12] Logistic regression was also conducted between EuroSCORE II, STSR, and OYSR to investigate their relationship.

## Results

Elderly patients who underwent CABG at Dr. Soetomo General Academic Hospital, Surabaya, in 2018 amounted to 36 patients, 34 patients in 2019, and 33 patients in 2020, totaling 103 patients from January 2018 to December 2020. However, due to incomplete or missing medical records, 18 patients were excluded, resulting in 85 patients as subjects.

Table 1. Perioperative characteristics

| Characteristics | 60-69 | 70–79 | > 79 | All |
|---|---|---|---|---|
| **Sex (n)** | | | | |
| Male | 56 | 8 | 1 | 65 (76.5%) |
| Female | 17 | 2 | 1 | 20 (23.5%) |
| **Age (years old)** | | | | |
| Mean | 64 ± 2.8 | 73 ± 2.8 | 83 ± 1.4 | 65.5 ± 4.9 |
| Mode | 60 | 71 | - | 60 |
| Range | 60-69 | 70-79 | 82-84 | 60-84 |
| **Number of vessel disease (n)** | | | | |
| 3VD | 61 | 8 | 1 | 71 (83.5%) |
| 2VD | 9 | 2 | 1 | 11 (13.5%) |
| 1VD | 3 | - | - | 3 (3.5%) |
| **EuroSCORE II (%)** | | | | |
| Mean | 2.2 ± 2.0 | 2.7 ± 2.5 | 3.1 ± 1.0 | 2.3 ± 2.0 |
| Median | 1.4 | 2.1 | 3.1 | 1.6 |
| Range | 0.5-9.2 | 0.9-9.5 | 2.4-3.9 | 0.5-9.5 |
| **EuroSCORE II risk (n)** | | | | |
| Low (<4%) | 65 | 9 | 2 | 76 (89.4%) |
| Moderate (4–9%) | 7 | - | - | 7 (8.2%) |
| High (>9%) | 1 | 1 | - | 2 (2.4%) |
| **Number of grafts per patient (n)** | | | | |
| Mean | 3.3 ± 0.7 | 3.2 ± 0.6 | 3.0 ± 0 | 3.3 ± 0.7 |
| Mode | 3 | 3 | 3 | 3 (54.1%) |
| Range | 1-5 | 2-4 | 3 | 1-5 |
| **Length of hospital stay (days)** | | | | |
| Mean | 7.2 ± 2.2 | 8.7 ± 3.2 | 6.0 ± 0 | 7.4 ± 2.4 |
| Mode | 6 | 7 | 6 | 6 |
| Range | 4-14 | 6-16 | 6 | 4-16 |

Source: Research data, processed

Most subjects were in their sixties (85.9%) and male (71.8%). The mean age was 65.5 ± 4.9 years old. Most subjects had three-vessel disease (3VD) (83.5%), low-risk EuroSCORE II (89.4%) with a predicted mortality of 1.6% (median of EuroSCORE II), and used three grafts (54.1%). Length of hospital stay is when patients are hospitalized

postoperatively until they are discharged. The mean length of hospital stay was 7.4 ± 2.4 days with most patients staying for six days postoperative (Table 1).

Table 2. Surgical outcomes

| Characteristics | 60–69 | 70–79 | > 79 | All |
|---|---|---|---|---|
| **Morbidity rate (n)** | | | | |
| Total (%) | 51 (69.9) | 9 (90) | 1 (50) | 61 (71.8) |
| Male | 37 | 7 | - | 44 (67.7) |
| Female | 14 | 2 | **1** | 17 (85) |
| **Mortality rate (n)** | | | | |
| Total (%) | 13 (17.8) | 1 (10) | 1 (10) | 15 (17.6) |
| Male | 9 | 1 | 0 | 10 (15.4) |
| Female | 4 | - | 1 | 5 (25) |
| **Short-term success rate (n)** | | | | |
| Total (%) | 60 (82.2) | 9 (90) | 1 (50) | 70 (82.4) |
| Male | 47 | 7 | 1 | 55 (84.6) |
| Female | 13 | 2 | - | 15 (75) |
| **One-year postoperative success rate (n)** | | | | |
| Total (%) | 59 (80.8) | 8 (80) | 1 (50) | 68 (80) |
| Male | 46 | 6 | 1 | 53 (81.5) |
| Female | 13 | 2 | - | 15 (75) |

Source: Research data, processed

Morbidity is complications that occurred postoperatively before the patient was discharged. Postoperative complications can include bleeding (>300ml or whereas transfusion and/or reoperation was required), acute kidney injury (AKI) (postoperative hemodialysis was required or > 1mg/dL increase of postoperative serum creatinine), acute respiratory failure (ARF) (>24hr postoperative mechanical ventilation, and/or postoperative lung edema with or without signs of acute respiratory distress syndrome), perioperative myocardial infarction (PMI) (confirmed with cardiac enzymes assays, electrocardiogram (ECG), or imaging), surgical site infection (SSI) (superficial & deep incisional also organ-space), cerebrovascular accident (CVA) (confirmed with imaging), or other causes listed and confirmed in the patient's medical record.

Almost 72% of the patients experienced at least one complication based on the abovementioned criteria. Postoperative complications were more common among female patients (85%) than male patients (67.7%) (Table 2). The most common complications were bleeding (36.5%), AKI (29.4%), and low cardiac output syndrome (LCOS) (12.9%) (Table 3). LCOS consisted of patients who were reported in the medical record as having postoperative heart failure (4 patients) and cardiogenic shock (7 patients).[13]

Mortality is defined as death that occurred postoperatively before the patient was discharged from the hospital. The mortality rate was 17.6%, with death occurring more commonly in women (25%) than men (15.4%). The most common cause of death was septic shock (53.3%), followed by cardiogenic shock and respiratory failure (20%) (Table 4).

In this study, CABG is regarded as successful when the patient survives the surgery and stays alive post-surgery. Therefore, this study measured the success rate by two timeframes, STSR and OYSR. STSR is the number of patients alive when immediately discharged from the hospital postoperatively. Seventy out of 85 patients were discharged alive from the hospital, making the STSR 82.4%. OYSR is the number of patients who remained alive one year after the date of CABG. OYSR was calculated not only for cardiac death but also based on all-cause mortality. Two patients died before the one-year postoperative period, making the OYSR 80% (Table 2). The cause of death remained unknown because the family members were not willing to disclose it. In accordance with mortality and morbidity rates, male patients (84.6% & 81.5%) were also more likely to have a successful surgery than female patients (75%) for both short-term and one-year postoperative.

Table 3. Causes of morbidity

| Causes | n(%) |
|---|---|
| Bleeding | 31 (36.5%) |
| AKI | 25 (29.4%) |
| LCOS | 11 (12.9%) |
| ARF | 11 (12.9%) |
| Arrhythmia | 10 (11.8%) |
| Sepsis | 10 (11.8%) |
| Pleural effusion | 7 (8.2%) |
| PMI | 3 (3.5%) |
| Pneumothorax | 2 (2.4%) |
| Pneumonia | 2 (2.4%) |
| SSI | 2 (2.4%) |
| CVA | 2 (2.4%) |
| Cardiac tamponade | 1 (1.2%) |

Source: Research data, processed

Logistic regression was performed to assess the relationship between EuroSCORE II and the success of CABG on elderly patients in Dr. Soetomo General Academic Hospital, Surabaya, from 2018 to 2020. The results were significant, meaning that EuroSCORE II affects the success of CABG on elderly patients ($p < 0.001$). The probability of a patient with a EuroSCORE II of 0.50% (lowest score possible for patients ≥60 years old) to have short-term success of CABG is 90.3% [$(e^{2.230} (1 + e^{2.230}) = 0.903$].

Table 4. Causes of mortality

| Causes | n(%) |
|---|---|
| Septic shock | 8 (53.3%) |
| Cardiogenic shock | 3 (20%) |
| Respiratory failure | 3 (20%) |
| Malignant arrhythmia | 1 (6.7%) |

Source: Research data, processed

Meanwhile, the probability of a patient with a EuroSCORE II of 0.50% surviving one year postoperative is 88% [$(e^{1.989} (1 + e^{1.989}) = 0.88$]). Because the prevalence ratio (PR) of EuroSCORE II is less than one, the probability of a successful surgery, both short-term and one year postoperative, is higher when EuroSCORE II is lower. The term PR will be used as this was a cross-sectional study. One percent increase in EuroSCORE II score was

associated with a 23.4% decrease in the probability of short-term success and a 21.3% increase in one-year postoperative success (1 - PR). Based on the results obtained, it can be predicted that there will be a decrease in the probability of short-term success between 50-99% and one-year postoperative success between 53-99% for patients with higher EuroSCORE II.

Table 5. Logistic regression between EuroSCORE II and STSR & OYSR

| | β | PR | p-value | Lower 95% CI | Upper 95% CI |
|---|---|---|---|---|---|
| **STSR** | | | | | |
| **(Intercept)** | 2.230 | 9.296 | <0.001 | 3.822 | 22.609 |
| **EuroSCORE II (%)** | -0.267 | 0.766 | 0.028 | 0.604 | 0.971 |
| **OYSR** | | | | | |
| **(Intercept)** | 1.989 | 7.310 | <0.001 | 3.168 | 16.869 |
| **EuroSCORE II (%)** | -0.240 | 0.787 | 0.044 | 0.624 | 0.993 |

Source: Research data, processed

## Discussion

As stated in the EuroSCORE II calculations, age affects the success of heart surgery.[11] The older a person is, the greater the risk of dying from heart surgery. However, when comparing the data, patients in the sixties seemed to have a lower STSR than the seventies group (82.2% vs 90%). Nevertheless, the OYSR was corrected to 80.8% for the sixties group and 80% for the seventies. This could happen because age is not the only factor that affects surgical success. Age is only one out of 18 variables that are taken into account in calculating EuroSCORE II. It is possible that the preoperative condition of 9 patients in the seventies group who had short-term success was overall better than the 13 patients in their sixties who passed away. This is exactly what the study found when comparing these two groups' mean of EuroSCORE II. The average EuroSCORE II of patients in their sixties who died was higher (2.86%) than patients in their seventies who survived (1.95%), regardless of age difference. Age is not an independent factor in determining postoperative mortality. Therefore, it cannot be justified if a patient refuses to undergo CABG just for the sole reason of old age. Aside from age, EuroSCORE II also considers gender as one of the factors affecting the success of heart surgery.[11]

A meta-analysis conducted by Alam, *et al*. (2013) found that being female increases the risk of short-term mortality after CABG by 77%.[14] This study also found that women are more likely to undergo urgent or emergency CABG than men.[14] This finding is in accordance with the situation in Dr. Soetomo General Academic Hospital, Surabaya, where this study found 67% of patients with urgent CABG were female with a 2:1 ratio. According to the study, this was because female patients were less likely to be recommended for elective CABG or were usually recommended at a later period when the arterial blockage was already more progressive.[14] In addition, women also have smaller coronary artery diameters than men.[15] This small diameter makes women have a higher risk of complications and death when undergoing CABG. At first glance, a morbidity rate of 72% may seem high. However, a study in the US, which included 67,568 CABG patients aged 70 years old and over, found similar results with a morbidity rate of 80% in patients aged 80-89 years old and around 73% in patients in their seventies.[16]

As found in this study, the most common complication in that study was also bleeding (41%).[16] Studies showed that old age is a risk factor for bleeding, even to the point of needing reoperation.[17] In addition, postoperative atrial fibrillation/arrhythmias, bleeding, PMI, LCOS, CVA, SSI, and kidney failure are more common in elderly patients and lead to poorer outcomes.[18] However, there was a 16% difference between the predicted and the actual mortality rate (1.6% vs 17.6%). A previous study in Dr. Soetomo General Academic Hospital, Surabaya, covering cardiac surgery patients from 2016 to 2018, also found that the single CABG mortality rate (7.9%) was higher than the mortality rate predicted by EuroSCORE II (1.75%).[19] A multicenter study in Indonesia in 2022 also found similar results (11.3% vs 1.28%).[20] It can be concluded from the studies that in Indonesia, the actual mortality rate tends to be higher than what EuroSCORE II predicted. Studies in Indonesia, including this study, agree that EuroSCORE II underestimates the mortality of CABG patients in Indonesia.[19,20] This underestimation may occur due to the absence of representation from the Indonesian population when determining indicators of EuroSCORE II.[11]

There were only 8 Asian countries out of the 43 countries involved, and none of them are from Southeast Asia.[11,20] Other studies in Asia have the same consideration, seeing the lack of representation of Asian races in the development of EuroSCORE II.[21–23] Although both were conducted in Indonesia, the multicenter study by Kurniawaty, *et al*. (2022) found that EuroSCORE II had poor calibration for the Indonesian population, whereas Sembiring, *et al*. (2021) found otherwise.[19,20] Due to the limited research related to the validation of EuroSCORE II in Indonesia, it is certainly not possible to conclude whether or not this scoring system is suitable to be applied in Indonesia. Singapore and China have even proposed separate scoring systems for Asian populations, such as the Asian System for Cardiac Operative Risk Evaluation (ASCORE-C) and the Sino System for Coronary Operative Risk Evaluation (SinoSCORE), based on the characteristics of their countries.[21,22] Thus, they have better discrimination and calibration abilities than EuroSCORE II.[21,22] In addition, a study in France assessed that EuroSCORE II significantly underestimated the mortality rate of elderly patients undergoing cardiac surgery.[24]

This study also found that the death of elderly patients who underwent CABG in this study was mostly caused by septic shock (53.3%). Sepsis increases a patient's chance of in-hospital mortality post-CABG by 4.2 times.[25] Of all patients who experienced postoperative sepsis in this study, 90% of patients died with 8 patients recorded due to septic shock and 1 patient due to cardiogenic shock. This is because sepsis was found to have a role in causing other complications post-CABG.[26] A study found that patients with postoperative sepsis experienced significantly more

postoperative AKI and ARF than patients without sepsis.[27] These findings are consistent with this study, where 80% of the patients with sepsis had ARF and 70% had AKI. Factors that increase the risk of sepsis in CABG patients include age >80 years old, body mass index (BMI) of 40 kg/m$^2$, poor preoperative condition, diabetes mellitus, congestive heart failure, preoperative renal function impairment, emergency surgery, and use of preoperative immunosuppressants.[26,28]

This study found that the patients with sepsis had moderate and severe renal impairment (70% and 30%), preoperative critical condition (20%), diabetes mellitus with insulin (60%), and heart failure (40%). These data are certainly in accordance with the mentioned literature, where 100% of the patients with sepsis had associated risk factors. In addition, mean age and EuroSCORE II in patients with sepsis (66.4 years old; 3.13%) were also higher than patients without sepsis (65.3 years old; 2.14%). Due to limited data in medical records, this study could not specify the exact entry point for infection for 70% of patients with sepsis. Infectious complications post-CABG that were recorded were pneumonia and SSI. All postoperative pneumonia patients had sepsis, but only one of two SSI patients had sepsis. This is in accordance with a study that found the respiratory tract was the most common infection entry point causing sepsis (72.1%) in cardiac surgery patients.[27]

Patients after cardiac surgery are particularly susceptible to infection, particularly ventilator-acquired pneumonia (VAP), in the first five days postoperative.[29] In addition, sterility during CABG and postoperative care in the intensive cardiac care unit (ICCU) is also very important to be re-evaluated. Periodical sterilization of rooms and equipment, as well as mobility restrictions of people in the ICCU, need to be performed strictly to prevent nosocomial infections in post-cardiac surgery patients. STSR for elderly CABG patients in this study was 82.4%, and the OYSR was 80% (from all patients) and 97.1% (from short-term successful patients). Since the success measurement in this study was limited to observing patients' postoperative survival, all factors that reduced the possibility of mortality were considered to increase the chances of a successful CABG in elderly patients. EuroSCORE II predicts patient mortality when undergoing cardiac surgery. Therefore, it can be assumed that the success rate of the operation will be higher when the value of EuroSCORE II is lower. Logistic regression was performed to ascertain the relationship between the two in elderly patients.[29]

The result found a significant negative relationship between the two, where a decrease will follow an increase of EuroSCORE II in the probability of both short-term (prevalence ratio [PR], 0.766; 95% CI, 0.604-0.971; p = .028) and one-year postoperative success (PR, 0.787; 95% CI, 0.624-0.993; p = .044). Simply put, patients with higher EuroSCORE II have a lower probability of surviving CABG up to one year later than patients with lower EuroSCORE II. Apart from the variables related to the patients' clinical characteristics covered in this study, however, many factors can still influence the success of CABG surgery. EuroSCORE II may be able to predict success based on a patient's clinical condition, but it does not cover factors that are not related to that. The factors include the hospital's experience in related operations and perioperative and postoperative care quality. The easiest way to assess a hospital's experience is by counting the number of procedures performed each year. Most studies agreed that a significant relationship exists between mortality rate and the frequency of CABG performed in the hospitals.[30–32] The lowest success rates were reported in hospitals with low frequency of procedures, defined by Peterson, *et al*. (2004) as performing ≤150 CABG per year.[30] This study found a significant mortality rate difference of 1.1% between hospitals with the highest and lowest frequencies.[30] This figure may seem small, but in that study, 1.1% represented the lives of 3,008 patients.

The study also found that in-hospital mortality decreases by 0.07% for every additional 100 CABGs per year.[30] A study in the US involving patients ≥65 years old found that the mortality rate decreases steadily with every increase in CABG frequency in hospitals.[31] Birkmeyer, *et al*. (2002) defined low procedure frequency as <230 CABGs per year.[31] The study argues that patients can substantially increase their chances of a successful surgery by choosing a hospital that performs CABG at a high frequency.[31] Unfortunately, due to various factors, such information might be difficult for the majority of Indonesians to access. Another study conducted in the US involving patients ≥65 years old found that the probability of in-hospital mortality in hospitals with low CABG frequency continued to increase significantly in 10 consecutive years of observation (2000–2009).[32] Although there has been a decrease in mortality rates in both high and low CABG frequency hospitals from year to year, the decline in higher-frequency hospitals is greater than in low-frequency ones.[32]

In Dr. Soetomo General Academic Hospital, Surabaya, CABG was performed 199 times between 2018 and 2020, with 77 patients in 2018 and 61 patients each in 2019 and 2020. For elderly patients (≥60 years old), there were 103 times (51.8%), with 36 patients in 2018, 34 patients in 2019, and 33 patients in 2020. Although this figure can be considered low frequency compared to studies in the US, as a tertiary referral hospital in Eastern Indonesia, it is safe to assume that Dr. Soetomo General Academic Hospital, Surabaya, has the highest frequency of CABG in Eastern Indonesia. This "low frequency" of CABG in Dr. Soetomo General Academic Hospital, Surabaya, is likely influenced by socioeconomic and cultural factors that made Indonesians reluctant to seek treatment, let alone undergo surgery at hospitals in Indonesia. The majority of Indonesians consider themselves healthy when they can do their daily activities without any disruptions.[33] Therefore, Indonesians usually seek treatment when CAD is already at a more advanced stage that produces symptoms disrupting daily activities (angina, dyspnea, and others). People with lower education and poorer economic conditions tend to seek treatment from traditional or alternative medicine and are more reluctant to seek care in modern health facilities like hospitals.[33]

There are several contributing factors to this, such as cultural beliefs, complex and confusing hospital administration, long waiting time, and cost of hospitalizations that are not covered by the National Health

Insurance (BPJS), such as transportation, the cost of family members accompanying, and the rest.[33] To make matters worse, Indonesia's middle and upper class prefer to seek treatment abroad rather than in Indonesian hospitals. The Indonesian Ministry of Tourism and Creative Economy stated that 600,000 Indonesians traveled abroad for healthcare in 2012 and valued at US$ 1.4 billion.[34] This number only went up as in 2021, the President of the Republic of Indonesia, Joko Widodo, stated that around two million Indonesians went abroad for medical treatments and spent almost one hundred trillion rupiah, equivalent to US$ 6.4 billion.[35]

This phenomenon of double reluctance from Indonesians to seek care in local hospitals certainly has an impact on the low frequency of various medical procedures, including CABG in Indonesian hospitals. Although there is a relationship between the frequency of CABG conducted and in-hospital mortality, this does not mean that frequency is the sole indicator of the quality of surgery. Therefore, for frequently performed surgeries like CABG, direct assessment of surgical outcomes such as postoperative complications and functional outcomes (readmission rate & patient's quality of life) would be a better indicator of a hospital's quality of surgery.[32]

## Strength and Limitations

This study is the first study in Indonesia to conduct a retrospective study regarding the success of CABG in the elderly population. It is also the first study to provide an overview of this group of patients' characteristics, both perioperative and postoperative, including EuroSCORE II predicted mortality in comparison to actual mortality. However, this is a single-centered study. Further, multicentered studies are highly encouraged to increase the representation of the Indonesian population. This study also only defines CABG success based on survival and all-cause mortality. Assessment of readmission rates, incidence of adverse cardiac events after discharge, and patients' quality of life postoperative may be taken into consideration in defining CABG success in further studies.

## Conclusion

Surgical success in elderly patients CABG is intricately influenced by numerous factors, challenging the notion that advanced age should stand as a sole deterrent for physicians when considering referrals for this procedure. The study revealed that despite the efficacy of EuroSCORE II in predicting both short-term and one-year survival in elderly CABG patients, there is also a need for a more nuanced approach due to raised concerns as the mortality rate surpassed the predictions made by EuroSCORE II in all studies conducted in Indonesia, hinting at potential underestimation of mortality risk within the Indonesian population. A holistic and locally validated scoring system becomes imperative in the unique healthcare landscape of Indonesia.

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## Conflict of Interest

The authors declared there is no conflict of interest.

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## Ethical Clearance

This study was ethically approved by the Health Research Ethics Committee of Dr. Soetomo General Academic Hospital, Surabaya (No. 0561/LOE/301.4.2/VIII/2021) on 30-08-2021 with a waiver of informed consent as this was a minimal-risk retrospective study.

## Authors' Contributions

Conceived the study, designed the study, gathered, analyzed, and interpreted the data, made tables and figures, and wrote the manuscript: AMT. Reviewed, revised, and approved the final version of the manuscript to be published: YES, BBD, ORSP.

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