Review Article

Modifying Risks to Improve Outcome in Cardiac Surgery: An Anesthesiologist's Perspective

Abstract

Challenging times are here for cardiac surgical and anesthesia team. The interventional cardiologist seem to have closed the flow of 'good cases' coming up for any of the surgery,; successful percutaneous interventions seem to be offering reasonable results in these patients, who therefore do not knock on the doors of the surgeons any more . It is a common experience among the cardiac anesthesiologists and surgeons that the type of the cases that come by now are high risk. That may be presence of comorbidities, ongoing medical therapies, unstable angina, uncontrolled heart failure and rhythm disturbances; and in patients with ischemic heart disease, the target coronaries are far from ideal. Several activities such as institution of preoperative supportive circulatory, ventilatory, and systemic disease control maneuvers seem to have helped improving the outcome of these 'high risk ' patients. This review attempts to look at various interventions and the resulting improvement in outcomes. Several changes have happened in the realm of cardiac surgery and several more are en route. At times, for want of evidence, maximal optimization may not take place and the patient may encounter unfavorable outcomes.. This review is an attempt to bring the focus of the members of the cardiac surgical team on the value of preoperative optimization of risks to improve the outcome. The cardiac surgical patients may broadly be divided into adults undergoing coronary artery bypass graft surgery, valve surgery and pediatric patients undergoing repair/ palliation of congenital heart ailments. Optimization of risks appear to be different in each genre of patients. This review also brings less often discussed issues such as anemia, nutritional issues and endocrine problems. The review is an attempt to data on ameliorating modifiable risk factors and altering non modifiable ones.

Keywords: *Modifiable, outcome improvement, risk stratification*

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Introduction

When patients undergo cardiac surgery or for that matter any surgery, the intention of the team providing health-care services is to have a successful short- and long-term outcome. Several preexisting factors, either modifiable or nonmodifiable may contribute to adverse outcomes. In this review, the authors attempt to discuss the effects of modification or attenuation of the risk factors on the outcome. Many of the nonmodifiable factors such age, sex, race are well-known risk factors contributing to adverse outcomes, but the treating team can hardly alter them or adverse outcomes due to them, other than raising a red flag if a patient shown to be high risk due to these nonmodifiable factor presents oneself to surgery. However, some of the factors such as uncontrolled diabetes, smoking, anemia, heart failure, renal dysfunction, and others could be attenuated and have been shown to improve outcome. Cardiac surgery is at cross roads with percutaneous revascularization taking precedence over surgery; it is very important to modify as many risk factors possible and improve outcome. Modifying risk factors with an aim to improve outcome may be possible when surgery is not urgent. However, even while emergent situations arise, some degree of modifications may still be possible unless the condition is life-threatening. This review perhaps points to the lack of ideal risk scoring system and the need to develop one.

The concept of risk stratification of cardiac surgical patients is developed, with an intention to identify high-risk patients and to improve the outcome by appropriately modifying them when possible. Perioperative morbidity and mortality result from multiple factors and these have been studied to risk stratify. Many such systems have been formulated to assess the risk.

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Several newer scores have been produced claiming benefit over the preexisting ones. An overview of the scores indicates the commonality of several risk factors such as sex, obesity, smoking, prior myocardial infarction among others which are validated. These scores appear to predict perioperative risks correctly, when a sub-sect of patients on whom it was designed, and suboptimally when yet another subsect is analyzed, probably due to racial and genetic variation in the second population. Recently, exponential increase in percutaneous coronary interventions (PCIs) has rendered "good" risk cardiovascular cases with predicted good outcomes diminishing. This has resulted in patients with higher risk being presented to undergo cardiac surgery (coronary artery bypass graft [CABG] surgery, valve, and congenital heart surgeries) than earlier. It is time that the cardiac surgical teams give a fresh look at ameliorating the morbidities and mortality by modifying the risk factors perioperatively and improve outcome. This review may not be the ideal locale to debate if PCI is superior to CABG; however, there are studies supporting either PCI or CABG. With superior materials used for stunting, and the procedure being semi-invasive, PCI will always hold the attraction to a patient.

Risk scoring

Probably, the first risk assessment tool was created by Paiement *et al*. in 1983.[1] Eight parameters were used to risk stratify patients by this method. The authors in a study of five hundred cases validated their scoring system. They found that the operated population at normal risk (no risk factors) had a mortality of 0.4%, the patient group with increased risk (one risk factor) had a mortality of 3.1%, and the high-risk group (more than one factor) had a 12.2% mortality. The next scoring method was the Parsonnet scoring described in the year 1989.[2] This additive model of scoring identified 14 risk factors after univariate regression analysis of a large number of patients. Acute structural defects, cardiogenic shock, acute kidney injury, pacemaker dependency, age >80 years, and congenital heart disease in adults carried high weightage points. The O'Connor scoring method was developed in the year 1992.[3] This scoring method included several novel factors such as ejection fraction, left ventricular (LV) end-diastolic pressure among others. In the same year (1992), Higgins *et al*. developed the clinical severity score by analyzing the logistic regression of data of about five thousand patients, which was later validated in more than four thousand patients.[4] In this scoring method, emergency procedure, preoperative serum creatinine level of >1.7 mg/dL, severe LV dysfunction, preoperative hematocrit (HCT) of less than 34%, increasing age, chronic pulmonary disease, prior vascular surgery, reoperation, and mitral valve insufficiency were identified as independent risk factors for 30 days mortality. Perhaps the most robust of all databases; and therefore, the scoring systems may be the Society of Thoracic Surgeons (STS), with more than eight hundred participating institutions and more than eighty thousand patients. There were several validations of this scoring method.[5] The European System for Cardiac Operative Risk Evaluation (EuroSCORE) for cardiac operative risk evaluation was developed from more than 19 thousand cardiac surgical procedures from more than one hundred centers across Europe. EuroSCORE I in the year 1999[6] was followed by EuroSCORE II in the year 2012.[7] Validation of the EuroSCORE in various populations has been undertaken. It is claimed to be valid in Taiwanese,[8] but not so in Chinese patients undergoing valve surgeries[9] and Indian patients.[10] It can be understood from the previous paragraph that various scoring systems fail validation when a population other than the ones originally meant for is analyzed. It is interesting to understand what ails the risk scores? It is quite obvious that the parameters studied perhaps differ from one population to another; additionally, more importantly, the risk scores do not factor several actualities. To name a few, using off-pump techniques in contrast to on-pump, using warm heart (without hypothermia) surgeries, use of minimal access cardiac surgeries (with cardiopulmonary bypass through the groin), varying indications for cessation of antiplatelet medications, institutional preferences over the choice of inotropic agents, varying indications and contraindications for the use of intra-aortic balloon counterpulsation are some.

It is not merely enough to understand the risks. These scores have been primarily developed to understand the risks, with aim to modifying it with an intention to improve the outcome. It seems all the more necessary in the present era when PCIs seems to threaten the existence of revascularization by surgery. It is not uncommon to note percutaneous interventions of even complex coronary diseases such as left main coronary artery, which were not a long ago considered for surgical domain only.[11]

Choosing the appropriate treatment mode through a scale was introduced by SYNTAX score.[12] The authors Kappetein *et al*. suggest that "In patients with multivessel or left main disease, still CABG remains the dominant revascularization strategy. PCI is performed frequently without supporting data from the literature. PCI for this indication is performed more often in Europe than in USA. Only a minority of the patients receives total arterial grafting in case of CABG. The SYNTAX trial with randomized and registry cohorts should provide guidance for selecting the preferred form of treatment."

It is important for the clinicians to modify the existing risks to generate better outcomes because it is unlikely that "low-risk patients" may neither be sent for nor opt for surgical revascularization in future. The onus of modifying the risks falls on the members of the cardiac surgery team, undeniably so, on the anesthesiologist. It is important to understand the risk factors that are amenable

Table 1: The modifiable and nonmodifiable risk factors

Nonmodifiable factors	Modifiable factors
Age	LV dysfunction/congestive heart failure
Sex	Control of diabetes
Race	Control of hypertension
Prior myocardial infarction	Alleviation of renal dysfunction
Prior cardiac surgery	Managing atherosclerosis
Emergent surgery	Smoking cessation
Combined procedure	Anemia
CABG surgery for left main disease	
Obesity	

CABG: Coronary artery bypass graft, LV: Left ventricular

for improvement and those that are not. Table 1 below shows the list. Nonmodifiable factors could be attenuated by interventions.

Nonmodifiable Factors

Age, sex, and race

Advancing age and female sex have been shown to adversely affect outcome after cardiac surgeries by many authors. There is hardly any mechanism that could be intervened to tackle issues arising out of advanced age and female sex. However, what one could do is to address physiological problems such as atherosclerosis, hormonal issues (hypothyroidism, diabetes mellitus, and estrogen deficiency), hypertension, and other systemic diseases associated with advancing age and female sex. Nonwhite race has been shown to be a risk factor.[13] Clinical profile of patients is quite different in Asia in contrast to the Western world. The difference is due to the differences of patient demographics, delayed clinical presentation due to socioeconomic, cultural and geographical reasons; inequitable distribution of medical facilities and different treatment patterns. Similar differences combined with altered risk-adjusted mortality were also found in China and India when compared with that of STS and EuroSCORE II sample population. Similar differences combined with altered risk-adjusted mortality were also found in China and India when compared with that of STS and EuroSCORE II sample population undergoing valve surgeries.[10,14,15] It is recommended that each population validates its own cardiac surgical patient subject. EuroSCORE, after all, is not meant to be universal, but just a guide.

Prior myocardial infarction

A landmark work on analysis of over ten thousand patients who had prior myocardial infarction, who underwent CABG surgery showed that age, female sex, nonatrial fibrillation arrhythmia, heart failure, respiratory disease, renal failure, diabetes mellitus, liver disease, peripheral vascular disease, prior unstable angina, and prior stroke all increased mortality. In contrast, hypertension appeared protective.[16] A few of the risk factors such as heart failure, diabetes, and prior unstable angina are the only amenable factors that could be optimized. Optimization of preoperative arrhythmias with specific antiarrhythmic may not only reduce their incidence postoperatively but also complications due to them.

Acute myocardial infarction and prior coronary artery bypass surgery

The VALsartan in acute myocardial iNfarcTion Trail (VALIANT) identified that the patients with prior CABG surgery are likely to suffer from more complications when they undergo a repeat CABG than those without prior surgery.[17] The authors opined "Patients with a history of CABG were more likely to experience renal insufficiency, dyslipidemia, and diabetes than patients without CABG. Congestive heart failure occurred with similar frequency in patients with or without prior CABG; however, ventricular fibrillation trended toward occurring less often in patients with prior CABG." Survival from cardiovascular death was significantly lesser in those without prior CABG. Overall, prior CABG is associated not only with more medications and complications but less survival-prior CABG was an independent predictor of adverse cardiovascular outcomes, including the composite outcome of cardiovascular death, myocardial infarction, and heart failure. A combination of acute coronary syndrome in patients with prior CABG appears to produce worse outcomes.

Emergent surgery

Emergent CABG for acute myocardial infarction is associated with elevated operative risk. Emergency CABG was associated with an overall in-hospital mortality rate was 18.3% (20 of 109 patients). In univariate analysis, significant preoperative risk factors for in-hospital mortality for emergency CABG were age, ST elevation myocardial infarction, poor LV ejection fraction, presence of cardiogenic shock, the need for intraaortic balloon pump (IABP), pulmonary hypertension, and high serum creatine level. The prediction of mortality by EuroSCORE is inaccurate in high-risk patients. Recently, treatment of acute coronary syndromes by PCI and CABG has been studied. There appears to be a consensus that PCI are preferred in the early days after myocardial infarction, and CABG was conducted at least 48 h after myocardial infarction.[18,19] Three distinct groups of risks could be identified-intermediate risk, high risk, and very high risk, which had different additional cofactors for mortality prediction. It appears from the available literature that in emergent situations, PCI appears to perform better, if CABG is the first choice, it may be conducted a few days later.

Combined procedures

Conducting combined procedures is associated with higher mortality, isolated valve surgery carried lower mortality

rate (3.5%) in contrast to combined surgery (13.5%).[20] Age more than 70 years, and emergency operations carried significantly high mortality. In a recent meta-analysis about combined mitral valve, repair/replacement surgery with CABG was compared with CABG only (despite the presence of ischemic mitral regurgitation [MR]). The outcome was not different between the two groups.[21] These authors did not find difference in the residual MR, LV ejection fraction, New York Heart Association classification of physical status, and long-term survival rates.

Coronary artery bypass graft in patients with left main coronary artery disease

It was hitherto thought that off-pump coronary artery bypass (OPCAB) reduces the incidence of stroke even in patients with left main coronary artery disease. The reduction in stroke is mainly due to the avoidance of cardiopulmonary bypass.[22] However, a recent meta-analysis showed that the risk of stroke appeared to be higher in patients with left main coronary artery disease.[23] The evidence on this topic is limited, but, there appears to be a significant association between ascending aortic atherosclerosis and left main coronary artery disease. The authors suggest preoperative, intraoperative, and postoperative strategies to prevent strokes in these patients. There is also an association observed between left main coronary artery disease, carotid artery disease, and ascending aortic atherosclerosis. This could perhaps not only explain the elevated stroke incidence but also guide us in providing neuroprotective strategy in these groups of patients.

Obesity

In a recent study, Gao *et al.* studied the outcome of body mass index on the outcome of CABG.[24] They observed that extreme obesity was significantly associated with severe major adverse clinical outcomes, which were deep sternal infection ($P = 0.002$), prolonged ventilation ($P = 0.001$), requirement of renal dialysis ($P = 0.010$), mortality (in hospital, surgical mortality, and 30 days mortality, $P = 0.004$–0.04), and readmission 0.005. The authors observed "obesity paradox" in those who were overweight or mildly obese (body mass index varying from 25 to 35); these patients had better in-hospital mortality, surgical mortality, and total Intensive Care Unit hours in contrast to severely obese patients.

As mentioned above, obesity is the reason for several adverse outcomes after cardiac surgery. But at times, a few patients might lose weight postoperatively.[25] These authors showed survival disadvantage in morbidly obese, obese, and overweight individuals who lost weight immediately after surgery. Individuals who lost weight after their CABG surgery (losers) had a pronouncedly higher mortality risk versus the gainers. Indeed, losers more than doubled their risk (hazard ratio [HR] = 2.66 [1.87–3.78], $P < 0.01$) when compared to gainers, and tripled their risk (HR = 3.13 [2.26–4.35], $P < 0.005$) when compared with the "no change" category.

Modifiable Factors

The modifiable factors are shown in Table 1.

Left ventricular dysfunction and congestive heart failure

Patients with LV dysfunction and/or congestive heart failure scheduled for CABG have higher mortality, and these subsect of patients are surgical challenges. Several factors such as inadequate revascularization (due to suboptimal quality of coronary arteries, poor distal runoff) and inability to alter the dysfunction due to myocardial scar are responsible are the etiologies. Isolated CABG in patients with LV dysfunction, is therefore, controversial.[26] These patients also represent a high mortality (2.7%–33%) and morbidity (30%–67%) group.[27] Several strategies have been utilized to improve outcomes in these patients. They are:

Preoperative use of intraaortic balloons pump[28]

In this recent study, using preoperative IABP, Yang *et al*. showed, a significant reduction in the incidence of conversion to cardiopulmonary bypass, low cardiac output syndrome, duration of ventilation, length of stay in the hospital, and 30 days mortality while performing OPCAB surgery in contrast to the controls, who underwent similar surgery without IABP. Use of IABP is not universally considered beneficial, a recent study concluded that the use of intraaortic balloon counterpulsation did not significantly reduce 30-day mortality in patients with cardiogenic shock complicating acute myocardial infarction for whom an early revascularization strategy was planned.[28,29]

Preoperative treatment with infusion of levosimendan

It has been shown the use of levosimendan improves outcomes in patients with LV dysfunction. In a study, a total of 252 patients were enrolled (127 in the levosimendan group and 125 in the control group), who received loading dose 10 μg/kg followed by a 23 h continuous infusion of 0.1 μg/kg/min of levosimendan a day before surgery in the test group while the controls received placebo. They showed that the individuals treated with levosimendan exhibited a lower incidence of complicated weaning from CPB (2.4% vs. 9.6%; $P < 0.05$), decreased mortality (3.9% versus 12.8%; $P < 0.05$), and a lower incidence of low cardiac output syndrome (7.1% versus 20.8%; $P < 0.05$) compared with the control group. The levosimendan group also had a lower requirement for inotropes (7.9% vs. 58.4%; $P < 0.05$), vasopressors (14.2% vs. 45.6%; $P < 0.05$), and IABPs (6.3% vs. 30.4%; $P < 0.05$). There are several other similar studies substantiating this observation of the authors.[30]

Preoperative extracorporeal membrane oxygenation

A recent publication from Taiwan discussed the role of decreasing risks in patients with ventricular septal rupture.

In their series of forty-seven patients, PCI, IABP, and extracorporeal membrane oxygenation (ECMO) were used. With these interventions, survival after surgery was about 50%.[31] This method appears to be beneficial and has to be studied on multicentric basis. According to personal opinion, the possible uses may be in cases of carcinogenic shock caused by mechanical disruptions in the heart, such as ruptured chord, acute severe MR, ventricular septal rupture, and contained free wall rupture following acute myocardial infarction. No final word can be said about preoperative use of ECMO till multicentric prospective trials are conducted to assess its role, however, studying it is a good research idea.

Control of diabetes

Control of diabetes is paramount before CABG, if one were to carry out CABG in an uncontrolled diabetic, complications such as readmission due to cardiac cause and any cause may occur. However, it was observed that diabetes was not a predictor of mortality after CABG surgery among patients with LV dysfunction despite associated comorbidities. However, diabetes was associated with increased postoperative complications and rehospitalization.[32] It may be imperative to work on the glycosylated hemoglobin in preoperative patients and bring about a change in the outcome.

Hypertension

Although control of hypertension either acutely or on a long-term basis is not difficult nowadays with the pharmacotherapeutic armamentarium in the anesthesiologist's basket. It is not unusual to encounter hypertensive patients showing up for emergency CABG. Aronson *et al*. have observed that isolated systolic hypertension is associated with increased postoperative risk of cardiovascular morbidity in patients undergoing CABG. In addition, adverse outcomes such as LV dysfunction, cerebral vascular dysfunction or events, renal insufficiency or failure, and all-cause mortality were significantly elevated in the presence of hypertension. Therefore, it may be a wise move to control the blood pressure, preoperatively and prevent the complications associated with isolated hypertension.[33]

Renal dysfunction, chronic kidney disease, and coronary revascularization

Coronary artery disease is the most common cause of morbidity and mortality in patients with CKD.[34] CKD patients are twenty times more likely to die of cardiovascular reasons than the develop end-stage renal disease.[35] The recent recommendation is to subject patients with renal dysfunction or CKD to CABG in preference to PCI.[36] Some of the modifiable risk factors in patients undergoing cardiac surgery identified three important factors: preoperative anemia, perioperative red blood cell transfusions, and postoperative re-exploration.[37] To achieve optimal outcome in patients with renal dysfunction, one has to prevent the onset of acute kidney injury (acute on chronic). Preventing bleeding and blood transfusion are the important cornerstone of managing patients with renal dysfunction undergoing CABG. Blood transfusion, whether intraoperatively or postoperatively, has been implicated during CABG in the production of renal dysfunction.[38] Vellinga *et al*. have concluded that apart from intraoperative blood transfusion, use of postoperative furosemide was strongly identified as the modifiable risk factors in preventing acute kidney injury.

Yet another important factor contributing to renal dysfunction is conducting the surgical procedure soon after coronary angiography/PCI. The contrast-induced nephropathy is common if cardiac surgery is carried out immediately after the contrast load. It is advisable to wait at least 24 h, following the contrast load and conduct the cardiac surgery.[39] There is no scientific evidence supporting routine use of diuretics either pre- or post-operatively in patients with or without renal dysfunction. Their routine use must be discouraged.

Atherosclerosis

Although in the strict sense, modifying the process of atherosclerosis, would mean modifying atherosclerotic process itself, which of course has immense value in preventing or retarding the progress of coronary artery disease, in the present contest, the author wishes to study the modifications of surgical technique that could avoid the consequences of atherosclerosis during surgery such as the embolism/embolic stroke. Atherosclerosis causes up to 21% of both major and minor strokes during cardiac surgery.[40] Unless one investigates and plans the surgical technique, it is nearly impossible to prevent strokes due to dislodgment of major atheroma from the ascending aorta. Epiaortic scanning,[41] transesophageal echocardiography, and additional use of "A view"[42] are likely to help the surgical team plan the surgery. Conducting arterial grafts through composite conduits using left internal mammary artery and radial/right mammary artery could substantially decrease stroke rates by performing coronary bypass grafts using "no touch aorta" technique.[43] Suitable modifications in the cardiopulmonary bypass circuitry such as incorporating arterial filters, slow cooling and rewarming, rewarming up to 37°C, and monitoring cerebral function/blood flow may decrease the stroke incidence [Table 2].

Smoking

Smoking cessation even for day has been shown to be beneficial. It has been widely documented that the cessation of smoking has beneficial effect in reducing mortality in patients with coronary artery disease with relative risk and odds ratio estimated between 1.5 and 3 times higher[44] and it has also been estimated that about 50% reduction in mortality occurs if one quits smoking (Office on Smoking

Table 2: Maneuvers that could be used to decrease the incidence of stroke during cardiac surgery

Preoperative maneuvers	Intraoperative operative maneuvers	Postoperative maneuvers
Carotid artery screening and revascularization	Aortic manipulation done after imaging ascending aorta	Prevent postoperative atrial fibrillation
Individualize carotid artery stenting versus surgical revascularization	Consider epiaortic ultrasound if images are suboptimal through TEE	Initiate beta blockade early
Continue medical treatment with statins and antiplatelet medications	Identify accurately disease free aorta for cannulation and side clamping	Commence therapy with statins
	Practice OPCAB where possible	
	Practice "no touch aortic technique" if possible	

TEE: Transesophageal echocardiography, OPCAB: Off-pump coronary artery bypass

and Health. The Health Benefits of Smoking Cessation: A Report of the Surgeon General. Rockville, Md: US Office of the Surgeon General; 1990). In a 20 years follow-up, it has been shown that quitting smoking positively affected patients undergoing CABG.[45] Therefore, all efforts must be made to encourage patients to quit smoking before undergoing CABG. These authors conclude "Patients who continued to smoke after CABG had a greater risk of death than patients who stopped smoking. They also underwent repeat revascularization procedures more frequently. Cessation of smoking is therefore strongly recommended after CABG. Clinicians are encouraged to start or to continue smoking-cessation programs to help smokers to quit smoking, especially after CABG."

Anemia

It has been shown that anemia on the one hand and blood transfusion on the other hand could independently cause mortality. Williams *et al*. opined "Preoperative hematocrit is a powerful independent predictor of perioperative mortality as well as renal failure and deep sternal wound infection in patients undergoing isolated primary CABG operation." Their five key findings have been shown in Table 3.[46] In a similar study conducted in the United Kingdom, Klein *et al*. in their cohort of 19,033 patients, about 6000 had preoperative anemia. A multivariate analysis showed independent association of anemia and transfusion, hospital stay, and mortality.[47] In a recent study, Borde *et al*. observed anemia in about 50% of their cohort (about 33% had mild anemia, and 19% had moderate anemia.[48] These patients not only had low HCT during cardiopulmonary bypass but required higher packed red cell transfusion. Despite restoring the HCT values, they observed higher mortality and acute kidney injury in their moderately anemic patients undergoing valve surgery. It appears that it is wise to "build" the HCT values before elective surgeries using erythropoietin. Song *et al*. have shown improvement in outcome after administering erythropoietin.[49] While dealing with anemic patients, it may be relevant to be aware about the higher mortality, stroke, and acute kidney injury rates while they undergo cardiac surgery.

Table 3: Five key findings about anemia[47]

Key	Findings
1	The preoperative HCT is a powerful independent predictor of mortality, renal failure, deep sternal wound infection, and prolonged hospital stay
2	The preoperative HCT has the greatest, and most consisted impact on the risk of renal failure
3	Elective surgical patients behaved similarly
4	For all major morbidities and mortality, there was a nadir consistently observed between HCT values of 42% and 46%
5	The likelihood of perioperative transfusion was dramatically influenced by the properative HCT

HCT: Hematocrit

Nutritional status

It is not uncommon for cardiac surgical patients presenting with poor nutritional status, children and adolescents undergoing valvular and congenital surgery in the developing countries and the elderly population appears to be particularly at risk.[50,51] It was observed by the latter authors that These postoperative outcomes were significantly lower in the low-geriatric nutritional risk index group than in the high-index group. The cutoff values for postoperative outcomes were hand grip, 22.7 kgf; knee extensor muscle strength, 41.5% body weight, gait speed 1.2 m/s, and one-leg standing time 6.7 s. Unfortunately, nutritional assessment in any patient group is not included in the conventional preanesthesia check forms. It may be prudent to conduct the nutritional checks and document the nutritional status, especially of the geriatric and the pediatric population.

Summary

Although several factors associated with higher morbidity and mortality are not modifiable, pharmacological, and mechanical interventions might alter them and improve the outcome favorably. It is imperative that the modifiable factors may suitably be altered to improve patient outcome. Mere obtaining a "high-risk consent" may, after all, protect one in the judicial realms, but not in patient care. It is time that the community of cardiac anesthesiology shows their true potential as the "perioperative physicians."

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Conflicts of interest

There are no conflicts of interest.

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