

MEET THE EXPERT UNPLUGGED

La consulenza cardiologica

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Conflitto di interessi

Nessuno



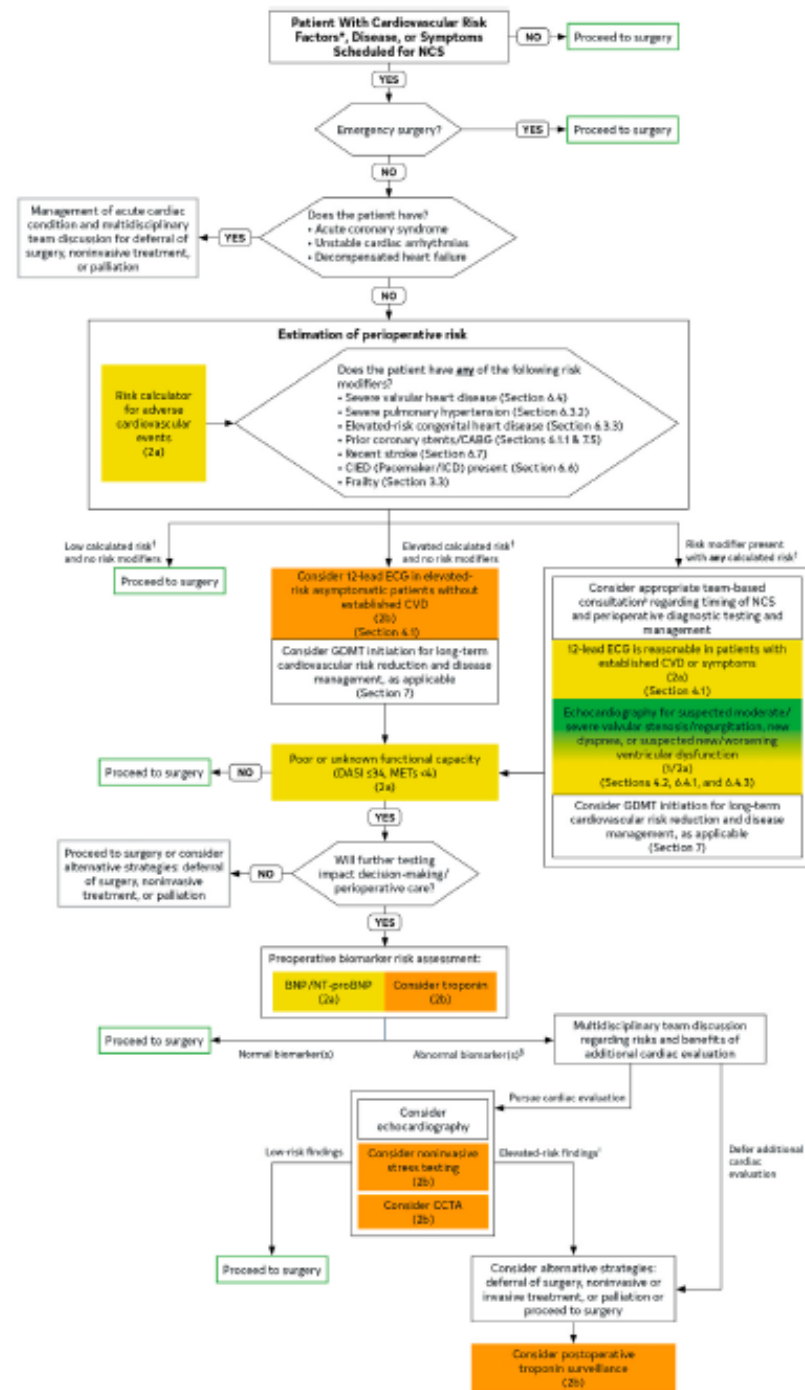
Non Cardiac Surgery: the dimensions of the problem

The annual volume of major surgery worldwide is estimated to be more than 300 million patients (about 5% of the world population), which is a 34% increase from 2004 to 2012. When applied to European Union countries, this figure translates into a crude estimate of nearly 22 million major procedures annually.

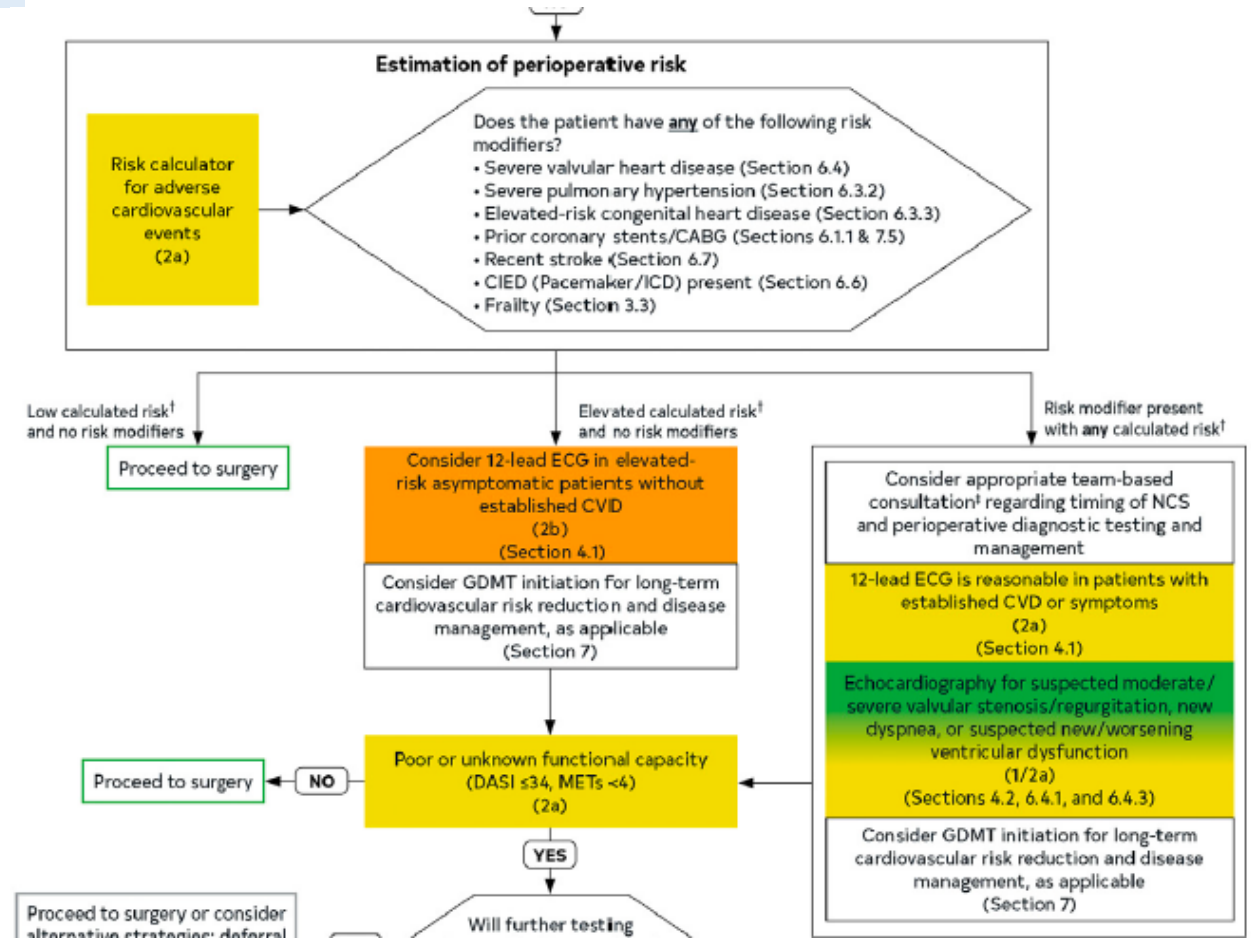
Nearly 85% of major operations are non-cardiac surgical procedures.

In a recent report from the USA National Inpatient Sample database, nearly half of adults aged ≥ 45 years undergoing major non-cardiac surgery (NCS) presented with at least two cardiovascular (CV) risk factors.

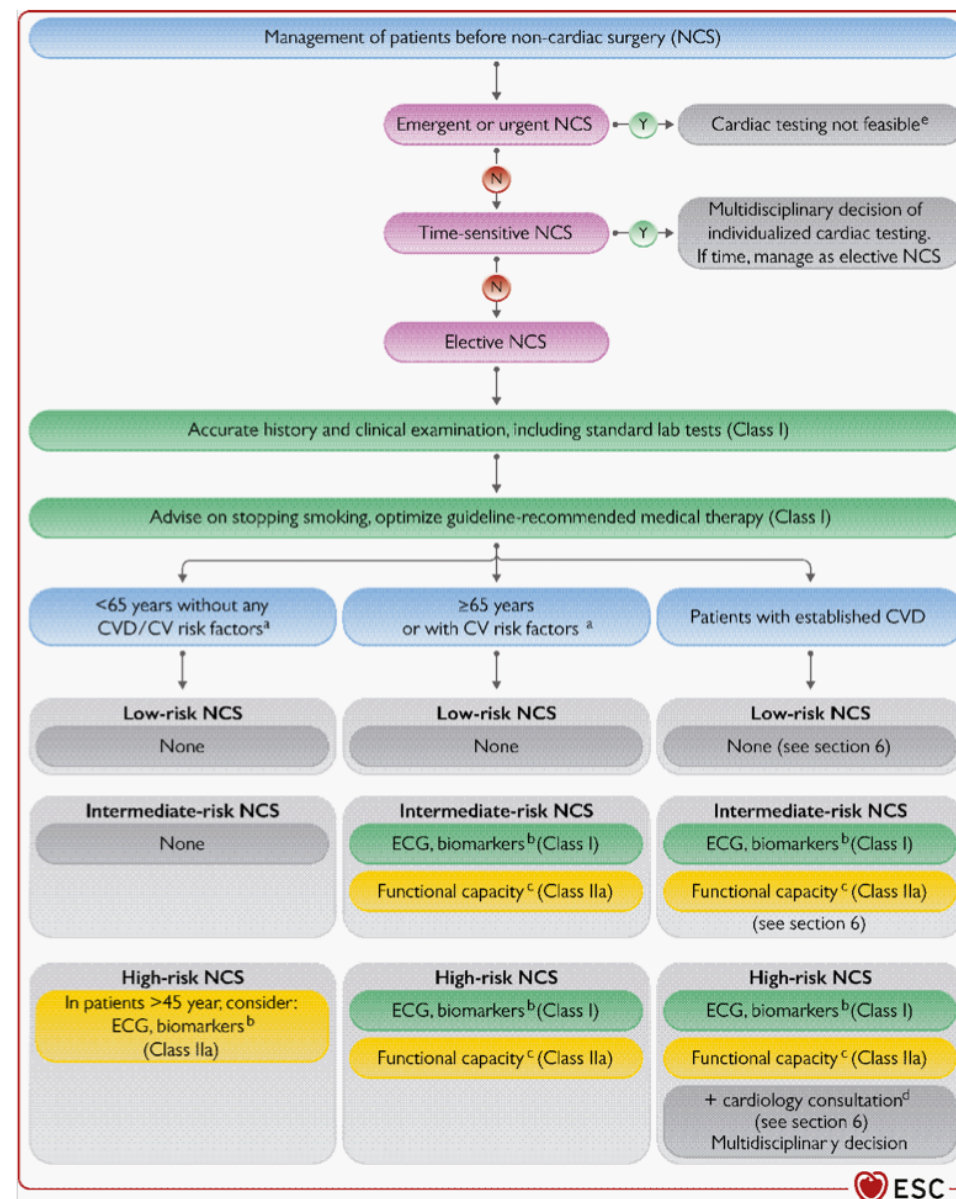
2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery



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Cosa deve contenere una richiesta di consulenza?

- Quale intervento?
- Quale anestesia?
- Esistono valide alternative terapeutiche?
- In quale tempistica è programmato?
- (Di quanto) l'intervento può essere differito senza compromettere la prognosi?
- Quale terapia antitrombotica è consentita?

Definitions of Surgical Timing and Surgical Risk

Timing	Definition
Emergency	Immediate threat to life or limb without surgical intervention, where there is very limited or no time for preoperative clinical evaluation, typically <2 h.
Urgent	Threat to life or limb without surgical intervention, where there may be time for preoperative clinical evaluation to allow interventions that could reduce risk of MACE or other postoperative complications, typically ≥ 2 to <24 h.
Time-sensitive	Surgery may be delayed up to 3 mo to allow for preoperative evaluation and management without negatively impacting outcomes.
Elective	The surgical procedure can be delayed to permit a complete preoperative evaluation and appropriate management.
Risk Category*	Definition
Low risk	Combined surgical and patient characteristics predict a low risk of MACE of <1%.*
Elevated risk†	Combined surgical and patient characteristics predict an elevated risk of MACE of $\geq 1\%$.*

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- Il paziente ha una sintomatologia suggestiva di attualità cardiologiche al momento della visita (SCA, scompenso, ...)?
- Qual è il rischio della procedura (basso, intermedio, alto)?
- Qual è il rischio del pz (METS, scores, ...)?
- Il rischio è riducibile?
- Come posso ottimizzare la terapia?

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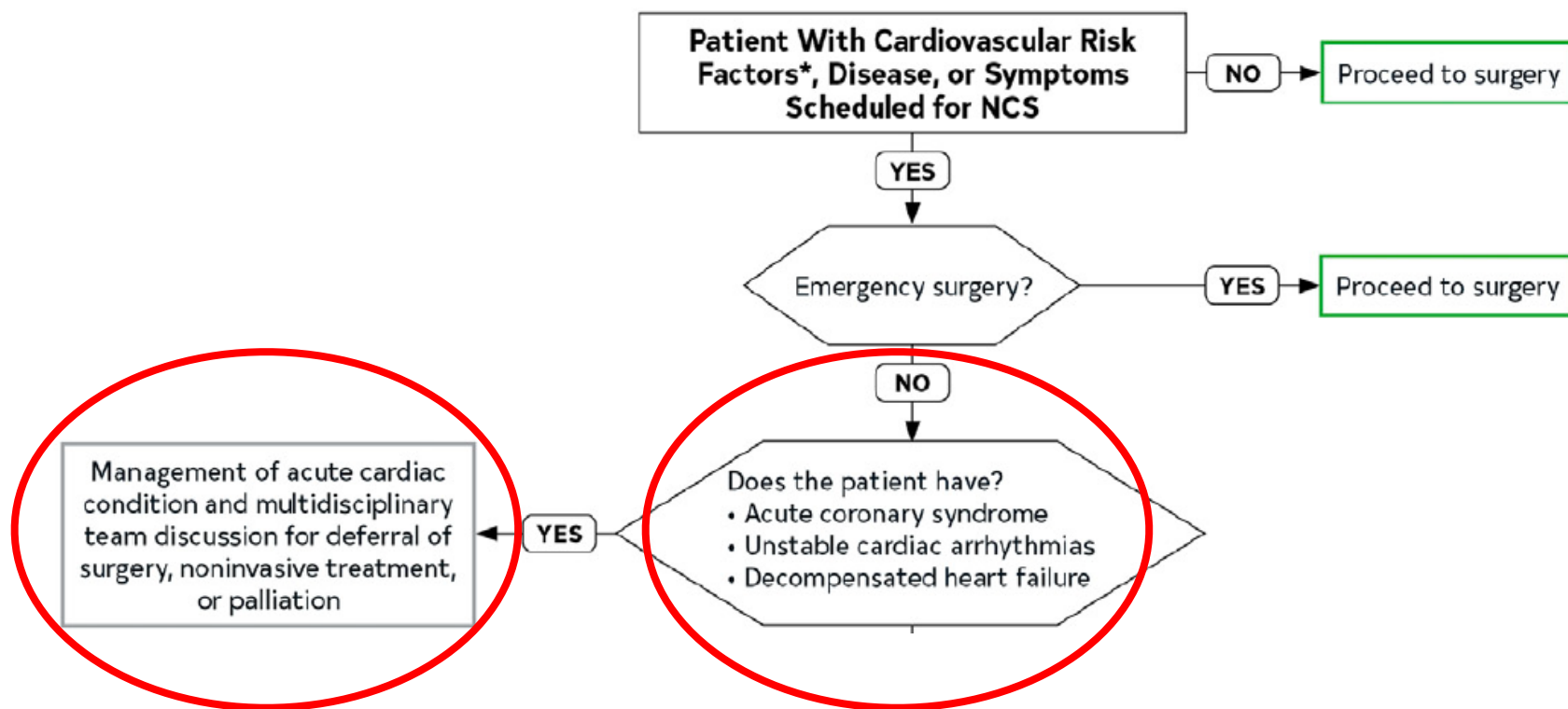
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Recommendation	Class
Clinical risk evaluation—Section 3	
Patients scheduled for NCS	
In all patients scheduled for NCS, an accurate history, and clinical examination are recommended.	I
It is recommended to perform a pre-operative risk assessment, ideally at the same time as the NCS is proposed.	I
If time allows, it is recommended to optimize guideline-recommended treatment of CVD and CV risk factors before NCS.	I

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Surgical risk estimate according to type of surgery or intervention

Low surgical risk (<1%)	Intermediate surgical risk (1–5%)	High surgical risk (>5%)
• Breast • Dental • Endocrine: thyroid • Eye • Gynaecological: minor • Orthopaedic minor (meniscectomy) • Reconstructive • Superficial surgery • Urological minor: (transurethral resection of the prostate) • VATS minor lung resection	• Carotid asymptomatic (CEA or CAS) • Carotid symptomatic (CEA) • Endovascular aortic aneurysm repair • Head or neck surgery • Intraperitoneal: splenectomy, hiatal hernia repair, cholecystectomy • Intrathoracic: non-major • Neurological or orthopaedic: major (hip and spine surgery) • Peripheral arterial angioplasty • Renal transplants • Urological or gynaecological: major	• Adrenal resection • Aortic and major vascular surgery • Carotid symptomatic (CAS) • Duodenal-pancreatic surgery • Liver resection, bile duct surgery • Oesophagectomy • Open lower limb revascularization for acute limb ischaemia or amputation • Pneumonectomy (VATS or open surgery) • Pulmonary or liver transplant • Repair of perforated bowel • Total cystectomy

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CAS, carotid artery stenting; CEA, carotid endarterectomy; CV, cardiovascular; MI, myocardial infarction; VATS, video-assisted thoracic surgery.

Surgical risk estimate is a broad approximation of 30 day risk of CV death, MI, and stroke that takes into account only the specific surgical intervention, without considering the patient's comorbidities.

Adapted from data in Glance *et al.*, Muller *et al.*, Bendixen *et al.*, and Falcoz *et al.*^{18–23}

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Risk Scores and Calculators

	Goldman Index of Cardiac Risk ¹⁶ (1977)	RCRI ² (1999)	Gupta NSQIP Risk Calculator for Perioperative MICA ⁵ (2011)	American College of Surgeons NSQIP Surgical Risk Calculator ^{3,13} (2023)	Surgical Outcome Risk Tool ¹² (2014)	NSQIP Geriatric-Sensitive Perioperative Cardiac Risk Index ¹⁷ (2017)	AUB-HAS2 Cardiovascular Risk Index ¹⁴ (2019)
Criteria	■ Age >70 y (5 points) ■ Recent MI within 6 mo (10 points) ■ Jugular venous distention or a third heart sound on auscultation (11 points) ■ ≥5 PVCs per minute (7 points) ■ Nonsinus rhythm or PACs on pre-operative ECG (7 points) ■ Aortic stenosis (3 points) ■ Intraperitoneal, intrathoracic, or aortic surgery (3 points) ■ Any emergency surgery (4 points)	■ Ischemic heart disease ■ Cerebrovascular disease ■ History of HF ■ Insulin therapy for diabetes ■ Serum creatinine ≥2.0 mg/dL ■ Planned high-risk procedure (intraperitoneal, intrathoracic, or vascular surgery) (1 point for each criterion)	■ Age ■ ASA class ■ Preoperative function ■ Creatinine ■ Procedure type (anorectal surgery, aortic, bariatric, brain, breast, cardiac, ENT, foregut/hepato-pancreatobiliary, gallbladder/appendix/adrenal/spleen, intestinal, neck, obstetric/gynecologic, orthopedic, other abdomen, peripheral vascular, skin, spine, thoracic, urology, vein)	■ Age group ■ Sex ■ ASA class ■ Functional status ■ Emergency case ■ Steroid use for chronic condition ■ Ascites within 30 d preoperatively ■ System sepsis within 48 h preoperatively ■ Ventilator dependent ■ Disseminated cancer ■ Diabetes ■ Hypertension requiring medication ■ Previous cardiac event ■ HF in 30 d preoperatively ■ Dyspnea ■ Current smoker within 1 y ■ History of COPD ■ Dialysis ■ Acute renal failure ■ BMI class ■ CPT-specific linear risk	■ Age group ■ ASA class ■ Urgency of surgery ■ Specialty ■ Severity of surgery ■ Cancer	■ ASA class ■ History of HF ■ History of stroke ■ Diabetes ■ Functional status (partially versus totally dependent) ■ Creatinine >1.5 mg/dL ■ Surgical category	■ Age ≥75 y ■ History of heart disease ■ Symptoms of angina/dyspnea ■ Hemoglobin <12 mg/dL ■ Vascular surgery ■ Emergency surgery

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Table 3. Perioperative Complications Among Patients With Good or Poor Exercise Tolerance

Perioperative Complications†	No. (%) of Patients		P*
	Good Exercise Tolerance (n = 269)	Poor Exercise Tolerance (n = 343)	
Cardiovascular (total)	14 (5.2)	33 (9.6)	.04
Arrhythmia	10 (3.7)	18 (5.3)	.37
Myocardial ischemia	2 (0.7)	13 (3.8)	.02
Myocardial infarction	1 (0.4)	2 (0.6)	>.99‡
Hypotension	4 (1.5)	6 (1.8)	>.99‡
Congestive failure	3 (1.1)	6 (1.8)	.74‡
Pulmonary (total)	17 (6.3)	31 (9.0)	.21
Hypoxia	8 (3.0)	19 (5.5)	.13
Ventilator ≥24 h	8 (3.0)	9 (2.6)	.79
Pneumonia	4 (1.5)	10 (2.9)	.24
Adult respiratory distress syndrome	2 (0.7)	4 (1.2)	.70‡
Bronchospasm	3 (1.1)	3 (0.9)	>.99‡
Pulmonary embolism	1 (0.4)	1 (0.3)	>.99‡
Other	2 (0.7)	0 (0.0)	.19‡
Neurologic (total)	6 (2.2)	20 (5.8)	.03
Delirium	6 (2.2)	17 (5.0)	.08
Other	0 (0.0)	4 (1.2)	.14‡
Infections (total serious)§	6 (2.2)	10 (2.9)	.60
Surgical site			
Superficial	5 (1.9)	11 (3.2)	.30
Deep	5 (1.9)	6 (1.8)	>.99‡
Bacteremia	1 (0.4)	3 (0.9)	.64‡
Abscess	0 (0.0)	1 (0.3)	>.99‡
Sepsis	0 (0.0)	1 (0.3)	>.99‡
Other	1 (0.4)	4 (1.2)	.39‡
Miscellaneous (total)	6 (2.2)	15 (4.4)	.15
Deep vein thrombosis	2 (0.7)	3 (0.9)	>.99‡
Renal insufficiency	2 (0.7)	3 (0.9)	>.99‡
Alcohol withdrawal	2 (0.7)	3 (0.9)	>.99‡
Fall	0 (0.0)	2 (0.6)	.51‡
Other	1 (0.4)	5 (1.5)	.24‡
Unexpected transfer	15 (5.6)	38 (11.1)	.02
Code blue	2 (0.7)	0 (0.0)	.19‡
Death	2 (0.7)	1 (0.3)	.59‡
Total serious complications	28 (10.4)	70 (20.4)	.001

Self-reported Exercise Tolerance and the Risk of Serious Perioperative Complications

Methods: Our study group consisted of 600 consecutive outpatients referred to a medical consultation clinic at a tertiary care medical center for preoperative evaluation before undergoing 612 major noncardiac procedures. Patients were asked to estimate the number of blocks they could walk and flights of stairs they could climb without experiencing symptomatic limitation. Patients who could not walk 4 blocks and climb 2 flights of stairs were considered to have poor exercise tolerance. All patients were evaluated for the development of 26 serious complications that occurred during hospitalization.

ASA classification and perioperative variables as predictors of postoperative outcome

Chronic health/physical status	Additional anaesthesia risk
1. A normal healthy patient	1. No additional risk
2. A patient with mild systemic disease	2. Minor
2.5. A patient with moderate systemic disease	2.5. Moderate
3. A patient with severe systemic disease that limits activity but is not incapacitating	3. Major
4. A patient with an incapacitating systemic disease that is a constant threat to life	4. Life threatening
5. A moribund patient who is not expected to survive for 24 h with or without an operation	

Wolters U, Wolf T, Stützer H, Schroder T. ASA classification and perioperative variables as predictors of postoperative outcome. *British Journal of Anaesthesia* 1996; 77: 217–222.

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Recommendations for 12-Lead Electrocardiogram

COR	LOE	RECOMMENDATIONS
2a	B-NR	1. For patients with known coronary heart disease, significant arrhythmia, peripheral arterial disease, cerebrovascular disease, other significant structural heart disease, or symptoms* of CVD undergoing elevated-risk surgery, a preoperative resting 12-lead electrocardiogram (ECG) is reasonable to establish a preoperative baseline and guide perioperative management. ^{1,2}
2a	B-NR	2. In patients undergoing NCS with a preoperative ECG exhibiting new abnormalities,† further evaluation is reasonable to refine assessment of cardiovascular risk. ³⁻⁸
2b	B-NR	3. For asymptomatic patients undergoing elevated-risk surgeries without known CVD, a preoperative resting 12-lead ECG may be considered to establish a baseline and guide perioperative management. ^{3,9,10}
3: No benefit	B-NR	4. For asymptomatic patients undergoing low-risk surgical procedures, a routine preoperative resting 12-lead ECG is not recommended to improve outcomes. ¹¹

Clinical risk assessment using validated tools is more useful to guide management and predict outcomes than are the findings of a single resting preoperative ECG. Available data suggest that in low-risk patients, a routine preoperative ECG has little effect on treatment or complication rates and should be omitted from standard preoperative evaluation.^{11,13} One study assessed 30,892 patients undergoing NCS with shock-wave lithotripsy for nephrolithiasis, in which a preoperative ECG triggered the cancellation of 13 (0.04%) treatments in low-risk patients (1 with new AF and 12 with ischemia or previous infarction). Of these patients, only 1 had a subsequent abnormal cardiac workup, and the remaining 11 ultimately underwent NCS without complications. The study concluded that in patients at low risk for cardiac complications, preoperative ECG triggered very few cancellations and did not predict cardiac complications after NCS.¹¹ Avoiding unnecessary testing can significantly save resources.¹⁵

Angina and revascularization

Recommendations for pre-operative assessment in patients with previously unknown murmur, angina, dyspnoea, or peripheral oedema (1)



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Recommendations	Class	Level
Newly detected murmur		
In patients with a newly detected murmur <i>and</i> symptoms or signs of CVD, TTE is recommended before NCS.	I	C
In patients with a newly detected murmur suggesting clinically significant pathology, TTE is recommended before high-risk NCS.	I	C
In patients with a newly detected murmur, but without other signs or symptoms of CVD, TTE should be considered before moderate and high-risk NCS.	IIa	C
Previously unknown angina		
If a patient scheduled for elective NCS has chest pain or other symptoms suggestive of undetected CAD, further diagnostic work-up before NCS is recommended.	I	C
If a patient in need of acute NCS also has chest pain or other symptoms suggestive of undetected CAD, a multidisciplinary assessment approach is recommended to choose the treatment with lowest total risk for the patient.	I	C

www.escardio.org/guidelines

2022 ESC Guidelines on cardiovascular assessment and management of patients undergoing non-cardiac surgery
(European Heart Journal 2022; doi:10.1093/eurheartj/ehac370)

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Recommendations for Stress Testing

Referenced studies that support the recommendations are summarized in the [Online Data Supplement](#).

COR	LOE	RECOMMENDATIONS
2b	B-NR	1. For patients undergoing elevated-risk NCS with poor or unknown functional capacity and elevated risk for perioperative cardiovascular events based on a validated risk tool, stress testing may be considered to evaluate for inducible myocardial ischemia. ¹
3: No benefit	B-R	2. In patients who are at low risk for perioperative cardiovascular events, have adequate* functional capacity with stable symptoms, or who are undergoing low-risk procedures, routine stress testing before NCS is not recommended due to lack of benefit. ¹⁻³

*Poor functional capacity is considered <4 METs or a DASI score of ≤34.

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Stress testing before abdominal aortic aneurysm repair does not lead to a reduction in perioperative cardiac events

Stress Test

Table III. Perioperative events for high vs low stress test centers

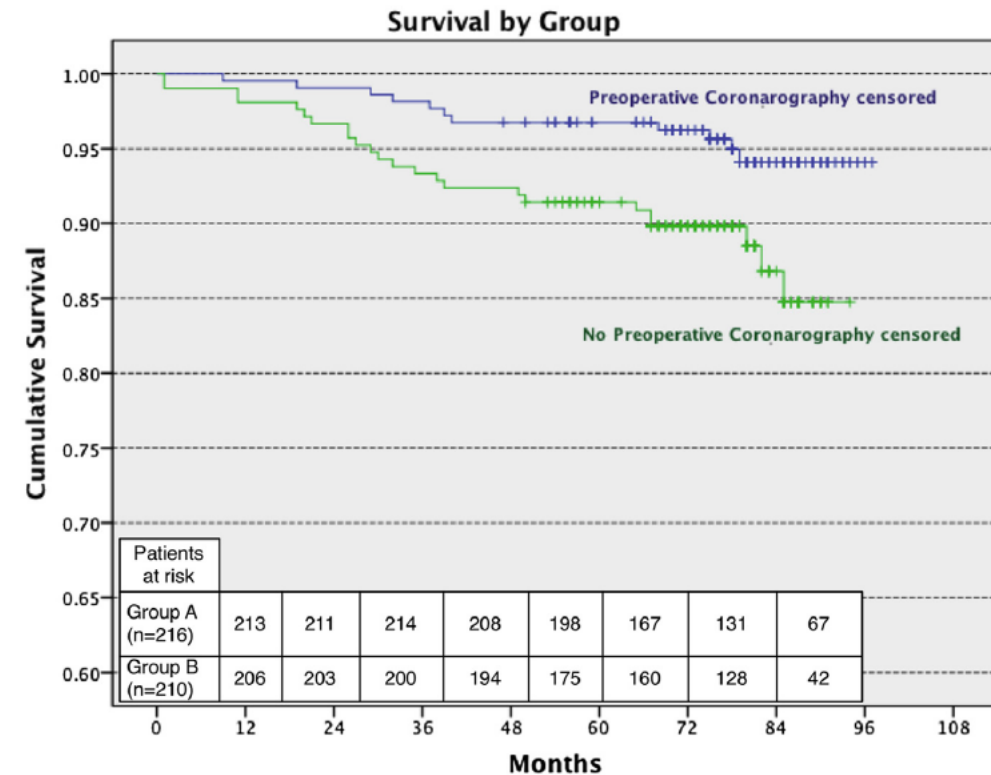
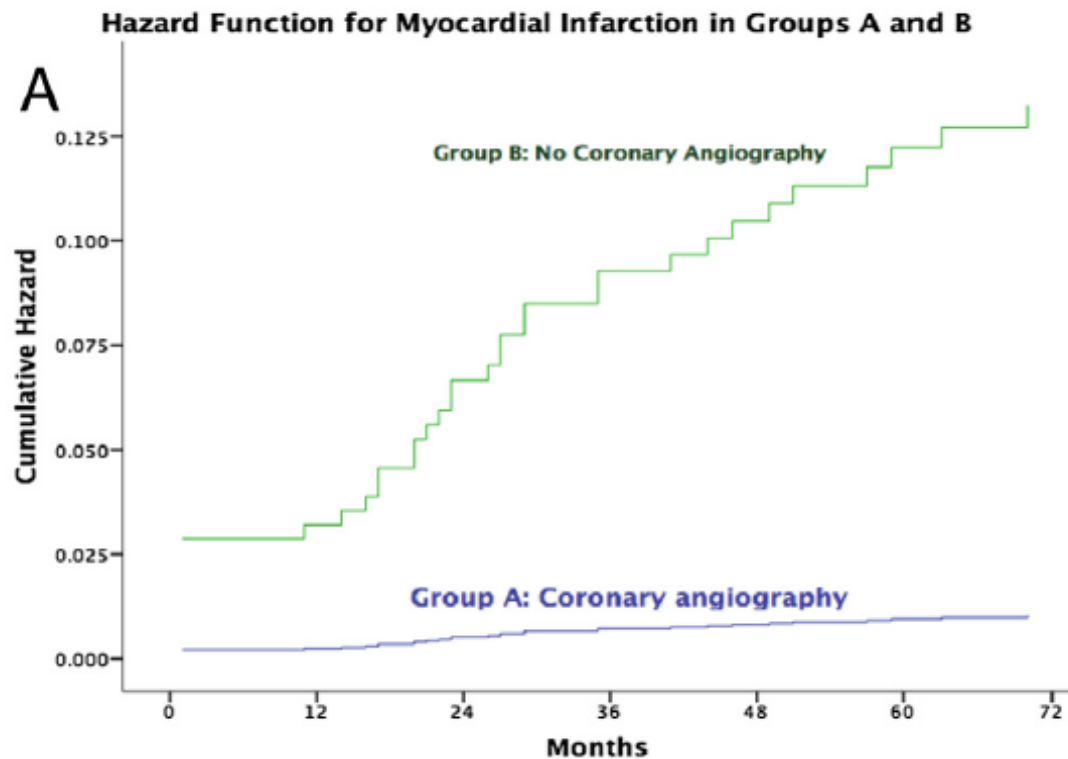
Variable	Stress test centers		Crude OR (95% CI)	Adjusted OR ^a (95% CI)
	High use	Low use		
EVAR				
MACE	2.1	1.2	1.79 (1.38-2.31)	1.78 (1.37-2.30)
1-Year mortality	5.0	4.3	1.18 (1.02-1.37)	1.22 (1.05-1.42)
VSG-CRI score	5.48 ± 2.05	5.45 ± 2.09	NA	NA
OAR				
MACE	13.1	7.1	1.96 (1.52-2.53)	1.99 (1.53-2.59)
1-Year mortality	5.4	6.3	0.87 (0.65-1.17)	0.89 (0.66-1.21)
VSG-CRI score	4.95 ± 2.02	4.91 ± 1.98	NA	NA

The Authors studied 43,396 EVAR patients and 8935 OAR patients across 324 centers. The median proportion of stress test usage across centers before EVAR was 35.9% and varied from 10.2% (5th percentile) to 73.7% (95th percentile)

Long-term Results of a Randomized Controlled Trial Analyzing the Role of Systematic Pre-operative Coronary Angiography before Elective Carotid Endarterectomy in Patients with Asymptomatic Coronary Artery Disease

Coronary Angiography

Primary end-point was the occurrence of MI at 3.5 years.
The secondary end-point was the overall survival rate



Long-term Results of a Randomized Controlled Trial Analyzing the Role of Systematic Pre-operative Coronary Angiography before Elective Carotid Endarterectomy in Patients with Asymptomatic Coronary Artery Disease ☆

Baseline characteristics	Group A N = 216	Group B N = 210	p value
Age, years $\pm$ SD	77 $\pm$ 7	74 $\pm$ 7	.79
Men (%)	140 (65)	143 (68)	.60
Hypertension (%)	164 (76)	168 (80)	.90
Active smokers (%)	86 (40)	90 (43)	.62
Hyperlipidemia (%)	63 (29)	55 (26)	.52
Diabetes (%)	52 (24)	46 (22)	.73
Lower limb occlusive disease (%)	22 (10)	17 (8)	.40
Chronic renal insufficiency (%)	9 (4)	10 (5)	.82
CAD ^a in Group A			
1-vessel disease (%)	43 (20)		
2-vessel disease (%)	19 (9)		
3-vessel disease (%)	3 (1.5)		
Left main disease (%)	3 (1.5)		
Indications for carotid surgery			
Asymptomatic	157 (72)	151 (71)	
TIA & Stroke	59 (28)	59 (28)	.56

Characteristics of patients randomized to systematic coronary angiography prior to carotid endarterectomy in group A or direct CEA in group B

Coronary-Artery Revascularization before Elective Major Vascular Surgery

Revascularization

Table 1. Baseline Clinical Variables According to the Assigned Treatment before the Elective Major Vascular Surgery.*

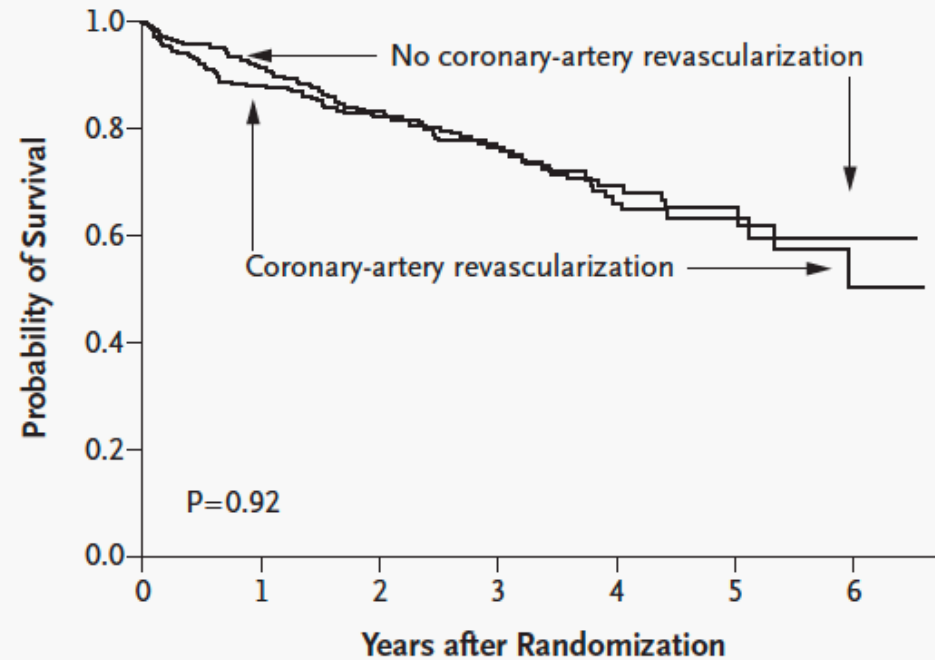
Variable	Revascularization (N=258)	No Revascularization (N=252)	P Value
Age — yr	65.6±11.1	67.2±10.4	0.10
Angina — no. (%)	103 (39.9)	95 (37.7)	0.61
Previous myocardial infarction — no. (%)	111 (43.0)	103 (40.9)	0.62
Previous congestive heart failure — no. (%)	31 (12.0)	19 (7.5)	0.09
Previous stroke or TIA — no. (%)	54 (20.9)	47 (18.7)	0.50
Diabetes — no. (%)			
Treated with oral agents	49 (19.0)	52 (20.6)	0.84
Treated with insulin	48 (18.6)	49 (19.4)	0.84
Current smoker — no. (%)	128 (49.6)	114 (45.2)	0.41
Albumin — g/dl	3.7±0.6	3.7±0.5	0.99
Hemoglobin — g/dl	14.0±2.4	13.8±1.9	0.26
Total cholesterol — mg/dl	175±45	182±51	0.13
LDL cholesterol — mg/dl	105±37	107±42	0.60
HDL cholesterol — mg/dl	37±10	37±11	0.95
Glycosylated hemoglobin — %	6.6±1.7	6.8±1.9	0.41
C-reactive protein — mg/dl			0.12
Median	0.4	0.3	
Interquartile range	0.05–1.4	0.04–1.3	
Homocysteine — mg/dl			0.63
Median	10.3	9.8	
Interquartile range	0.8–13.6	0.3–12.8	
Left ventricular ejection fraction — %	54±12	55±12	0.36
Three-vessel coronary artery disease — no. (%)	91 (35.3)	79 (31.3)	0.69
Previous CABG — no. (%)	38 (14.7)	39 (15.5)	0.83
Indication for surgery†			0.61
Abdominal aneurysm — no. (%)	88 (34.1)	81 (32.1)	—
Claudication — no. (%)	100 (38.8)	89 (35.3)	—
Pain at rest — no. (%)	30 (11.6)	35 (13.9)	—
Tissue breakdown — no. (%)	40 (15.5)	47 (18.7)	—

Table 2. Procedural Characteristics and Postprocedural Complications of CABG and Percutaneous Coronary Intervention (PCI) in 240 Patients Assigned to Undergo Coronary-Artery Revascularization before Elective Major Vascular Surgery.*

Characteristic	CABG (N=99)	PCI (N=141)
Days since randomization		
Median	18	1
Interquartile range	7–34	0–7
Urgent or emergency cardiac status — no. (%)	2 (2.0)	1 (0.7)
No. of vessels revascularized	3.0±0.8	1.3±0.8
Completeness of revascularization — %†	98.0	61.9
Death — no. (%)‡	2 (2.0)	2 (1.4)
Myocardial infarction — no. (%)	7 (7.1)	7 (5.0)
Stroke, loss of leg, or renal dialysis — no.	0	0
Reoperation — no. (%)	6 (6.1)	NA
Urgent CABG — no. (%)	NA	1 (0.7)
Days in hospital after procedure		
Median	7	1
Interquartile range	5–12	1–2

Coronary-Artery Revascularization before Elective Major Vascular Surgery

Revascularization



No. at Risk

Revascularization	226	175	113	65	18	7
No revascularization	229	172	108	55	17	12

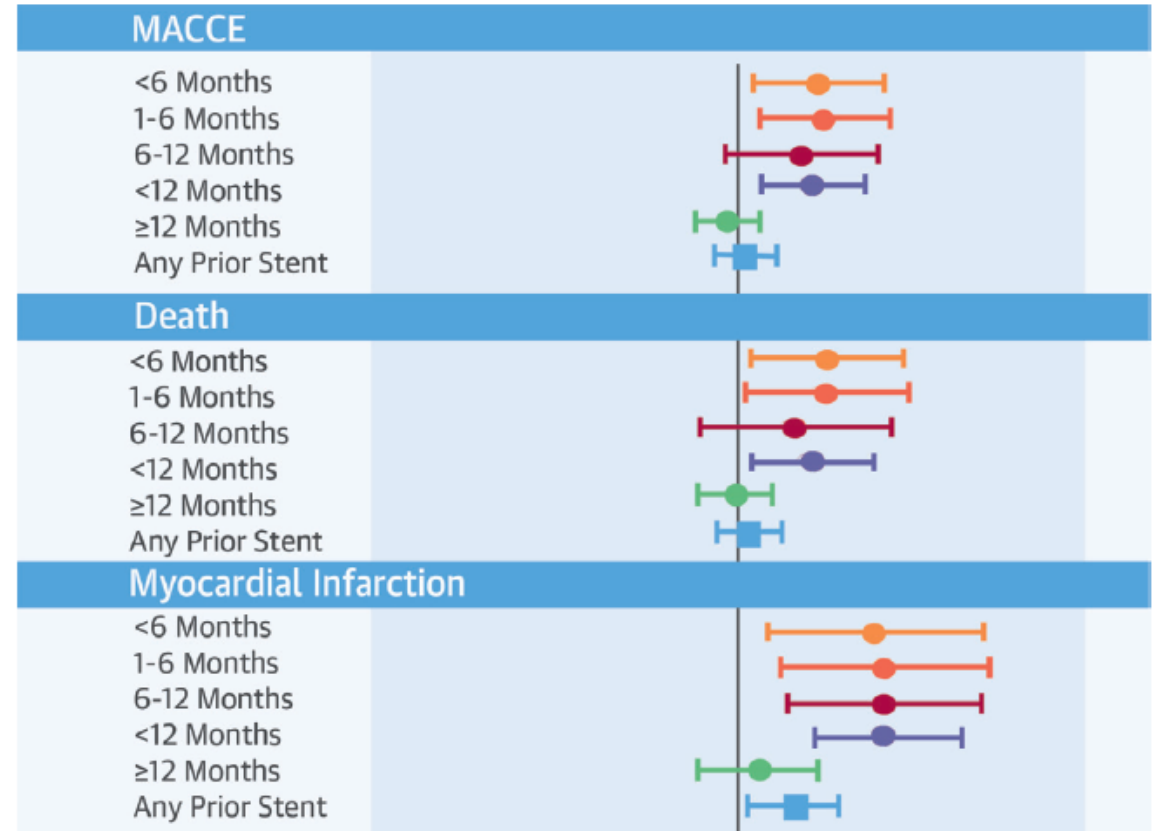
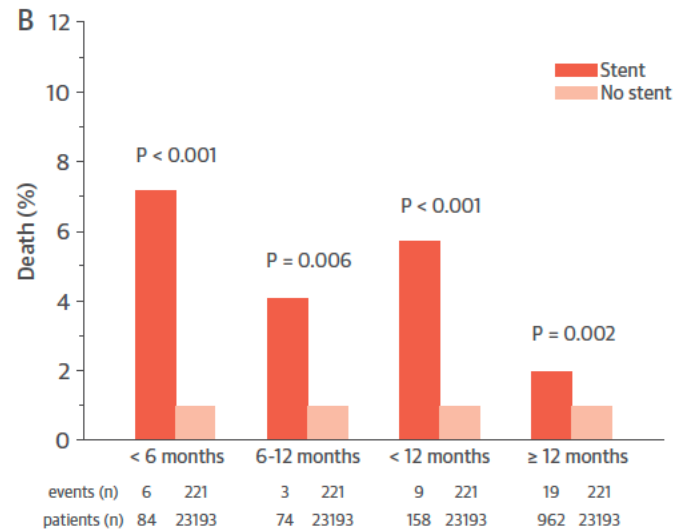
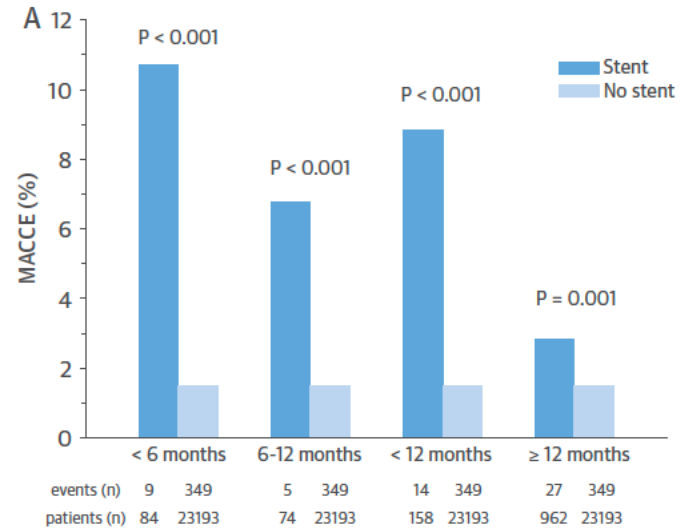
Table 4. Influence of Coronary-Artery Revascularization on Long-Term Survival among High-Risk Subgroups of Patients Scheduled for Vascular Surgery.*

High-Risk Variable	Patients (N=510) no. (%)	Hazard Ratio (95% CI)	P Value
Angina	198 (38.8)	1.45 (0.79–2.64)	0.23
Positive stress imaging test†	226 (44.3)	1.26 (0.77–2.06)	0.35
Fulfillment of criteria of Eagle and colleagues‡	142 (27.8)	0.90 (0.51–1.62)	0.73
With large stress-induced defect	37 (7.3)	3.96 (0.82–19.11)	0.09
Category of revised Cardiac Risk Index‡§	248 (48.6)	1.20 (0.76–1.89)	0.44
With large stress-induced defect	50 (9.8)	1.65 (0.64–4.25)	0.30
Prior CABG	77 (15.1)	1.81 (0.81–4.05)	0.15
Three-vessel disease and left ventricular dysfunction	74 (14.5)	1.29 (0.62–2.65)	0.50
Pain at rest and tissue breakdown	152 (29.8)	0.76 (0.43–1.34)	0.34

Statins 54% of pts

Perioperative Cardiovascular Risk of Prior Coronary Stent Implantation Among Patients Undergoing Noncardiac Surgery

Revascularization



Recommendations for Stress Test

Synopsis

The presence of reversible myocardial ischemia on a preoperative stress test is associated with increased risk for perioperative cardiac events.¹ However, the positive predictive value of an abnormal test is modest, and it is not clear that an abnormal test provides incremental prognostic value beyond standard risk assessment tools (eg, RCRI) or biomarkers (eg, natriuretic peptides).^{1,4-11} Testing is also expensive and may lead to unnecessary downstream testing or delays in performing the indicated surgery.¹² Moreover, preoperative revascularization has not been shown to reduce perioperative MACE or cardiac

mortality, and there is high potential for overtesting and overtreatment unless further perioperative testing is limited to patients in whom high-risk coronary lesions are likely.^{3,13,14} Therefore, the goal of preoperative testing for ischemia is not to identify undiagnosed CAD but to identify patients for whom revascularization is believed to improve clinical outcomes, specifically those with left main disease or severe multivessel disease with a reduced LVEF.¹³ These patients have been excluded from studies of preoperative revascularization, and the utility of revascularization in this context is unknown. Thus, in select patients in whom high-risk ischemia is suspected

Recommendations for Stress Test and ICA

COR	LOE	RECOMMENDATIONS
2b	B-NR	1. For patients undergoing elevated-risk NCS with poor or unknown functional capacity and elevated risk for perioperative cardiovascular events based on a validated risk tool, stress testing may be considered to evaluate for inducible myocardial ischemia. ¹
3: No benefit	B-R	2. In patients who are at low risk for perioperative cardiovascular events, have adequate* functional capacity with stable symptoms, or who are undergoing low-risk procedures, routine stress testing before NCS is not recommended due to lack of benefit. ¹⁻³

*Poor functional capacity is considered <4 METs or a DASI score of ≤34.

COR	LOE	RECOMMENDATION
3: No benefit	C-LD	1. In patients undergoing NCS, routine preoperative invasive coronary angiography (ICA) is not recommended to improve perioperative outcomes. ^{1,2}

Considerations and Contraindications for Specific Stress Testing Modalities

Modality	Contraindication*
Vasodilator pharmacological stress imaging	Significant arrhythmias (eg, VT, second- or third-degree atrioventricular block), significant hypotension (SBP <90 mm Hg), known or suspected bronchoconstrictive or bronchospastic disease or use of dipyridamole or methylxanthines (eg, aminophylline, caffeine) within 12 h
Exercise stress testing (with or without imaging)	Inability to exercise
Dobutamine stress echocardiography	Critical aortic stenosis, hemodynamically significant LVOT obstruction

Recommendations for Coronary Revascularization

Recommendations for Coronary Revascularization

Referenced studies that support the recommendations are summarized in the [Online Data Supplement](#).

COR	LOE	RECOMMENDATIONS
1	C-LD	1. In patients with ACS being considered for elective NCS, coronary revascularization as appropriate and deferral of surgery is recommended to reduce perioperative cardiovascular events. ¹⁻⁹
2a	C-LD	2. In patients with CCD and hemodynamically significant left main coronary artery stenosis $\geq 50\%$ who are planning elective NCS, coronary revascularization and deferral of surgery is reasonable to reduce perioperative cardiovascular events. ^{10,11}
3: No benefit	B-R	3. In patients with non-left main CAD who are planned for NCS, routine preoperative coronary revascularization is not recommended to reduce perioperative cardiovascular events. ^{*12-15}

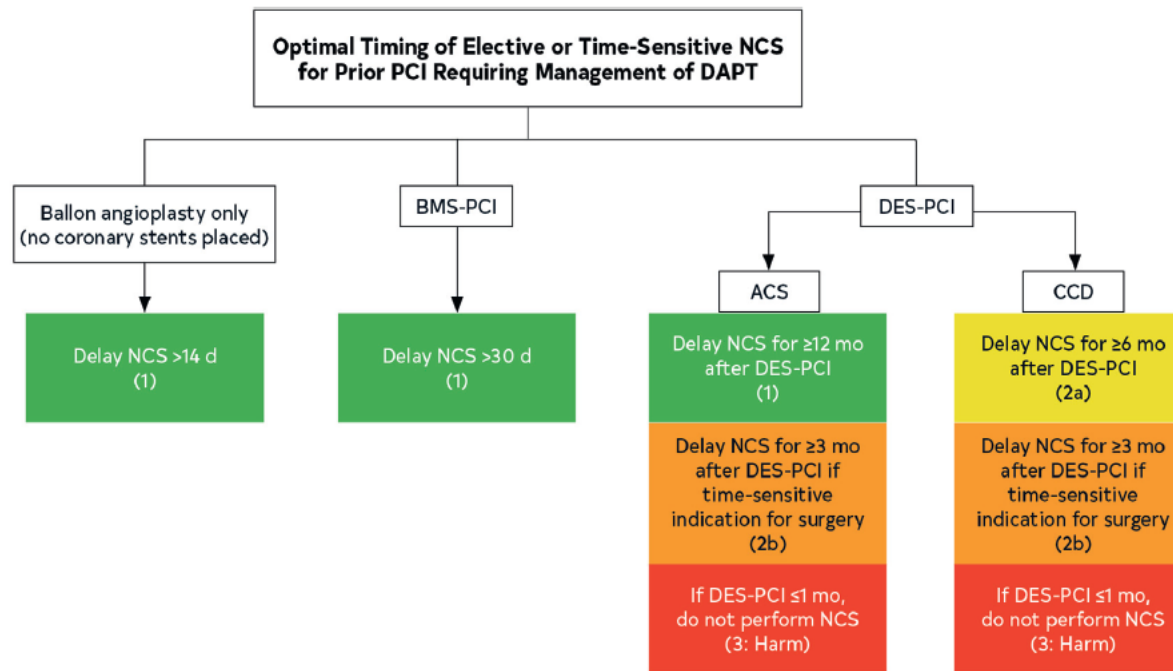
left main CAD compared with medical therapy.¹⁰ Therefore, preoperative coronary revascularization before NCS is a reasonable consideration in patients with CCD and significant left main CAD (defined as $>50\%$ stenosis).^{16,17}

3. In the CARP trial, routine prophylactic coronary revascularization with either PCI or CABG before elective major vascular surgery was not associated with differences in 30-day or 1-year rates of death or MI.¹² Patients with left main CAD, LVEF $<20\%$, or severe

indicated, before NCS.²⁰⁻²² However, a meta-analysis of 3949 patients including CARP and 6 other retrospective studies did not show any benefit from routine revascularization before NCS.²³ Coronary artery revascularization in patients undergoing vascular surgery has been noted to shift the mortality from cardiovascular to noncardiovascular causes, without an absolute reduction in mortality.²⁴ Bleeding complications are higher with PCI, specifically in the first 6 months after placement of a drug-eluting stent (DES).²⁵

Perioperative Antiplatelet Management in Patients With Prior PCI

FIGURE 5 Optimal Timing of Elective or Time-Sensitive NCS for Prior PCI Requiring Management of DAPT

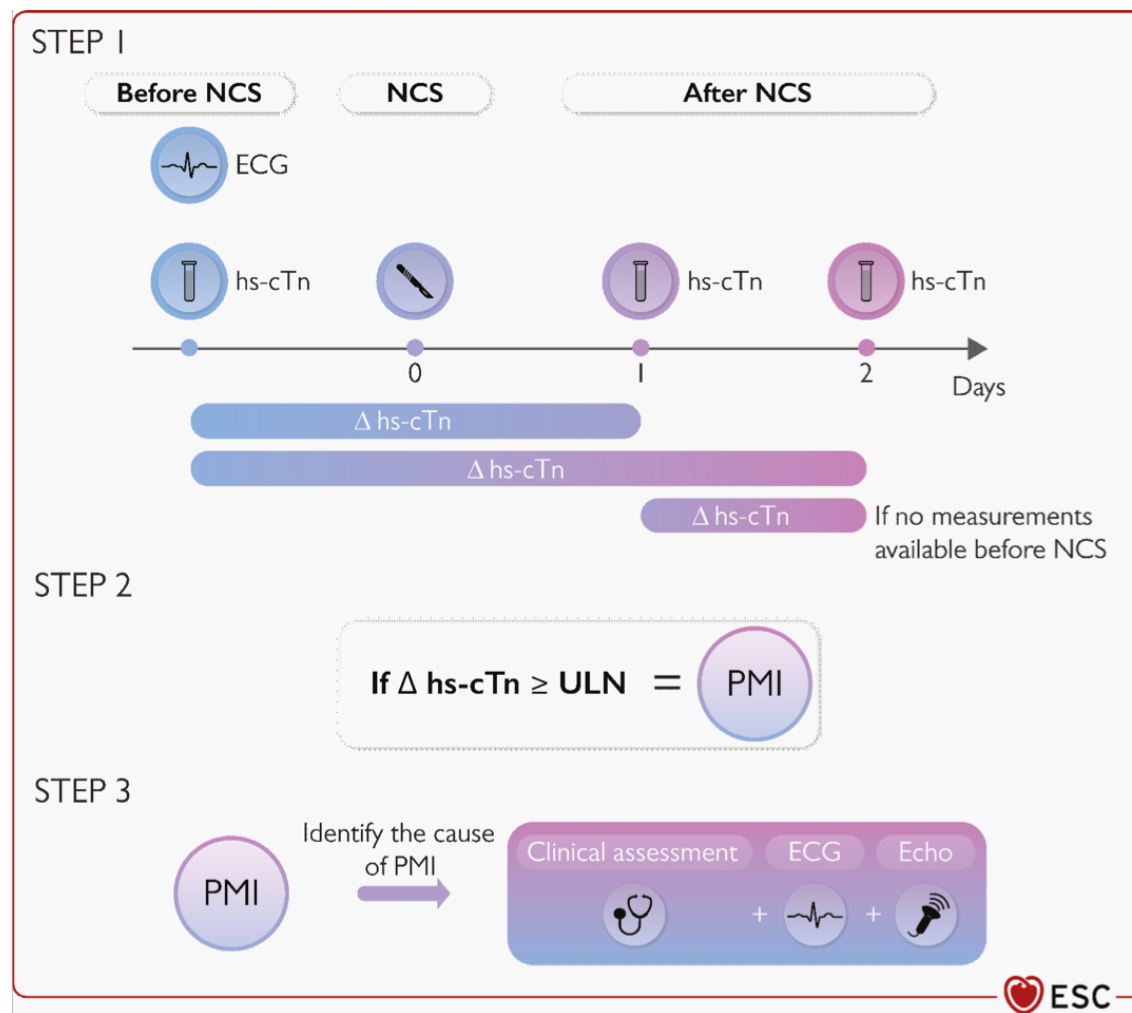


Colors correspond to Class of Recommendation in Table 3. ACS indicates acute coronary syndrome; BMS, bare-metal stent; CCD, chronic coronary disease; DAPT, dual antiplatelet therapy; DES, drug-eluting stent; NCS, noncardiac surgery; and PCI, percutaneous coronary intervention.

Recommendations for Troponin measurement

Figure 4

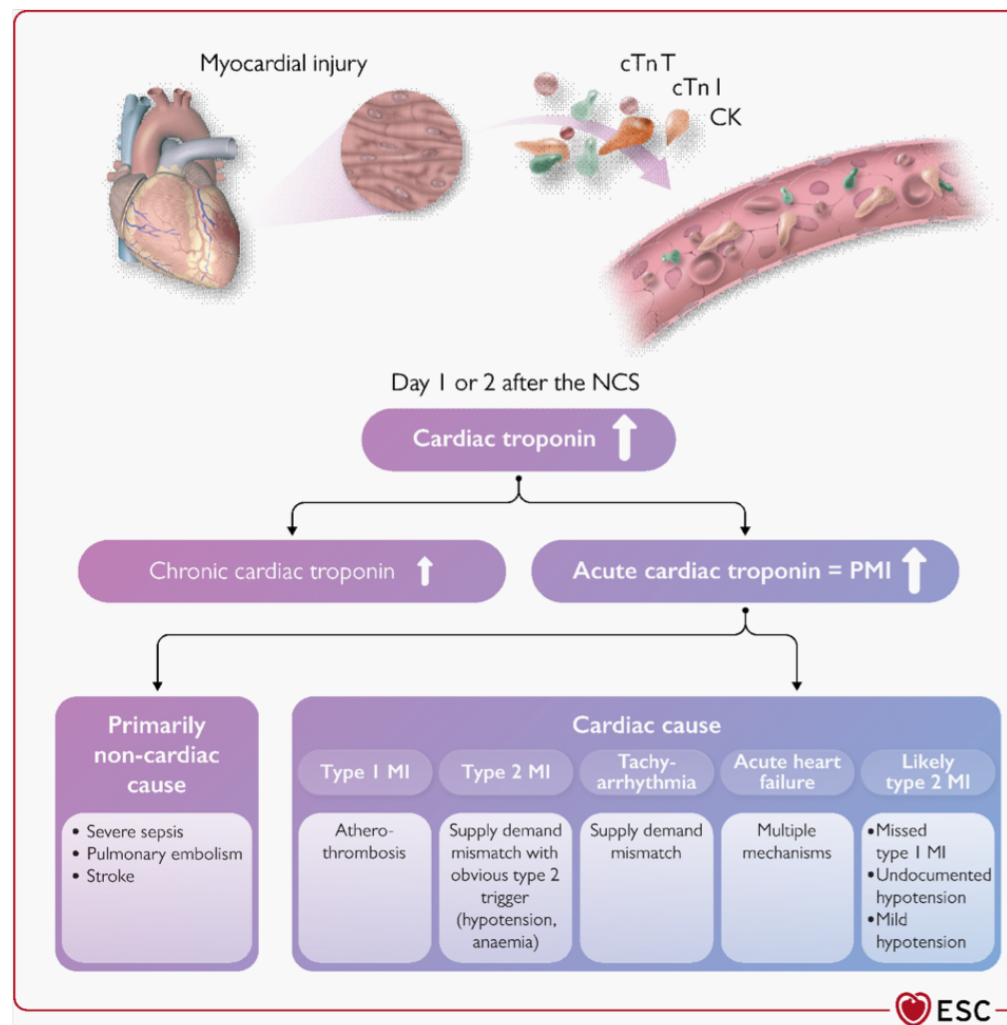
Recommended measurements to assess and detect the risk of post-operative cardiac complications



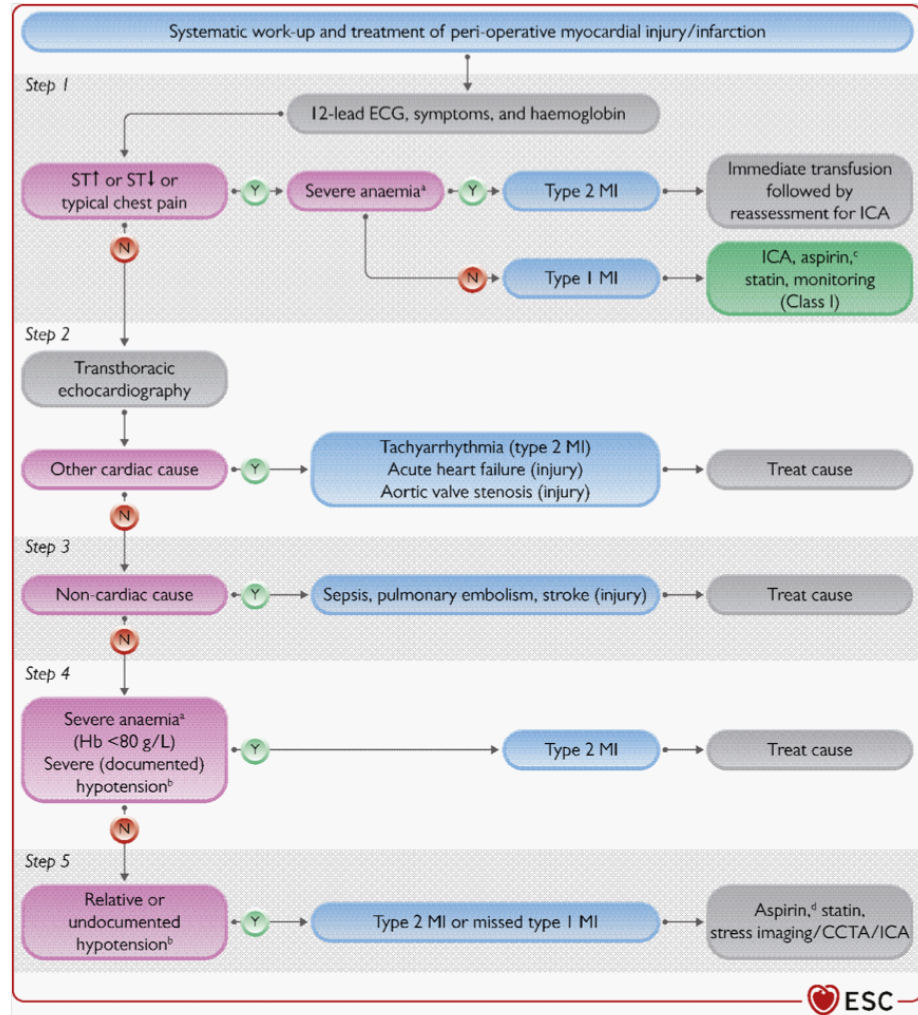
Recommendations for Troponin measurement

Figure 18

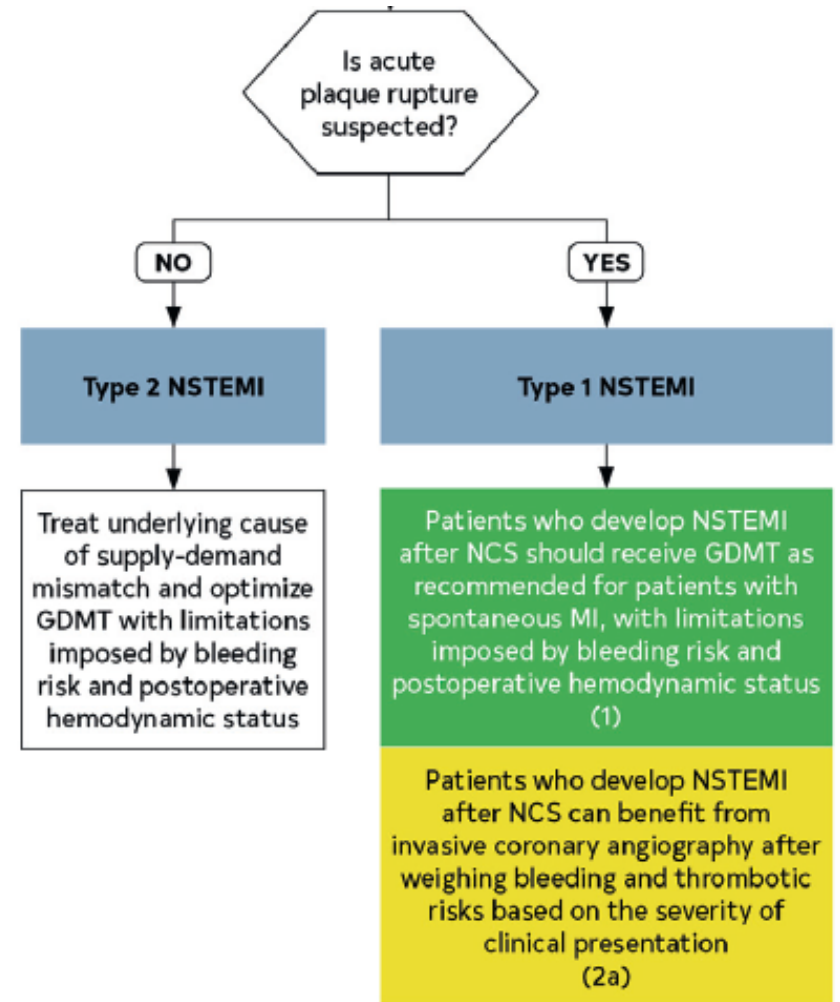
**Differential diagnosis
of elevated post-
operative cardiac
troponin
concentrations**



Recommendations for Troponin measurement



2022 ESC Guidelines on cardiovascular assessment and management of patients undergoing non-cardiac surgery



2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery

Recommendations for Troponin measurement

2. Preoperative high-sensitivity cTn concentrations in patients without symptoms or signs of ischemia can identify patients with chronic myocardial injury as well as those at increased risk during and after the procedure.^{4,8} There is no action predicated on this knowledge alone, although preoperative baseline troponin concentrations also inform the interpretation of postoperative troponin measurements and can help confirm a diagnosis of acute myocardial injury in the postoperative setting. There is limited evidence from heterogeneous populations that preoperative cTn can predict short- or long-term adverse outcomes.⁴ The predictive performance of the RCRI to identify patients who develop perioperative MACE is improved with the addition of preoperative cTn concentrations.⁵

Recommendations for Heart Failure

COR	LOE	RECOMMENDATIONS
1	C-LD	1. In patients with HF undergoing elective NCS, sodium-glucose cotransporter-2 inhibitors (SGLT2i) should be withheld for 3 to 4 days* before surgery when feasible to reduce the risk of perioperative metabolic acidosis. ¹⁻³
2a	C-LD	2. In patients with compensated HF undergoing NCS, it is reasonable to continue GDMT (excluding SGLT2i) in the perioperative period, unless contraindicated, to reduce the risk of worsening HF. ⁴⁻⁸

*Canagliflozin, dapagliflozin, and empagliflozin should be stopped ≥ 3 days and ertugliflozin ≥ 4 days before scheduled surgery.³

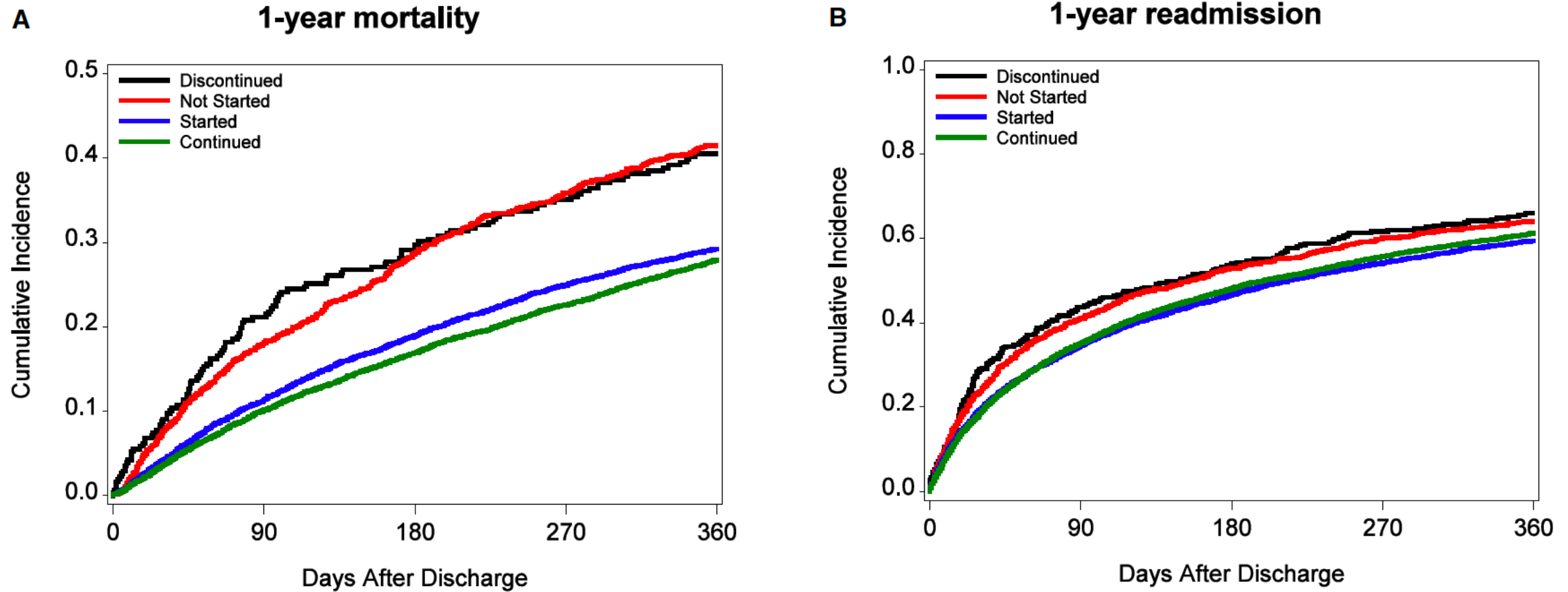
Recommendations for Heart Failure

	N	Crude Mortality Rate	Crude OR	Adjusted OR
No heart failure	561,738	1.22%	Reference	Reference
HFpEF, LVEF $\geq 50\%$	28,742	4.88%	4.14 (3.90-4.39)	1.51 (1.40-1.62)
LVEF 40%-49%	7,612	5.11%	4.34 (3.91-4.82)	1.53 (1.38-1.71)
LVEF 30%-39%	6,048	6.58%	5.68 (5.12-6.31)	1.85 (1.68-2.05)
LVEF <30%	4,185	8.34%	7.34 (6.56-8.21)	2.35 (2.09-2.63)

period and should be withheld for 3 to 4 days before surgery when feasible.^{1-3,14} In patients with advanced HF (New York Heart Association [NYHA] class III-IV) who are clinically decompensated or hemodynamically unstable, consideration should be given to postponing elective surgery and obtaining cardiology consultation to assist with perioperative management.

2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery

Initiation, Continuation, or Withdrawal of Angiotensin-Converting
Enzyme Inhibitors/Angiotensin Receptor Blockers and Outcomes in
Patients Hospitalized With Heart Failure With Reduced Ejection
Fraction



Discontinuation vs. continuation of renin–angiotensin system inhibition before non-cardiac surgery: the SPACE trial

Table 4 Primary and secondary outcomes

Outcomes		Number of patients with available data—no. (%)		Summary measure		Treatment effect (95% CI)	P-value
		Stop ^a (n = 124/130)	Continue ^b (n = 130/132)	Stop	Continue		
Primary outcome							
Myocardial injury ^{c,g}		120 (96.8)	121 (93.1)	58 (48.3)	50 (41.3)	0.77 (0.45, 1.31) ^e	.33
Secondary outcomes							
Peak level	Troponin-T ^c	120 (96.8)	121 (93.1)	18.4 (19.5)	16.8 (12.7)	−0.16 (−3.13, 2.82) ^f	.92
Infection ^{d,g}		124 (100.0)	123 (94.6)	26 (21.0)	24 (19.5)	0.93 (0.50, 1.76) ^e	.83
Myocardial infarction ^d		124 (100.0)	123 (94.6)	3 (2.4)	0 (0.0)		
Acute heart failure ^d		124 (100.0)	123 (94.6)	2 (1.6)	0 (0.0)		
Stroke ^d		124 (100.0)	123 (94.6)	1 (0.8)	0 (0.0)		
Death ^d		124 (100.0)	123 (94.6)	1 (0.8)	2 (1.6)		

Table 5 Pre-specified adverse events

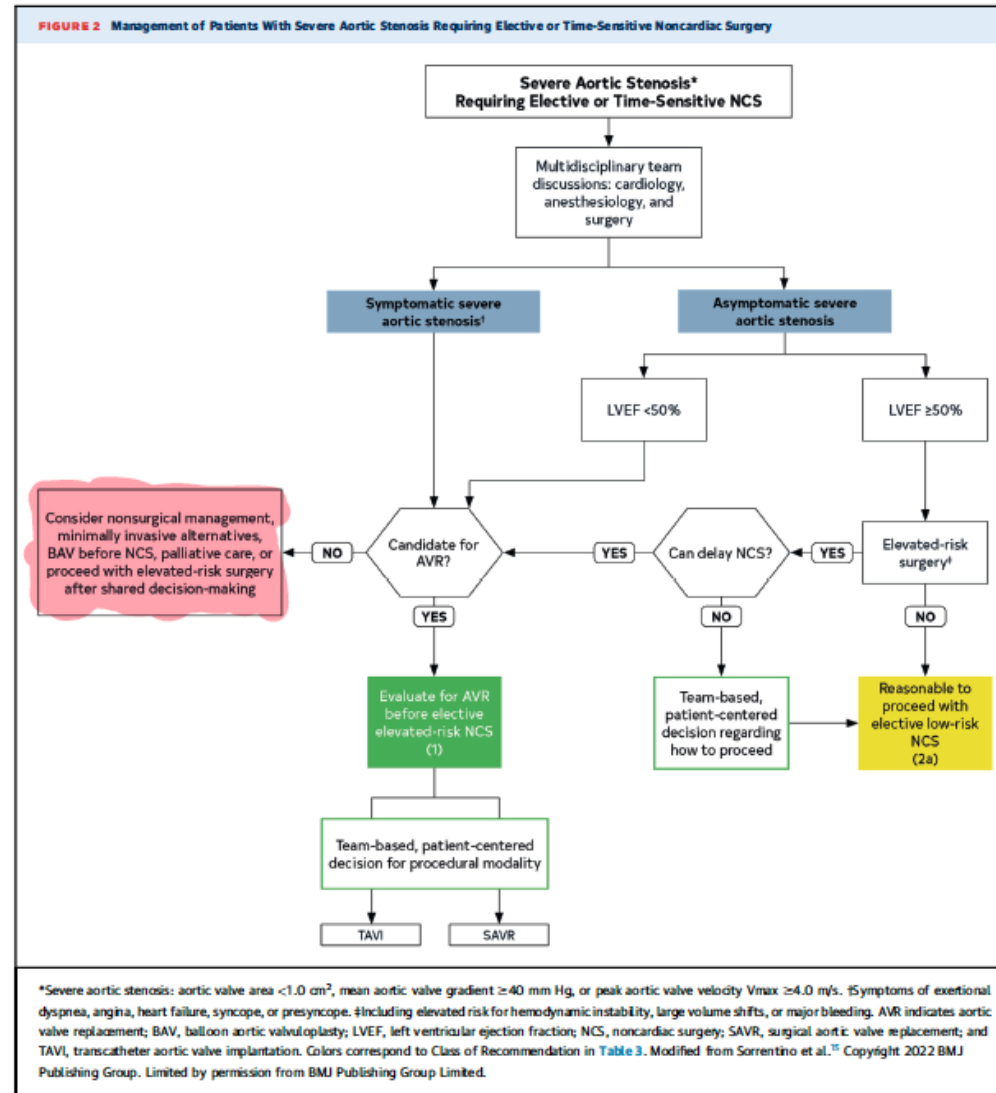
Adverse events—no. (%)	Summary measure		P-values
	Stop ^a (n = 124/130)	Continue ^b (n = 130/132)	
Patients with ≥1 adverse events	43 (34.7)	43 (33.1)	.93
Hypotension ^c	12 (9.7)	11 (8.5)	.80
Hypertension ^d	16 (12.9)	7 (5.4)	.05
Acute kidney injury ^e	14 (11.3)	12 (9.2)	.65
Other	15 (12.1)	19 (14.6)	.49

Recommendations for Aortic Stenosis

Recommendations for Aortic Stenosis

COR	LOE	RECOMMENDATIONS
1	C-LD	1. Patients with severe AS should be evaluated for the need for aortic valve intervention before elective NCS to reduce perioperative risk.* ^{1,2}
1	C-EO	2. In patients with suspected moderate or severe AS who are undergoing elevated-risk NCS, preoperative echocardiography is recommended before elective NCS to guide perioperative management.*
2a	C-LD	3. In asymptomatic patients with moderate or severe AS and normal LV systolic function as assessed by echocardiography within the past year, it is reasonable to proceed with elective low-risk NCS. ³⁻⁵

Recommendations for Severe Aortic Stenosis



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Perioperative Cardiovascular
Management for Noncardiac Surgery

Cosa si deve condividere con il paziente?

- Qual è il quesito cui deve rispondere il cardiologo nella consulenza (che è «il paziente può affrontare l'intervento?»)
- Quali rischi corre il paziente durante l'intervento e nei primi 30 giorni?
- Quali rischi corre il paziente a non fare l'intervento?
- Quali rischi corre il paziente a differire l'intervento (es. per effettuare ulteriori approfondimenti diagnostici cardiologici e/o PCI)?
- Quali modifiche terapeutiche si vengono suggerite?

Quando la consulenza cardiologica ha un valore aggiunto?

(Quando ha senso chiedere una consulenza cardiologica)

- Trattare un'acuzie cardiologica
- Ottimizzare *risk modifiers*
- Eseguire ecocardio in pz con METS <4 o non valutabili (specie se associati ad aumentati valori di NTproBNP) in pazienti candidati a chirurgia a rischio intermedio/alto
- Eseguire ecocardio in pz con sospetta stenosi aortica
- Stima accurata del rischio chirurgico in pazienti con rischio aumentato ed alternative terapeutiche alla chirurgia

Conclusioni

- Il numero di interventi di chirurgia non cardiaca è significativo e spesso i pazienti presentano fattori rischio CV
- Il rischio operatorio dipende dal rischio della procedura, dalla storia clinica del paziente e dalla sua capacità funzionale
- Il rischio operatorio, nella maggior parte dei casi, può essere determinato senza una consulenza cardiologica
- La valutazione cardiologica dovrebbe essere richiesta in casi complessi in cui abbia un evidente valore aggiunto
- Test provocativo e/o rivascolarizzazione coronarica preoperatori hanno scarso valore aggiunto
- Prima di procedere a eventuali test provocativi e/o rivascolarizzazione coronarica preoperatori dovranno essere presi in considerazione i costi, i rischi legati a tali procedure e i rischi legati al ritardo/annullamento dell'intervento di chirurgia non cardiaca