



UCL Anaesthesia and Perioperative Medicine

Evaluating the Heart before Non-Cardiac Surgery

A faded, purple-tinted background image showing three medical professionals in a hospital setting. On the left, a man in a dark scrub top is looking at a document. In the center, a woman with her hair in a bun is looking down. On the right, another woman in a dark scrub top is looking towards the center. In the foreground, a patient is lying in a hospital bed, partially visible.

Study **Perioperative
Medicine** MSc /
Diploma / Certificate

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Evaluating the Heart before Non-Cardiac Surgery

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Interests

Education- lead for the year 4 MBBS, 6 SSM, 'Intro to Anaesthesia' course and on the MSc in [Perioperative Medicine](#)

Undergraduate Education in Anaesthesia & Perioperative Medicine

[Innovative Education Methods](#)

Endotoxin & perioperative inflammation

[Cardiopulmonary Exercise Testing](#)

Maintaining Centre for Anaesthesia website

Clinical trials

Selected

[Preoperative systemic inflammation and perioperative myocardial injury: prospective observational multicentre cohort](#)

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Infomed and ICU trainees
Assessing the heart for non
Cardiac Surgery

Slides from talk

 [talk2023.pdf](#)

 [assessing_the_heart_trainees.pdf](#)

Guidelines

[European ESC 2022 guidelines](#)

 [Canadian Guidelines](#)

 [US AHA/ACC 2014 Updated Guidelines](#)

 [European ESC/ESA 2014 Updated Guidelines](#)

[European 2009 Guidelines](#)

[2021 RCS](#)

Studies

[MANAGE Dabigatran Trial 2018](#)

[JAMA Systematic Review 2017 on Stents](#)

 [mins_2014](#)

 [London B Blocker Meta-analysis 2013](#)

 [VISION Study 2012](#)

 [Foix & Sear B Blockers 2013](#)

 [CARP 2004](#)

 [carp.pdf](#)

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Contents

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- Where to look- ESC 2022
- Basic Principles
- Guidelines: Decisions
- Guidelines: Putting it all together
- Which test?
- ECHO
- CPET
- B Block?
- Troponins?
- COVID19 = 1 slide!
- Summary

Introduction

- You're all experts!
- Seems big, complex
- Conflicting, absent and changing evidence!
- Assessing CVS system vs interventions

Introduction

Table 2 Level of evidence

Level of Evidence A	Data derived from multiple randomized clinical trials or meta-analyses.
Level of Evidence B	Data derived from a single randomized clinical trial or large non-randomized studies.
Level of Evidence C	Consensus of opinion of the experts and/or small studies, retrospective studies, registries.

Where to start?!

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- Google 'ESC assess heart non- cardiac'

esc assess heart non cardiac

Gmail CLWRota : Consultant Home RISE 360 Dashboard Lloyds Bank NHS mail UCL Moodle

Ch... JA... UC... Wi... CP... Y4... W... ES... Em...

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About 14,600,000 results (0.45 seconds)

No cardiac testing is recommended before low-risk or intermediate-risk NCS. Electrocardiogram (ECG) and biomarkers are recommended only for high-risk NCS, if age ≥ 45 (Class IIa). ECG plus transthoracic echocardiography (TTE) are recommended with family history of genetic cardiomyopathy (Class I). 1 Sept 2022



American College of Cardiology

<https://www.acc.org> › Latest-in-Cardiology › 2022/09/01

2022 ESC Guidelines for CV Assessment of Noncardiac Surgery

About featured snippets • Feedback



European Society of Cardiology

<https://www.escardio.org> › Clinical-Practice-Guidelines

ESC Guidelines on non-cardiac surgery

26 Aug 2022 — ESC Guidelines on **cardiovascular assessment** and management of patients undergoing non cardiac surgery. ESC Clinical Practice Guidelines 26

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9. Key messages

- The occurrence of CV complications in the peri-operative phase of NCS has a dramatic impact on prognosis.
- The risk of CV complications in patients undergoing NCS is determined by patient-related factors, type of surgery or procedure, and the circumstances under which surgery takes place (elective vs. emergency procedure; local or tertiary hospital).
- Specific patient-related risk factors may be reduced by adequate pre-operative risk assessment and initiation of effective risk-reduction strategies.
- The quantification of surgical risk as low, intermediate, and high is helpful in identifying the group of patients who should most benefit from preventive, diagnostic, and therapeutic approaches to concomitant CV conditions.
- Proper selection of type and timing of the surgical procedure may reduce the risk of complications.
- It is important that patients' values, quality of life, and preferences regarding the benefits and risks of surgery are taken into consideration, and that well-informed patients are involved in the decisions. Risk should be communicated to the patient in absolute terms (e.g. 1 out of 100).
- Clinical examination, patient-reported functional capacity, and non-invasive tests represent the cornerstone of pre-operative cardiac assessment.
- Instrumental and functional cardiac examination tools should be selected in view of the surgical risk, relative diagnostic proficiency, and healthcare resource utilization and costs.
- The peri-operative evaluation of elderly patients who require elective major NCS should include frailty screening, which has proven to be an excellent predictor of unfavourable health outcomes in the older surgical population.
- Treatment of pre-existing or newly diagnosed CV conditions (e.g. coronary and peripheral vascular disease, rhythm disorders, and HF) should be individualized according to the pre-operative risk of NCS, and considering the recommendations of specialty guidelines.
- A multidisciplinary approach to evaluate whether the treatment of concomitant cardiac conditions before scheduled NCS improves peri-operative safety without unnecessary delay is encouraged.

It is important to document and measure the success of preventive and therapeutic strategies in patients undergoing NCS.

10. Gaps in evidence

- The age cut-off for individuals (considered to be cardiovascularly healthy) benefiting from risk stratification work-out before NCS needs to be evaluated.
- Further studies are needed to characterize outcome differences in NCS between men and women, and between different countries, in order to individualize peri-operative management and improve patient safety.
- Evidence on the additive value of cardiac biomarkers, hand-held ultrasound, problem FOCUS, and stress echocardiography for cardiac risk stratification of patients scheduled for NCS presenting with previously unknown cardiac murmur, dyspnoea, oedema, and chest pain is still lacking. The impact of FOCUS on outcomes of urgent or time-sensitive surgery needs further investigation.
- The impact of stress imaging (echocardiography or MRI) before NCS on reduction of peri-operative CV complications in non-ischaemic heart diseases needs further research.
- The role of right heart catheterization in patients with advanced HF or patients with severe pulmonary hypertension undergoing NCS is unknown.
- It is unknown whether artificial intelligence-based systems facilitate prompt detection and response to imminent adverse events in high-risk cardiac patients undergoing high-risk NCS.
- Systematic and structured research to investigate pathophysiology, causes, and time distribution of serious peri-operative arrhythmic events among patients undergoing NCS is still needed.
- Strategies for timing of pre-operative CIED control dependent on device type, urgency, and type of NCS, and risk of EMI during NCS need to be developed to ensure maximal patient safety.
- Benefit of routine myocardial revascularization of high-risk CCS patients (except left main or three-vessel CAD, reduced LV function) before elective intermediate- and high-risk NCS is not well-established.
- More evidence regarding the need for bridging of anticoagulation in patients with MHVs is needed.
- There is a lack of evidence regarding the optimal strategies before emergent or time-sensitive NCS for patients on antithrombotic treatment at high risk of thromboembolic events, including the:

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and risk factors, which may have an impact on peri-operative morbidity and mortality. However, there is a paucity of data specifically addressing the interplay between sex, age, and comorbidities in patients scheduled for NCS.

The pre-operative assessment before NCS might take sex into consideration, since the age-adjusted incidence of CVD is lower in

strate, complications, or long-term outcomes have been reported in patients undergoing CIED implantation,^{695,696} and female sex is a well-known risk factor for stroke in patients with AF.⁶⁹⁷ However, no specific data exist that suggest sex differences in risk profile or outcomes of patients with CIEDs or arrhythmias who undergo NCS.

12. ‘What to do’ and ‘what not to do’ messages from the Guidelines

Recommendations	Class ^a	Level ^b
Recommendations for clinical risk evaluation		
In all patients scheduled for NCS, an accurate history and clinical examination are recommended.	I	C
It is recommended to perform a pre-operative risk assessment, ideally at the same time as the NCS is proposed.	I	B
If time allows, it is recommended to optimize guideline-recommended treatment of CVD and CV risk factors before NCS.	I	C
In patients with a family history of genetic cardiomyopathy, it is recommended to perform an ECG and TTE before NCS, regardless of age and symptoms.	I	C
In patients with a newly detected murmur and 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

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ESC Guidelines	
<p>premature cessation or bridging during interruption of oral P2Y₁₂ receptor inhibitors (glycoprotein IIb/IIIa receptor inhibitors or cangrelar)</p> <p>There is no high-quality evidence to indicate the optimal timing of interruption of therapy to guide the strategy for treatment of NCSs in patients undergoing surgery.</p> <p>Evidence regarding the need for and benefit of anticoagulation in NCSs patients with post-operative AF is still lacking (ongoing APEACE trial NCT03493873).</p> <p>Prophylactic strategies to reduce the incidence of post-operative AF in NCS patients adhere to low-bloody maintenance in the blood already in this treatment need to be evaluated.</p> <p>The optimal timing, monitoring and therapy for patients with PMIs with oral anticoagulation should be evaluated.</p> <p>Studies are needed to investigate the impact of the treatment of post-operative hyperkalaemia on post-operative outcomes, the use of new IV drug classes (SGLT-2 inhibitors and analogues), and the use of RAASs as a temporary treatment of acute post-operative pain.</p> <p>Prophylactic studies are needed to investigate the incremental value of various algorithms and dosing strategies (use of blood-sparing blood tests) to reduce the risk of anaemia-associated adverse outcomes among CV patients undergoing NCS.</p>	
11. Sex differences	
Sex and gender may significantly affect the management and outcomes of patients with specific disease undergoing NCS. There are sex- and gender-dependent clinical phenotypes of cardiovascular diseases and factors which may have an impact on post-operative morbidity and mortality. However, there is a paucity of data specifically addressing the interplay between sex, age, and comorbidity in patients scheduled for NCS. <p>The pre-operative assessment before NCS might take sex into consideration, since the age-adjusted incidence of CVD is lower in women than men, and the risk of undetected disease could therefore be lower in women. However, the risk also exists in non-specific assessment strategies.</p> <p>In patients undergoing surgery, sex may significantly affect the outcome of the treatment. In contrast, among 69773 patients who underwent elective NCS between 2008 and 2016, the odds of post-operative 90-day mortality were higher among women with AF compared with men. Further studies are needed to provide more information about outcome differences between men and women in NCS.</p> <p>Some studies have reported a higher risk of bleeding in women than men, but other studies could not confirm this. No study has systematically investigated the impact of sex differences on timing, therapy and safety of combination, or interruption of antithrombotic therapy in patients undergoing NCS.</p> <p>The prevalence of atrial fibrillation or other arrhythmias up to high risk of stroke (CHA₂DS₂-VASc score ≥ 2) is higher in women than in men. In women, the risk of stroke is higher in women undergoing surgery every year despite post-operative anaesthesia. Furthermore, older women have lower blood volume and lower haemoglobin values than men, but the same surgical blood loss as men. They are exposed to a higher risk of post-operative complications. Also, higher transfusion rates and volume have been reported in women compared with men in elective surgery¹⁰¹. It is therefore of particular importance that clinicians follow the Patient Blood Management program in women undergoing NCS. Other associated differences in pharmacology and pharmacokinetics of anaesthetic drugs may influence the anaesthesia plan, post-operative recovery and patient satisfaction.</p> <p>Sex differences regarding presentation, neurophysiological substrate, complications, or long-term outcomes have been reported in patients undergoing CVD implantation^{102,103} and beside sex as a well-known risk factor for stroke in patients with AF¹⁰⁴. However, no specific data exist that suggest an influence in risk profile or outcomes of patients with CVDs or arrhythmias who undergo NCS.</p>	
12. 'What to do' and 'what not to do' messages from the Guidelines	
Recommendations	
Recommendations for clinical risk reduction	
In patients scheduled for NCS, an accurate history and clinical examination are recommended.	I C
If it is recommended to perform a pre-operative assessment, ideally at the same time as the NCS is proposed.	I B
If time allows, it is recommended to optimize guideline-recommended treatment of CVD and CV risk factors in patients.	I C
In patients with a family history of genetic cardiovascular, it is recommended to perform an ECG and TTE before NCS, regardless of age and symptoms.	I C
In patients with a newly detected murmur and 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

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ESC Guidelines	
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 is found to have NCS, also chest pain or other symptoms suggestive of undetected CAD, a multidisciplinary assessment is recommended to choose the treatment with lowest risk for the patient.	I C
In patients with symptoms and/or pathological findings on ECG or on NT-proBNP that are not indicated before NCS, unless there is a certain non-operative indication.	I C
In patients with symptoms and/or pathological findings and elevated NT-proBNP, TTE is recommended before NCS.	I C
Recommendations for patient information	
It is recommended to give patients individualized information for pre-operative and post-operative changes in medication, in verbal and written format with clear and concise direction.	I C
Recommendations for use of risk assessment tools	
In patients with known CVD or CV risk factors (including age ≥ 65 years), or symptoms or signs suggestive of CVD, it is recommended to assess the risk of stroke using CHA ₂ DS ₂ -VASc score.	I C
In patients with known CVD, CV risk factors (including age ≥ 65 years), or symptoms suggestive of CVD, it is recommended to assess the risk of bleeding using HAS-BLED score.	I C
TTE is recommended in patients with post-functional capacity and high NT-proBNP, if it remains or decreases below normal NCS, in order to estimate the risk of stroke.	I C
Stroke imaging is recommended before high-risk elective NCS in patients with post-functional capacity and high likelihood of CAD or high-risk stroke.	I C
It is recommended to use the same indication for CAA for revascularization pre-operatively as in the non-surgical setting.	I C
In high-risk patients undergoing low and intermediate-risk NCS, it is not recommended to routinely do pre-operative ECG, but to TTE or BNP/NT-proBNP assessment.	I C
Pre-operative evaluation of LV function is not recommended.	I C
TTE or BNP/NT-proBNP assessment.	I C
Stroke imaging is not recommended routinely before NCS.	I C
Routine pre-operative CAA is not recommended to stable CCS patients undergoing low and intermediate-risk NCS.	I C
Recommendations for CV risk factors and therapy interventions	
Stroke imaging is not recommended routinely before NCS.	I C
Routine pre-operative CAA is not recommended to stable CCS patients undergoing low and intermediate-risk NCS.	I C
Recommendations for pharmacological risk-reduction strategies	
Beta-blockers	
Pre-operative administration of beta-blockers is recommended to patients currently receiving this medication.	I C
Routine initiation of beta-blocker preoperatively is not recommended.	I C
Diuretics	
In patients already on diuretics, it is recommended to continue diuretics during the peri-operative period.	I C
Recommendations for peri-operative handling of antithrombotic agents	
Antiplatelets	
It is recommended to delay elective NCS and 4 months after elective NCS and 12 months after ACS.	I C
After elective NCS, it is recommended to delay the resumption of NCS with a minimum of 1 month if DAPT of treatment has been given.	I C
In patients with a recent NCS scheduled for NCS, it is recommended that management of antithrombotic therapy is discussed between the surgeon, cardiologist, or cardiologist.	I C

Continued

ESC Guidelines	
<p>A multidisciplinary team including VAD specialists is recommended for perioperative management of patients with HF receiving continuous veno-arterial support.</p>	
CV Patients with NCS	
Clinical and echocardiographic evaluation (if not recently performed) is recommended in all patients with known or suspected NCS who are scheduled for elective intermediate- and high-risk NCS.	I C
AAHA (AAHA or TAVI) is recommended in symptomatic patients with severe Aortic valve disease scheduled for elective intermediate- or high-risk NCS.	I C
In patients with symptomatic aortic valve disease, severe Aortic valve disease (Aortic valve area < 1.0 cm ² or AVED > 125 mm ²) is recommended to delay elective NCS and 4 months after elective NCS, unless there is a certain non-operative indication.	I C
CV Patients with ACHD	
In patients with ACHD, it is recommended to consider the need for high-risk elective surgery preoperatively in a centre with experience in the care of ACHD patients.	I C
CV Patients with arrhythmias	
In patients with ACHD, it is recommended to consider the need for high-risk elective surgery preoperatively in a centre with experience in the care of ACHD patients.	I C
In patients with DVT treated by medication, it is recommended that ACHD are continued during the peri-operative period.	I C
In AF patients with acute or worsening haemodynamically unstable underlying NCS, emergency electrical cardioversion is recommended.	I B
In patients with symptomatic, non-paroxysmal, and sustained VT associated with myocardial scar, non-drug specific medical therapy, ablation of arrhythmia is recommended before elective NCS.	I C
It is recommended that patients with symptomatic, sustained VT have continuous ECG monitoring, and during the peri-operative period are accompanied by personnel skilled in early detection and treatment of arrhythmia in high-risk patients (e.g. paroxysmal atrial fibrillation or VT patients). If it remains or decreases below normal NCS, it is recommended to place transvenous pacemaker/pacemaker pads prior to NCS.	I C
In patients with symptomatic, sustained VT associated with myocardial scar, non-drug specific medical therapy, ablation of arrhythmia is recommended before elective intermediate- or high-risk NCS.	I C
CV Patients with AF	
It is not recommended to initiate treatment of atrial fibrillation during NCS.	II C
CV Patients with pulmonary hypertension	
It is recommended to continue chronic therapy for PH in the peri-operative phase of NCS.	I C
It is recommended that haemodynamic monitoring of patients with severe PH continues for at least 24 h in the post-operative period.	I C
In the case of progression of right HF in the post-operative period in patients with PH, it is recommended that the diuretic dose be optimized and, if necessary, in pre-emptive analgesics be initiated under the guidance of a physician experienced in the management of PH.	I C
CV Patients with hypertension	
In patients with chronic hypertension undergoing elective NCS, it is recommended to avoid large peri-operative fluctuations in blood pressure, particularly hypotension during the peri-operative period.	I A
It is recommended to perform pre-operative screening for hypertension-related organ damage for CV risk factors in newly diagnosed hypertensive patients who are scheduled for elective high-risk NCS.	I C
It is not recommended to delay NCS in patients with stage 1 or 2 hypertension.	II C
CV Patients with PAD	
In patients with post-functional capacity and/or significant risk factors or symptoms (such as ischaemia to severe angina pectoris, intermittent claudication, critical limb ischaemia and/or peripheral artery disease), referral for further work-up and optimization is recommended prior to elective surgery for PAD or AAA.	I C
Routine referral for cardiac work-up, coronary angiography, or CMT prior to elective surgery for PAD or AAA is not recommended.	II C

Continued



ESC Guidelines	
<p>I) Patients with cerebrovascular disease</p> <p>Pre-operative carotid artery and cerebral imaging is recommended in patients with a history of TIA or stroke in the previous 6 months and who have not undergone ipsilateral revascularization.</p> <p>Pre-operative routine carotid artery imaging is not recommended in patients undergoing NCS.</p>	
J) Patients with renal disease	
In patients with known risk factors (age > 65 years, BMI > 30 kg/m ² , diabetes, hypertension, hyperlipidaemia, CV disease, or smoking) undergoing intermediate- or high-risk NCS, it is recommended to screen for pre-operative renal disease by measuring serum creatinine and GFR.	I C
K) Patients with obesity	
It is recommended to assess cardiorespiratory fitness to estimate peri-operative CV risk in obese patients, with particular attention to those undergoing intermediate- and high-risk NCS.	I B
L) Patients with diabetes mellitus	
A pre-operative assessment for concomitant cardiac conditions is recommended in patients with diabetes with suspected or known CAD, and those with autonomic neuropathy, retinopathy, or renal disease and scheduled to undergo intermediate- and high-risk NCS.	I C
In patients with diabetes or disturbed glucose metabolism, a pre-operative HbA1c is recommended, if this measurement has been not performed in the previous 3 months. In case of HbA1c $\geq 8.5\%$ (≥ 69 mmol/mol), elective NCS should be postponed, if safe and practical.	I B
Recommendations for peri-operative monitoring and anaesthesia	
In order to preserve optimal CV stability, it is recommended to apply goal-directed haemodynamic therapy in patients undergoing high-risk NCS.	I A
It is recommended to avoid post-operative acute pain.	I B
In order to minimize the risk of post-operative organ dysfunction, it is recommended to avoid an intra-operative mean arterial pressure decrease of $> 20\%$ from baseline values or < 60 –70 mmHg for ≥ 10 min.	I B
Non-opioid NSAIDs are not recommended as first-line analgesics in patients with established or high risk of CVD.	III B

Recommendations for treatment of post-operative cardiovascular complications	
It is recommended to have high awareness of peri-operative CV complications, combined with surveillance for PMI in patients undergoing intermediate- or high-risk NCS.	I B
Systematic PMI work-up is recommended to identify the underlying pathophysiology and define therapy.	I B
It is recommended to treat post-operative STEMI, NSTEMI-ACS, acute HF, and tachyarrhythmias in accordance with guidelines for the non-surgical setting, after interdisciplinary discussion with the surgeon about bleeding risk.	I C
In patients with post-operative PE of high or intermediate clinical probability, initiation of anticoagulation is recommended without delay, while diagnostic work-up is in progress, if bleeding risk is low.	I C
Post-operative oral anticoagulation for PE is recommended to be administered for a period of at least 3 months.	I C
In patients with a post-operative indication for OAC, NOAC is generally recommended over VKA.	I A
Routine use of beta-blocker for the prevention of post-operative AF in patients undergoing NCS is not recommended.	III B

AAA, abdominal aortic aneurysm; AAD, aortic dissection; AHA, adult with congenital heart disease; ACS, acute coronary syndrome; AF, atrial fibrillation; AF, aortic valve regurgitation; AS, aortic valve stenosis; AVR, aortic valve replacement; BMI, body mass index; BNP, B-type natriuretic peptide; BSA, body surface area; CAD, coronary artery disease; CCS, chronic coronary syndrome; CIED, cardiac implantable electronic device; CPET, cardiopulmonary exercise testing; CV, cardiovascular; CVD, cardiovascular disease; DAPT, dual antiplatelet therapy; DES, drug-eluting stent; ECG, electrocardiogram; ESC, European Society of Cardiology; GFR, glomerular filtration rate; HbA1c, glycated haemoglobin; HF, heart failure; hs-TnT, high-sensitivity cardiac troponin; ICA, invasive coronary angiography; ICD, implantable cardioverter-defibrillator; LMWH, low molecular weight heparin; LV, left ventricle; LVEF, left ventricular ejection fraction; LVESD, left ventricular end-systolic diameter; LVESD, left ventricular end-systolic diameter index; PHV, mechanical heart valve; PS, mitral valve stenosis; NCS, non-cardiac surgery; NOAC, non-vitamin K antagonist oral anticoagulant; NSAID, non-steroidal anti-inflammatory drug; NSTEMI-ACS, non-ST-segment elevation acute coronary syndrome; NT-proBNP, N-terminal pro-B-type natriuretic peptide; OAC, oral anticoagulant; PAD, peripheral artery disease; PAH, pulmonary arterial hypertension; PCL, percutaneous coronary intervention; PE, pulmonary embolism; PMI, peri-operative myocardial infarction; PVP, premature ventricular contractions; RBC, red blood cell; SAVR, surgical aortic valve replacement; SPAP, systolic pulmonary artery pressure; STEMI, ST-segment elevation myocardial infarction; TAVI, transcatheter aortic valve implantation; TIA, transient ischaemic attack; TTE, transthoracic echocardiography; UFH, unfractionated heparin; VAD, ventricular assist device; VHD, valvular heart disease; VKA, vitamin K antagonist; VT, ventricular tachycardia.

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and GFR.

K) Patients with obesity

It is recommended to assess cardiorespiratory fitness to estimate peri-operative CV risk in obese patients, with particular attention to those undergoing intermediate- and high-risk NCS.

I

B

L) Patients with diabetes mellitus

A pre-operative assessment for concomitant cardiac conditions is recommended in patients with diabetes with suspected or known CAD, and those with autonomic neuropathy, retinopathy, or renal disease and scheduled to undergo intermediate- and high-risk NCS.

I

C

In patients with diabetes or disturbed glucose metabolism, a pre-operative HbA1c is recommended, if this measurement has been not performed in the previous 3 months. In case of HbA1c $\geq 8.5\%$ (≥ 69 mmol/mol), elective NCS should be postponed, if safe and practical.

I

B

Recommendations for peri-operative monitoring and anaesthesia

In order to preserve optimal CV stability, it is recommended to apply goal-directed haemodynamic therapy in patients undergoing high-risk NCS.

I

A

It is recommended to avoid post-operative acute pain.

I

B

In order to minimize the risk of post-operative organ dysfunction, it is recommended to avoid an intra-operative mean arterial pressure decrease of $>20\%$ from baseline values or <60 – 70 mmHg for ≥ 10 min.

I

B

Non-aspirin NSAIDs are not recommended as first-line analgesics in patients with established or high risk of CVD.

III

B

Recommendations for treatment of post-operative cardiovascular complications

It is recommended to have high awareness of peri-operative CV complications, combined with surveillance for PMI in patients undergoing intermediate- or high-risk NCS.

I

B

Systematic PMI work-up is recommended to identify the underlying pathophysiology and define therapy.

I

B

It is recommended to treat post-operative STEMI, NSTEMI-ACS, acute HF, and tachyarrhythmias in accordance with guidelines for the non-surgical setting, after interdisciplinary discussion with the surgeon about bleeding risk.

I

C

In patients with post-operative PE of high or intermediate clinical probability, initiation of anticoagulation is recommended without

I

C

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It is recommended to use the same indications for ICA and revascularization pre-operatively as in the non-surgical setting.	I	C
In low-risk patients undergoing low- and intermediate-risk NCS, it is not recommended to routinely obtain pre-operative ECG, hs-cTn T/I, or BNP/NT-proBNP concentrations.	III	B
Routine pre-operative evaluation of LV function is not recommended.	III	C
Stress imaging is not recommended routinely before NCS.	III	C
Routine pre-operative ICA is not recommended in stable CCS patients undergoing low- and intermediate-risk NCS.	III	C
Recommendations for CV risk factors and lifestyle interventions		
Smoking cessation >4 weeks before NCS is recommended to reduce post-operative complications and mortality.	I	B
Control of CV risk factors—including blood pressure, dyslipidaemia, and diabetes—is recommended before NCS.	I	B
Recommendations for pharmacological risk-reduction strategies		
Beta-blockers		
Peri-operative continuation of beta-blockers is recommended in patients currently receiving this medication.	I	B
Routine initiation of beta-blocker peri-operatively is not recommended.	III	A
Statins		
In patients already on statins, it is recommended to continue statins during the peri-operative period.	I	B
Recommendations for peri-operative handling of antithrombotic agents		
Antiplatelets		

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ESC Guidelines

A multidisciplinary team including VAD specialists is recommended for peri-operative management of patients with HF receiving mechanical circulatory support.	I	C
C) Patients with VHD		
Clinical and echocardiographic evaluation (if not recently performed) is recommended in all patients with known or suspected VHD who are scheduled for elective intermediate- or high-risk NCS.	I	C
AVR (SAVR or TAVI) is recommended in symptomatic patients with severe AS who are scheduled for elective intermediate- or high-risk NCS.	I	C
In patients with symptomatic severe AR or asymptomatic severe AR and LVESD >50 mm or LVESDi (LVESD/BSA) >25 mm/m ² (in patients with small body size) or resting LVEF ≤50%, valve surgery is recommended prior to elective intermediate- or high-risk NCS.	I	C
In patients with moderate-to-severe rheumatic MS and symptoms or SPAP >50 mmHg, valve intervention (percutaneous mitral commissurotomy or surgery) is recommended before elective intermediate- or high-risk NCS.	I	C
D) Patients with ACHD		
In patients with ACHD, a consultation with an ACHD specialist is recommended before intermediate- or high-risk surgery.	I	C
In patients with ACHD, it is recommended that intermediate- and high-risk elective surgery is performed in a centre with experience in the care of ACHD patients.	I	C
E) Patients with arrhythmias		
In patients with SVT controlled by medication, it is recommended that AADs are continued during the peri-operative period.	I	C
In AF patients with acute or worsening haemodynamic instability undergoing NCS, emergency electrical cardioversion is recommended.	I	B
In patients with symptomatic, monomorphic, and sustained VT associated with myocardial scar, recurring despite optimal medical therapy, ablation of arrhythmia is recommended before elective NCS.	I	B
It is recommended that patients with temporarily deactivated ICDs have continuous ECG monitoring, and during the peri-operative		

Background: Basic Principles 1

Aims

Assess risk: consent + patient decisions

Assess risk: specific interventions

Diagnose conditions : caution = screening?

Assessing to intervene and reduce risk- problem

Cancer surgery: Expedited

“Probably”, “reasonable”, “is not well established”

Guidelines History

- 2022 ESC guidelines
- Royal College Surgeons 2021
- Canadian 2017 – troponin heavy
- 2014 ACC/AHA guideline revision
- 2014 ESC/ESA guideline revision
- ACC/AHA 2007 (small revision 2009)
- ESC 2009
- Fraud of Poldermans
- B Blocker story
- No UK based guidelines

Guideline concepts

- MINS- Myocardial Injury after Non-Cardiac Surgery
 - Troponin Canadians 2017 for 2-3 days postop
- 'MACE'- Major Adverse Cardiac Event
- Different Order to risk asses ... different ways..
- Risk Asses using
 - NSQIOP *riskcalculator.facs.org*
 - rCRI or 'SORT surgery'
- CPET –'considered for elevated risk procedures in unknown functional capacity'
- Coronary Stent Guidelines
- POISE 2 study – no benefit in adding aspirin
- METS study



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of Cardiology

European Heart Journal (2022) 00, 1–99

<https://doi.org/10.1093/eurheartj/ehac270>

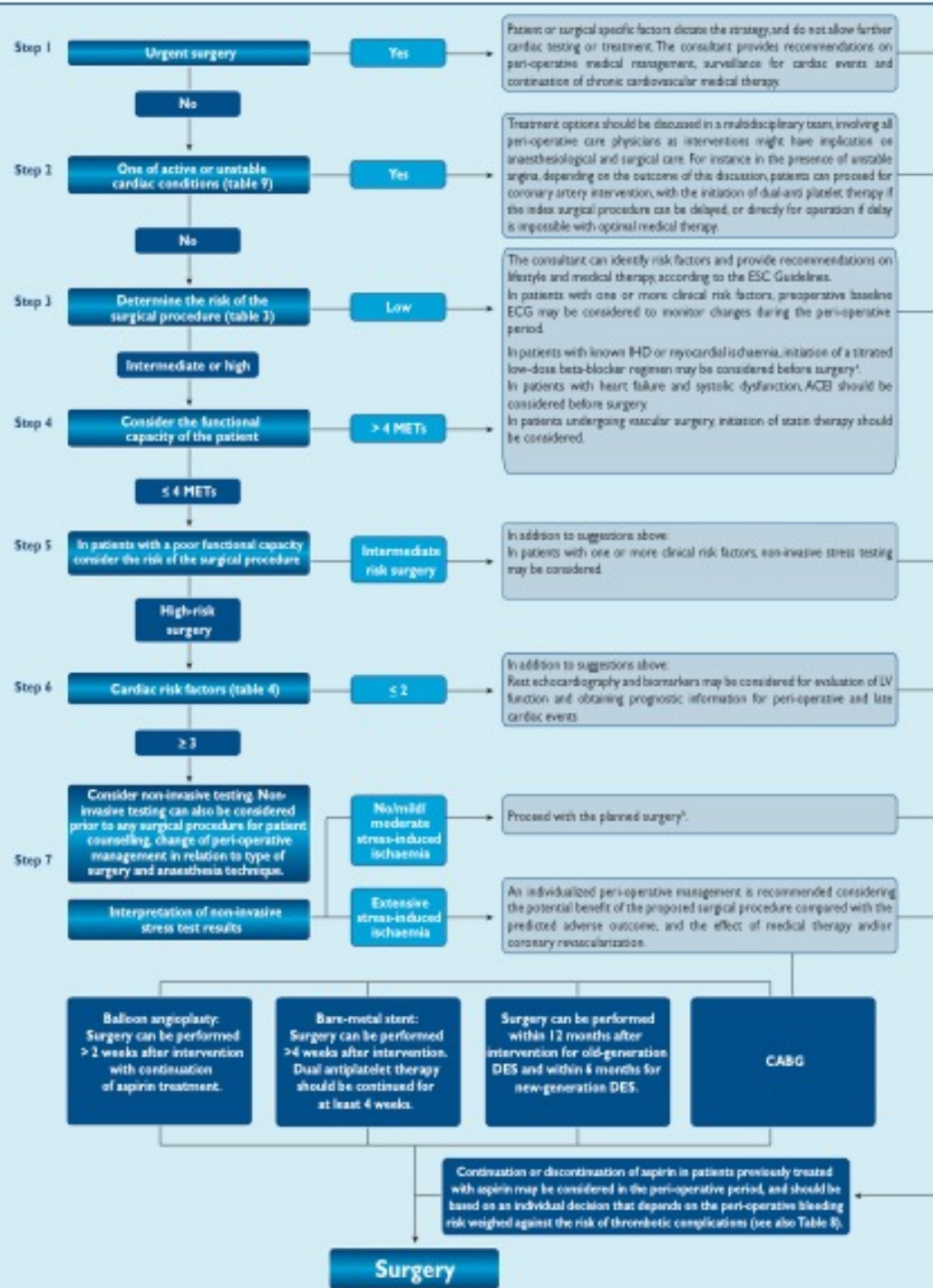
ESC GUIDELINES

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

Developed by the task force for cardiovascular assessment and management of patients undergoing non-cardiac surgery of the European Society of Cardiology (ESC)

Endorsed by the European Society of Anaesthesiology and Intensive Care (ESAIC)

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Editorial

Pre-operative coronary revascularisation before non-cardiac surgery: think long and hard before making a pre-operative referral

Many of us use the 'American College of Cardiology/American Heart Association (ACC/AHA) 2007 Guidelines on Perioperative Cardiovascular Evaluation and Care for Noncardiac Surgery', to inform our practice [1]. These guide-

The NEW ENGLAND JOURNAL *of* MEDICINE

ESTABLISHED IN 1812

DECEMBER 30, 2004

VOL. 351 NO. 27

Coronary-Artery Revascularization before Elective Major Vascular Surgery

Edward O. McFalls, M.D., Ph.D., Herbert B. Ward, M.D., Ph.D., Thomas E. Moritz, M.S., Steven Goldman, M.D., William C. Krupski, M.D.,* Fred Littooy, M.D., Gordon Pierpont, M.D., Steve Santilli, M.D., Joseph Rapp, M.D., Brack Hattler, M.D., Kendrick Shunk, M.D., Ph.D., Connie Jaenicke, R.N., B.S.N., Lizy Thottapurathu, M.S., Nancy Ellis, M.S., Domenic J. Reda, Ph.D., and William G. Henderson, Ph.D.

ABSTRACT

BACKGROUND

The benefit of coronary-artery revascularization before elective major vascular surgery is unclear

From the Minneapolis Veterans Affairs (VA) Medical Center (E.O.M., H.B.W., G.P., S.S.,

CARP

Revascularised vs not before Vascular Surgery

- 5859 patients screened;
- 510 selected revascularization vs not

Postoperative 30 day mortality

- 3.1% vs 3.4%, rev vs not; P = .87

Long term mortality 2.8 years

- 22% vs 24%, rev vs not P = .92

ARTICLES

Cardiac Risk of Noncardiac Surgery

Influence of Coronary Disease and Type of Surgery in 3368 Operations

Kim A. Eagle, Charanjit S. Rihal, Mary C. Mickel, David R. Holmes, Eric D. Foster, Bernard J. Gersh, for the CASS Investigators, University of Michigan Heart Care Program

DOI <https://doi.org/10.1161/01.CIR.96.6.1882>

Circulation. 1997;96:1882-1887

Originally published September 16, 1997

[Article](#)[Figures & Tables](#)[Info & Metrics](#)[eLetters](#)

Abstract

Background The influence of prior coronary artery bypass surgery (CABG) versus medical

This Issue

Circulation

September 16, 1997,

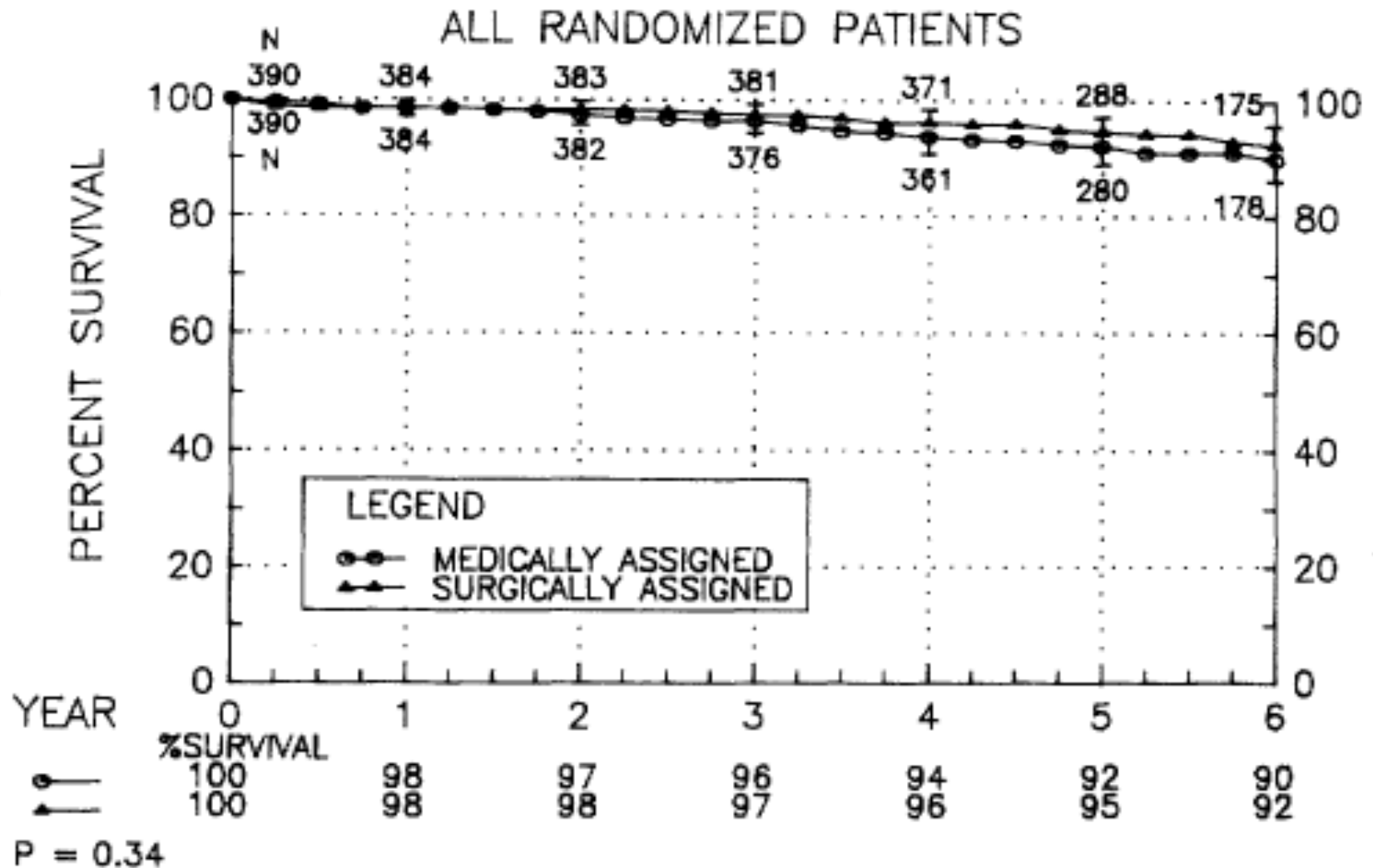
CASS

Coronary Artery Surgery Study

- 24,959 Pts undergoing Coronary Angiogram 1970's
- Pts randomised to CABG vs Medical
- Retrospectively examined
- ~3500 Patients non-cardiac operations in Yr 1
 - Hi risk Thoracic, Abdominal Max Fax
 - vs low risk

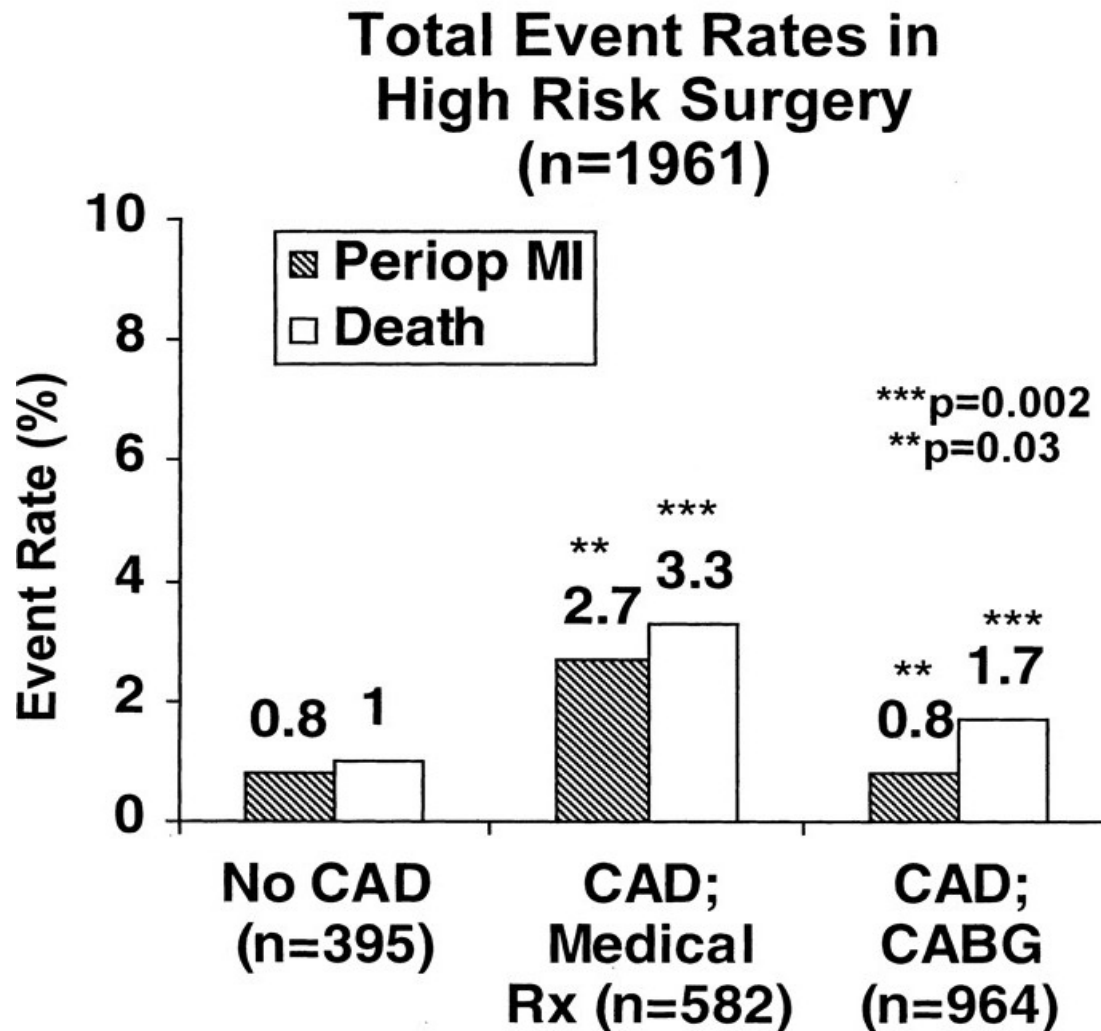
CASS

Coronary Artery Surgery Study



CASS

But CABG
associated
deaths
excluded !



ESC 2022

‘No well-established benefit’ of myocardial revascularization of high-risk patients

before elective intermediate- and high-risk NCS

Unless

- left mainstem or
- three-vessel CAD or
- reduced LV function

Guideline

- Surgery Urgency
- Active Cardiac Condition
- Patient Exercise Capacity
- Surgery Severity
- Patient Specific risks / Comorbidities
- Biomarkers

Guideline

- **Surgery Urgency**
- Active Cardiac Condition
- Patient Exercise Capacity
- Surgery Severity
- Patient Specific risks / Comorbidities
- Biomarkers

Guideline

Surgery Urgency (US vs NCEPOD)

– Emergency/ Immediate  **proceed**

NCEPOD 2004

IMMEDIATE – Immediate life, limb or organ-saving intervention – resuscitation simultaneous with intervention. Normally within minutes of decision to operate.

- A) Life-saving
- B) Other e.g. limb or organ saving

URGENT – Intervention for acute onset or clinical deterioration of potentially life-threatening conditions, for those conditions that may threaten the survival of limb or organ, for fixation of many fractures and for relief of pain or other distressing symptoms. Normally within hours of decision to operate.

EXPEDITED – Patient requiring early treatment where the condition is not an immediate threat to life, limb or organ survival. Normally within days of decision to operate.

ELECTIVE – Intervention planned or booked in advance of routine admission to hospital. Timing to suit patient, hospital and staff.

Guideline

Surgery Urgency

- **Truly Elective** – time to treat / discuss
- Treat/refer broadly as according to non-preoperative guidelines
- warn about possible delay to surgery
- evidence of benefit for subsequent surgery ?

Guideline

Surgery Urgency

– **Cancer** - ?Not *truly* Elective!

- Consider effect of Ix +Rx
- Consider
 - lack of benefit from CVS interventions
 - potential delay after CVS intervention
 - coronary stent anticoagulation

Guideline

- Surgery Urgency
- **Active Cardiac Condition**
- Patient Exercise Capacity
- Surgery Severity
- Patient Specific risks / Risk calculator
- Biomarkers

Guideline

Guidelines: Patient Risk factors

- 3 levels: **Serious** / 'Intermediate' / 'Minor'
- **'Serious'** ; 'active cardiac conditions'
 - Recent MI/Unstable Angina
 - New /Acute Ht Failure
 - Serious abnormal rhythm
 - Severe valve disease



Pause and discuss with teams

Guideline

- Surgery Urgency
- Active Cardiac Condition
- **Patient Exercise Capacity**
- Surgery Severity
- Patient Specific risks / Comorbidities
- Biomarkers

Guideline

Patient Exercise Capacity

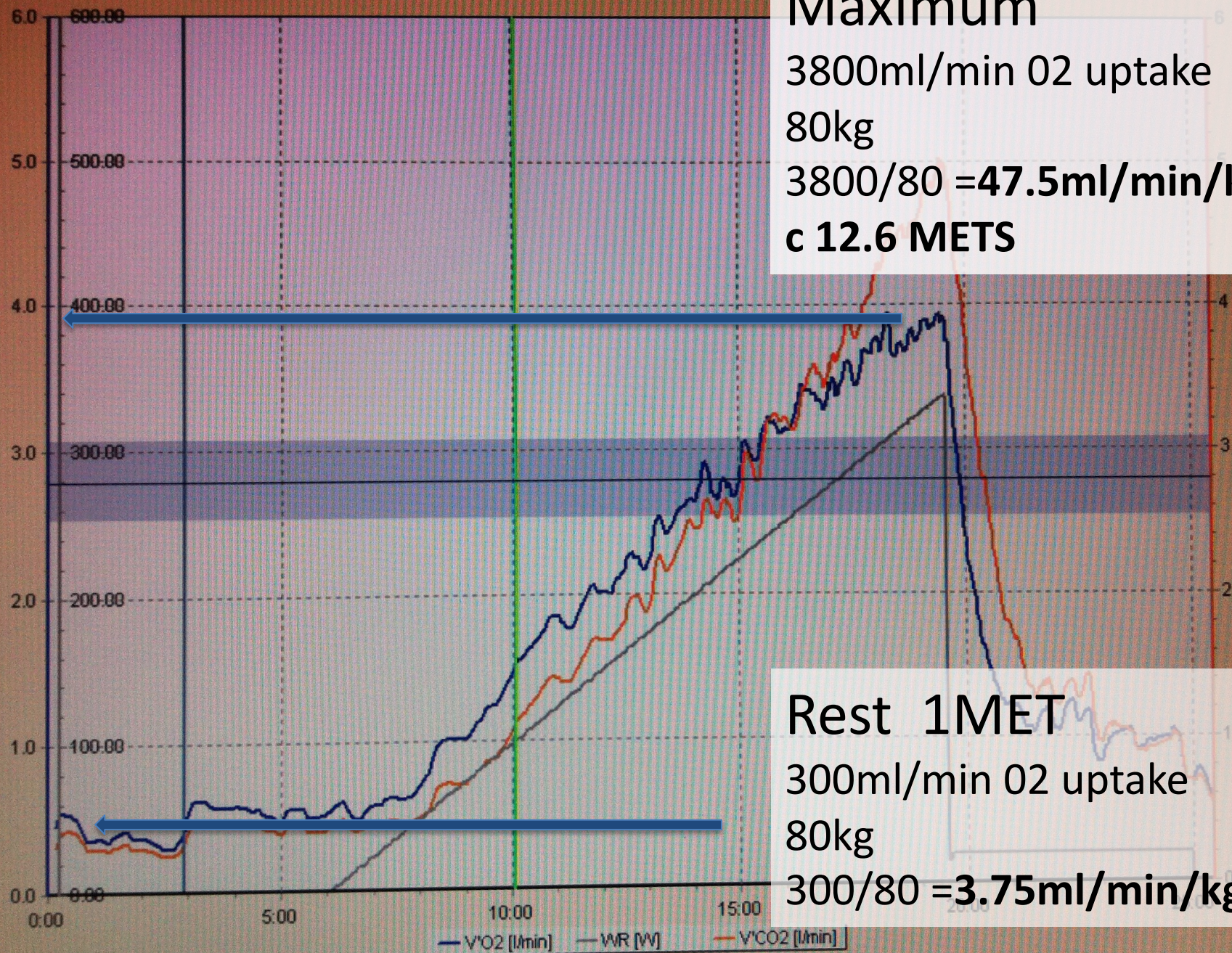
- Metabolic Equivalent of Task - MET
- 1 MET is O_2 uptake at rest =

C 3.5 ml/min/kg O_2 uptake

2 METS ~ 2x O_2 uptake of 1 METS

Easily Quantified by CPEx

Mostly estimated by history



Maximum

3800ml/min O₂ uptake

80kg

$3800/80 = 47.5 \text{ ml/min/kg}$

c 12.6 METS

Rest 1MET

300ml/min O₂ uptake

80kg

$300/80 = 3.75 \text{ ml/min/kg}$

Guideline

Patient Exercise Capacity

2 MET Strolling

4 MET Fast flat walking, up 1-2 flight stairs
 ?do everything in a normal day
 walking a dog, moderate gardening

6+ Most sports, running
 ‘Playing a heavy musical instrument
 while actively running in a marching band’

Take care of self e.g. eating, dressing, bathing, using the toilet	No 0	Yes +2.75
Walk indoors	No 0	Yes +1.75
Walk 1–2 blocks on level ground	No 0	Yes +2.75
Climb a flight of stairs or walk up a hill	No 0	Yes +5.5
Run a short distance	No 0	Yes +8
Do light work around the house e.g. dusting, washing dishes	No 0	Yes +2.7
Do moderate work around the house e.g. vacuuming, sweeping floors, carrying in groceries	No 0	Yes +3.5
Do heavy work around the house e.g. scrubbing floors, lifting or moving heavy furniture	No 0	Yes +8
Do yardwork e.g. raking leaves, weeding, pushing a power mower	No 0	Yes +4.5
Have sexual relations	No 0	Yes +5.25
Participate in moderate recreational activities e.g. golf, bowling, dancing, doubles tennis, throwing a baseball or football	No 0	Yes +6
Participate in strenuous sports e.g. swimming, singles tennis, football, basketball, skiing	No 0	Yes +7.5

15.45 points

The higher the score (maximum 58.2), the higher the functional status.

4.64 METs

METS; DASI

Duke Activity Status Index

I used 'MD Calc'

Guideline

Patient Exercise Capacity

4 METS without significant symptoms

Operations  proceed

Less than 4 METS  consider

Guideline

- Surgery Urgency
- Active Cardiac Condition
- Patient Exercise Capacity
- **Surgery Severity**
- Patient Specific risks / Comorbidities
- Biomarkers

Guideline

Severity of surgery



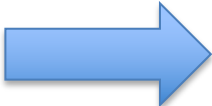
- Minor  proceed
- Intermediate  consider further
- Major  consider further

Table 3 Surgical risk estimate according to type of surgery or intervention^{a,b}

Low-risk: < 1%	Intermediate-risk: 1–5%	High-risk: > 5%
<ul style="list-style-type: none"> • Superficial surgery • Breast • Dental • Endocrine: thyroid • Eye • Reconstructive • Carotid asymptomatic (CEA or CAS) • Gynaecology: minor • Orthopaedic: minor (meniscectomy) • Urological: minor (transurethral resection of the prostate) 	<ul style="list-style-type: none"> • Intraperitoneal: splenectomy, hiatal hernia repair, cholecystectomy • Carotid symptomatic (CEA or CAS) • Peripheral arterial angioplasty • Endovascular aneurysm repair • Head and neck surgery • Neurological or orthopaedic: major (hip and spine surgery) • Urological or gynaecological: major • Renal transplant • Intra-thoracic: non-major 	<ul style="list-style-type: none"> • Aortic and major vascular surgery • Open lower limb revascularization or amputation or thromboembolectomy • Duodeno-pancreatic surgery • Liver resection, bile duct surgery • Oesophagectomy • Repair of perforated bowel • Adrenal resection • Total cystectomy • Pneumonectomy • Pulmonary or liver transplant

CAS = carotid artery stenting; CEA = carotid endarterectomy.

^aSurgical risk estimate is a broad approximation of 30-day risk of cardiovascular death and myocardial infarction that takes into account only the specific surgical intervention, without considering the patient's comorbidities.

^bAdapted from Glance et al.¹¹

The objective is to endorse a standardized and evidence-based approach to perioperative cardiac management. The Guidelines recommend a practical, stepwise evaluation of the patient that integrates clinical risk factors and test results with the estimated stress of the planned surgical procedure. This results in an individualized cardiac risk assessment, with the opportunity of initiating medical therapy, coronary interventions, and specific surgical and anaesthetic techniques in order to optimize the patient's perioperative condition.

Compared with the non-surgical setting, data from randomized

both began the process of revising their respective guidelines concurrently. The respective writing committees independently performed their literature review and analysis, and then developed their recommendations. Once peer review of both guidelines was completed, the writing committees chose to discuss their respective recommendations regarding beta-blocker therapy and other relevant issues. Any differences in recommendations were discussed and clearly articulated in the text; however, the writing committees aligned a few recommendations to avoid confusion within the clinical community,

Guideline

- Surgery Urgency
- Active Cardiac Condition
- Patient Exercise Capacity
- Surgery Severity
- **Patient Specific risks / Comorbidities**
- Biomarkers

Guideline

- ACC/AHA and ESC/ESA Patient Risk factors
- 3 levels: **Serious** / 'Intermediate' / 'Minor'
- 'Serious' ; 'active cardiac conditions'
 - Recent MI/Unstable Angina
 - New /Acute Ht Failure
 - Serious abnormal rhythm
 - Severe valve disease



Pause and discuss with teams

Guideline

- ACC/AHA and ESC/ESA Patient Risk factors
- 3 levels: Serious / **'Intermediate'** / 'minor'
- 'Intermediate'- same as 'Lees rCRI' 0-2 vs ≥ 3
 - Any Ischaemic Ht Disease
 - Any Ht Failure
 - Any Cerebro-Vascular Disease
 - Diabetes needing insulin
 - Renal Injury (Cr 177+)
- Do a risk score: 1% Cardiac risk or more?



ation with post-operative cardiac events or death.³⁹ Notably, when functional capacity is high, the prognosis is excellent, even in the presence of stable IHD or risk factors;⁴⁰ otherwise, when functional capacity is poor or unknown, the presence and number of risk factors in relation to the risk of surgery will determine pre-operative risk stratification and perioperative management.

3.4 Risk indices

For two main reasons, effective strategies aimed at reducing the risk of perioperative cardiac complications should involve cardiac evaluation, using medical history before the surgical procedure.. Firstly, patients with an anticipated low cardiac risk—after thorough evaluation—can be operated on safely without further delay. It is unlikely that risk-reduction strategies will further reduce the perioperative risk. Secondly, risk reduction by pharmacological treatment is most cost-effective in patients with a suspected increased cardiac risk. Additional non-invasive cardiac imaging techniques are tools to identify patients at higher risk; however, imaging techniques should be reserved for those patients in whom test results would influence and change management. Clearly, the intensity of the pre-operative cardiac evaluation must be tailored to the patient's clinical condition and the urgency of the circumstances requiring surgery. When emergency surgery is needed, the evaluation must necessarily be limited; however, most clinical circumstances allow the application of a more extensive systematic approach with cardiac risk evaluation

set, based on patients from 180 hospitals, and was validated with the 2008 data set, both containing > 200 000 patients and having predictability. The primary endpoint was intra-operative/post-operative myocardial infarction or cardiac arrest up to 30 days after surgery. Five predictors of perioperative myocardial infarction/cardiac arrest were identified: type of surgery, functional status, elevated creatinine (> 130 $\mu\text{mol/L}$ or > 1.5 mg/dL), American Society of Anesthesiologists (ASA) class (*Class I*, patient is completely healthy; *Class II*, patient has mild systemic disease; *Class III*, patient has severe systemic disease that is not incapacitating; *Class IV*, patient has incapacitating disease that is a constant threat to life; and *Class V*, a moribund patient who is not expected to live for 24 hours, with or without the surgery), and age. This model is presented as an interactive risk calculator (<http://www.surgicalriskcalculator.com/miocardiacarrest>) so that the risk can be calculated at the bedside or clinic in a simple and accurate way. Unlike other risk scores, the NSQIP model did not establish a scoring system but provides a model-based estimate of the probability of myocardial infarction/cardiac arrest for an individual patient. The risk calculator performed better than the Lee risk index, with some reduction in performance in vascular patients, although it was still superior; however, some perioperative cardiac complications of interest to clinicians, such as pulmonary oedema and complete heart block, were not considered in the NSQIP model because those variables were not included in the NSQIP database. By contrast, the Lee index allows estimation of the risk of perioperative pulmonary

Surgical Risk Calculator

Search this site

- Home
- Acute Mesenteric Ischemia Perioperative Risk Calculator
- Aortic Risk Calculator (Open)
- Bariatric Surgery Perioperative Morbidity and Mortality Risk Calculators
- Feedback
- Infrainguinal Bypass Surgery Perioperative Mortality Risk Calculator
- Perioperative Cardiac Risk Calculator**
- Postoperative Pneumonia Risk Calculator
- Postoperative Respiratory Failure (PRF) Risk Calculator
- Sitemap

Perioperative Cardiac Risk Calculator

Full methodology in the paper-
Circulation. 2011 Jul 26;124(4):381-7. Epub 2011 Jul 5.

For accompanying editorial, [click here](#)

For excel 2007 or above users, you can **download** the cardiac risk calculator [here](#).
For excel 2003 users, you can **download** the risk calculator [here](#)

To **use online**, you can click [here](#)

For questions or comments, please email me at pgupta5@uthsc.edu or fill out the [Feedback form](#).

Risk calculator

Percentile	Percent Risk
25th percentile	0.05%
50th percentile	0.14%
75th percentile	0.61%
90th percentile	1.47%
95th percentile	2.60%
99th percentile	7.69%

Estimate risk of perioperative myocardial infarction or cardiac arrest.

Age

46

Creatinine

<1.5 mg/dL / 133 μ mol/L

ASA Class

ASA 1

ASA 1 = Normal healthy patient

ASA 2 = Patients with mild systemic disease

ASA 3 = Patients with severe systemic disease

ASA 4 = Patients with severe systemic disease

that is a constant threat to life

ASA 5 = Moribund patients who are not expected

to survive without the operation

Preoperative Function

Totally Independent

Procedure

Intestinal

Submit

Estimate risk of perioperative myocardial infarction or cardiac arrest.

Age

Creatinine

ASA Class

ASA 1 = Normal healthy patient

ASA 2 = Patients with mild systemic disease

ASA 3 = Patients with severe systemic disease

ASA 4 = Patients with severe systemic disease

that is a constant threat to life

ASA 5 = Moribund patients who are not expected

to survive without the operation

Preoperative Function

Procedure

Submit

Surgical Outcome Risk Tool (SORT)

Main Group

Sub Group

Procedure Description

Severity ?

Minor ☐ Intermediate ☐ Major ☐ Xmajor/complex ☐

ASA-PS ?

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

Urgency

Elective ☐ Expedited ☐ Urgent ☐ Immediate ☐

Thoracics, gastrointestinal or vascular surgery

Yes ☐ No ☐

Cancer ?

Yes ☐ No ☐

Age

<65 ☐ 65-79 ☐ >80 ☐

Disclaimer:

The SORT uses some information about patient health and the planned surgical procedure to provide an estimate of the risk of death within 30 days of an operation. The percentages provided by the SORT are only estimates taking into account the general risks of the procedure and some information about the patient, but should not be confused with a patient-specific estimate in an individual case. As with all risk prediction tools, not every factor which may affect outcome can be included, and there may well be other patient-specific and surgical factors which may influence the risk of death significantly.

User notes

All values must be present before the calculation can take place.
Surgical severity will be calculated automatically on entry of procedure details.
If the procedure you are searching for is not listed, please use the nearest available procedure for calculation.

About SORT

The SORT is a pre-operative risk prediction tool for death within 30 days of surgery. It has been developed and validated for use in inpatient non-neurological, non-cardiac surgery in adults (aged 16 or over).

This web resource is the result of a collaborative effort between NCEPOD researchers (Karen Protopapa and Neil Smith) and doctors in anaesthesia and intensive care medicine who are part of the SOuRce team (Ramani Moonesinghe and Jo Simpson).

The UCL/UCLH Surgical Outcomes Research Centre (SOuRce)
www.uclsource.com

The National Confidential Enquiry into Patient Outcome and Death (NCEPOD)
www.ncepod.org.uk

Further Information

Guideline

Putting it together: **5 Intermediate risk factors**

3 levels: Serious / **'Intermediate'** / 'minor'

- 'Intermediate'- same as rCRI
 - Any Ischaemic Ht Disease
 - Any Ht Failure
 - Any Cerebro-Vascular Disease
 - Diabetes – insulin
 - Renal Injury (Cr 177+)

Guideline

Putting it together: **5 Intermediate risk factors**

No intermediate risk factors or risk < 1%

 proceed

Any intermediate risk factors 

More factors increases risk

proceed +/- 'B Blockade' or

'consider testing if changes management'

When do we do a stress test?

Recommendations	Class ^a	Level ^b
Stress imaging is recommended before high-risk elective NCS in patients with poor functional capacity ^c and high likelihood of CAD ^d or high clinical risk. ^{e,146,156–158}	I	B
Stress imaging should be considered before high-risk NCS in asymptomatic patients with poor functional capacity, ^d and previous PCI or CABG. ¹⁴⁷	IIa	C
Stress imaging may be considered before intermediate-risk NCS when ischaemia is of concern in patients with clinical risk factors and poor functional capacity. ^{d,152,157,158}	IIb	B
Stress imaging is not recommended routinely before NCS.	III	C

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Guideline

**Always in the context of ‘what next?’ ie
‘will/should it change management?’**

Calculate Cardiac Risk

“Consider testing”

Stress ECHO

Myocardial Perfusion Scan

CPET – includes Exercise ECG

Exercise ECG

MRI or CT coronary angiogram

Guideline

- Surgery Urgency
- Active Cardiac Condition
- Patient Exercise Capacity
- Surgery Severity
- Patient Specific risks / Risk calculator
- **Biomarkers**

Biomarkers

Biomarker =

- “a characteristic that can be objectively measured that is an indicator of pathology / response to treatments”

Troponin - myocardial cell injury

BNP + pro NT BNP - myocardial wall stress increases

CRP - liver and smooth muscle

Biomarkers in Guideline

- Biomarkers in ESC Guidelines 2009 & Canadian 2017

Troponin

Postop – small ↑ associated ↑ mortality ‘VISION’

Preop – predictive, no ideal cut off

BNP + pro NT BNP

Ht Failure /IHD / ACS - rises relate to outcome

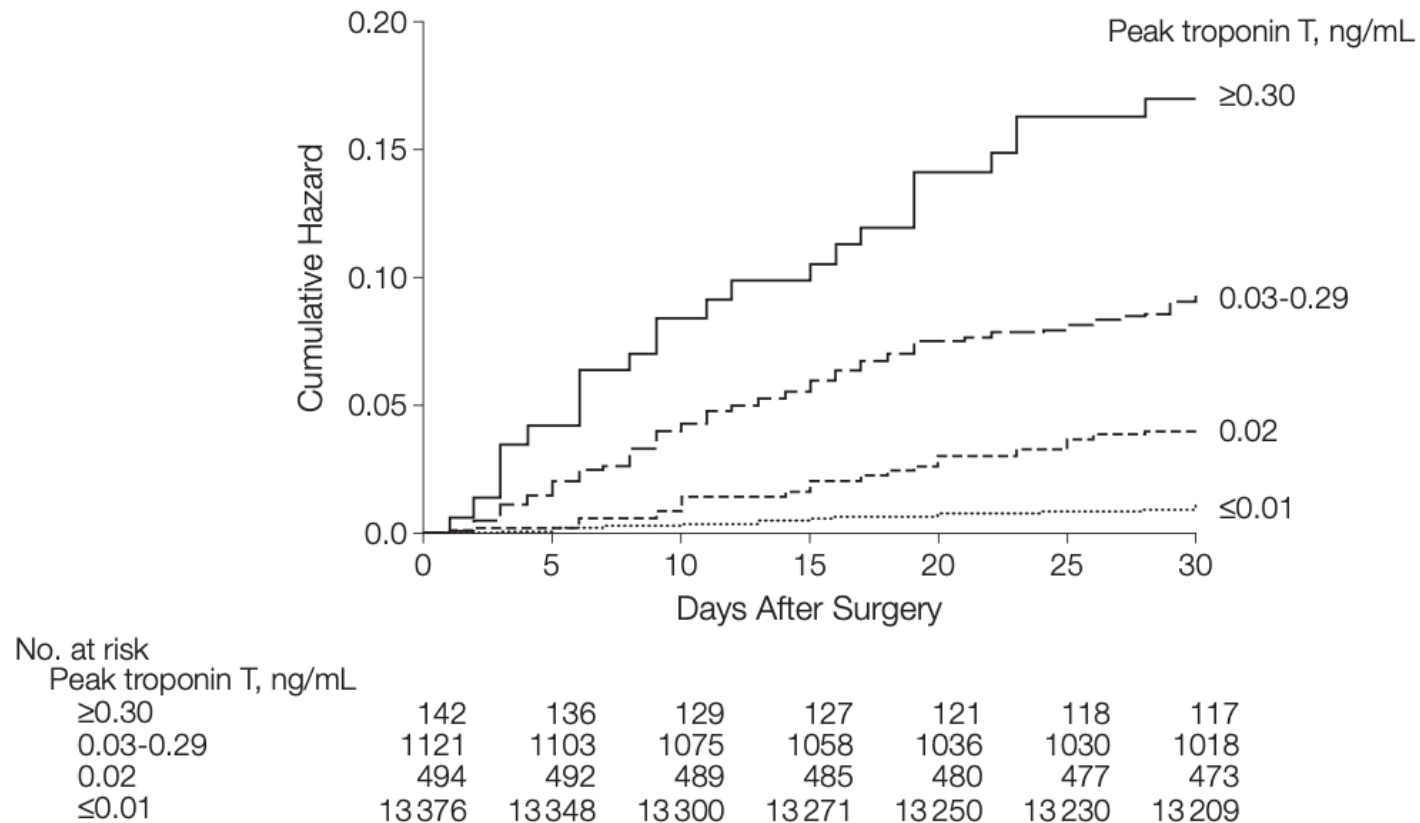
Preop – adds predictive ability >48 pg/ml

CRP – ‘inflammatory marker’

ESC, Biccard, Devereaux 2012

Postop troponin and death

Figure 2. Kaplan-Meier Estimates of 30-Day Mortality Based on Peak Troponin T Values



Biomarkers in Guideline

- Biomarkers in ESC Guidelines 2009 & Canadian 2017

Troponin

Postop – small ↑ associated ↑ mortality ‘VISION’

Preop – predictive, no ideal cut off..

BNP + pro NT BNP

Ht Failure /IHD / ACS - rises relate to outcome

May diagnose and guide Rx of CCF

Preop – adds predictive ability >48 pg/ml

CRP – ‘inflammatory marker’

ESC, Biccard, Devereaux 2012

Biomarkers in Guideline

Patients with known CVS disease/risk factors

‘recommended’ measure

- Preop, 24, 48 Troponin
- Preop BNP preop

Canadian Guidelines use Preop BNP and postop Troponin

RCS 2021 COVID-19

Patients should be/have

- Assessed for **impact of comorbidities** on
 - **function**, perioperative pathways and surgical outcome
- **Individualised risk assessed** using objective measures
 - eg SORT Surgery combined with senior clinical judgement
 - with >5% risk consider postoperative critical care
- **Screened for ▼ functional capacity** using eg Duke Activity Status Index
 - Patients with ▼ fitness screening undergo eg CPET or simpler alternative methods
- **Advised to improve fitness** before surgery

Next

- ECHO
- CPET
- B Blockers

ECHO Evidence

- Valves, Function, estimates Pulmonary pressures
- Degree of dysfunction, regional wall motion abn
- LVEF <40% - 2x higher risk
 - sensitivity 43%
 - positive predictive 13%
- “resting LV function was not found to be a consistent predictor of perioperative ischemic events or death”
- But ECHO enthusiasts in preassessment..
 - 30% new CVS disease, ↑Mx 20% Mx ↓34%

Halm, Rofdhe, Canty

ECHO indication

Routine Evaluation – NO

Dyspnea of unknown origin – reasonable

Ht Failure with ↑symptoms (1 yr) - reasonable

New murmur - reasonable

Ht Failure / Valves clinically stable –
‘not well established’

CPET Background

Functional assessment

Population data – survival

Heart Failure Classification

VO₂ peak, AT, VE/VCO₂, ECG ischaemia etc

But

Associations with outcome and complications

Most studies unblinded, small

Await results of only RCT

‘Prehabilitation’ studies awaited

Older, Hennis, Snowden, O’Doherty

CPET Background

n=548

Lower anaerobic threshold worse:	higher mortality
Raised Respiratory Equivalent:	higher mortality

	Mortality
AT more 14 ml/min /kg	0%
AT more 11 ml/min /kg but other badness	1.7%
AT less 11 ml/min /kg	4.6%

Older 1999

CPET Background

Complication on day 7	AT < 10.1 n= 51	AT > 10.1 n=65	p=
Pulmonary	57%	15%	<0.0001
Renal	40%	11%	0.0004
GI	33%	11%	0.005
Infective	27%	11%	0.003
Cardiovascular	25%	3%	0.0005
Neurological	10%	5%	0.29
Hematology	8%	0	0.04
Pain	8%	0	0.04
Wound	4%	0	0.2

CPET use

“....may be considered for patients with unknown functional capacity having elevated risk procedures”
AHA/ACC 2014

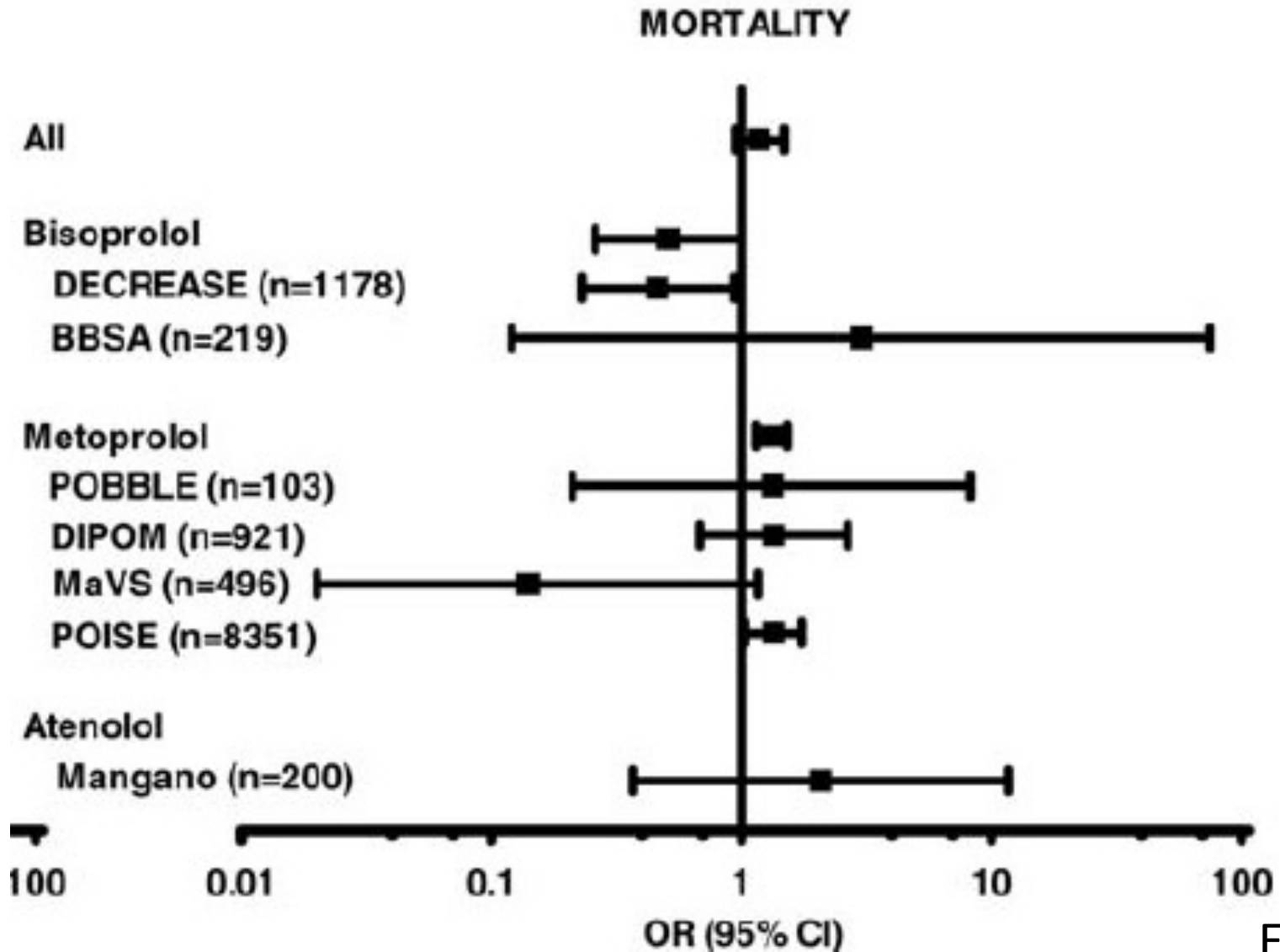
- Use very variable, increasing
- Enthusiasts vs sceptics
- Probably best not to emphasise single value
 - VO_2 peak, AT, VE/VCO_2 , ECG ischaemia
- METS 2018 study
 - Peak VO_2 associated complications not death
 - CPET ‘not improve most aspects of preop risk assessment’

B Block? background

- B blockers – in community
 - reduce adrenergic activity + myocardial O_2 use
 - associated with survival
- RCT Perioperative studies
 - Mangano
 - POISE
 - DECREASE, Others
- Observational perioperative data
- US and European Perioperative Guidelines

Mangano, London, Sear, Devereaux, Bouri

B Block?



B Block?: Endpoints important!

POISE Lancet 2008

- 8351 patients
- with/at risk of, atherosclerotic disease
- non-cardiac surgery
- B Block 24 hrs preoperatively – 30 days postop

Metoprolol vs Placebo

MI	4.2% vs 5.7%	0.84	p=0.002
Deaths	3.1% vs 2.3%	1.33	p=0.03
Stroke	1.0% vs 0.5%	2.17	p=0.005
↓BP	15.0% vs. 9.7%		p < 0.0001
Bradycardia	6.6% vs. 2.4%		p < 0.0001

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Betablockers 'have caused 800,000 deaths'

At least 800,000 deaths worldwide have been caused by drugs used to cut the risk of a heart attack after surgery, experts have claimed.

By **Laura Clout**

12:06AM BST 14 May 2008

Patients taking beta blockers, the cornerstone of treatment for heart disease since the 1970s, are a third more likely to die within a month of surgery and twice as likely to suffer a stroke, a study found.

Dr PJ Devereaux, a cardiologist and epidemiologist at McMaster University in Hamilton, Canada, who led the research, which was published in the *Lancet*, said the drugs had cost more lives than they had saved and their use in surgery patients was based on inadequate research.

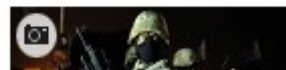
Guidelines established in 1996 by the American College of Cardiology recommend that beta blockers be used in all operations, except those on the heart. The advice was adopted worldwide but Dr Devereaux claimed that the guidelines were based on the findings of two small studies.

He said: "On a conservative estimate, if 10 per cent of physicians acted



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Friday, 31 January 2014

Beta Blockers kill 800,000 patients in 5 years!

"Beta Blocker drugs are well tolerated".

This is what my doctor told me in May 2007, meaning that they have few side-effects or adverse reactions. I wrote a blog about this here in 2010, and this is what I wrote at the time.

"Now, Beta Blockers have been found to cause fatal heart attacks, alongside SSRI drugs like Prozac, and Cox-2 pain-killers (research conducted by University of Rochester, New York, and reported in the magazine What Doctors Don't Tell You, April 2010). So I was being offered the usual ConMed deal - swap an illness with a more serious disease, and perhaps even death".

I declined the 'deal', and fought for homeopathic treatment instead. Now my heart palpitations are a thing of the past. Had I not done so it is more than likely that I would still be taking these drugs.

What concerned me at the time was that the NHS were not telling patients about the [DIEs \(disease/death inducing effects\)](#) of their drugs, or perhaps not even aware of them, even though Beta Blocking drugs had been around since the early 1960's.

"I will leave you to decide which is worse - that they (doctors) know about the DIEs and don't tell us; or they don't know or understand the workings of their own drugs after several decades!

Now, new research (mentioned in this [WDDTY article](#), [click here](#), and taken from the [European Heart](#)

Blog Archive

▼ 2014 (40)

► May (7)

► April (1)

► March (3)

► February (19)

▼ January (10)

[Beta Blockers kill 800,000 patients in 5 years!](#)

[Peanut Allergy Treatment - another success for Hom...](#)

[Statins. From 'wonder' drug to 'killer' drug?](#)

[The Ages of Conventional Medical Drugs](#)

[Mastitis. Why Homeopathy?](#)

[Menstruation: comparison of conventional and homeo...](#)

[Child Protection and Medical 'Experts'](#)

[Hay Fever. Why Homeopathy?](#)

["First do no harm". A test Conventional Medicine r...](#)

[Militant Skepticism and Homeopathy: what do they h](#)

B Block

- Maintain current B Blockade
- Treat concomitant anaemia
- Meta-analysis / prospective studies don't support
- Use in 'high risk' people only
 - Those that may be on B Blockers anyway
 - rCRI >1
- ?Atenolol or Bisoprolol
- Start /titrate to rate of 60-80 bpm
- ?7+ days before

COVID

- COVIDSurg Collaborative, GlobalSurg Collaborative.
Timing of surgery following SARS- CoV-2 infection
 - Mortality back to baseline if 7+ weeks delay

Early in the epidemic, International Study (COVID Surg Collaborative Lancet)

- 1128 adults with a COVID-19 diagnosis having surgery
- COVID19 + postoperatively in 71.5%
- 30 day mortality at = 23.8%
 - Systematic Review (Brown 2021)

Smaller London Study (Kasivisvanathan 2020)

- 500 adults having planned surgery
- 2% patients diagnosed with postop COVID-19
- 0% 30-day mortality from COVID-19

Contents

- Introduction
 - Basic Principles
 - Guidelines: Decisions + Putting it all together
 - Which test?
 - ECHO
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 - Summary
- Surgery Urgency
 - Active Cardiac Condition
 - Patient Exercise Capacity
 - Surgery Severity
 - Patient Specific risks / Comorbidities
 - ?? 1%- consider testing
 - Biomarkers

Thank you

For listening

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This full talk

All Guidelines

Some References