European Society of Anaesthesiology ESA
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ESC/ESA Guidelines on non-cardiac surgery:

cardiovascular assessment and management

2014 version

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The magnitude of the problem

- **Annually:**
  - 5.7 million procedures in European patients with increased risk of cardiovascular complications
  - For EU countries: at least 167,000 cardiac complications due to non-cardiac surgical procedures, of which 19,000 are life-threatening

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Rationale for new ESC Guidelines

- **High incidence of peri-operative cardiac mortality and morbidity**
- **Impact of vascular disease and comorbity on postoperative outcome**
- **Impact of risk reduction strategies**
  - Medications: β-blockers, statins, ACE-inhibitors, platelet inhibitors and oral anti-coagulants
  - Coronary revascularization: Stents and duration of DAPT
- **Changes of surgical techniques**
- **Type of anaesthesia**

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ESC/ESA GUIDELINES

European Society of Anaesthesiology ESA

2014 ESC/ESA Guidelines on non-cardiac surgery: cardiovascular assessment and management

The Joint Task Force on non-cardiac surgery: cardiovascular assessment and management of the European Society of Cardiology (ESC) and the European Society of Anaesthesiology (ESA)

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Objectives of these guidelines

- To describe how to assess perioperative cardiac risk using clinical risk factors and type of surgical procedure
- To describe a stepwise approach for pre-operative cardiac risk assessment
- To address the impact of various co-morbidities on perioperative risk
- To describe how to reduce cardiac risk
- To be easy to use for practitioners

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Classes of recommendations

Classes of recommendations	Definition	Suggested wording to use
Class I	**Evidence and/or general agreement that a given treatment or procedure is beneficial, useful, effective.**	**Is recommmended/ is indicated.**
Class II	**Conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of the given treatment or procedure.**	
Class IIa	***Weight of evidence/opinion is in favour of usefulness/efficacy.***	***Should be considered.***
Class IIb	***Usefulness/efficacy is less well established by evidence/opinion.***	**May be considered.**
Class III	**Evidence or general agreement that the given treatment or procedure is not useful/effective, and in some cases may be harmful.**	**Is not recommended.**

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Levels 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.

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The role of multidisciplinary team

Recommendations on pre-operative evaluation	Class[a]	Level[b]
Selected patients with cardiac disease undergoing low- and intermediate-risk non-cardiac surgery may be referred by the anaesthesiologist for cardiological evaluation and medical optimization.	IIb	C
A multidisciplinary expert team should be considered for pre-operative evaluation of patients with known or high-risk of cardiac disease undergoing high-risk non-cardiac surgery.	IIa	C

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A stepwise approach

Step 1: Urgent surgery

Step 2: Active or unstable cardiac conditions

Step 3: What is the risk of the surgical procedure?

Step 4: What is the functional capacity of the patient?

Step 5: In patients with poor low functional capacity: consider the risk of surgical procedure

Step 6: Consider cardiac risk factors

Step 7: Consider non invasive testing

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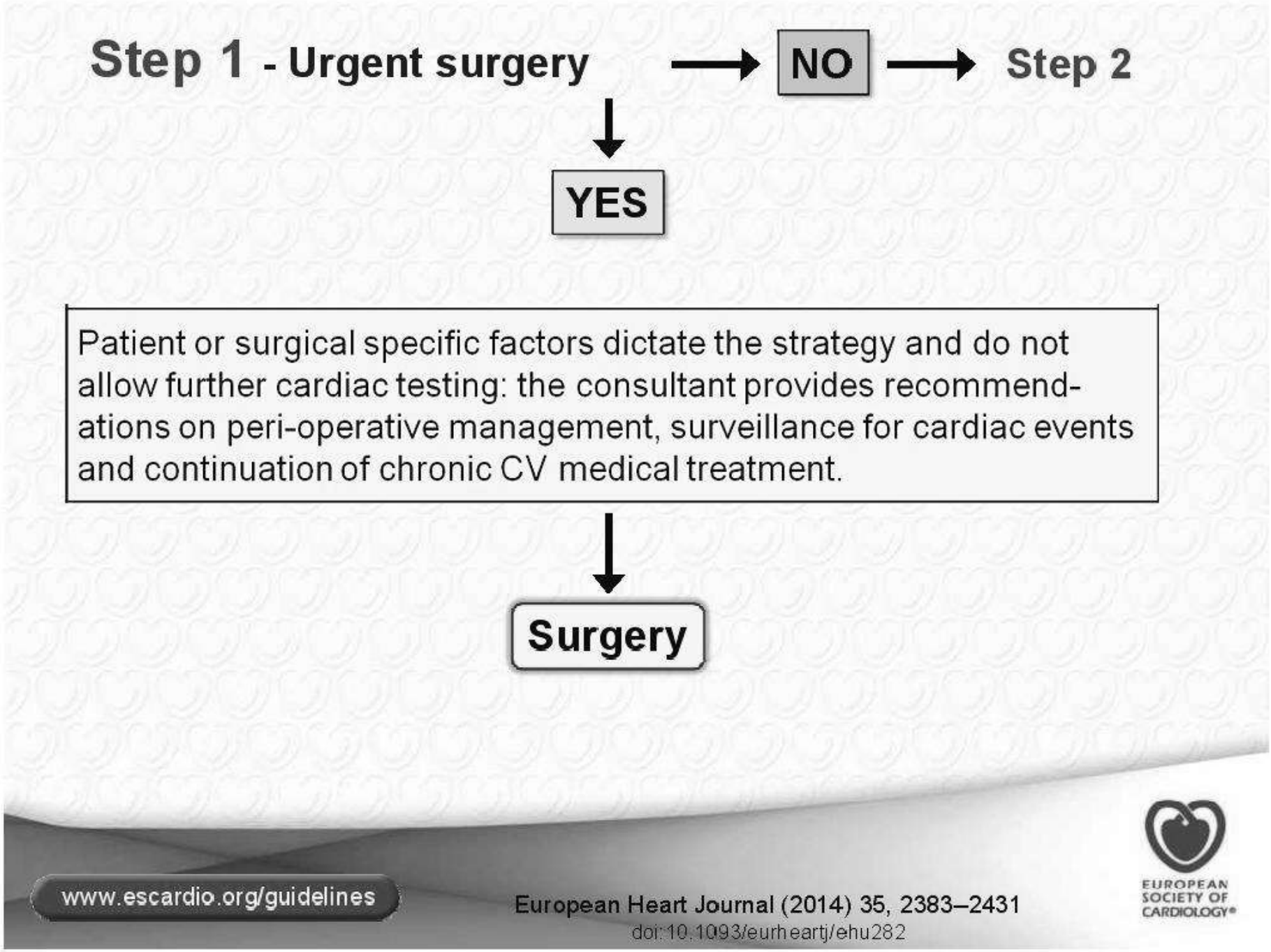
Step 1 - Urgent surgery
NO
Step 2
YES
Patient or surgical specific factors dictate the strategy and do not allow further cardiac testing: the consultant provides recommend-ations on peri-operative management, surveillance for cardiac events and continuation of chronic CV medical treatment.
Surgery
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Step 2 - Active or unstable cardiac condition(s):

- Unstable angina pectoris
- Acute heart failure
- Significant cardiac arrhythmias
- Symptomatic valvular heart disease
- Recent myocardial infarction[a] and residual myocardial ischemia

→ **No** → **Step 3**

↓

Yes

- Postpone the procedure
- Treatment options should be discussed in a multi-disciplinary team involving **all** peri-operative care physicians

↓

Surgery

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Step 3 - Risk of surgical produre: 30-day CV death and MI

Low-risk: < 1%	Intermediate-risk: 1-5%	High-risk: > 5%
• Superficial surgery • Breast • Dental • Endocrine: thyroid • Eye • Reconstructive • Carotid asymptomatic (CEA or CAS) • Gynecology: minor • Orthopaedic: minor (meniscectomy) • Urological: minor (transurethral resection of the prostate)	• Intraperitoneal: splenectomy, hiatal hernia repair, cholecy-stectomy • 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	• Aortic and major vascular surgery • Open lower limb revascularization or amputation or thrombo-embolectomy • Duodeno-pancreatic surgery • Liver resection, bile duct surgery • Oesophagectomy • Repair of perforated bowel • Adrenal resection • Total cystectomy • Pneumonectomy • Pulmonary or liver transplant

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Step 3 - Risk of surgical procedure

Low risk (<1%) of surgical procedure

Identify risk factors and provide recommendations on lifestyle and medical treatment according to relevant ESC guidelines

Intermediate or High Risk of surgical procedure

↓

Step 4

Recommendations	Class	Level
In patients with known IHD or myocardial ischaemia, initiation of a titrated low-dose beta-blocker regimen may be considered before surgery.	IIb	B
In patient with heart failure and systolic dysfunction, ACEI should be considered before surgery.	IIa	C
In patients undergoing vascular surgery, initiation of statin therapy should be considered.	IIa	B

↓

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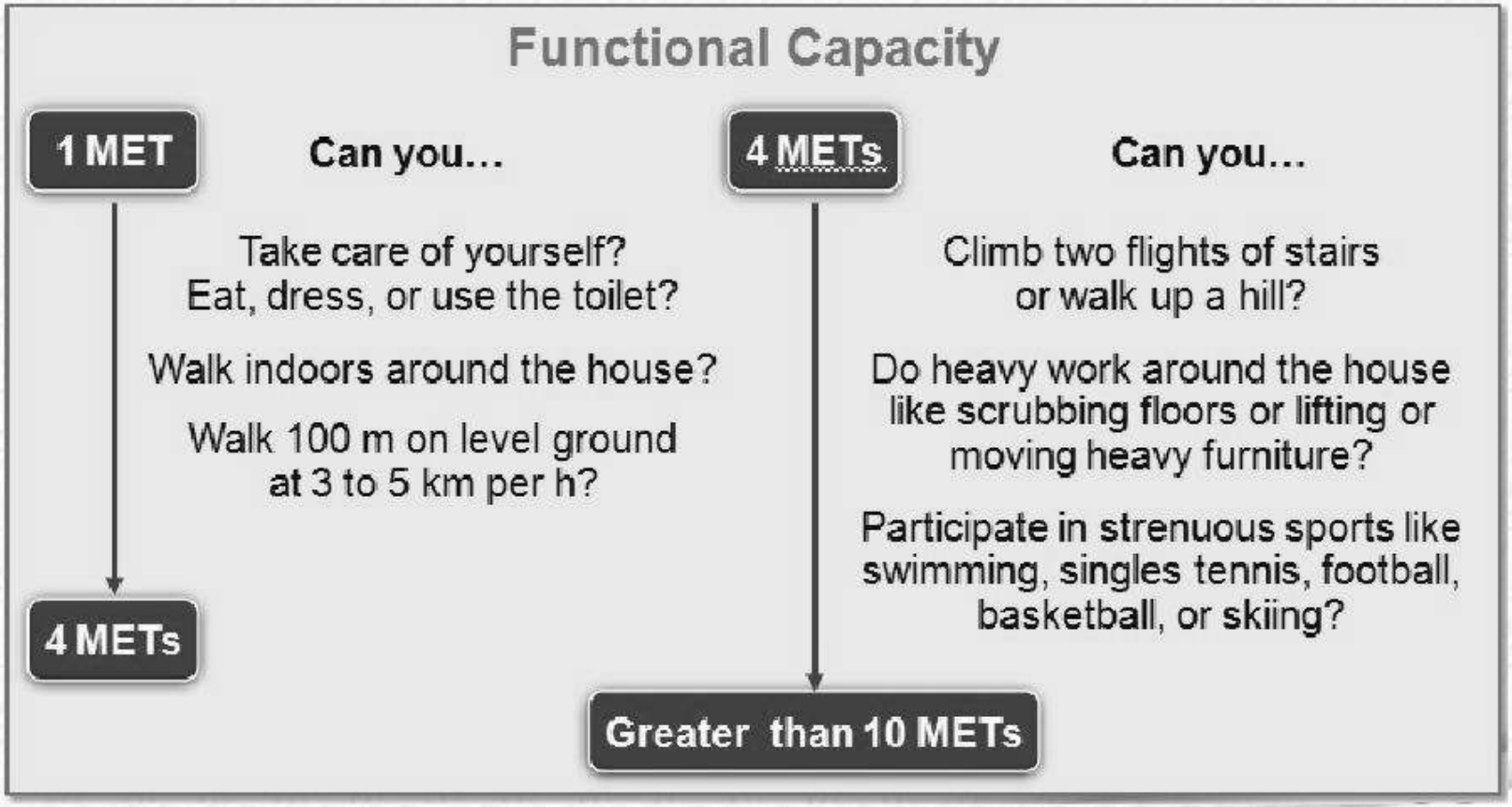
Step 4 - Functional capacity of the patient scheduled for intermediate or high-risk surgery



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Step 4 - Functional capacity of the patient scheduled for intermediate or high-risk surgery

Good (≥4 METS)

Moderate or poor (<4 METS) → **Step 5**

Recommendations	Class	Level
In patients with known IHD or myocardial ischaemia, initiation of a titrated low-dose beta-blocker regimen may be considered before surgery.	IIb	B
In patient with heart failure and systolic dysfunction, ACEI should be considered before surgery.	IIa	C
In patients undergoing vascular surgery, initiation of statin therapy should be considered.	IIa	B

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Step 5 - In patients with functional capacity <4 METS consider risk of surgery

Intermediate risk surgery

High risk surgery → **Step 6**

Recommendations	Class	Level
In patients with one or more clinical risk factors non-invasive testing may be considered.	IIb	B
In patients with one or more clinical risk factors baseline ECG is recommended	I	C

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Step 6
Clinical risk factors

• Ischaemic heart disease (angina pectoris and/or previous myocardial infarction[a])
• Heart failure
• Stroke or transient ischaemic attack
• Renal dysfunction (serum creatinine >170 µmol/L or 2 mg/dL or a creatinine clearance of <60 mL/min/1.73 m^2)
• Diabetes mellitus requiring insulin therapy

[a] According to the universal definition of myocardial infarction

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Step 6
Cardiac risk factors in high-risk surgery

1. Ischaemic heart disease
2. Heart failure
3. Stroke or TIA
4. Renal dysfunction
5. Diabetes mellitus

Recommendations	Class	Level
Number of risk factors ≤2 Rest echocardiography and biomarkers for evaluation of LV function may be considered.	IIb	B-C

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Number of risk factors ≥3

Step 7

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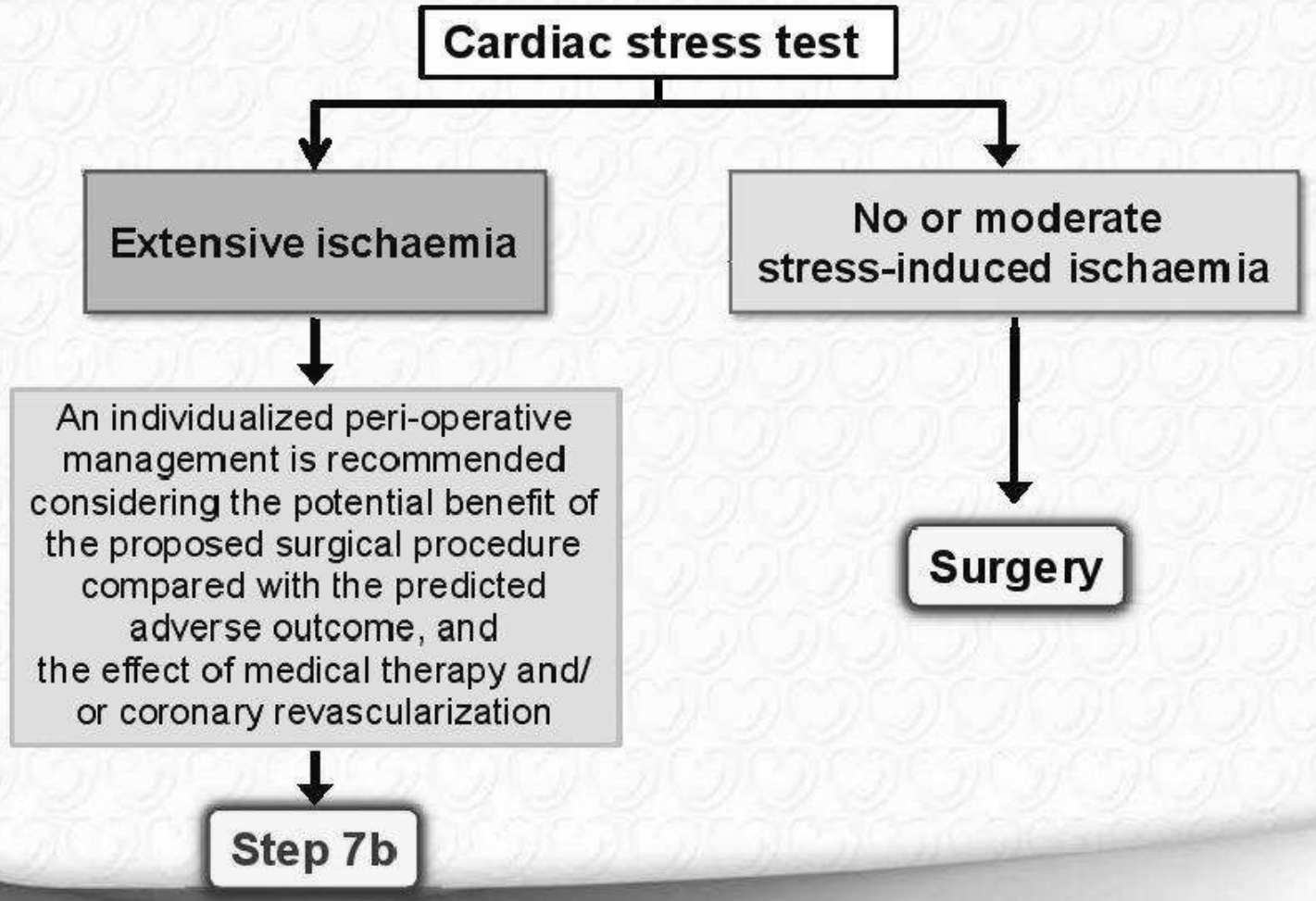
Step 7 – Pre-operative testing

Consider also for patient counselling, surgery, and anaesthesia technique



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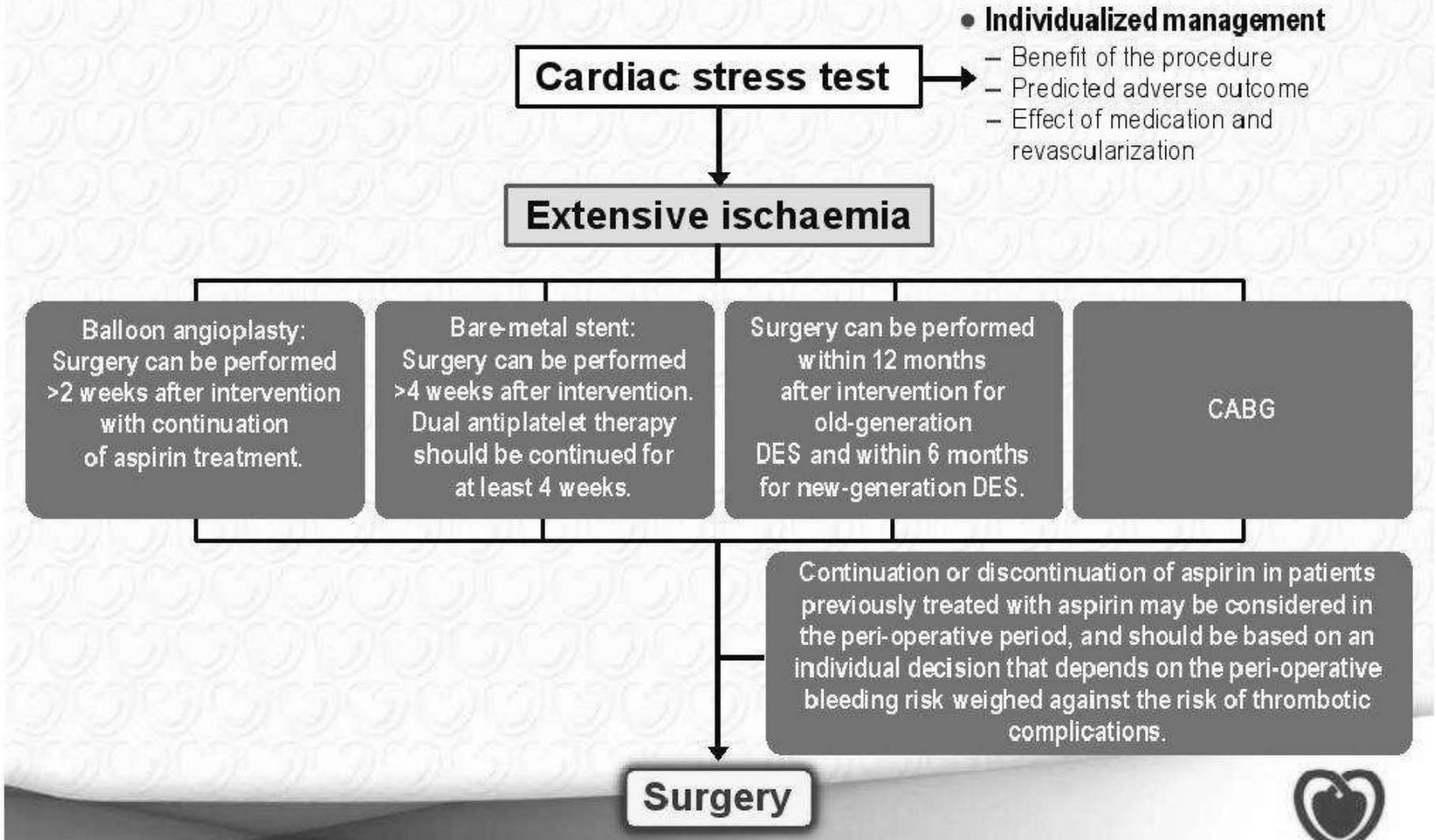
Step 7b
Extensive stress induced ischaemia



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β-Blockers and perioperative cardiac events in randomized trials

Study	n	Beta-blocker		30-day mortality		30-day rate of non-fatal MI	
		Type	Dose Titration	Beta-blocker	Control	Beta-blocker	Control
Mangano et al.	200	Atenolol	No	5.1%*	11.9%	–	–
POBBLE	103	Metoprolol	No	5.4%	2.1%	5.5%	10.4%
MaVS	496	Metoprolol	No	0 %	1.6%	7.7%	8.4%
DIPOM	921	Metoprolol	No	16.0%	15.7%	0.6%	0.9%
BBSA	219	Bisoprolol	Yes	0.9%	0 %	0 %	0 %
POISE	8351	Metoprolol	No	3.1%**	2.3%	3.6%***	5.1%

*:at 6 months and incuding in-hospital deaths, **:p=0.0317, ***:p=0.0008

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Peri-operative β-blocker use

Recommendations	Class	Level
Peri-operative continuation of beta-blockers is recommended in patients currently receiving this medication.	I	B
Pre-operative initiation of beta-blockers may be considered in patients scheduled for high-risk surgery and who have ≥2 clinical risk factors or ASA status ≥3.	IIb	B
Pre-operative initiation of beta-blockers may be considered in patients who have known IHD or myocardial ischaemia.	IIb	B
When oral beta-blockade is initiated in patients who undergo non-cardiac surgery, the use of atenolol or bisoprolol as a first choice may be considered.	IIb	B
Initiation of peri-operative highdose beta-blockers without titration is not recommended.	III	B
Pre-operative initiation of beta-blockers is not recommended in patients scheduled for low-risk surgery.	III	B

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Peri-operative statin use

Recommendations	Class	Level
Peri-operative continuation of statins is recommended, favouring statins with a long half-life or extended-release formulation.	I	C
Pre-operative initiation of statin therapy should be considered in patients undergoing vascular surgery, ideally at least 2 weeks before surgery.	IIa	B

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ESC recommendations on peri-operative aspirin use

Recommendations	Class	Level
Continuation of aspirin in patients previously treated with aspirin may be considered in the peri-operative period (based on risk of bleeding and thrombosis).	IIb	B
Discontinuation of aspirin in patients previously treated with that drug should be considered in patients in whom haemostasis is anticipated to be difficult to control during surgery.	IIa	B

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Prophylactic coronary revascularization in stable cardiac patients

Recommendations	Class	Level
Performance of myocardial revascularization is recommended according to the applicable guidelines for management in stable coronary artery disease.	I	B
Late revascularization after successful non-cardiac surgery should be considered, in accordance with ESC Guidelines on stable coronary artery disease.	I	C
Prophylactic myocardial revascularization before high-risk surgery may be considered, depending on the extent of a stress-induced perfusion defect.	IIb	B
Routine prophylactic myocardial revascularization before low- and intermediate-risk surgery in patients with proven IHD is not recommended.	III	B

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Pathophysiology of peri-operative myocardial infarction

- Increased risk of plaque rupture and thrombus formation due to the stress surgical response on haemodynamically (in)significant coronary stenosis, haemodynamic stress, vasospasm, fibrinolytic activity, platelet activation, hypercoagulability

- Sustained ischaemia
  - Myocardial oxygen supply/demand mismatch

Accordingly:
Choose between local or systemic treatment

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Summary of pre-operative cardiac risk evaluation and peri-operative management

Step	Urgency	Cardiac condition	Type of surgery	Functional capacity	Number of clinical risk factors	ECG	LV echo	Imaging Stress Testing	BNP and TnT	β-blockers	ACE-inhibitors	Aspirin	Statins	Coronary Revascu-larisation
1	Urgent surgery	Stable					III C	III C		I B (continu-ation)	IIa C (continu-ation)	IIb B (continu-ation	I C (continu-ation)	III C
2	Urgent surgery	Unstable												IIa C
	Elective surgery	Unstable				I C	I C	III C	IIb B					I A
3	Elective surgery	Stable	Low risk (<1%)		None	III C	III C	III C	III C	III B	IIa C	I C	IIa B	III B
					≥1	IIb C	III C	III C		IIb B	IIa C	I C	IIa B	III B
4	Elective surgery	Stable	Intermediate (1-5%) or high risk (>5%)	Excellent or good			III C	III C	III C	IIb B	IIa C	I C	IIa B	III B
5	Elective surgery	Stable	Intermediate risk (1-5%)	Poor	None	IIb C	III C		III C	IIb B	IIa C	I C	IIa B	III B
					≥1	I C	III C	IIb C		IIb B	IIa C	I C	IIa B	III B
6	Elective surgery	Stable	High risk (>5%)	Poor	1-2	I C	IIb C	IIb C	IIb B	IIb B	IIa C	I C	IIa B	IIb B
					≥3	I C	IIb C	I C	I Ib B	IIb B	IIa C	I C	IIa B	IIb B

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What is new in these Guidelines?

- A multi-disciplinary expert team should be consulted for pre-operative evaluation of patients with known or high risk of cardiac disease undergoing high-risk non-cardiac surgery.
- The surgical risk assessment, which depends on the type of procedure, has been updated.
- The patient risk assessment now includes not only Lee score but also other validated risk scores such as NSQIP and recommendations on biomarkers (BNP and Troponins)
- Pre-operative initiation of beta-blockers is not recommended in all patients but may be considered in patients scheduled for high-risk surgery and who have clinical risk factors, or who has known ischemic heart disease or myocardial ischaemia

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What is new in these Guidelines?

- Recommendations on the use of aspirin and P2Y12 inhibitors in patients undergoing non-cardiac surgery is updated.
- Section on management of patients treated with new oral anticoagulants undergoing non-cardiac surgery is included.
- Recommendations on timing of non-cardiac surgery after revascularization is updated.
- The section on specific concomitant diseases has been updated.
- The peri-operative monitoring section has been updated and expanded with help from anesthesia experts.

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Gaps in evidence

- Optimal type, dose and duration of beta-blockers in high-risk surgery and their benefits in patients at intermediate surgical risk?
- The benefits of statins in high-risk surgery?
- Interventional or outcome studies on biomarkers, peri-operative haemodynamics and depth of anaesthesia
- How non-cardiac risk factors interact with cardiovascular risk factors and impact on the outcomes of non-cardiac surgery
- Risk scores that can predict mortality from non-cardiac causes
- Effects of patient status, non-cardiac risk-factors, operating team size or skills, and the invasiveness of procedures on outcomes

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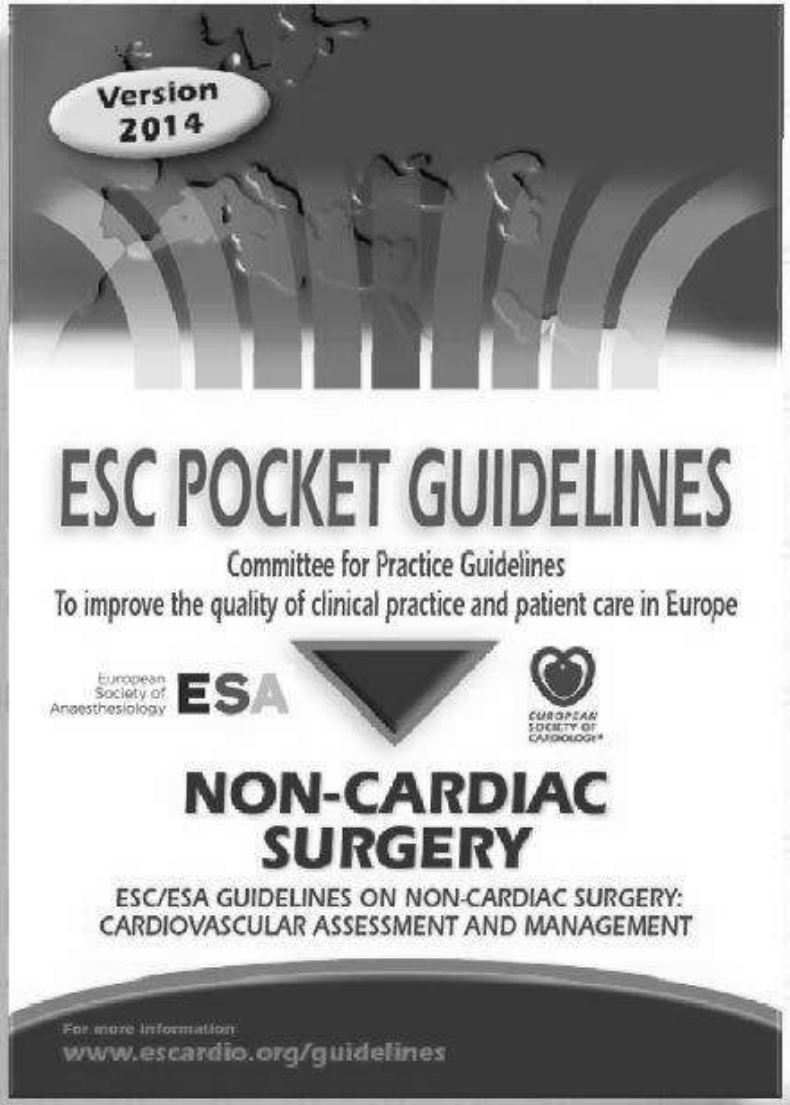

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β-blockers and peri-operative cardiac events in randomized trials

Summary of randomized, controlled trials evaluating the effect of peri-operative beta-blockade on postoperative mortality and non-fatal myocardial infarction

Study	n	Vascular Surgery (%)	Beta-blocker				Patient selection according to cardiac risk	30-day mortality, n/N (%)		30-day rate of non-fatal MI, n/N (%)	
			Type	Onset (before surgery)	Duration (days after surgery)	Dose Titration		Beta-blocker	Control	Beta-blocker	Control
Mangano et al	200	40	Atenolol	30 min	7	No	IHD or ≥2 risk factor	5/99 (5.1)	10/101 (9.9)	–	–
POBBLE	103	100	Metoprolol tartrate	<24 h	7	No	No	3/55 (5.4)	1/48 (2.1)	3/55 (5.5)	5/48 (10.4)
MaVS	496	100	Metoprolol succinate	2 h	5	No	No	0/246 (0)	4/250 (1.6)	19/246 (7.7)	21/250 (8.4)
DIPOM	921	7	Metoprolol succinate	12 h	8	No	Diabetes	74/462 (16.0)	72/459 (15.7)	3/462 (0.6)	4/459 (0.9)
BBSA	219	5	Bisoprolol	>3 h	10	Yes	IHD or ≥2 risk factor	1/110 (0.9)	0/109 (0)	0/110 (0)	0/109 (0)
POISE	8351	41	Metoprolol succinate	2-4 h	30	No	IHD or atherosclerosis or major vascular surgery or ≥3 risk factor	129/4174 (3.1)	97/4177 (2.3)	152/4174 (3.6)	215/4177 (5.1)

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