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ESC/ESA Guidelines on non-cardiac surgery:

cardiovascular assessment and management

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2014 version

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Introduction

The magnitude of the problem

cardiac complications can arise in patients with documented or asymptomatic:

- ischaemic heart disease (IHD)
- left ventricular (LV) dysfunction
- valvular heart disease (VHD)
- arrhythmias

perioperative cardiac mortality and morbidity are predominantly an issue in the adult population.

The magnitude of the problem

The number of major operations is 4% of the world population per year.

30% of patients undergo extensive surgical procedures in the presence of cardiovascular comorbidity.

Pre-operative evaluation

Surgical risk for cardiac events

Surgical factors that influence cardiac risk

- urgency
- invasiveness
- type, and duration of the procedure
- change in body core temperature
- blood loss
- fluid shifts
- alterations in the balance between prothrombotic and fibrinolytic factors.

Less invasive anaesthetic techniques may reduce early mortality.

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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Surgical risk for cardiac events

In the case of emergency surgical procedures (ruptured AAA ,major trauma, perforated viscus) cardiac evaluation will not alter the course or result of the intervention.

In the case of urgent surgical conditions (bypass for acute limb ischaemia, treatment of bowel obstruction) cardiological evaluation may influence the perioperative measures taken to reduce cardiac risk but will not influence the decision to perform the intervention.

Functional capacity

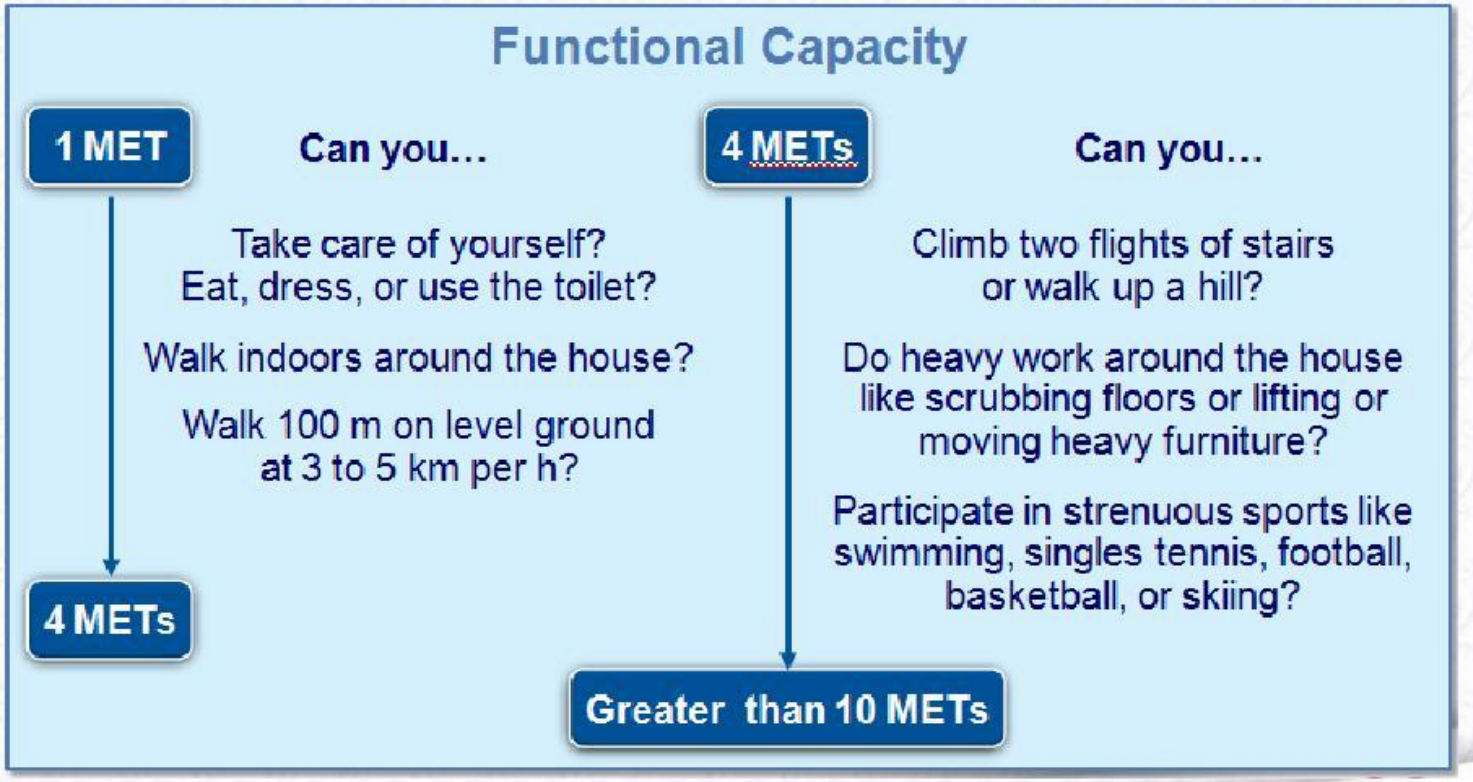
measured in metabolic equivalents (METs).

Measured in Exercise testing.

< 4METs indicates poor functional capacity and is associated with an increased incidence of postoperative cardiac events.

when functional capacity is high, the prognosis is excellent, even in the presence of stable IHD or risk factors.

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



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Risk indices

the NSQIP and Lee risk index models provide complementary prognostic perspectives.

- **The Lee index or 'revised cardiac risk' index:**

predict post-operative myocardial infarction, pulmonary oedema, ventricular fibrillation or cardiac arrest, and complete heart block.

type of surgery, history of IHD, history of heart failure, history of cerebrovascular disease, preoperative treatment with insulin, and preoperative creatinine >170 mmol/L (>2 mg/dL).

Biomarkers

Assessment of cardiac troponins in highrisk patients,both before and 48–72 hours after major surgery, may be considered.

assessment of serum biomarkers (cTn, BNP, NT pro BNP) for patients under going noncardiac surgery can not be proposed for routine use,but may be considered in high risk patients (METs≤4 or with a revised cardiac risk index value >1 for vascular surgery and >2 for non-vascular surgery).

Non-invasive testing

The over all theme is that the diagnostic algorithm for risk stratification of myocardial ischaemia and LV function should be similar to that proposed for patients in the non-surgical setting with known or suspected IHD.

Preoperative testing is recommended in the case of high-risk surgery in patients with poor functional capacity (<4METS) and more than two of the clinical risk factors, may also be considered in patients with fewer than three of these risk factors.

Non-invasive testing of cardiac disease

Recommendations on routine pre-operative ECG

Recommendations	Class[a]	Level[b]	Ref.[c]
Pre-operative ECG is recommended for patients who have risk factor(s)[d] and are scheduled for intermediate- or high-risk surgery.	I	C	57
Pre-operative ECG may be considered for patients who have risk factor(s) and are scheduled for low-risk surgery.	IIb	C	
Pre-operative ECG may be considered for patients who have no risk factors, are above 65 years of age, and are scheduled for intermediate-risk surgery.	IIb	C	
Routine pre-operative ECG is not recommended for patients who have no risk factors and are scheduled for low-risk surgery.	III	B	71

Non-invasive testing of cardiac disease

Recommendations on resting echocardiography in asymptomatic patients without signs of cardiac disease or electrocardiographic abnormalities

Recommendations	Class[a]	Level[b]
Rest echocardiography may be considered in patients undergoing high-risk surgery.	IIb	C
Routine echocardiography is not recommended in patients undergoing intermediate- or low-risk surgery.	III	C

Non-invasive testing of ischaemic heart disease

Physical exercise:

not suitable for patients with limited exercise capacity or pre-existing ST-segment abnormalities at rest.

patients with limited exercise capacity pharmacological stress is an alternative.

nuclear imaging studies:

high sensitivity of for detecting IHD,patients with a normal scan have an excellent prognosis.

Invasive coronary angiography

Despite the fact that CAD may be present in a significant number of patients requiring non-cardiac surgery, indications for preoperative coronary angiography and revascularization are similar to angiography indications in the non-surgical setting.

Preoperative treatment of myocardial ischaemia, either medically or with intervention, is recommended whenever non-cardiac surgery can be delayed.

Recommendations on pre-operative coronary angiography

Recommendations	Class[a]	Level[b]	Ref.[c]
Indications for pre-operative coronary angiography and revascularization are similar to those for the non-surgical setting.	I	C	56
Urgent angiography is recommended in patients with acute ST-segment elevation myocardial infarction requiring non-urgent, non-cardiac surgery.	I	A	75
Urgent or early invasive strategy is recommended in patients with NSTE-ACS requiring non-urgent, non-cardiac surgery according to risk assessment.	I	B	73

Pre-operative angiography is recommended in patients with proven myocardial ischaemia and unstabilized chest pain (Canadian Cardiovascular Society Class III–IV) with adequate medical therapy requiring non-urgent, non-cardiac surgery.	I	C	56,72
Pre-operative angiography may be considered in stable cardiac patients undergoing non-urgent carotid endarterectomy surgery.	IIb	B	76
Pre-operative angiography is not recommended in cardiac-stable patients undergoing low-risk surgery.	III	C	

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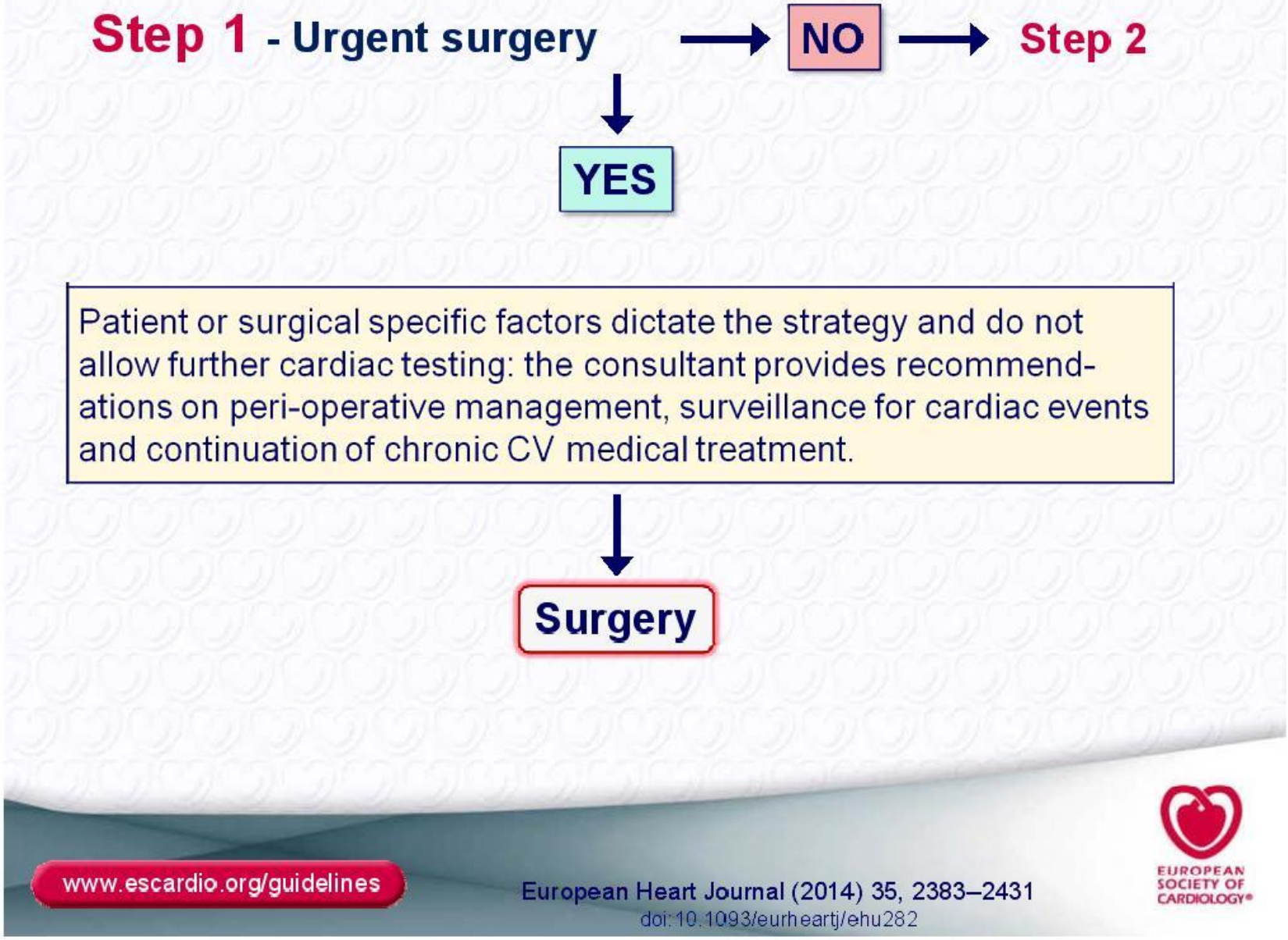
Step 1 - Urgent surgery
NO
Step 2
YES
Patient or surgical specific factors dictate the strategy and do not allow further cardiac testing: the consultant provides recommend-ations on peri-operative management, surveillance for cardiac events and continuation of chronic CV medical treatment.
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Step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

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Yes

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

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Surgery

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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

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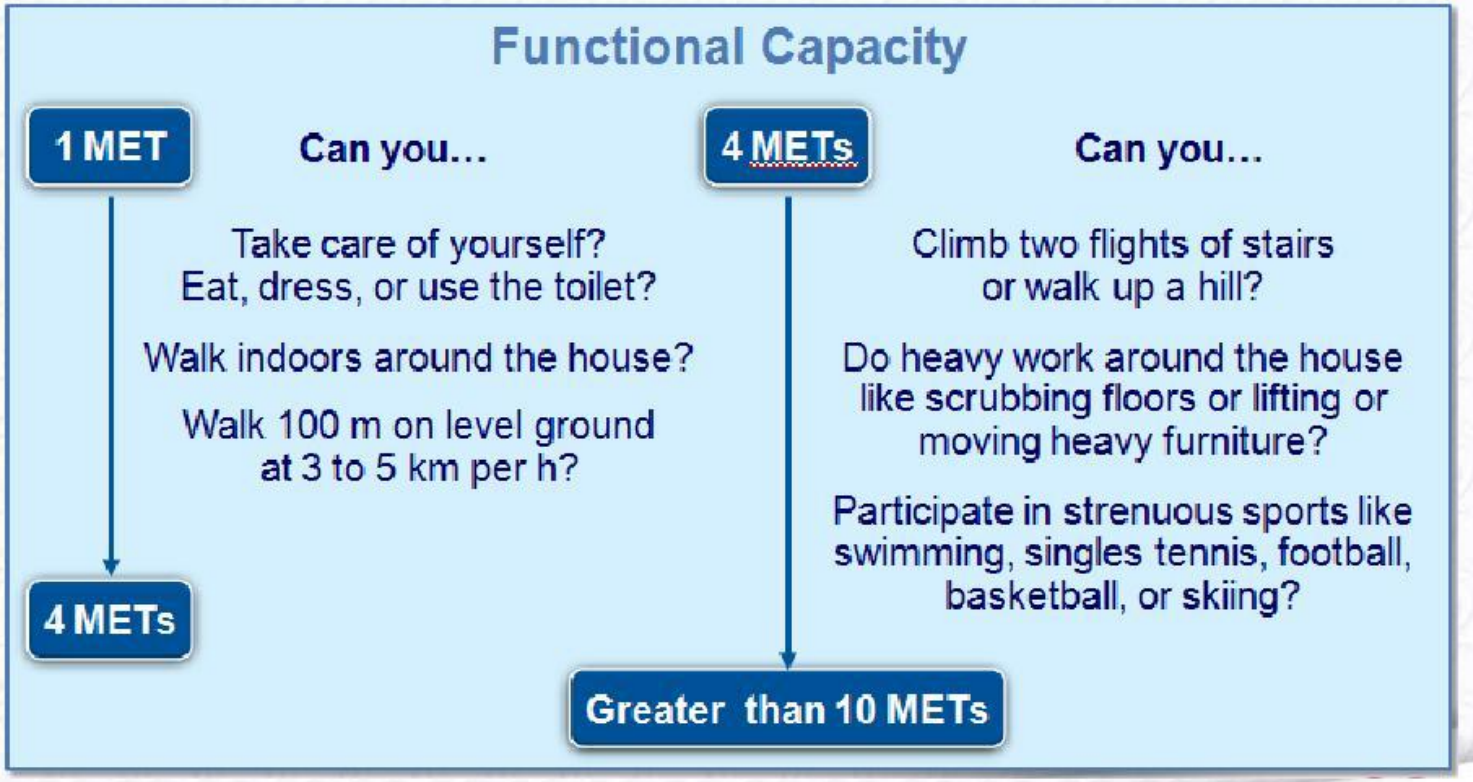
Step 4 - Functional capacity of the patient scheduled for intermediate or high-risk surgery



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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

Surgery

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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

→ **Surgery**

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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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Surgery

Number of risk factors ≥3

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Step 7

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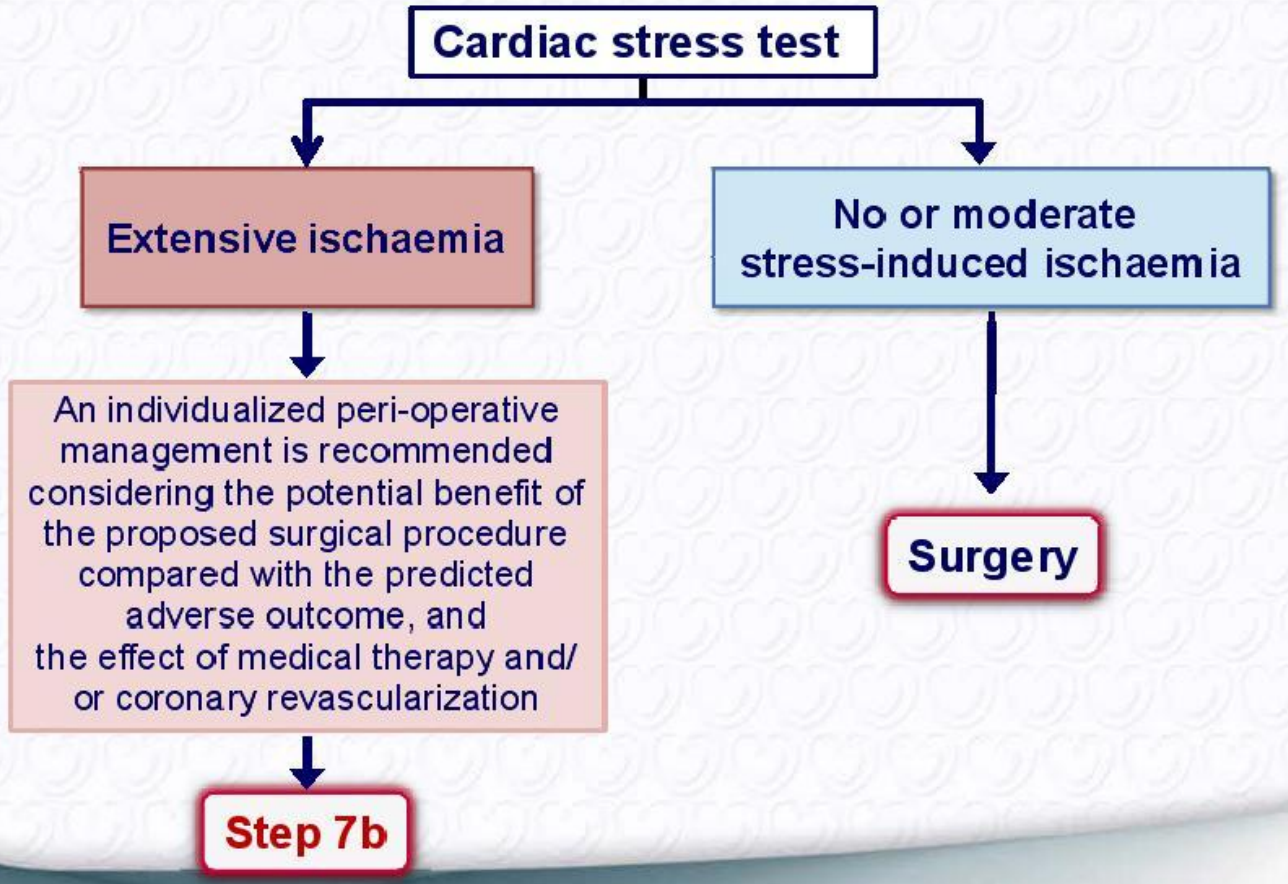
Step 7 – Pre-operative testing

Consider also for patient counselling, surgery, and anaesthesia technique



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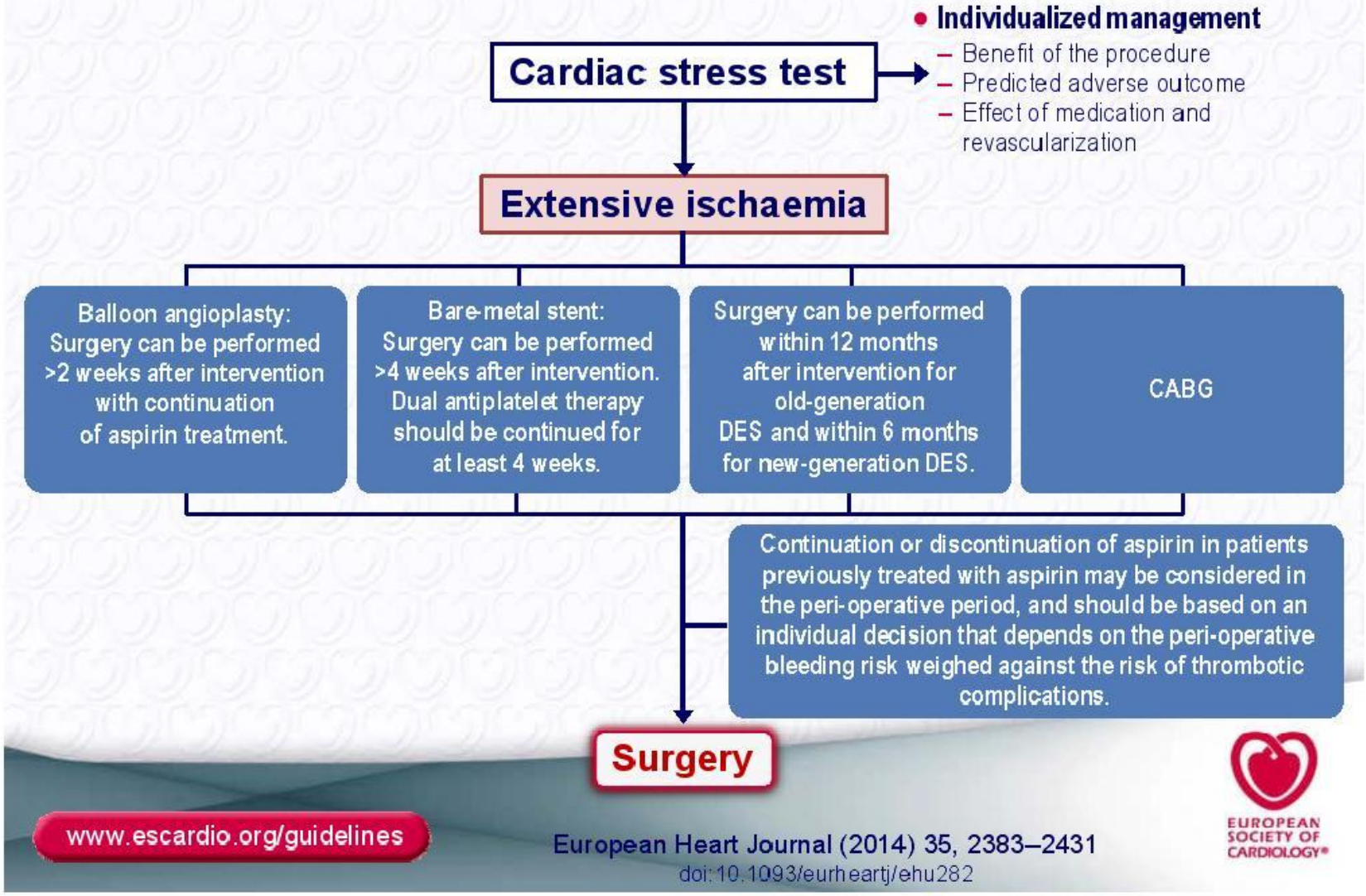
Step 7b
Extensive stress induced ischaemia



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