How should I manage...

Patients with heart disease who need non cardiac surgery?

Dr Bethan Freestone
Birmingham Heartlands
Cardiology update day
10 October 2016
Learning objectives

❖ How to go about evaluating your patient
❖ How to apply risk scores
❖ How to manage cardiac risk
Many patients undergoing major non-cardiac surgery are at risk for a cardiovascular event.

Risk is related to both patient and surgical characteristics.

Identification of increased risk provides the patient and the surgeon with information that helps them make an informed decision about having a procedure and may lead to interventions to decrease risk.
Pre-operative cardiac evaluation should…

1. Attempt to quantify risk
2. Manage cardiac risk (in an attempt to reduce morbidity and mortality)
Very high risk patients

- Recent myocardial infarction
- Heart failure
- Aortic stenosis
- High grade arrhythmia
## Initial evaluation

- Current symptoms
- Past medical history
- Estimated cardiac functional status
- Examination
- ECG

<table>
<thead>
<tr>
<th>Cardiac functional status</th>
<th>1 met</th>
<th>4 mets</th>
<th>4-10 mets</th>
<th>&gt; 10 mets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Can take care of self (eat, wash, dress)</td>
<td>Can walk up 1 flight stairs or on ground at 3-4 mph</td>
<td>2 flights stairs, heavy work in house</td>
<td>Swimming, tennis, football, skiing</td>
</tr>
</tbody>
</table>
Risk models to estimate peri-operative risk

- Revised (Lee) cardiac risk index
- NSQIP
  - Gupta peri-operative cardiovascular risk
Revised Cardiovascular risk index (Lee)

- High risk surgery
- Coronary artery disease
- Congestive heart failure
- Cerebrovascular disease
- Diabetes mellitus on insulin
- Serum Cr>177 microMol/L
Gupta Preoperative Cardiac Risk

- Age
- Cr (>130 mMol/ml)
- ASA class (I-V)
- Pre-op functional status
- Procedure site
Management is based on risk...

- Low risk (<1%), no additional testing required
- Intermediate / high risk, further evaluation is required
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)

Authors/Task Force Members: Steen Dalby Kristensen* (Chairperson) (Denmark), Juhani Knuuti* (Chairperson) (Finland), Antti Saraste (Finland), Stefan Anker (Germany), Hans Erik Bøtker (Denmark), Stefan De Hert (Belgium), Ian Ford (UK), Jose Ramón Gonzalez-Juanatey (Spain), Bulent Gorenek (Turkey), Guy Robert Heyndrickx (Belgium), Andreas Hoeft (Germany), Kurt Huber (Austria), Bernard Jung (France), Keld Per Kjeldsen (Denmark), Dan Longrois (France), Thomas F. Lüscher (Switzerland), Luc Pierard (Belgium), Stuart Pocock (UK), Susanna Price (UK), Marco Roffi (Switzerland), Per Anton Sirnes (Norway), Miguel Sousa-Uva (Portugal), Vasilis Voudris (Greece), Christian Funck-Brentano (France).
ESC guidelines 2014: A stepwise approach

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
Step 1 - Urgent surgery

YES

Patient or surgical specific factors dictate the strategy and do not allow further cardiac testing: the consultant provides recommendations on peri-operative management, surveillance for cardiac events and continuation of chronic CV medical treatment.

Surgery
Step 2 - Active or unstable cardiac condition(s):

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

If the answer is No, proceed to Step 3. If the answer is Yes, continue as follows:

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

Surgery
Surgical risk estimate according to type of surgery or intervention

<table>
<thead>
<tr>
<th>Low-risk: &lt; 1%</th>
<th>Intermediate-risk: 1-5%</th>
<th>High-risk: &gt; 5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Superficial surgery</td>
<td>- Intraperitoneal: splenectomy, hiatal hernia repair, cholecystectomy</td>
<td>- Aortic and major vascular surgery</td>
</tr>
<tr>
<td>- Breast</td>
<td>- Carotid symptomatic (CEA or CAS)</td>
<td>- Open lower limb revascularization or amputation or thromboendarterectomy</td>
</tr>
<tr>
<td>- Dental</td>
<td>- Peripheral arterial angioplasty</td>
<td>- Duodenal-pancreatic surgery</td>
</tr>
<tr>
<td>- Endocrine: thyroid</td>
<td>- Endovascular aneurysm repair</td>
<td>- Liver resection, bile duct surgery</td>
</tr>
<tr>
<td>- Eye</td>
<td>- Head and neck surgery</td>
<td>- Oesophagectomy</td>
</tr>
<tr>
<td>- Reconstructive</td>
<td>- Neurological or orthopaedic: major (hip and spine surgery)</td>
<td>- Repair of perforated bowel</td>
</tr>
<tr>
<td>- Carotid asymptomatic (CEA or CAS)</td>
<td>- Urological or gynaecological: major</td>
<td>- Adrenal resection</td>
</tr>
<tr>
<td>- Gynaecology: minor</td>
<td>- Renal transplant</td>
<td>- Total cystectomy</td>
</tr>
<tr>
<td>- Orthopaedic: minor (meniscectomy)</td>
<td>- Intra-thoracic: non-major</td>
<td>- Pneumonectomy</td>
</tr>
<tr>
<td>- Urological: minor (transurethral resection of the prostate)</td>
<td></td>
<td>- Pulmonary or liver transplant</td>
</tr>
</tbody>
</table>

CAS = carotid artery stenting; CEA = carotid endarterectomy.

*Surgical 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.

*Adapted from Glance et al.*
### Step 3 - Risk of surgical procedure

<table>
<thead>
<tr>
<th>Low risk (&lt;1%) of surgical procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify risk factors and provide recommendations on lifestyle and medical treatment according to relevant ESC guidelines</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intermediate or High Risk of surgical procedure</th>
</tr>
</thead>
</table>

#### Step 4

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
</tr>
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<tbody>
<tr>
<td>In patients with known IHD or myocardial ischaemia, initiation of a titrated low-dose beta-blocker regimen may be considered before surgery.</td>
<td>IIb</td>
<td>B</td>
</tr>
<tr>
<td>In patients with heart failure and systolic dysfunction, ACEI should be considered before surgery.</td>
<td>Ila</td>
<td>C</td>
</tr>
<tr>
<td>In patients undergoing vascular surgery, initiation of statin therapy should be considered.</td>
<td>Ila</td>
<td>B</td>
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[www.escardio.org/guidelines](http://www.escardio.org/guidelines)

*European Heart Journal (2014) 35, 2383–2431*

doi:10.1093/eurheartj/ehu282
Step 4 - Functional capacity of the patient scheduled for intermediate or high-risk surgery

**Good (≥4 METS)**

**Moderate or poor (<4 METS)**

Step 5

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<td>In patients undergoing vascular surgery, initiation of statin therapy should be considered.</td>
<td>IIa</td>
<td>B</td>
</tr>
</tbody>
</table>
Step 5 - In patients with functional capacity <4 METS consider risk of surgery

Intermediate risk surgery

High risk surgery

Step 6

Recommendations

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>In patients with one or more clinical risk factors non-invasive testing may be considered.</td>
<td>IIb</td>
<td>B</td>
</tr>
<tr>
<td>In patients with one or more clinical risk factors baseline ECG is recommended</td>
<td>I</td>
<td>C</td>
</tr>
</tbody>
</table>

European Heart Journal (2014) 35, 2383–2431
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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

<table>
<thead>
<tr>
<th>Number of risk factors ≤ 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rest echocardiography and biomarkers for evaluation of LV function may be considered.</td>
</tr>
</tbody>
</table>

Class: IIb  
Level: B-C

Surgery

Number of risk factors ≥ 3

Step 7
Step 7 – Pre-operative testing

Consider also for patient counselling, surgery, and anaesthesia technique

Cardiac stress test

Extensive ischaemia

An individualized peri-operative management is recommended considering the potential benefit of the proposed surgical procedure compared with the predicted adverse outcome, and the effect of medical therapy and/or coronary revascularization

No or moderate stress-induced ischaemia

Surgery

Step 7b
Step 7b
Extensive stress induced ischaemia

Cardiac stress test

Extensive ischaemia

Balloon angioplasty: Surgery can be performed >2 weeks after intervention with continuation of aspirin treatment.

Bare-metal stent: Surgery can be performed >4 weeks after intervention. Dual antiplatelet therapy should be continued for at least 4 weeks.

Surgery can be performed within 12 months after intervention for old-generation DES and within 6 months for new-generation DES.

CABG

Continuation or discontinuation of aspirin in patients previously treated with aspirin may be considered in the peri-operative period, and should be based on an individual decision that depends on the peri-operative bleeding risk weighed against the risk of thrombotic complications.

Surgery

www.escardio.org/guidelines

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Non invasive testing

- Aims to identify LV function, myocardial ischaemia, heart valve abn
- Application of non-invasive stress testing should be the same as in the non surgical setting
Invasive coronary angiography

- Rarely indicated purely for non-cardiac surgical risk evaluation
- Independent procedural risks and delays op
- Indications are similar to angiographic indications in the non-surgical setting

### Recommendations on pre-operative coronary angiography

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indications for pre-operative coronary angiography and revascularization are similar to those for the non-surgical setting.</td>
<td>I</td>
<td>C</td>
<td>56</td>
</tr>
<tr>
<td>Urgent angiography is recommended in patients with acute ST-segment elevation myocardial infarction requiring non-urgent, non-cardiac surgery.</td>
<td>I</td>
<td>A</td>
<td>75</td>
</tr>
<tr>
<td>Urgent or early invasive strategy is recommended in patients with NSTE-ACS requiring non-urgent, non-cardiac surgery according to risk assessment.</td>
<td>I</td>
<td>B</td>
<td>73</td>
</tr>
<tr>
<td>Pre-operative angiography is recommended in patients with proven myocardial ischaemia and unstable chest pain (Canadian Cardiovascular Society Class III–IV) with adequate medical therapy requiring non-urgent, non-cardiac surgery.</td>
<td>I</td>
<td>C</td>
<td>56,72</td>
</tr>
<tr>
<td>Pre-operative angiography may be considered in stable cardiac patients undergoing non-urgent carotid endarterectomy surgery.</td>
<td>IIb</td>
<td>B</td>
<td>76</td>
</tr>
<tr>
<td>Pre-operative angiography is not recommended in cardiac-stable patients undergoing low-risk surgery.</td>
<td>III</td>
<td>C</td>
<td></td>
</tr>
</tbody>
</table>
Case 1

- 80 yo lady
- Routine pre-op for Total Hip Replacement
- No cardiovascular symptoms
- **PMH** Hypertension
- **DH** Bendroflumethiazide
- Functional status difficult to assess (hip pain)
- **O/E** Tachycardia
- Routine ECG shows…
Case 1
Case 1: Atrial fibrillation

- Patient’s risk (RCRI) 0.4%

- AF rate control (Beta blocker)

- Advise on need for anticoagulation for stroke thromboprophylaxis (post op) on basis of CHADSVASC score

- ?? Echo (not required in setting of otherwise normal exam)
Considerations in AF patients

Pre-op SVT (inc. AF) management

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuation of oral anti-arrhythmic drugs before surgery is recommended.</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>Electrical cardioversion when haemodynamic instability occurs is recommended.</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>Vagal manoeuvres and anti-arrhythmic therapy for termination of SVT in haemodynamically stable patients is recommended.</td>
<td>I</td>
<td>C</td>
</tr>
</tbody>
</table>

SVT = supraventricular tachycardia.
*Class of recommendation.
Level of evidence.

Anticoagulation

- should be ‘bridged’ for high risk patients on warfarin (eg. mechanical valve replacement, thrombophilia, DVT/PE within 3mo, AF with CHADSVASC≥4) using LMW heparin from when INR<2, with last dose >12h pre op
- INR needs to be <1.5
- NOACs should be stopped for 2-3x biological half life pre-op (24-48h in most where ‘normal’ risk of bleeding)
- Warfarin or NOACs are generally re-started 1-2 days post op

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Case 2

- 56 yo man
- Known IHD, prior LAD stent
- recurrent Angina under inv
- Good LV on echo with limited ischaemia on DSE
- Good functional status (>10mets)

- Due minor orthopaedic surgery under GA

(considered semi-urgent because of malunion #clavicle post RTA)
Case 2: Angina

Proximal diagonal and distal LAD disease on coronary angiogram
Case 2: Management of stable angina

❖ Risk (RCRI) 0.9%
❖ On beta blocker and statin already (maintained peri-op)
❖ (Good functional status, good LV, limited ischaemic area at risk)
❖ Went ahead with operation without complication
  (Anaesthetist altered positioning of patient, used arterial line for close MAP monitoring, HDU monitoring brief period post op)
❖ (Due PCI LAD for symptom control in due course)
Beta-blockers peri-operatively

<table>
<thead>
<tr>
<th>Study</th>
<th>n</th>
<th>Vascular Surgery (%)</th>
<th>Beta-blocker Type</th>
<th>Onset (before surgery)</th>
<th>Duration (days after surgery)</th>
<th>Dose Titration</th>
<th>Patient selection according to cardiac risk</th>
<th>30-day mortality, n/N (%)</th>
<th>30-day rate of non-fatal MI, n/N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mangano et al.</td>
<td>200</td>
<td>40</td>
<td>Atenolol</td>
<td>30 min</td>
<td>7</td>
<td>No</td>
<td>IHD or ≥2 risk factors</td>
<td>5/99 (5.1%)</td>
<td>10/101 (9.9%)</td>
</tr>
<tr>
<td>POBBLE</td>
<td>103</td>
<td>100</td>
<td>Metoprolol tartrate</td>
<td>&lt;24 h</td>
<td>7</td>
<td>No</td>
<td>No</td>
<td>3/55 (5.4%)</td>
<td>1/48 (2.1%)</td>
</tr>
<tr>
<td>MaV5</td>
<td>496</td>
<td>100</td>
<td>Metoprolol succinate</td>
<td>2 h</td>
<td>5</td>
<td>No</td>
<td>No</td>
<td>0/246 (0)</td>
<td>4/250 (1.6%)</td>
</tr>
<tr>
<td>DIPOM</td>
<td>921</td>
<td>7</td>
<td>Metoprolol succinate</td>
<td>12 h</td>
<td>8</td>
<td>No</td>
<td>Diabetes</td>
<td>74/462 (16.0%)</td>
<td>72/459 (15.7%)</td>
</tr>
<tr>
<td>BBSA</td>
<td>219</td>
<td>5</td>
<td>Bisoprolol</td>
<td>&gt;3 h</td>
<td>10</td>
<td>Yes</td>
<td>IHD or ≥2 risk factors</td>
<td>1/110 (0.9%)</td>
<td>0/109 (0)</td>
</tr>
<tr>
<td>POISE</td>
<td>8351</td>
<td>41</td>
<td>Metoprolol succinate</td>
<td>2–4 h</td>
<td>30</td>
<td>No</td>
<td>IHD or atherosclerosis or major vascular surgery or ≥3 risk factors</td>
<td>129/4174 (3.1%)</td>
<td>97/4177 (2.3%)</td>
</tr>
</tbody>
</table>

BBSA = Beta-Blocker in Spinal Anesthesia; DIPOM = Diabetic Postoperative Mortality and Morbidity; IHD = Ischaemic heart disease; MaV5 = Metoprolol after Vascular Surgery; MI = myocardial infarction; POBBLE = PeriOperative Beta-Blockade; POISE = PeriOperative Ischemic Evaluation.

*At 6 months and including in-hospital deaths.

*p = 0.0317,

"p = 0.00068.
Beta-blockers

- Routine beta-blockers not recommended in low risk patients
- Beta-blockers should be continued when used for IHD or arrhythmias and in stable patients with heart failure
- Beta-blockers should not be withdrawn peri-op (4 retrospective studies showed increased mortality)
Statin use peri-operatively

1 RCT Atorvastatin vs placebo in patients going for vascular surgery. 6/12 follow up
Reduced event rate in statin arm (8% v 26%)

**Recommendations on statins**

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peri-operative continuation of statins is recommended, favouring statins with a long half-life or extended-release formulation.</td>
<td>I</td>
<td>C</td>
<td>112, 113, 115</td>
</tr>
<tr>
<td>Pre-operative initiation of statin therapy should be considered in patients undergoing vascular surgery, ideally at least 2 weeks before surgery.</td>
<td>IIa</td>
<td>B</td>
<td></td>
</tr>
</tbody>
</table>

*Class of recommendation.*

*Level of evidence.*

*Reference(s) supporting recommendations.*
Anti-platelet therapy

- POISE2 RCT, 10000 patients having non cardiac surgery, aspirin did not decrease event rate (7% both groups) and increased bleeding seen in Asp group (4.6% v 3.8%) but only 23% had CVD and small% PCI

- Aspirin should ideally be continued longterm in any patient with a stent

- Second antiplatelet agent duration depends on type of stent (4 weeks for bare metal stent, 6 or 12 months for a drug-eluting stent)
Case 3

- 69 yo man
- NSTE MI presentation
- PMH Type 2 Diabetes
- Mild anaemia, mild CRF
- Functional status <4mets prior to adm
- O/E Ejection systolic murmur
Case 3

- Inpatient investigation:
  - Echo showed moderate aortic stenosis
  - 3 vessel disease at coronary angio: (90% LAD, 90% Cx, 70% RCA)
  - After initial heart MDT referred for CABG
Case 3

- IHD (3 Vdx) and aortic stenosis
- Sigmoid cancer diagnosed on pre-op work up for CABG
- What now?
### Recommendations on routine myocardial revascularization in patients with NSTE-ACS

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>If non-cardiac surgery can safely be postponed, it is recommended that patients should be diagnosed and treated in line with the guidelines on NSTE-ACS.</td>
<td>I</td>
<td>A</td>
<td>73, 75, 133, 158</td>
</tr>
<tr>
<td>In the unlikely combination of a life-threatening clinical condition requiring urgent non-cardiac surgery and revascularization for NSTE-ACS, the expert team should discuss, case by case, the priority of surgery.</td>
<td>IIa</td>
<td>C</td>
<td>133</td>
</tr>
<tr>
<td>In patients who have undergone non-cardiac surgery, aggressive medical treatment and myocardial revascularization according to the guidelines on NSTE-ACS are recommended following surgery.</td>
<td>I</td>
<td>B</td>
<td>73</td>
</tr>
<tr>
<td>If PCI is indicated before semi-urgent surgery, the use of new-generation DES, BMS or even balloon angioplasty is recommended.</td>
<td>I</td>
<td>B</td>
<td>151, 156</td>
</tr>
</tbody>
</table>
Case 3: Significant IHD and cancer

- Re-discussed at MDT
- Risk (RCRI) >11% of peri-op event during non cardiac surgery
- Revascularised (BMS to LAD and Cx) with 4 weeks DAPT
- Sigmoid colectomy 6 weeks post PCI (on aspirin)
- Followed up in clinic this week (1 year post PCI and cancer surgery) for aortic valve surveillance
Recommendations on the timing of non-cardiac surgery in cardiac-stable/asymptomatic patients with previous revascularization

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<th>Level</th>
<th>Ref.</th>
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<tbody>
<tr>
<td>It is recommended that, except for high-risk patients, asymptomatic patients who have undergone CABG in the past 6 years be sent for non-urgent, non-cardiac surgery without angiographic evaluation.</td>
<td>I</td>
<td>B</td>
<td>147,148</td>
</tr>
<tr>
<td>Consideration should be given to performing non-urgent, non-cardiac surgery in patients with recent BMS implantation after a minimum of 4 weeks and ideally 3 months following the intervention.</td>
<td>IIa</td>
<td>B</td>
<td>129</td>
</tr>
<tr>
<td>Consideration should be given to performing non-urgent, non-cardiac surgery in patients who have had recent DES implantation no sooner than 12 months following the intervention. This delay may be reduced to 6 months for the new-generation DES.</td>
<td>IIa</td>
<td>B</td>
<td>149,150</td>
</tr>
<tr>
<td>In patients who have had recent balloon angioplasty, surgeons should consider postponing non-cardiac surgery until at least 2 weeks after the intervention.</td>
<td>IIa</td>
<td>B</td>
<td>127,151</td>
</tr>
</tbody>
</table>
Case 4

- 67 yo man
- Chest pain of recent onset (atypical, some exertional element)
- **PMH** Hypertension
- Smoker
- Investigated with CXR and ETT
Case 4: IHD vs Cancer
Surgical stress response increases risk of plaque rupture and thrombus formation due to haemodynamic stress, vasospasm, fibrinolytic activity, platelet activation and hyper coagulability.

Sustained ischaemia (myocardial oxygen supply/demand mismatch)

- Incidence of Type 2 MI is increasing in peri-operative period compared with Type 1 MI
Heart failure

- Chronic HF patients need optimisation and stabilisation of medications pre-op
- Newly diagnosed HF patients may need intermediate or high risk surgery deferred by 3 months
- Initiation of high one beta-blockade immediately pre-op is not recommended
ACEi peri-operatively

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<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuation of ACEIs or ARBs, under close monitoring, should be considered during non-cardiac surgery in stable patients with heart failure and LV systolic dysfunction.</td>
<td>IIa</td>
<td>C</td>
</tr>
<tr>
<td>Initiation of ACEIs or ARBs should be considered at least 1 week before surgery in cardiac-stable patients with heart failure and LV systolic dysfunction.</td>
<td>IIa</td>
<td>C</td>
</tr>
<tr>
<td>Transient discontinuation of ACEIs or ARBs before non-cardiac surgery in hypertensive patients should be considered.</td>
<td>IIa</td>
<td>C</td>
</tr>
</tbody>
</table>

NB.
ACEi/ARB do not reduce risk of 30d or 1 year mortality or CV events in setting of vascular surgery in high risk patients.

ACEI = angiotensin converting enzyme inhibitor; ARB = angiotensin receptor blocker; LV = left ventricular.

*Class of recommendation.

Level of evidence.
Case 5

❖ 78 yo lady
❖ Referred for AAA intervention (EVAR)
❖ Known stable angina (CTO Cx and RCA, distal LAD disease)
❖ Functional status 4 mets
❖ No diabetes
❖ Normal LV
❖ Normal Cr
❖ RCRI 6.6%
Gaps in our knowledge…

❖ How should beta-blockers be used in high risk patients, should they be used in intermediate risk patients?
❖ What is the role of statins?
❖ How do non-cardiac risk factors interact with cardiac risk to affect outcome?
❖ The impact of peri-operative haemodynamics and depth of anaesthesia on outcome
❖ Is there any role for biomarkers in the prediction of risk?
Conclusions

❖ Risk stratification helps patients, anaesthetists and surgeons make informed decisions on treatment options when considering non-cardiac surgery

❖ Management of your patient should be based on long term prevention of cardiac events rather than just reducing perceived peri-operative risk

❖ **Reference**: 2014 ESC/ESA Guidelines on non cardiac surgery: cardiovascular assessment and management

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