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UCL DIVISION OF SURGERY & INTERVENTIONAL SCIENCE
Evaluating the Heart before Non-Cardiac Surgery

Dr Rob Stephens
Anaesthetist UCLH + UCL
Dr Robert CM Stephens BA MD FRCA FFICM

Consultant in Anaesthesia, UCLH
Associate Professor in Anaesthesia & Perioperative Medicine, UCL

<table>
<thead>
<tr>
<th>Interests</th>
<th>Education: lead for the year 4 MBBS, 6 SSM, 'Intro to Anaesthesia' course and on the MSc in Perioperative Medicine</th>
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<tr>
<td></td>
<td>Undergraduate Education in Anaesthesia &amp; Perioperative Medicine</td>
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<tr>
<td></td>
<td>Innovative Education Methods</td>
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<td>Endotoxin &amp; perioperative inflammation</td>
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<td>Cardiopulmonary Exercise Testing</td>
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<td>Maintaining Centre for Anaesthesia website</td>
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<td>Clinical trials</td>
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<tr>
<td>Selected</td>
<td>Preoperative systemic inflammation and perioperative myocardial injury: prospective observational multicentre cohort</td>
</tr>
</tbody>
</table>

www.ucl.ac.uk/anaesthesia/people/stephens
Google UCL Stephens
Contents

• Introduction
• Basic Principles
• Guidelines: Decisions
• Guidelines: Putting it all together
• Which test?
• ECHO
• CPET
• B Block?
• Summary
You’re all experts!
Seems big, complex
Conflicting, absent and changing evidence!
Assessing CVS system vs interventions
Introduction

<table>
<thead>
<tr>
<th>Level of Evidence</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Level of Evidence A</td>
<td>Data derived from multiple randomized clinical trials or meta-analyses.</td>
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<tr>
<td>Level of Evidence B</td>
<td>Data derived from a single randomized clinical trial or large non-randomized studies.</td>
</tr>
<tr>
<td>Level of Evidence C</td>
<td>Consensus of opinion of the experts and/or small studies, retrospective studies, registries.</td>
</tr>
</tbody>
</table>
Background: Basic Principles?

Aims

Assess risk: consent + patient decisions
Assess risk: specific interventions
Diagnose conditions: caution = screening?

Cancer surgery: Expedited
Test: what next?
Ischaemia vs Heart Failure vs Death
“Probably”, “reasonable”, “is not well established”
Guidelines 1 History

- Canadian 2017
- 2014 ACC/AHA guideline revision
- 2014 ESC/ESA guideline revision
- ACC/AHA 2007 (small revision 2009)
- ESC 2009
- Guidelines - Cardiology
- Fraud of Poldermans
- B Blocker story

- RCoA / AAGBI ?
2014 Guidelines + others

• 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
• 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
CLINICAL PRACTICE GUIDELINE

2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery

A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines

Developed in Collaboration With the American College of Surgeons, American Society of Anesthesiologists, American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Rhythm Society, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Anesthesiologists, and Society of Vascular Medicine

Endorsed by the Society of Hospital Medicine

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†Writing committee members are required to recuse themselves from
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), Bülent Görenek (Turkey), Guy Robert Heyndrickx (Belgium), Andreas Hoeft (Germany), Kurt Huber (Austria), Bernard Iung (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 Sires (Norway), Miguel Sousa-Uva (Portugal), Vasilis Voudris (Greece), Christian Funck-Brentano (France).

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Step 1
Urgent surgery
Yes
No

Step 2
One of active or unstable cardiac conditions (Table 9)
Yes
No

Step 3
Determine the risk of the surgical procedure (Table 3)
Low
Intermediate or high

Step 4
Consider the functional capacity of the patient
≤ 4 METs
> 4 METs

Step 5
In patients with a poor functional capacity consider the risk of the surgical procedure
Intermediate risk surgery
High-risk surgery

Step 6
Cardiac risk factors (Table 4)
≤ 2
≥ 3

Step 7
Interpretation of non-invasive stress test results
Balloon angioplasty: Surgery can be performed ≥ 2 weeks after intervention with continuation of aspirin treatment.
Bare-metal stent: Surgery can be performed 3–4 weeks after intervention. Dual antiplatelet therapy should be continued for at least 4 weeks.

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.

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 (see also Table 8).

*Treatment should be initiated optimally between 30 days and at least 2 days before surgery and should be continued postoperatively aiming at target resting heart rate of 60–70 beats per minute and systolic blood pressure >100 mmHg.

**For strategy of anaesthesia and perioperative monitoring see appropriate sections.

ESC/ESA Guidelines 2014
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-
Coronary-Artery Revascularization before Elective Major Vascular Surgery


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

McFalls 2004
Cardiac Risk of Noncardiac Surgery
Influence of Coronary Disease and Type of Surgery in 3368 Operations

Kim A. Eagle, Charanjit S. Rihal, Mary G. 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

Abstract

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

Eagle 1997
CASS
Coronary Artery Surgery Study

Eagle 1997
CASS

Total Event Rates in High Risk Surgery
(n=1961)

- Periop MI
- Death

<table>
<thead>
<tr>
<th>Condition</th>
<th>Event Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No CAD (n=395)</td>
<td>0.8 1</td>
</tr>
<tr>
<td>CAD; Medical Rx (n=582)</td>
<td>2.7 3.3</td>
</tr>
<tr>
<td>CAD; CABG (n=964)</td>
<td>0.8 1.7</td>
</tr>
</tbody>
</table>

**p=0.03  ***p=0.002

But CABG associated deaths excluded!

Eagle 1997
Guideline 2

ACC/AHA and ESC/ESA 2014
• Surgery Urgency
• Active Cardiac Condition
• Patient Exercise Capacity
• Surgery Severity
• Patient Specific risks / Comorbidities

ACC/AHA 214 and ESC/ESA and Canadian 2018
• Biomarkers
Guideline 2

ACC/AHA and ESC/ESA

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

ACC/AHA 214 and ESC/ESA

- Biomarkers
Guideline 3

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 4

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 5

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 6

ACC/AHA and ESC/ESA
- Surgery Urgency
- **Active Cardiac Condition**
- Patient Exercise Capacity
- Surgery Severity
- Patient Specific risks / Comorbidities

ACC/AHA 214 and ESC/ESA
- Biomarkers
Guideline 7

• 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 8

ACC/AHA and ESC/ESA
• Surgery Urgency
• Active Cardiac Condition
• **Patient Exercise Capacity**
• Surgery Severity
• Patient Specific risks / Comorbidities

ACC/AHA 214 and ESC/ESA
• Biomarkers
Guideline 9

Patient Exercise Capacity

• Metabolic Equivalent of Task - MET
• 1 MET is $O_2$ uptake at rest = $C \times 3.5 \text{ ml/min/kg} \times O_2$ 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 = 47.5ml/min/kg
c 12.6 METS

Rest 1MET
300ml/min O2 uptake
80kg
300/80 = 3.75ml/min/kg
Guideline 10

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’
Guideline 11

Patient Exercise Capacity

4 METS without significant symptoms
Operations proceed

Less than 4 METS consider
Guideline 12

ACC/AHA and ESC/ESA

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

ACC/AHA 214 and ESC/ESA

- Biomarkers
Guideline 13

Severity of surgery

• Minor proceed
• Intermediate consider further
• Major consider further
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 clinical trials—which provide the ideal evidence-base for the guidelines—are sparse. Consequently, when no trials are available on a specific cardiac-management regimen in the surgical setting, data from the non-surgical setting are extrapolated and similar recommendations made, but with different levels of evidence. Anaesthesiologists, who are experts on the specific demands of the proposed surgical procedure, will usually co-ordinate the pre-operative evaluation. The majority of patients with stable heart disease can undergo low and intermediate-risk surgery (Table 3) without additional evaluation. Selected patients require evaluation by a team of integrated multidisciplinary specialists including anaesthesiologists, cardiologists, and surgeons and, when appropriate, an extended team (e.g. internists, intensivists, pulmonologists or geriatricians).

Selected patients include those identified by the anaesthesiologist because of suspected or known cardiac disease with sufficient complexity to carry a potential perioperative risk (e.g. congenital heart disease, unstable symptoms or low functional capacity), patients in whom pre-operative medical optimization is expected to reduce perioperative risk before low- and intermediate-risk surgery, and patients with known or high risk of cardiac disease who are undergoing high-risk surgery. Guidelines have the potential to improve post-operative outcomes and highlight the existence of a clear opportunity for improving the quality of care in this high-risk group of patients. In addition to promoting an improvement in immediate perioperative care, guidelines should provide long-term advice.

Because of the availability of new evidence and the international impact of the controversy over the DECREASE trials, the ESC/ESA and American College of Cardiology/American Heart Association 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, except where international practice variation was prevalent.

Following the development and introduction of perioperative cardiac guidelines, their effect on outcome should be monitored. The objective evaluation of changes in outcome will form an essential part of future perioperative guideline development.

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

<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>• Intrapitoneal: 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 thromboembolectomy</td>
</tr>
<tr>
<td>• Dental</td>
<td>• Peripheral arterial angioplasty</td>
<td>• Duodeno-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.

\(^a\)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.

\(^b\)Adapted from Glance et al. \(^{11}\)
Guideline 14

ACC/AHA and ESC/ESA

• Surgery Urgency
• Patient Exercise Capacity
• Surgery Severity
• Patient Specific risks / Comorbidities

ACC/AHA 214 and ESC/ESA

• Biomarkers
Guideline 15

• 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 16

• 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 – insulin
  – Renal Injury (Cr 177+)
• Do a risk score: 1% Cardiac risk or more?
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 preoperative 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 160 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 μmol/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 Outcome Risk Tool (SORT)

Main Group

Select procedure group...

Sub Group

Select procedure sub-group...

Procedure Description

Select procedure...

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 savaniry 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 17

ACC/AHA and ESC/ESA
• Surgery Urgency
• Patient Exercise Capacity
• Surgery Severity
• Patient Specific risks / Comorbidities

ACC/AHA 214 and ESC/ESA
• Biomarkers
Guideline 18

- Biomarkers in ESC Guidelines 2009
  “a characteristic that can be objectively measured that is an indicator of pathology or an abnormal response to treatments”
  - Troponin: myocardial cell injury
  - BNP: myocardial wall stress increases
  - pro NT BNP
  - CRP: liver and smooth muscle

ESC, Biccard, Devereaux 2012
Guideline 19

- 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
Guideline 20

• Biomarkers in ESC Guidelines 2009
  All higher in patients that have postoperative cardiac events / die

  None recommended for routine screening

• Canadian use Preop BNP and postop Troponin

  Troponin
  BNP
  CRP
Assessing CVS disease: Together
Step 1
**Urgent surgery**

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

Step 2
**One of active or unstable cardiac conditions (table 9)**

Treatment options should be discussed in a multidisciplinary team, involving all peri-operative care physicians as interventions might have implication on anaesthesiological and surgical care. For instance in the presence of unstable angina, depending on the outcome of the discussion, patients can proceed for coronary artery intervention, with the initiation of dual antiplatelet therapy if the index surgical procedure can be delayed, or directly for operation if delay is impossible with optimal medical therapy.

Step 3
**Determine the risk of the surgical procedure (table 3)**

The consultant can identify risk factors and provide recommendations on lifestyle and medical therapy, according to the ESC Guidelines. In patients with one or more clinical risk factors, preoperative baseline ECG may be considered to monitor changes during the peri-operative period.

Step 4
**Consider the functional capacity of the patient**

In patients with one or more clinical risk factors, non-invasive stress testing may be considered.

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

In addition to suggestions above:

- In patients with one or more clinical risk factors, non-invasive stress testing may be considered.
- In patients with known IHD or myocardial ischaemia, initiation of a titrated low-dose beta-blocker regimen may be considered before surgery.
- In patients with heart failure and systolic dysfunction, ACEI should be considered before surgery.
- In patients undergoing vascular surgery, initiation of statin therapy should be considered.

Step 6
**Cardiac risk factors (table 4)**

- **Intermediate or high risk surgery**
  - In patients with one or more clinical risk factors, non-invasive stress testing may be considered.
  - In addition to suggestions above:
    - Rest echocardiography and biomarkers may be considered for evaluation of LV function and obtaining prognostic information for peri-operative and late cardiac events.

Step 7
**Interpretation of non-invasive stress test results**

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.

- **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.

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

- **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 (see also Table 8).**

**ESC/ESA 2014**

*Figure 3: Summary of pre-operative cardiac risk evaluation and perioperative management.*

**Table references:**
- Table 3: Determining the risk of the surgical procedure
- Table 4: Cardiac risk factors
- Table 8: Continuation or discontinuation of aspirin

**References:**
- ESC/ESA Guidelines
- Angiotensin converting enzyme inhibitor (ACEI)
- CABG = coronary artery bypass graft
- DES = drug-eluting stent
- ECG = electrocardiogram
- IHD = ischaemic heart disease
- MET = metabolic equivalent
AHA 2014

Fleisher, 2014
Guideline 21

1. Putting it together: **Urgency**
2. Emergency operation
3. Elective consider further
4. In between consider further
Guideline 22

Putting it together: 2 Active Cardiac Condition
Guideline 23

Putting it together: 2 Active Cardiac Condition

- **Serious’ = ‘active cardiac condition’**
  - Recent MI/Unstable Angina
  - Acute LVF
  - Serious abnormal rhythm
  - Severe valve disease
Guideline 24

Putting it together: 2 Active Cardiac Condition

Yes

Emergency → operation and Rx
Elective → pause & refer/lx/Rx
In between → pause & consider refer

No

Elective → consider further
In between → consider further
Guideline 25

Putting it together: 3 Operation risk
?Low risk surgery

Intermediate or higher
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 clinical trials—which provide the ideal evidence-base for the guidelines—are sparse. Consequently, when no trials are available on a specific cardiac-management regimen in the surgical setting, data from the non-surgical setting are extrapolated and similar recommendations made, but with different levels of evidence. Anaesthesiologists, who are experts on the specific demands of the proposed surgical procedure, will usually co-ordinate the pre-operative evaluation. The majority of patients with stable heart disease can undergo low and intermediate-risk surgery (Table 3) without additional evaluation. Selected patients require evaluation by a team of integrated multidisciplinary specialists including anaesthesiologists, cardiologists, and surgeons and, when appropriate, an extended team (e.g. internists, intensivists, pulmonologists or geriatricians).

Selected patients include those identified by the anaesthesiologist because of suspected or known cardiac disease with sufficient complexity to carry a potential perioperative risk (e.g. congenital heart disease, unstable symptoms or low functional capacity), patients in whom pre-operative medical optimization is expected to reduce perioperative risk before low- and intermediate-risk surgery, and patients with known or high risk of cardiac disease who are undergoing high-risk surgery. Guidelines have the potential to improve post-operative outcomes and highlight the existence of a clear opportunity for improving the quality of care in this high-risk group of patients. In addition to promoting an improvement in immediate perioperative care, guidelines should provide long-term advice.

Because of the availability of new evidence and the international impact of the controversy over the DECREASE trials, the ESC/ESA and American College of Cardiology/American Heart Association 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, except where international practice variation was prevalent.

Following publication of the respective guidelines, an objective evaluation of changes in outcome will form an essential part of future perioperative guideline development.

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

<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 asymptomatic (CEA or CAS)</td>
<td>• Open lower limb revascularization or amputation or thromboembolectomy</td>
</tr>
<tr>
<td>• Dental</td>
<td>• Peripheral arterial angioplasty</td>
<td>• Duodeno-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>• Oesphagectomy</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.

$^a$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.

$^b$Adapted from Glance et al.11
Guideline 26

Putting it together: 3 Operation risk

?Low risk surgery

Elective operation
In between operation

Intermediate or higher

Elective consider further
In between consider further
Guideline 27

Putting it together: **4 Exercise capacity > 4 METS** without symptoms......’probably’

- Elective  \(\rightarrow\) operation
- In between  \(\rightarrow\) operation

**Less than 4 METS or can’t tell**

- Elective  \(\rightarrow\) consider further
- In between  \(\rightarrow\) consider further
Guideline 28

Putting it together: 5 Intermediate risk factors
Guideline 29

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 30

Putting it together: 5 Intermediate risk factors

No intermediate risk factors → proceed

Any intermediate risk factors
  More factors increases risk
  proceed +/- ‘B Blockade’ or
  ‘consider testing if changes management’

Do risk score- more than 1%?
Guideline 31

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

? Calculate Cardiac Risk

“Consider testing” ACC/AHA

- Stress ECHO
- Myocardial Perfusion Scan
- CPET – includes Exercise ECG
- Exercise ECG
- MRI or CT
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
Routine Evaluation – NO
Dyspnea of unknown origin – reasonable
Ht Failure with \(\uparrow\) symptoms (1 yr) - reasonable
New murmur - reasonable
Ht Failure / Valves clinically stable – ‘not well established’

ACC/AHA 2009
CPET Background

Functional assessment
Population data – survival
Heart Failure Classification
VO\textsubscript{2} peak, AT, VE/VCO\textsubscript{2}, 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
Peak VO₂
3800ml/min O₂ uptake
80kg
3800/80 = 47.5ml/min/kg

VO₂ at Anaerobic T
1600ml/min O₂ uptake
80kg
1600/80 = 20ml/min/kg
suggests important physiological differences between the two tests. The duration of the peri-operative stress response after major surgery demands that it is sustained by aerobic metabolism [26]. While the anaerobic threshold is a marker of maximal aerobic capacity or oxidative

Table 4 Peri-operative mortality related to anaerobic threshold.

<table>
<thead>
<tr>
<th>First author (year) [reference]</th>
<th>Deaths in patients with anaerobic threshold &lt; 11 ml kg⁻¹.min⁻¹</th>
<th>Deaths in patients with anaerobic threshold ≥ 11 ml kg⁻¹.min⁻¹</th>
<th>Risk ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Older (1993) [2]</td>
<td>18% (10/55)</td>
<td>0.8% (1/132)</td>
<td>24 (3.1–183)</td>
</tr>
<tr>
<td>Older (1999) [3]</td>
<td>4.6% (7/153)</td>
<td>0.5% (2/395)</td>
<td>9 (1.9–43)</td>
</tr>
</tbody>
</table>

From Biccard 2005
<table>
<thead>
<tr>
<th>Complication</th>
<th>AT &lt; 10.1</th>
<th>AT &gt; 10.1</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>on day 7  n= 51</td>
<td>n=65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulmonary</td>
<td>57%</td>
<td>15%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Renal</td>
<td>40%</td>
<td>11%</td>
<td>0.0004</td>
</tr>
<tr>
<td>GI</td>
<td>33%</td>
<td>11%</td>
<td>0.005</td>
</tr>
<tr>
<td>Infective</td>
<td>27%</td>
<td>11%</td>
<td>0.003</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>25%</td>
<td>3%</td>
<td>0.0005</td>
</tr>
<tr>
<td>Neurological</td>
<td>10%</td>
<td>5%</td>
<td>0.29</td>
</tr>
<tr>
<td>Hematology</td>
<td>8%</td>
<td>0</td>
<td>0.04</td>
</tr>
<tr>
<td>Pain</td>
<td>8%</td>
<td>0</td>
<td>0.04</td>
</tr>
<tr>
<td>Wound</td>
<td>4%</td>
<td>0</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Snowden 2010
CPET use

“Cardiopulmonary exercise testing may be considered for patients undergoing elevated risk procedures in whom functional capacity is unknown”  AHA/ACC 2014

• Use very variable, increasing
• Enthusiasts vs sceptics
• Probably best not to emphasise single value
  – VO₂ peak, AT, VE/VCO₂, ECG ischaemia
• ATS/ACCP 2001
  “helpful in objectively assessing the adequacy of CV reserve and in predicting CV risk in elderly”
• ESC 2009’
  “not established role in preoperative assessment”
www.ucl.ac.uk/anaesthesia/research/CPET

Google UCL CPEX

CARDIO PULMONARY EXERCISE TEST: CPET

Aims: to accurately measure exercise capacity for clinical use and research

What is CPET?
Cardio pulmonary Exercise Testing (CPET) is a non-invasive simultaneous measurement of the cardiovascular and respiratory system during exercise to assess a patient’s exercise capacity.

How to refer
Please download + print/email this referral form to ucl-tr.CPEXref@nhs.net

Mobile Number 07849 016074
Landline 020 3447 2838

Why do a CPET?
CPET is used for many specific reasons, but in general it can
- help estimate risk for patients undergoing surgery
- be useful in investigating breathlessness
- be used in exercise programmes to increase fitness

Patients: What does it involve for you?

Patients please click here to see our YOU tube guide!

Before the test- please don’t eat for 2 hours and drink no coffee or tea for 4 hours. Take all your normal medicines as usual.

When you arrive we will ask you about your medical history and what exercise you’re normally able to do, and ask your permission to record your data for research and audit use.

We take baseline observations and a blood test. You wear a mask to allow us to measure the gas you breathe in and out.

Once seated on the bike, we ask you to start cycling. The bike then gets harder to cycle-
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?

MORTALITY

All

Bisoprolol
  DECREASE (n=1178)
  BBSA (n=219)

Metoprolol
  POBBLE (n=103)
  DIPOM (n=921)
  MaVS (n=496)
  POISE (n=8351)

Atenolol
  Mangano (n=200)

OR (95% CI)

ESC 2009
The POISE trial randomized 8351 patients to metoprolol succinate or placebo. 78 Patients were aged \( \geq 45 \) years and had known CVD, or at least three of seven clinical risk factors for high-risk surgery, or were scheduled for major vascular surgery. Treatment consisted of metoprolol succinate 100 mg 2–4 hours before surgery, 100 mg during the first 6 hours after surgery, but medication was withheld if systolic blood pressure dipped below 100 mm Hg. Maintenance therapy started 12 hours later, bringing the total dose of metoprolol succinate in the first 24 hours to 400 mg in some patients. There was a 17% decrease in the primary composite endpoint of death, myocardial infarction, or non-fatal cardiac arrest at 30 days (5.8% vs. 6.9%; \( P = 0.04 \)); however, the 30% decrease in non-fatal myocardial infarction (3.6% vs. 5.1%; \( P = 0.001 \)) was offset by a 33% increase in total mortality (3.1% vs. 2.3%; \( P = 0.03 \)) and a doubling of stroke incidence (1.0% vs. 0.5%; \( P = 0.005 \)). Hypotension was more frequent with metoprolol (15.0% vs. 9.7%; \( P = 0.0001 \)).

Post-hoc analysis showed that hypotension carried the greatest attributable risk of death and stroke.

Eight meta-analyses have pooled 9, 25, 5, 11, 6, 8, 22, and 33 published, randomized trials on perioperative beta-blockers, totalling, respectively, 10 529, 12 928, 586, 866, 632, 2437, 2057, and 12 306 patients. Four meta-analyses showed a significant reduction in perioperative myocardial ischaemia and myocardial infarction in patients receiving beta-blockers, this being more marked in high-risk patients. Two meta-analyses showed no significant reduction in perioperative myocardial infarction or cardiac mortality in patients receiving beta-blockers.

These meta-analyses (except the two most recent ones) have been criticized because of heterogeneity of included studies and types of surgery, inclusion of studies of the DECREASE family, imprecision regarding patients' cardiac risk profiles, and variable timing of beta-blocker administrations, doses, and targets. The recent POISE trial had the greatest weight in all of these analyses. In POISE, all-cause mortality increased by 33% in patients receiving beta-blockers; perioperative death in patients receiving metoprolol succinate were associated with perioperative hypotension, bradycardia, and stroke. A history of cerebrovascular disease was associated with an increased risk of stroke. Hypotension was related to high-dose metoprolol without dose titration.

In a meta-analysis that excluded the DECREASE trials, perioperative beta-blockade was associated with a statistically significant 27% (95% CI 1–60) increase in mortality (nine trials, 10 529 patients) but the POISE trial again largely explained this result, and also the reduced incidence of non-fatal myocardial infarction and increased incidence of non-fatal strokes. Another recent meta-analysis, involving 12 928 patients, examined the influence of beta-blockade on all-

### Table 5  Summary of randomized, controlled trials evaluating the effect of peri-operative beta-blockade on post-operative mortality and non-fatal myocardial infarction

<table>
<thead>
<tr>
<th>Study</th>
<th>n</th>
<th>Vascular Surgery (%)</th>
<th>Beta-blocker</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.⁸³</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 (5.1⁴)</td>
<td>10/101 (9.9⁴)</td>
</tr>
<tr>
<td>POBBLE⁸²</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>MaVS⁸⁰</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>DIPOM⁸¹</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>BBSA⁷⁹</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>POISE⁷⁸</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 (3.1⁵)</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; MaVS = Metoprolol after Vascular Surgery; MI = myocardial infarction; POBBLE = PeriOperative Beta-BlockadE; POISE = PeriOperative ISchemic Evaluation.

⁴At 6 months and including in-hospital deaths.

⁵\( p = 0.0317 \).

⁶\( p = 0.0008 \).
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

<table>
<thead>
<tr>
<th>Event</th>
<th>Metoprolol (%)</th>
<th>Placebo (%)</th>
<th>Odds Ratio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MI</td>
<td>4.2%</td>
<td>5.7%</td>
<td>0.84</td>
<td>p=0.002</td>
</tr>
<tr>
<td>Deaths</td>
<td>3.1%</td>
<td>2.3%</td>
<td>1.33</td>
<td>p=0.03</td>
</tr>
<tr>
<td>Stroke</td>
<td>1.0%</td>
<td>0.5%</td>
<td>2.17</td>
<td>p=0.005</td>
</tr>
<tr>
<td>↓BP</td>
<td>15.0%</td>
<td>9.7%</td>
<td>p &lt; 0.0001</td>
<td></td>
</tr>
<tr>
<td>Bradycardia</td>
<td>6.6%</td>
<td>2.4%</td>
<td>p &lt; 0.0001</td>
<td></td>
</tr>
</tbody>
</table>

Devereaux
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
Homeopathy Safe Medicine

Searching for safe medicine. Exposing dangerous drugs and vaccines.

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 WDDTV article, click here, and taken from the European Heart Journal) has been written this year - like this. ‘New Evidence Shows 800,000 Deaths’.
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
Contents

• Introduction
• Basic Principles
• Guidelines: Decisions + Putting it all together
• Which test?
• ECHO
• CPEx
• B Block?
• Summary

- Surgery Urgency
- Patient Exercise Capacity
- Surgery Severity
- Patient Specific risks / Comorbidities
- Biomarkers
Thank you

For listening

Please Google ‘stephens UCL’ for website

This full talk

All Guidelines

Some References
CPET Background

n=548

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