



The Cardiological Management of the Surgical Patient

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I HAVE NO DECLARATIONS OF INTEREST TO MAKE

Cardiac Conditions and Perioperative Risk

- ▶ Unstable Cardiac Conditions result in very high risk
 - ▶ ACS within 30 days
 - ▶ Decompensated Heart Failure
 - ▶ Significant valve disease (AS)
 - ▶ High Grade Dysrhythmias
- ▶ IHD and HF are independent perioperative risk factors
- ▶ 1/3 perioperative deaths cardiac
 - ▶ Fatal MI: 2/3 LMS or 3VD; only 1/3 thrombus

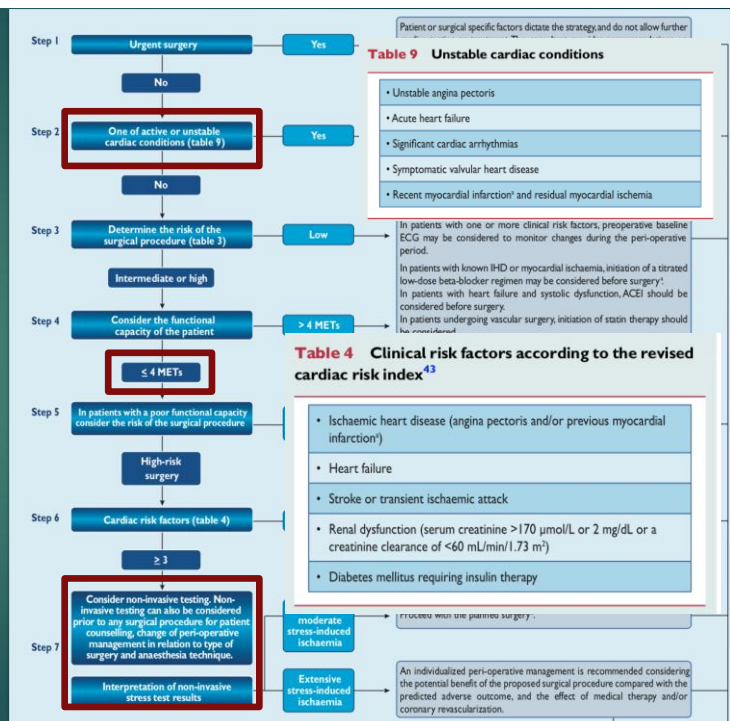
20 minutes Focusses Even the Cardiologist's Mind

- ▶ The Cardiologist and Preoperative Cardiac Risk Assessment
- ▶ Dual Anti Platelet Therapy (DAPT)
- ▶ Heart Failure
- ▶ Pacemakers and Devices
- ▶ Valvular Heart Disease

Preoperative Cardiovascular Risk Stratification and the Cardiologist

CARDIOLOGY OPINION?

- ▶ Cardiac concerns after patient review
 - ▶ Angina?
 - ▶ Syncope/Palpitations?
 - ▶ SOB/OE/Orthopnoea?
- ▶ ECG Abnormality
 - ▶ > low risk
- ▶ Echo Abnormality
 - ▶ Murmur
 - ▶ SOB/OE ? cause
 - ▶ Known HF



Stress Imaging

Multiple studies show moderate/large areas ischaemia predict perioperative risk
 A normal study has a very high NPV for MI/Death
 RCTs have not demonstrated that intervention improves perioperative outcomes

Recommendations on imaging stress testing before surgery in asymptomatic patients

Recommendations	Class ^a	Level ^b
Imaging stress testing is recommended before high-risk surgery in patients with more than two clinical risk factors and poor functional capacity (<4 METs). ^c	I	C
Imaging stress testing may be considered before high- or intermediate-risk surgery in patients with one or two clinical risk factors and poor functional capacity (<4 METs). ^c	IIb	C
Imaging stress testing is not recommended before low-risk surgery, regardless of the patient's clinical risk.	III	C

5.5. Pharmacological Stress Testing

5.5.1. Noninvasive Pharmacological Stress Testing Before Noncardiac Surgery: Recommendations

Class IIa

1. It is reasonable for patients who are at an elevated risk for noncardiac surgery and have poor functional capacity (<4 METs) to undergo noninvasive pharmacological stress testing (either dobutamine stress echocardiogram [DSE] or pharmacological stress MPI) if it will change management.¹⁸³⁻¹⁸⁷ (Level of Evidence: B)

Class III: No Benefit

1. Routine screening with noninvasive stress testing is not useful for patients undergoing low-risk noncardiac surgery.^{165,166} (Level of Evidence: B)

Preop Revascularisation of the Stable Patient

6.1. Coronary Revascularization Before Noncardiac Surgery: Recommendations

Class I

1. Revascularization before noncardiac surgery is recommended in circumstances in which revascularization is indicated according to existing CPGs.^{25,26} (Level of Evidence: C) (See Table A in Appendix 3 for related recommendations.)

Class III: No Benefit

1. It is not recommended that routine coronary revascularization be performed before noncardiac surgery exclusively to reduce perioperative cardiac events.¹¹⁶ (Level of Evidence: B)

Recommendations	Class ^a	Level ^b	Ref. ^c
Performance of myocardial revascularization is recommended according to the applicable guidelines for management in stable coronary artery disease.	I	B	56
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	147
Routine prophylactic myocardial revascularization before low- and intermediate-risk surgery in patients with proven IHD is not recommended.	III	B	152

Don't Revascularise just for surgery.
 Only revascularize if delay reasonable
 ACC: If CABG needed do before surgery, PCI only if LMS disease
 ESC: 'Revasc does not confer benefits vs OMT perioperatively
 MDT: Weigh the risks vs benefits of undergoing BOTH procedures

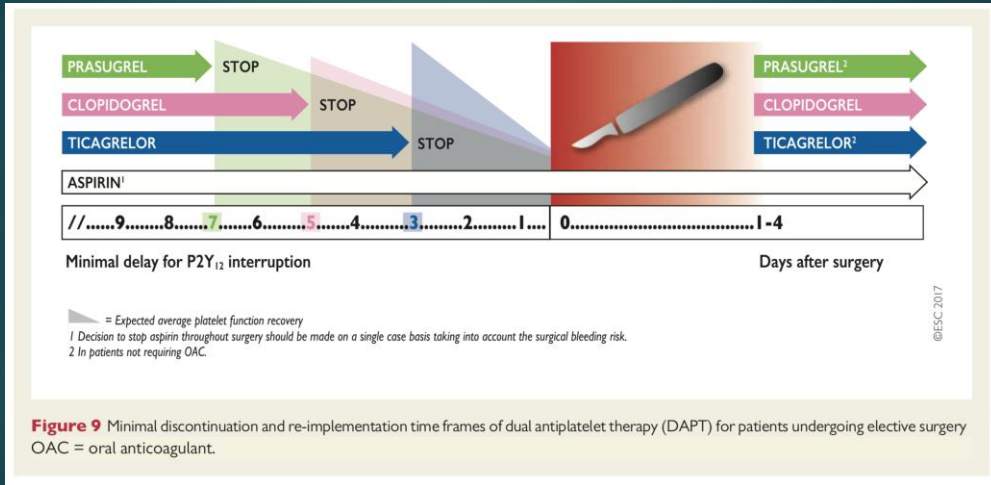
Dual Antiplatelet Therapy (DAPT)

- ▶ 5-10% post stent are considered for surgery within 12 months
- ▶ Premature cessation DAPT is the major predictor of stent thrombosis
- ▶ Current DES have lower thrombosis rate and shorter DAPT duration requirements
- ▶ No randomized data regarding premature DAPT interruption
- ▶ Multiple observational studies: suggest thrombosis risk plateaus at 3-6 months
- ▶ 2 Cohort studies (2016) in DES suggested excess risk was within first 1 month
 - ▶ 50% were post ACS
- ▶ DAPT decisions case by case by MDT: Cardiologist/Surgeon/Anaesthetist
 - ▶ Risk of Stent thrombosis vs delay vs bleed risk with DAPT/SAPT continuation

ESC Focused Update on DAPT 2017

- ▶ Elective non-cardiac surgery in patients on DAPT
 - ▶ Postpone unless essential
- ▶ Stent After Surgery Group have classified Bleeding Risk by surgery
 - ▶ EuroIntervention 2014; 10: 38-46
 - ▶ Low bleed risk: Continue DAPT
 - ▶ Mod bleed risk : Continue SAPT
 - ▶ High bleed risk : Stop DAPT for minimum time
 - ▶ Vascular reconstructions, complex visceral, neurosurgery, transbronchial, TURP, intraocular

Stop Drugs for the Minimum Time



ESC IIa B. Restart within 48 hours (MDT approach)

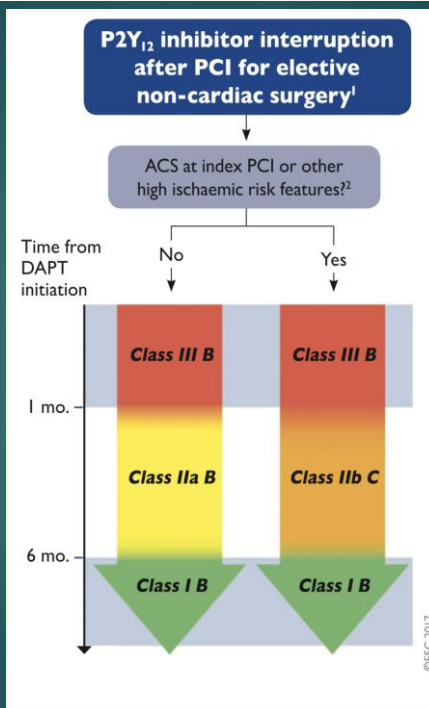
ESC 2017 Focused Update on DAPT

If both stopped < 1 month

Consider :

Intravenous P2Y12 inhibitor
 Cangrelor IIb C

Hospital with 24 hour PCI



In patients at high ischaemic risk

Wait 6 months if possible

ACS or..

Table 5 High-risk features of stent-driven recurrent ischaemic events

• Prior stent thrombosis on adequate antiplatelet therapy
• Stenting of the last remaining patent coronary artery
• Diffuse multivessel disease especially in diabetic patients
• Chronic kidney disease (i.e. creatinine clearance <60 mL/min)
• At least three stents implanted
• At least three lesions treated
• Bifurcation with two stents implanted
• Total stent length >60 mm
• Treatment of a chronic total occlusion

Heart Failure

- ▶ 1-2 % population but ≥ 10 % if aged ≥ 70 years
- ▶ HF is a recognized risk factor for cardiac events
- ▶ Medicare Registry Data (2004) 160,000 procedures in patients ≥ 65
 - ▶ 18% had HF
 - ▶ 30d mortality and readmission rate 50-100% increased
- ▶ Cohort Study (2011) 38,047 patients
 - ▶ 30d Mortality HF 9.3% vs CAD 2.9%
- ▶ Worse perioperative outcomes associated with:
 - ▶ Decompensated HF/Signs HF/Poor functional status
 - ▶ Severe LVSD EF $\leq 30-35\%$
 - ▶ Elevated NT pro BNP levels

Preoperative Evaluation of Heart Failure

- ▶ Identify HF by Hx and Exam
 - ▶ NYHA class
 - ▶ PND/Orthopnoea
 - ▶ Oedema, JVP, S3
- ▶ Assess the risk
 - ▶ Cause and severity / stability HF
 - ▶ Presence of other cardiac risk factors
 - ▶ Urgency/Type of Surgery
- ▶ Investigations
 - ▶ ECG +/- BNP
 - ▶ Echo: SOBOE ? Cause or worsening symptoms

Recommendations on heart failure

Recommendations	Class ^a	Level ^b	Ref. ^c
It is recommended that patients with established or suspected heart failure, and who are scheduled for non-cardiac intermediate or high-risk surgery, undergo evaluation of LV function with transthoracic echocardiography and/or assessment of natriuretic peptides, unless they have recently been assessed for these.	I	A	55,165, 167,175,176

Heart Failure Recommendations

- ▶ If for high/intermediate risk surgery
 - ▶ Optimize with ACE/ARB, BB, MRA, diuretics preoperatively ESC I A
 - ▶ Avoid rapid preoperative BB and ACE ESC III B
 - ▶ Defer non-urgent surgery at least 3 months to allow optimization ESC I C
 - ▶ Consider CRT-P/D therapy preop

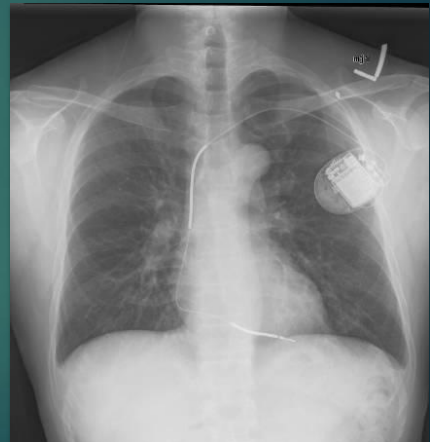
- ▶ Continue BB (and ACE) perioperatively ESC IC
 - ▶ If concerns re hypotension consider holding ACE/ARB on day of/before surgery

- ▶ Restart ACE/ARB as soon as clinically possible
 - ▶ Failure to restart within 48 hrs associated with increased 30d mortality

- ▶ HF MDT follow up recommended by ESC

Pacemakers / Devices

- ▶ Electrocautery
 - ▶ Inhibit a demand pacemaker with asystole
 - ▶ May be misinterpreted resulting in ICD shock
 - ▶ Less common
 - ▶ Tachycardia
 - ▶ Reset to factory settings
 - ▶ Total device failure (older devices)
- ▶ Proximity
 - ▶ Above the umbilicus
- ▶ Other Sources of Interference
 - ▶ Nerve stimulators, lithotripsy
 - ▶ Mechanical: central lines, Bone saws



Routine Perioperative Device Management

- ▶ Consult with Pacing Team Preoperatively
 - ▶ If Electromagnetic Interference anticipated
 - ▶ If patient movement from ICD shock dangerous eg: intraocular surgery
- ▶ Pacing Dependent?
 - ▶ Reprogram preop to asynchronous (non-sensing) mode
 - ▶ Asynchronous mode may lose AV synch and CRT
- ▶ ICD?
 - ▶ Program AT therapy off for surgery (and back on in recovery)
 - ▶ If Pacing dependent set to non sensing mode
 - ▶ Continuous monitoring required while off
 - ▶ External Defibrillator must be immediately available
- ▶ Post procedure check to ensure programming and thresholds

Urgent Surgery Device Management

- ▶ If all beats paced on the ECG assume pacing dependent
- ▶ Magnet
 - ▶ Pacemakers: Most pace asynchronously (may be programmed off)
 - ▶ ICDs: Most suspend ATP (may be programmed off)
 - ▶ NO EFFECT ON PACING
 - ▶ Continuous monitoring until reset
 - ▶ MHRA cautions re use of magnet
- ▶ VF?
 - ▶ Stop Electrocautery
 - ▶ Remove magnet to ICD shock
 - ▶ If this fails external shock



Aortic Stenosis

- ▶ Commonest valve disease
 - ▶ 1-2% 65-75 and 5% ≥ 75
- ▶ Associated Coronary Disease common
 - ▶ 50% aged if angina and 20% without chest pain
- ▶ Symptoms develop late
- ▶ Fixed obstruction, LVH and high LVEDP mean:
 - ▶ Predisposed to ischaemia
 - ▶ Intolerant of tachycardia/loss of SR
 - ▶ Reductions in SVR
 - ▶ Reductions in preload
 - ▶ Mechanoreceptor mediated brady/vasodilation
- ▶ Severe AS ECHO: Velocity ≥ 4 m/sec Mean P 40 mm Hg AVA ≤ 1 cm²

Perioperative Risk

- ▶ Risk of cardiac complications with severe AS is approximately 10-30%
- ▶ Risk of mortality with severe AS and Int/High risk surgery 6-10%
- ▶ Mayo Clinic 256 patients SAS vs controls Int-High risk surgery 2000-2010:
 - ▶ 30d mort 5.9% vs 3.1% NS
 - ▶ Symptomatic severe vs asymptomatic mortality 9.4% vs 3.3%
 - ▶ Severe AS more adverse events (HF) 18.8% vs 10.5%
 - ▶ Symptomatic vs asymptomatic: 28.3% vs 12%
 - ▶ Emergency surgery, AF and Cr > 177 $\mu\text{mol/L}$ predictors of death

Assessment/Recognition

- ▶ Evaluate symptoms and signs
- ▶ Preop ECHO for AS and LV is needed to assess severity
 - ▶ (If new, change symptoms, no echo in last year)
- ▶ Consider evidence of co-existing CAD and other cardiac risks
 - ▶ If angina or HF investigate for CAD
- ▶ Estimation of the risk of surgery
 - ▶ Symptoms
 - ▶ Additional Cardiac Risk Factors
 - ▶ Presence of Moderate/Severe MR

Recommendations for Aortic Stenosis ESC 2014

- ▶ Echo all with known/suspected valve disease pre Int/High risk ES I C
- ▶ Elective Low/Int NC surgery should be considered in asympt SAS IIa C
- ▶ AVR recommended for symptomatic SAS pre elective surgery I B
- ▶ AVR considered for asymptomatic SAS pre high risk ES IIa C
- ▶ Consider TAVI/BAP if severe symptomatic not suitable AVR IIa C
- ▶ Only essential surgery if symptomatic SAS not suitable for AVR

Other Valvular Heart Disease

- ▶ Mitral Stenosis
 - ▶ Low risk
 - ▶ Mild (VA > 1.5 cm²)
 - ▶ Severe (VA < 1.5 cm²) IF asymptomatic AND PAP < 50 mm Hg
 - ▶ High risk
 - ▶ Severe AND symptomatic OR PAP > 50 mm Hg
 - ▶ Consider valve surgery pre Int/High risk surgery ESC IIa C
- ▶ Fluid overload, hypotension and tachycardia are poorly tolerated

Other Valvular Heart Disease

- ▶ Aortic or Mitral Regurgitation
 - ▶ Low risk
 - ▶ Asymptomatic severe AR/MR with normal LV function ESC IIa C
 - ▶ High Risk avoid surgery if possible
 - ▶ Severe and Symptomatic
 - ▶ Severe and Asymptomatic with EF < 30%
- ▶ Optimize HF for 3/12 pre Int/High Risk Surgery ESC I C



Prosthetic Valves

- ▶ Thromboembolic risk highest first 3 months
- ▶ Minor procedures/low bleed risk
 - ▶ Continue anticoagulation
- ▶ Major Procedures
 - ▶ Stop warfarin 3-5 days
 - ▶ Restart ASAP usually 12-24 hours

Prosthetic Valves Bridging Anticoagulation

- ▶ Mechanical MVR or TVR
- ▶ Old generation Mechanical AVR
- ▶ Modern Mechanical AVR + elevated embolic risk
 - ▶ AF, previous embolism, LV <30%, >1 mechanical valve
- ▶ IV heparin APTT 1.5-2 x control, stop 4-6 hours preop
- ▶ LMWH 1 mg /kg enoxaparin 12 hourly last dose 24 hours preop
- ▶ Resumption at 24 hours (48-72 if high bleed risk)

AF

- ▶ AF common:
- ▶ Studies suggest that presence of AF bestows 30d mortality twice IHD
 - ▶ 6.4% vs 2.9% in large Canadian Study of 38,000 patients
- ▶ Rate control HR 50-100
 - ▶ <120 preop??
 - ▶ BB > CCB > Digoxin
- ▶ Cardioversion generally mandates 4 weeks anticoagulation
- ▶ Cessation of anticoagulation
 - ▶ Complex: Follow locally agreed guidelines
 - ▶ Depends on NOAC, Cr, Bleeding Risk
- ▶ Preop:
 - ▶ Suggest postpone elective and review (unless minor surgery and asymptomatic)
 - ▶ Query hypertension or thyrotoxicosis or other as cause

AF

- ▶ Intra-operative
 - ▶ Unstable: DCV
 - ▶ Rate control BB or CCB aim HR < 100-110
 - ▶ Esmolol, Metoprolol
 - ▶ Diltiazem
- ▶ Post op: 0.4-3%
 - ▶ Treat correctables: Elecs, Hypoxia, Acidosis, Infection, Pain, Volume
 - ▶ > 50% revert spontaneously in 24 hours
 - ▶ Cardioversion vs Rate control within 48 hours
 - ▶ Anticoagulation?
 - ▶ Not if single episode < 24-48 hours
 - ▶ If longer/multiple follw chads2vasc and give 4 weeks? Then review

ESC Revascularisation Guidelines 2018

Indications for revascularization in patients with stable angina or silent ischaemia

Extent of CAD (anatomical and/or functional)		Class ^a	Level ^b
For prognosis	Left main disease with stenosis >50%. ^{c 68-71}	I	A
	Proximal LAD stenosis >50%. ^{c 62,68,70,72}	I	A
	Two- or three-vessel disease with stenosis >50% with impaired LV function (LVEF ≤35%). ^{c 61,62,68,70,73-83}	I	A
	Large area of ischaemia detected by functional testing (>10% LV) or abnormal invasive FFR. ^{d 24,59,84-90}	I	B
	Single remaining patent coronary artery with stenosis >50%. ^c	I	C
For symptoms	Haemodynamically significant coronary stenosis ^c in the presence of limiting angina or angina equivalent, with insufficient response to optimized medical therapy. ^{e 24,63,91-97}	I	A