

# Pre-operative Assessment of Cardiac Patients with Valvular Heart Disease, Arrhythmia and Pacemaker



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## Purpose of Preoperative Evaluation



- Evaluate patient's current medical status
- Provide clinical risk profile
- Recommend management of cardiac risk over entire perioperative period
- Treatment of modifiable risk factors

## Role of the Consultant



- Review available patient data, history and physical examination.
- Determine if further testing is needed to define cardiovascular status.
- Recommend treatment to improve medical condition.
- Preoperative testing recommended only if it will change surgical care or perioperative medical therapy.

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## General Approach to the Patient



- History – angina, recent or past MI, HF, symptomatic arrhythmias, presence of pacemaker or ICD.
- Physical Examination – general appearance, rales, elevated JVP, carotid and other arterial pulses, S<sup>3</sup> gallop, murmurs.
- Co morbid Diseases
  - Pulmonary
  - Diabetes Mellitus
  - Renal Impairment
  - Hematologic Disorders
- Ancillary Studies - ECG almost always indicated, blood chemistries and chest X-ray based on history and physical findings.

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## Clinical Predictors of Increased Perioperative Cardiovascular Risk



- Major
  - Unstable coronary syndromes
  - Decompensated CHF
  - Significant Arrhythmias
- Intermediate
  - Mild angina pectoris
  - Prior MI
  - Compensated or prior HF
  - Diabetes Mellitus (particularly taking insulin)
  - Renal insufficiency
- Minor
  - Advanced Age.
  - Abnormal ECG.
  - Rhythm other than sinus.
  - Low functional capacity.
  - History of stroke.
  - Uncontrolled systemic hypertension

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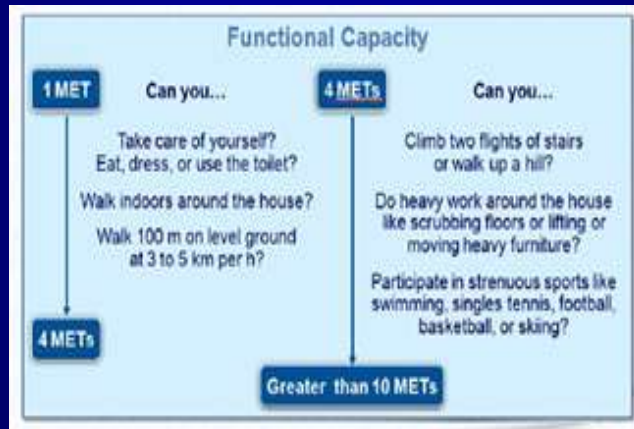
## Risk of surgical procedure 30 days CV death and MI



Low-risk: < 1%	Intermediate-risk: 1-5%	High-risk: > 5%
<ul style="list-style-type: none"> <li>• Superficial surgery</li> <li>• Breast</li> <li>• Dental</li> <li>• Endocrine: thyroid</li> <li>• Eye</li> <li>• Reconstructive</li> <li>• Carotid asymptomatic (CEA or CAS)</li> <li>• Gynecology: minor</li> <li>• Orthopaedic: minor (meniscectomy)</li> <li>• Urological: minor (transurethral resection of the prostate)</li> </ul>	<ul style="list-style-type: none"> <li>• Intra-abdominal: splenectomy, hiatal hernia repair, cholecystectomy</li> <li>• Carotid symptomatic (CEA or CAS)</li> <li>• Peripheral arterial angioplasty</li> <li>• Endovascular aneurysm repair</li> <li>• Head and neck surgery</li> <li>• Neurological or orthopaedic: major (hip and spine surgery)</li> <li>• Urological or gynaecological: major</li> <li>• Renal transplant</li> <li>• Intra-thoracic: non-major</li> </ul>	<ul style="list-style-type: none"> <li>• Aortic and major vascular surgery</li> <li>• Open lower limb revascularization or amputation or thromboembolism</li> <li>• Duodeno-pancreatic surgery</li> <li>• Liver resection, bile duct surgery</li> <li>• Oesophagectomy</li> <li>• Repair of perforated bowel</li> <li>• Adrenal resection</li> <li>• Total cystectomy</li> <li>• Pneumonectomy</li> <li>• Pulmonary or liver transplant</li> </ul>

ESC guidelines based on Glance LG et al. The Surgical Mortality Probability Model: derivation and validation of a simple risk prediction rule for noncardiac surgery. Ann Surg 2012;255:696–702

## Function capacity of the patient scheduled for intermediate to high risk surgery



ESC guidelines based on Fletcher GF et al. Exercise standards for testing and training: A statement for healthcare professionals from the American Heart Association. Circulation 2001;104:1694-1740



## Valvular Heart Disease

## Valvular heart disease



- Patients with VHD are at increased risk of peri-operative cardiovascular complications during non-cardiac surgery.
- The risk is highly variable, according to the type and severity of VHD as well as the type of non cardiac surgery

ESC guidelines based on Vahanian A, et al. Guidelines on the management of valvular heart disease (version 2012): The Joint Task Force on the Management of Valvular Heart Disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). Eur Heart J 2012;33:2451–2496

## Valvular heart disease



The key issues are to assess the severity of VHD, the symptoms and their relationship to VHD, and the estimated risks of valvular intervention and of cardiac complications according to the type of non-cardiac surgery

## Patient evaluation



- Echocardiography in order to assess:
  - severity and consequences.
  - In case of severe VHD.
- it is recommended that condition is to be treated before non-cardiac surgery.

Recommendations	Class <sup>a</sup>	Level <sup>b</sup>	Ref. <sup>c</sup>
Clinical and echocardiographic evaluation is recommended in all patients with known or suspected VHD, who are scheduled for elective intermediate or high-risk non-cardiac surgery.	I	C	

## Aortic Stenosis



Severe aortic stenosis is defined according to an integrative approach taking into account:

valve area ( $\leq 1.0$  cm<sup>2</sup> or  $0.6$  cm<sup>2</sup>/m<sup>2</sup> body surface area, except in obese patients), (maximum jet velocity 4 m/sec and mean aortic pressure gradient  $\geq 40$  mmHg).

## Aortic Stenosis



Severe AS is associated with an increased risk for non-cardiac surgery, depending on:

- the specific degree of valve narrowing.
- LV systolic function,
- concurrent CAD,
- and other risk factors for surgery.

ESC guidelines based on Vahanian A, et al. Guidelines on the management of valvular heart disease (version 2012): The Joint Task Force on the Management of Valvular Heart Disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). Eur Heart J 2012;33:2451–2496

## Aortic Stenosis



- The estimated rate of cardiac complications in patients with undiagnosed severe AS undergoing non-cardiac surgery is 10% to 30%.
- AS is present in 1% to 2% of all patients >65 years of age and 3% to 8% of all patients >75 years of age.

ESC guidelines based on Vahanian A, et al. Guidelines on the management of valvular heart disease (version 2012): The Joint Task Force on the Management of Valvular Heart Disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). Eur Heart J 2012;33:2451–2496

## Aortic Stenosis



- In the case of urgent non-cardiac surgery in patients with severe aortic stenosis, such procedures should be performed under more invasive haemodynamic monitoring, avoiding rapid changes in volume status and heart rhythm as far as possible.
- In the case of elective non-cardiac surgery, the presence of symptoms is essential for decision-making.

## Aortic Stenosis



- In symptomatic patients, aortic valve replacement should be considered before elective surgery.
- In patients who are not candidates for valve replacement, due either to high risks associated with serious comorbidities or refusal to undergo the operation, non cardiac surgery should be performed only if is essential.

I	B	69
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Aortic valve replacement is recommended in symptomatic patients with severe aortic stenosis, who are scheduled for elective non-cardiac surgery, provided that they are not at high risk of an adverse outcome from for valvular surgery.

ESC guidelines based on Vahanian A, et al. Guidelines on the management of valvular heart disease (version 2012): The Joint Task Force on the Management of Valvular Heart Disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). Eur Heart J 2012;33:2451–2496



## Aortic Stenosis



- In patients at high risk or contra indicated for aortic valve replacement, balloon aortic valvuloplasty or, preferably, transcatheter aortic valve implantation (TAVI) may be a reasonable therapeutic option before surgery.
- The choice between balloon aortic valvuloplasty and TAVI should take into account the impact of non-cardiac disease on life expectancy and the degree of urgency of the non-cardiac surgery.

In symptomatic patients with severe aortic stenosis who are scheduled for elective non-cardiac surgery, TAVI or balloon aortic valvuloplasty should be considered by the expert team if they are at high risk of an adverse outcome from for valvular surgery.

IIa	C
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ESC guidelines based on Vahanian A, et al. Guidelines on the management of valvular heart disease (version 2012): The Joint Task Force on the Management of Valvular Heart Disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). Eur Heart J 2012;33:2451–2496

## Aortic Stenosis



- In asymptomatic patients, non-cardiac surgery of low to intermediate risk can be performed safely; If possible, the absence of symptoms should be confirmed by exercise testing.
- If high-risk surgery is planned, further clinical assessment is necessary to assess the risk of aortic valve replacement.

Aortic valve replacement should be considered in asymptomatic patients with severe aortic stenosis, who are scheduled for elective high-risk non-cardiac surgery, provided that they are not at high risk of an adverse outcome from for valvular surgery.

IIa	C
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Elective low or intermediate-risk non-cardiac surgery should be considered in asymptomatic patients with severe aortic stenosis if there has been no previous intervention on the aortic valve.

IIa	C
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ESC guidelines based on Calleja AM et al. Cardiac risk in patients aged >75 years with asymptomatic severe aortic stenosis undergoing noncardiac surgery. Am J Cardiol 2010;105:1159–1163

## Mitral stenosis



- Non-cardiac surgery can be performed with relatively low levels of risk in patients with:
  - Non-significant mitral stenosis (valve area  $>1.5$  cm<sup>2</sup>).
  - Asymptomatic patients with (valve area  $\leq 1.5$  cm<sup>2</sup>) and systolic pulmonary artery pressure  $\leq 50$  mm Hg.
- Pre-operative surgical in these patients is not indicated.
- Control of heart rate is essential to avoid tachycardia, which may cause pulmonary oedema.
- Attentive control of fluid overload is also important.
- Development of AF may be associated with high risk of embolism, anticoagulation control is important.

ESC guidelines based on Vahanian A, et al. Guidelines on the management of valvular heart disease (version 2012): The Joint Task Force on the Management of Valvular Heart Disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). Eur Heart J 2012;33:2451–2496

## Mitral stenosis



In asymptomatic patients with significant mitral stenosis and systolic pulmonary artery pressure  $>50$  mm Hg, and in symptomatic patients, the risk related to the non-cardiac procedure is significantly higher, and these patients may benefit from percutaneous mitral commissurotomy (or open surgical repair) particularly before high-risk surgery.

Percutaneous mitral commissurotomy should be considered in patients with severe mitral stenosis, who have symptoms of pulmonary hypertension and are scheduled for elective intermediate- or high-risk non-cardiac surgery.	IIa	C

ESC guidelines based on Vahanian A, et al. Guidelines on the management of valvular heart disease (version 2012): The Joint Task Force on the Management of Valvular Heart Disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). Eur Heart J 2012;33:2451–2496

## Primary aortic regurgitation and mitral regurgitation



- Non-significant aortic regurgitation and mitral regurgitation do not independently increase the risk of cardiovascular complications during non-cardiac surgery.
- In asymptomatic patients with severe aortic or mitral regurgitation and preserved LV function, non-cardiac surgery can be performed without additional risk.

## Primary aortic regurgitation and mitral regurgitation



Symptomatic patients and those who are asymptomatic with severely impaired LVEF (<30%)—are at high risk of cardiovascular complications, and non-cardiac surgery should be performed only if necessary.

Patients with severe aortic or mitral regurgitation and heart failure may benefit from optimization of pharmacological therapy to produce maximal haemodynamic stabilization before undergoing high-risk surgery

ESC guidelines based on Vahanian A, et al. Guidelines on the management of valvular heart disease (version 2012): The Joint Task Force on the Management of Valvular Heart Disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). Eur Heart J 2012;33:2451–2496

## Secondary mitral regurgitation



- those patients should undergo peri-operative evaluation and management according to the recommendations for LV systolic dysfunction and, if secondary mitral regurgitation is due to IHD, those for IHD.
- Because secondary mitral regurgitation is variable according to loading conditions, particular attention should be paid to the assessment of volume status and heart rhythm during the perioperative period

Elective non-cardiac surgery should be considered in patients with severe valvular regurgitation, who do not have severe heart failure or LV dysfunction.

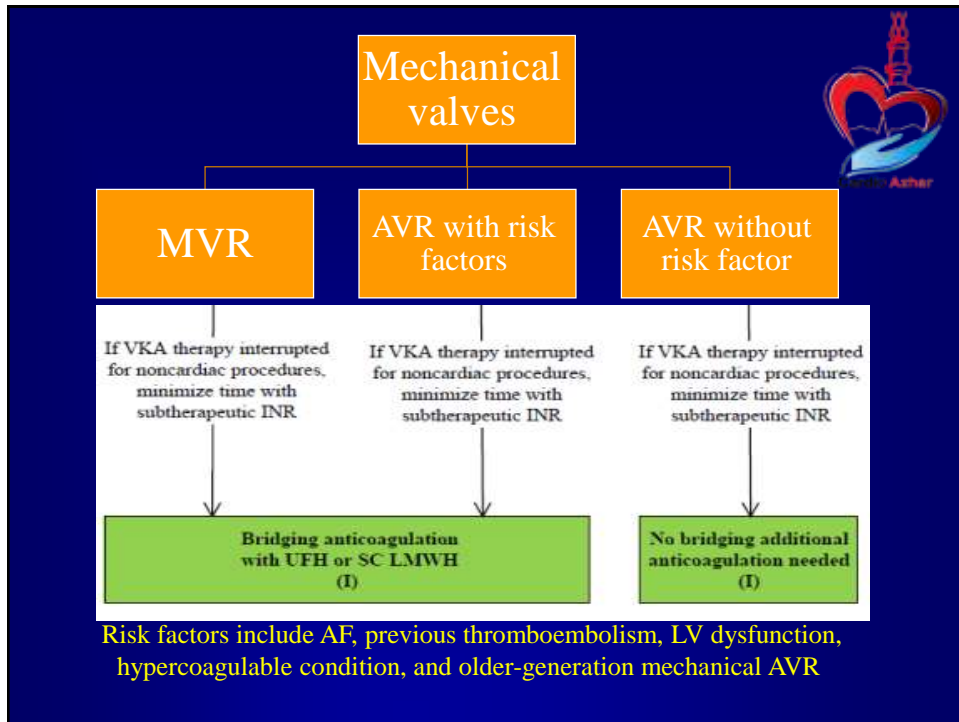
IIa

C

## Patients with prosthetic valve(s)



- Patients who have undergone previous surgical correction of VHD and have a prosthetic valve can undergo non-cardiac surgery without additional risk, provided that there is no evidence of valve or ventricular dysfunction.
- In current practice, the main problem is the need for a modification of the anticoagulation regimen in patients in the perioperative period, with oral anticoagulants being temporarily replaced by UFH or LMWH at therapeutic doses.



## Prophylaxis of infective endocarditis

- Indications for antibiotic prophylaxis are limited to high-risk patients undergoing dental care; however, non-specific prophylaxis remains recommended in all patients at intermediate or high risk of infective endocarditis.
- This is of particular importance in the field of non cardiac surgery, given the increasing burden of healthcare-related infective endocarditis.

ESC guidelines based on Habib et al. Guidelines on the prevention, diagnosis, and treatment of infective endocarditis (new version 2009): the Task Force on the Prevention, Diagnosis, and Treatment of Infective Endocarditis of the European Society of Cardiology (ESC). Endorsed by the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) and the International Society of Chemotherapy (ISC) for Infection and Cancer. Eur Heart

J 2009;30:2369–2413.

## Cardiac condition at highest risk of IE

Recommendations	Class	Level
<b>Antibiotic prophylaxis should only be recommended for patients at highest risk of IE:</b> <ol style="list-style-type: none"> <li>1. Patients with a prosthetic valve or any prosthetic material used for cardiac valve repair,</li> <li>2. Patients with previous IE,</li> <li>3. Patients with congenital heart disease (CHD):               <ol style="list-style-type: none"> <li>a. Cyanotic CHD with or without previous interventions,</li> <li>b. CHD with complete repair (surgical or percutaneous) for the next 6 months,</li> <li>c. When a residual defect persists after cardiac surgery or percutaneous technique.</li> </ol> </li> </ol>	<b>IIa</b>	<b>C</b>
<b>Antibiotic prophylaxis is no longer recommended in other forms of valvular or CHD.</b>	<b>III</b>	<b>C</b>

ESC guidelines based on Habib et al. Guidelines on the prevention, diagnosis, and treatment of infective endocarditis (new version 2009): the Task Force on the Prevention, Diagnosis, and Treatment of Infective Endocarditis of the European Society of Cardiology (ESC). Endorsed by the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) and the International Society of Chemotherapy (ISC) for Infection and Cancer. Eur Heart J 2009;30:2369–2413.

## Arrhythmias

# Arrhythmias



- Cardiac arrhythmias are a significant cause of morbidity and mortality in the peri-operative period.
- Before surgery, patients with a history of arrhythmias should be evaluated.
- Arrhythmias such as AF and ventricular tachycardia often indicate underlying structural heart disease; therefore the discovery of such pre-operative arrhythmias should lead to proper evaluation.

## New-onset ventricular arrhythmias in the pre-operative period



- Ventricular arrhythmias, including ventricular premature beats (VPBs) and ventricular tachycardia (VT) are particularly common in high-risk patients.
- Monomorphic VT may result from myocardial scarring, and polymorphic VT is a common result of acute myocardial ischaemia.
- Pre-operative detection of these arrhythmias should therefore lead to evaluation including methods such as echocardiography, coronary angiography (with revascularization) and, in selected cases, invasive electrophysiological study, as appropriate.

ESC guidelines based on Drew BJ, et al. Prevention of torsade de pointes in hospital settings: a scientific statement from the American Heart Association and the American College of Cardiology Foundation. J Am Coll Cardiol 2010;55:934–947

## New-onset ventricular arrhythmias in the pre-operative period



- Treatment steps for VPBs include identifying and correcting the reversible causes (e.g. hypoxia, hypokalemia and hypomagnesaemia). There is no evidence that VPBs or non-sustained VTs alone are associated with a worse prognosis or that suppressive therapy is beneficial.
- ACC/AHA/ESC Guidelines for management of patients with ventricular arrhythmias and the prevention of sudden cardiac death recommend that, regardless of the cause, sustained monomorphic VT with haemodynamic compromise must be treated promptly with electric cardioversion.

## New-onset ventricular arrhythmias in the pre-operative period



- Beta-blockers are useful in patients with recurrent sustained polymorphic VT, especially if ischaemia is suspected or cannot be excluded.
- Amiodarone is reasonable for patients with recurrent sustained polymorphic VT in the absence of long QT syndrome.



## New-onset ventricular arrhythmias in the pre-operative period



- Torsades de pointes (TdP) may occur and the withdrawal of any offending drugs and correction of electrolyte abnormalities are recommended.
- Management with magnesium sulphate should be considered for patients with TdP and long QT syndrome.
- Beta-blockade, combined with temporary pacing, is suggested in patients with TdP and sinus bradycardia.
- Isoproterenol is recommended in patients with recurrent, pause-dependent TdP, who do not have congenital long QT syndrome

ESC guidelines based on Drew BJ, et al. Prevention of torsade de pointes in hospital settings: a scientific statement from the American Heart Association and the American College of Cardiology Foundation. J Am Coll Cardiol 2010;55:934–947

## New-onset ventricular arrhythmias in the pre-operative period



- If the diagnosis is unclear, wide-QRS tachycardia should be presumed to be VT until proven otherwise. Especially in patients with a history of myocardial dysfunction

Continuation of oral anti-arrhythmic drugs before surgery is recommended.	I	C
Anti-arrhythmic drugs are recommended for patients with sustained VT, depending on the patient's characteristics.	I	C
Anti-arrhythmic drugs are not recommended for patients with VPBs.	III	C

## Supraventricular arrhythmias and atrial fibrillation in the pre-operative period



- Supraventricular arrhythmias and AF are more common than ventricular arrhythmias in the peri-operative period.
- The aetiology of these arrhythmias is multifactorial. Sympathetic activity, as the primary autonomic mechanism, can be responsible for triggering AF.
- While initiating specific drug therapy, possible aggravating factors such as respiratory failure or electrolyte imbalance should also be corrected.

ESC guidelines based on Camm AJ et al. 2012 focussed update of the ESC Guidelines for the management of atrial fibrillation: a update of the 2010 ESC Guidelines for the management of atrial fibrillation. Developed with the special contribution of the European Heart Rhythm Association. Eur Heart J 2012;33:2719–2747.

## Supraventricular arrhythmias and atrial fibrillation in the pre-operative period



- No medication is recommended to suppress supraventricular premature beats. Vagal manoeuvres may terminate SVT in some cases; they usually respond well to treatment with adenosine.
- In cases with incessant or commonly recurring SVT in the peri-operative setting, where prophylactic treatment is needed, beta-blockers, calcium channel blockers, or amiodarone treatment can be used.
- In rare cases pre-operative catheter ablation of the arrhythmia substrate may be considered, e.g. for patients with Wolff-Parkinson-White syndrome and pre-excited AF

## Supraventricular arrhythmias and atrial fibrillation in the pre-operative period



- The objective in managing peri-operative AF is usually ventricular rate control. Using beta-blockers and calcium channel blockers (verapamil, diltiazem) are the drugs of choice for rate control.
- Amiodarone can be used as first line drug in patients with heart failure, since digoxin is frequently ineffective in high adrenergic states such as surgery.
- Anticoagulation must be based on the individual clinical situation.

Continuation of oral anti-arrhythmic drugs before surgery is recommended.	I	C
Electrical cardioversion when haemodynamic instability occurs is recommended.	I	C
Vagal manoeuvres and anti-arrhythmic therapy for termination of SVT in haemodynamically stable patients is recommended.	I	C

ESC guidelines based on Camm AJ et al. 2012 focussed update of the ESC Guidelines for the management of atrial fibrillation: a update of the 2010 ESC Guidelines for the management of atrial fibrillation. Developed with the special contribution of the European Heart Rhythm Association. Eur Heart J 2012;33:2719–2747.

## Peri-operative Brady-arrhythmias



- Peri-operative brady arrhythmias usually respond well to short term pharmacological therapy; temporary cardiac pacing is rarely required.
- Prophylactic pacing before non-cardiac surgery is not commonly indicated.
- Pre-operative establishment of temporary or permanent cardiac pacing may be appropriate for patients with complete heart block or symptomatic asystolic episodes.

## Peri-operative Brady-arrhythmias



- The indications for temporary pacemakers during the perioperative period are generally the same as those for permanent pacemakers.
- Asymptomatic bifascicular block, with or without first-degree atrioventricular block, is not an indication for temporary pacing; however, the availability of an external pacemaker for transcutaneous pacing is appropriate

ESC guidelines based on Healey JS et al. Canadian Cardiovascular Society/Canadian Anesthesiologists' Society/Canadian Heart Rhythm Society joint position statement on the peri-operative management of patients with implanted pacemakers, defibrillators, and neurostimulating devices. Can J Cardiol 2012;28:141–151



## Pace Makers

## Peri-operative management of patients with pacemaker/implantable cardioverter defibrillator



- Patients with a permanent pacemaker can safely undergo surgery if appropriate precautions are taken.
- The use of unipolar electrocautery represents a significant risk, as the electrical stimulus from electrocautery may inhibit 'demand' pacemakers, or may reprogram the pacemaker.

ESC guidelines based on Healey JS et al. Canadian Cardiovascular Society/Canadian Anesthesiologists' Society/Canadian Heart Rhythm Society joint position statement on the peri-operative management of patients with implanted pacemakers, defibrillators, and neurostimulating devices. Can J Cardiol 2012;28:141-151

## Peri-operative management of patients with pacemaker/implantable cardioverter defibrillator



- This is easily done by
  - placing a magnet on the skin over the pacemaker.
- Patients whose underlying rhythm is unreliable should have pacemaker interrogation after surgery, to ensure appropriate programming and sensing-pacing thresholds.
- Interference with the function of (ICD) can also occur during non-cardiac surgery, as a result of the electrical current generated by electrocautery.

These problems can be avoided or minimized by using:



- Bipolar electrocautery
- Correct positioning the ground plate for the electrical circuit.
- Keeping the electrocautery device away from the pacemaker
- Giving only brief bursts
- Using the lowest possible amplitude may also decrease the interference.
- The pacemaker should be set in an asynchronous or non-sensing mode in patients who are pacemaker-dependent

## Peri-operative management of patients with pacemaker/implantable cardioverter defibrillator



- The ICD should be turned off during surgery and switched on in the recovery phase before discharge to the ward. The defibrillator function of an ICD can be temporarily deactivated by placing a magnet on the skin over the ICD. While the device is deactivated, an external defibrillator should be immediately available

The indications for temporary pacemakers during the peri-operative period are generally the same as those for permanent pacemakers.	I	C
It is recommended that the hospital nominate a person who is responsible for programming of the implanted arrhythmia devices before and after surgery.	I	C
Patients with ICDs, whose devices have been pre-operatively deactivated, should be on continuous cardiac monitor throughout the period of deactivation. External defibrillation equipment should be readily available.	I	C
Patients who have asymptomatic bifascicular or trifascicular block are not recommended for routine management with a peri-operative temporary pacing wire.	III	C

