

Intraoperative management of critical arrhythmia

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วิสัญญีแพทย์ โรงพยาบาลกำแพงเพชร

Intraoperative management of critical arrhythmia

- ▶ Intraoperative arrhythmia is clinically important
- ▶ associated with significant hemodynamic instability
- ▶ The action potential of the myocardium is composed of five phases

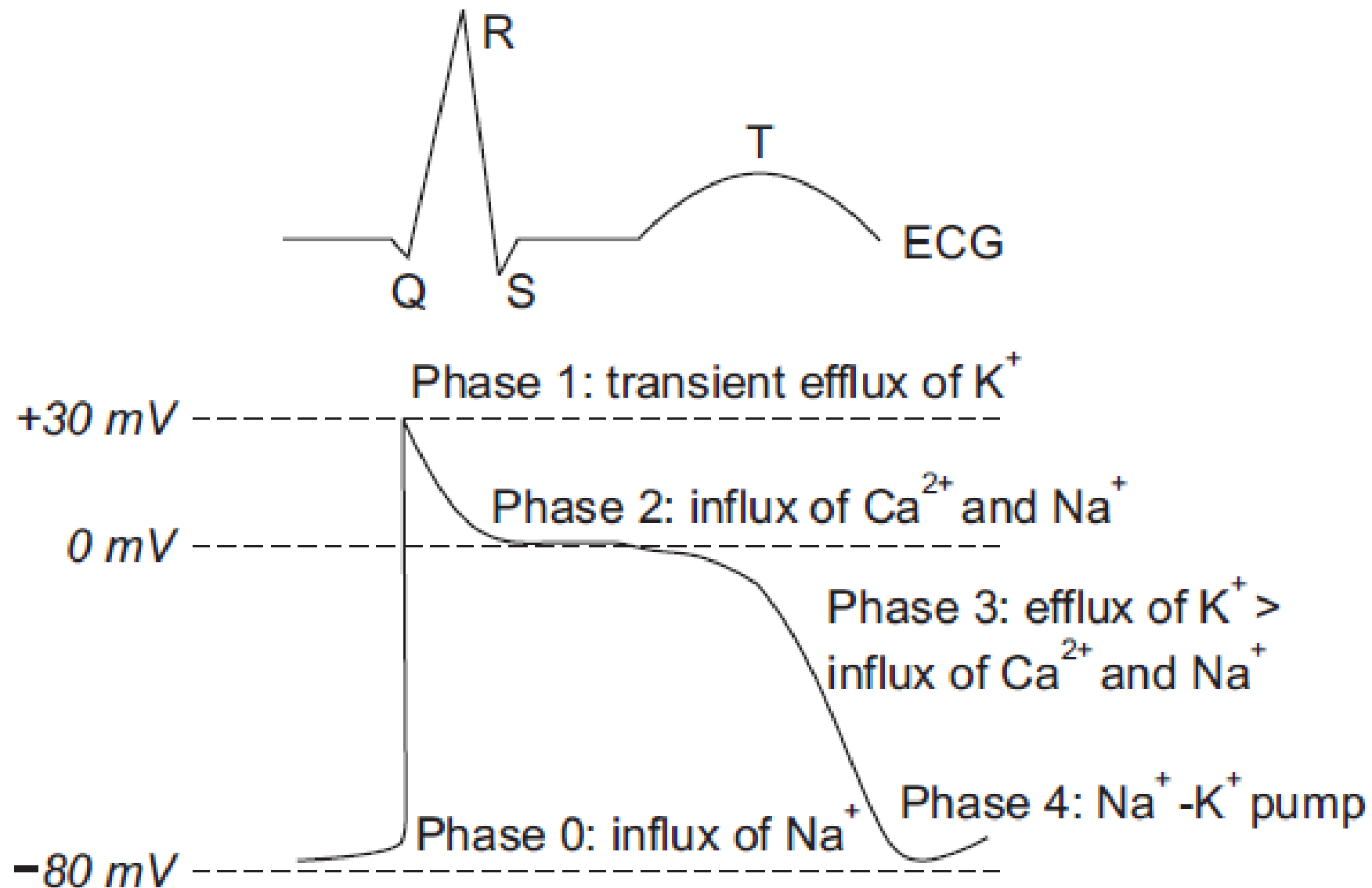


Fig. 1. Electrocardiograph (ECG) and cardiac action potential of the ventricle.

Intraoperative management of critical arrhythmia

- ▶ The mechanism of arrhythmia is roughly divided into three categories
 - ▶ 1) increased automaticity due to reduced threshold of the action potential or increased slope of phase 4 depolarization
 - ▶ 2) triggered activity due to afterdepolarization reaching the threshold of the action potential
 - ▶ 3) circus movement or re-entry.

Intraoperative management of critical arrhythmia

- ▶ the goals of treatment are
 - ▶ prevention of blood clots
 - ▶ control of the heart rate (HR)
 - ▶ correction of the condition that caused the arrhythmia
 - ▶ reduction of other risk factors for heart disease and stroke.

Table 1. Anti-arrhythmic Agents

Class	Basic mechanism	Comments	Drugs	Uses
I	Sodium-channel blockade	Reduce phase 0 slope and peak of action potential		
IA	Moderate	Moderate reduction in phase 0 slope; increase action potential duration; increase effective refractory period.	Quinidine, procainamide, disopyramide	Ventricular arrhythmias, atrial fibrillation
IB	Weak	Small reduction in phase 0 slope; reduce action potential duration; decrease effective refractory period.	Lidocaine, tocainide, mexiletine	Ventricular arrhythmias
IC	Strong	Pronounced reduction in phase 0 slope; no effect on action potential duration or effective refractory period.	Flecainide, propafenone	Paroxysmal atrial fibrillation
II	Beta-blockade	Block sympathetic activity; reduce rate and conduction	Acebutolol, atenolol, bisoprolol, esmolol, metoprolol, nadolol, propranolol, carvedilol, labetalol	
III	Potassium-channel blockade	Delay repolarization (phase 3) and thereby increase action potential duration and effective refractory period	Sotalol, dofetilide, ibutilide, bretylium, amidodarone	Ventricular arrhythmias, atrial fibrillation
IV	Calcium-channel blockade	Block L-type calcium-channels; most effective at sinoatrial and atrioventricular nodes; reduce rate and conduction	Amlodipine, felodipine, isradipine, nicardipine, nifedine, diltiazem, verapamil	

Causes of Intraoperative Arrhythmia

- ▶ divided into three groups: patient, surgical procedure, and anesthesia.
- ▶ endotracheal intubation, which accompanies hemodynamic disturbance by autonomic reflexes.

Anesthetic Agents and Arrhythmia

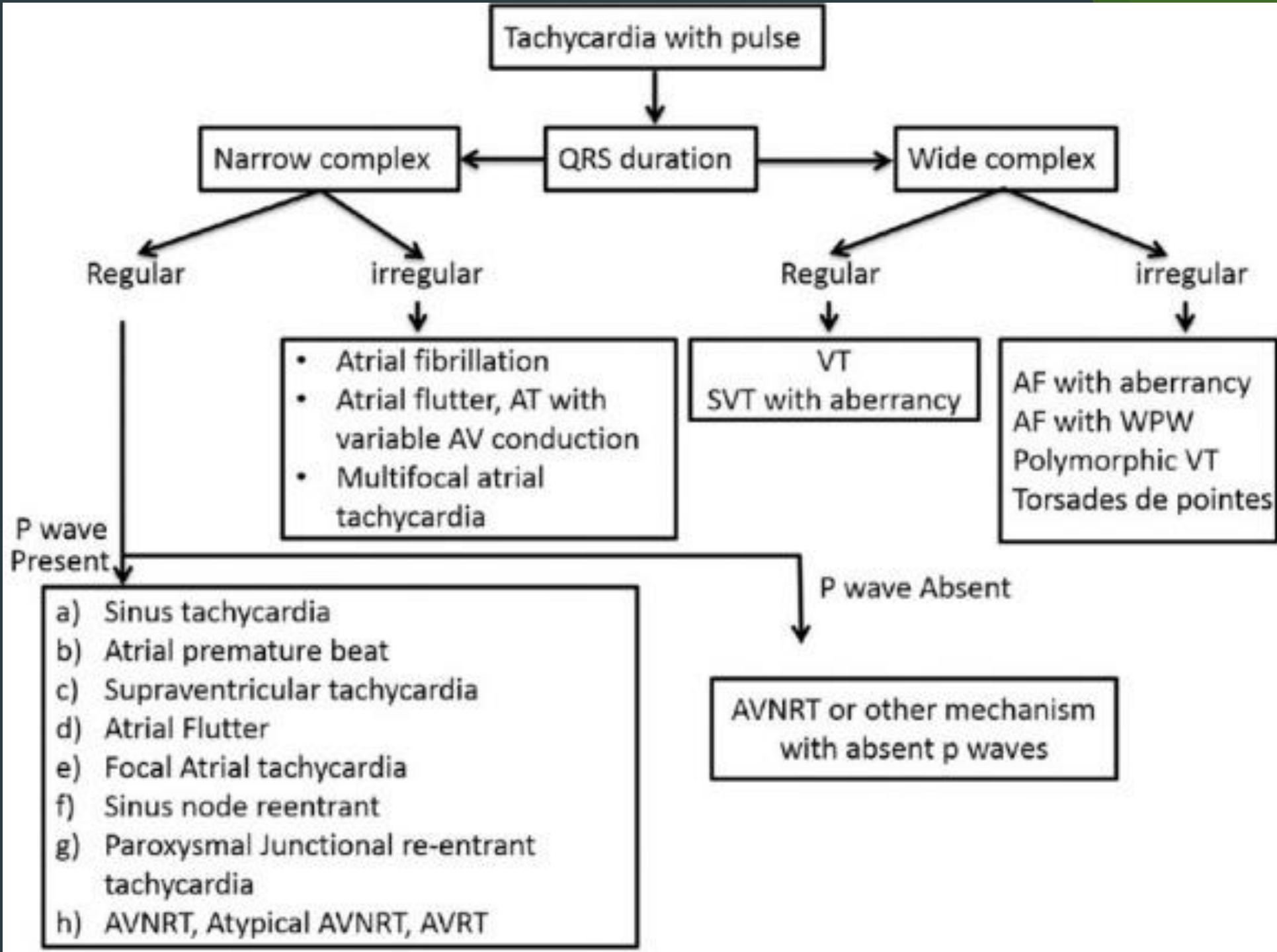
- ▶ Drug-induced prolonged ventricular repolarization is associated with torsade de pointes and sudden cardiac arrest
- ▶ All of the inhaled anesthetic agents prolong QTc and QTd
- ▶ Propofol does not significantly affect QTc
- ▶ Opioids have no effects on QTc , but a high dose of sufentanil may produce QT interval prolongation
- ▶ Succinylcholine significantly prolongs the QT interval and QTc, particularly with thiopental

Anesthetic Agents and Arrhythmia

- ▶ most non-depolarizing neuromuscular blockers have not been associated with prolongation
- ▶ reverse neuromuscular blockade causes transient but significant prolongation of QTc
- ▶ sugammadex is relatively safe
- ▶ Interscalene brachial plexus block with ropivacaine or bupivacaine do not produce any change in QT interval or QTc

Identification of Intraoperative Arrhythmia and Management

- ▶ the anesthesiologist should be aware of the following
 - ▶ 1) What is HR?
 - ▶ 2) Is the rhythm regular or irregular?
 - ▶ 3) Is one P present for each QRS?
 - ▶ 4) Is the QRS normal?
 - ▶ 5) Is the rhythm associated with hemodynamic instability?
 - ▶ 6) Does the rhythm require treatment?



Sinus bradycardia

- ▶ sinus bradycardia is defined as HR < 60 beats/min
- ▶ HR < 40 beats/min may be poorly tolerated in healthy patients,
- ▶ Intravenous atropine of 0.5 mg is used as first-line therapy
- ▶ repeated every 3 to 5 min up to a total of 3 mg.
- ▶ The most common cause is autonomic disturbance including vasovagal stimulation.
- ▶ Hypoxia, hypothermia, endotracheal suctioning, and increased intracranial pressure

Sinus tachycardia

- ▶ sinus tachycardia is defined as HR > 100 beats/ min at resting state in adults.
- ▶ include pain, fever, and hypercarbia.
- ▶ The most common causes for sinus tachycardia such as light planes of anaesthesia, lack of adequate analgesia, dehydration or wearing off of muscle relaxation

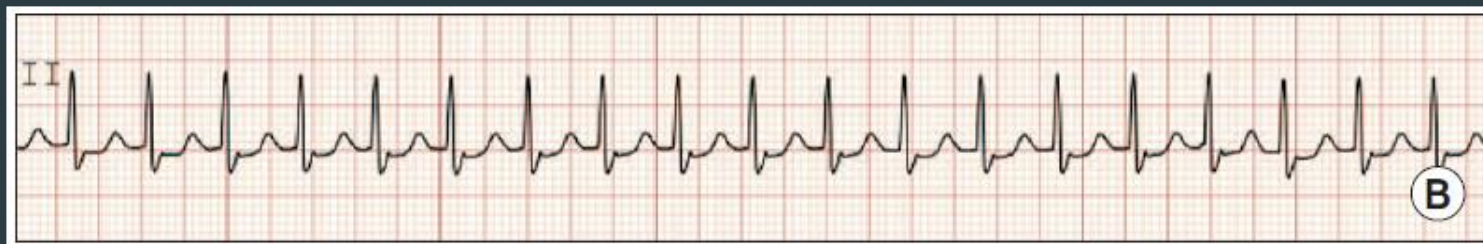
AV block

- ▶ First-degree AV block does not require treatment.
- ▶ In second-degree AV block, pacing may be required if bradycardia is severe or causes hemodynamic instability.
- ▶ Third-degree AV block is characterized by P waves that are discordant with QRS waves.
- ▶ Pacing is usually required because escape junctional or ventricular rhythm is usually very slow at < 40 beats/min.



Paroxysmal supraventricular tachycardia (PSVT)

- ▶ PSVT has a regular rhythm, and a ratio of P to QRS of 1 : 1 with normal QRS
- ▶ HRs of 130-270 beats/min.
- ▶ The P wave may often be hidden
- ▶ intravenous adenosine (6 mg) was shown to rapidly slow AV nodal function.
- ▶ Up to 80% of atrial tachycardias may be terminated by adenosine.
- ▶ Vagal manoeuvres



VALSALVA MANOEUVRE

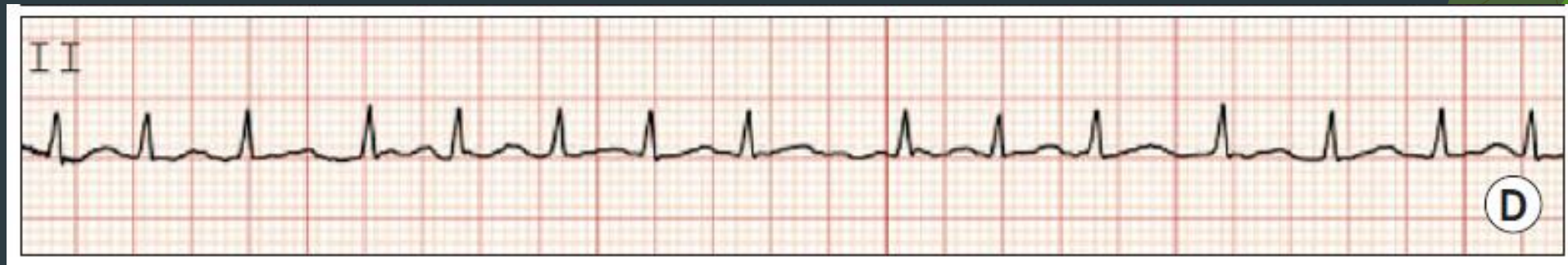
- ▶ The Valsalva is generally divided into four separate phases:
 - ▶ Phase 1, onset of straining and the beginning of an increase in intrathoracic pressure 30-40 mmHg with glottic closure
 - ▶ Phase 2, persistent straining and maintenance of the increased intrathoracic pressure
 - ▶ Phase 3, release of breath-holding and glottic pressure with a sudden drop in the intrathoracic pressure
 - ▶ Phase 4, sudden increase in cardiac output and aortic pressure.

CAROTID SINUS MASSAGE

- ▶ CSM is performed by applying a steady pressure over right or left carotid sinus for 5-10 s.
- ▶ Hence, one has to rule out the presence of carotid bruit clinically before applying CSM.

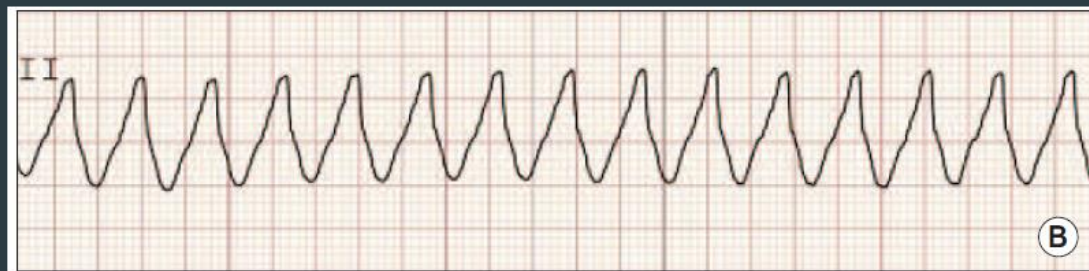
Atrial fibrillation

- ▶ Atrial fibrillation has an irregularly irregular rhythm, and normal QRS
- ▶ HRs of 350-500 atrial beats/min and 60-170 ventricular beats/min.
- ▶ The P wave is absent
- ▶ The significance of atrial fibrillation is that the loss of atrial kick
- ▶ associated with reduction of left ventricular filling and stroke volume.
- ▶ if atrial fibrillation is present for longer than 48 h
- ▶ increase the risk of thromboembolism.



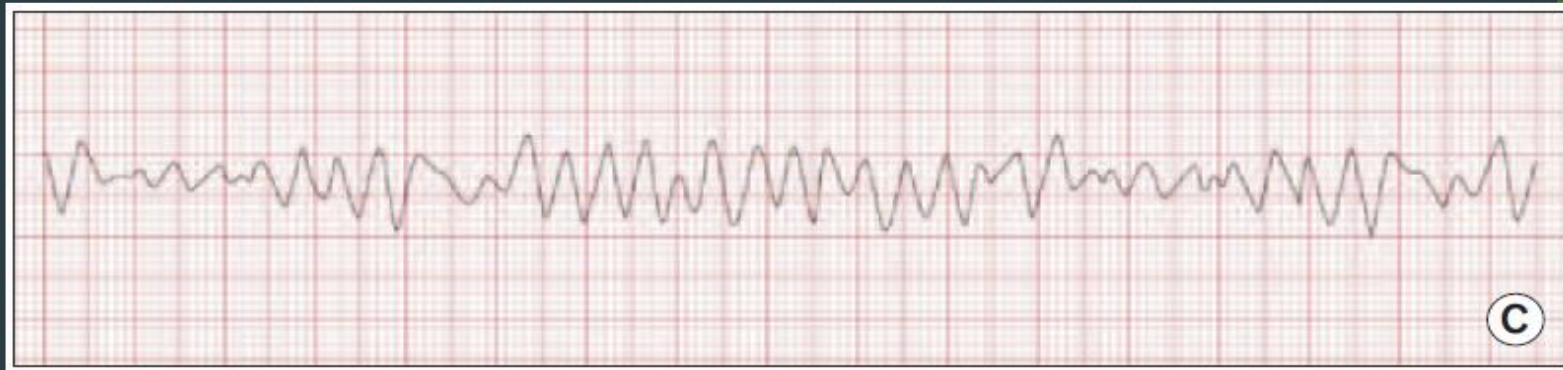
Ventricular tachycardia (VT)

- ▶ If three or more sequential PVCs are present, it is defined as VT.
- ▶ VT has a regular rhythm at HRs of 100-200 beats/min.
- ▶ The ratio of P and QRS has no fixed relationship
- ▶ VT is a life-threatening state and needs emergent treatment.
- ▶ Amiodarone 150 mg for longer than 10 min is used for a loading dose.
- ▶ 1 mg/min for 6 h and 0.5 mg/min for 18 h is followed by dose reduction or administration by the oral route.
- ▶ Synchronized cardioversion is applied for hemodynamic instability



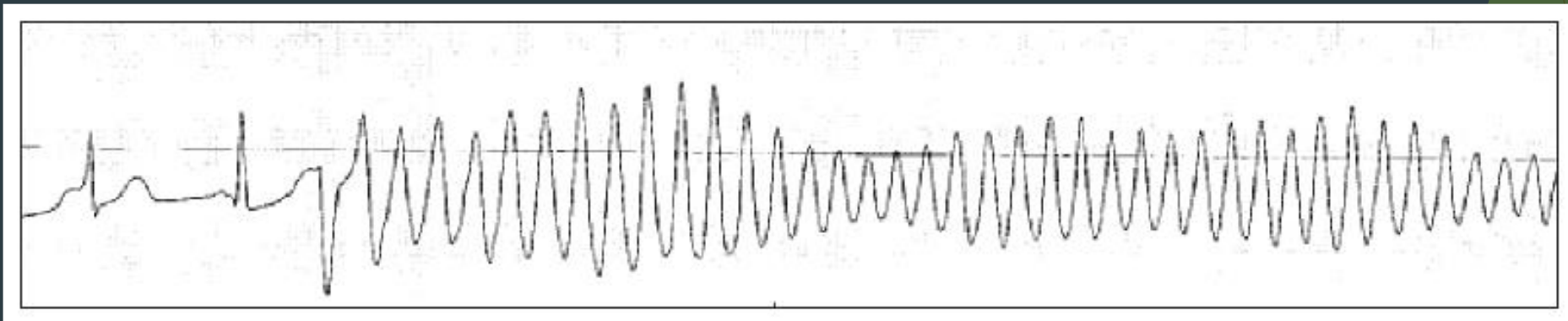
ventricular fibrillation (VF)

- ▶ VF has an irregular and grossly disorganized HR
- ▶ The QRS is absent.
- ▶ It means that no effective cardiac contraction with output exists.
- ▶ Immediate cardiopulmonary resuscitation is required.
- ▶ A non-synchronized defibrillation with 200-360 J is used.
- ▶ Biphasic shock reduces the required energy level and increases the efficacy of defibrillation.



Torsade de pointes

- ▶ Torsade de pointes is usually invoked in the situation of prolonged QT interval
- ▶ Many anesthetic agents may cause mild prolongation of the QT interval
- ▶ If the patient is hemodynamically unstable, defibrillation should be delivered promptly.
- ▶ first-line therapy is administration of magnesium sulfate 2 g as a slow intravenous bolus.

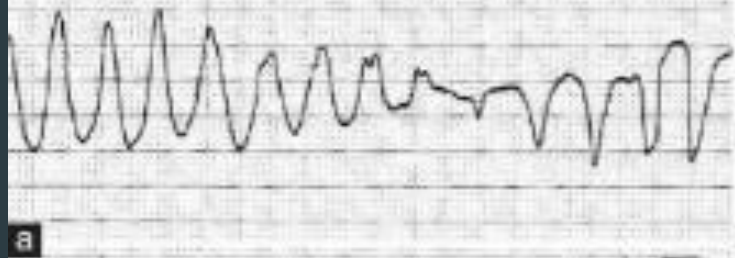


Artifacts

- ▶ misinterpret ECGs as indicating atrial fibrillation or VF
- ▶ check the patient's vital signs, particularly arterial pulse or arterial blood pressure monitoring
- ▶ correct the potential causes that can induce artifacts.

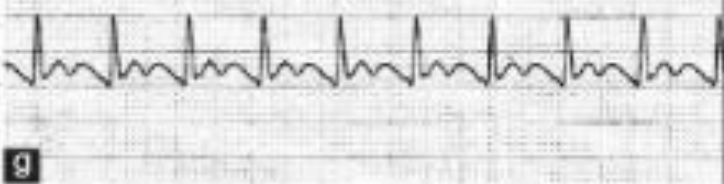
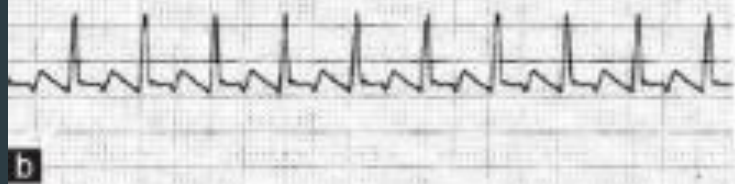


(a) torsades



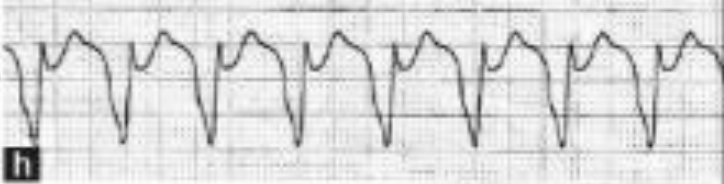
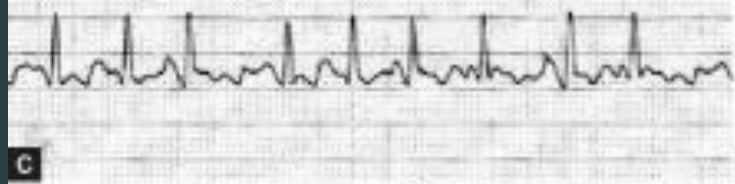
(f) atrial tachycardia

(b) atrial flutter



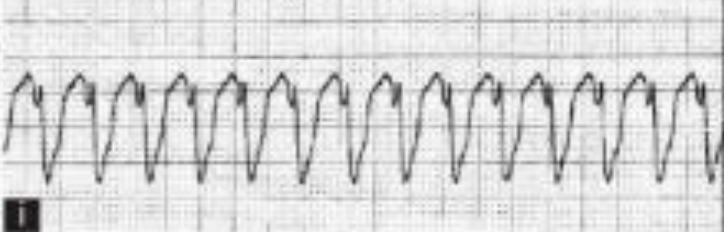
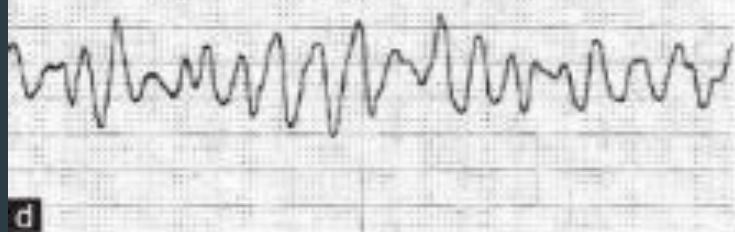
(g) sinus tachycardia

(c) atrial fibrillation



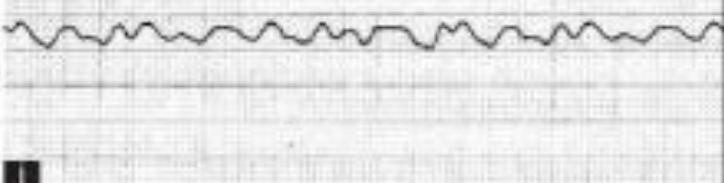
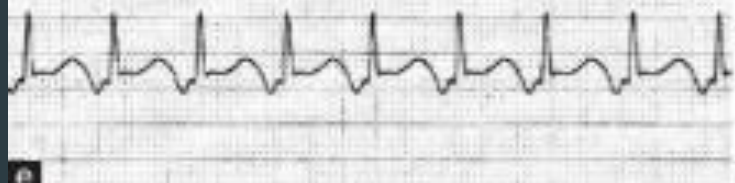
(h) slow ventricular tachycardia

(d) coarse ventricular fibrillation



(i) fast ventricular tachycardia

(e) Junctional tachycardia



(j) fine ventricular fibrillation

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NAME _____

NAME _____

RECORDED ECG

RECORDED ECG

ECG LEAD II

ECG LEAD II

ECG SIZE 1.0

ECG SIZE 1.0

HEART RATE 98

HEART RATE 89



SUMMARY COMPLETE

The End

Thank you for your attention.