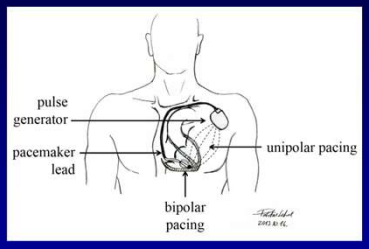
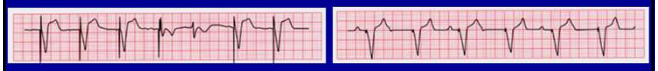
Electronic Pacemakers

Mechanisms Of Arrhythmias

University Of Debrecen
Faculty Of Medicine
Division of Clinical Physiology

ECG signs of unipolar and bipolar pacemakers





Unipolar pacemaker | Bipolar pacemaker

Codes of pacemakers

I. Chamber paced	II. Chamber sensed	III. Pacemaker activity	IV. Rate responsive function	V. Special function
A: Atrium	A: Atrium	I: Inhibited	M: Multi-programmable	P: Anti-tachycardia
V: Ventricle	V: Ventricle	T: Triggered	R: Rate responsive	S: Shock-, CV defibrillation
D: Dual	D: Dual	D: Dual	C: Advanced communication	D: P+S
	O: None	O: None	O: None	O: None

Frequently used permanent pacemakers

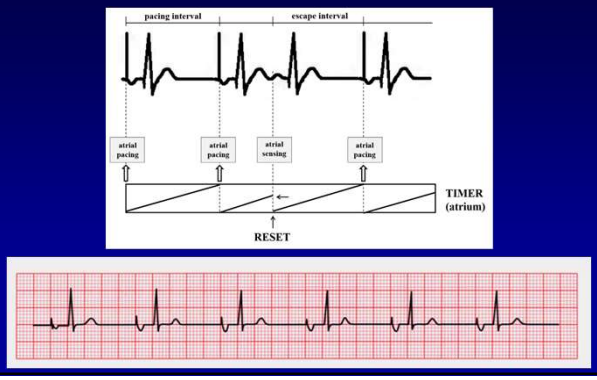
AAI (AAIR): P wave inhibited atrial demand
(R = rate responsive)

VVI (VVIR): R wave inhibited ventricular demand
(R = rate responsive)

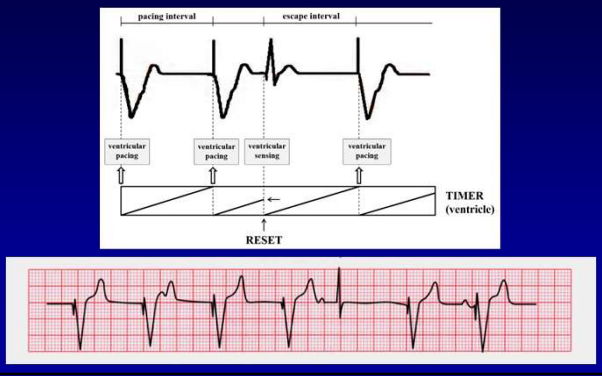
DDD (DDDR): combined atrial-ventricular, AV sequential stimulation (R = rate responsive)

VDD (VDDR): two chamber, one electrode, P wave sensed ventricular stimulation (R = rate responsive)

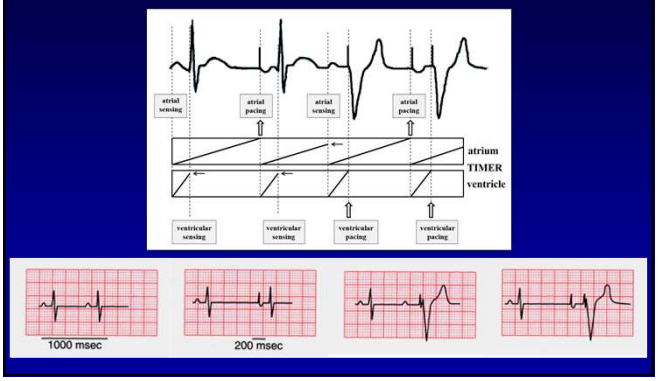
AAI pacemaker



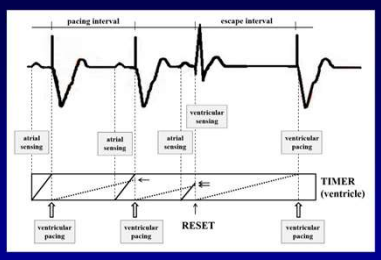
VVI pacemaker



DDD pacemaker



VDD pacemaker



Testing the pacemaker function

- ECG registration (at least 3 channels)

- activation of the pacemaker stimulating frequency
  (carotis massage, or magnet)

- detection of a low battery (with or without magnet)
  battery low: reduced stimulating frequency
  increased duration of PM pulse (special unit is needed)

- 24-hour Holter monitoring

- chest X-ray (testing the electrode position)

Normal pacemaker function with seemingly abnormal ECG signs

Pseudofusion

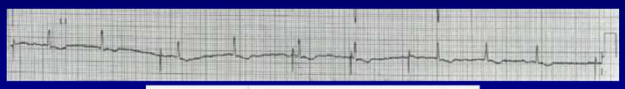
Fusion

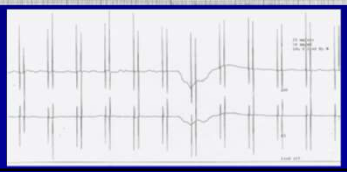
Hysteresis

Real PM disorders

I. Ineffective stimulation

- exit block
- missing pacemaker spike
- alterations in pacing frequency

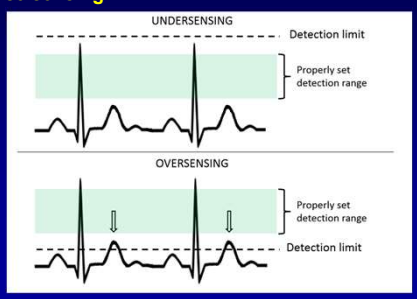




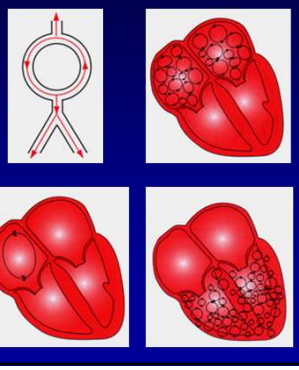
Real PM disorders

II. Disorders of impulse sensing

- undersensing
- oversensing



Reentry



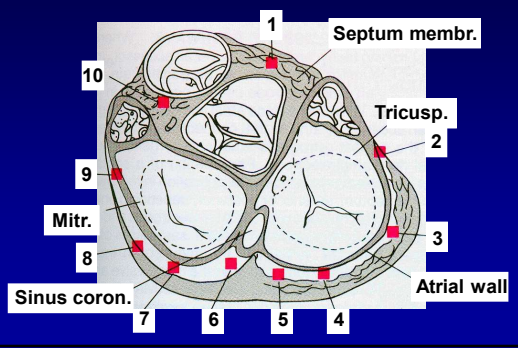
General characteristics of reentry arrhythmias

- start and stop abruptly (paroxismally)
- mostly initiated by a premature beat
- regularity
- terminated by increasing the refractoriness of one part of the reentry circle (e.g. vagal maneuvers)

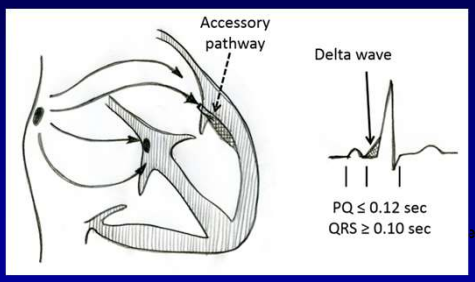
Clinical forms of reentry arrhythmias

1. Sinus node reentry tachycardia
2. Atrial reentry tachycardia
3. Atrial flutter
4. Atrial fibrillation
5. AV node reentry tachycardia (AVNRT)
6. Atrioventricular reentry tachycardia (AVRT)
7. Bundle branch reentry
8. Most ventricular tachycardias (VT) (90%)
9. Ventricular fibrillation (VF)

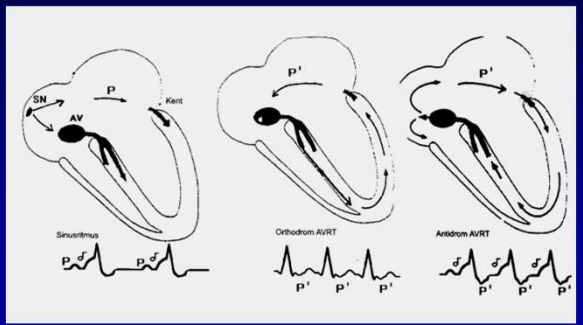
Possible locations of accessory pathways



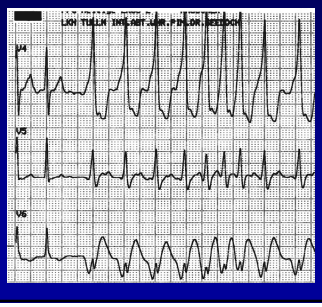
Wolff-Parkinson-White syndrome (WPW)

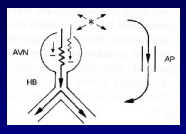


WPW and AVRT



Paroxismal atrial fibrillation in WPW syndrome





FBI tachycardia

Fast

Broad

Irregular

Ectopy

Requirements:
- slowing of the normal dominant sinus rhythm and/or
- usurpation – an acceleration of a lower pacemaker which takes control

Characteristics:
- gradual onset
- usually not initiated by a premature beat
- somewhat irregular
- not terminated by vagal maneuvers
- AV block of varying degrees is frequently present

Clinical forms:
1. Wandering atrial pacemaker
2. Ectopic atrial tachycardia
3. Multifocal atrial tachycardia
4. Ectopic junctional rhythms
5. Ectopic ventricular rhythms

Triggered activity

Characteristics:
- initiated by afterdepolarisations (EAD, DAD)
- EADs may result in „torsade de pointes" VT
- DADs occur in digitalis-, reperfusion- and catecholamine-induced arrhythmias
- EADs and DADs are evoked by increases in the intracellular Ca^{2+} concentration

Clinical forms:
1. „torsade de pointes"
2. some ventricular tachycardias

Torsade de pointes

Final exam test bank – Int-1.24

A regular wide QRS complex tachycardia can not be:

A) ventricular tachycardia

B) supraventricular tachycardia with bundle branch block

C) atrial fibrillation with bundle branch block

D) antidromic atrioventricular reentry tachycardia (WPW-syndrome)

E) atrial flutter with bundle branch block

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Final exam test bank – Int-1.126

Implantable cardioverter defibrillator can be used as the treatment of arrhythmia because these devices can cure the underlying disease which caused the arrhythmia.

A) Both of them are correct, there is causal relationship between them

B) Both of them are correct, but there is no causal relationship between them

C) The first part is correct, the second one is wrong

D) The first part is wrong, the second one is correct

E) Both of them are incorrect

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Final exam test bank – Int-1.181

An 81-year-old man has been complaining about fatigue for few weeks, one time he had syncope and collapse. ECG: bradyarrhythmia. In the anamnesis there are diabetes mellitus, hypertension, EF (ejection fraction):47%. Which device would you choose?

A) one chamber pacemaker

B) biventricular pacemaker

C) VVI pacemaker

D) DDD pacemaker

E) biventricular ICD

Final exam test bank – Int-1.183

The function of the pacemaker, except:

A) hysteresis

B) sensitivity

C) basic frequency

D) antitachycardia pacing function

Final exam test bank – Int-1.184

Indication for pacemaker implantation, except:

A) third-degree atrioventricular block

B) first-degree atrioventricular block

C) bradyarrhythmia

D) carotis sinus hyperaesthesia

Final exam test bank – Int-1.193

Where are you positioning the ICD electrode?

A) right atrium

B) right ventricle

C) left atrium

D) left ventricle

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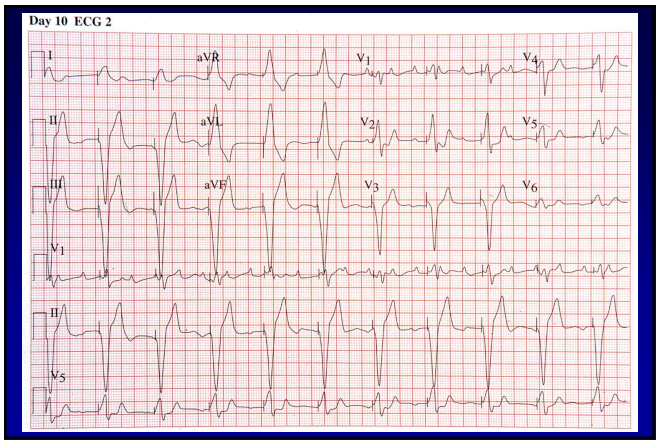
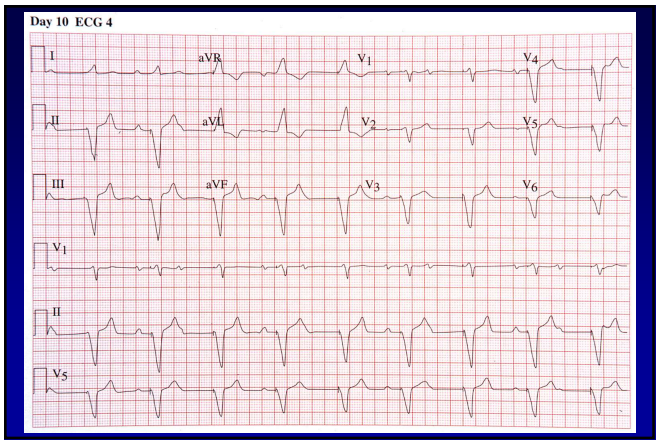
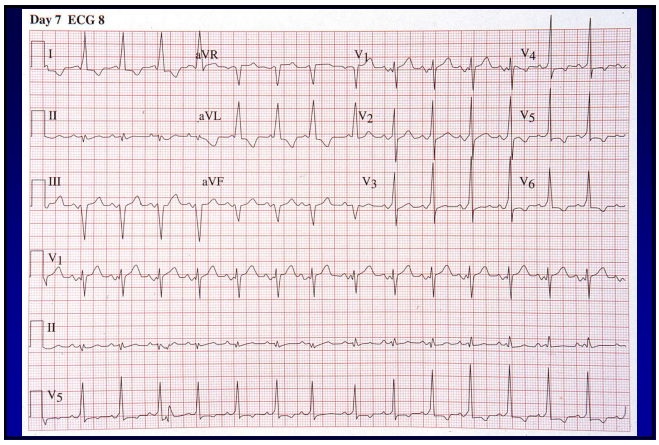
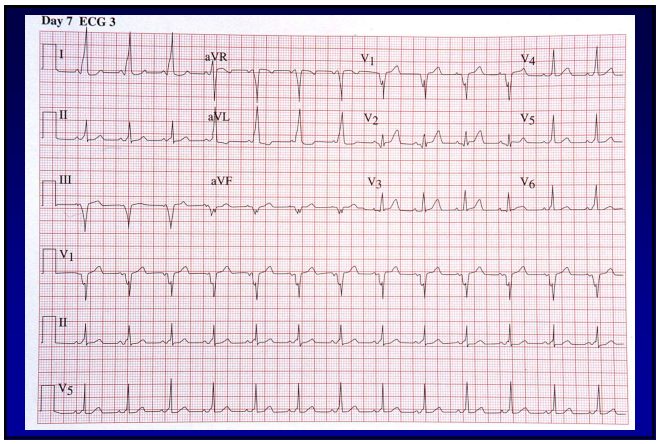





Day 7 ECG 8
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5


Day 7 ECG 3
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5