

Pacemakers

Outline

1. Pacemaker codes
2. Pacemaker configurations
3. Indications for pacemakers
4. Problems with pacemakers
5. Examples

Pacemakers



Pacemaker Codes

Position Function	1 Chambers Paced	2 Chambers Sensed	3 Response to Sensed Stimulus	4 Rate Modulation?
	O (none)	O	O	O (non-rate responsive)
	A (atrium)	A	T (triggered)	R (rate responsive)
	V (ventricle)	V	I (inhibited)	
	D (both atrium & ventricle)			

Pacemaker Configurations

VOO



Indications

Temporary mode some-times used during surgery to prevent interference from electrocautery



Pacemaker



Pacing Only



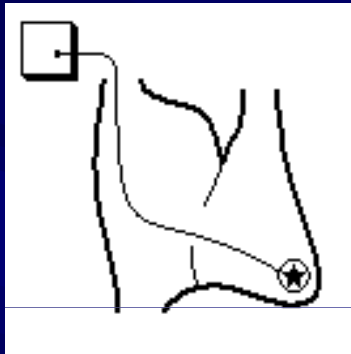
Sensing Only



Pacing and Sensing

Pacemaker Configurations

VVI



Indications

The combination of AV block and chronic atrial arrhythmias (particularly atrial fibrillation).



Pacemaker



Pacing Only



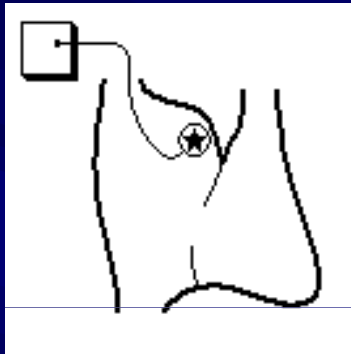
Sensing Only



Pacing and Sensing

Pacemaker Configurations

AAI



Indications

Sick sinus syndrome in the absence of AV node disease or atrial fibrillation.



Pacemaker



Pacing Only



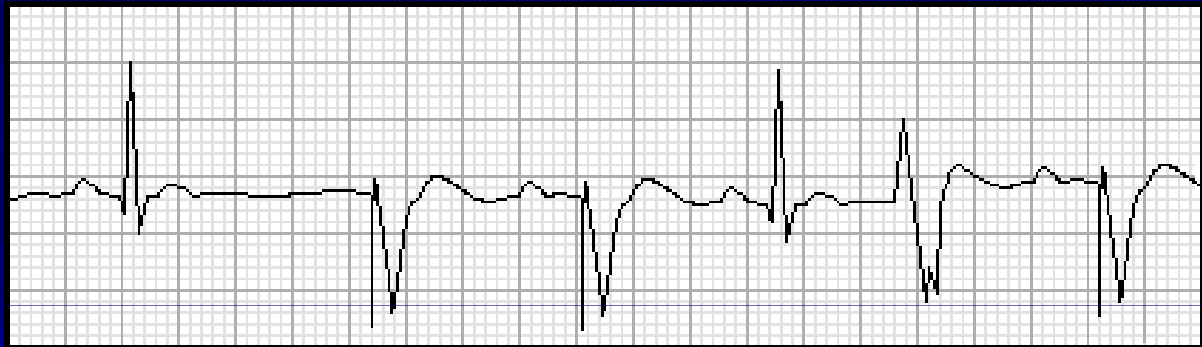
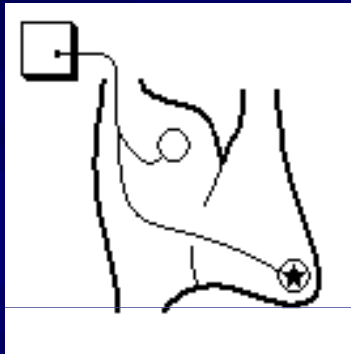
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Pacing and Sensing

Pacemaker Configurations

VDD



Indications

AV block with intact sinus node function (particularly useful in congenital AV block).



Pacemaker



Pacing Only



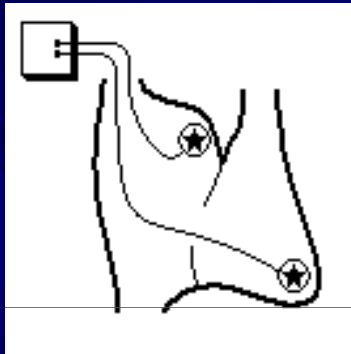
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Pacing and Sensing

Pacemaker Configurations

DDD



Indications

1. The combination of AV block and SSS.
2. Patients with LV dysfunction and LV hypertrophy who need coordination of atrial and ventricular contractions to maintain adequate CO.



Pacemaker



Pacing Only



Sensing Only



Pacing and Sensing

Indications for Pacemaker

Class I

1. Sinus node dysfunction with documented symptomatic bradycardia
2. Symptomatic chronotropic incompetence (failure to increase HR with exercise or increased metabolic demand)
3. 3° and advanced 2° AV block associated with any of the following:
 - Arrhythmias that require drugs resulting in symptomatic bradycardia
 - Sinus pauses > 3 seconds
 - Asymptomatic escape rate < 40bpm while awake
4. 3° or 2° AV block with associated symptomatic bradycardia
5. Type II 2° AV block with wide QRS, regardless of symptoms

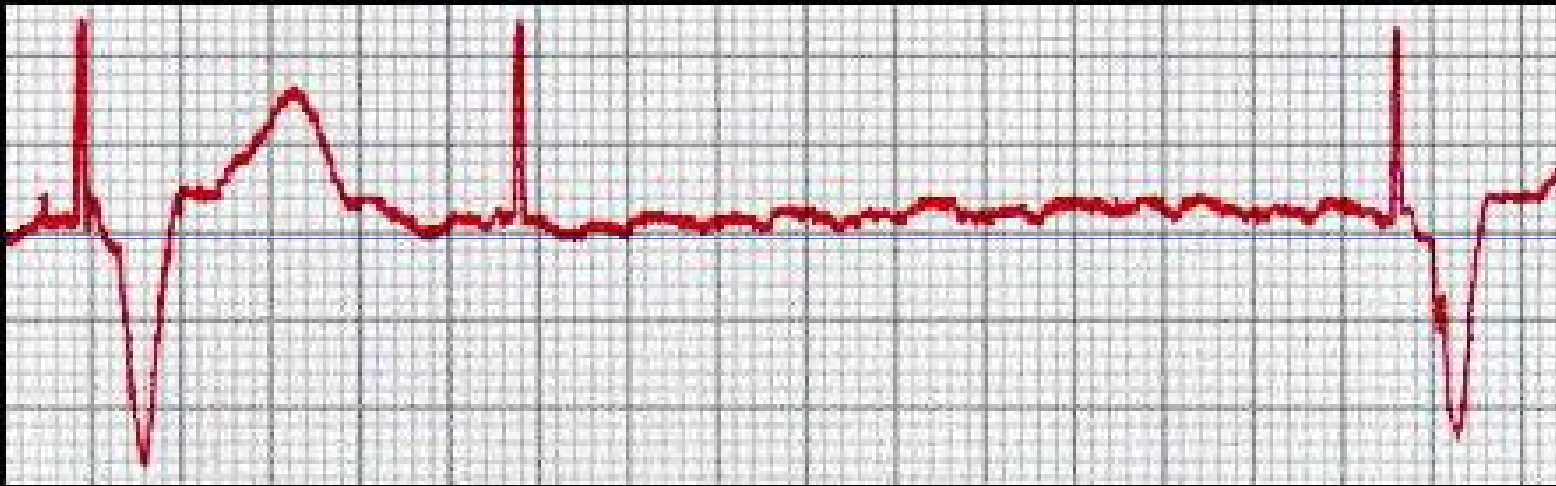
Indications for Pacemaker

Class IIa

1. Syncope of unexplained origin when major abnormalities of sinus node function are discovered or provoked during EP studies.
2. Asymptomatic 3° AV block with an awake ventricular rate > 40bpm
3. Asymptomatic type II 2° AV block

Problems with Pacemakers

Failure to Capture



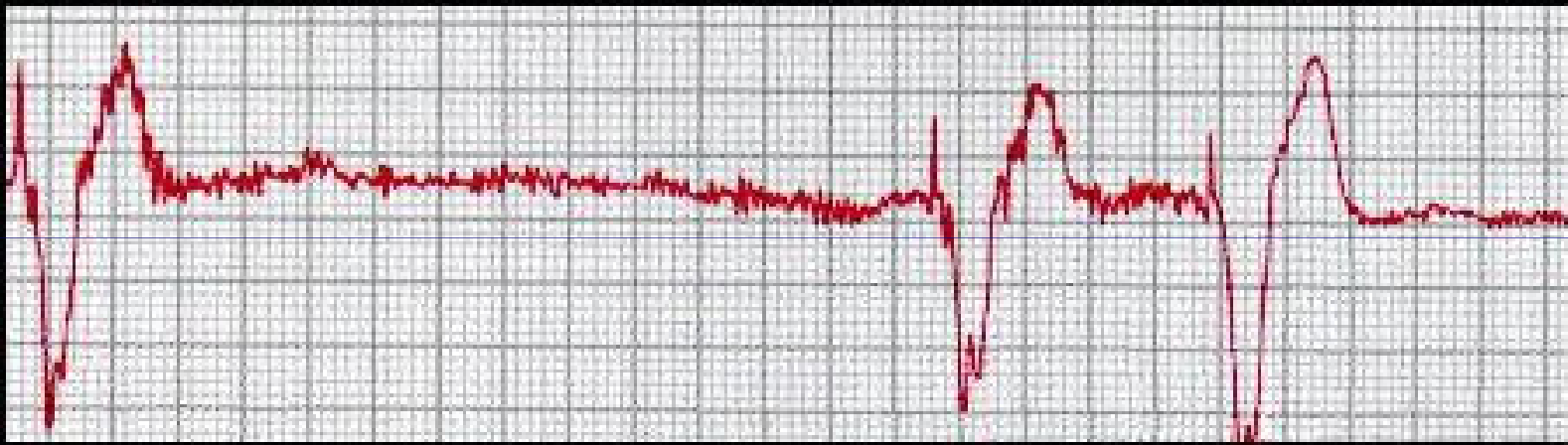
Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine, 7th ed., 2005.

Causes:

- Threshold rise (electrolytes, drugs)
- Lead dislodgement
- Lead fracture
- RV infarct

Problems with Pacemakers

Failure to Pace



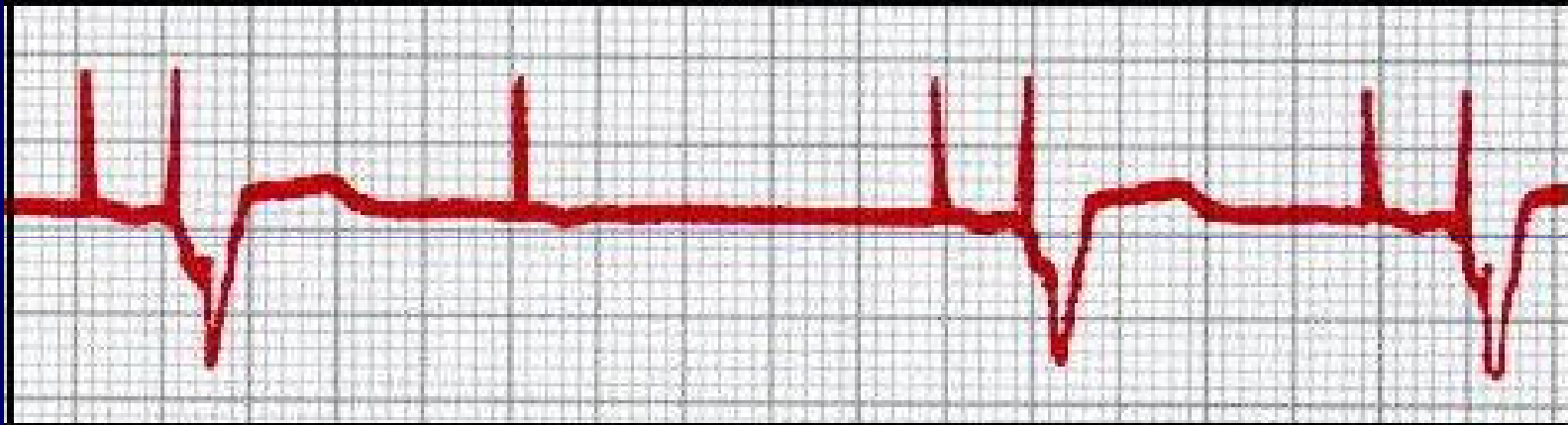
Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine, 7th ed., 2005.

Causes:

- Oversensing
- Battery failure
- Internal insulation failure
- Conductor coil fracture

Problems with Pacemakers

Failure to Pace

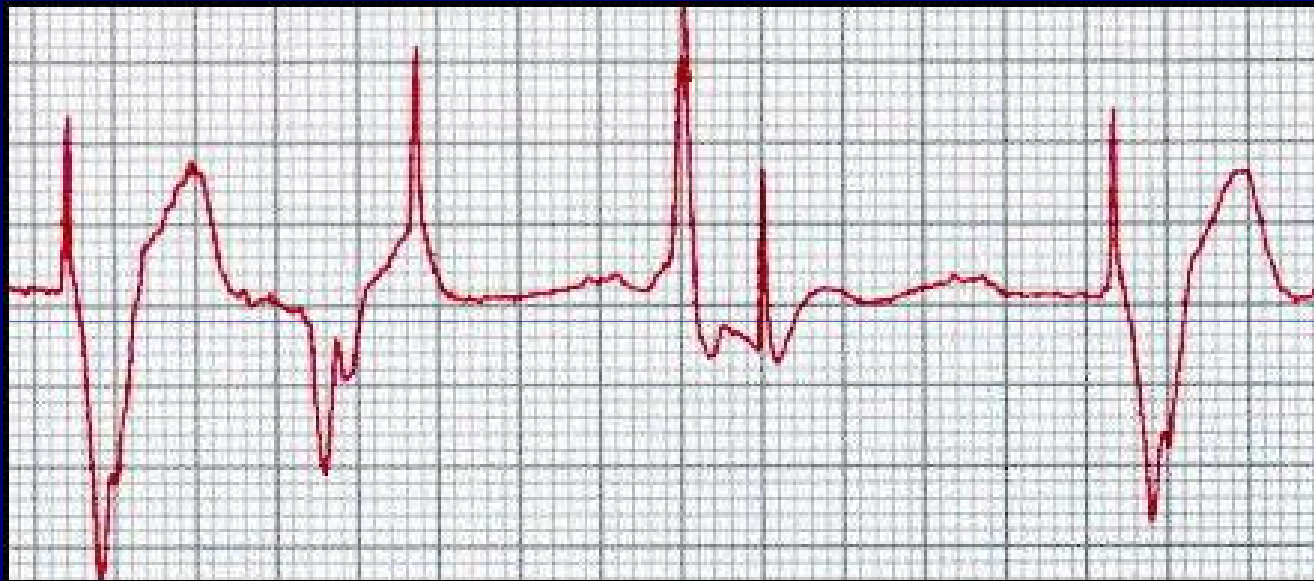


Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine, 7th ed., 2005.

Causes: • Crosstalk

Problems with Pacemakers

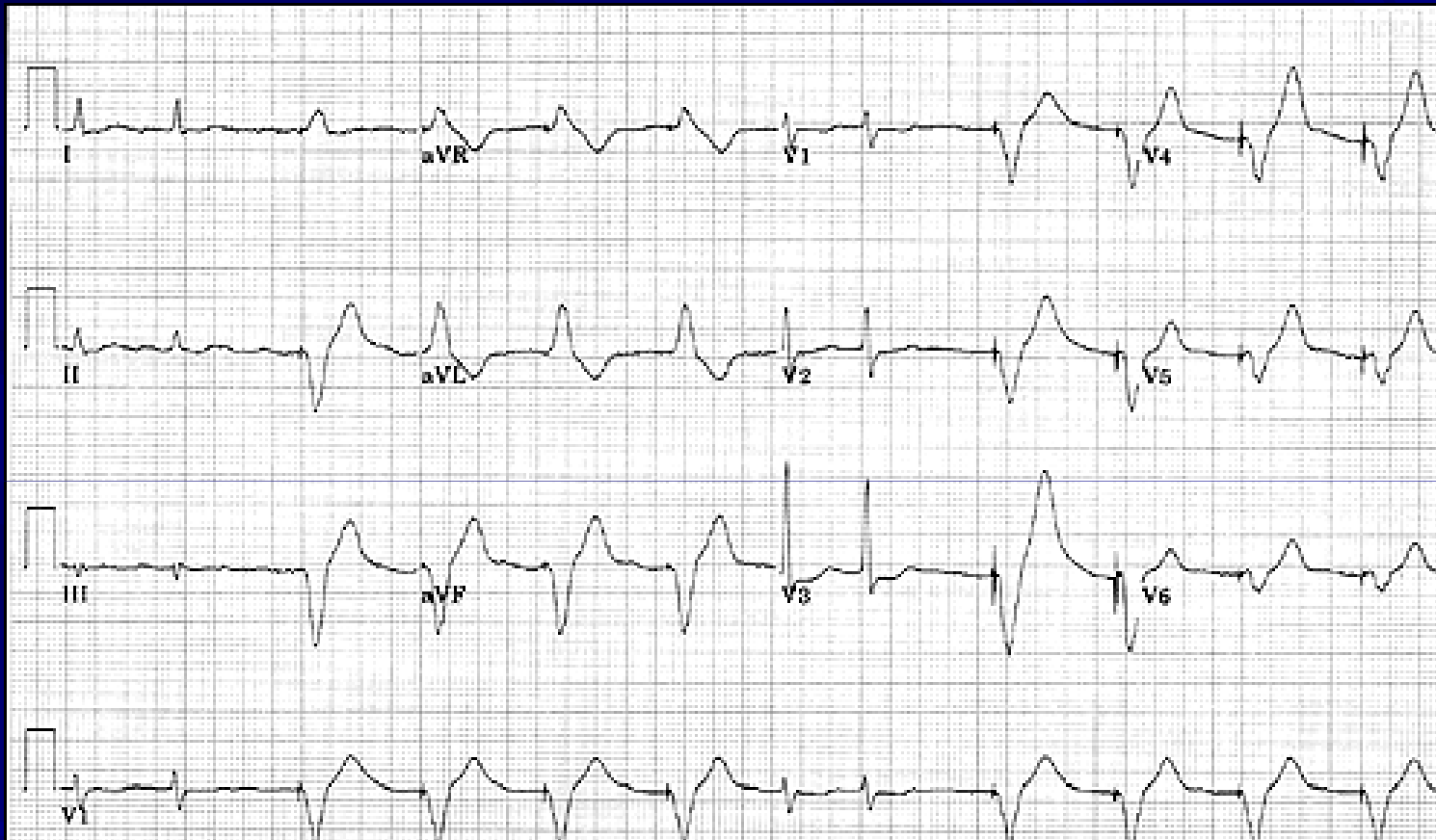
Failure to Sense



Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine, 7th ed., 2005.

- Causes:
- Undersensing
 - Lead Fracture

Example 1

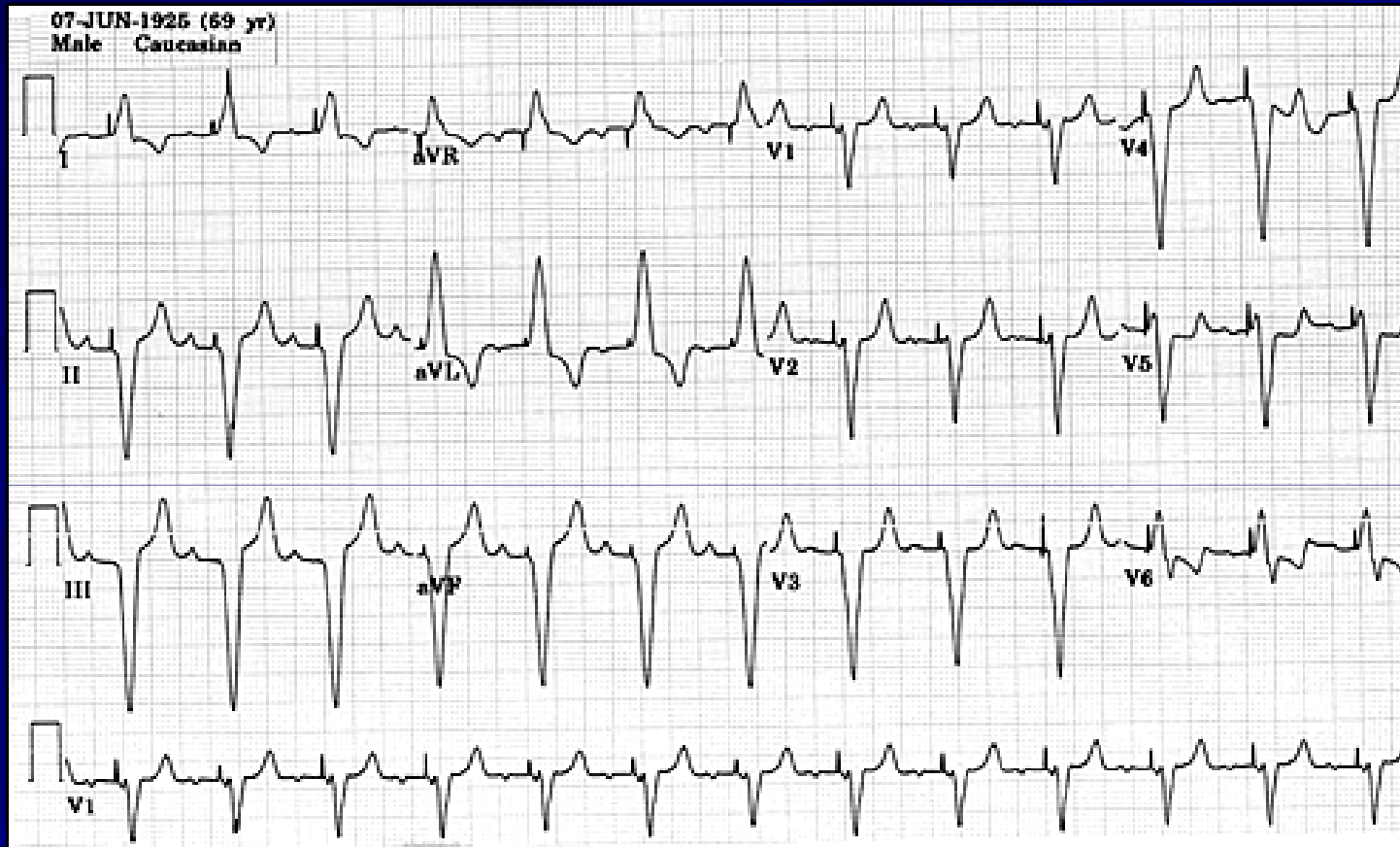


The Alan E. Lindsay ECG Learning Center ; <http://medstat.med.utah.edu/kw/ecg/>

Ventricular sensed, ventricular paced

Consistent with VVI

Example 2

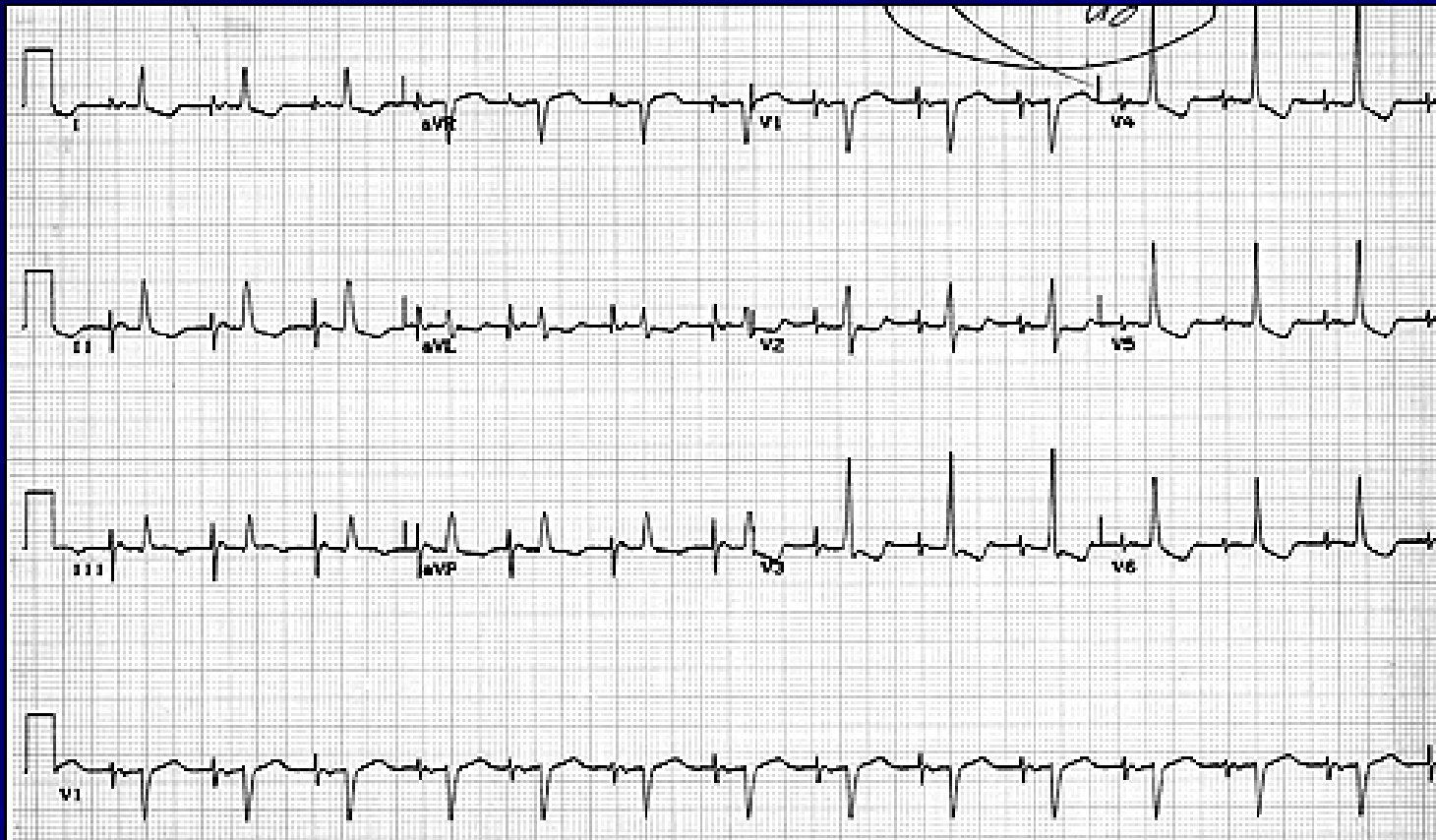


The Alan E. Lindsay ECG Learning Center ; <http://medstat.med.utah.edu/kw/ecg/>

Atrial sensed, ventricular paced

Consistent with DDD or VDD

Example 3

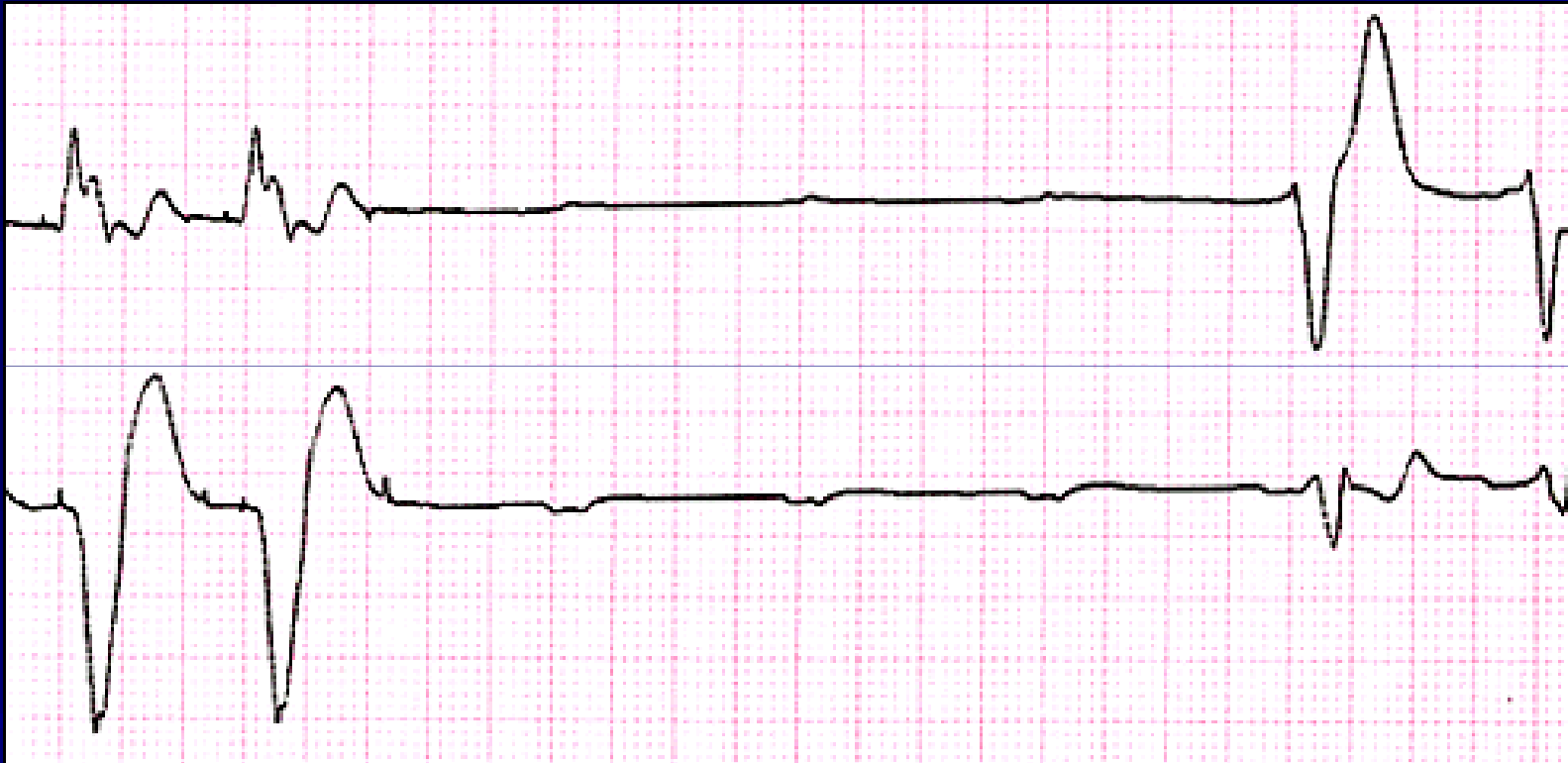


The Alan E. Lindsay ECG Learning Center ; <http://medstat.med.utah.edu/kw/ecg/>

Atrial paced

Consistent with AAI or DDD

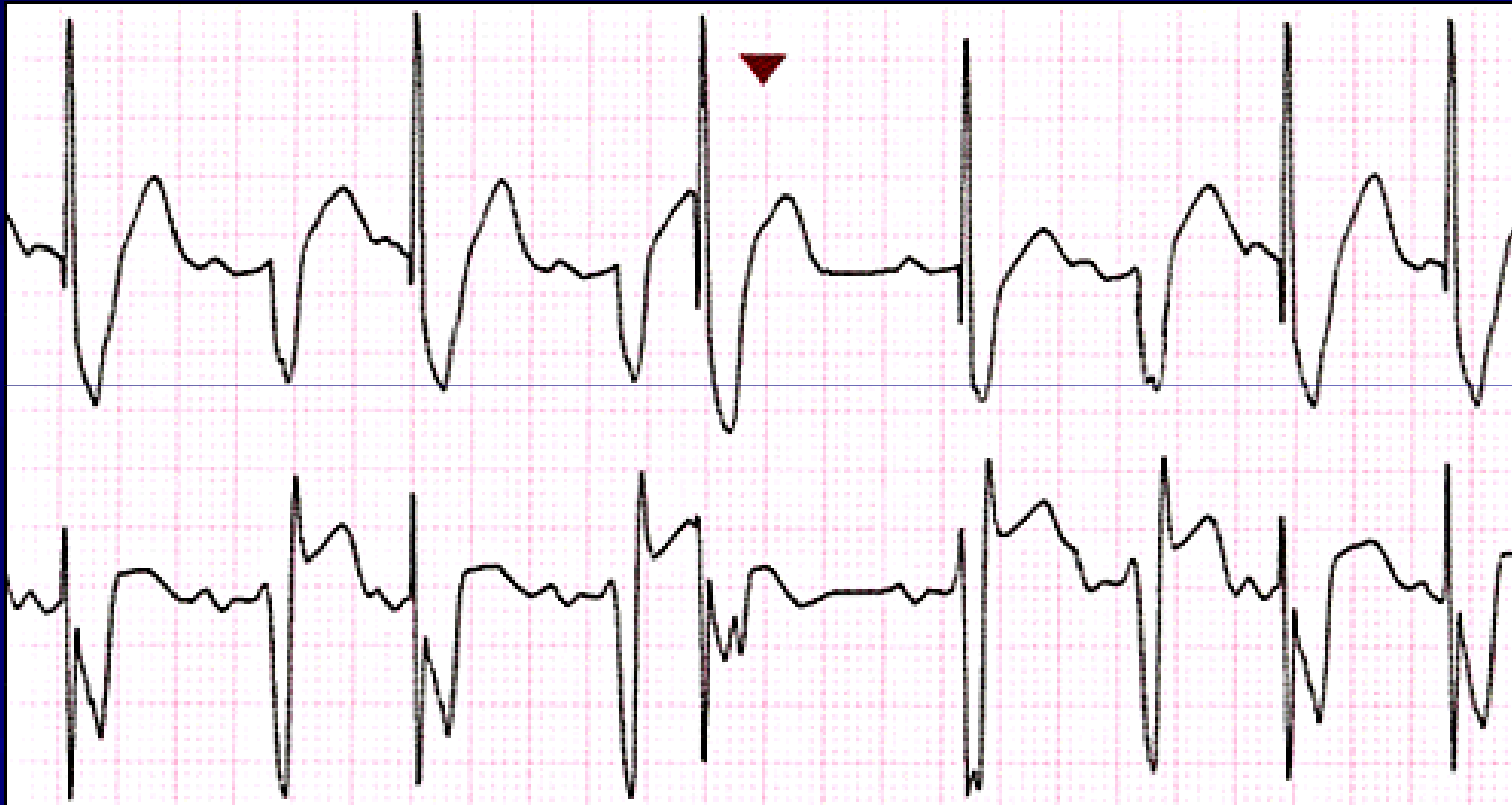
Example 4



The Alan E. Lindsay ECG Learning Center ; <http://medstat.med.utah.edu/kw/ecg/>

Failure to Pace

Example 5



The Alan E. Lindsay ECG Learning Center ; <http://medstat.med.utah.edu/kw/ecg/>

Failure to Sense