



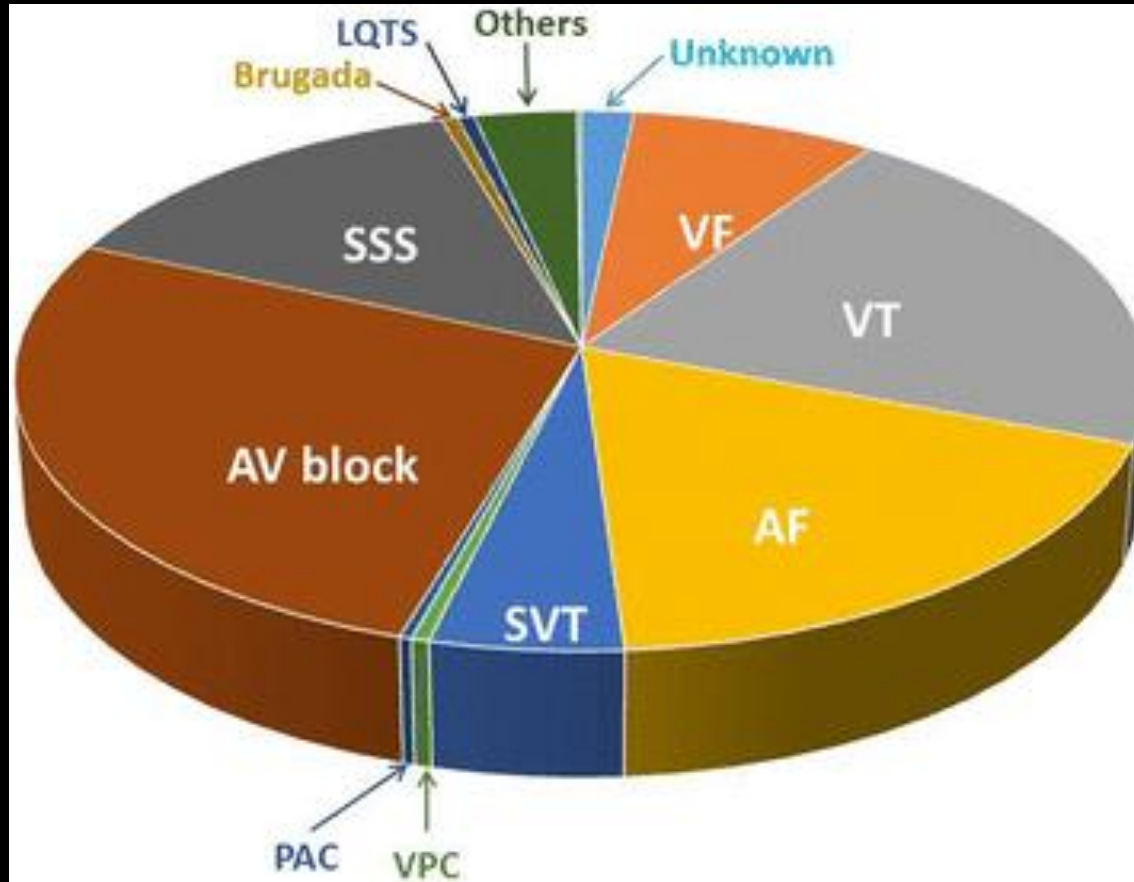
# Arrhythmia 341

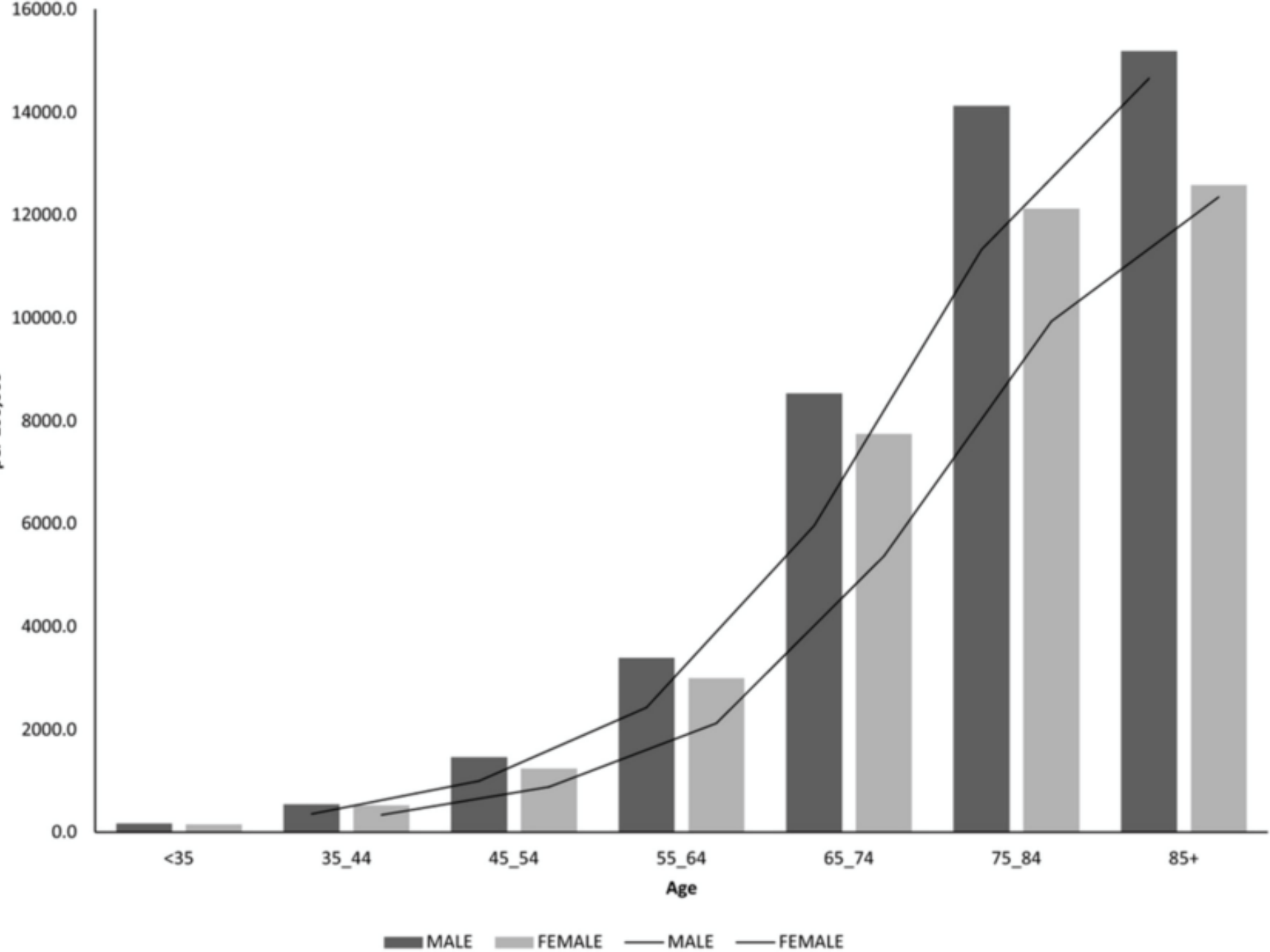
- Ahmad Hersi  
Professor of Cardiology



# Objectives

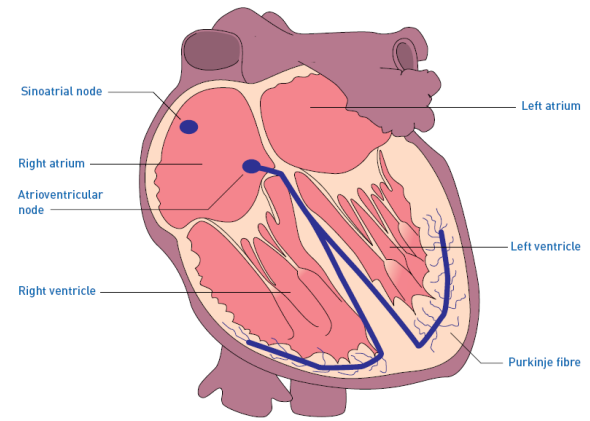
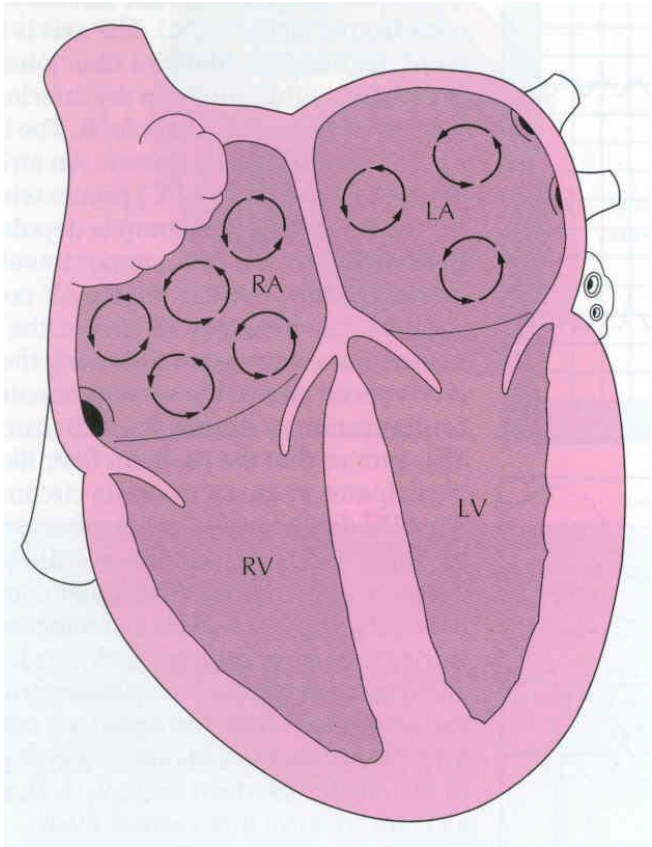
- Epidemiology and Mechanisms of AF
- Evaluation of AF patients
- Classification of AF
- Treatment and Risk stratification of AF
- Identify other forms of Arrhythmia





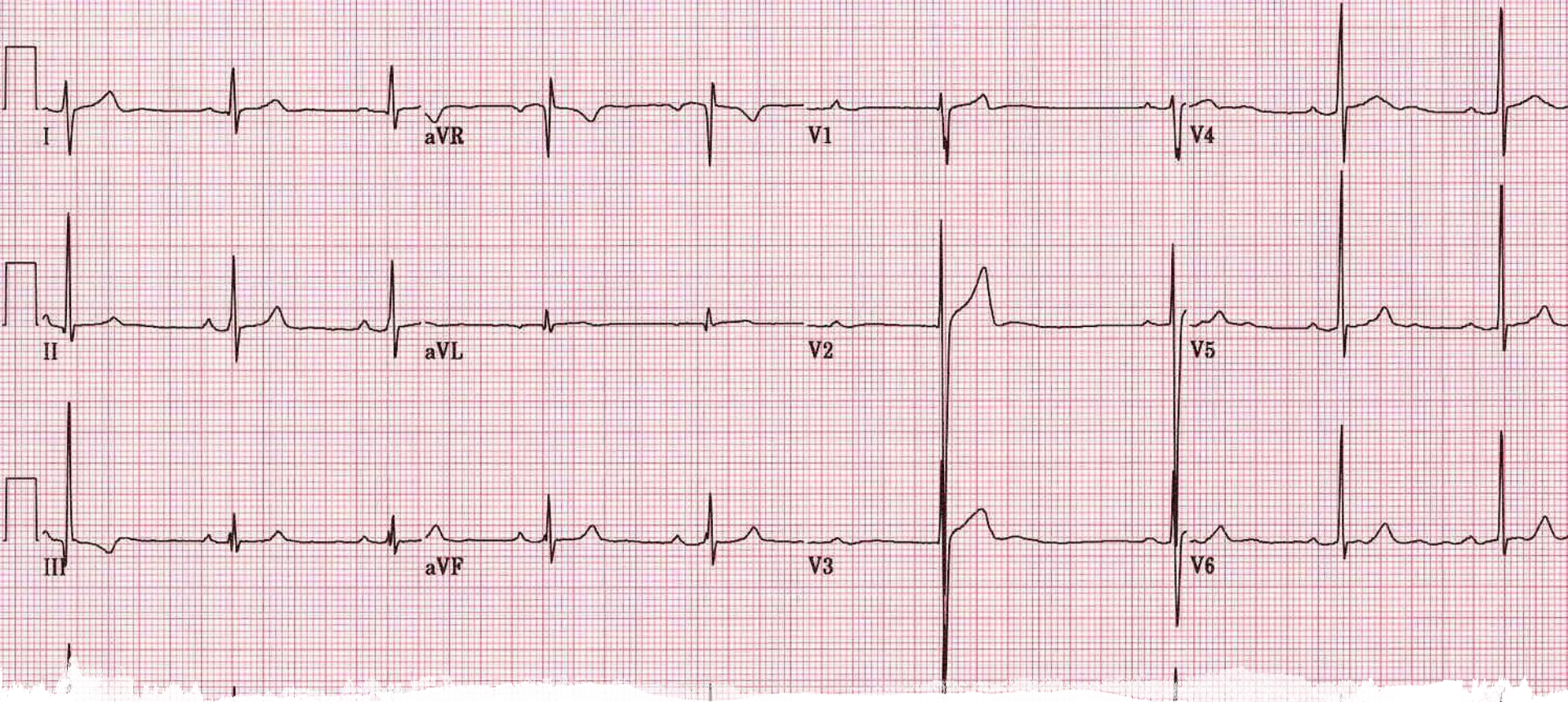


# Pathophysiology of Atrial Fibrillation and associated Stroke



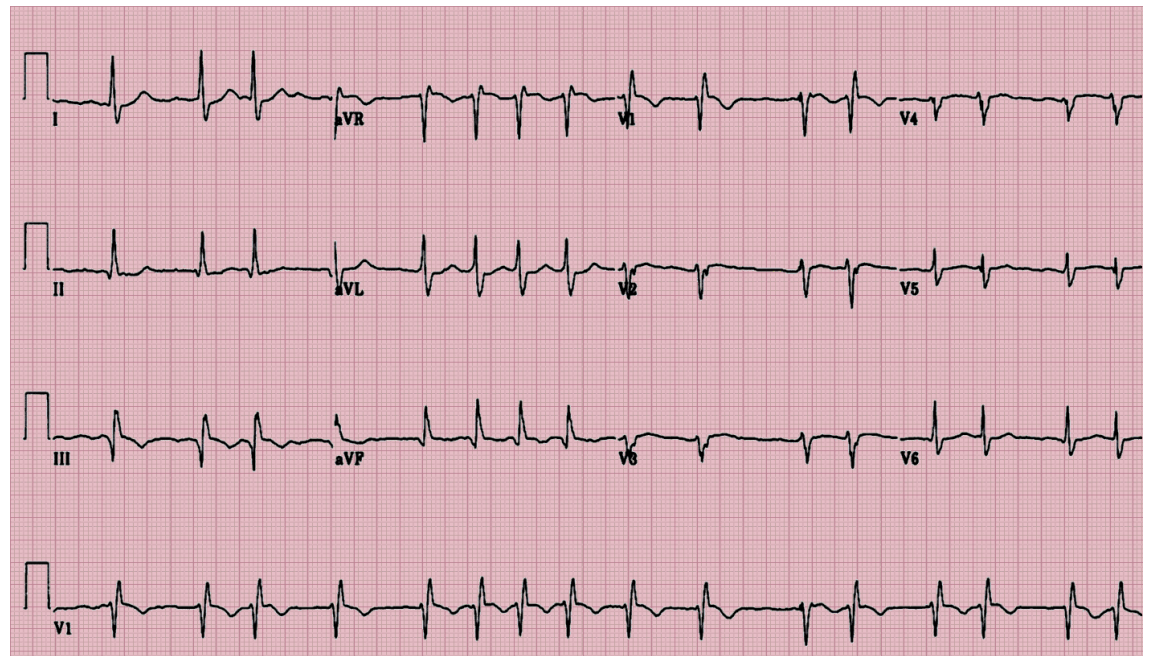
Contraction is controlled by the sinoatrial (SA) node

## Normal regulation of heart rate and rhythm




Normal EKG

AF







Normal heart  
rhythm is  
disrupted in  
AF

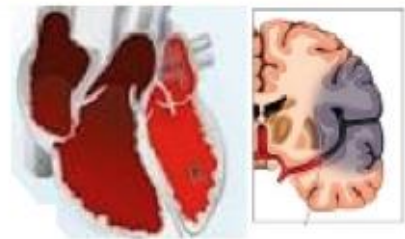
- AF is characterized by:
  - Rapid (350–600 beats/min) and irregular atrial rhythm
  - Reduced filling of the left and right ventricles
- Conduction of most impulses from the atria to ventricles is blocked at the AV node
- Contraction of the ventricles can be:
  - Irregular and rapid (110–180 beats/min; tachycardia)
  - Irregular and slow (<50 beats/min; bradycardia)
  - Normal
- Cardiac output can be reduced



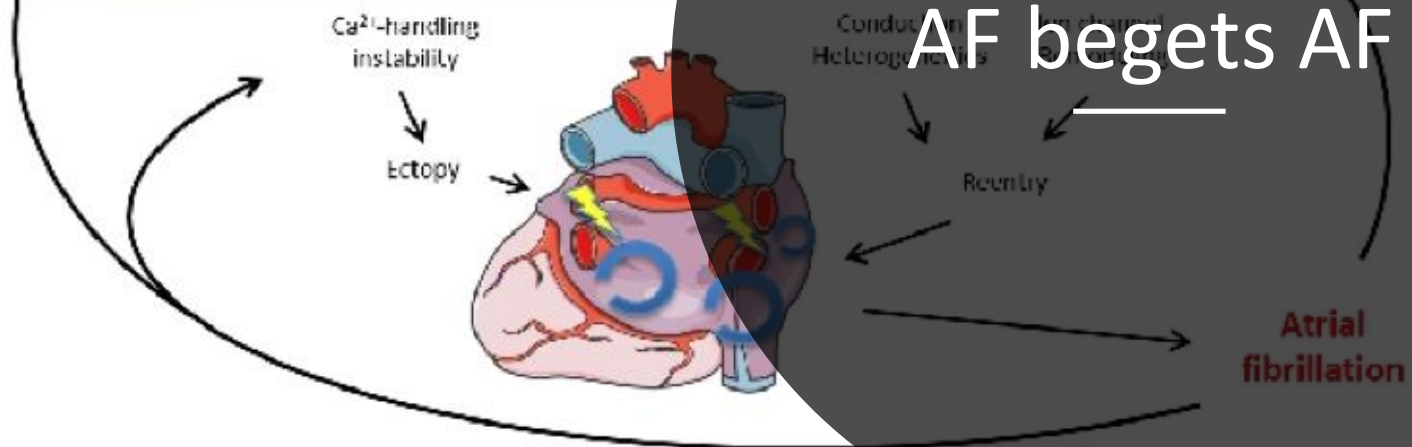
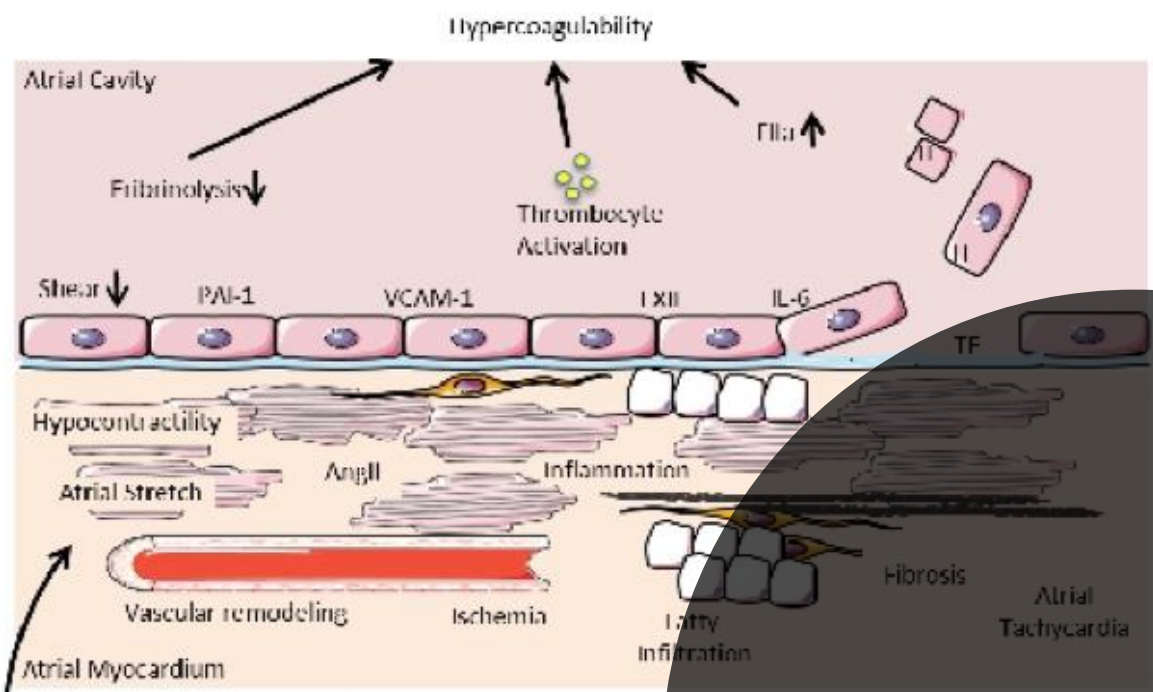
# AF begets AF

- AF causes remodelling:
  - **Electrical:** shortening of refractory period
  - **Structural:** enlargement of atrial cavities
- Many episodes of AF resolve spontaneously
- Over time AF tends to become persistent or permanent.

Diabetes  
 Heart failure  
 Obesity  
 Coronary artery disease  
 Hypertension  
 Ageing  
 Genetic predisposition



Stroke




AF begets AF

Atrial fibrillation

Death	Increased mortality, especially cardiovascular mortality due to sudden death, heart failure or stroke.
Stroke	20–30% of all strokes are due to AF. A growing number of patients with stroke are diagnosed with 'silent', paroxysmal AF.
Hospitalizations	10–40% of AF patients are hospitalized every year.
Quality of life	Quality of life is impaired in AF patients independent of other cardiovascular conditions.
Left ventricular dysfunction and heart failure	Left ventricular dysfunction is found in 20–30% of all AF patients. AF causes or aggravates LV dysfunction in many AF patients, while others have completely preserved LV function despite long-standing AF.
Cognitive decline and vascular dementia	Cognitive decline and vascular dementia can develop even in anticoagulated AF patients. Brain white matter lesions are more common in AF patients than in patients without AF.

## Consequences of AF



# Diagnosis of Atrial Fibrillation



# Atrial Fibrillation: Cardiac Causes

- Hypertensive heart disease
- Ischemic heart disease
- Valvular heart disease
  - Rheumatic: mitral stenosis
  - Non-rheumatic: aortic stenosis, mitral regurgitation
- Pericarditis
- Cardiac tumors: atrial myxoma
- Sick sinus syndrome
- Cardiomyopathy
  - Hypertrophic
  - Idiopathic dilated (? cause vs. effect)
- Post-coronary bypass surgery



# Atrial Fibrillation: Non-Cardiac Causes

- Pulmonary
  - COPD
  - Pneumonia
  - Pulmonary embolism
- Metabolic
  - Thyroid disease:  
hyperthyroidism
  - Electrolyte disorder
- Toxic: alcohol ('holiday heart'  
syndrome)



# Clinical presentation of AF

- With or without detectable heart disease
- Episodic
  - Symptoms may be absent or intermittent
  - Up to 90% of episodes may not cause symptoms
- Symptoms vary according to
  - Irregularity and rate of ventricular response
  - Functional status
  - AF duration
  - Patient factors
  - Co-morbidities

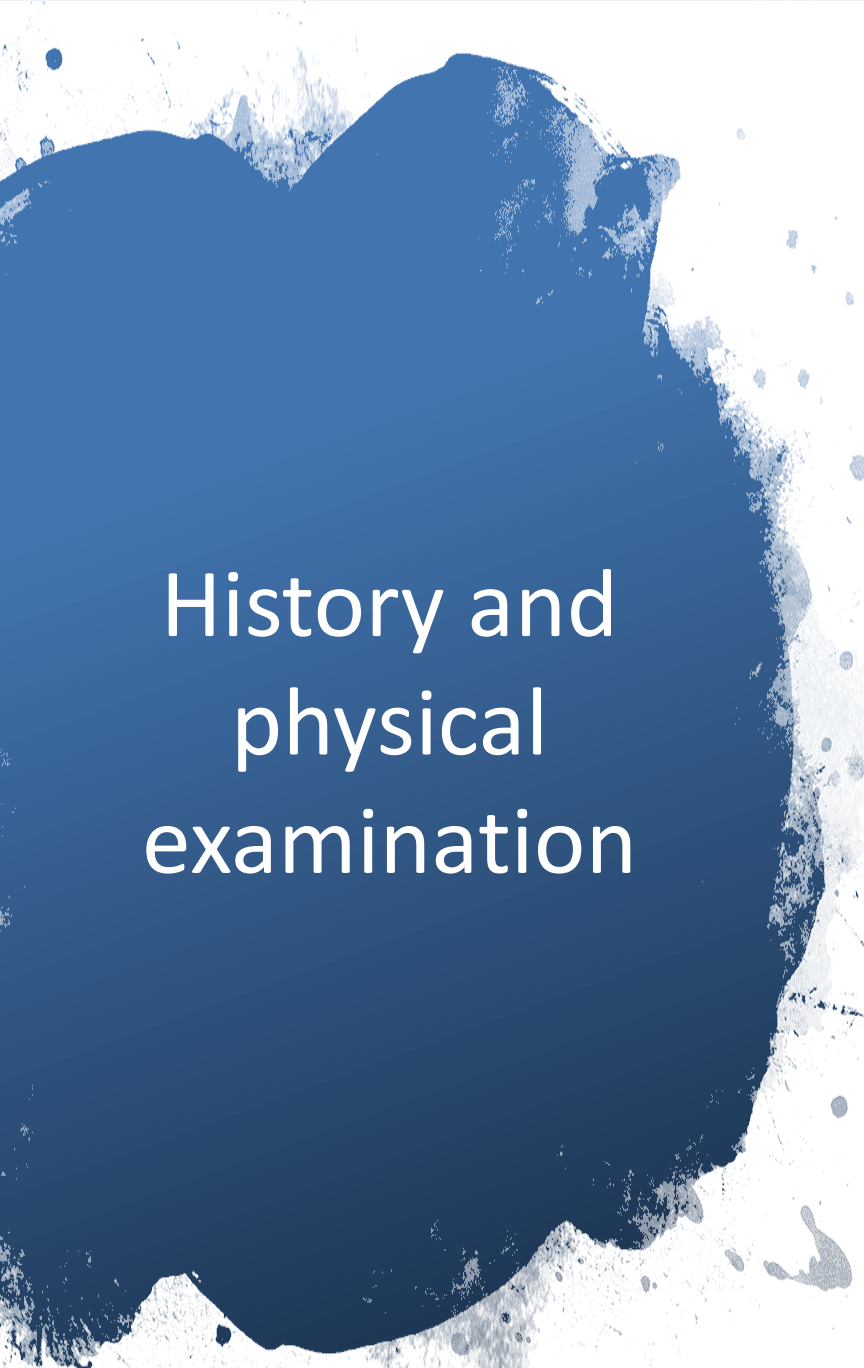


# Signs and symptoms

---

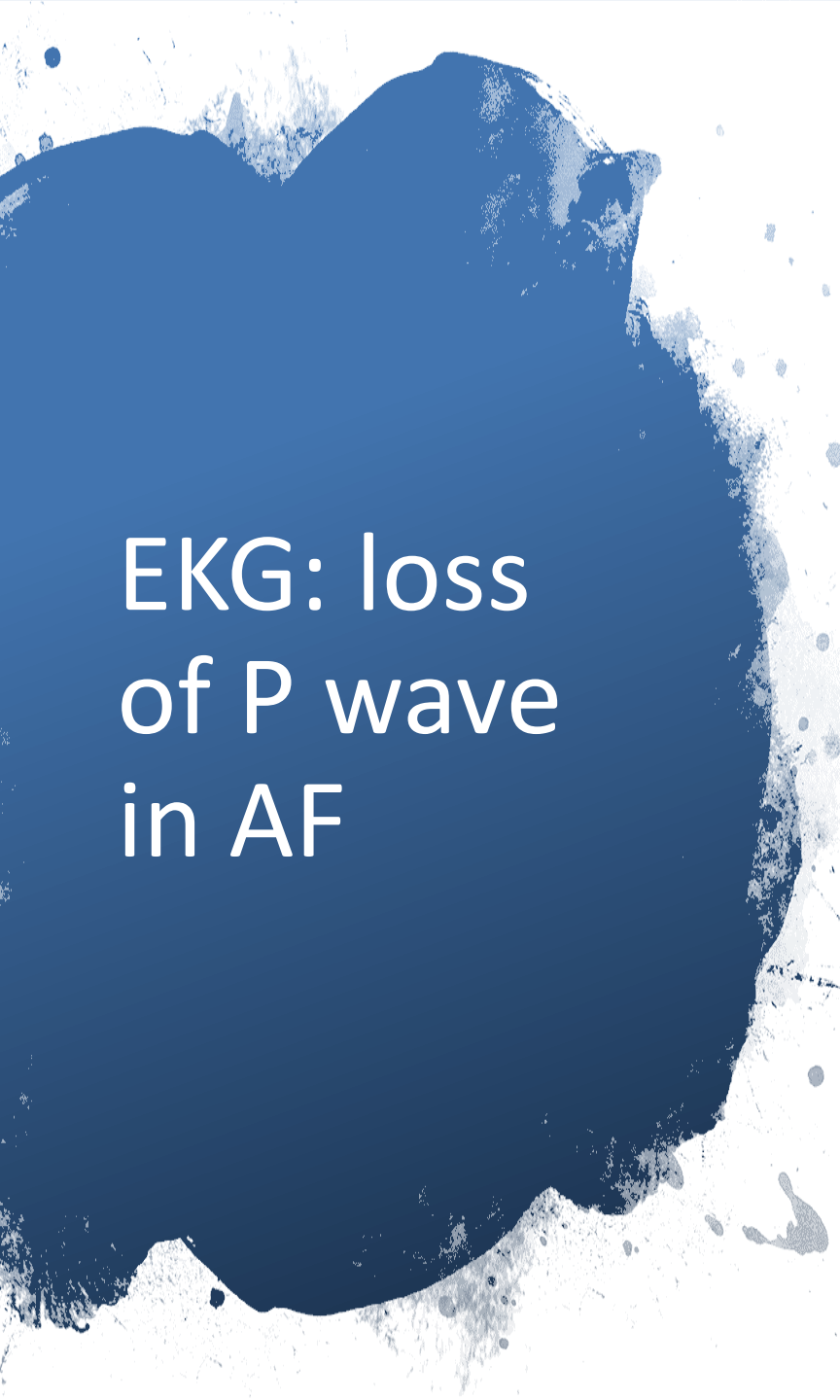
<b>Cause</b>	<b>Sign/symptom</b>
<ul style="list-style-type: none"><li>• Irregular heart beat</li></ul>	<ul style="list-style-type: none"><li>• Irregularly irregular pulse</li><li>• Palpitations</li></ul>
<ul style="list-style-type: none"><li>• Decreased cardiac output</li></ul>	<ul style="list-style-type: none"><li>• Fatigue</li><li>• Diminished exercise capacity</li><li>• Breathlessness (dyspnoea)</li><li>• Weakness (asthenia)</li></ul>
<ul style="list-style-type: none"><li>• Hypotension</li></ul>	<ul style="list-style-type: none"><li>• Dizziness and fainting (syncope)</li></ul>
<ul style="list-style-type: none"><li>• Cardiac ischaemia</li></ul>	<ul style="list-style-type: none"><li>• Chest pain (angina)</li></ul>
<ul style="list-style-type: none"><li>• Increased risk of clot formation</li></ul>	<ul style="list-style-type: none"><li>• Thromboembolic TIA, stroke</li></ul>

---



# History and physical examination

- Clinical conditions associated with AF
  - Underlying heart conditions (e.g. valvular heart disease, heart failure, coronary artery disease, hypertension)
  - Other reversible conditions
- Family history
  - Familial AF (lone AF in a family)
  - AF secondary to other genetic conditions (familial cardiomyopathies)
- Type of AF
  - First episode, paroxysmal, persistent, permanent
  - Triggers – e.g. emotional stress, alcohol, physical exercise, gastroesophageal disease
  - Specific symptoms
  - Response to any treatments administered

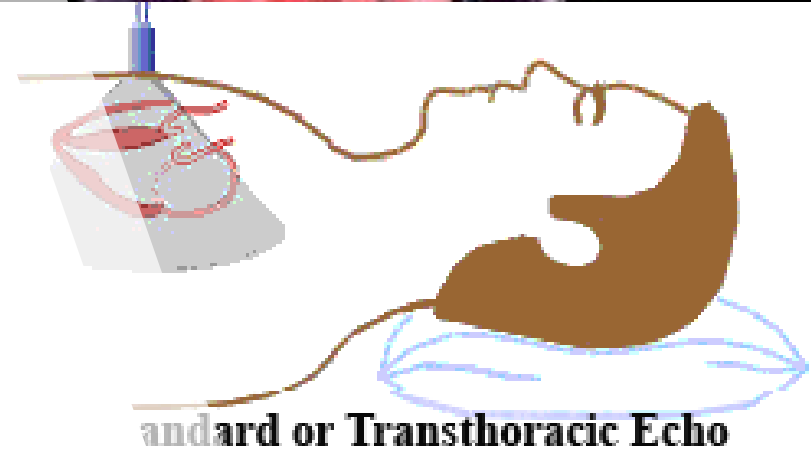


EKG: loss  
of P wave  
in AF

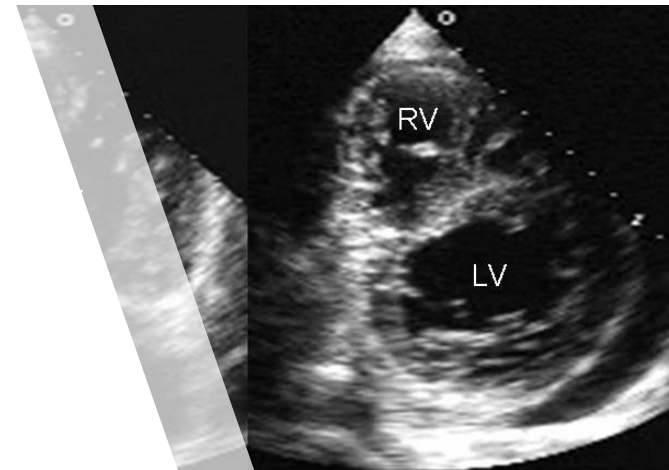
- AF
  - Heart rate increased (tachyarrhythmia)\*
  - Irregular rhythm
  - No P wave
  - Irregular baseline

# Transthoracic echocardiography (TTE)

- Non-invasive
- Used to identify
  - Size and functioning of atria and ventricles
  - Ventricle hypertrophy
  - Pericardial disease
  - Valvular heart disease



**Standard or Transthoracic Echo**





# Laboratory tests

- Important parameters to assess include:
  - Thyroid function
  - Renal function
  - Hepatic function
  - Serum electrolytes
  - Complete blood count

**A**

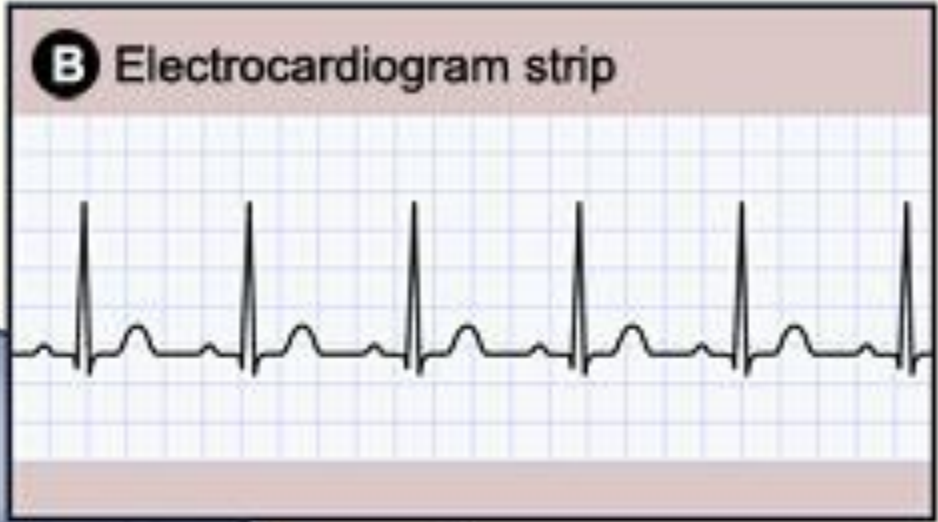
**B**

Electrocardiogram strip

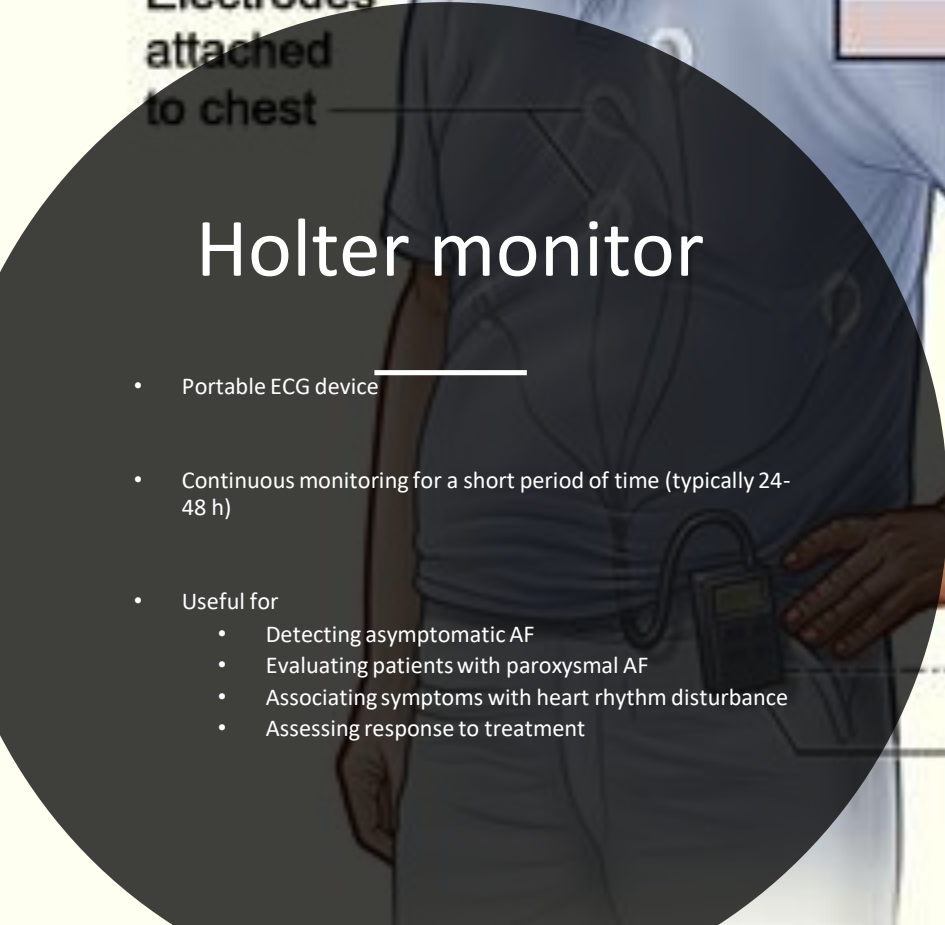
Electrodes attached to chest

# Holter monitor

- Portable ECG device
- Continuous monitoring for a short period of time (typically 24-48 h)
- Useful for
  - Detecting asymptomatic AF
  - Evaluating patients with paroxysmal AF
  - Associating symptoms with heart rhythm disturbance
  - Assessing response to treatment

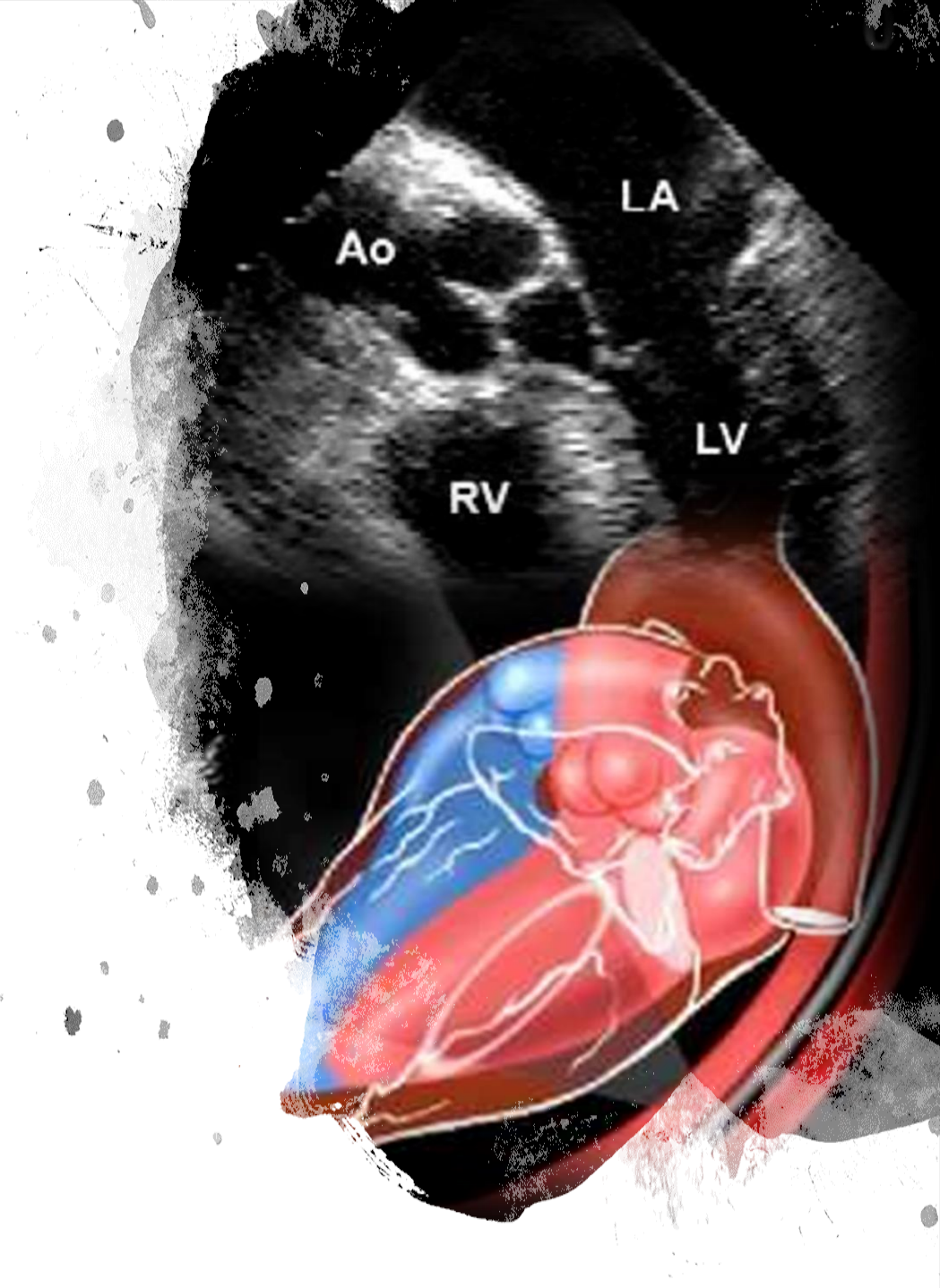


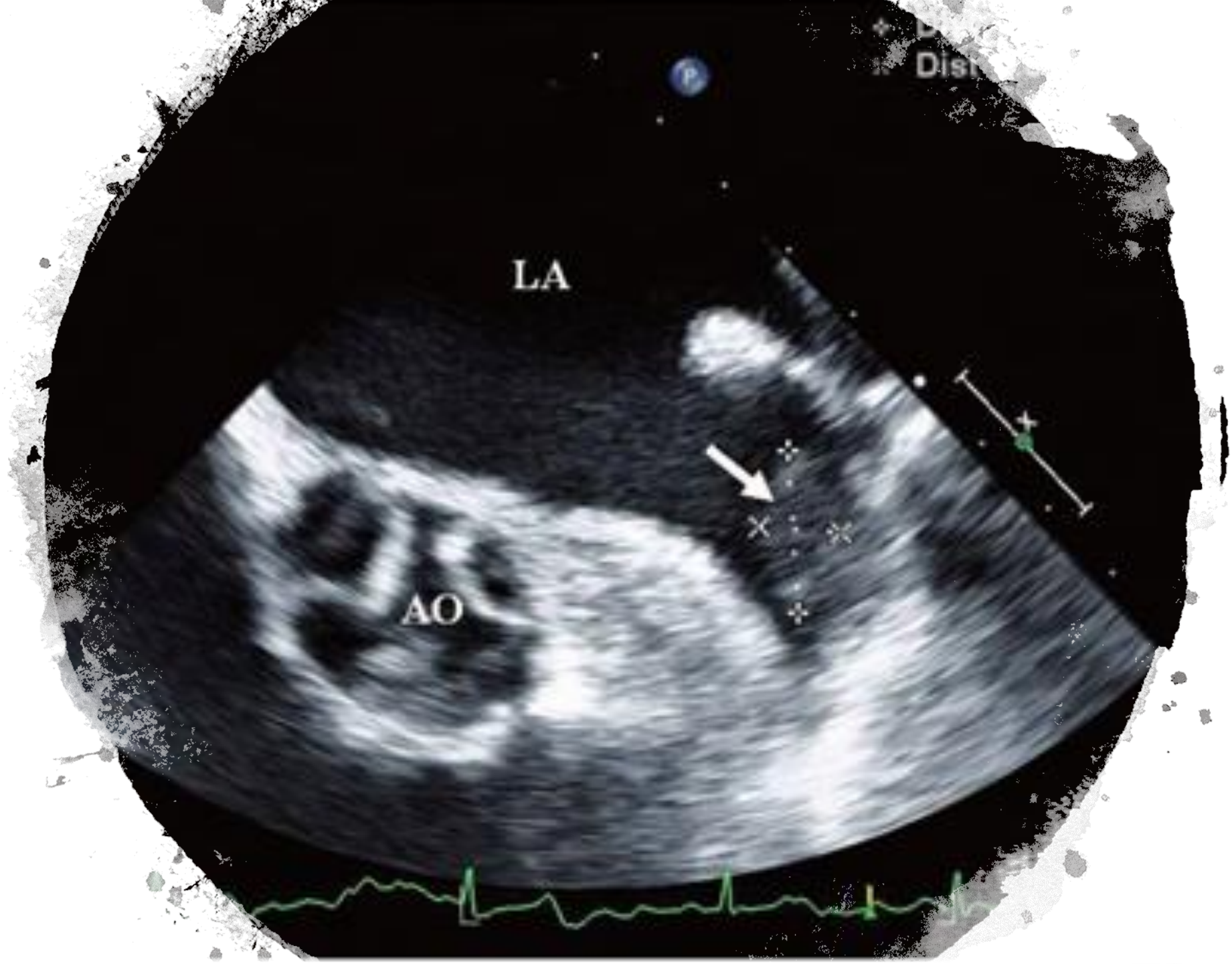
Recording device



# Transoesophageal echocardiogram (TEE)

- Ultrasound transducer positioned close to the heart using an endoscope-like device
- High quality images of cardiac structure and function
  - Particularly the left atrial appendage, the most common site of thrombi in patients with AF







# Chest Radiography

- When clinical findings suggest an abnormality chest radiography may be used to
  - Evaluate pulmonary pathology and vasculature
  - Detect congestive heart failure
  - Assess enlargement of the cardiac chambers



# Summary slide for evaluation of AF patient

## APPENDIX 3. INITIAL CLINICAL EVALUATION IN PATIENTS WITH AF

### Minimum Evaluation

1. History and physical examination, to define	<ul style="list-style-type: none"> <li>• Presence and nature of symptoms associated with AF</li> <li>• Clinical type of AF (paroxysmal, persistent, or permanent)</li> <li>• Onset of first symptomatic attack or date of discovery of AF</li> <li>• Frequency, duration, precipitating factors, and modes of initiation or termination of AF</li> <li>• Response to any pharmacological agents that have been administered</li> <li>• Presence of any underlying heart disease or reversible conditions (e.g., hyperthyroidism or alcohol consumption)</li> </ul>
2. ECG, to identify	<ul style="list-style-type: none"> <li>• Rhythm (verify AF)</li> <li>• LVH</li> <li>• P-wave duration and morphology or fibrillatory waves</li> <li>• Pre-excitation</li> <li>• Bundle-branch block</li> <li>• Prior MI</li> <li>• Other atrial arrhythmias</li> <li>• To measure and follow R-R, QRS, and QT intervals in conjunction with antiarrhythmic drug therapy</li> </ul>
3. TTE, to identify	<ul style="list-style-type: none"> <li>• VHD</li> <li>• LA and RA size</li> <li>• LV and RV size and function</li> <li>• Peak RV pressure (pulmonary hypertension)</li> <li>• LV hypertrophy</li> <li>• LA thrombus (low sensitivity)</li> <li>• Pericardial disease</li> </ul>
4. Blood tests of thyroid, renal, and hepatic function	<ul style="list-style-type: none"> <li>• For a first episode of AF</li> <li>• When ventricular rate is difficult to control</li> </ul>

### Additional Testing (1 or several tests may be necessary)

1. 6-min walk test	<ul style="list-style-type: none"> <li>• If adequacy of rate control is in question</li> <li>• If adequacy of rate control is in question</li> </ul>
2. Exercise testing	<ul style="list-style-type: none"> <li>• To reproduce exercise-induced AF</li> <li>• To exclude ischemia before treatment of selected patients with a type IC * antiarrhythmic drug</li> </ul>
3. Holter or event monitoring	<ul style="list-style-type: none"> <li>• If diagnosis of type of arrhythmia is in question</li> <li>• As a means of evaluating rate control</li> </ul>
4. TEE	<ul style="list-style-type: none"> <li>• To identify LA thrombus (in LAA)</li> <li>• To guide cardioversion</li> </ul>
5. Electrophysiological study	<ul style="list-style-type: none"> <li>• To clarify the mechanism of wide-QRS-complex tachycardia</li> <li>• To identify a predisposing arrhythmia such as atrial flutter or paroxysmal supraventricular tachycardia</li> <li>• To seek sites for curative AF ablation or AV conduction block/modification</li> </ul>
6. Chest radiograph, to evaluate	<ul style="list-style-type: none"> <li>• Lung parenchyma, when clinical findings suggest an abnormality</li> <li>• Pulmonary vasculature, when clinical findings suggest an abnormality</li> </ul>



# Classification of Atrial Fibrillation

**TABLE 3** Definitions of AF: A Simplified Scheme

<b>Term</b>	<b>Definition</b>
Paroxysmal AF	<ul style="list-style-type: none"><li>• AF that terminates spontaneously or with intervention within 7 d of onset.</li><li>• Episodes may recur with variable frequency.</li></ul>
Persistent AF	<ul style="list-style-type: none"><li>• Continuous AF that is sustained &gt;7 d.</li></ul>
Long-standing persistent AF	<ul style="list-style-type: none"><li>• Continuous AF &gt;12 mo in duration.</li></ul>
Permanent AF	<ul style="list-style-type: none"><li>• The term "permanent AF" is used when the patient and clinician make a joint decision to stop further attempts to restore and/or maintain sinus rhythm.</li><li>• Acceptance of AF represents a therapeutic attitude on the part of the patient and clinician rather than an inherent pathophysiological attribute of AF.</li><li>• Acceptance of AF may change as symptoms, efficacy of therapeutic interventions, and patient and clinician preferences evolve.</li></ul>
Nonvalvular AF	<ul style="list-style-type: none"><li>• AF in the absence of rheumatic mitral stenosis, a mechanical or bioprosthetic heart valve, or mitral valve repair.</li></ul>

## Classification of AF

---

Lone or primary AF without clinical/ECG evidence of cardiopulmonary disease

Non-valvular AF that is not associated with damage to the heart valves (e.g. rheumatic mitral valve disease, prosthetic heart valve or mitral valve repair)

## Classification of AF

## Change in Guideline Recommendations (Only major included)

2014

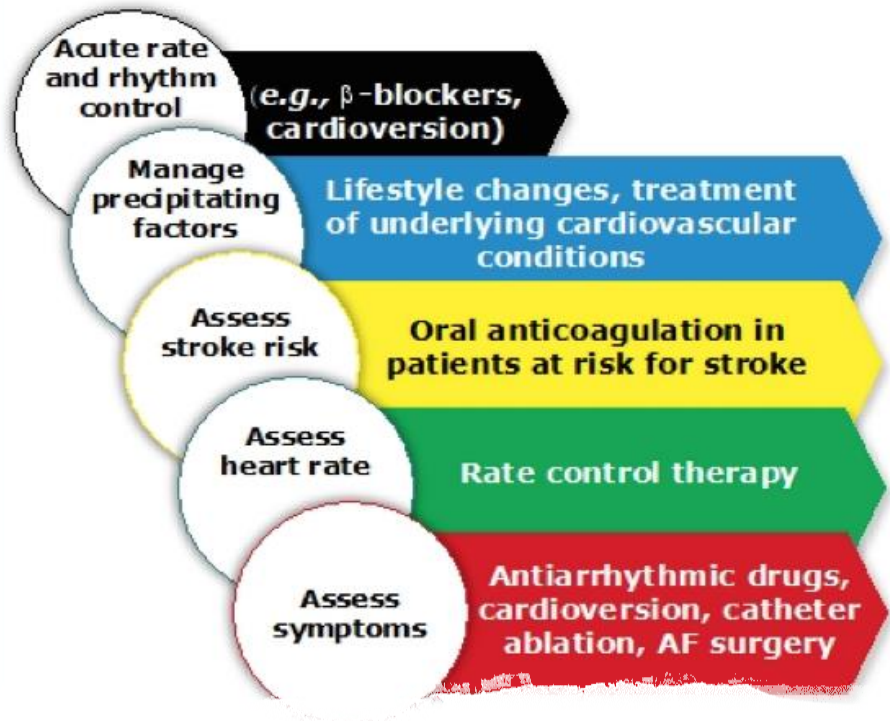
2019

The term "*nonvalvular AF*" is no longer used



# Treatment Atrial Fibrillation

## Treatment



## Desired outcome

Haemodynamic stability

Cardiovascular risk reduction

Stroke prevention

Symptom improvement, preservation of LV function

Symptom improvement

## Patient benefit

Improved life expectancy

Improved quality of life, autonomy, social functioning

The Five Domains of Integrated AF Management



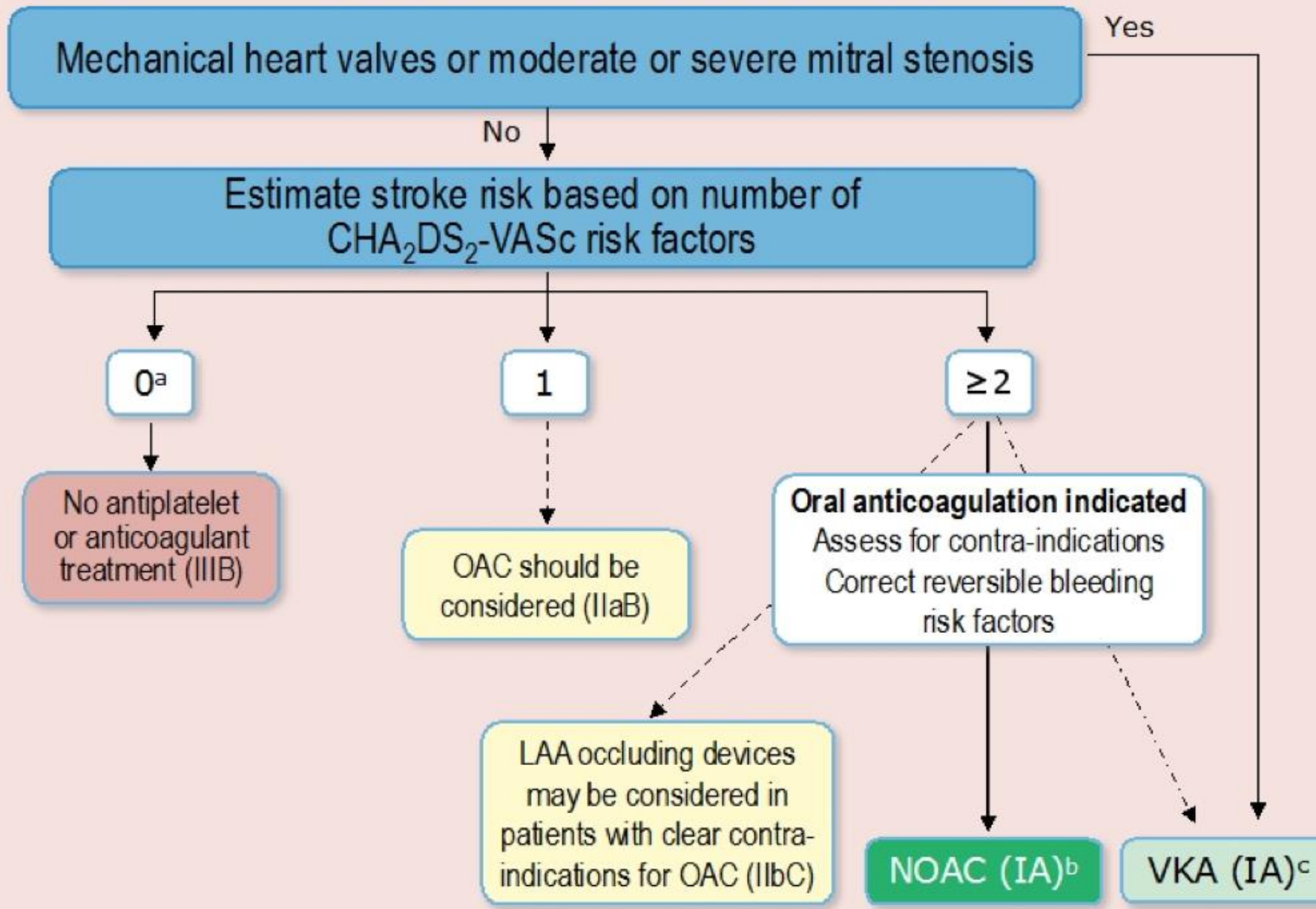


# 3 Strategies

- Prevention of thromboembolism
- Rate control
- Restoration and maintenance of sinus rhythm

<b>CHADS<sub>2</sub> score</b>	<b>Patients (n= 1733)</b>	<b>Adjusted stroke rate (%/year)<sup>a</sup> (95% confidence interval)</b>
0	120	1.9 (1.2–3.0)
1	463	2.8 (2.0–3.8)
2	523	4.0 (3.1–5.1)
3	337	5.9 (4.6–7.3)
4	220	8.5 (6.3–11.1)
5	65	12.5 (8.2–17.5)
6	5	18.2 (10.5–27.4)

<b>CHA<sub>2</sub>DS<sub>2</sub>-VASc</b>	<b>Score</b>
<b>C</b> ongestive heart failure/LV dysfunction	<b>1</b>
<b>H</b> ypertension	<b>1</b>
<b>A</b> ge ≥ 75 years	<b>2</b>
<b>D</b> iabetes mellitus	<b>1</b>
<b>S</b> troke/TIA/TE	<b>2</b>
<b>V</b> ascular disease [prior MI, PAD, or aortic plaque]	<b>1</b>
<b>A</b> ge 65-74 years	<b>1</b>
<b>S</b> ex category (female)	<b>1</b>



<sup>a</sup> Includes women without other stroke risk factors

<sup>b</sup> IIaB for women with only one additional stroke risk factor

<sup>c</sup> IB for patients with mechanical heart valves or mitral stenosis

# 1-STROKE PREVENTION

- Warfarin
- Aspirin
- Dabigatran
- Apixaban
- Rivaroxaba
- Edoxaban
- Removal/isolation of left atrial appendage, e.g. WATCHMAN<sup>®</sup> device or surgery

# 2-Rate control

- $\text{Ca}^{2+}$ -channel blockers
- $\beta$ -blockers
- Digoxin
- Ablate/pace

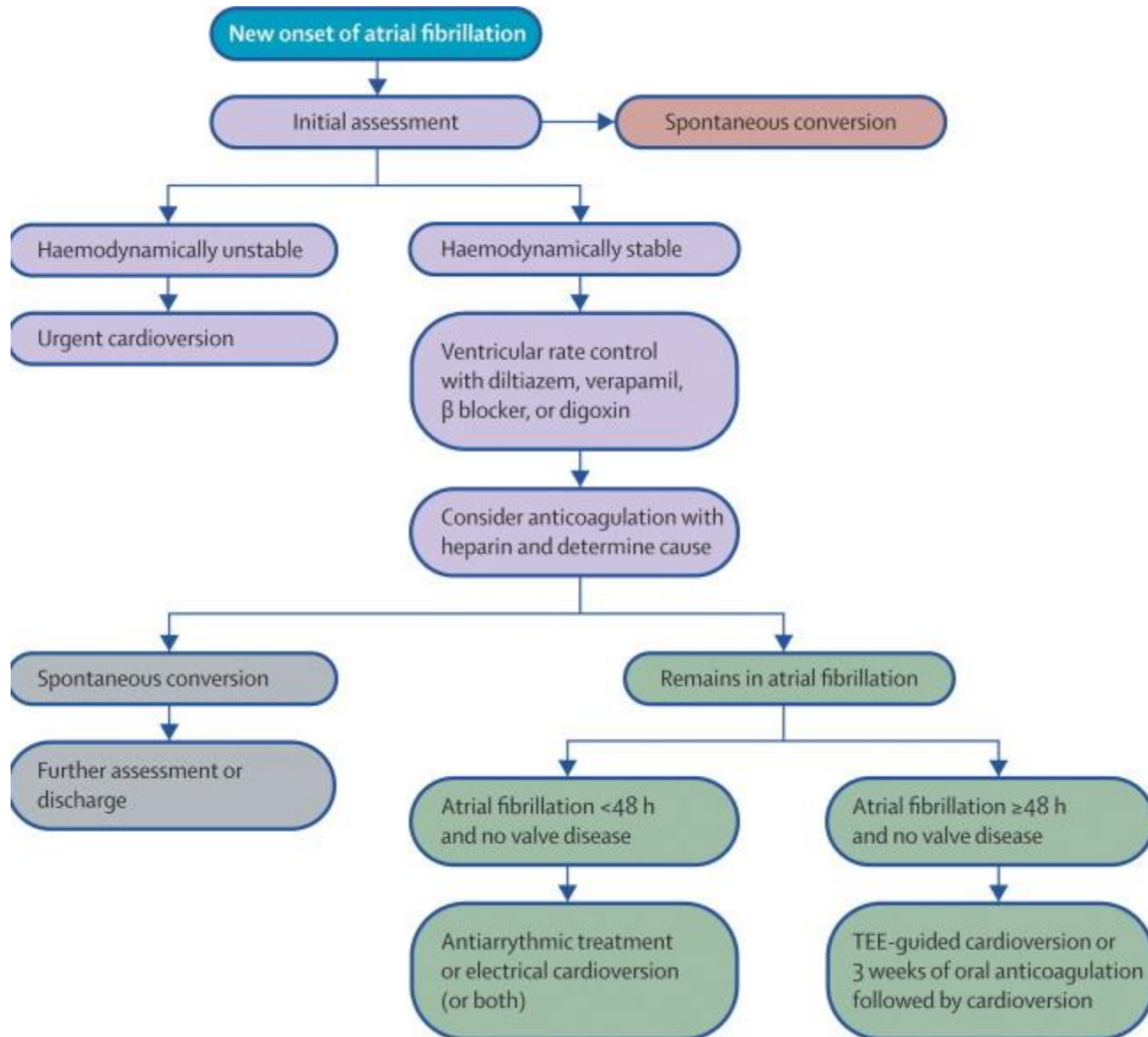
### **3-MAINTENANCE OF SINUS RHYTHM**

- Antiarrhythmic drugs
  - – Class IA
  - – Class IC
    - Class III: e.g. amiodarone, dronedarone
- Ablation
- Surgery (MAZE)



# Rhythm-control therapies

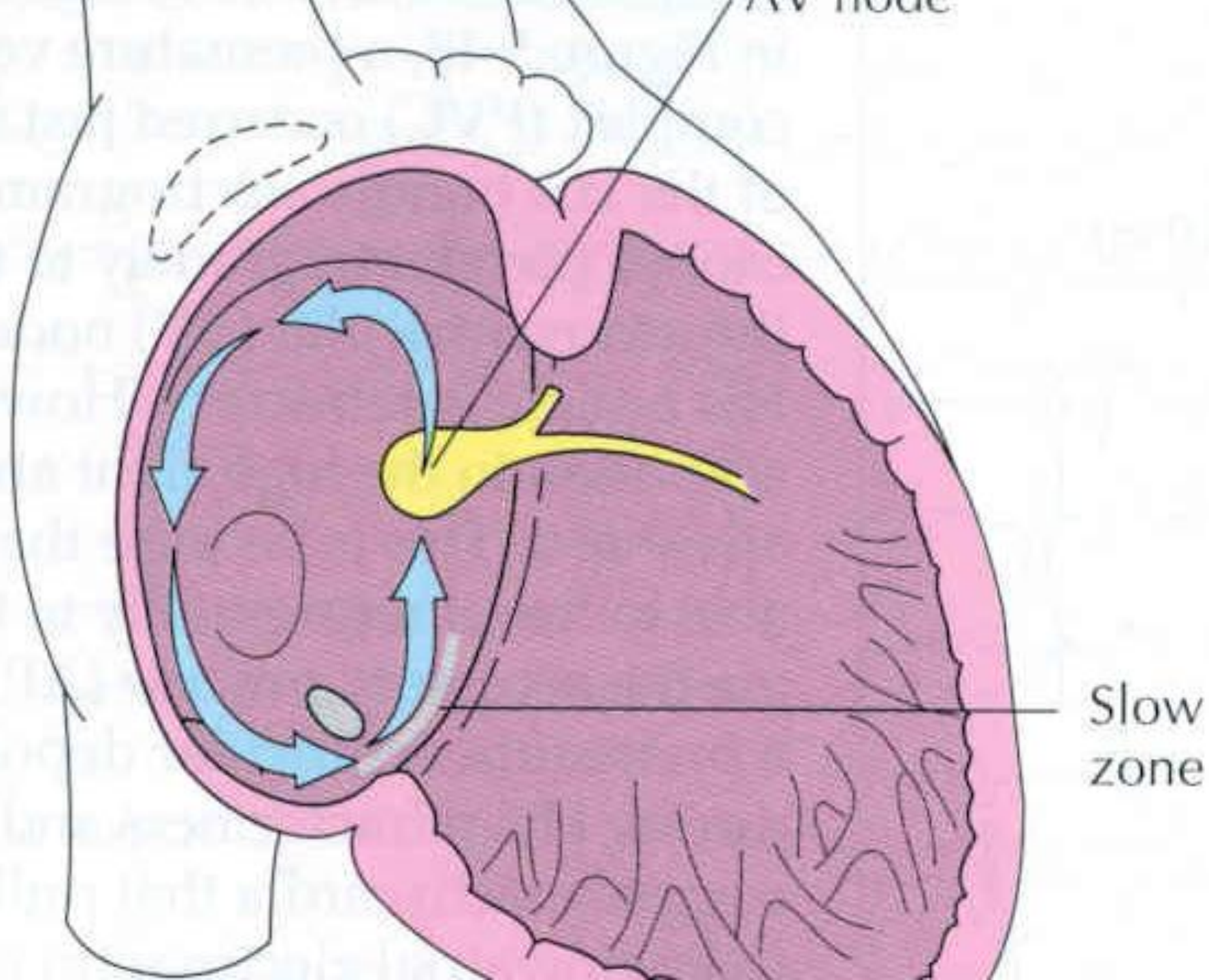
- The objective of rhythm-control therapy is to restore (cardioversion) and maintain normal sinus rhythm
- Cardioversion can be achieved by:
  - Pharmacotherapy with antiarrhythmic agents
  - Electrical shocks (direct-current cardioversion)
- Direct-current cardioversion is generally more effective than pharmacotherapy
- Likelihood of successful cardioversion decreases with the duration of AF
  - Pharmacological cardioversion is most effective when initiated within 7 days of AF onset
- Cardioversion can dislodge thrombi in the atria, increasing the risk of stroke
  - Thromboprophylaxis is recommended for  $\geq 3$  wk before and for at least 4 wks after cardioversion in patients with AF that has persisted for  $\geq 48$  h

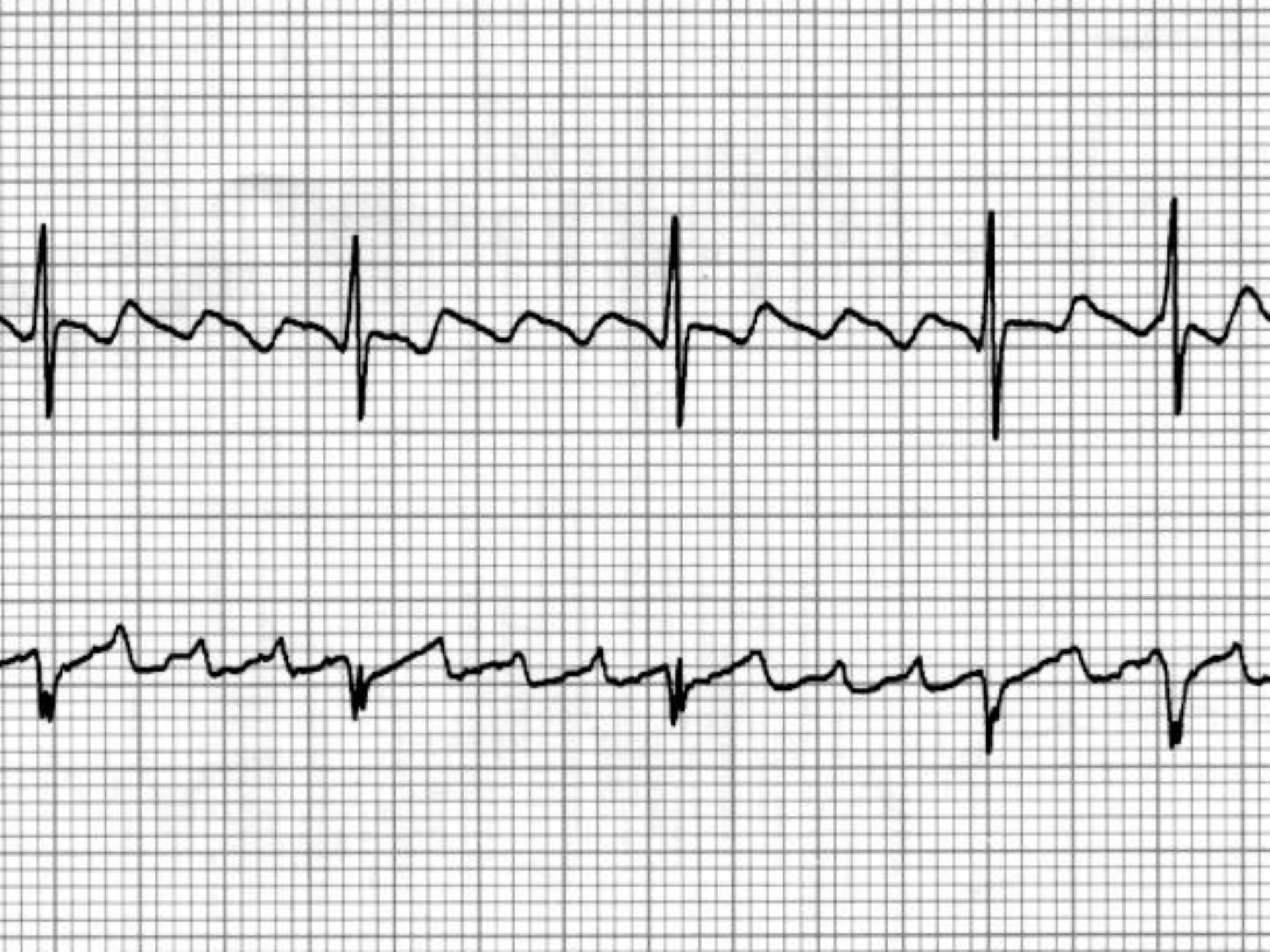






Atrial Flutter



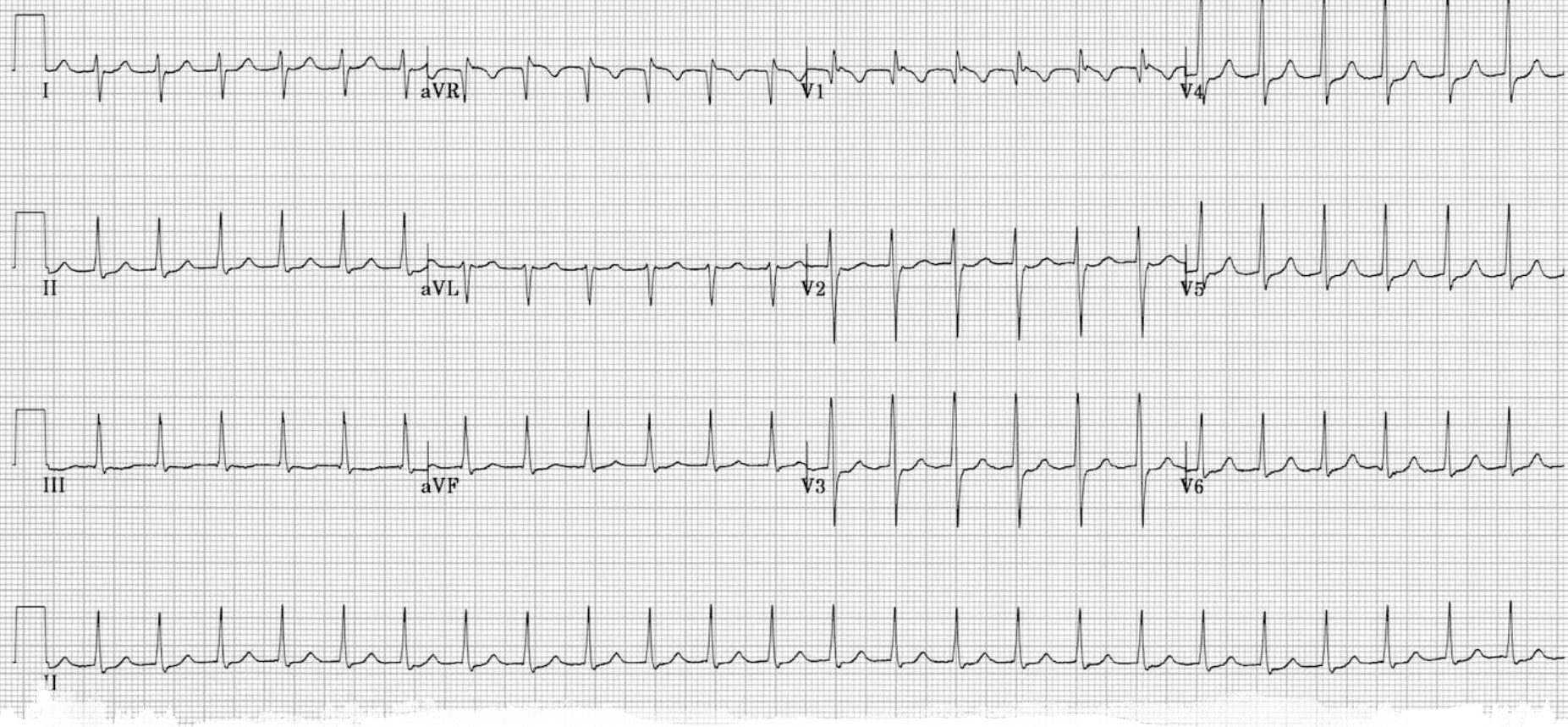


# Atrial Flutter

- ***Unstable*** pt:
  - Synchronized cardioversion as per ACLS
- ***Stable*** pt:
  - Rate control :just like atrial fibrillation AF
  - Elective cardioversion :just like AF
  - Anti-coagulation :just like AF
  - Refer for Ablation



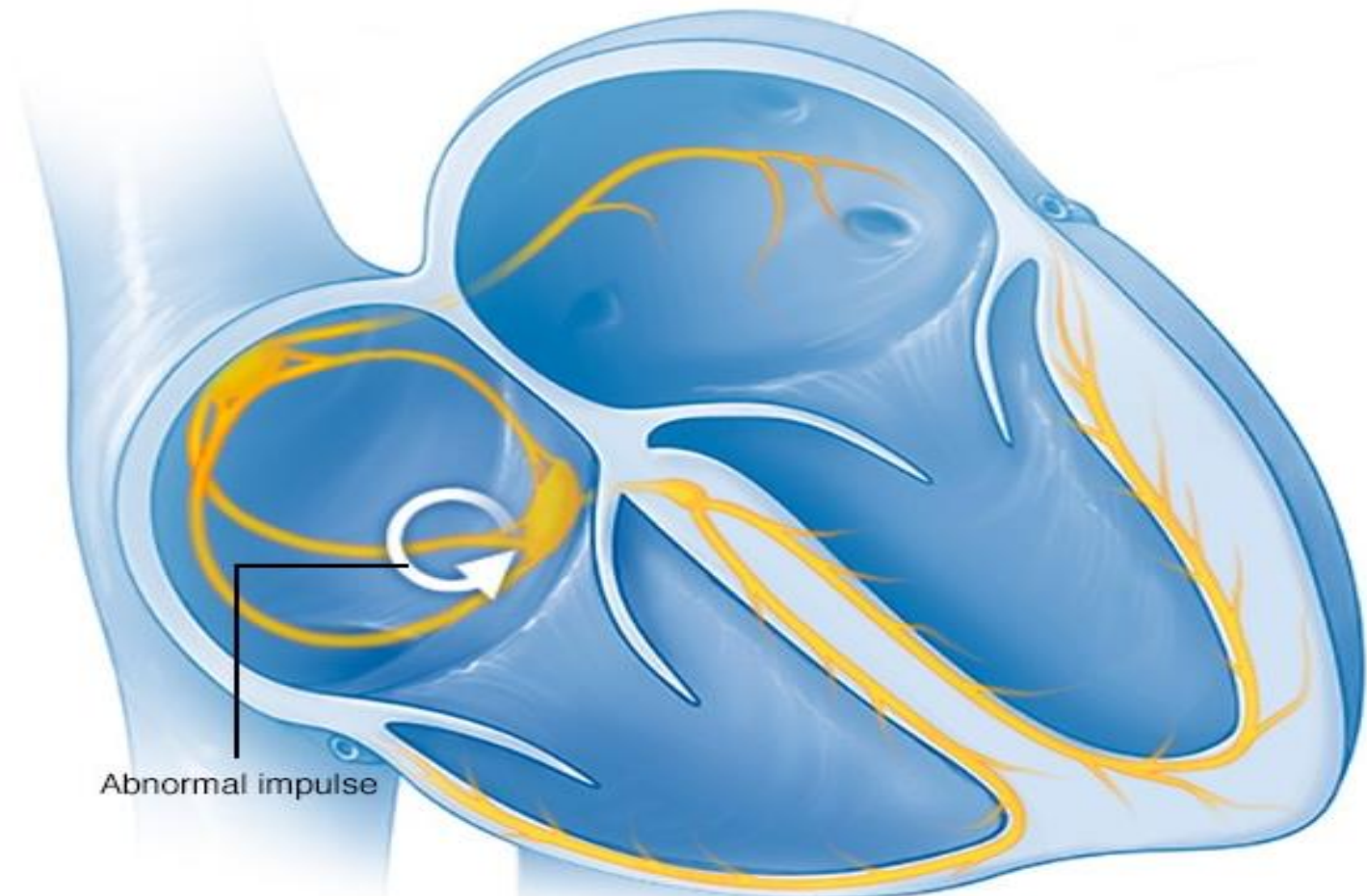
**SVT**



- AVNRT

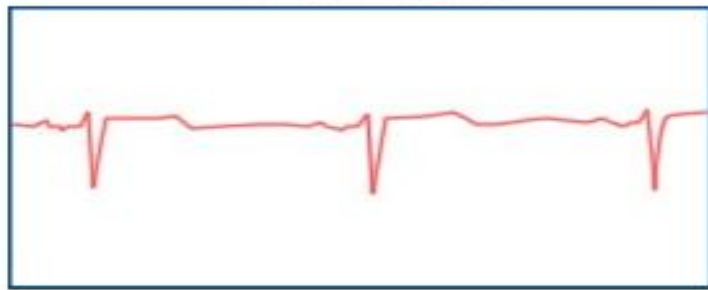
# SVT

- AVNRT (60%)
- AVRT (30%)
- Atrial tachycardia (10%)

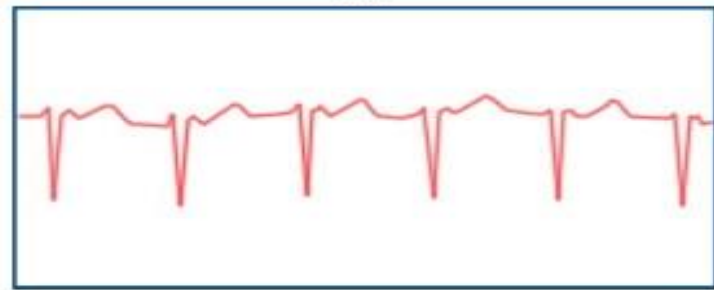


Abnormal impulse

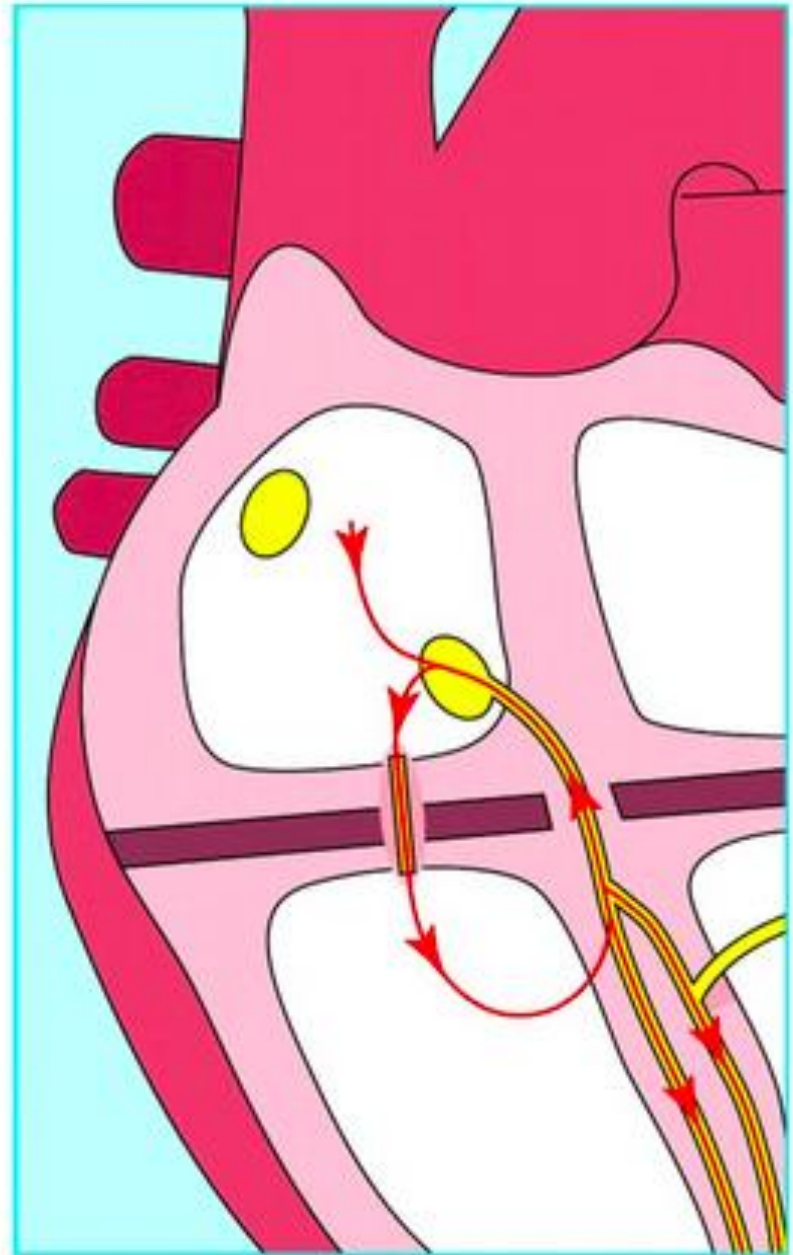
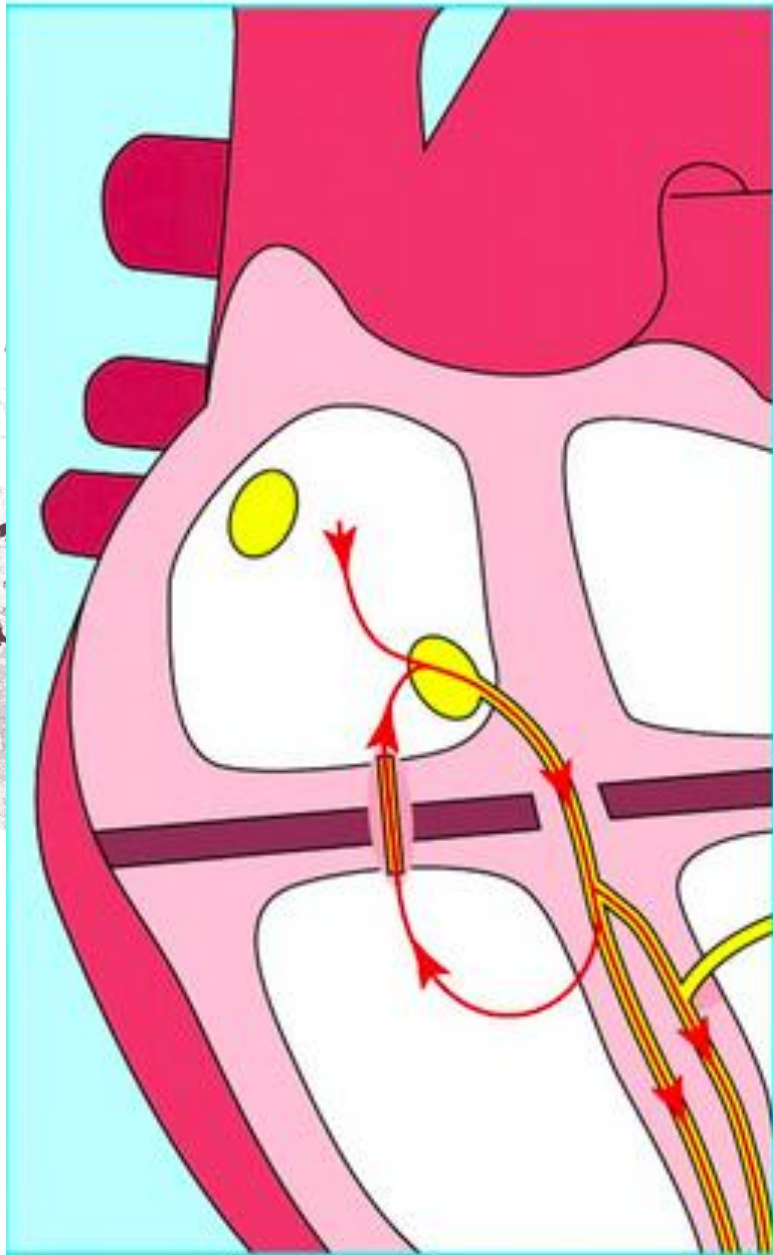
Normal heartbeat



SVT

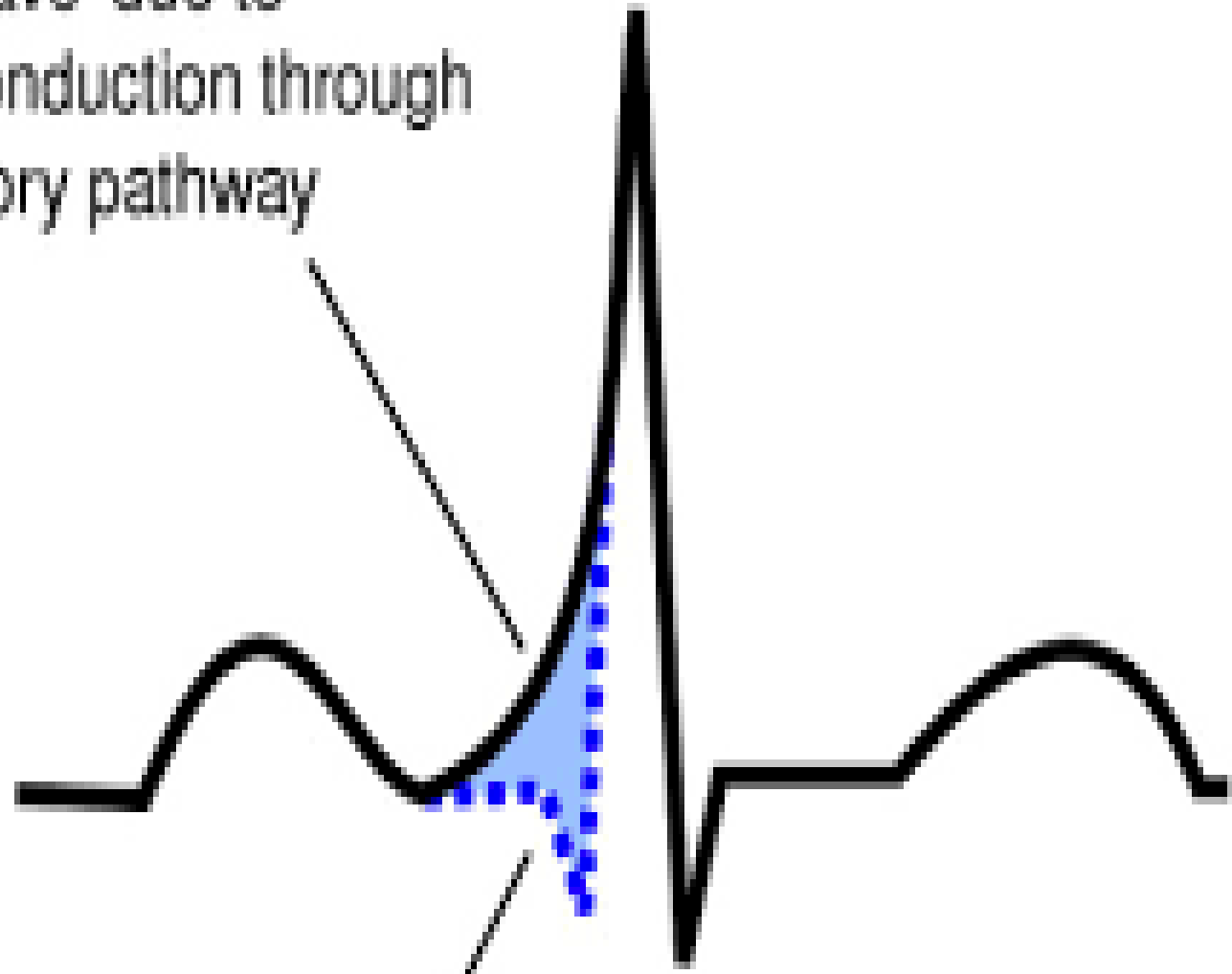






AVRT with orthodromic (left ) and antidromic (right) AV nodal conduction

delta wave' due to  
early conduction through  
accessory pathway

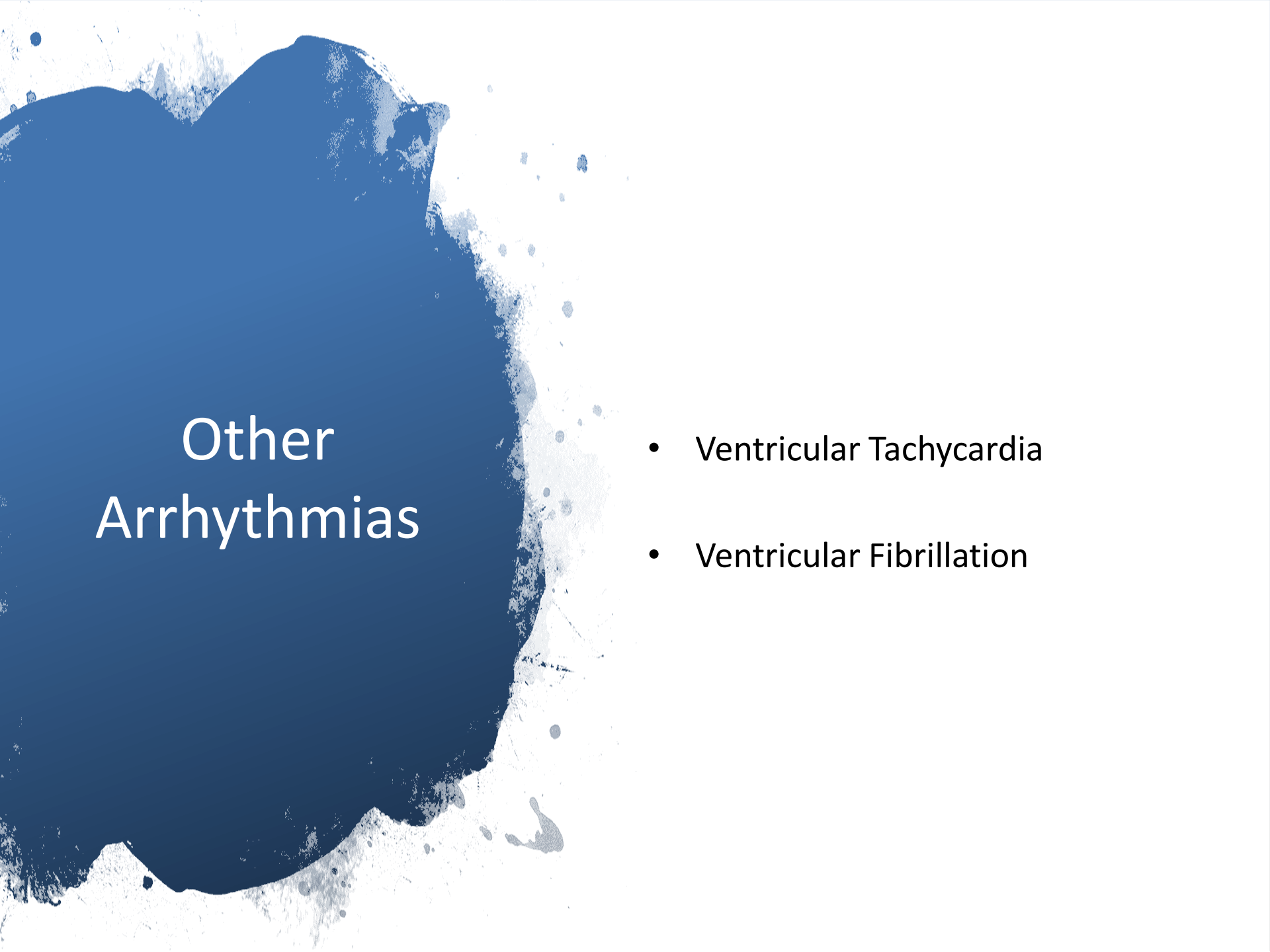


normal tracing



# Treatment options

- Medical therapy
- Radio Frequency Ablation

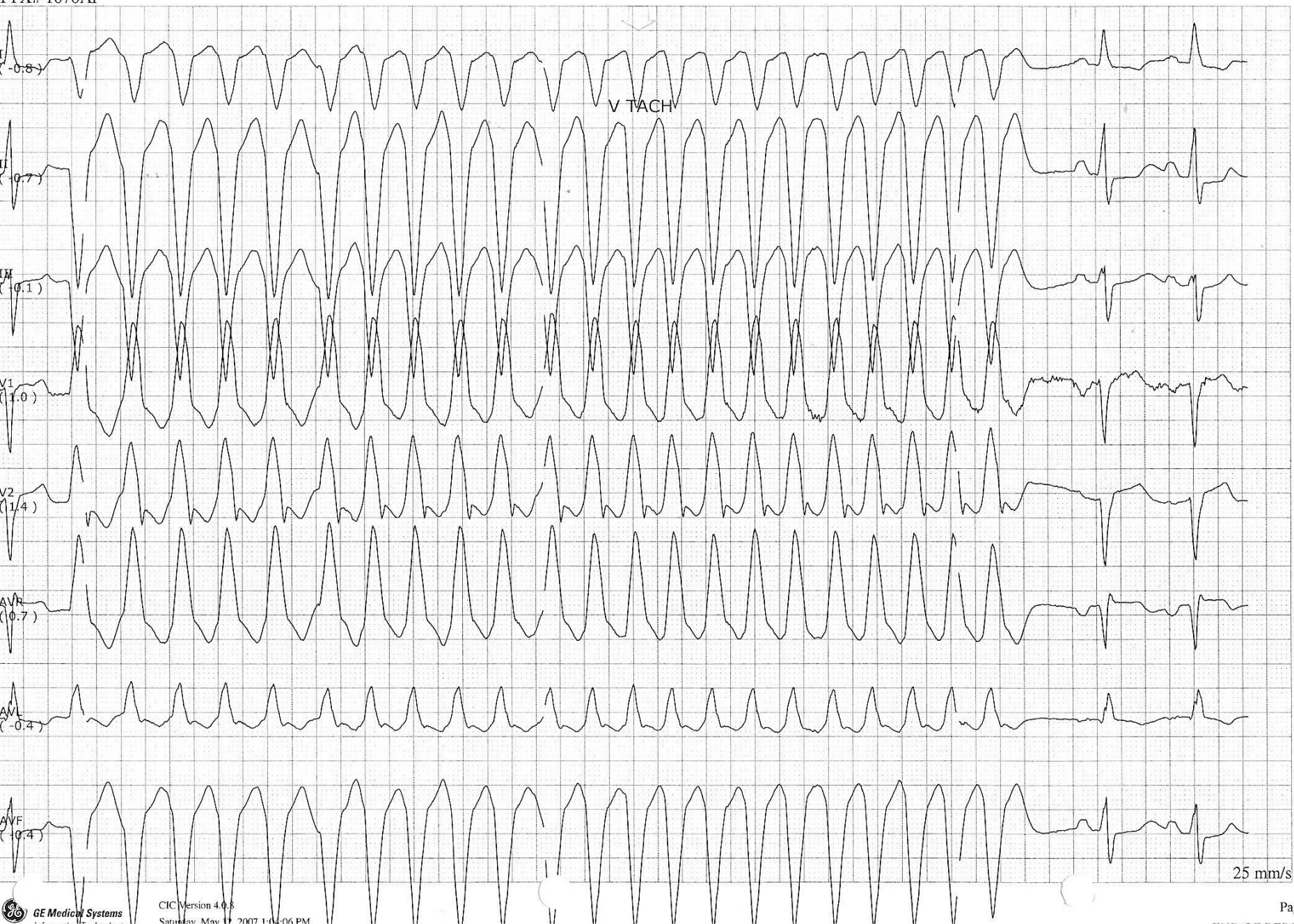


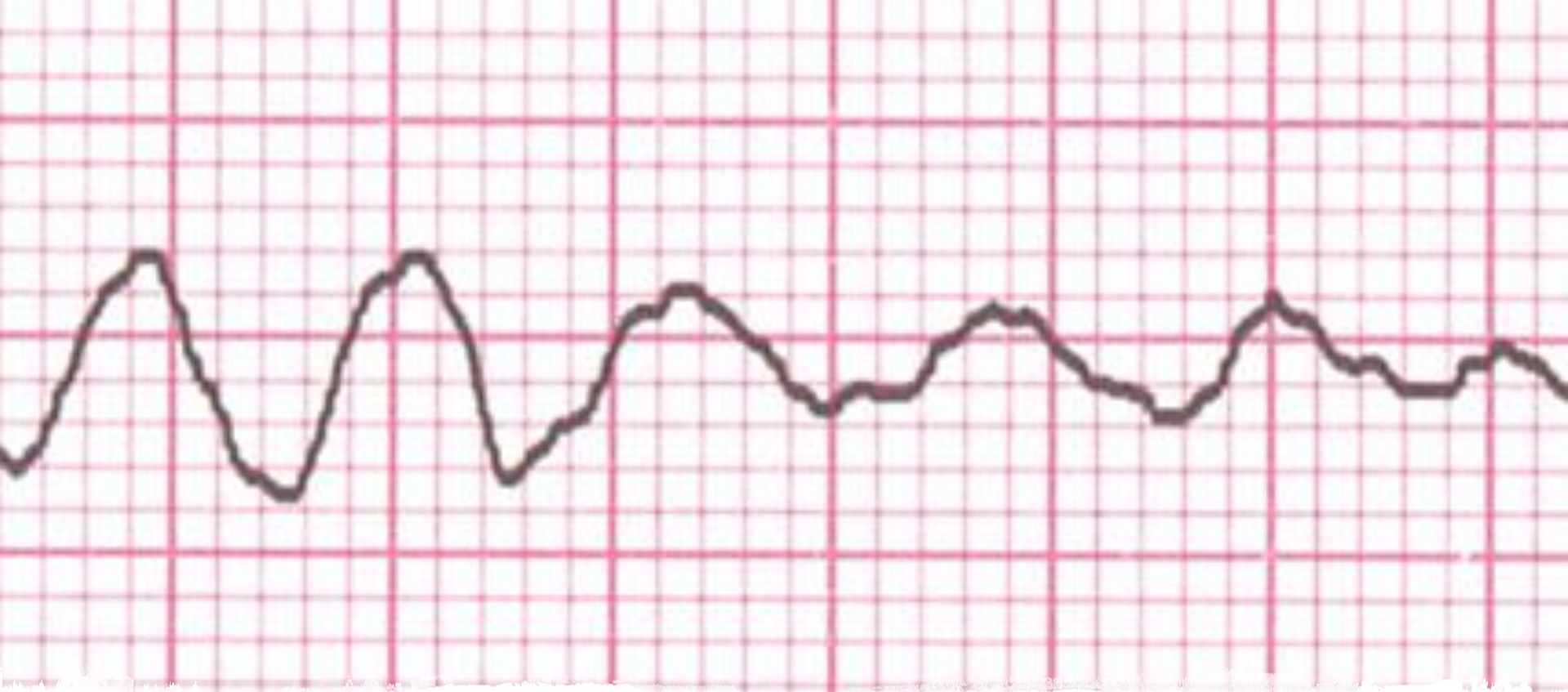
# Other Arrhythmias

- Ventricular Tachycardia
- Ventricular Fibrillation

V TACH HR 130 PVC 7 ST V1 1.0 mm

TTX# 1070AP





VF



# Treatment options

- Treat the underlying cause
- Automatic Implantable defibrillators



Thank You