Project: Ghana Emergency Medicine Collaborative

Document Title: Tachydysrhythmias

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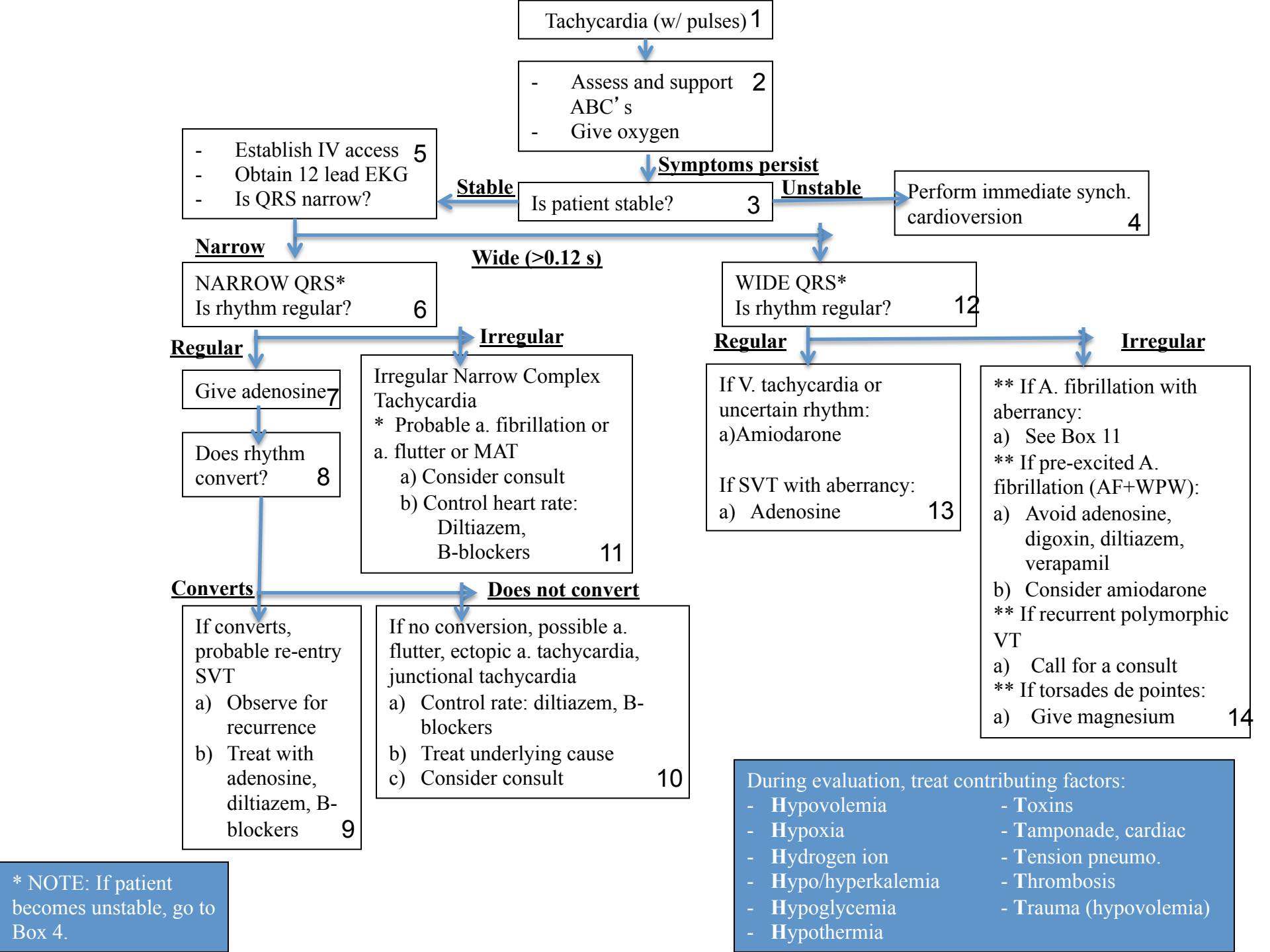
Objectives

- Review ACLS management of tachydysrhythmias
- Discuss common narrow complex tachycardias
- Discuss medications used in management of these narrow complex tachycardias
- Indications and technique for cardioversion
- Practice cases

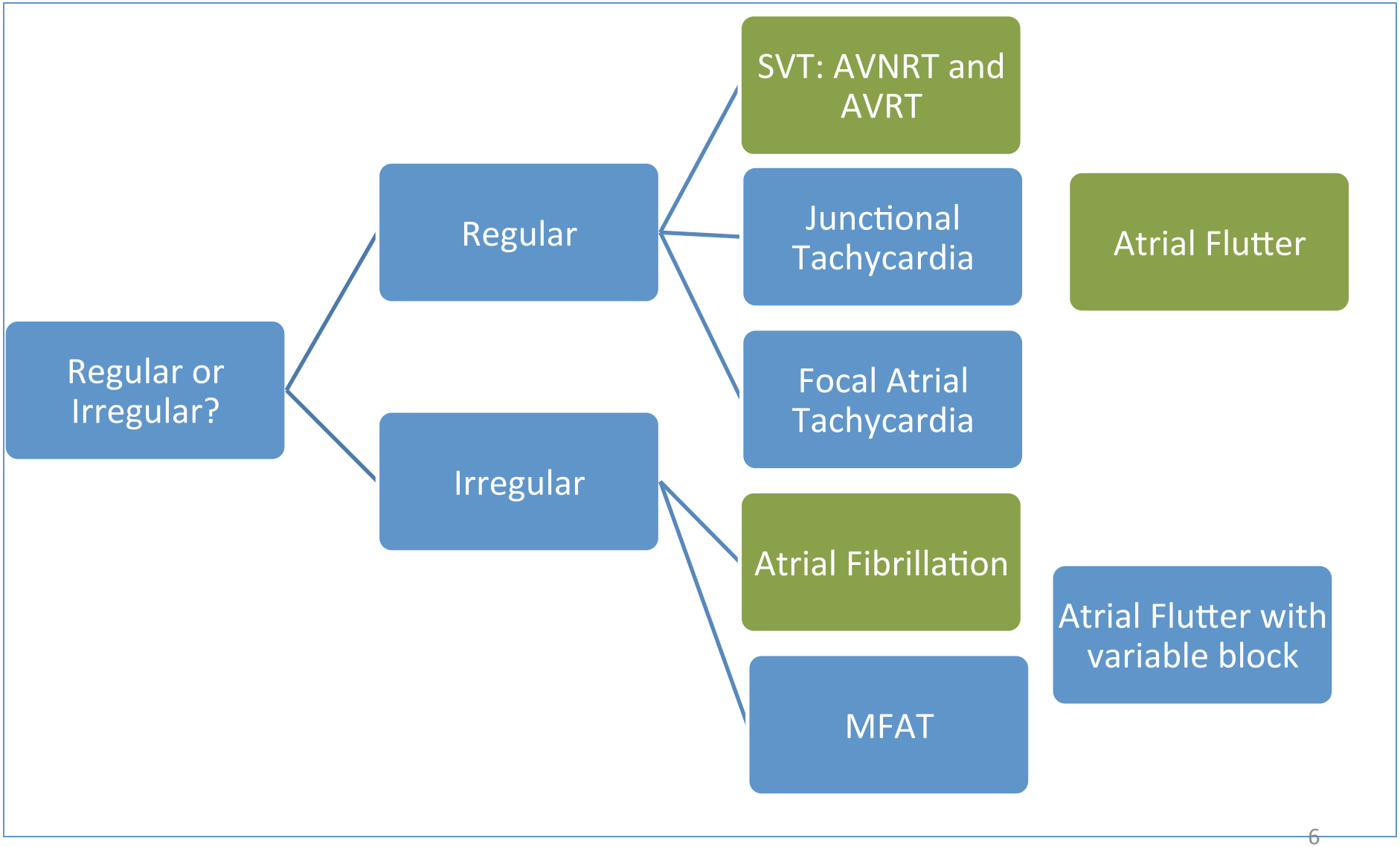
2010 ACLS Guidelines-Management of Symptomatic Arrhythmias

Some important changes

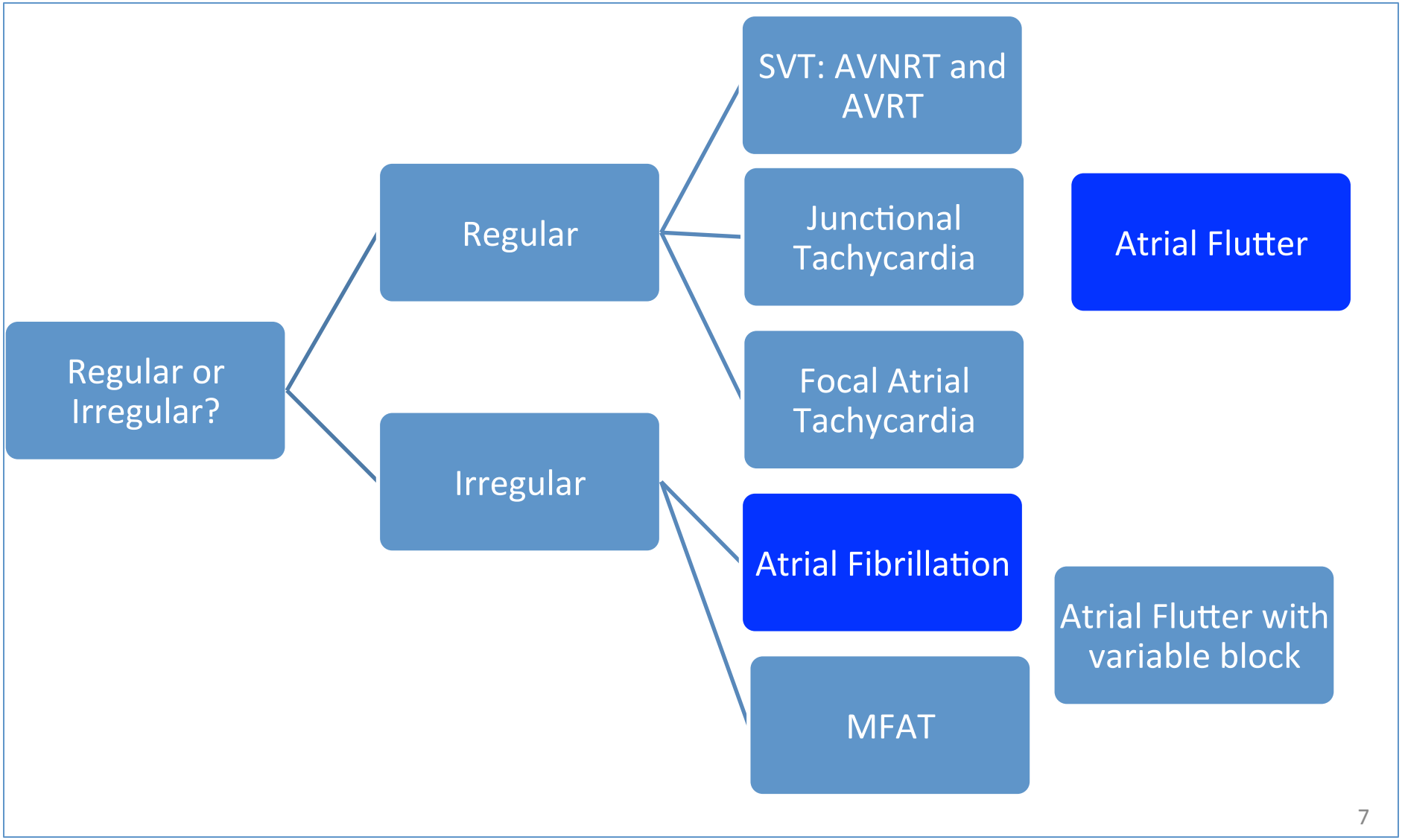
1. **Adenosine** can now be considered for the diagnosis and treatment of stable undifferentiated wide-complex tachycardia when the rhythm is regular and the QRS waveform is monomorphic.
2. IV infusion of **chronotropic agents** is now recommended as an **equally effective** alternative to external pacing when **atropine** is ineffective.
3. Atropine is **no longer recommended** for routine use in the management of PEA and asystole.


Tachycardia (w/ pulses) 1
- Assess and support ABC's 2
- Give oxygen
Symptoms persist
Is patient stable? 3
Stable
Unstable
Perform immediate synch. cardioversion 4
- Establish IV access 5
- Obtain 12 lead EKG
- Is QRS narrow?
Narrow
Wide (>0.12 s)
NARROW QRS*
Is rhythm regular? 6
Regular
Irregular
Give adenosine 7
Does rhythm convert? 8
Converts
Does not convert
If converts, probable re-entry SVT
a) Observe for recurrence
b) Treat with adenosine, diltiazem, B-blockers 9
If no conversion, possible a. flutter, ectopic a. tachycardia, junctional tachycardia
a) Control rate: diltiazem, B-blockers
b) Treat underlying cause
c) Consider consult 10
Irregular Narrow Complex Tachycardia
* Probable a. fibrillation or a. flutter or MAT
a) Consider consult
b) Control heart rate: Diltiazem, B-blockers 11
WIDE QRS*
Is rhythm regular? 12
Regular
Irregular
If V. tachycardia or uncertain rhythm:
a)Amiodarone
If SVT with aberrancy:
a) Adenosine 13
** If A. fibrillation with aberrancy:
a) See Box 11
** If pre-excited A. fibrillation (AF+WPW):
a) Avoid adenosine, digoxin, diltiazem, verapamil
b) Consider amiodarone
** If recurrent polymorphic VT
a) Call for a consult
** If torsades de pointes:
a) Give magnesium 14
* NOTE: If patient becomes unstable, go to Box 4.
During evaluation, treat contributing factors:
- Hypovolemia
- Hypoxia
- Hydrogen ion
- Hypo/hyperkalemia
- Hypoglycemia
- Hypothermia
- Toxins
- Tamponade, cardiac
- Tension pneumo.
- Thrombosis
- Trauma (hypovolemia)

Narrow Complex Tachycardias



Narrow Complex Tachycardias



A-fib and A-flutter

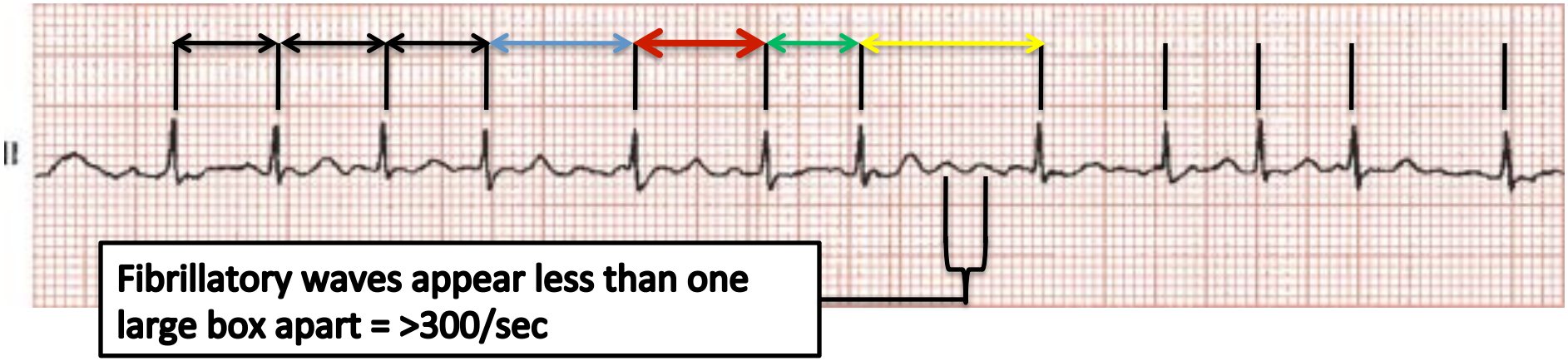
- Considerable overlap in clinical and electrophysiologic features
- Etiologies, workup, and treatment identical to a-fib

Issues in Newly Diagnosed A-fib

- What are the etiologies of atrial fibrillation?
- What workup is required of these patients?
- What are priorities in management?
- What are indications for emergent cardioversion of a-fib of duration >48 hours/ unknown duration?

ECG Characteristics of A-fib

- Irregularly irregular ventricular rhythm
- Irregular, wavy pattern in place of p waves, called fibrillatory waves
  - Fibrillatory wave rate is between 350-600/min



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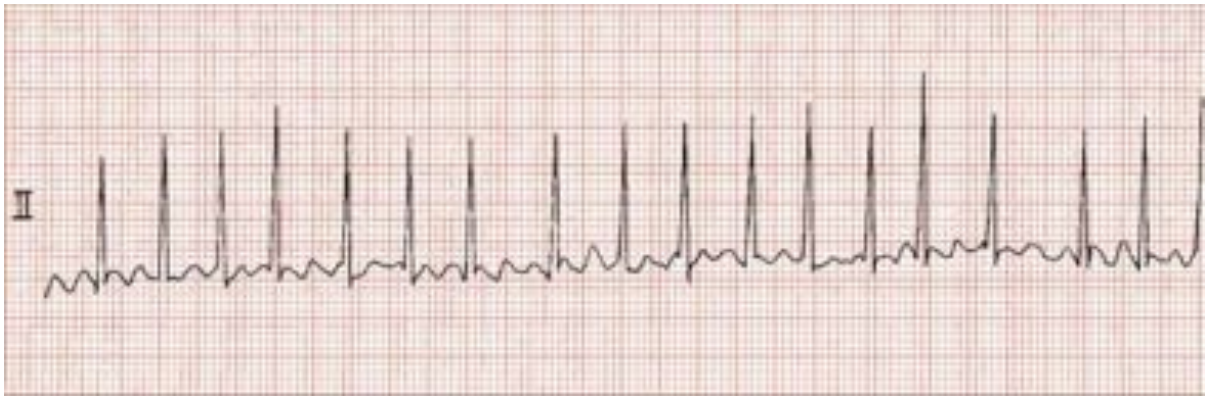
Fibrillatory Waves

- May be coarse and look similar to a very irregular flutter, as in this patient with hypothyroidism



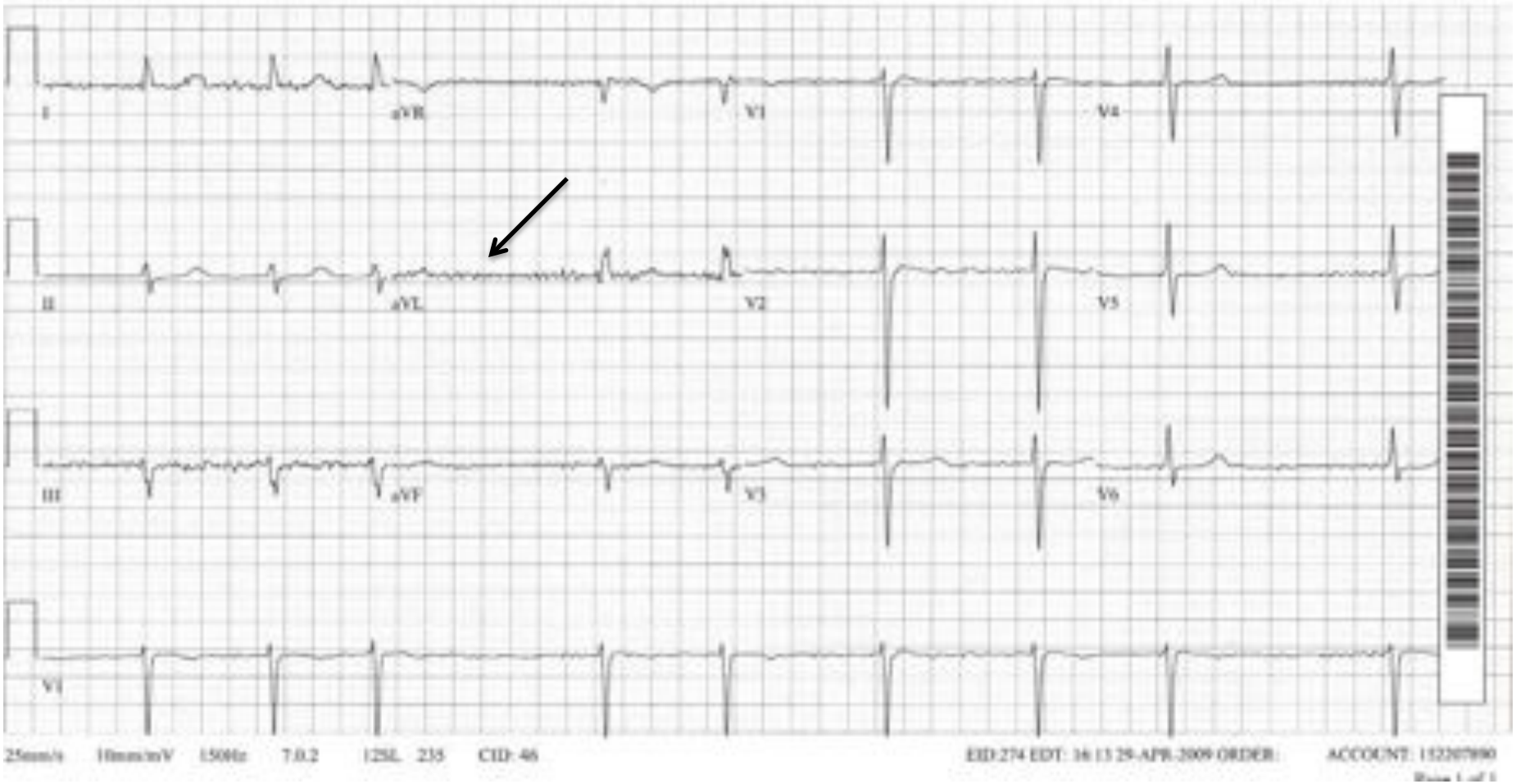
Source Undetermined

Fibrillatory Waves

- May be very fine/unobservable as in this patient

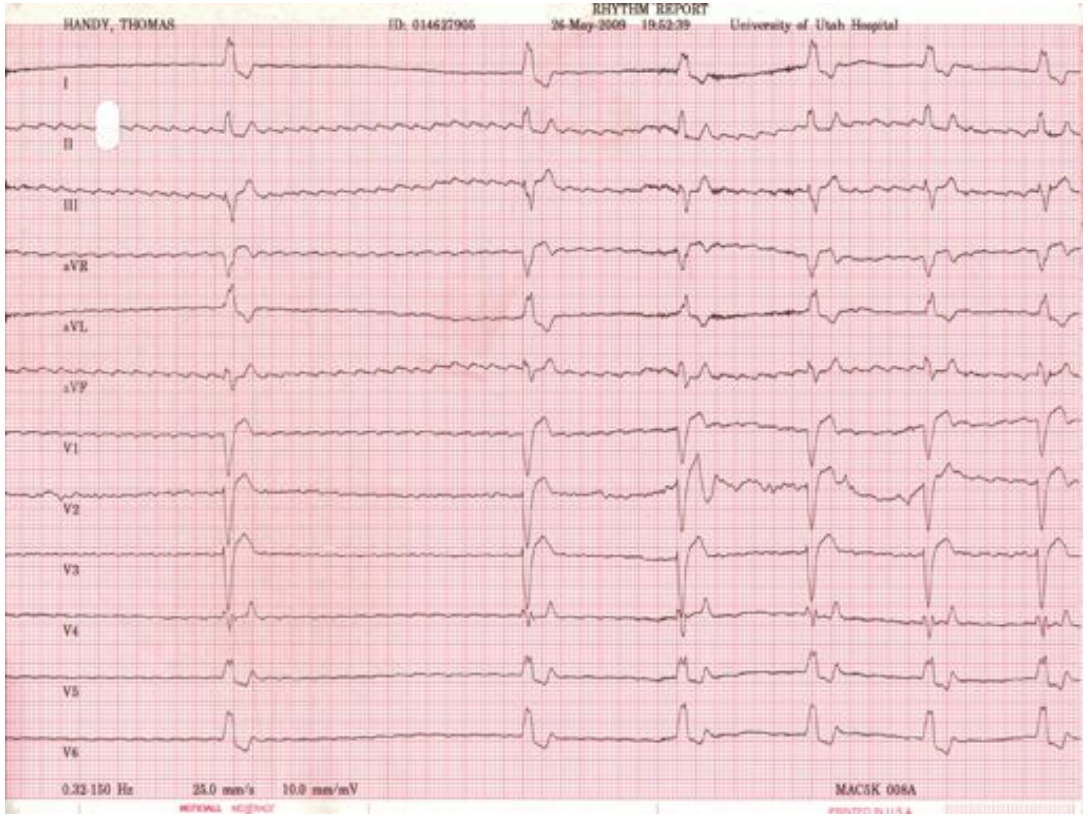
Source Undetermined

Fine fibrillatory waves



ECG Characteristics of A-flutter

- Regular rate, usually 150bpm or 300bpm
- Sawtooth flutter waves
- AV block



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Burden of A-fib

- Affects ~5% of people aged ≥60 years
  ~10% of those aged ≥80 years
- 5%/year stroke rate
- ~30% lifetime risk of stroke
- A-fib increases risk of stroke 5X above baseline

Source: Halperin JL, AHA 2008

Etiologies of A-fib

- Hyperthyroidism (8.3%)
- Obesity/Metabolic Syndrome
- PE (10-14% of patients)
- Valvular heart disease (16-70%)
- Cardiomyopathy
- Congenital heart disease
- COPD
- OSA
- Hypertension
- Alcohol
- Caffeine
- Medications
- Stimulants
- Cardiac surgery
- Genetic syndromes

Recommended Minimum Workup Newly Diagnosed AF

- ECG
- CXR
- TSH
- Transthoracic Echocardiogram
  - May be deferred to outpatient setting

AHA 2008

Treatment of a-fib/flutter

- Adenosine is both diagnostic and therapeutic
- Electrical cardioversion
  - Safe if done within 48 hours of onset
  - Indicated in any unstable patient regardless of time of onset of a-fib
- Rate Control with AV nodal blocking agent
  - Traditionally use diltiazem or metoprolol
  - Labetalol?
  - Digoxin

Electrical Cardioversion for A-fib

- 24 patients with a-fib <48 hours in PA in whom DC Cardioversion attempted
- Historical rate control group used as comparator
- Median LOS 4 hrs in cardioversion group, 39.3 hrs in rate control group
- Charges of $1598 vs. rate control $4271

Jacoby JL, et al. J Emerg Med 2005

Electrical Cardioversion for A-fib

- 33 patients a. fib <48 hrs in Australian ED
- 91% success with biphasic cardioversion
- 7/33 (22%) had recurrence of a. fib at 3 mos.
- Mean LOS in ED 5.6 hours
- 31/33 (97%) of patients satisfied

Lo GK, et al. Emerg Med J 2006

Electrical Cardioversion

- Common complications
  - Transient asystole (like giving adenosine)
  - Post-cardioversion bradycardia
  - ST segment elevation
- Uncommon complications
  - Converting a-flutter to a-fib
  - Converting a-fib to VF

Avoiding VF

- Review of 5,155 external cardioversion shocks for a-fib and 1,243 for a-flutter
- All attempted with monophasic devices
- VF in 5 cases
  - All after ≤100 J shock
  - 2 cases had verified shock during ventricular repolarization

Gallagher et al. Int J Cardiol 2008

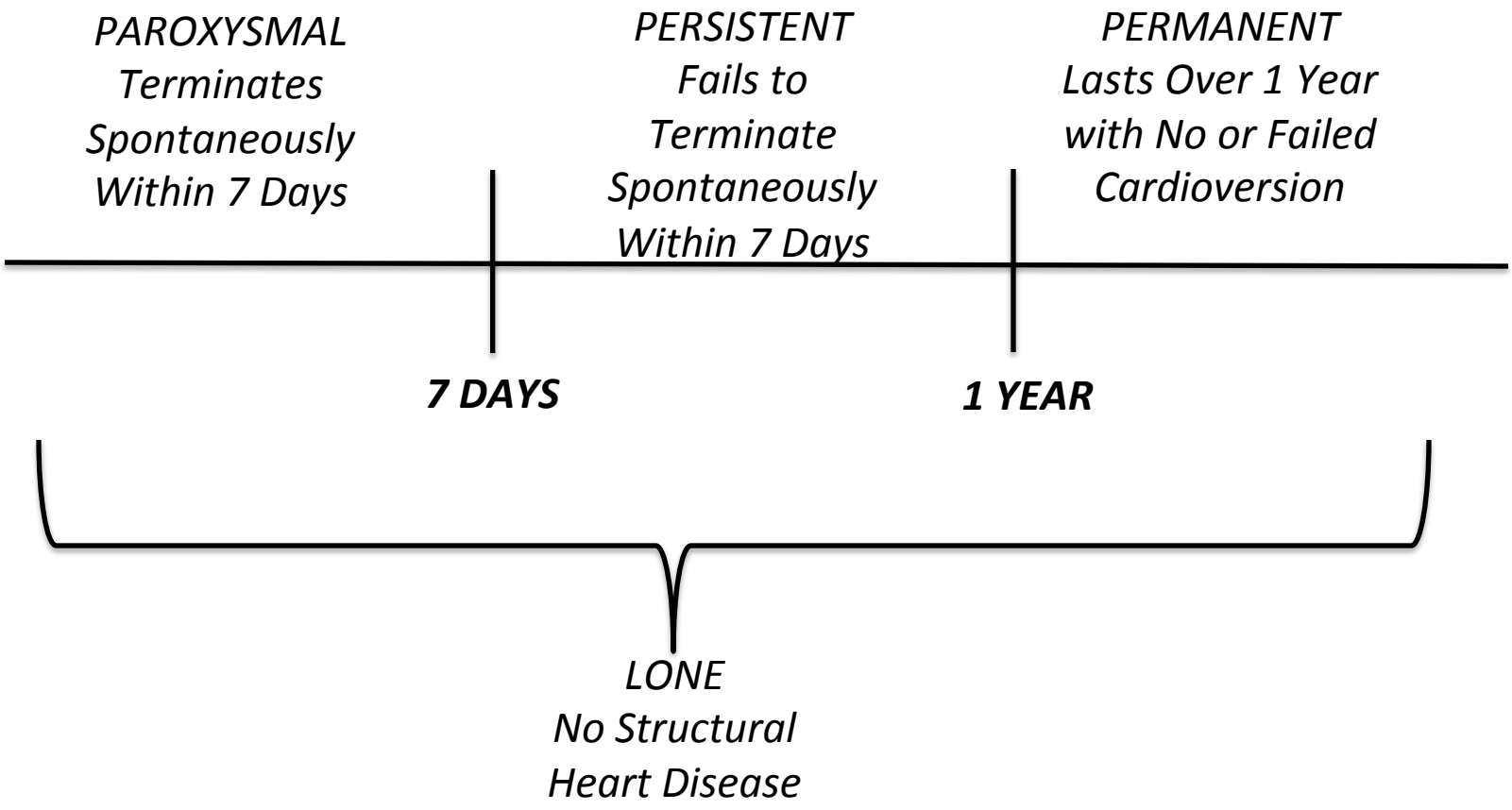
Electrical Cardioversion

- Bottom line
  - Very safe procedure
  - Procedural sedation-associated complications were higher (22/388) than those associated with cardioversion (5/388) in one ED-based study

Burton JH et al. Ann Emerg Med 2004

Ernstl, Wikimedia Commons

A-fib Classification



Do all newly dx AF patients need a rule-out?

- One prospective study of 109 patients found 100% negative predictive value for MI if:
  - No ST-segment elevation
  - No ST depression > 2 mm
- Chest pain and ST depression < 2 mm was very common and benign

Zimetbaum PJ, et al. J Am Cardiol 2000.

Do all newly dx AF patients need a rule-out?

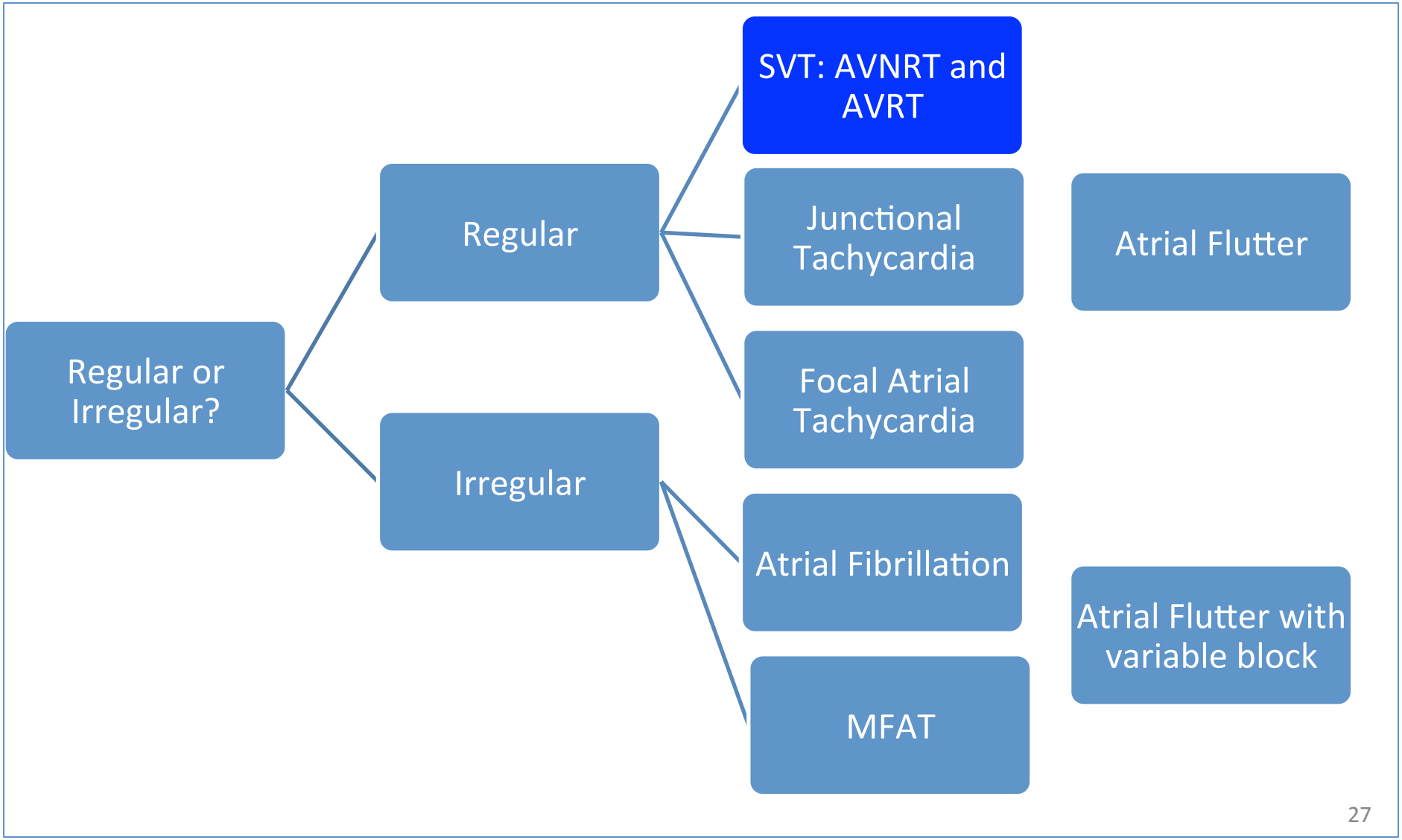
- Elevations of troponin due to non-coronary cause occur in substantial proportion of a-fib patients.
- Not helpful in absence of characteristic symptoms and ECG findings

Barasch E, et al. Cardiology 2000

Jeremias A, et al. Ann Intern Med 2005

Nunes JP, et al. Acta Cardiol 2004

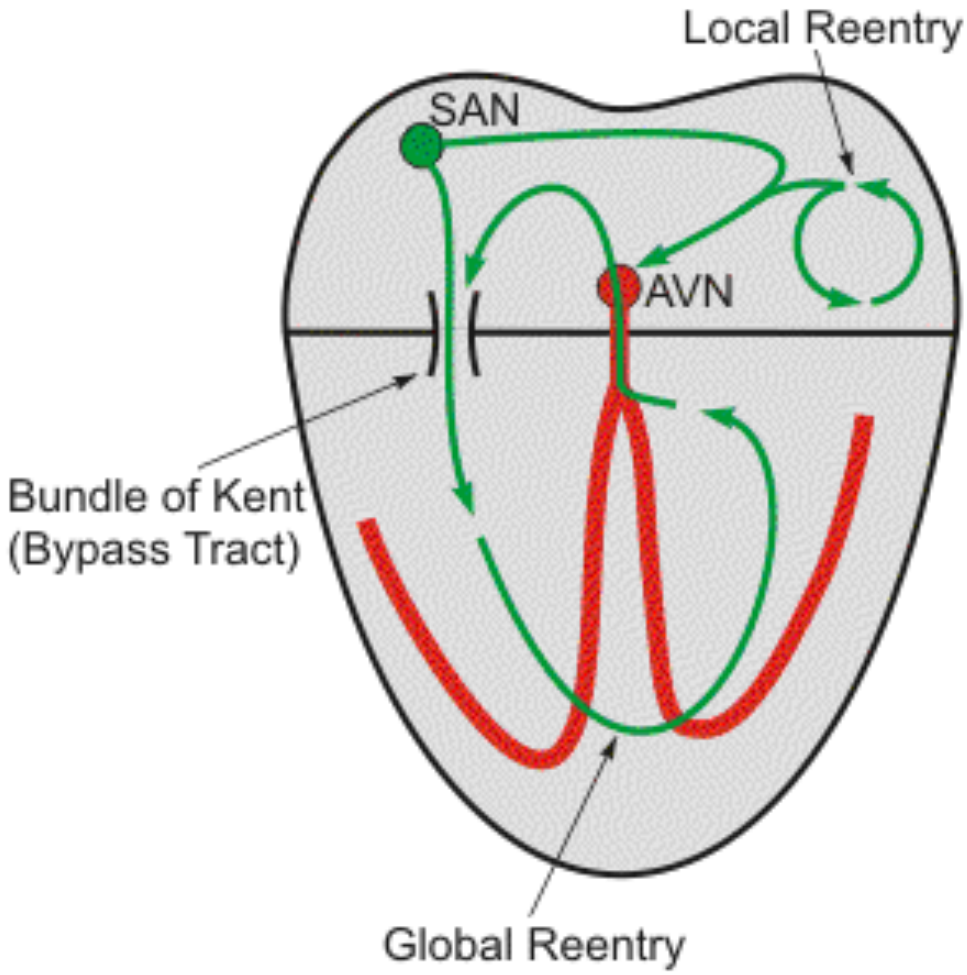
Narrow Complex Tachycardias



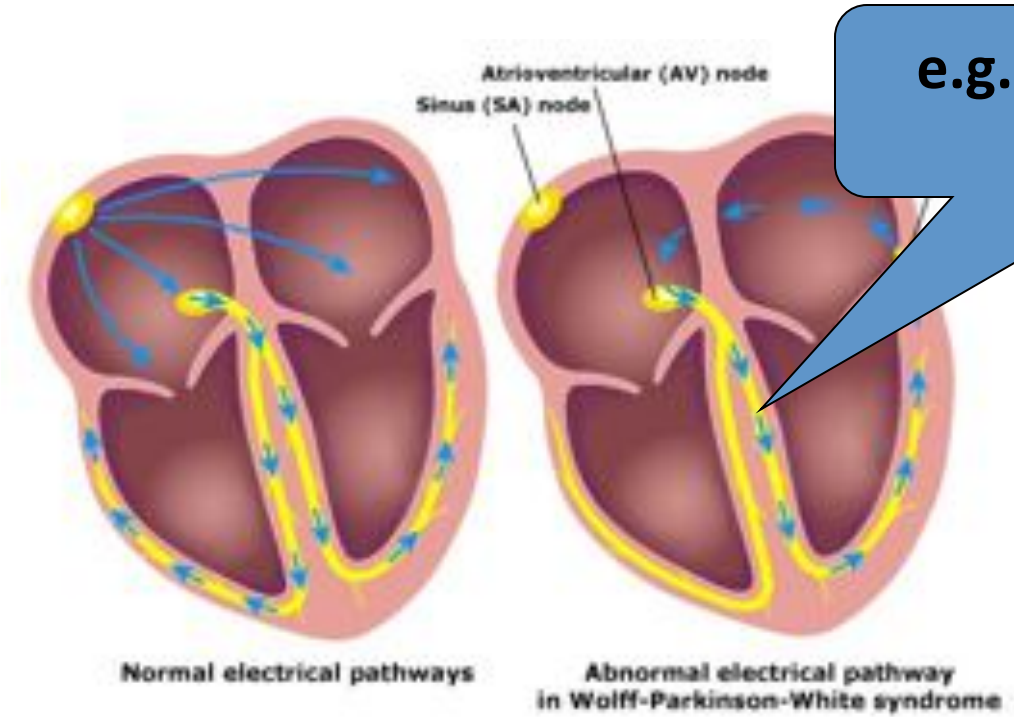
Supraventricular Tachycardia

- Terminology is confusing…
- Two Major Mechanisms
  - AV Nodal Reentrant Tachycardia (AVNRT)
  - AV Reentrant Tachycardia (AVRT)
- Types often indistinguishable on ECG
- Distinctions clinically unimportant in the emergency department

Pathways for AVNRT vs. AVRT



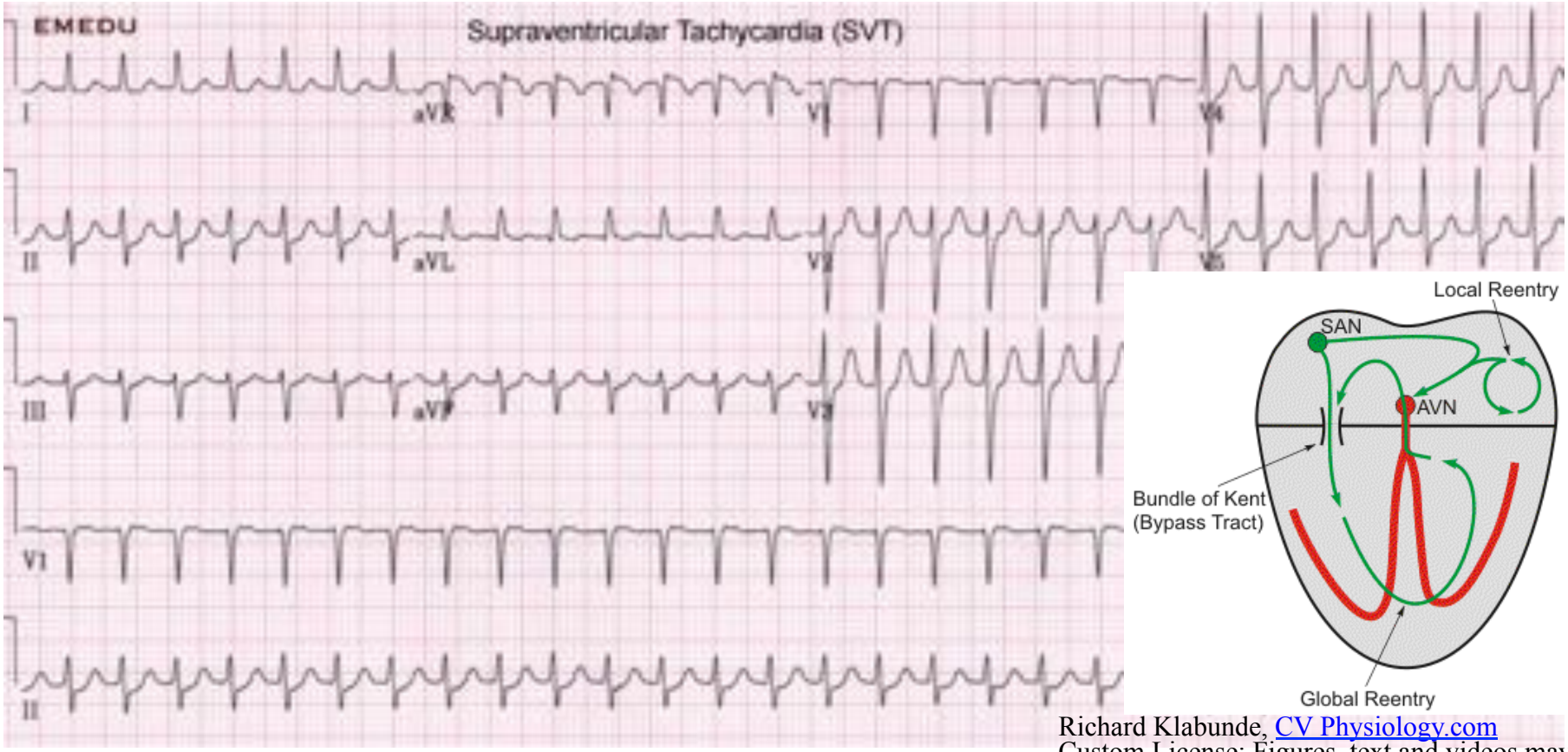
Pathways for AVNRT vs. AVRT



e.g. Wolf-Parkinson-White

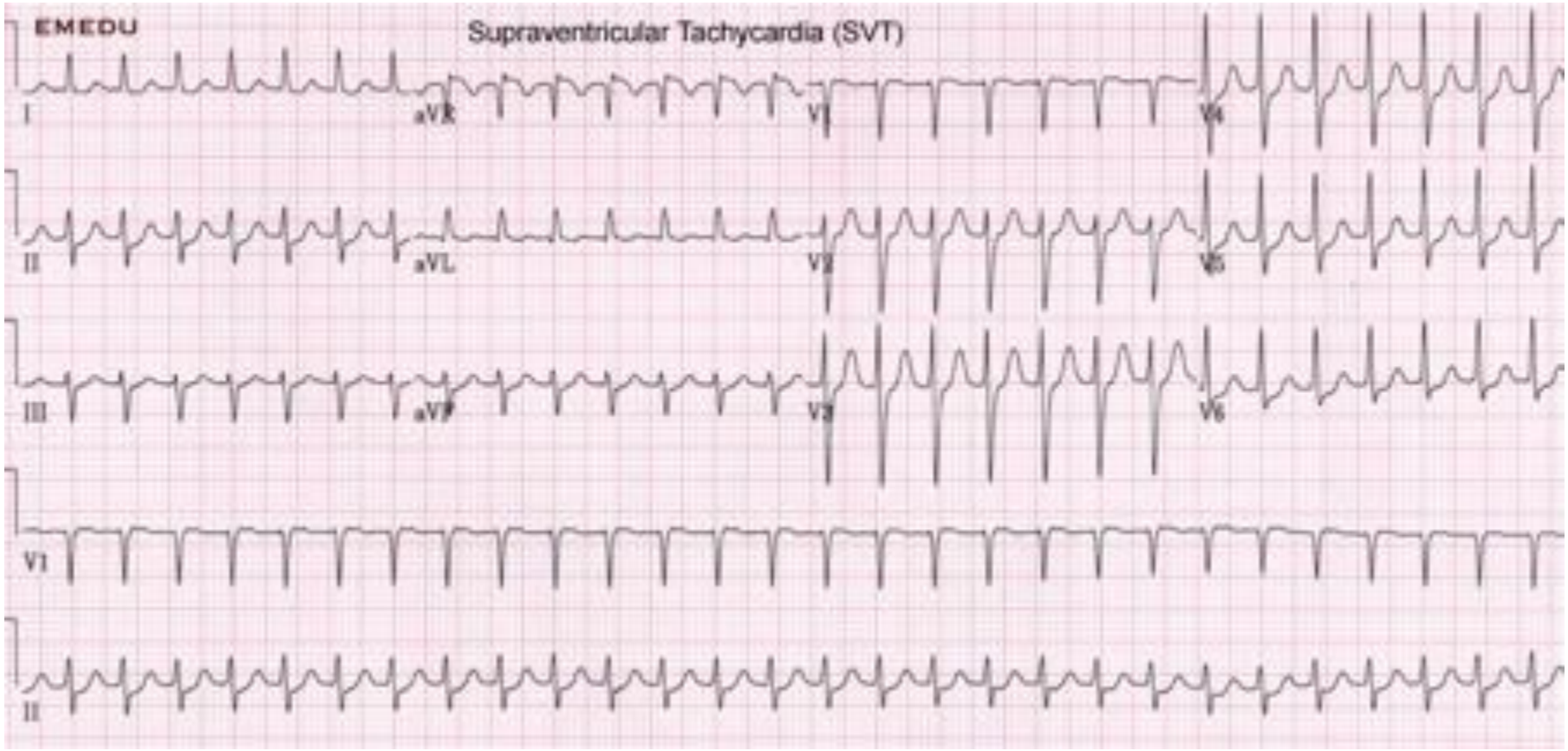
Supraventricular Tachycardia

- AV Reentrant Tachycardia (AVRT)
  - 20% of patients with SVT
  - Reentrant circuit involving AV node + accessory pathway (e.g. WPW)
    - Orthodromic conduction in 85% of WPW pts
    - Antidromic conduction
  - P waves more often seen
    - Retrograde
  - Rate usually 169-200 bpm



Richard Klabunde, CV Physiology.com

- Orthodromic conduction



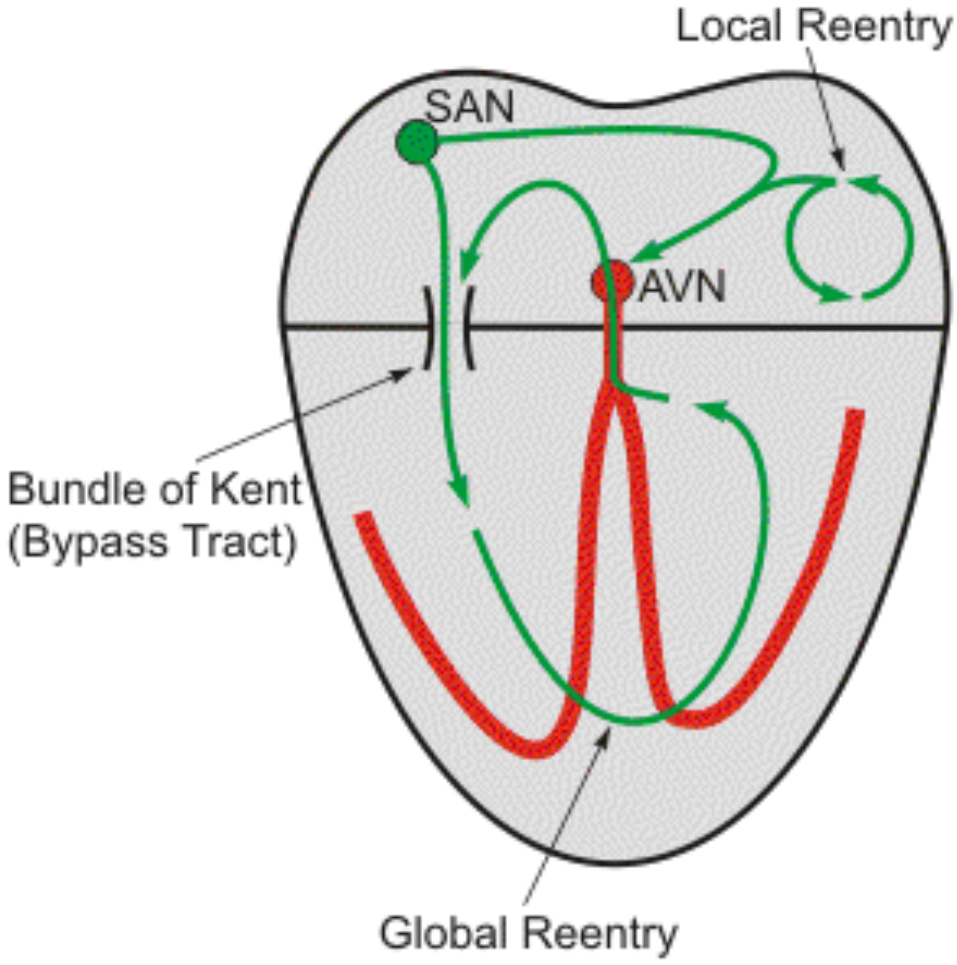
P waves may be buried somewhere in T waves

- Antidromic conductance

Supraventricular Tachycardia

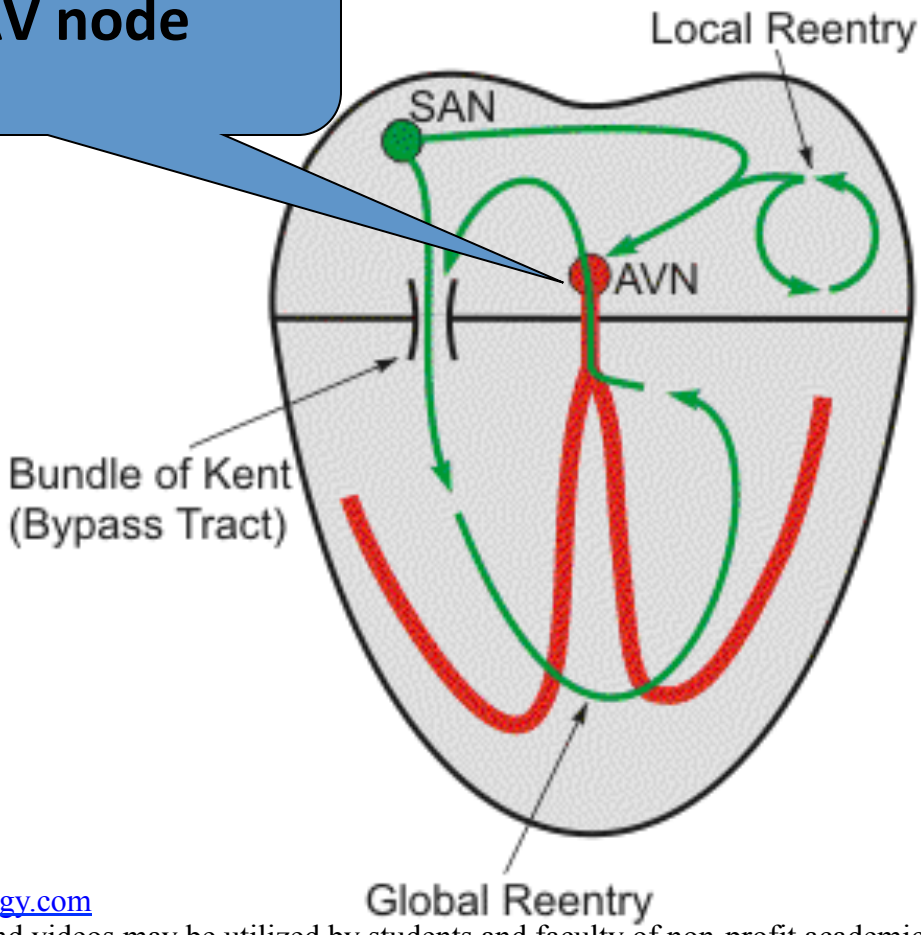
- AV Nodal Reentrant Tachycardia (AVNRT)
  - Most common SVT – 60% of patients
  - Reentrant circuit in AV node
  - P waves not visible 90-95% of time
    - When present retrograde axis (away from inferior leads)
  - Rate ~180-220 bpm

Pathways for AVNRT vs. AVRT



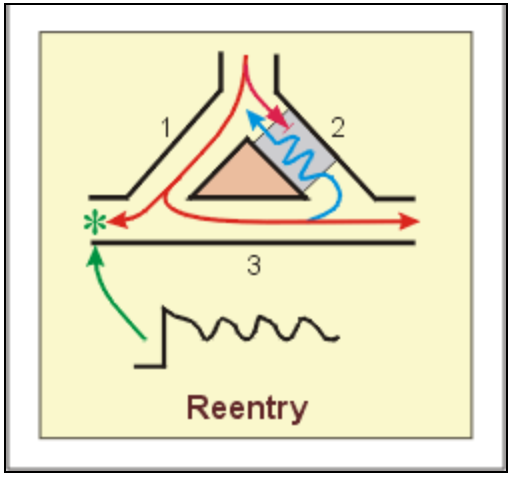
Pathways for AVNRT vs. AVRT

Circuit occurs within the AV node



Re-entrant Pathways

- Re-entry (circus movement)
  - Two pathways for current: one fast, one slow
  - Precipitated by premature beat
  - Immediately begins at maximal rate
  - No beat-to-beat variability



Supraventricular Tachycardia

- Who gets it?
  - Normal people with normal hearts
  - Rheumatic Heart Disease
  - Pericarditis
  - Myocardial Infarction
  - Mitral Valve Prolapse
  - Pre-excitation syndromes (WPW)

Treatment

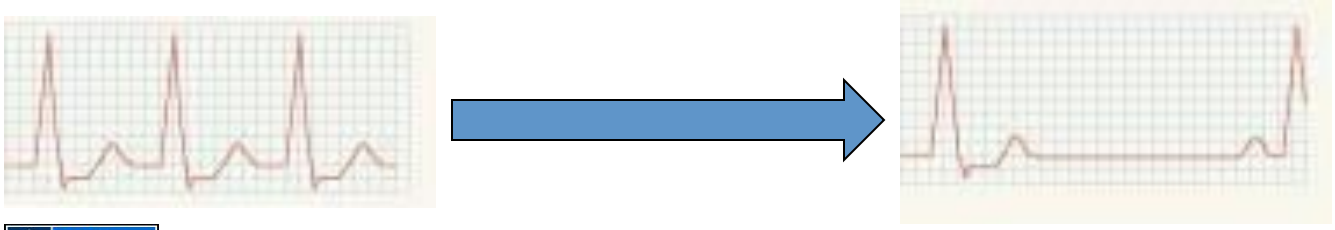
- If unstable:
  - Electrical Cardioversion (≥100 Joules)
- Stable:
  - Vagal maneuvers
  - AV nodal blocking agents
    - Adenosine
    - Beta blockade/CCB
    - Digoxin

Carotid sinus massage

Wellcome Photo Library, Wellcome Images

Using the following procedure, success rose from baseline 5% to 30% (n=19): *While lying supine on the bed in a Trendelenberg position, patients forcefully expire into a section of suction tubing and pressure gauge for at least 15 s and at a pressure of at least 40 mm Hg*

Walker S, Cutting P. Emerg Med J 2010;27:287-291



Source Undetermined

Carotid sinus massage

- Caution or contraindicated in:
  - Severe carotid stenosis
  - Hx of CVA

Adenosine

- Interacts with A1 receptors on cardiac cells
  - Promotes hyperpolarization of cardiac tissue
- Effects
  - Slowing of sinus rate
  - Increased AV conduction delay

Adenosine

- Rapid bolus injection over 1-2 seconds with NS flush – half life is 20s
- Effects blocked by methylxanthines (aminophylline)
- Effects potentiated by dipyridamole
- Can put heart transplant patients into *permanent* asystole
- Reduce dose through central lines

Adenosine

- May be diagnostic for AVNRT/AVRT
- Often therapeutic for AVNRT/AVRT
- 6 mg followed by 12 mg 2 minutes later if initial dose ineffective
- Warn patients they will may feel flushed, experience chest pain
  - At least 50% report feeling distressed
- Cumulative success of approx 95%
  - Although up to 25% will have early recurrence

Adenosine

- Is it safe to give in cases of WPW?

Adenosine

- Is it safe to give in cases of WPW?
  - It is the preferred treatment for narrow complex tachycardias, including orthodromic WPW (AVRT)
  - 2010 ACLS guidelines recommend its use in undifferentiated, regular, monomorphic wide-complex tachycardia!

AV Nodal Blocking Agents

- Calcium Channel Blockers
  - Non-dihydropyridines act to prolong AV refractory period
  - Diltiazem, Verapamil
- Beta-Blockers
  - Metoprolol, esmolol, propranolol most commonly used
  - Labetalol? Nonselective beta blockade plus alpha-1 blockade

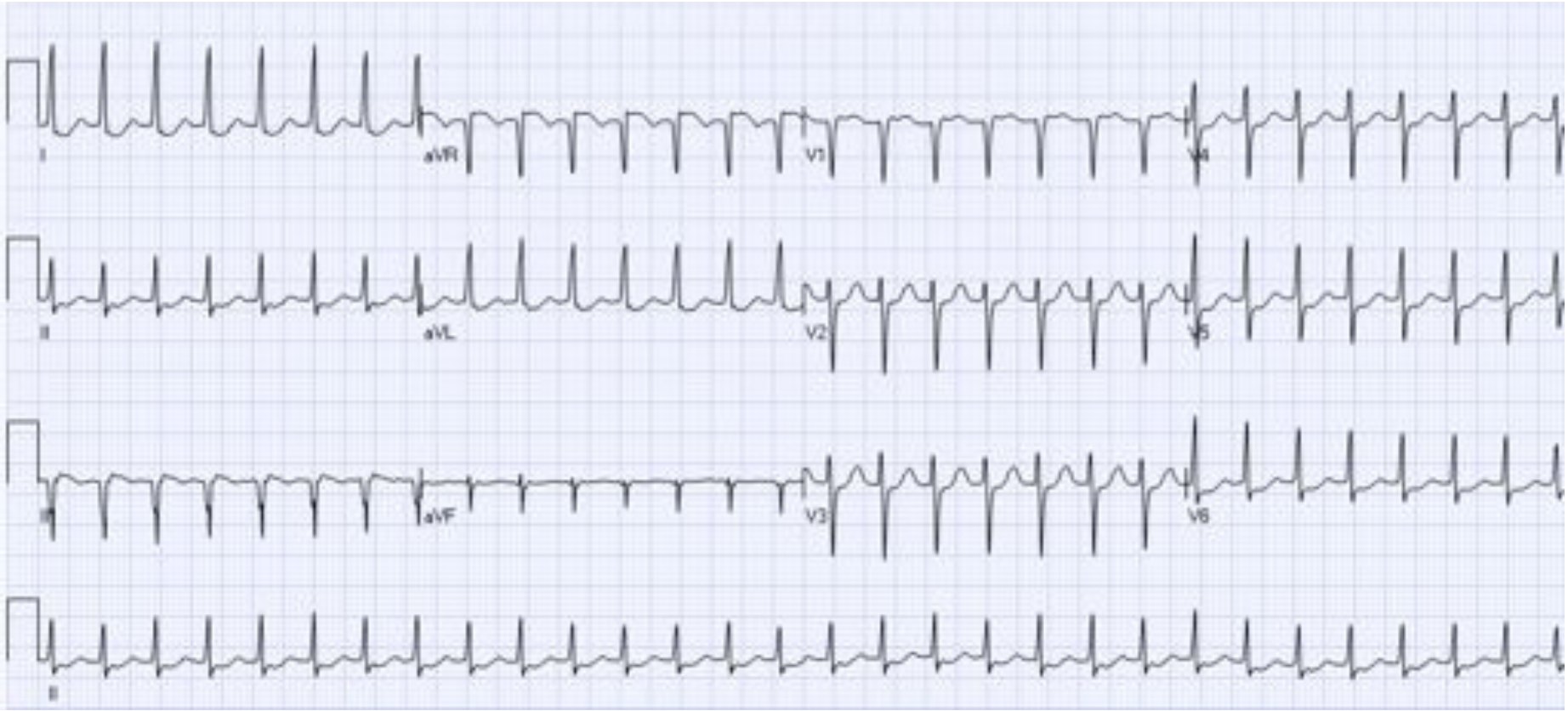
Electrical Cardioversion

- The practicalities

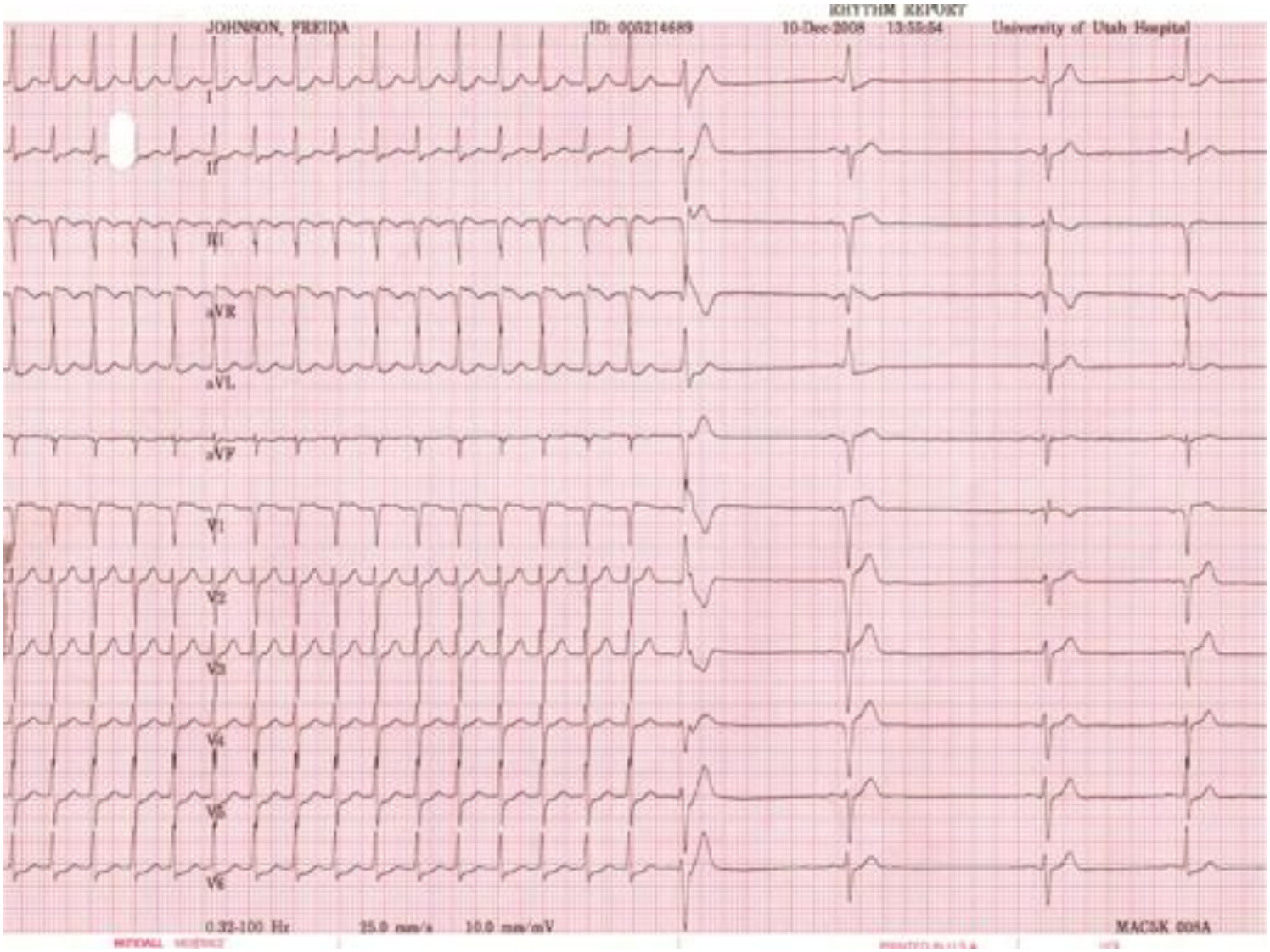
Ernstl, Wikimedia Commons

Practice Cases

56 year old female heart racing



Following Adenosine Administration



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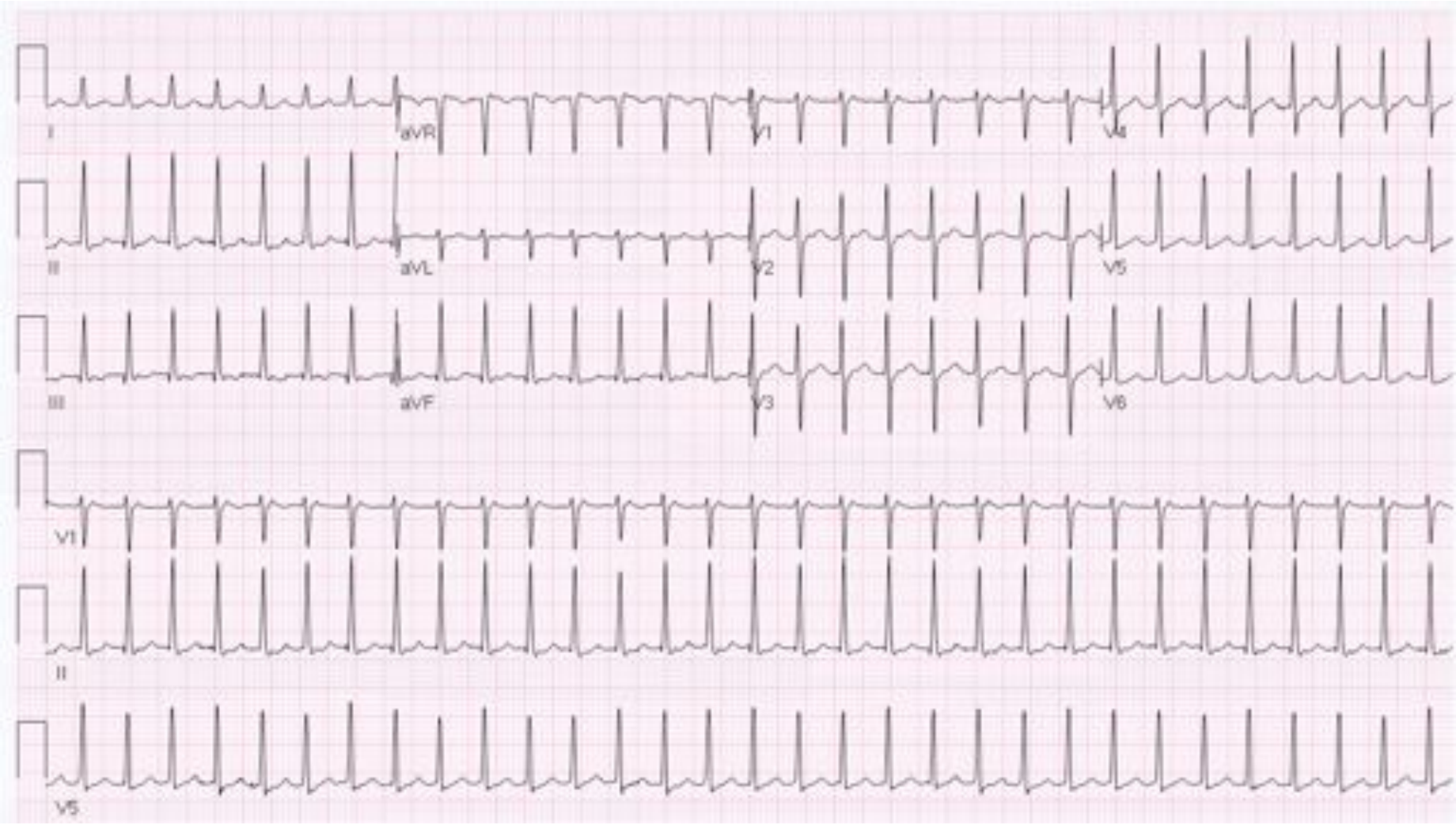
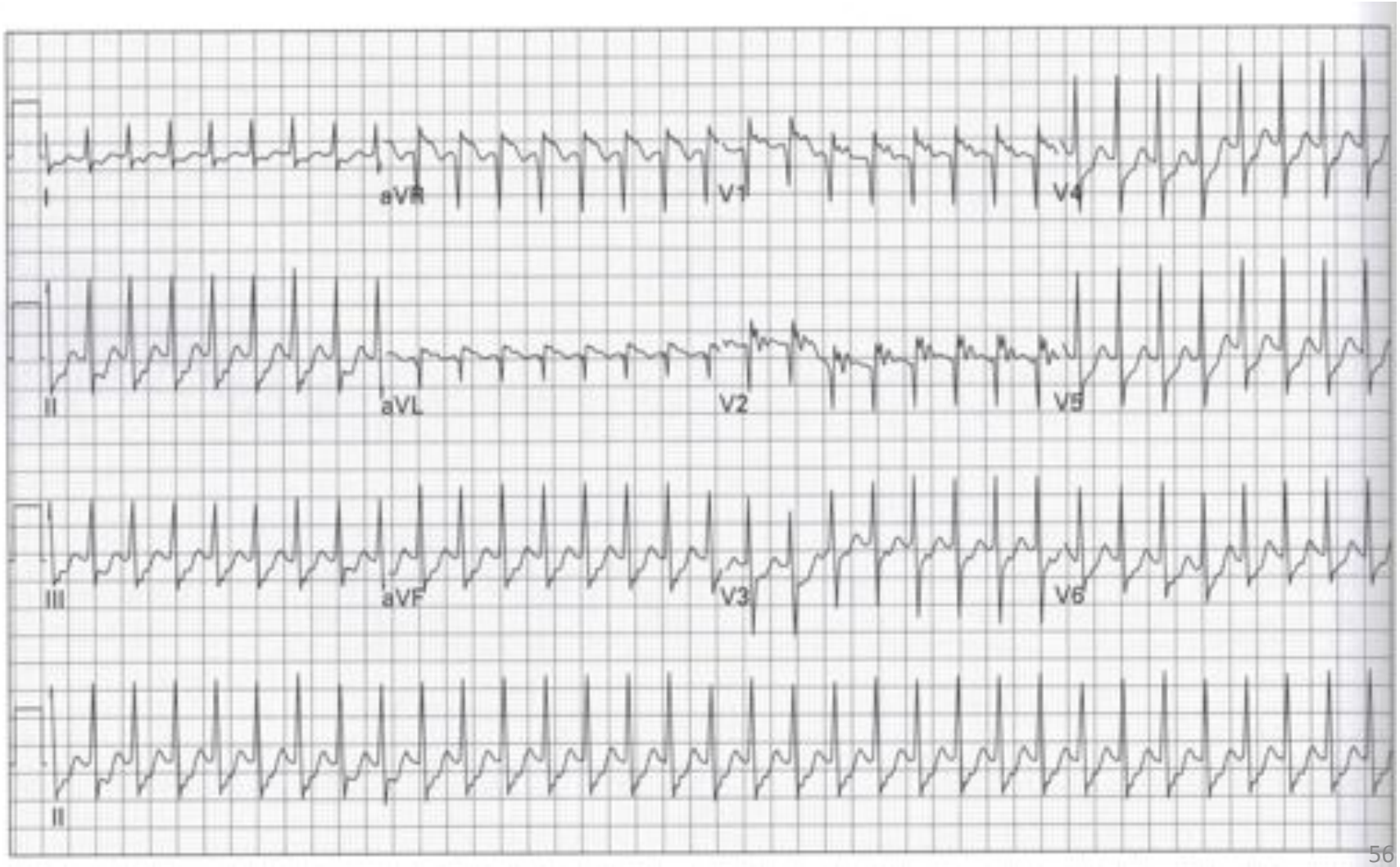
28 year old female with palpitations

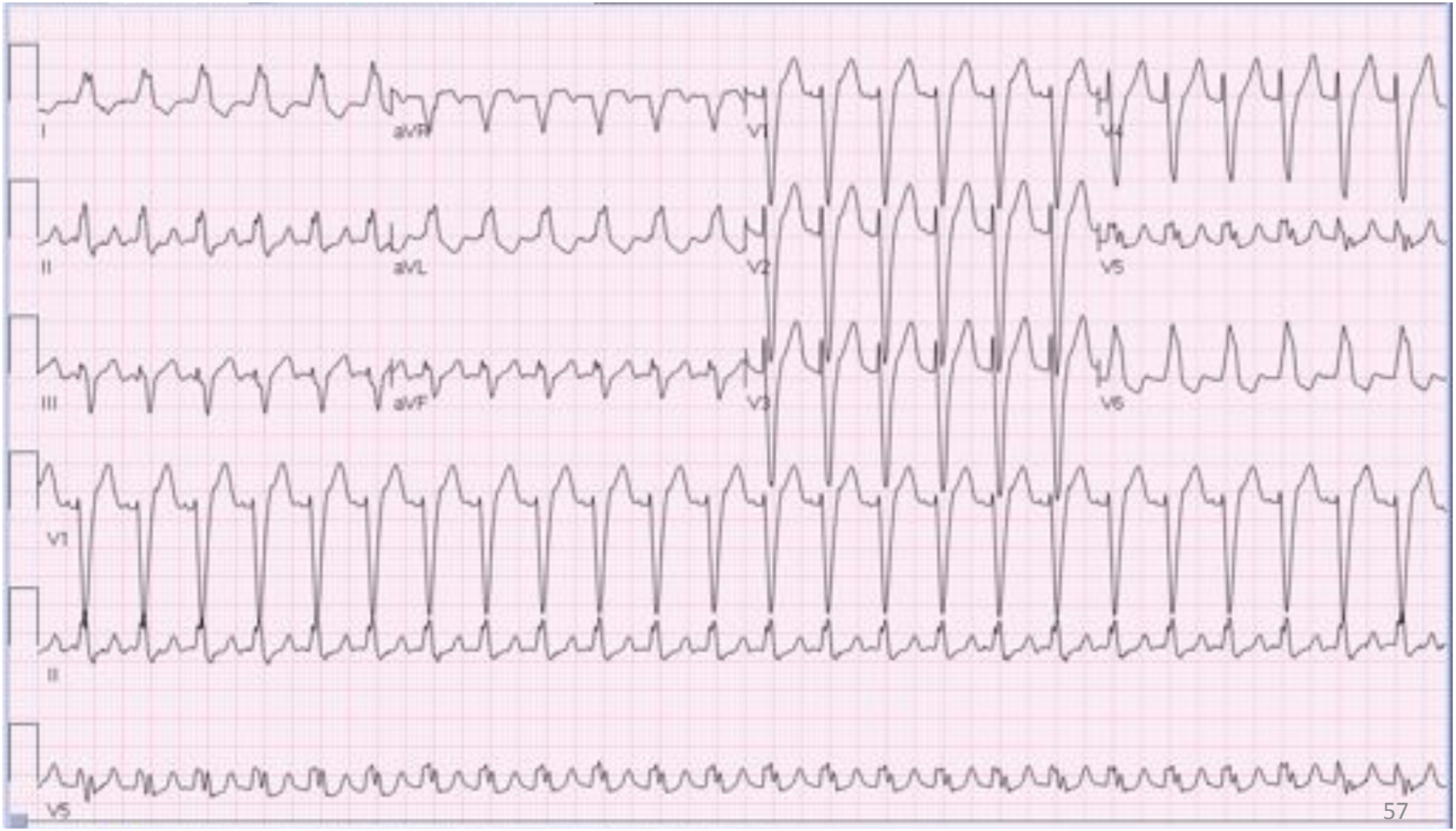


46 year old female lightheaded

60 year old female palpitations

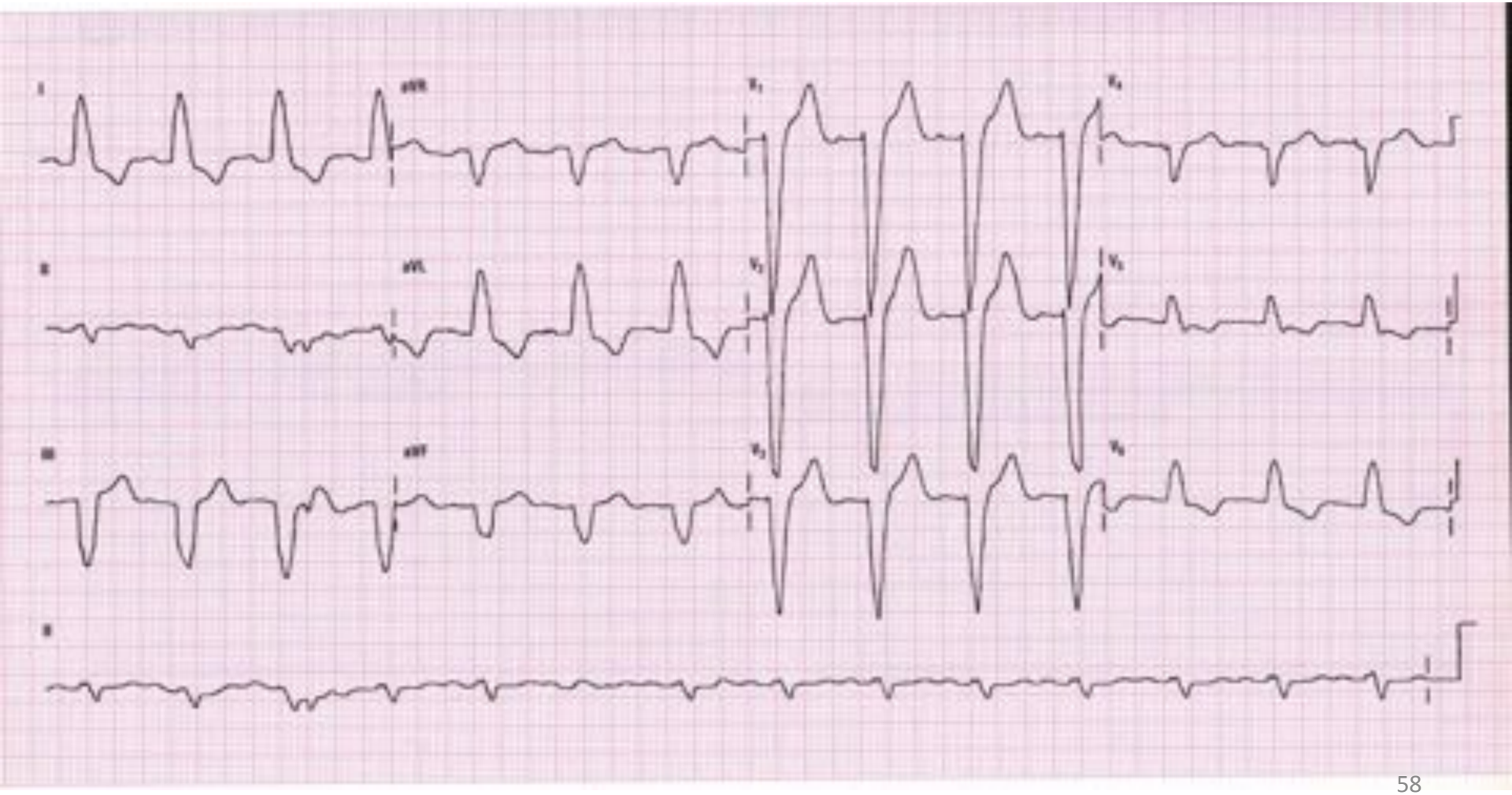


54 year old male with palpitations

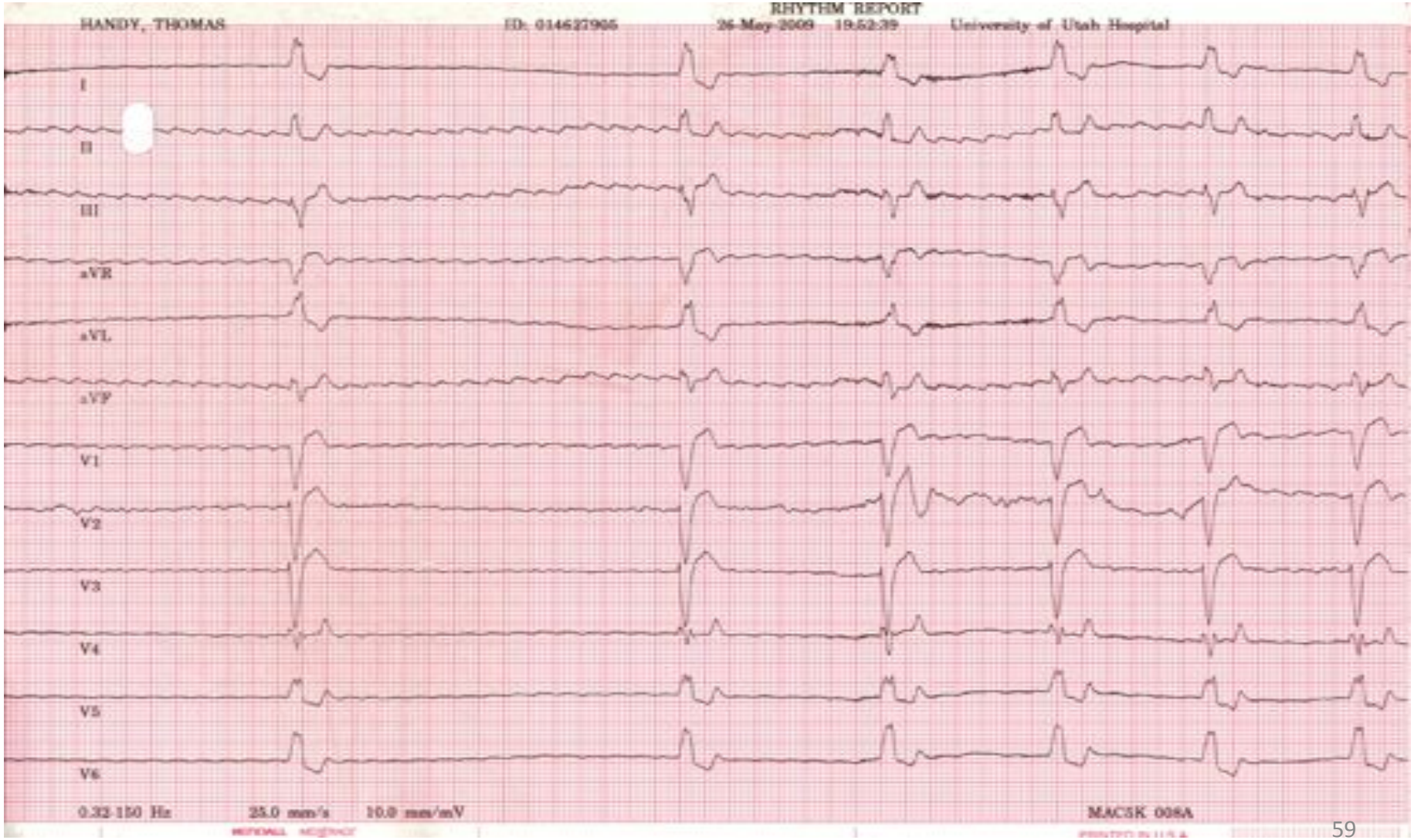


Source Undetermined

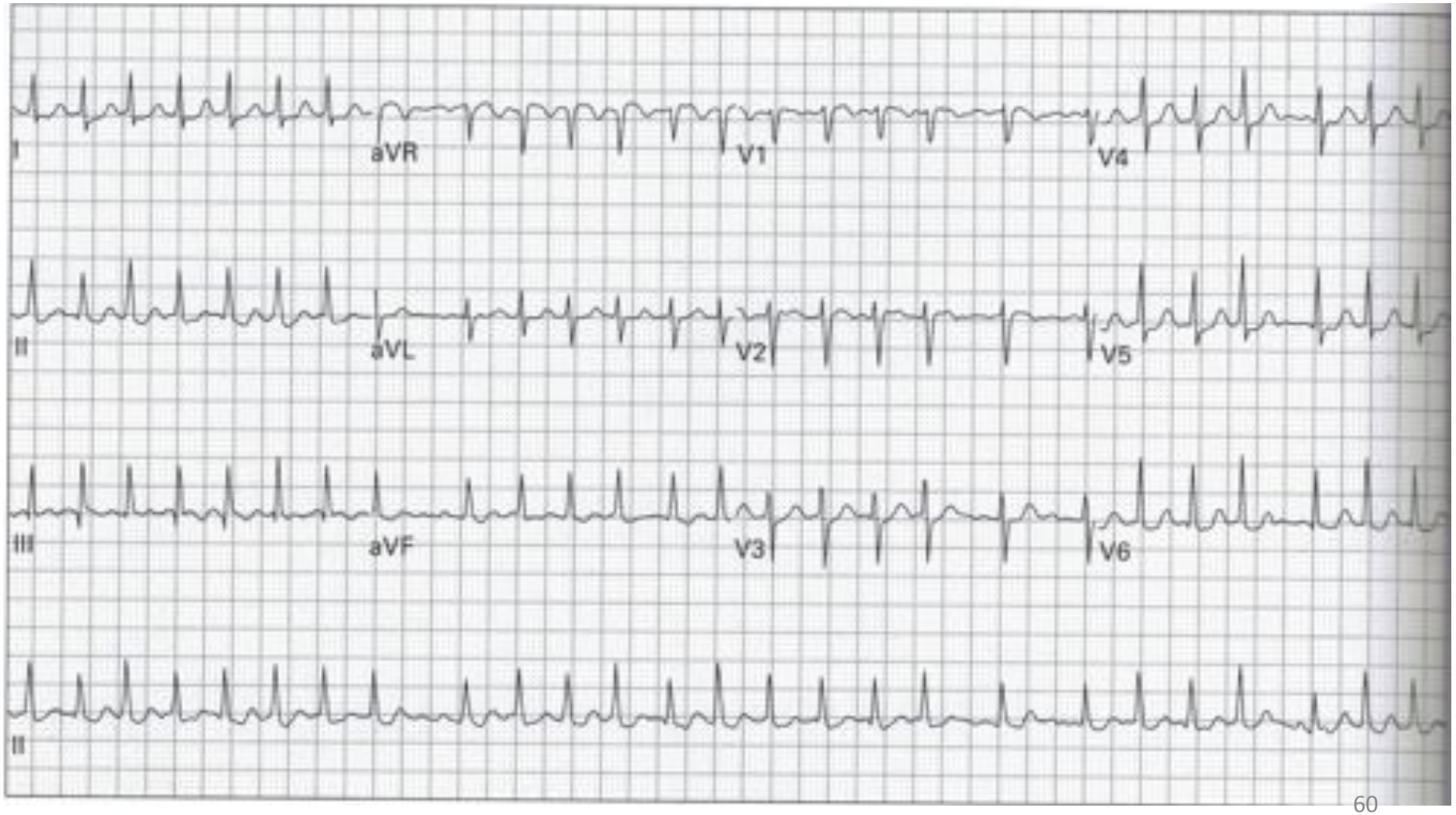
Old ECG Obtained



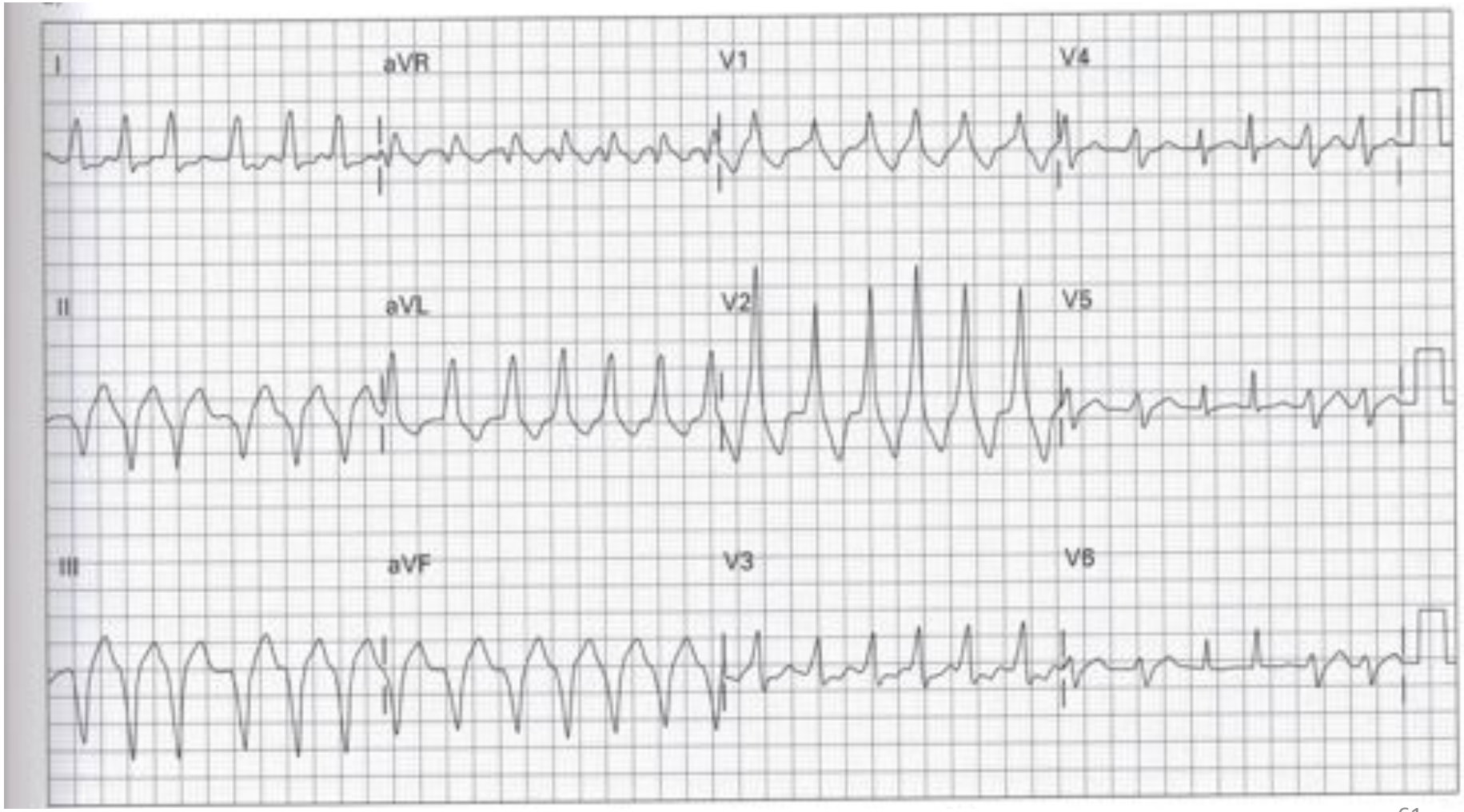
Following Adenosine Administration, A Diagnostic Maneuver was Performed



48 year old male with palpitations



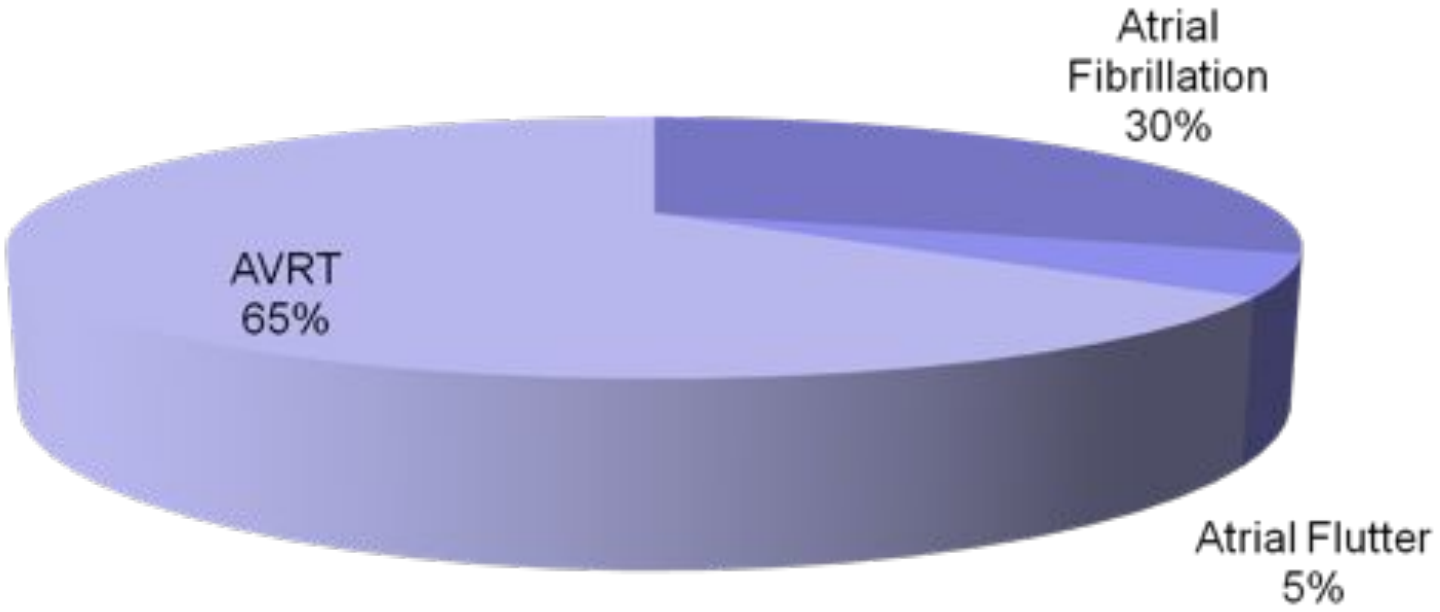
21 year old female with palpitations



Wolff-Parkinson-White Syndrome

- ECG pattern seen in 0.25% of population
  - 1.8% develop syndrome
    - Yearly risk of arrhythmia 1%/patient
- ECG pattern may be intermittent and disappear permanently with age
  - Effects of autonomic tone?

Types of Arrhythmias with WPW



Risk of Sudden Death

- 0% in patients with ECG pattern who never develop symptoms
- 0.4% annually in patients with symptoms
- A-fib was preceding rhythm in all three deaths out of 162 initially asymptomatic patients followed 5 years

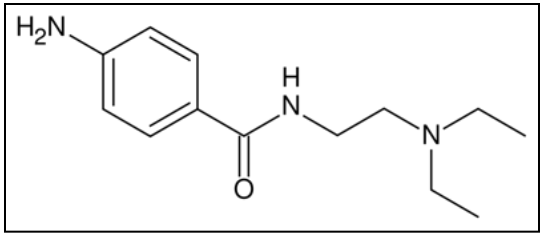
Pappone et al. J Am Coll Cardiol 2003.

Torsades de pointes

Source Undetermined

Treatments for WPW with A. fib

- Procainamide if stable
  - Increases refractory period of accessory pathway
- Synchronized electrical cardioversion
  - 200J Biphasic



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