

# EP for The Generalist

*Some clinical pearls for the busy PCP*

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## Our 1:30pm patient

43yo female who presented to an outside ER (a town 40 miles away) one month ago with sudden onset palpitations and dizziness while gardening. She is active and otherwise asymptomatic.

No PMH

Medications: Multivitamin

Vitals: BP 105/65 HR 68

Exam: unremarkable.

Labs / CXR in ER: normal

### **Her list of questions includes:**

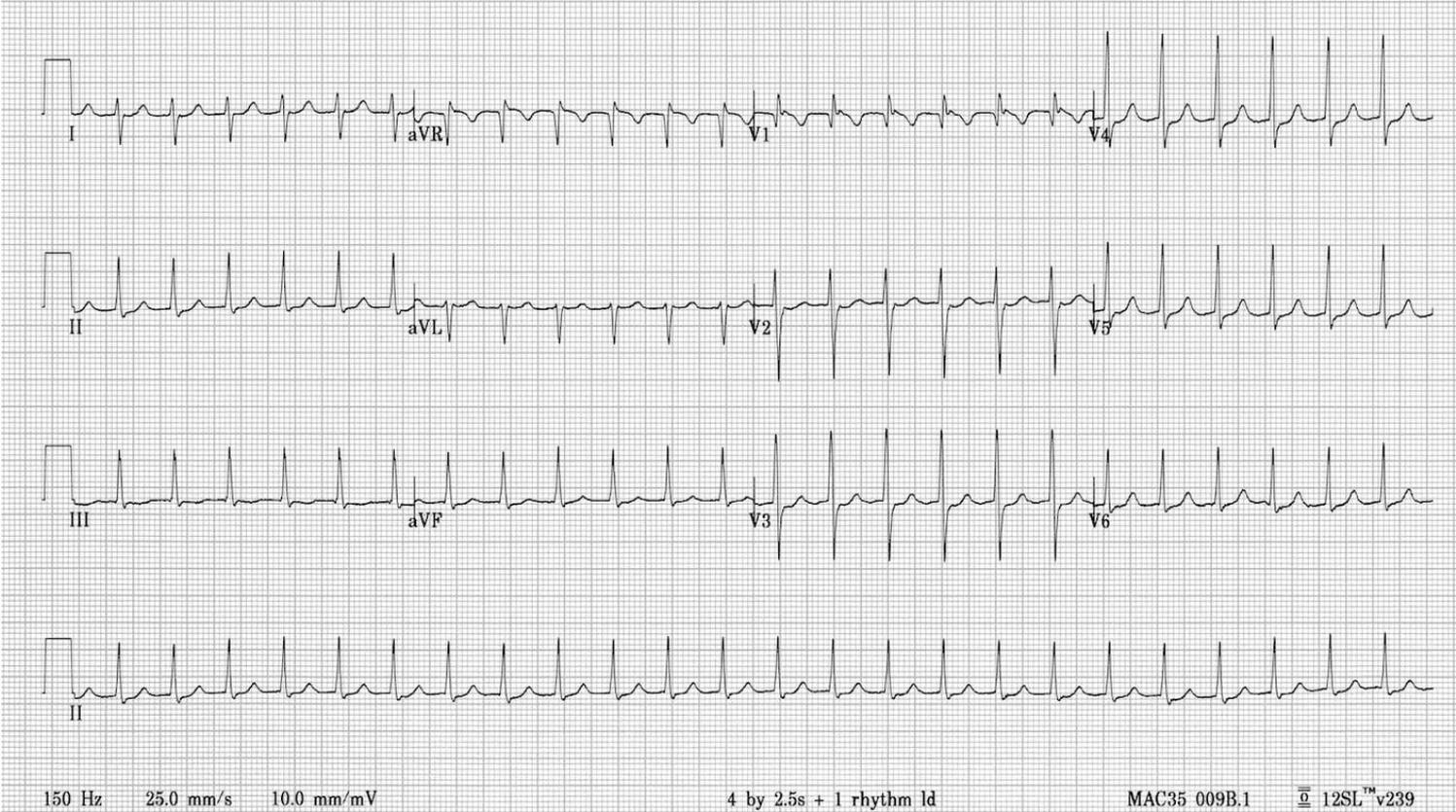
1. Why did this happen?
2. How do I prevent it from happening again?

# Palpitations: Things to consider

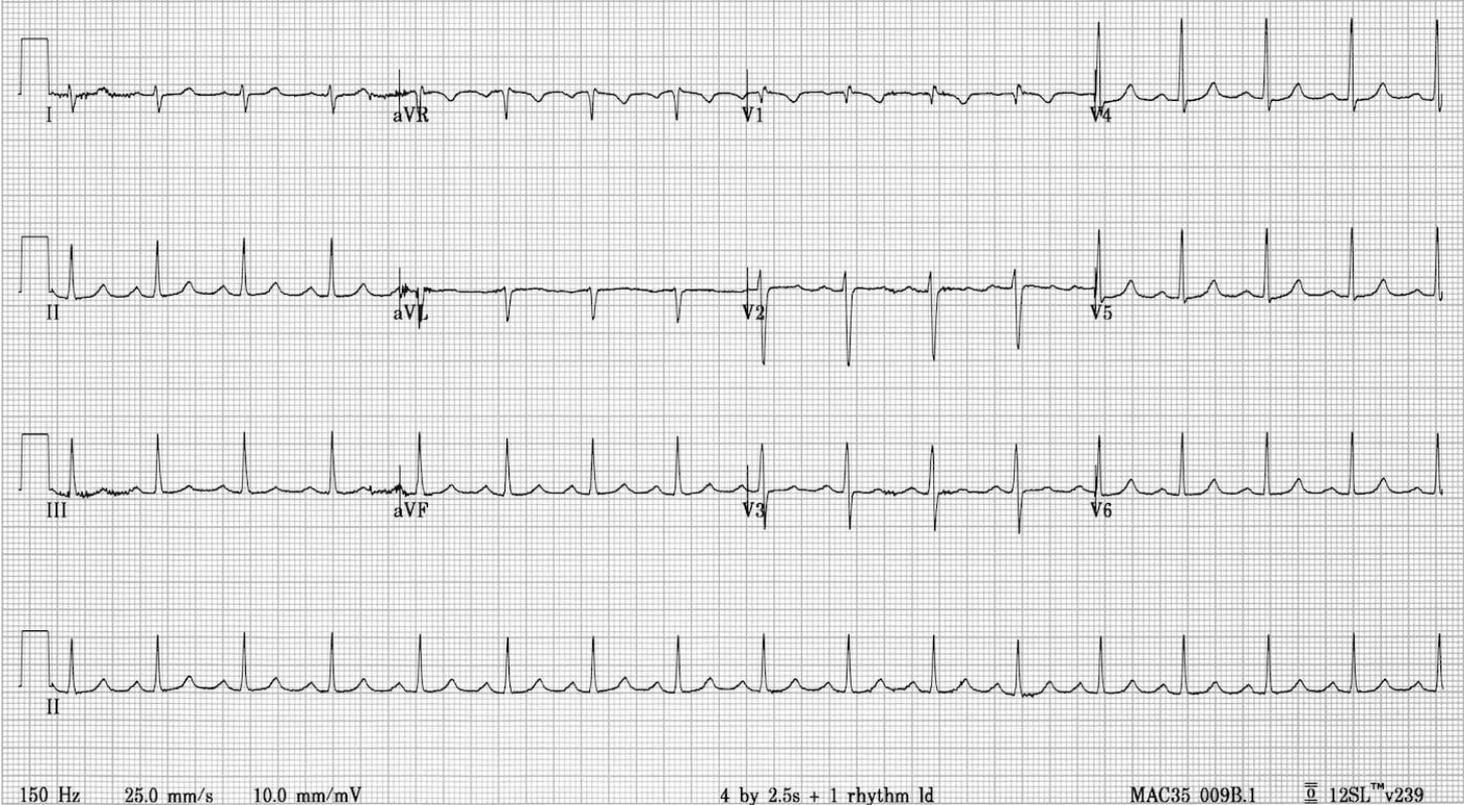
- Onset of symptoms: abrupt or gradual?
- Regularity of rhythm: what did it feel like?
- Duration: How long did it last?
- Cessation: How did it terminate? Abrupt or gradual?

*These considerations apply to both the patient's symptoms and ECG/rhythm strip*

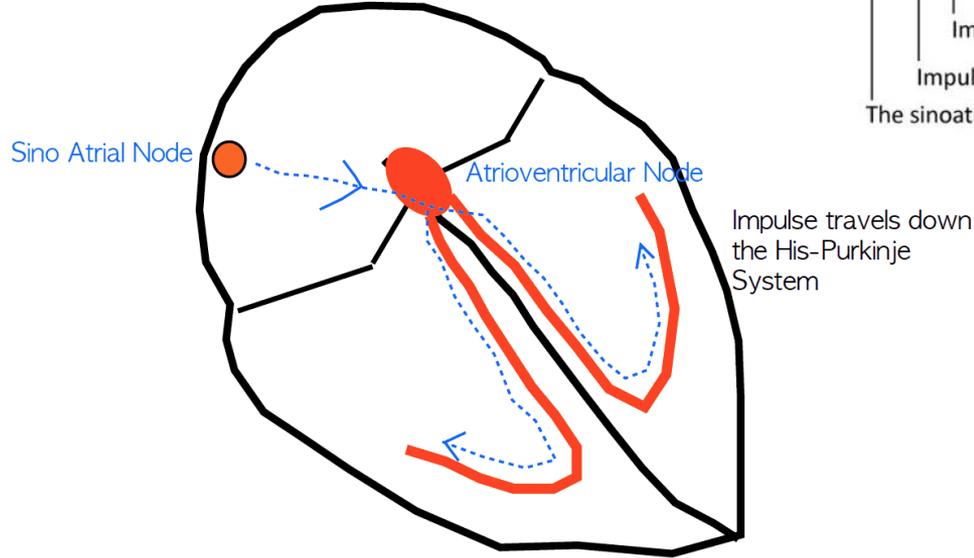
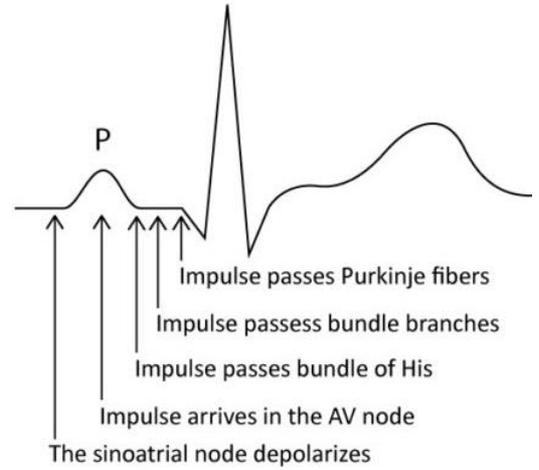
# Patient ECG on arrival to ER



# ECG after IV Diltiazem

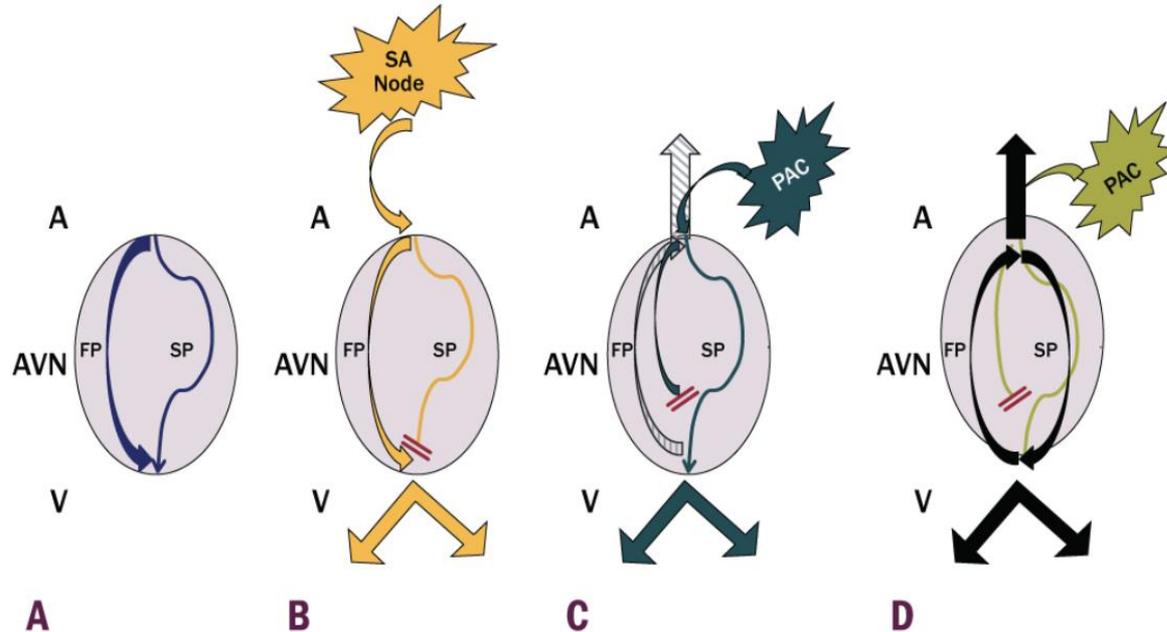


# Normal Conduction



# AVNRT

## Dual AV Nodal Physiology



## Treatment:

### AV Nodal blocking Agents

- Adenosine
- Beta Blockers
- Calcium Channel Blockers
- Digoxin

*Dual AV nodal physiology is seen in up to 10% of the population*

# AVNRT = Short RP Tachycardia (< 70msec)

## RP interval

RP interval Short and <70 ms

Typical AVNRT. AVRT is unusual.



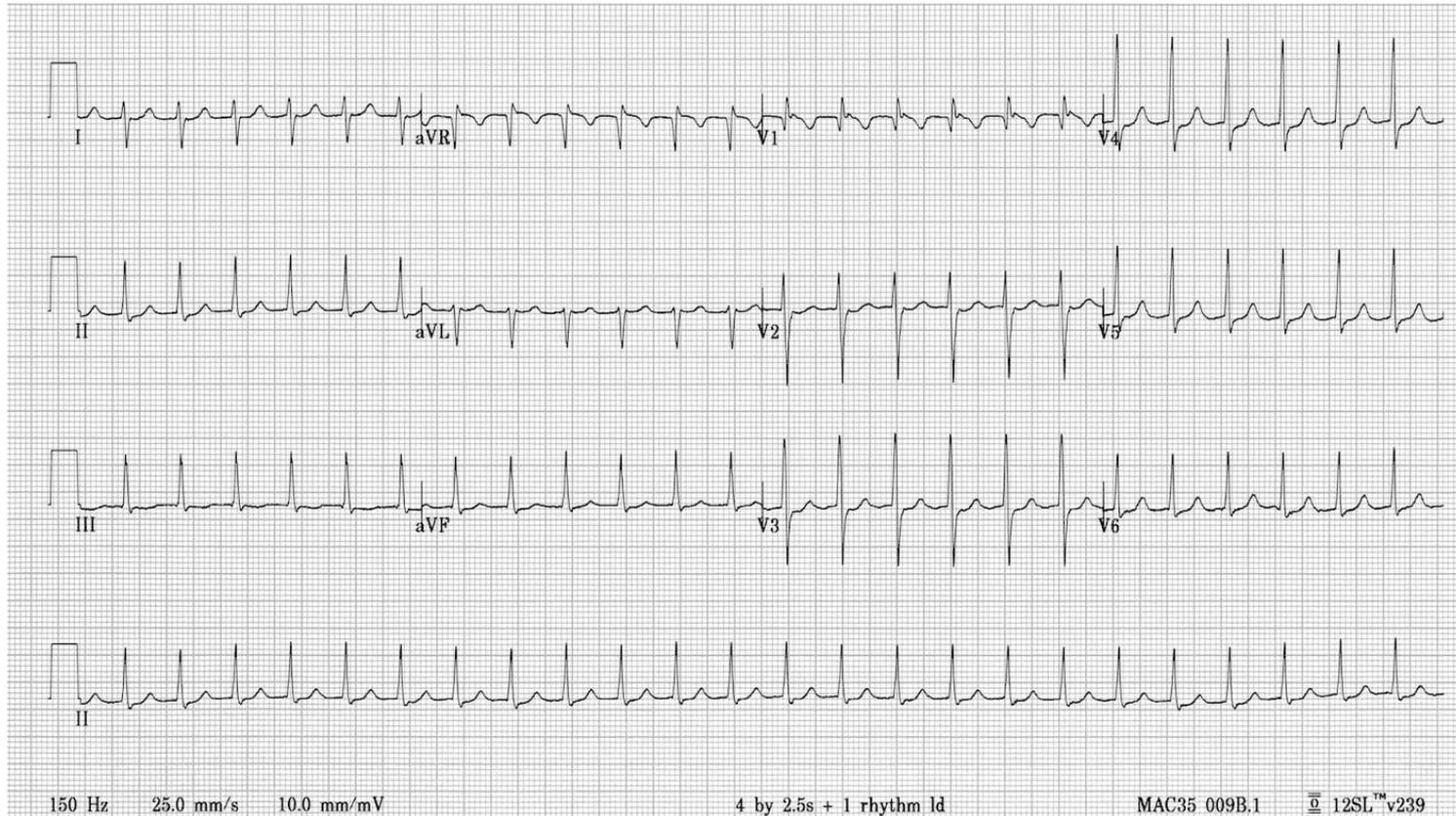
RP interval No visible P-wave

Typical AVNRT

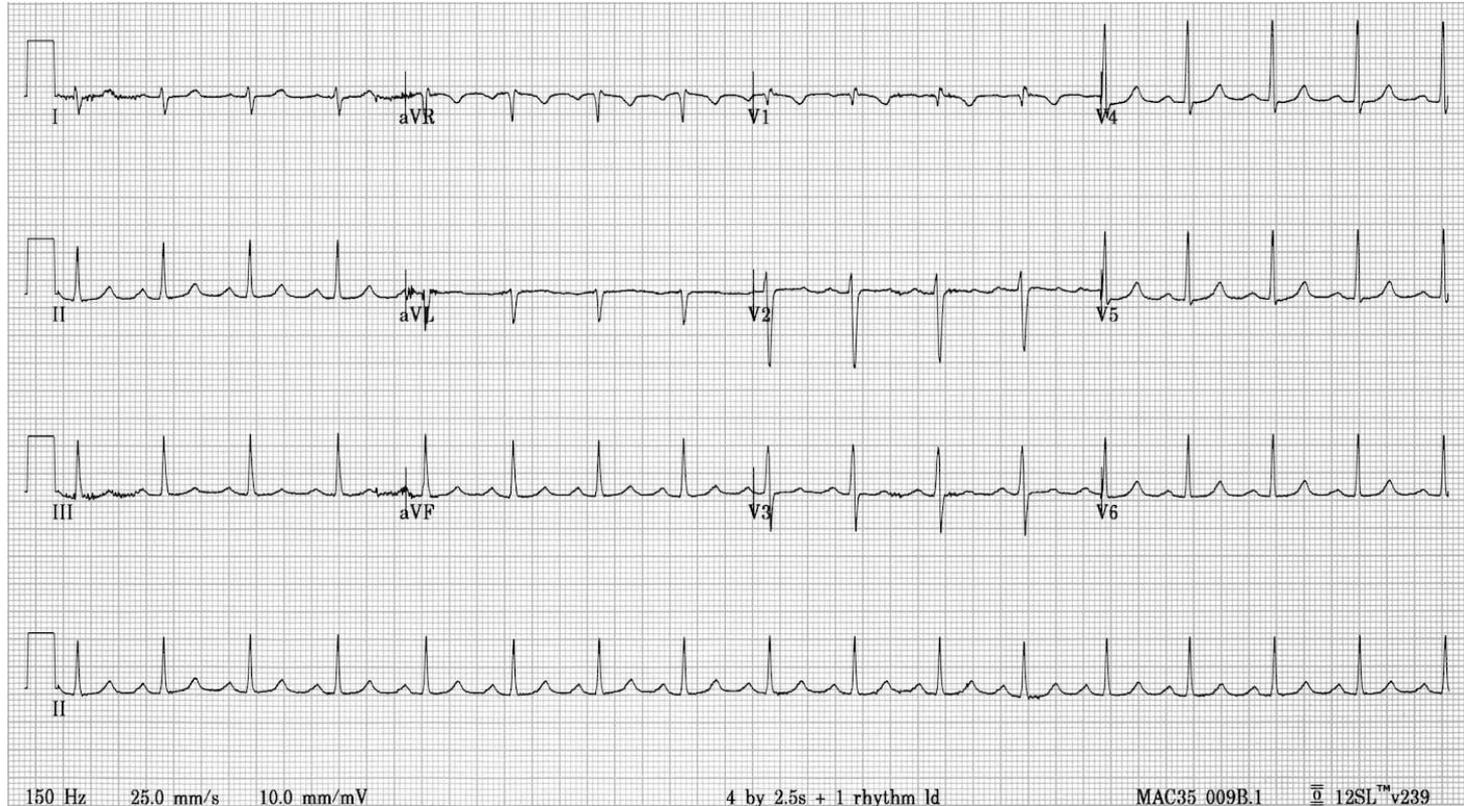


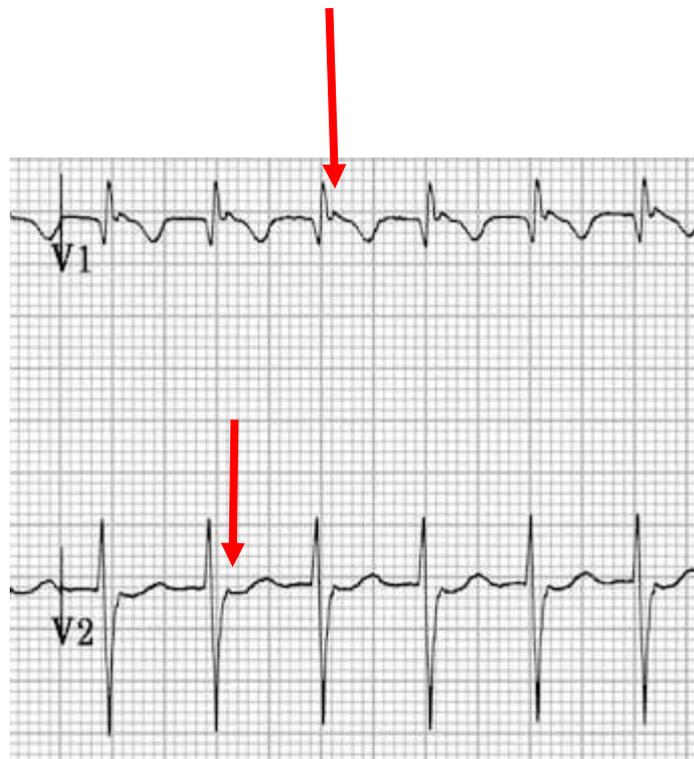
If the P-wave is invisible, it is classified as short RP interval.

# AVNRT: ECG



# AVNRT: Baseline ECG





SVT  
Retrograde P wave



Sinus  
No retrograde P wave

# AVNRT: Treatment

Acute: assess stability, try Valsalva maneuvers / cough / carotid sinus massage, and AV nodal agents (Adenosine, Beta Blockers, Calcium Channel Blockers)

Chronic: Often depends on the frequency and clinical characteristics

Beta blockers and Calcium channel blockers are reasonable.

- Chronic medical management rarely has a role for long-term treatment of SVT.

**Preferred treatment (Class I) is catheter ablation.**

- > 95% success rate, low rate of complications.

# Our 1:30pm patient

- Discussed the pathophysiology of AVNRT.
- Started oral Diltiazem ER 120mg daily per patient preference.
- Ordered a TTE.
- EP referral for consideration of EP study and ablation.
- Encouraged ongoing activity as tolerated.
- Close outpatient follow up.

## Our 2:30pm Patient

21yo male with numerous brief episodes of palpitations and dizziness, usually lasting about 5 minutes, and resolving spontaneously. Have occurred for about 2 years, but more frequent of late.

PMH: none

Medications: none

Vital signs: BP 120/70 HR 80

Physical exam: unremarkable.

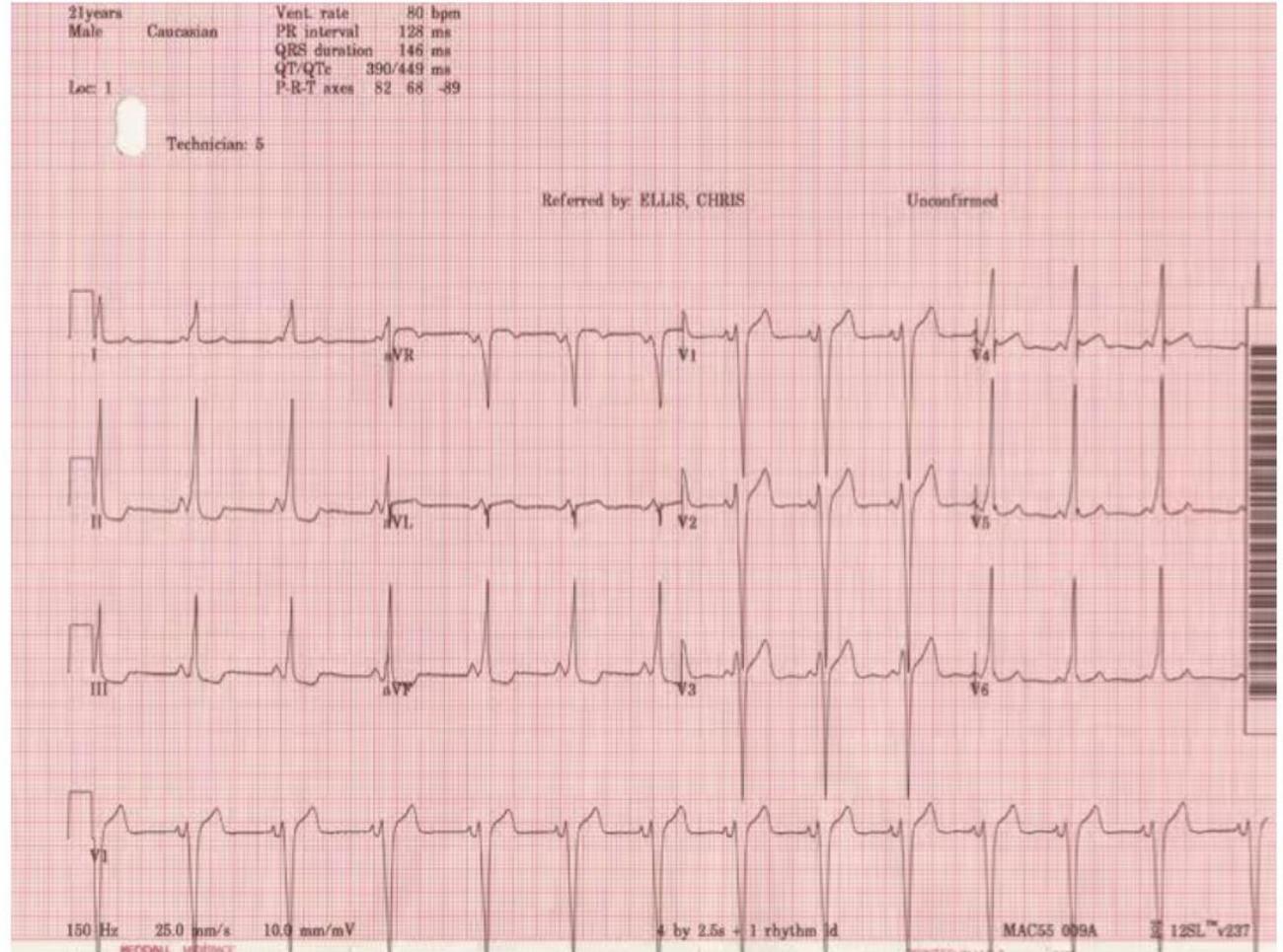
TTE: normal

# ECG



WPW Pattern:  
Detectable in 0.25%  
of the population.

Pattern + Symptoms =  
**WPW Syndrome**

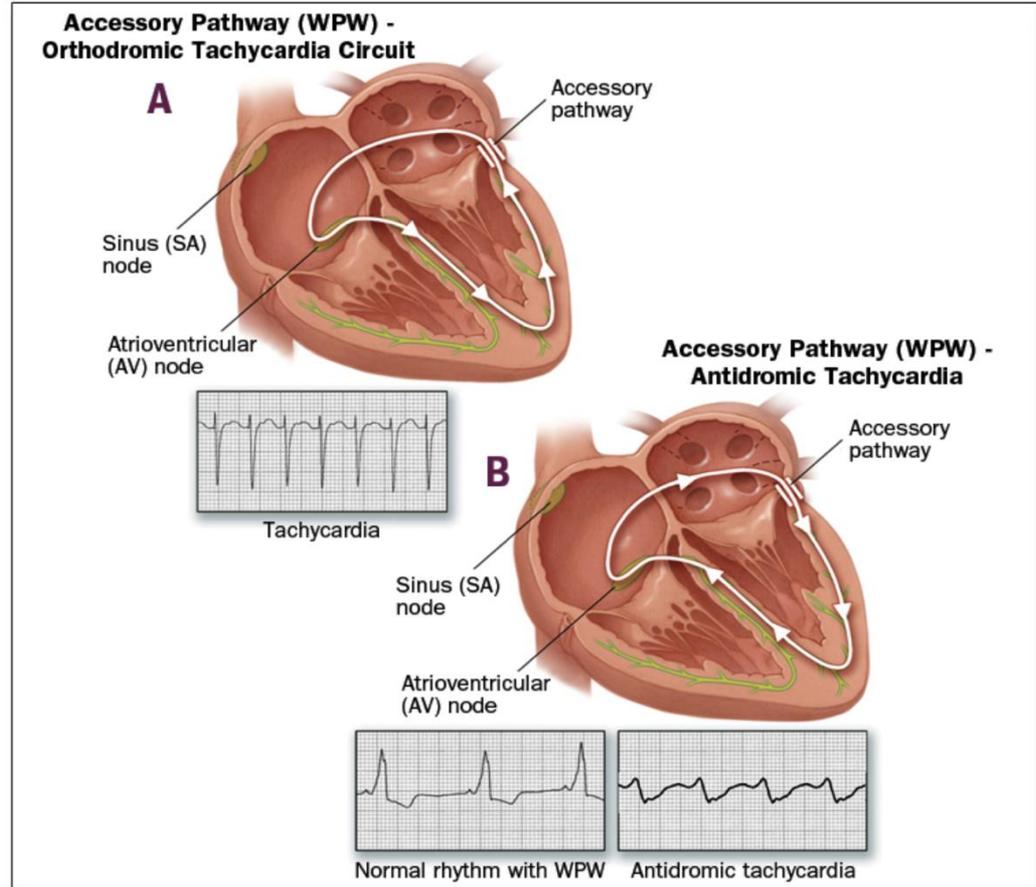


# AVRT: WPW

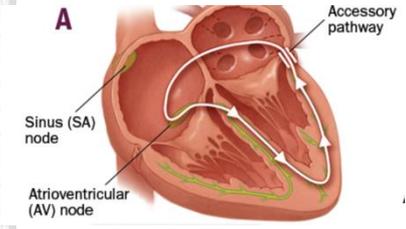
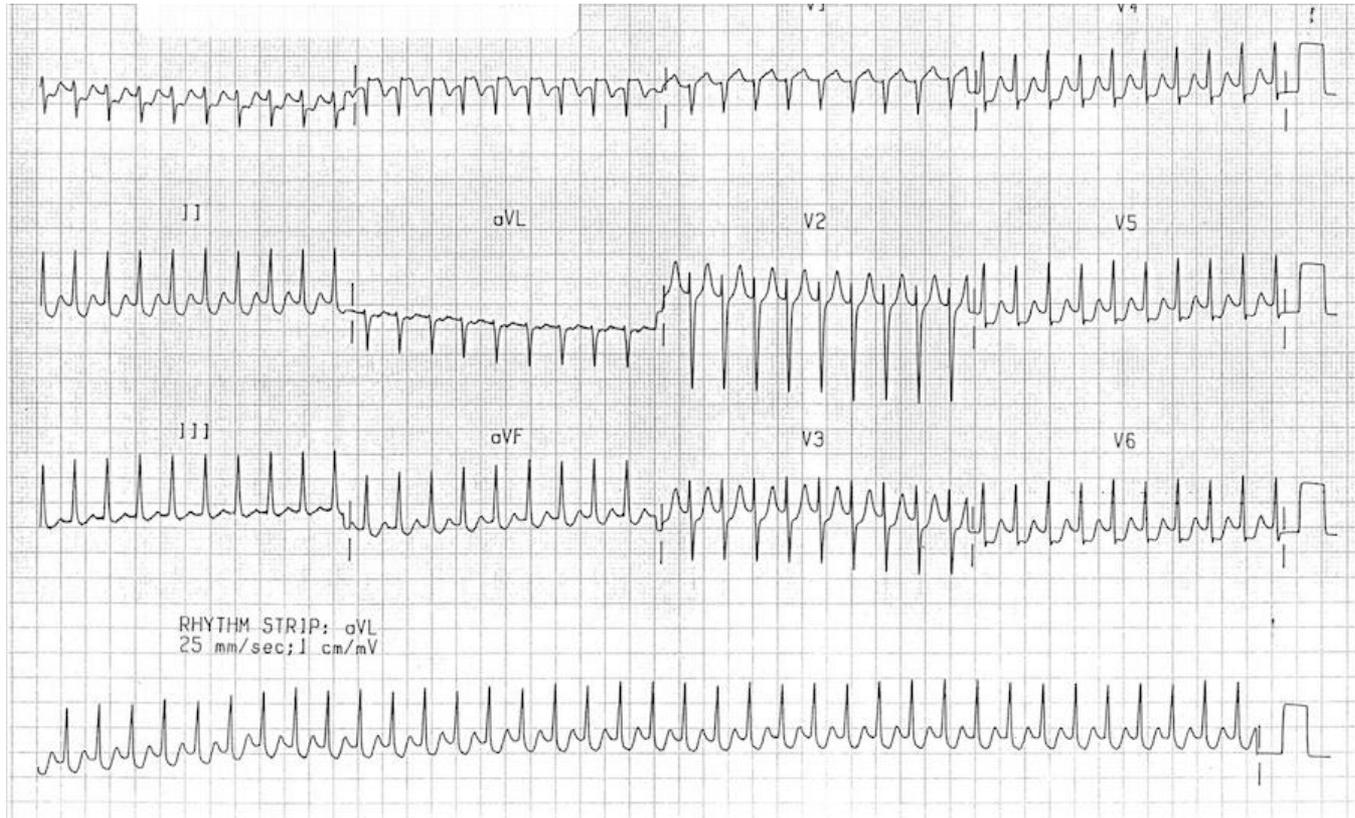
Orthodromic: Antegrade conduction **down the AV node** and up the accessory pathway (**narrow**).

Antidromic: Antegrade conduction **down the accessory pathway** and up the AV node (**wide**).

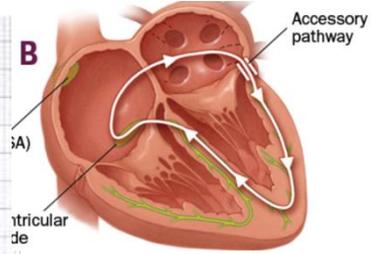
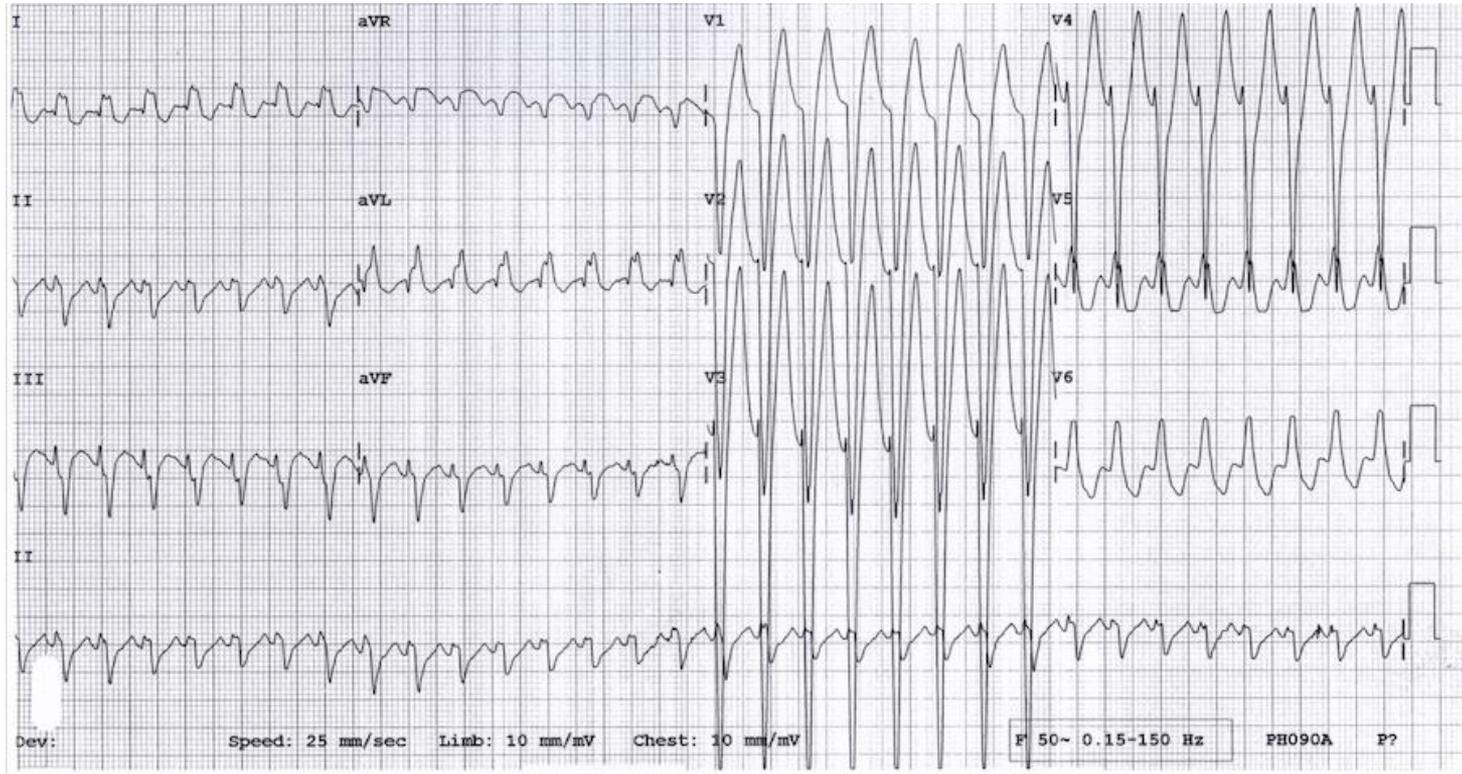
## Circuit of Orthodromic Reciprocating Tachycardia (ORT) and Antidromic Reciprocating Tachycardia (ART)



# Narrow WPW (down AV node, up AP)

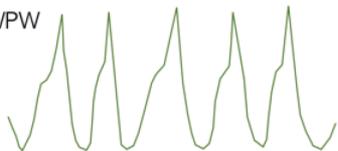


# Wide WPW (down AP, up the AV node)

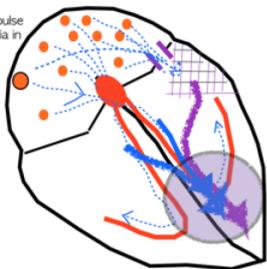


# AF with WPW

AF WITH WPW



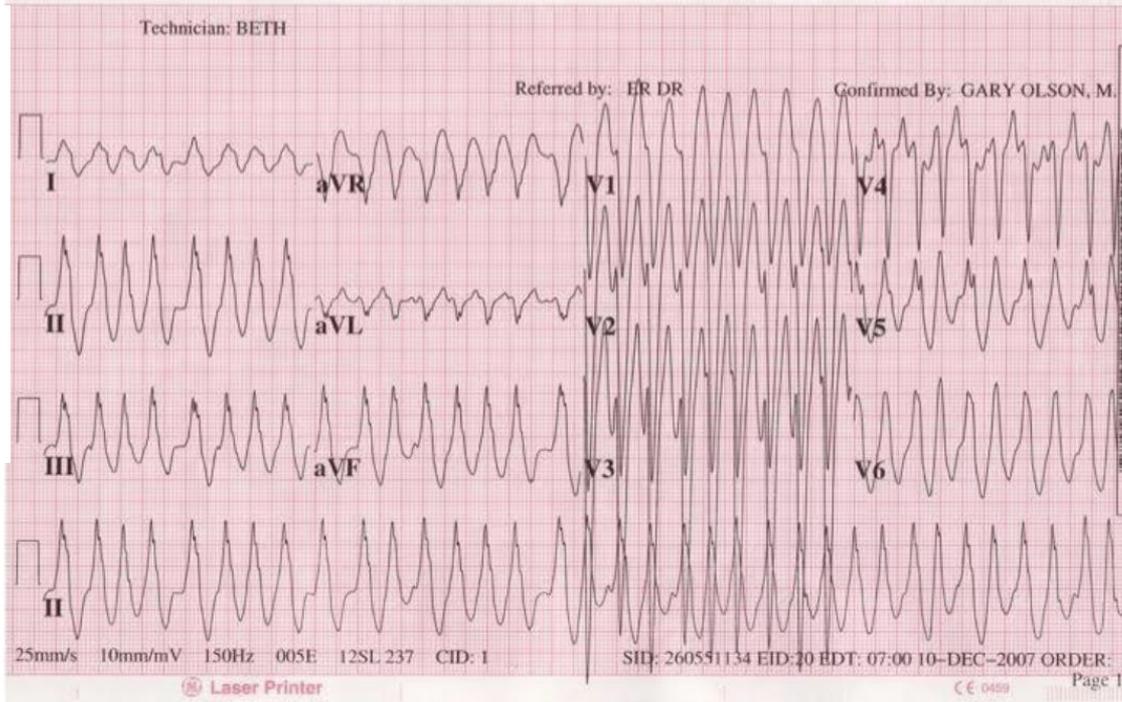
Multiple area of impulse formation in the atria in Atrial Fibrillation



Atria fire at 300-600 beats per minute. Some of those impulses travel down the Atrioventricular node, some travel down the accessory pathway in an anterograde fashion. The result is that part of the myocardium depolarizes faster than expected if normal conduction occurred. There is also an area that reflects the summation of depolarization that occurs by passage of impulses via the AVN and accessory pathway.

High risk pathway:  
R-R interval < 250 msec.

15-MAY-1986 (21 yr)	Vent. rate	210BPM	<i>Atrial fibrillation with rapid ventricular response with aberrantly conducted complexes</i> <i>Abnormal ECG</i> <i>No previous ECGs available</i>
Male Caucasian	PR interval	* ms	
Room:16	QRS duration	212 ms	
Loc:10	QT/QTc	310/579 ms	
	P-R-T axes	* 78 245	



# Stress Test in WPW: Tells you about the AP

Abrupt loss of pre-excitation with elevated heart rate.

Risk of sudden death, in general for WPW, is low.



# AVRT: Treatment

AV nodal agents typically not recommended (including amio)

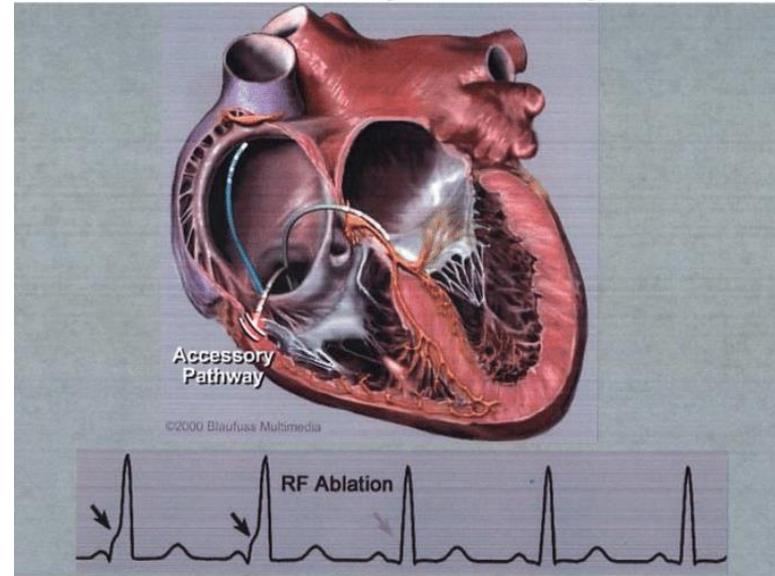
Adenosine: could increase the risk for AF and 1:1 conduction down AP.

Acute: IV ibutilide or IV procainimide (DC cardioversion for instability)

## Chronic: Catheter Ablation (class I).

- WPW syndrome
- WPW pattern but higher risk or high risk occupation (aviation, drivers, etc).

## WPW: Catheter Ablation of Accessory Pathway



## Our 2:30pm patient

- Discussed the relatively low risk nature of his situation.
- He was concerned about his symptoms, needing to potentially go to the ER, and psychologically scaling back his lifestyle to mitigate risks.
- After a discussion on ablation, he requested an EP referral.
- Ordered a Zio patch for 2 weeks to try and capture his episodes and correlate symptoms with a rhythm. May also get his heart rate response to pre-excitation on the Zio.

# Our 3:30pm patient

35yo female with occasional brief palpitations, “like my heart stops and then thumps”. No other symptoms. Sedentary lifestyle. No triggering factors.

PMH: Pre-diabetes

Meds: None.

Non-smoker, rare EtOH use, 1 caffeinated beverage per day, no drugs. Works at Dominos as a shift manager.

Family History: no sudden death or premature CAD.

Vital signs: BP 135/70 HR 80

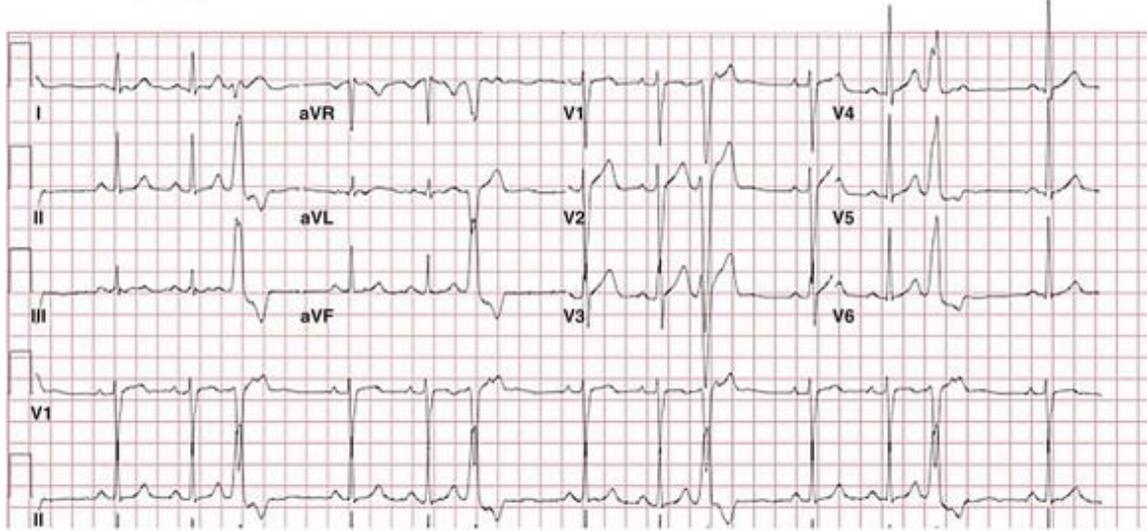
Exam: trace ankle edema, occasional ectopy noted.

# Data

Zio: Frequent PVCs.  
(17.2%)

TTE: EF 45%, mild global  
hypokinesis.

Labs: normal



1

Isolated VE Beats by Unique Morphology



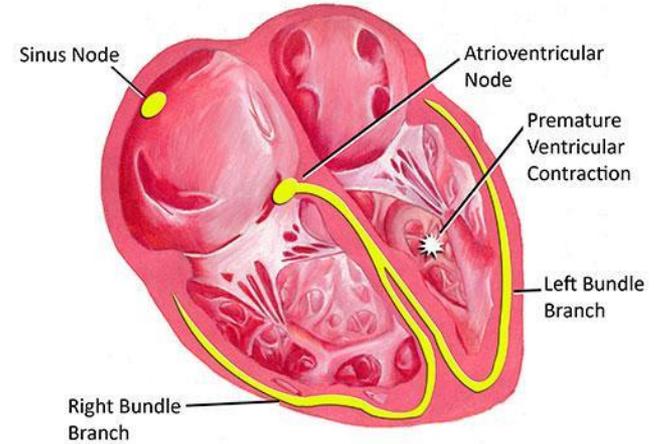
1 7.2% burden

# VT / PVCs with normal Heart

## Presentation

- Young and often asymptomatic
- Palpitations, lightheadedness
- Syncope rare, even with sustained VT
- VF extremely rare

Premature Ventricular Contraction



# VT / PVCs with normal heart: Site of Origin

- **RV outflow tract (RVOT)**
- **LV outflow tract (LVOT)**
- Papillary muscles (LV or RV)
- Mitral annulus
- Coronary venous system
- Posterior fascicle

## Outflow Tract Tachycardia

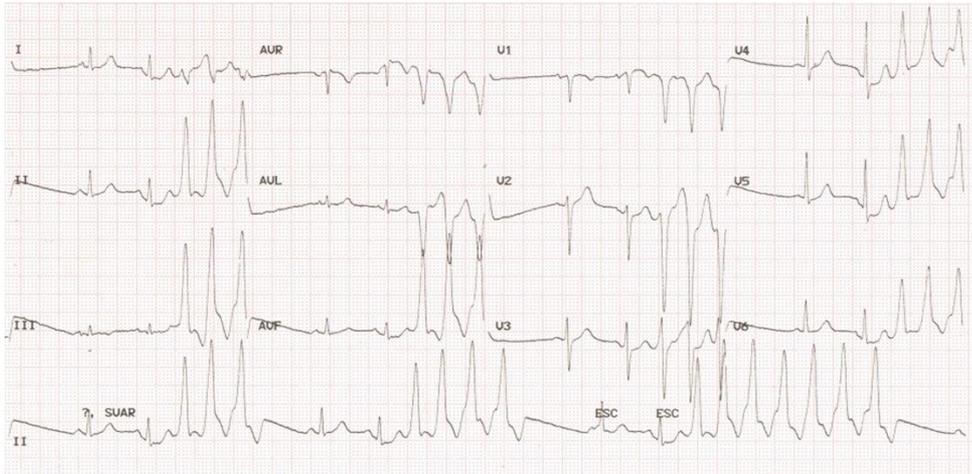
Men = Women

Mean age at diagnosis 50 +/- 15

PVC cardiomyopathy > 15-20% PVCs  
(reversible)

RVOT more common than LVOT.

# Outflow Tract Tachycardia: ECG Features

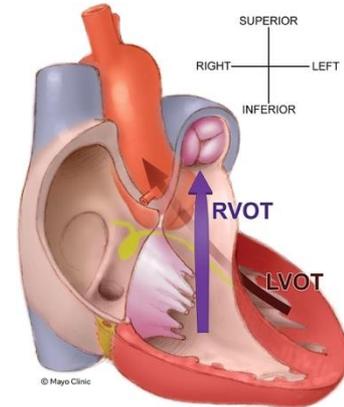
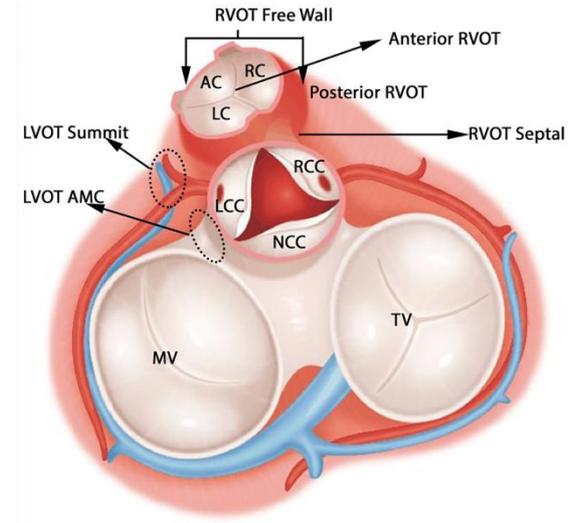


RVOT Tachycardia important to recognize: ablatable

Inferior axis (positive in II, III, aVF)

Left bundle branch block pattern

Later precordial lead transition (V3-V4)



# Mechanisms

Often catecholamine-induced (exercise, emotional stress)

Men: classically with exercise

VT most often occurs in the warm down period.

Women: often a relationship with menstrual cycles (increase in pregnancy, increase at onset of menopause)

**12-Lead ECG Showing PVCs  
Originating From the Left Coronary Cusp Region**



# Clinical Evaluation: Points to consider

**Location / Exclude channelopathy:** 12 Lead ECG

**PVC / VT Burden:** Ambulatory monitoring

**Is this normal heart?:** Transthoracic Echocardiogram

- RV dysfunction: Think of ARVCM (Arrhythmogenic RV cardiomyopathy)
- LV dysfunction: consider ischemia (vs PVC burden)
- Cardiac MRI: can help assess at the tissue level (fat, scar, granulomas, etc)
- Mitral valve prolapse

# PVCs / VT with normal heart: Treatment

*The majority of patients require no treatment.* Consider treatment for the following:

## Symptoms

- Beta Blockers
- CCBs
- AADs: Class Ic (propafenone, flecainide) or Class III (amiodarone, sotalol, dofetilide)

**Suspected PVC-induced Cardiomyopathy:** Ablation is optimal.

- Unclear etiology (bradycardia-mediated vs dyssynchrony vs alternate).
- Typically occurs when > 20% PVCs.

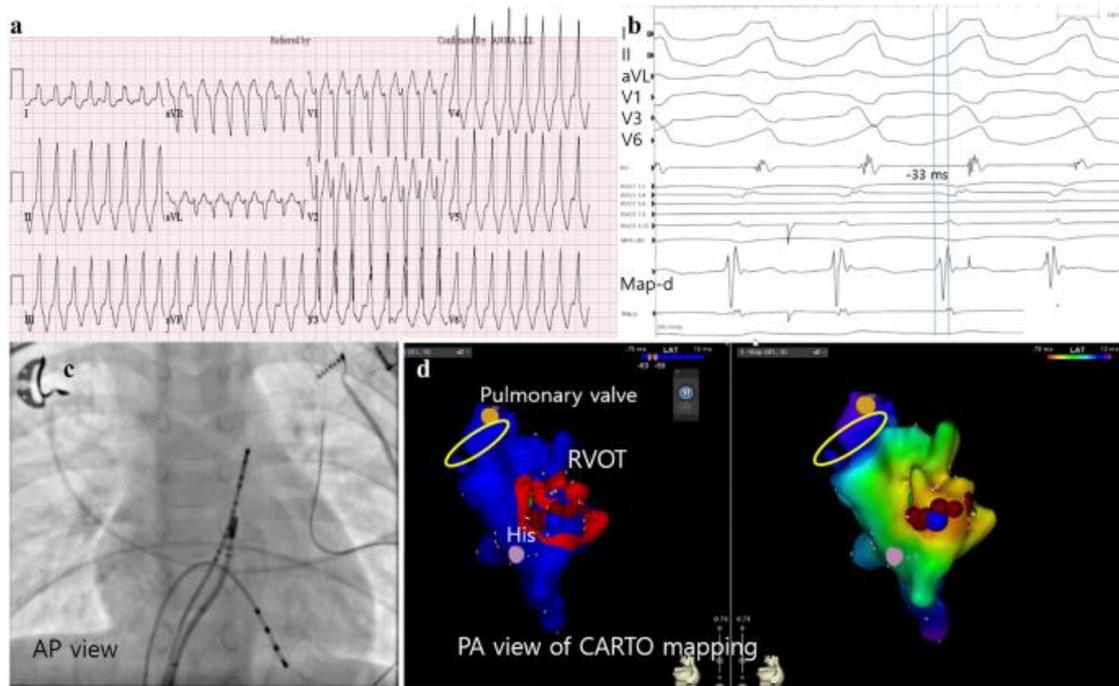
**Malignant Idiopathic VT: Ablation and ICD**

- Syncope
- Very fast VT (>230 bpm)
- Short coupling interval (second PVC on or near the preceding T wave)

# Catheter ablation for PVCs / VT

Medical therapy often not tolerated in younger patients.

80-100% success rate. Can get complex (epicardial origin, LV origin).



# Our 3:30pm patient

- Discussed how PVCs occur and the nature of her problem related to frequent PVCs.
- Given her fairly typical picture of RVOT PVCs and ongoing cardiomyopathy, recommended an EP referral to consider an ablation.
- Arranged a cardiac MRI to exclude ARVCM and other infiltrative conditions.
- Started her on Metoprolol succinate 25mg daily.
- Encouraged regular exercise, ongoing lifestyle modifications.

# 5pm: Day is over! Celebrate with your Inbox!

88yo male you saw last week for his initial visit with you to establish care with the following history:

## **Location 1**

2013-2015: Multiple ablations for paroxysmal atrial arrhythmias.

2016: Dual chamber pacemaker placement with AV nodal ablation for symptom management of atrial arrhythmias.

## **Location 2**

2018: Presentation with HF, EF 30%. Device upgraded to CRT. A review of his procedure logs shows his “right atrial lead removed”.

## **Location 3 (near you)**

2025: Device change out for battery EOL. He has two ventricular leads. No atrial lead.

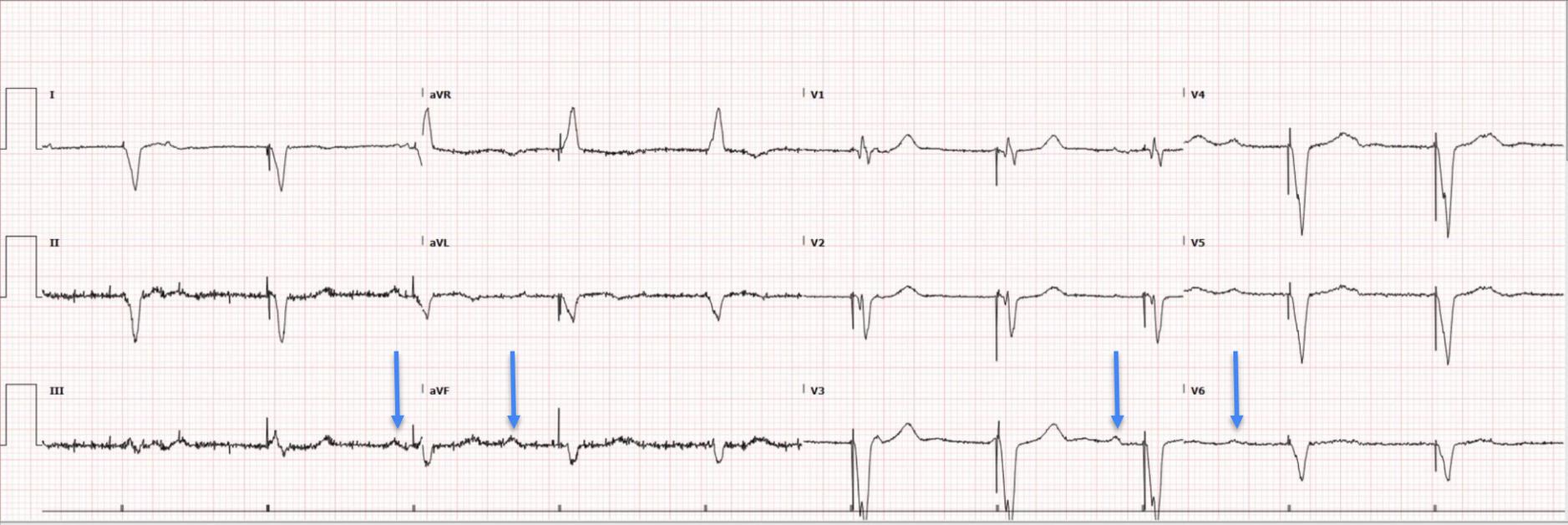
# Inbox Patient

Patient's daughter calls about his recent TTE results because he continues to be short of breath and fatigued.

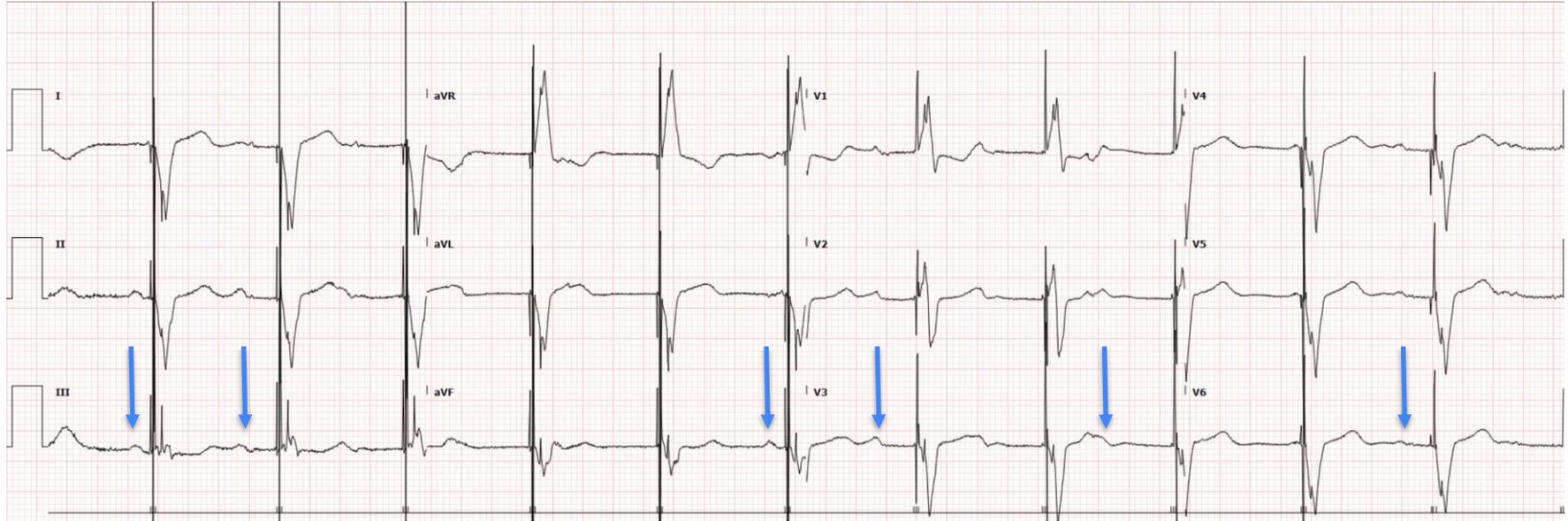
EF 50%, mild MR, PASP 35mmHg, moderate biatrial enlargement.

You got an ECG at his visit last week on his way out the door which you reviewed again today.

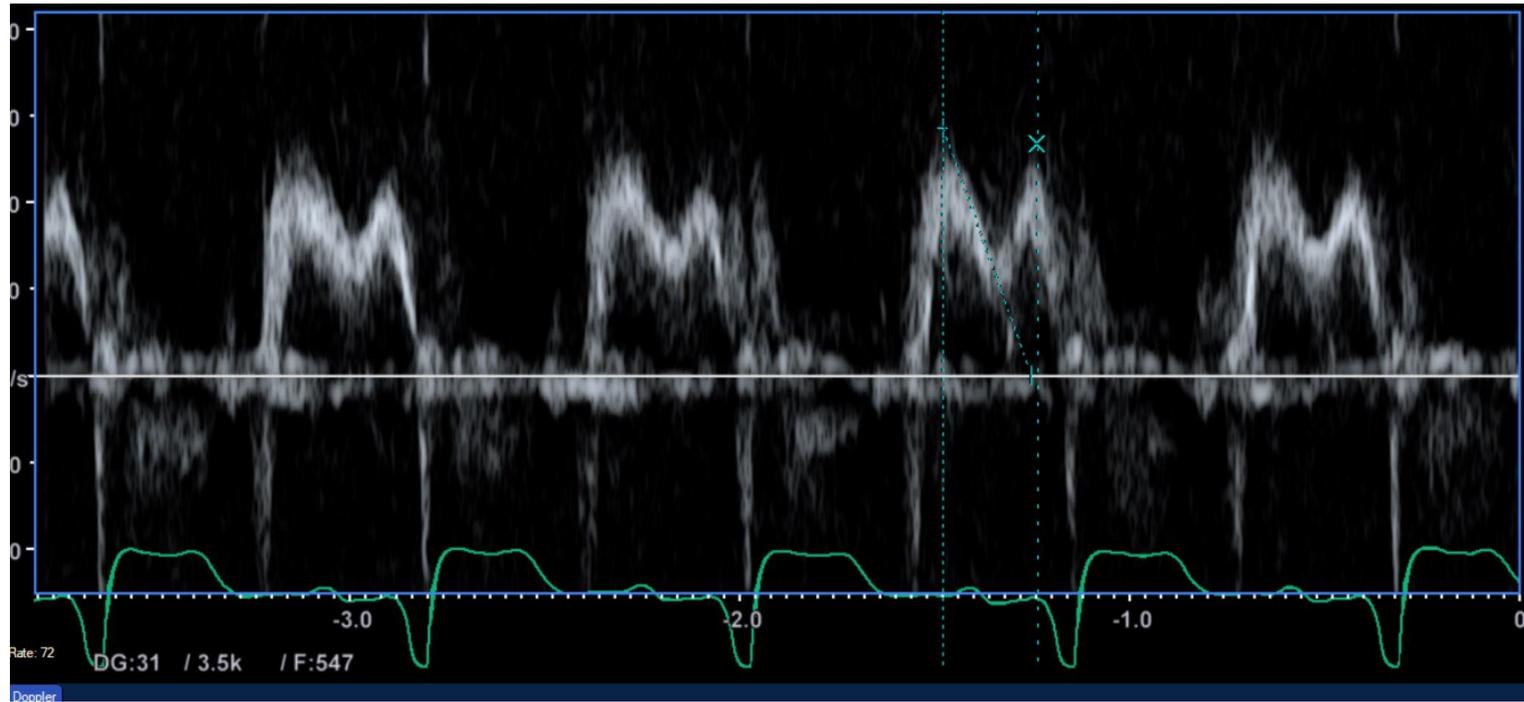
# Last ECG 11/25



# ECG from 2024

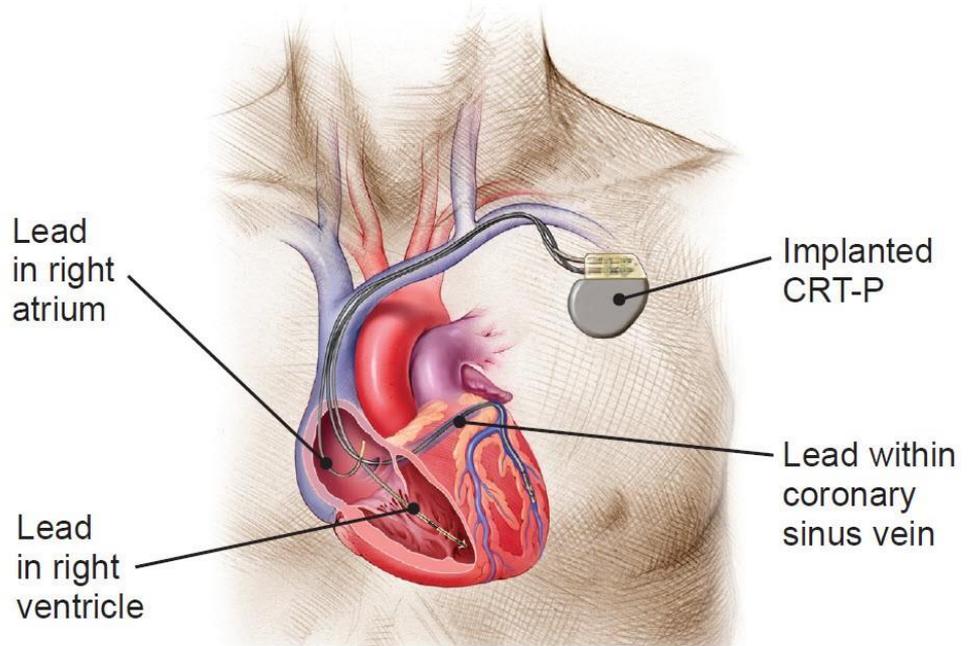


# TTE 10/25



# Our conundrum

- The patient is in sinus rhythm.
- His device cannot track his p waves (no atrial lead)
- He is pacing in his ventricles without tracking his p waves, so has no A-V synchrony.



So let's recap your afternoon:



1:30pm: 43yo female with AVNRT → **Refer to EP for ablation.**

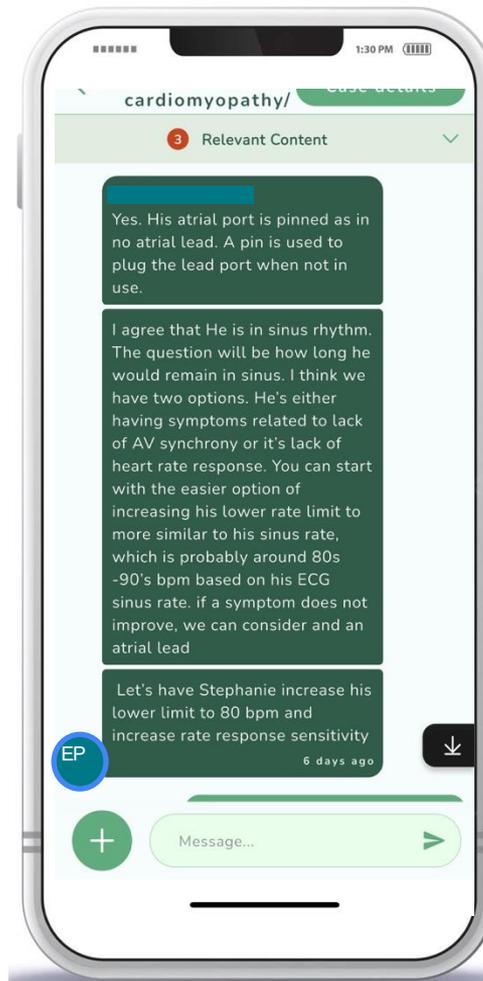
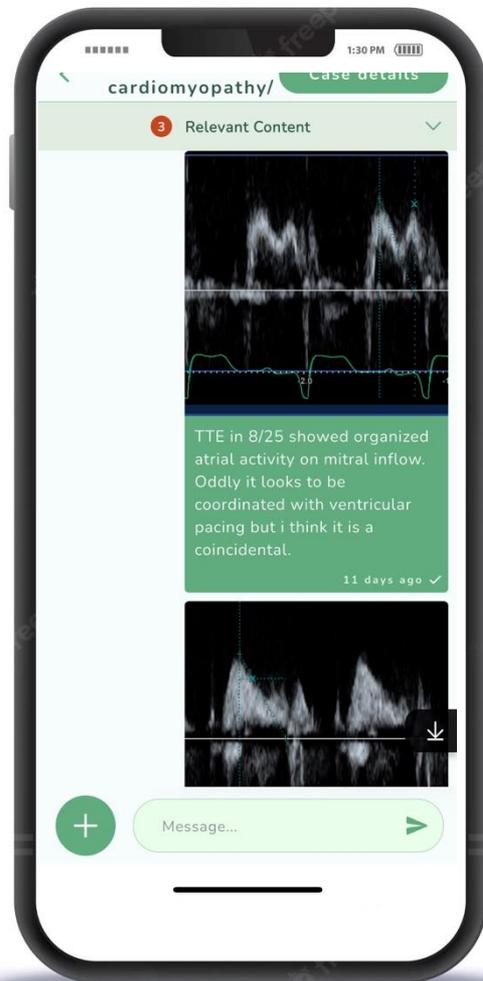
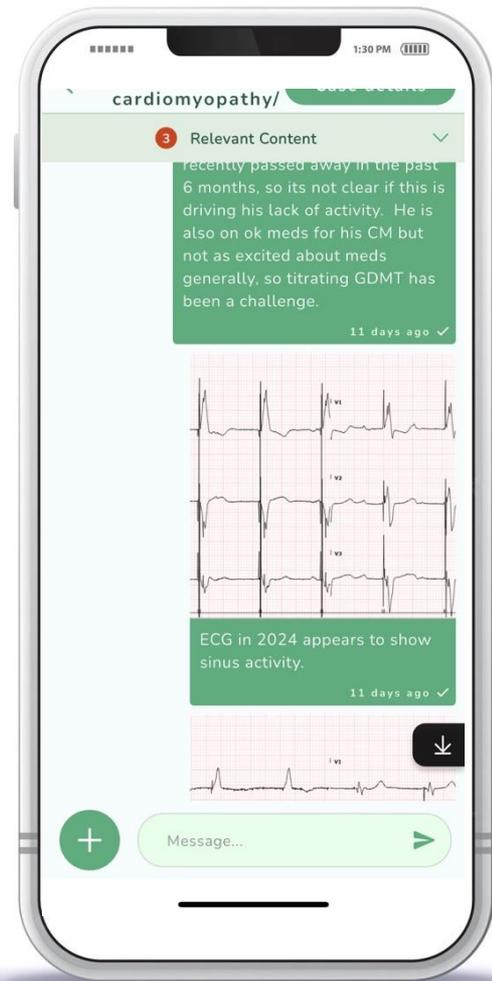
2:30pm: 21yo male with AVRT / WPW syndrome → **Refer to EP for ablation.**

3:30pm: 35yo female with frequent PVCs and CM → **Refer to EP for ablation.**

Inbox after hours: wouldn't it be great to just get some advice??



# My Inbox Patient, November 2025



# Thank You!

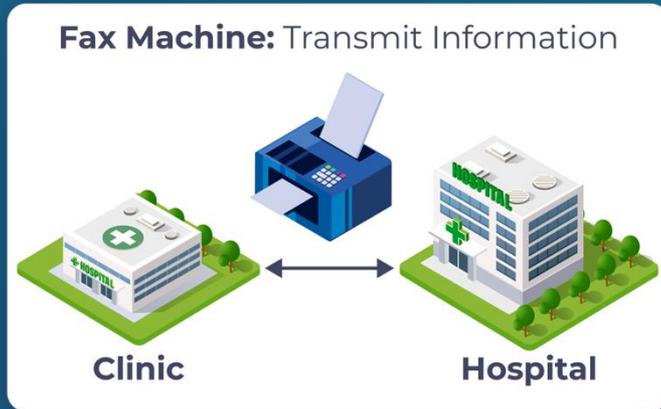


- Email: [gautam@coltrain.io](mailto:gautam@coltrain.io)
- Phone: 509-393-3299



## The Problem

**Clinicians struggle to share information and work as a team**  
**Data silos force clinicians to connect inefficiently.**

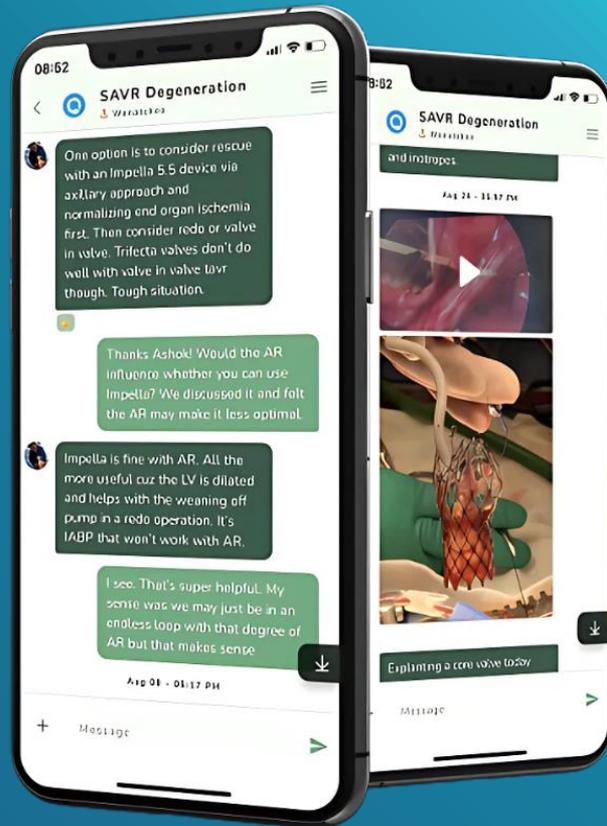


*85% of clinicians lose more than hour each day to workflow inefficiencies*

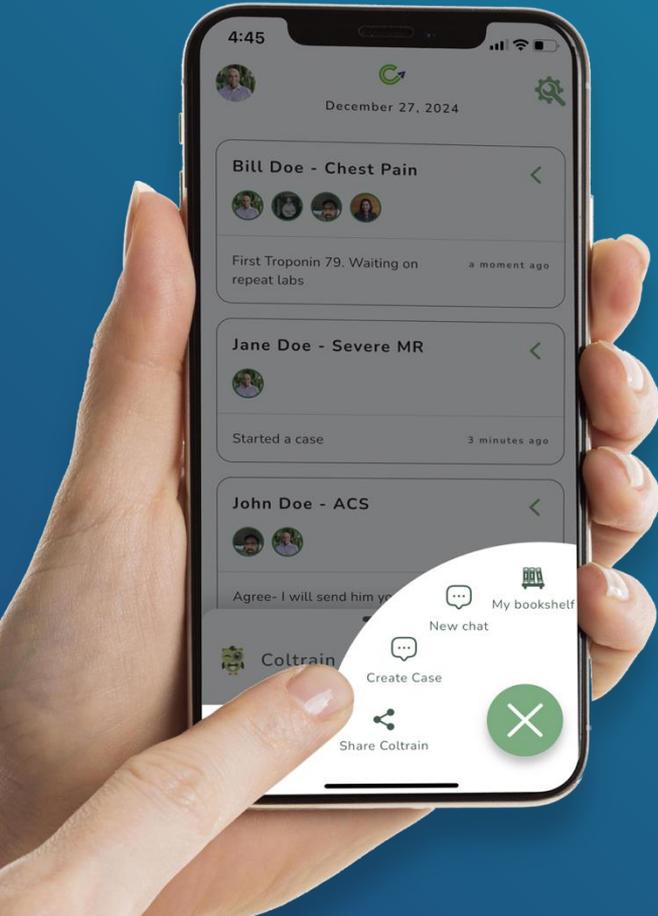
# Meet Coltrain

**Simple. Secure.  
HIPAA-compliant.  
Open Network.**

**Any clinician. Any location.  
Effortless connections.  
EMR Independent.**



# Today's Clinical Tech should be Powered by Today's Technology



## Cases and Chats

for asynchronous communication

**Phone Calls and Video Conferencing**  
directly within the platform

Easily searchable **Address Book**  
featuring every clinician on Coltrain

**AI Support** to summarize and  
provide resources.

**Security and HIPAA Compliance**  
Best in Class

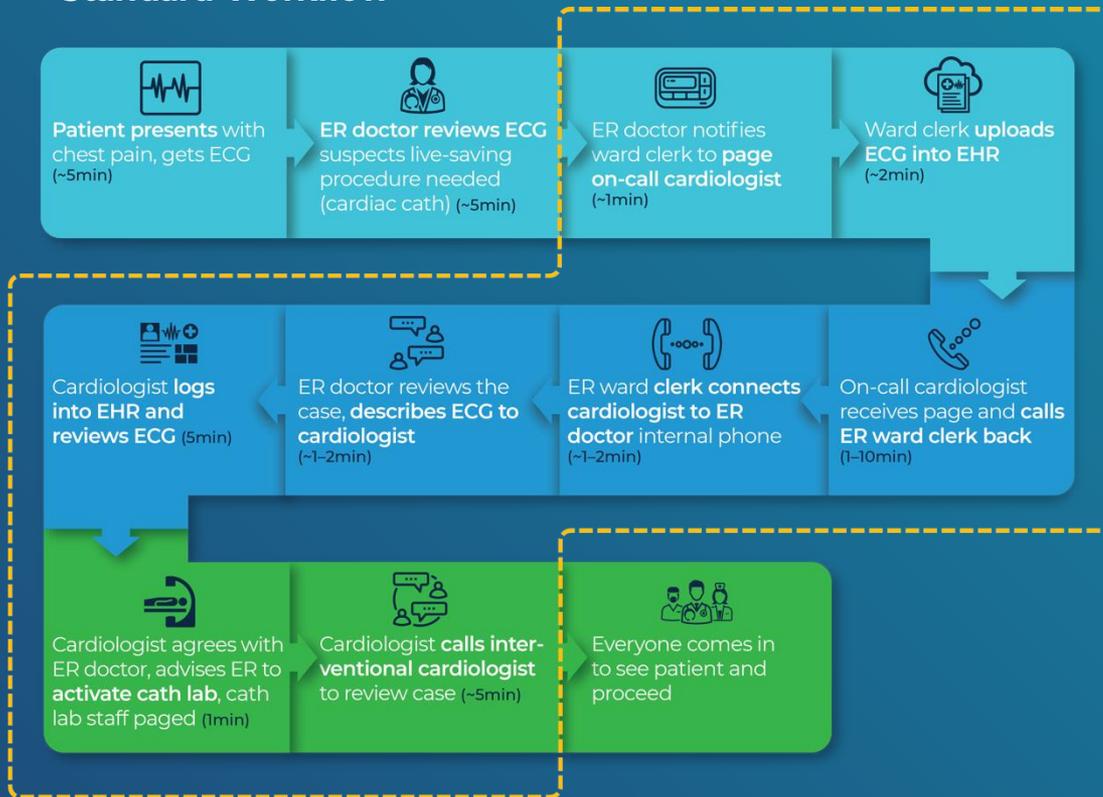
# Actual Coltrain Case: A Patient Presented to the ER with a Heart Attack

Coltrain **eliminates** redundancy and **decreases** time to patient care.

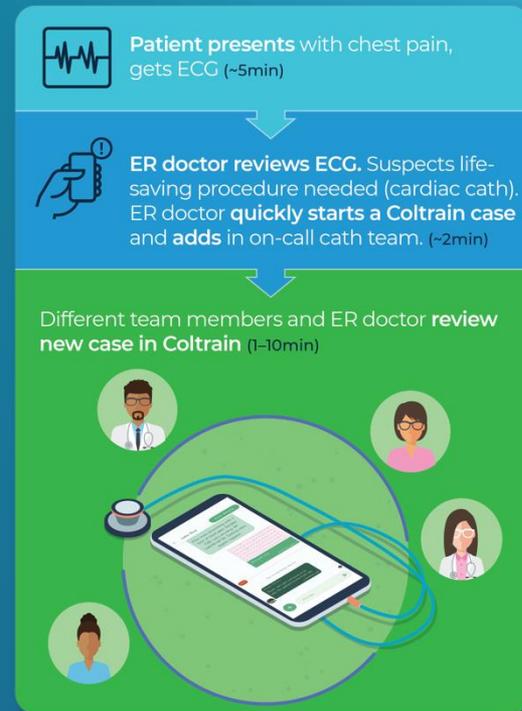
Coltrain saved 15 crucial minutes, **reducing mortality by 15%**



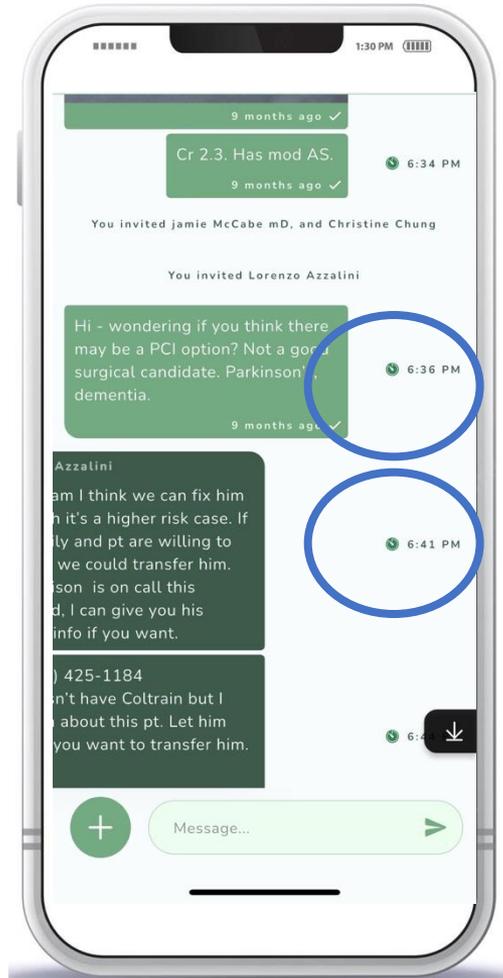
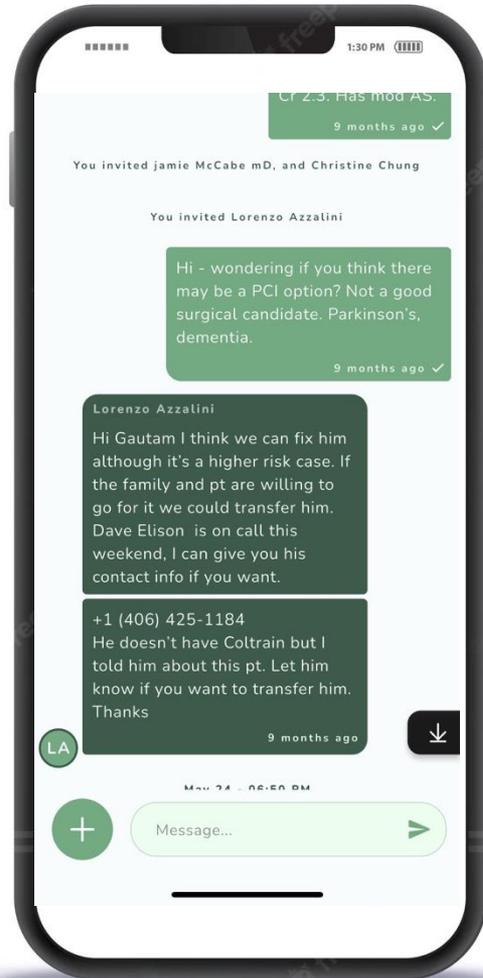
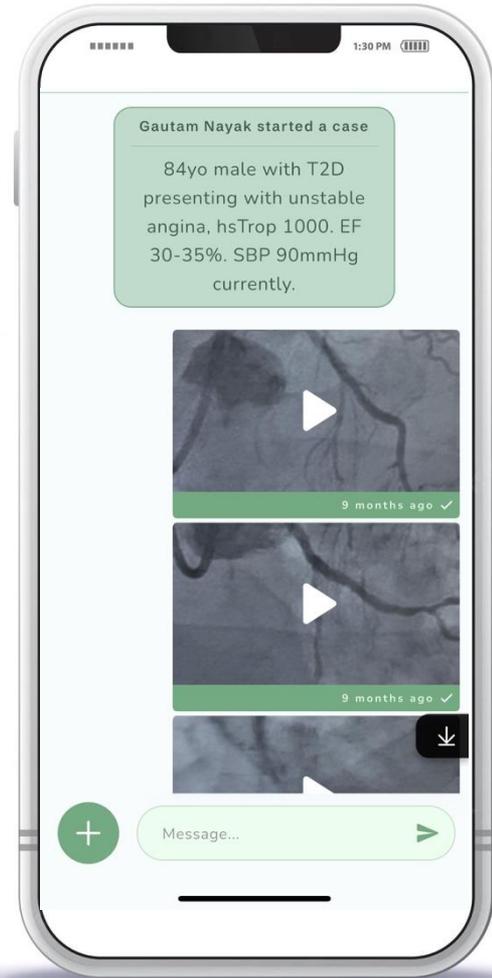
## Standard Workflow



## Coltrain Workflow



# A Patient in Cardiogenic Shock on Friday, Memorial Day Weekend, 2024



# The Washington Cardiogenic Shock Network

Shock Team → Shock Networks

Washington (into Oregon)

Washington State (All Regions)

**Level 1**  
Hubs



**Seattle-Tacoma**  
**Spokane • Portland**

**Level 2**  
Spokes



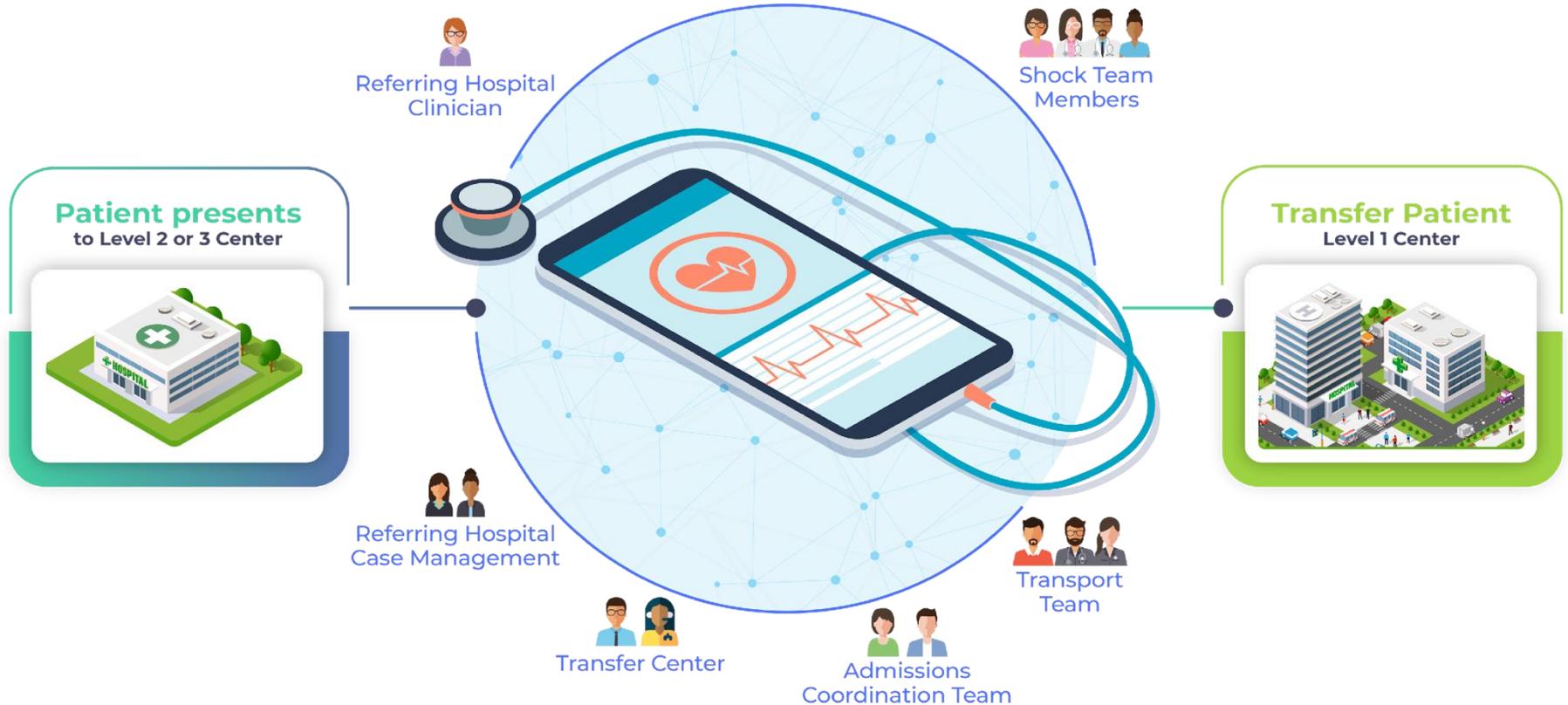
**Bellingham • Everett**  
**Olympia • Tri Cities**  
**Vancouver • Yakima**  
**Walla Walla • Wenatchee**

**Level 3**  
Spokes



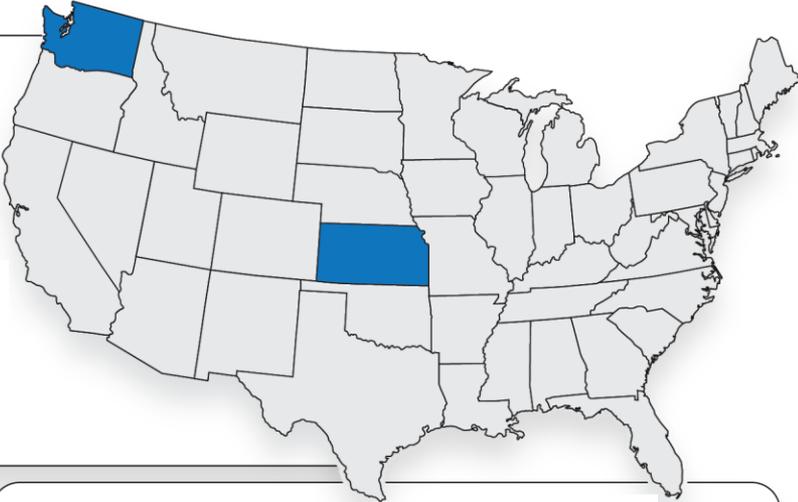
**Central • East • North**  
**North Central**  
**Northwest**  
**South Central**  
**Southwest • West**

# One-Touch Centralized System of Care



# Coltrain Metrics

Through December 2025



**1685**

Clinicians

**45%** **54%**

Washington Kansas

- Coltrain is free for clinicians
- Growth has been through word of mouth and professional societies

↑ **5%**

Monthly Growth Rate

**53%**

Physicians

**35%**

Advanced Practive Providers

**270**

Weekly Active Users

**5000+**

Clinical Cases

**5**

Average Number of Clinicians per Case

# Coltrain Transfer Workflow vs Standard Transfer Workflow

## Standard Patient Transfer Workflow



## Coltrain Transfer Workflow

