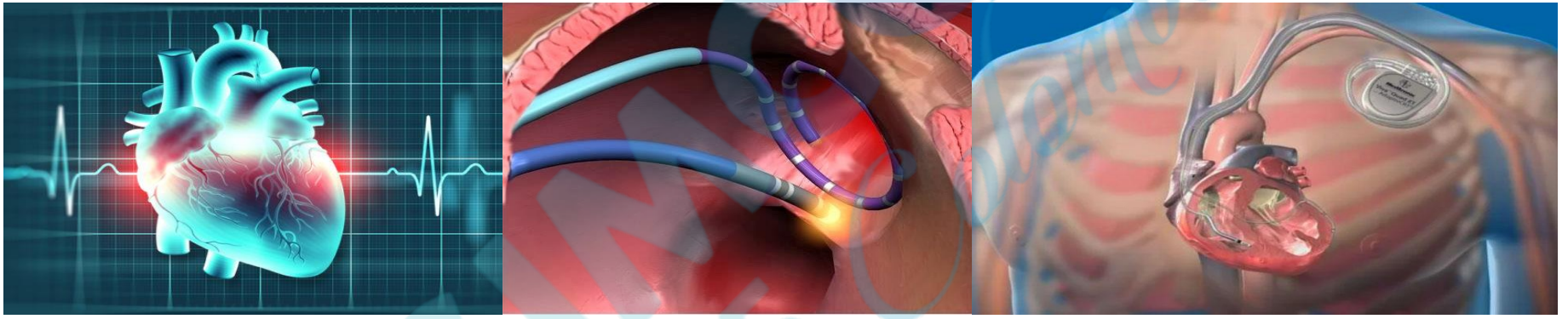
# ECG MASTERCLASS:
# TACKLING THE TOUGHEST TRACINGS
## SIMCON,2025



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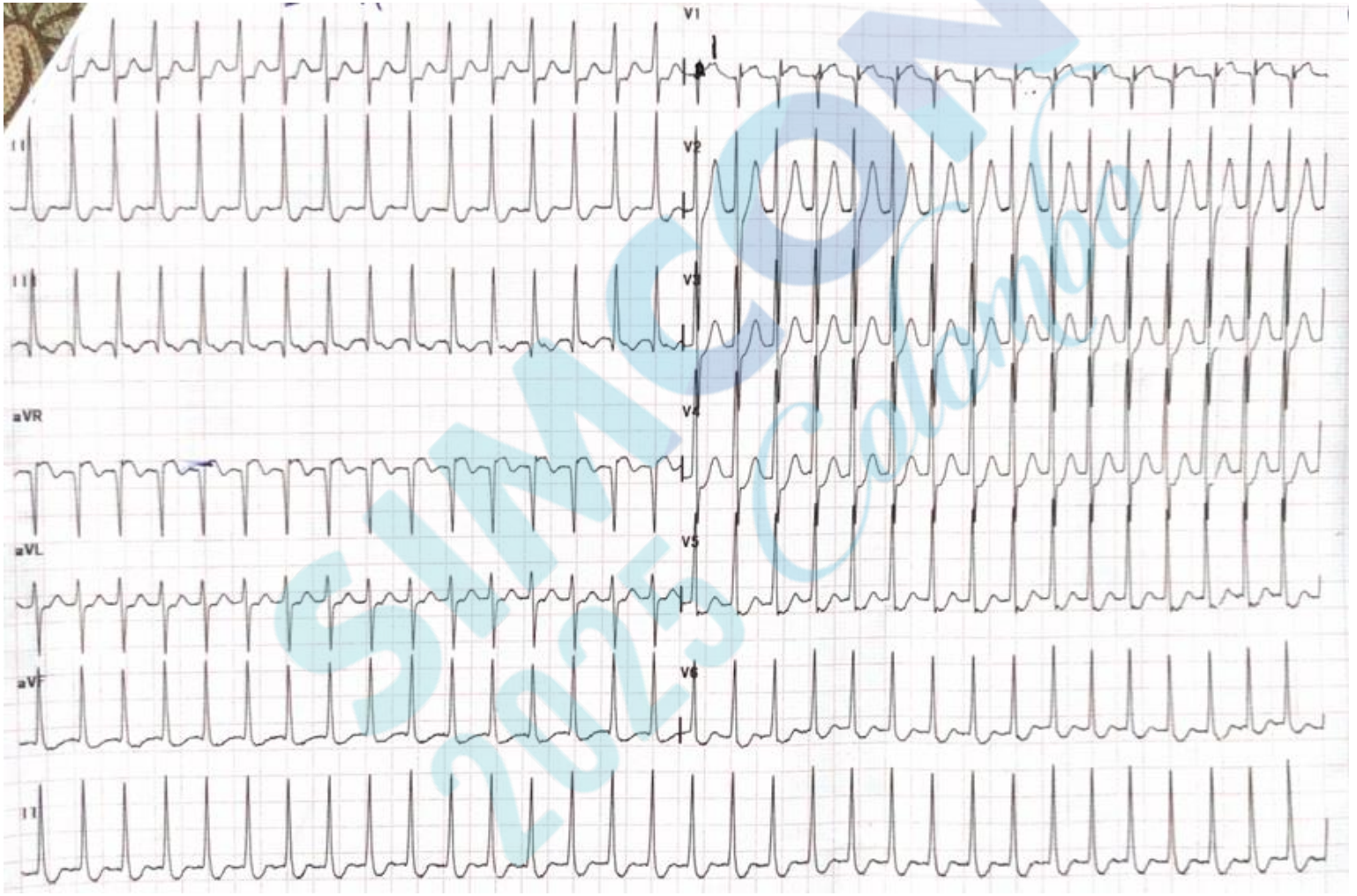
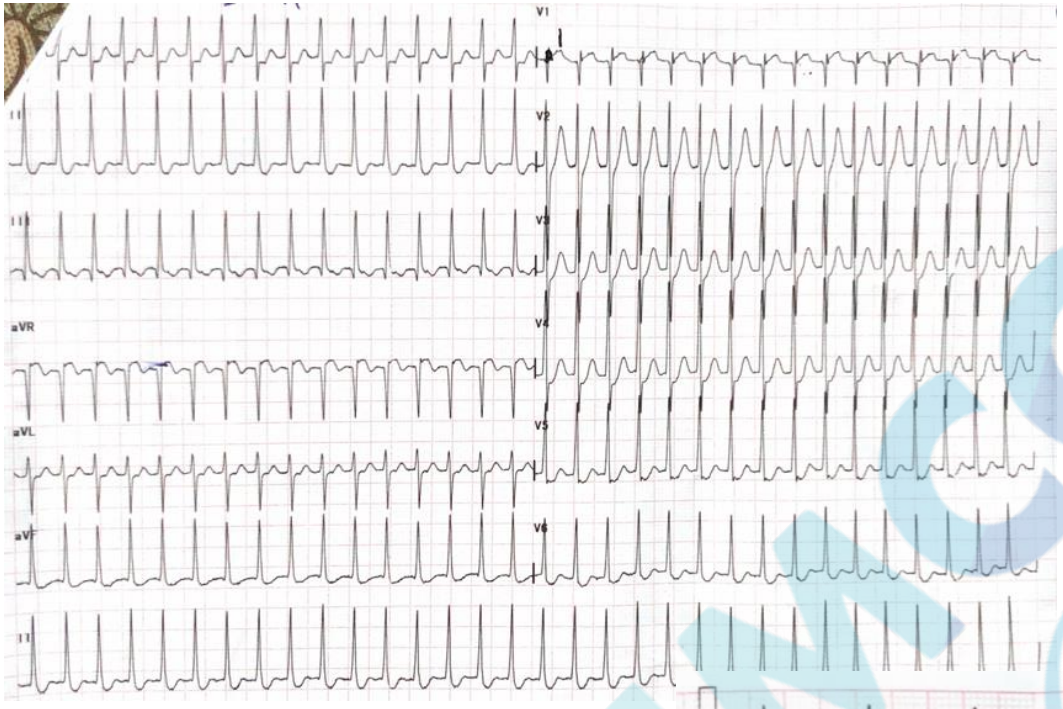
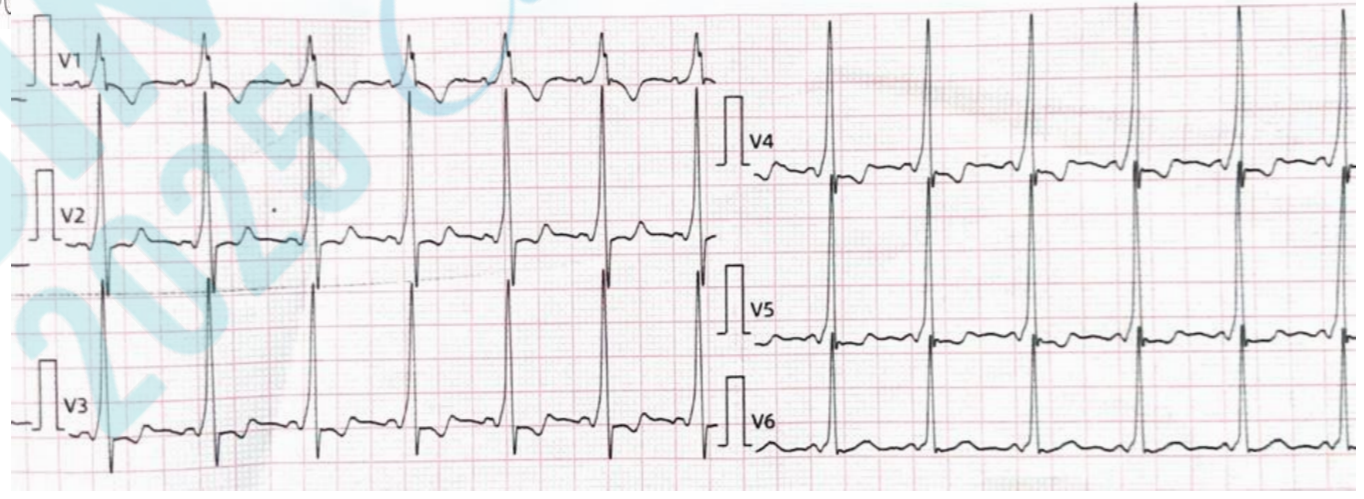
National Hospital- Galle

1. A 25yr-old female with sudden onset palpitations and chest tightness.

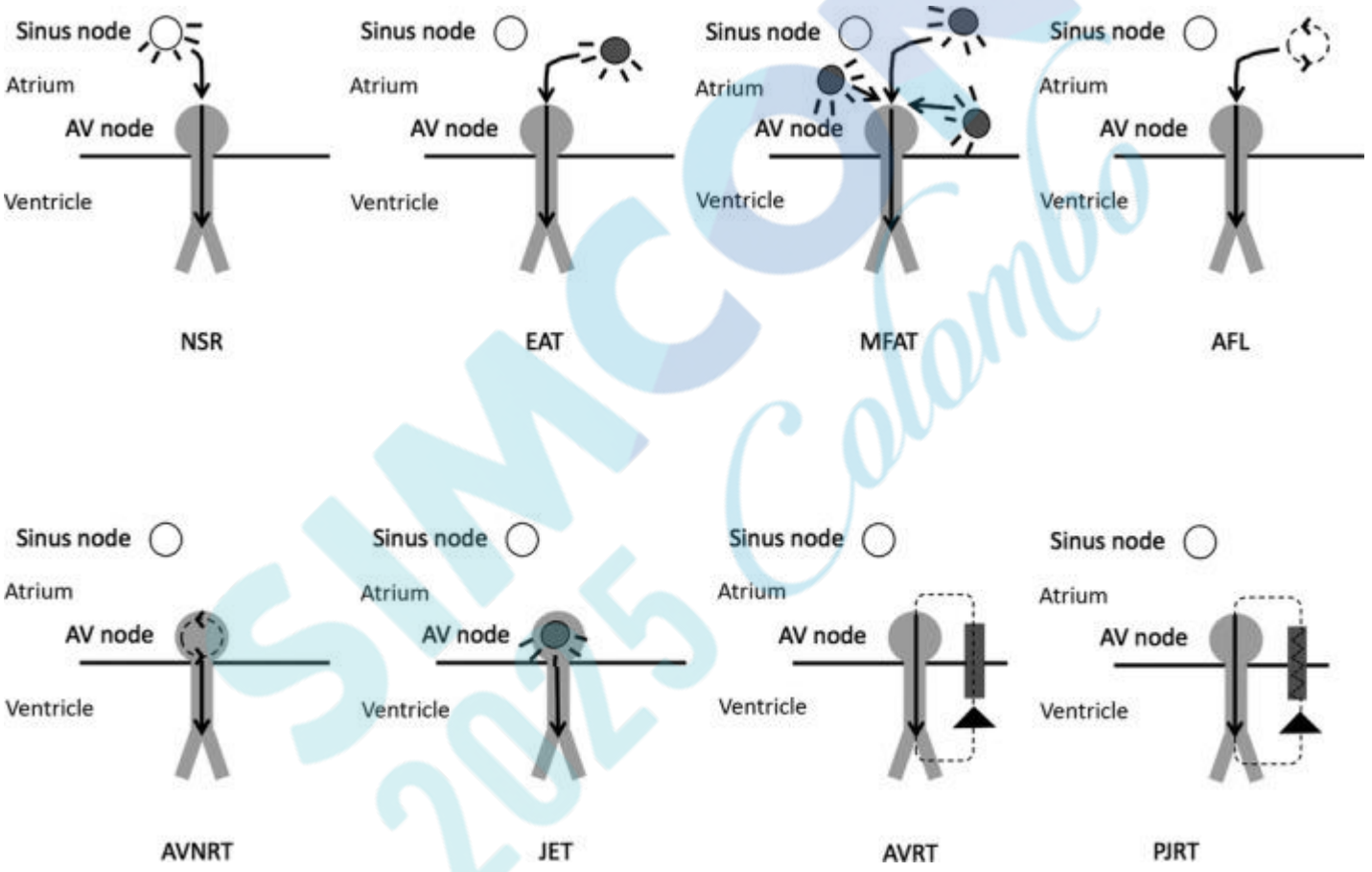





- NC regular tachycardia,HR 260bpm
- Retro grade P
- Short RP tachycardia (RP>70ms)
- **Orthrodromic AVRT**

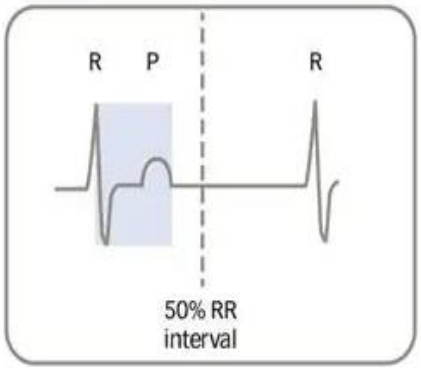


# EP Mechanisms of narrow complex tacycardia

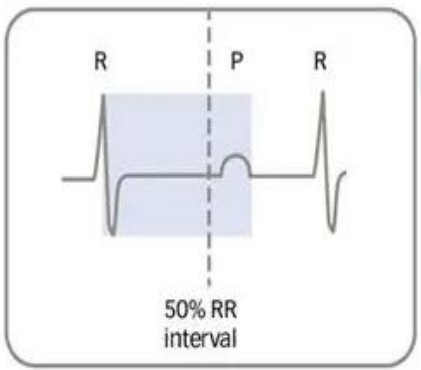


# Differentiation of narrow complex regular tachycardia

Short RP tachycardia

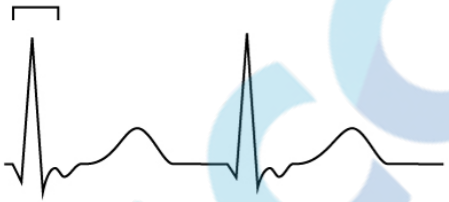



Long RP tachycardia



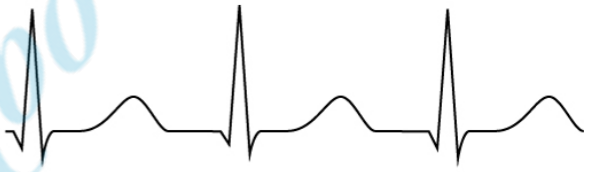

**RP interval** Short and <70 ms

Typical AVNRT. AVRT is unusual.



**RP interval** No visible P-wave

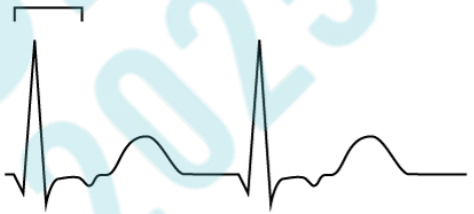
Typical AVNRT



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

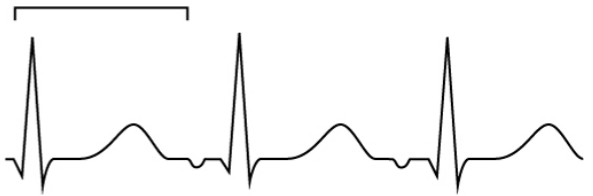
**RP interval** Short but >70 ms

In most cases AVRT. Occasionally atypical AVNRT or AT.

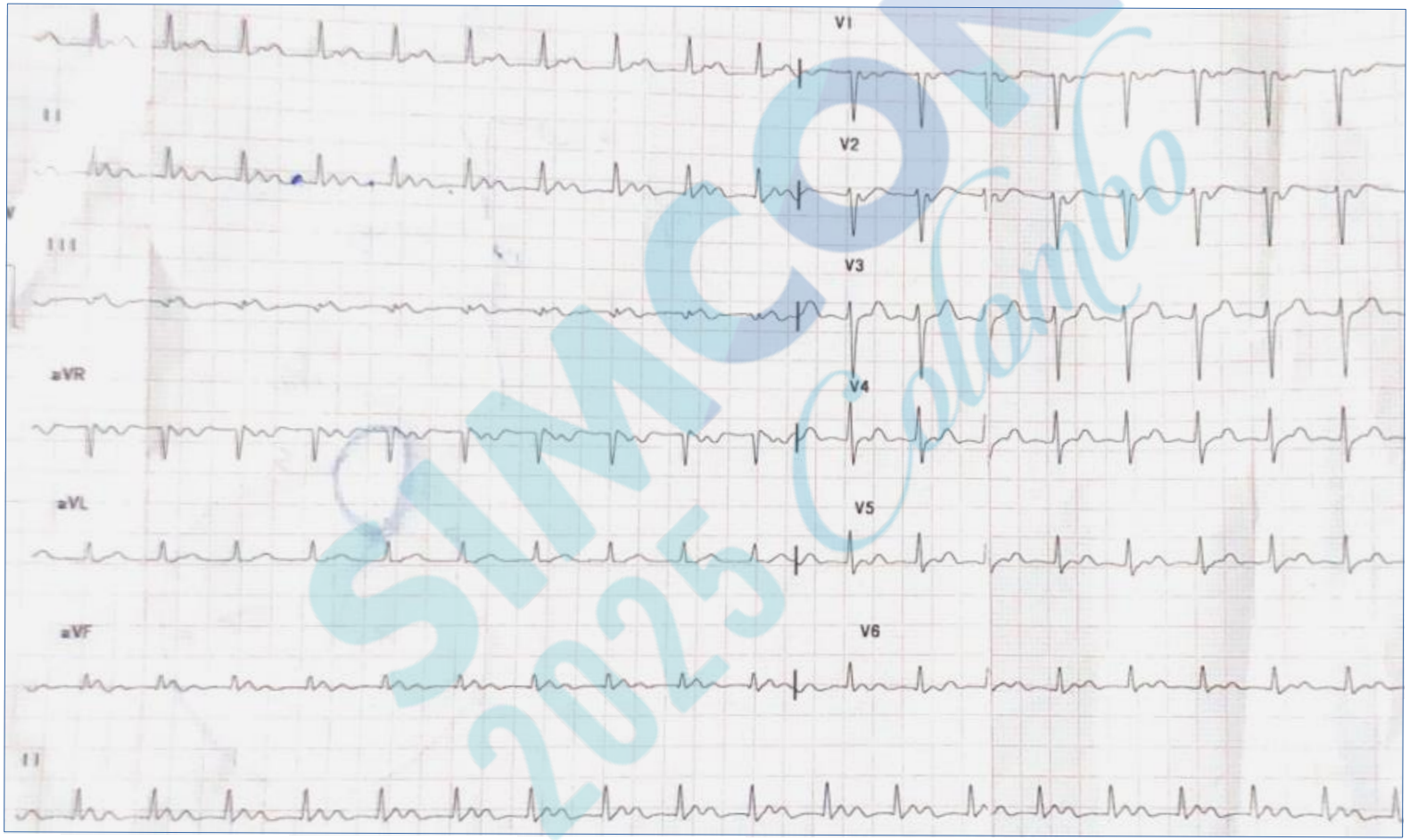


**RP interval** Long

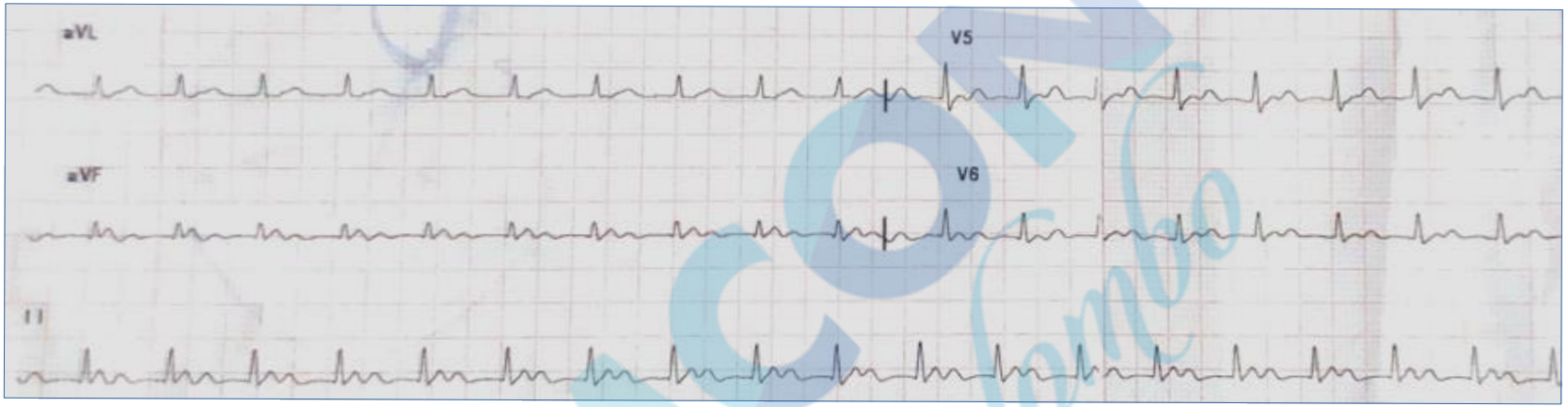
In most cases AT. Occassionally atypical AVNRT. Rarely PJRT.



2. A 65yrs-old male with LRTI was on Derriphyllin,admitted with palpitations.

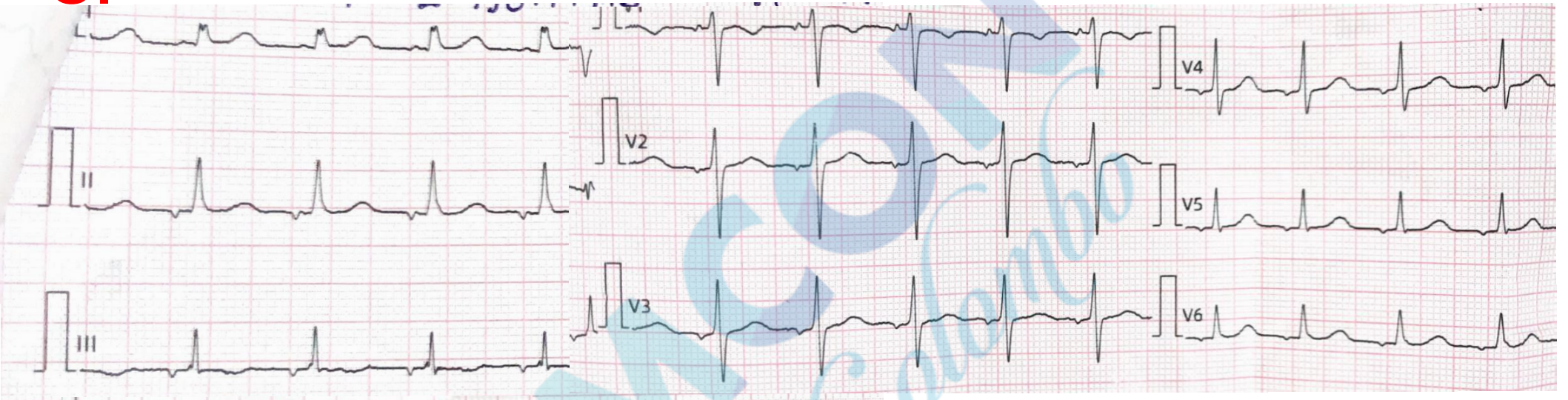


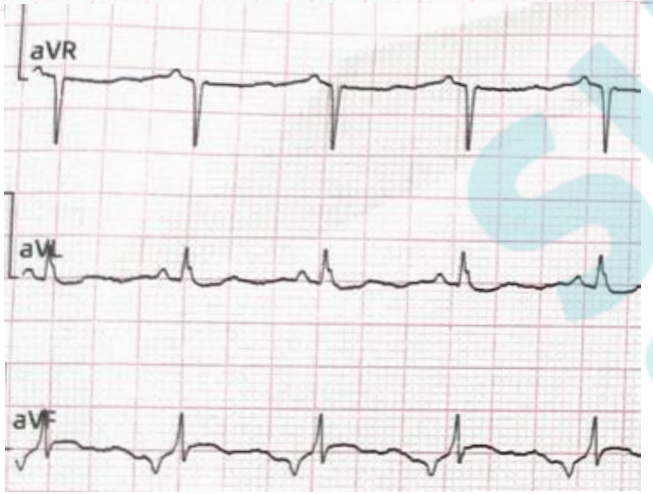
# Sinus tachycardia with a 1st degree HB




- Narrow complex tachycardia with a short R-P intervals,
- P wave is conducted with a prolonged PR interval >300ms.
- P wave morphology -identical to sinus P wave.

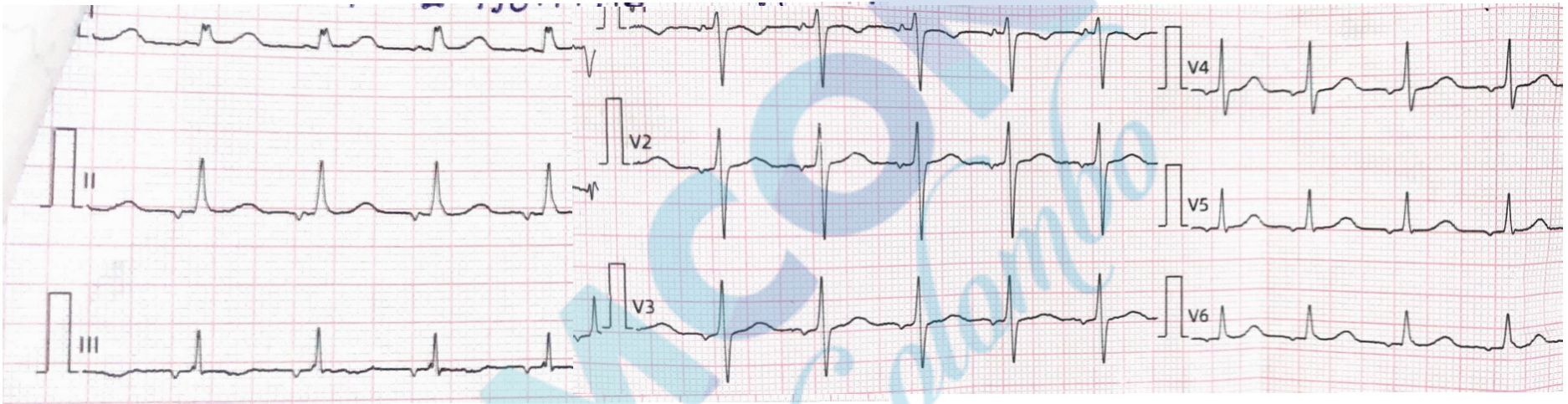
3.



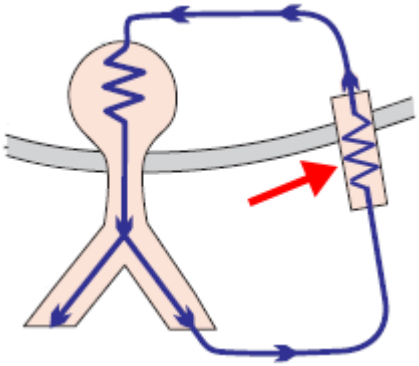

A 20 yr-old boy with a worsening of SOB found to have LVSD,
Found to have tachycardia: responded to Adenosine  incessant tachycardia> resistant to medications

- **Permanent junctional reciprocating tachycardia (PJRT)**

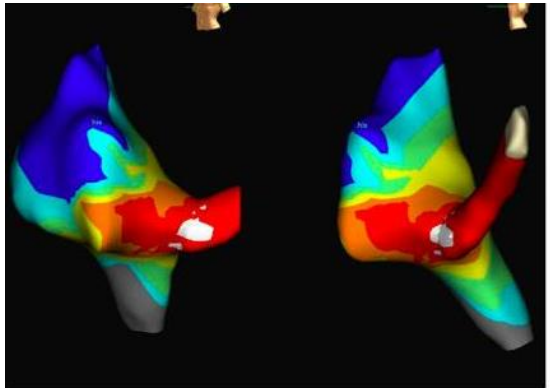



- Narrow complex regular tachycardia HR 110bpm
- long RP with narrow QRS
- reverse-sharp (sharp) P waves in the inferior leads during tachycardia.

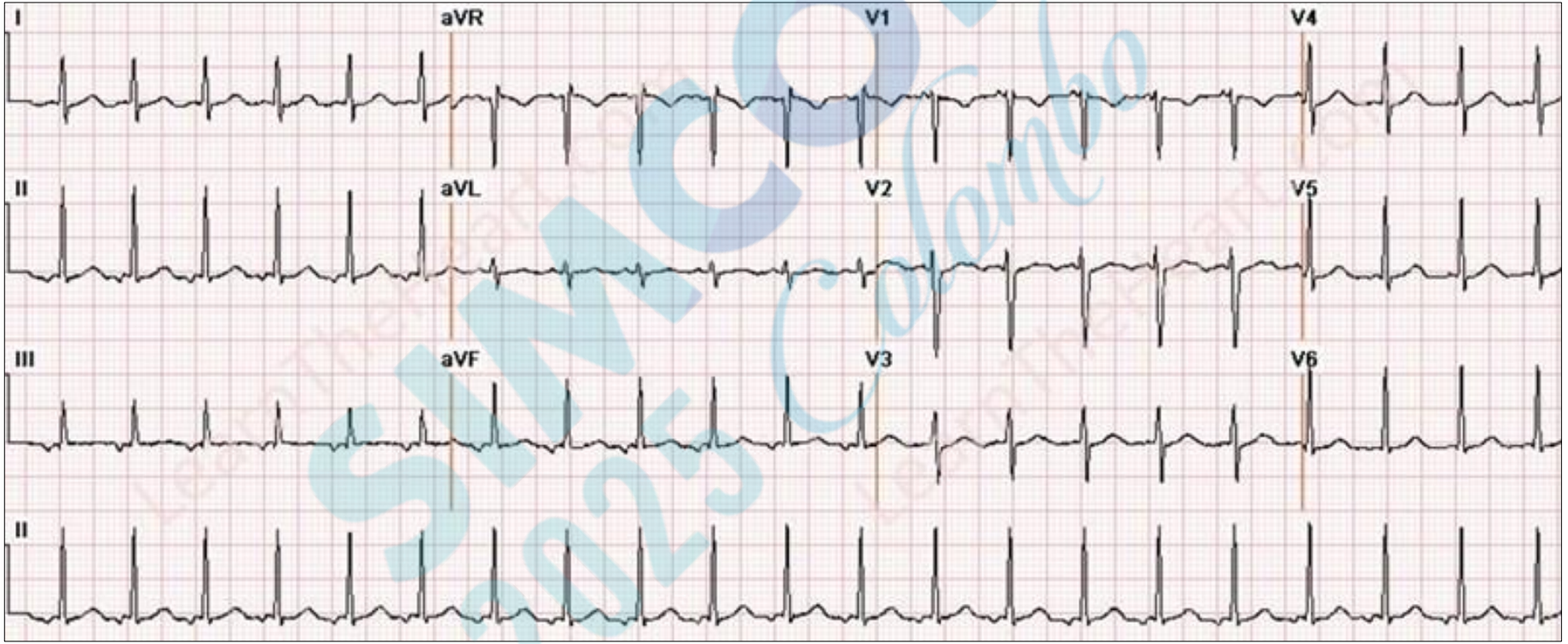
## Permanent junctional reciprocating tachycardia (PJRT)



- Permanent junctional reciprocating tachycardia (PJRT) is a subtype of AVRT
- response to Adenosine and persistence or frequent recurrences
- predominantly in infants and children
- Can leads to tachycardia induced cardiomyopathy- if undetected during early ages-(adult presentation)
- AV node acts -ante grade ,unique concealed AP - the retrograde limb.
- The retrograde conduction in the AP is characteristically slow and decremental
- Similar conduction characteristics to the AV node -creates a stable re-entrant circuit
- HR in PJRT can range from 200 to 300 in infancy and later on decreases - 120 in

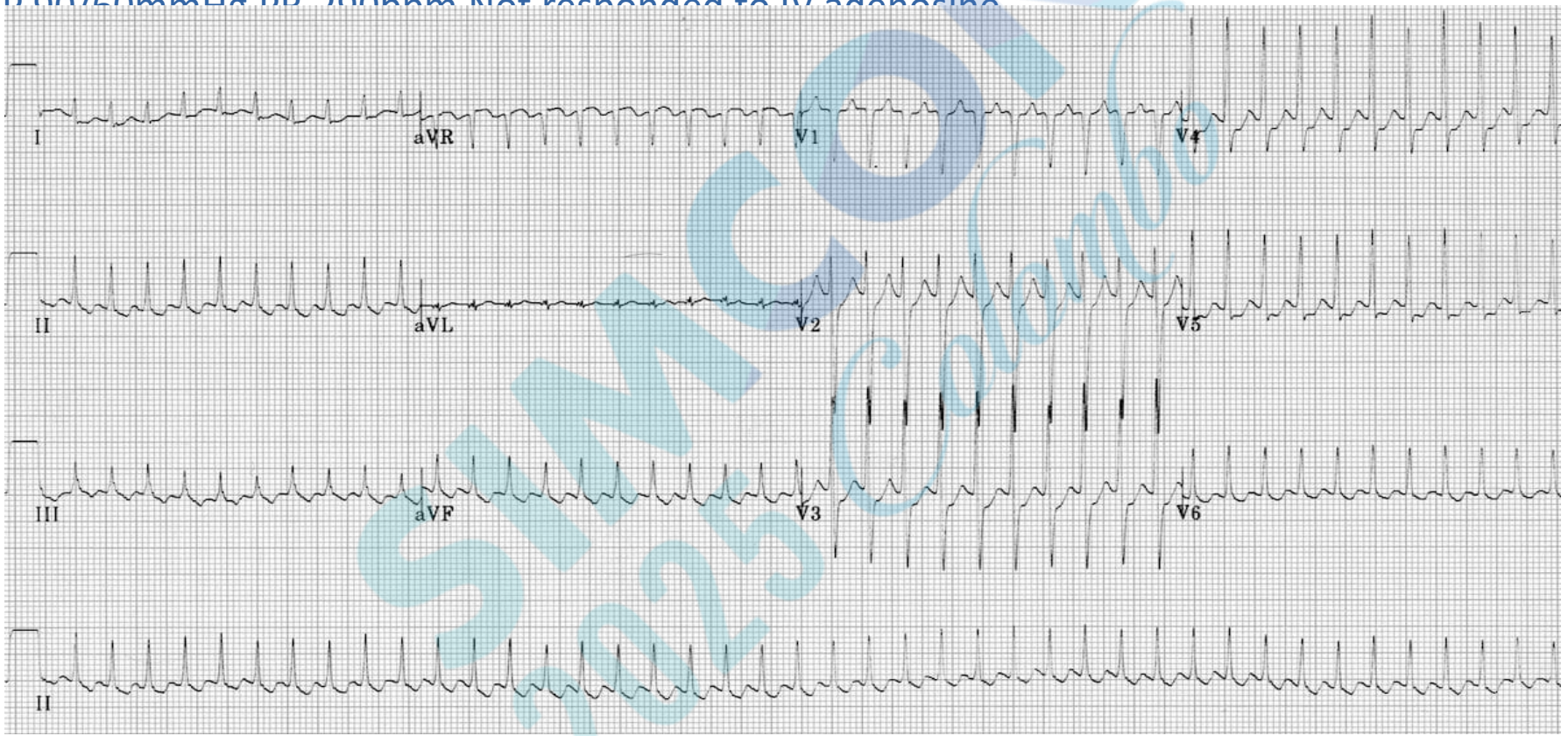


Can mimic AT >Long RP tachycardia

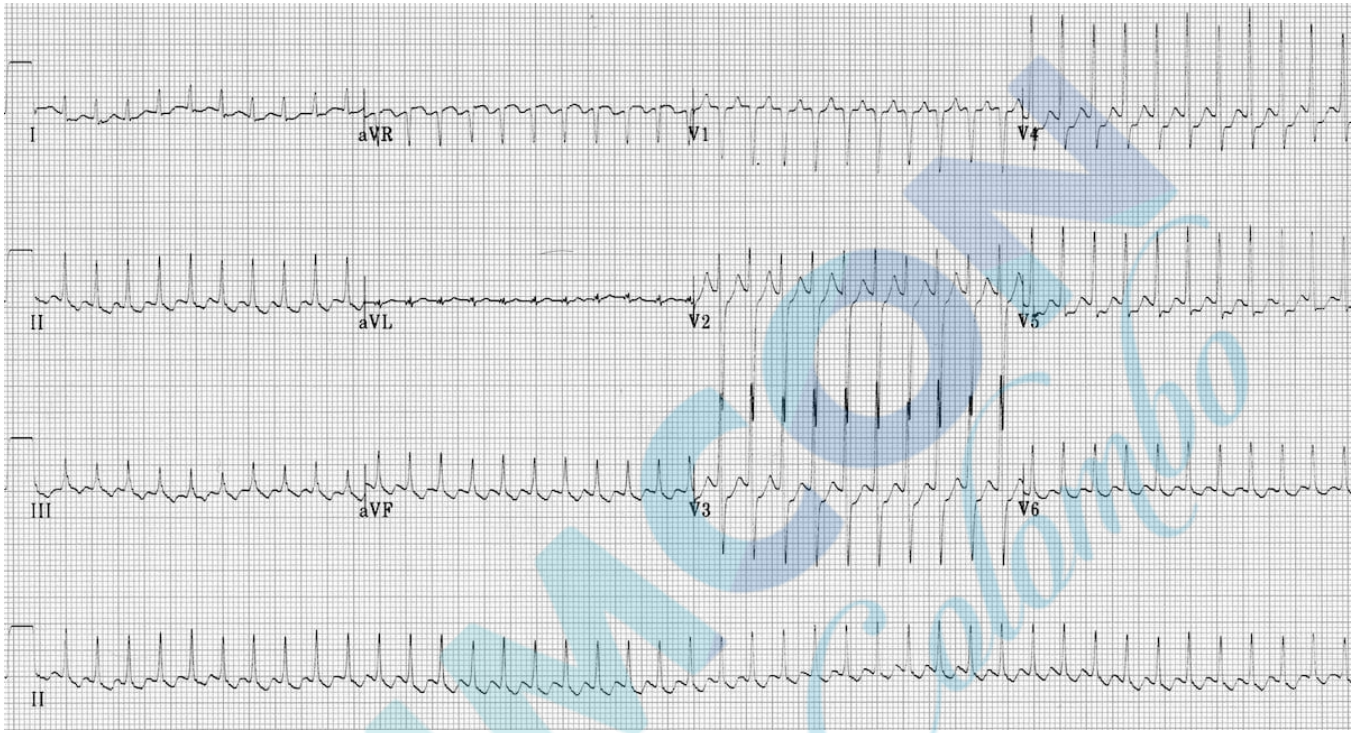


4. A 15y old boy with a history of ASD S/C,admitted with a sudden onset palpitations & dizziness,

BP 90/60mmHg RR 200bpm Not responded to IV adenosine




What's the most probable ECG diagnosis ?



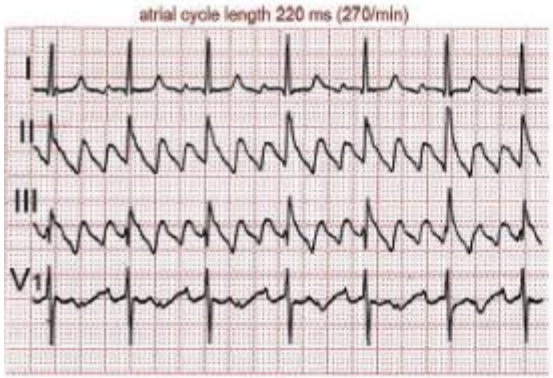

**Atrial flutter with 1:1 conduction**

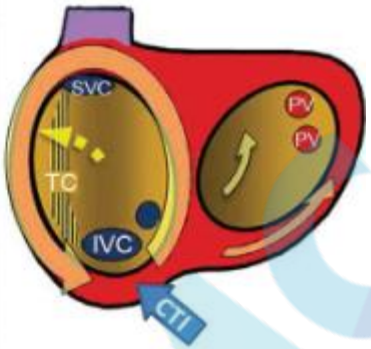
- Narrow complex tachycardia
- Regular atrial activity at ~300 bpm
- Loss of the isoelectric baseline
- “Saw-tooth” pattern of inverted flutter waves in leads II, III, aVF

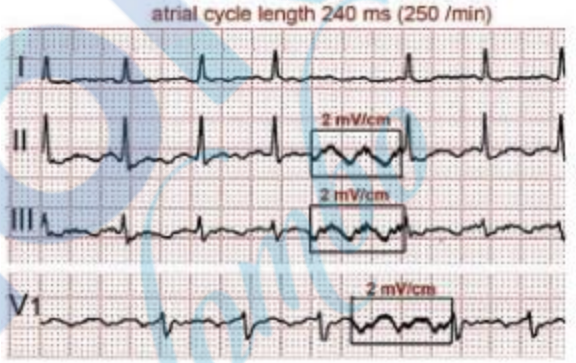
# Atrial flutter with 1:1 conduction

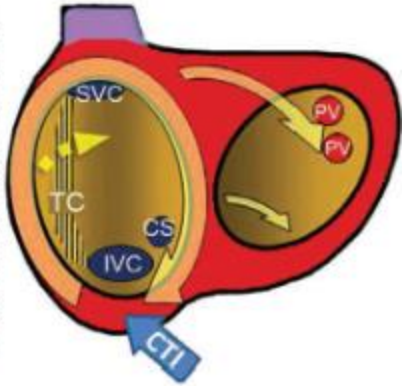
- Atrial flutter with 1:1 conduction is a rare arrhythmia
- characterized by rapid atrial rates and direct conduction to the ventricles approximately 300bpm.
    - **Mechanisms promoting 1:1 conduction:**
    - High sympathetic tone
    - (pediatric and adolescents,stress, exercise, sepsis, hyperthyroidism)
    - Enhanced AV nodal conduction
    - Rarely due to accessory pathways

# Typical A flutter




***Anticlockwise Reentry:*** Commonest form of atrial flutter (90% of cases). Retrograde atrial conduction produces:

- Inverted flutter waves in leads II,III, aVF
- Positive flutter waves in V1 — may resemble upright P waves

***Clockwise Reentry:*** This uncommon variant produces the *opposite* pattern:

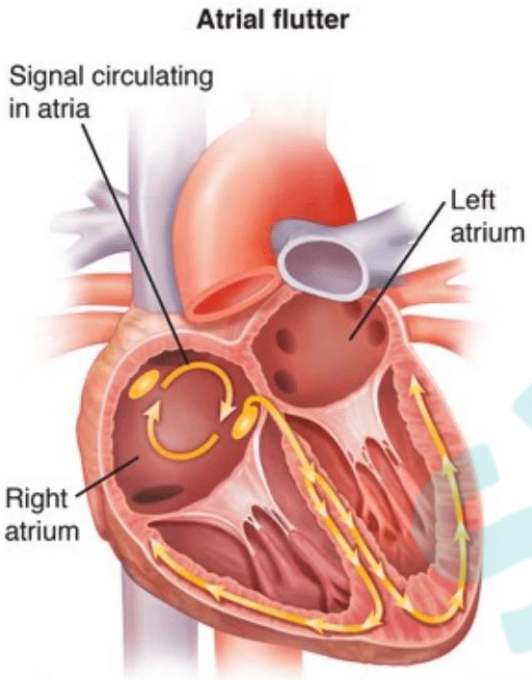
- Positive flutter waves in leads II, III, aVF
- Broad, inverted flutter waves in V1

**Fixed AV conduction ratio ("AV block")**

Ventricular rate is a fraction of the atrial rate, for example:

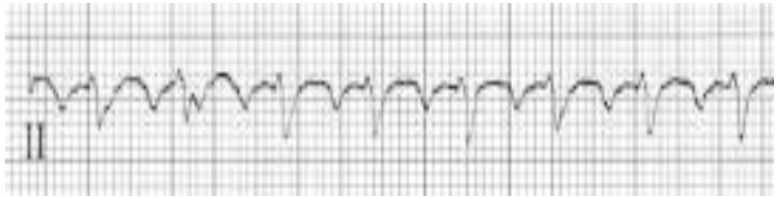
- 2:1 block = 150 bpm
- 3:1 block = 100 bpm
- 4:1 block = 75 bpm

# Electrophysiological mechanism

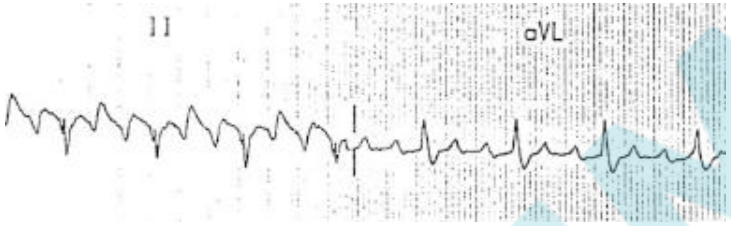



- 1:1 block = 300 bpm
- 2:1 block = 150 bpm
- 3:1 block = 100 bpm
- 4:1 block = 75 bpm
- Variable conduction
- Flutter with complete AV block

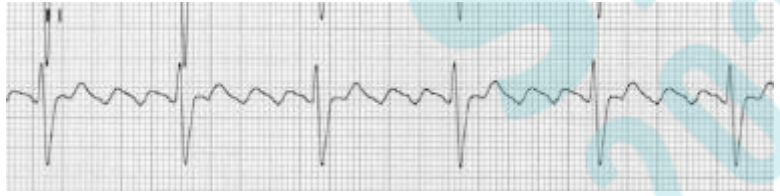
# Spectrum of ECGs with A flutter with different types of AV conduction



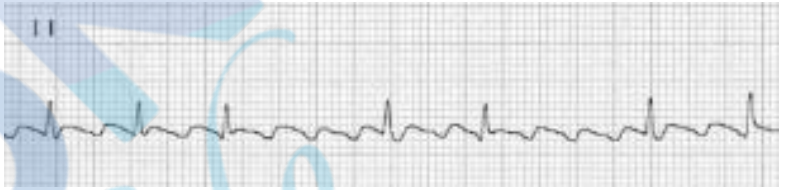

- Flutter with 2:1 block



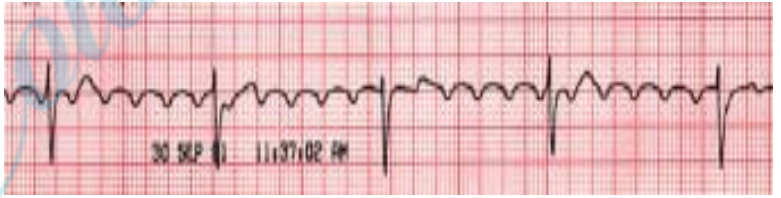

- Flutter with 3:1 block



- Flutter with 4:1 block

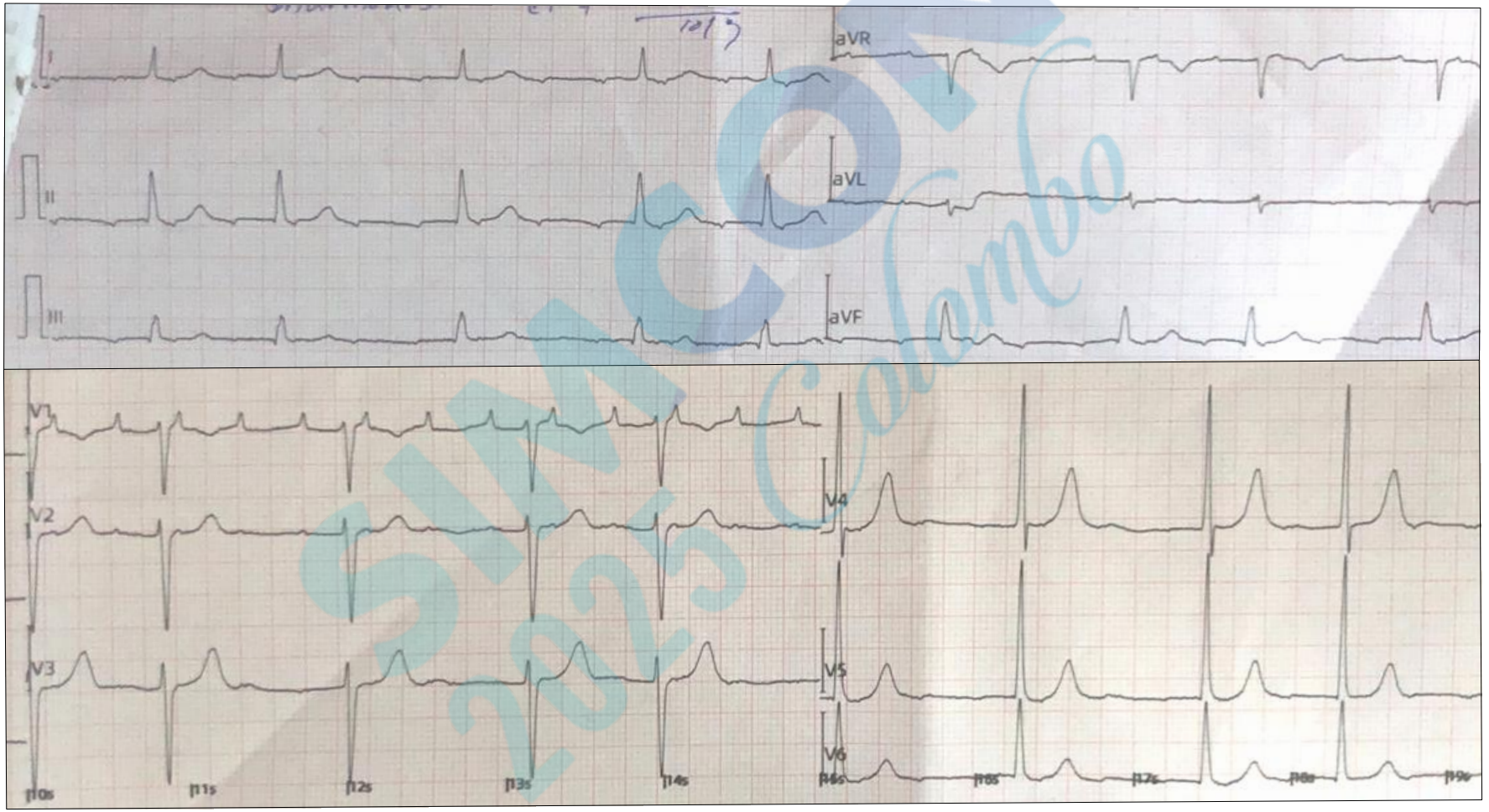


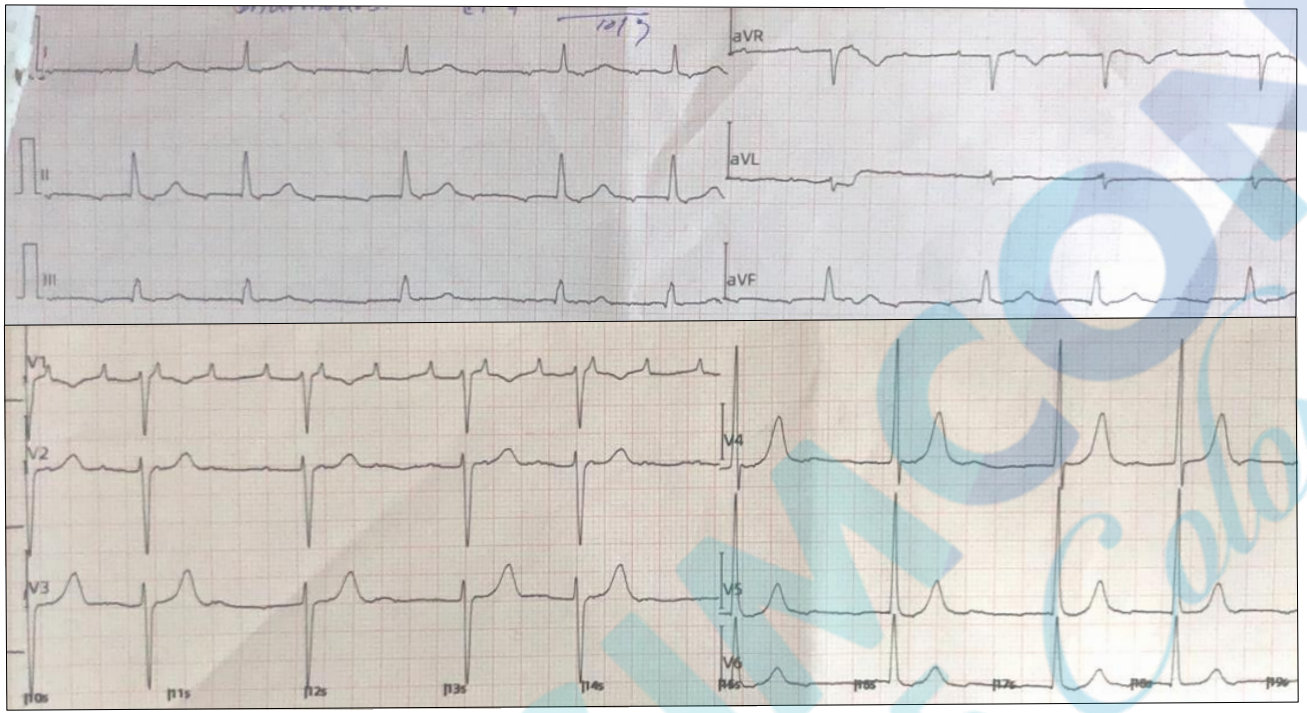

- flutter with Variable conduction



- Flutter with complete AV block

5. A 58 yr-old man presented with intermittent presyncope,PMHx-ASD S/C 30yrs before

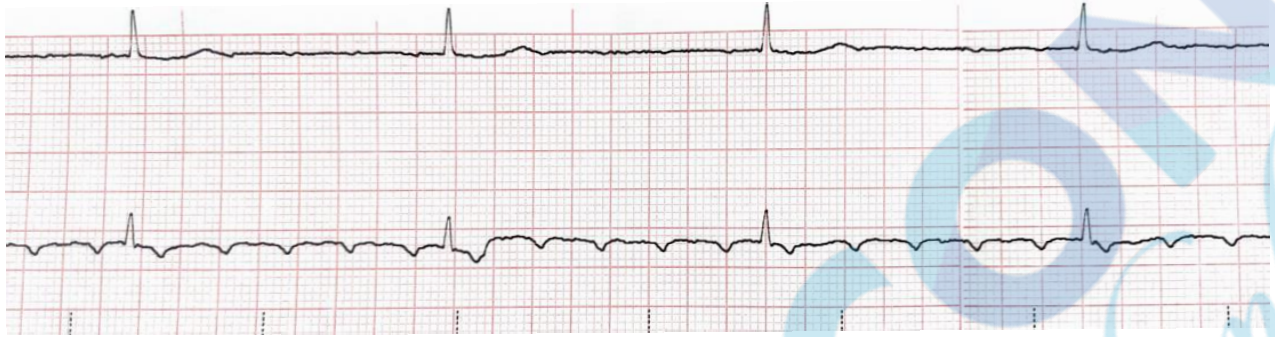


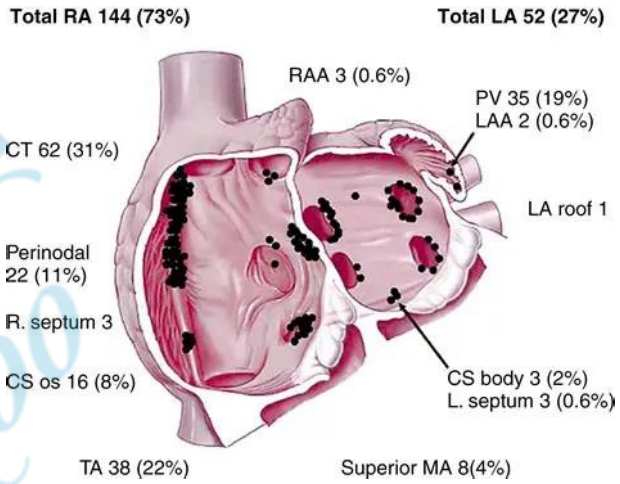



**AT with slow variable AV conduction**

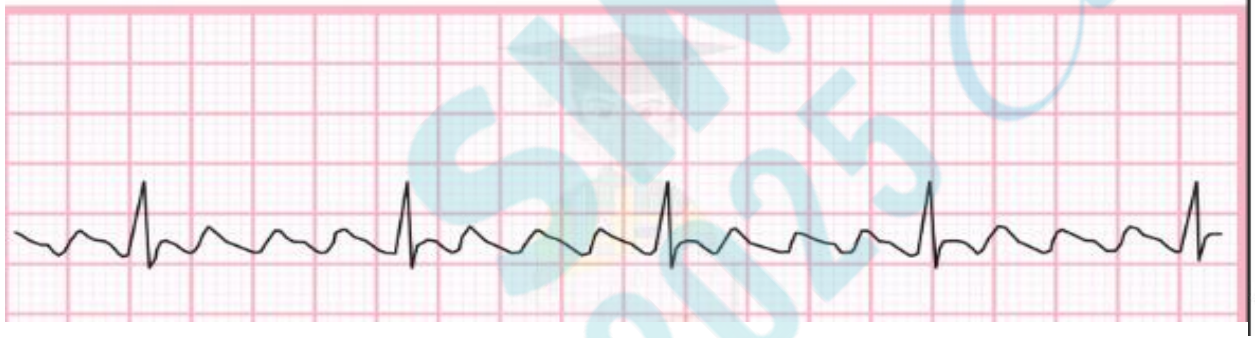
- Narrow QRS with some irregularity.
- P waves more than QRS complexes.
- P-P interval 380ms(160bpm)

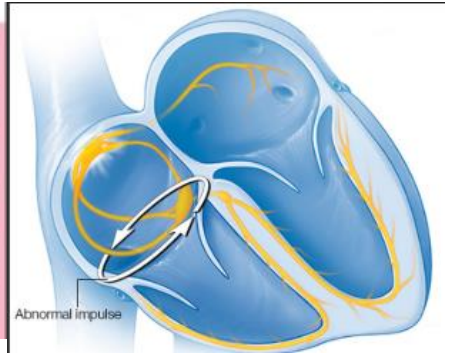
## Atrial Tachycardia P-P interval (350ms)





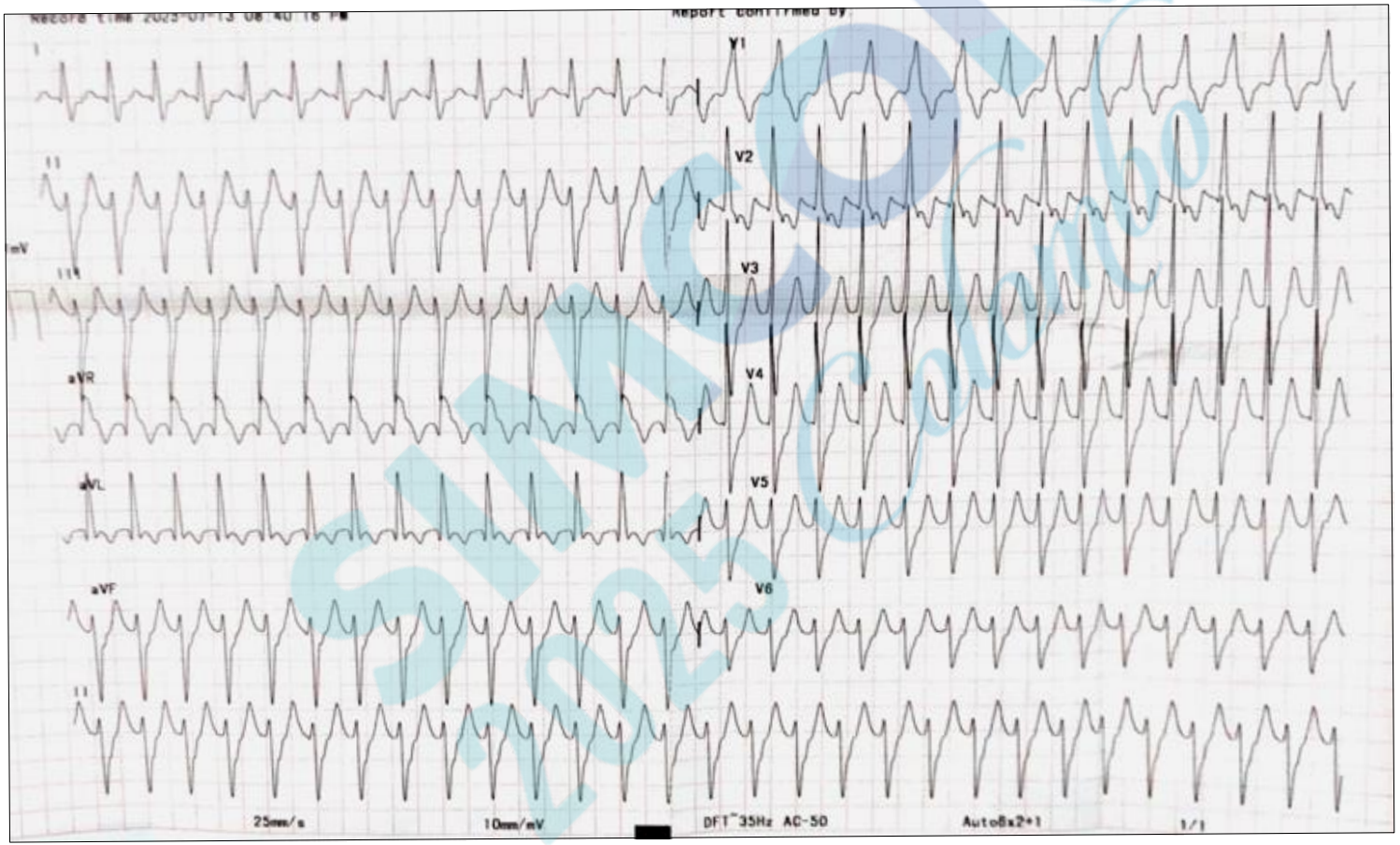

## A flutter P-P intervals (200ms)



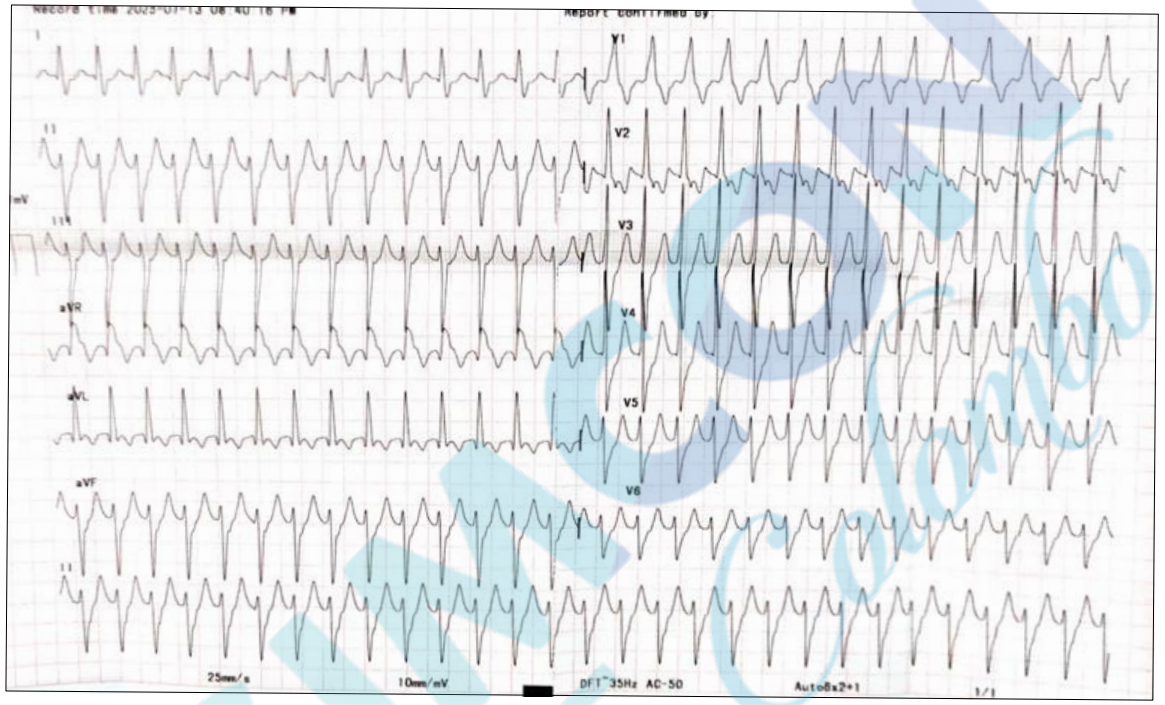



Important in clinical decision making regarding anti-coagulation

# 6. A 32yr-old male had sudden onset palpitation and dizziness



# Idiopathic Fascicular VT:



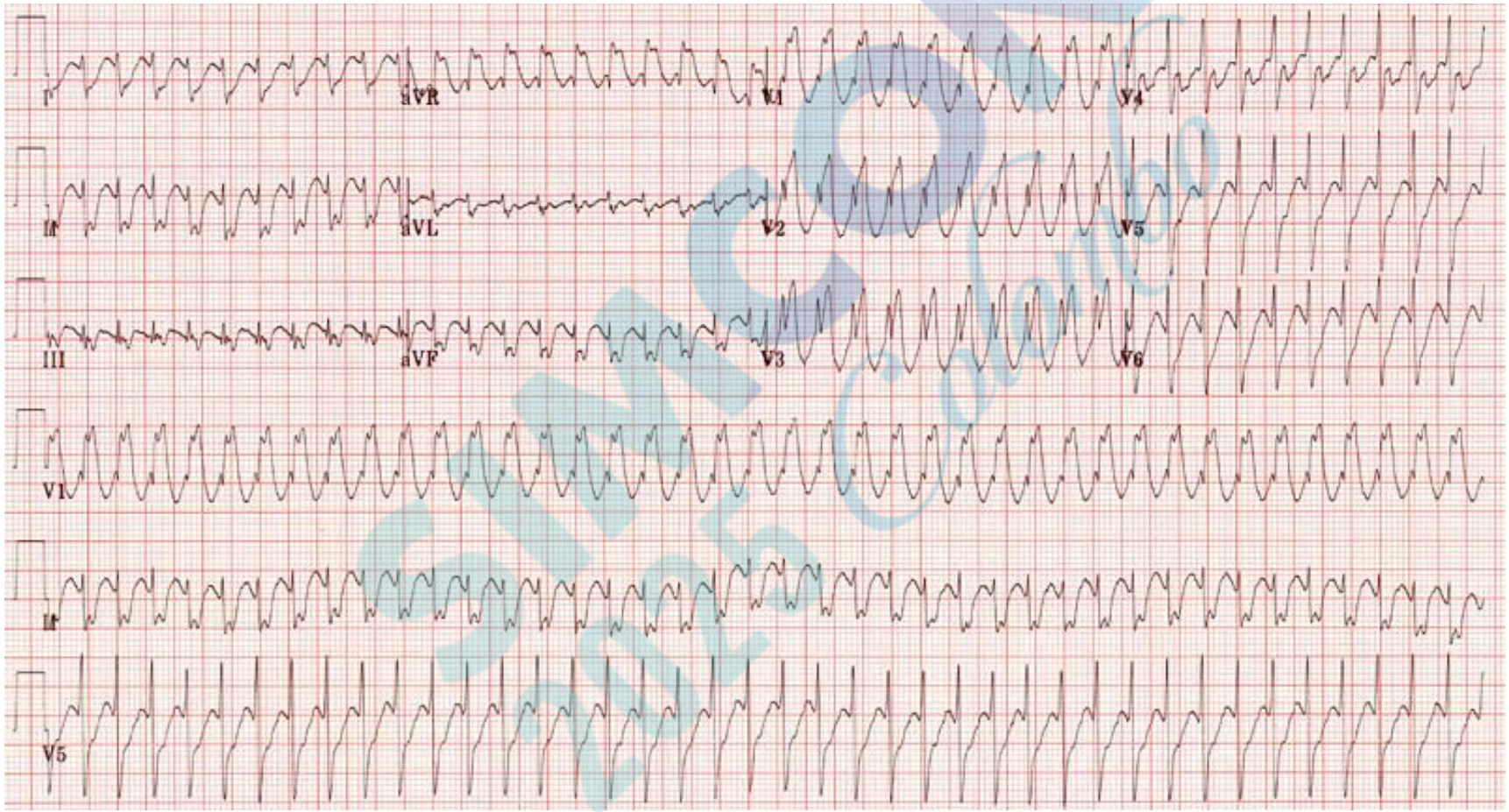

- Broad-complex complex tachycardia with modest increase in QRS width (~120 ms)
- Negative L 2,3,aVF
- RBBB morphology (RSR’ in V1)

Left axis deviation (-90 degrees)( left posterior fascicular tachycardia )

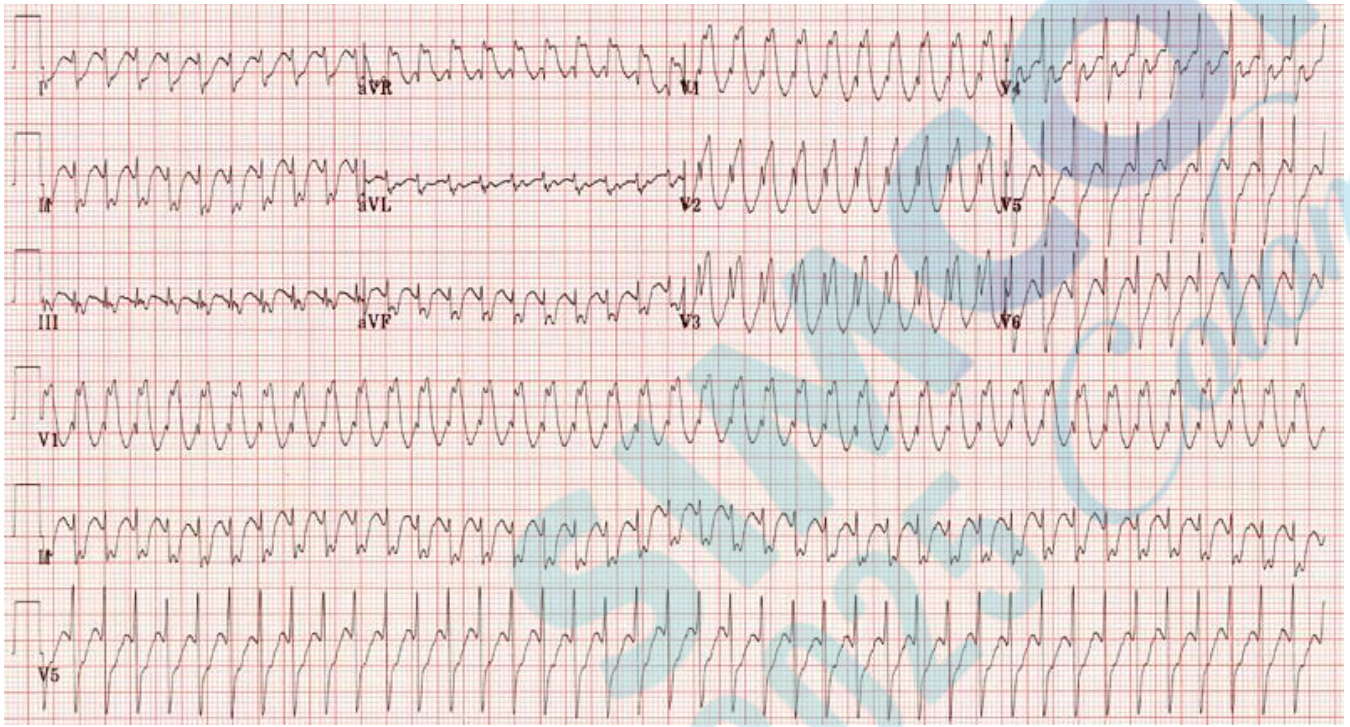
# Idiopathic Fascicular VT/ Idiopathic Left Ventricular Tachycardia (ILVT)

- Fascicular tachycardia is usually seen in individuals without structural heart disease
- re-entrant tachycardia
- Commonly seen in 15-40 years of age; 60-80% male
- left **posterior** fascicular tachycardia>RBBB+LAD **(common)**
- left **anterior** fascicular tachycardia>RBBB+RAD
- QRS duration 100 – 140 ms — this is narrower than other forms of VT
- Short RS interval of 60-80 ms — the RS interval is usually > 100 ms in other types o
- Response to verapamil is an important feature of fascicular tachycardia
- Need RF ablation as first line treatment

# 7. A 52yr-old female with sudden onset palpitation and chest tightness.



## SVT with RBBB pattern AV conduction



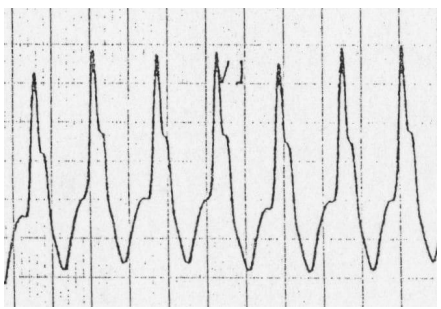

- Broad complex regular tachycardia

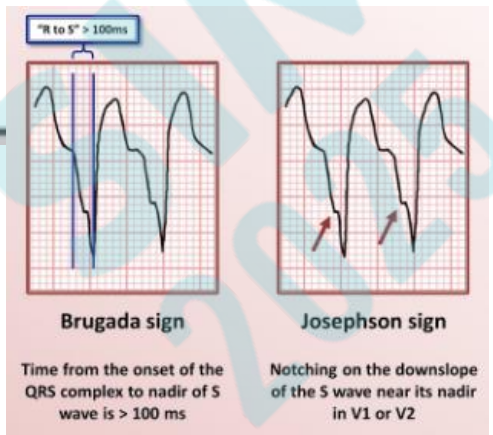
- No signd of VT
- RBBB morphology QRS
- Big right rabit ear

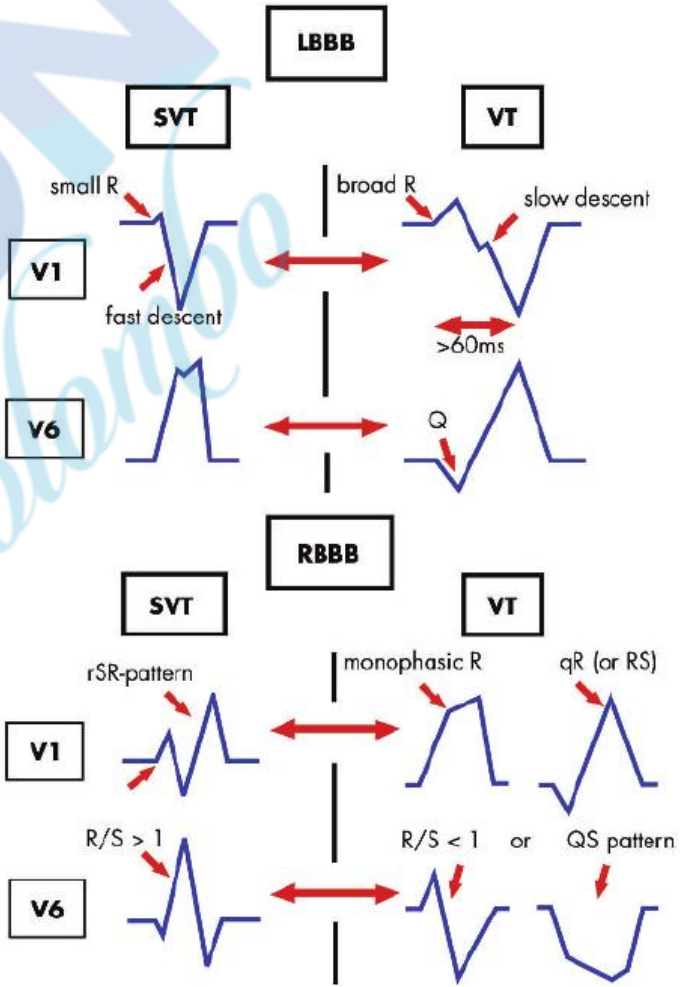
# VT vs SVT with BBB/ rate dependent Aberrancy

## VT is more likely

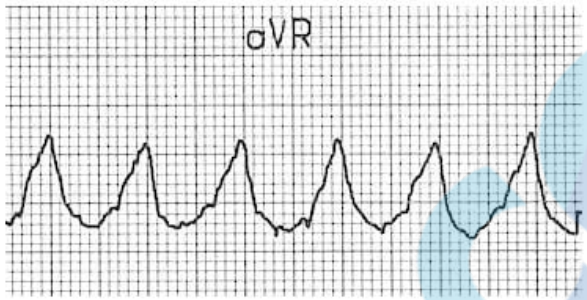
- AV dissociation
- Capture beats
- Fusion beats
- Concordance in precordial leads
- QRS duration > 160ms
- Extreme QRS axis (+180° to +270°)
- R > R' in V1 (big left "rabbit ear")
- Brugada sign
- Josephson sign



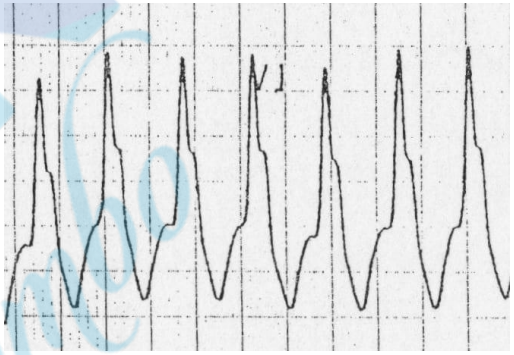


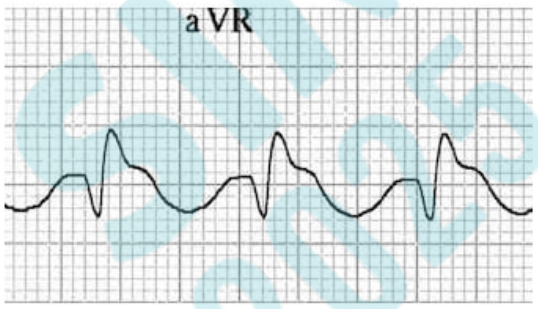
- **Dominant *initial* R wave in aVR**
  - Indicative of **VT**



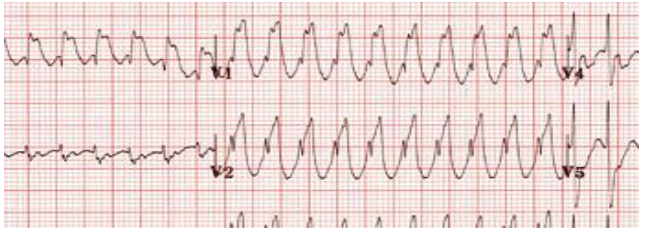

Big left rabbit ear>VT



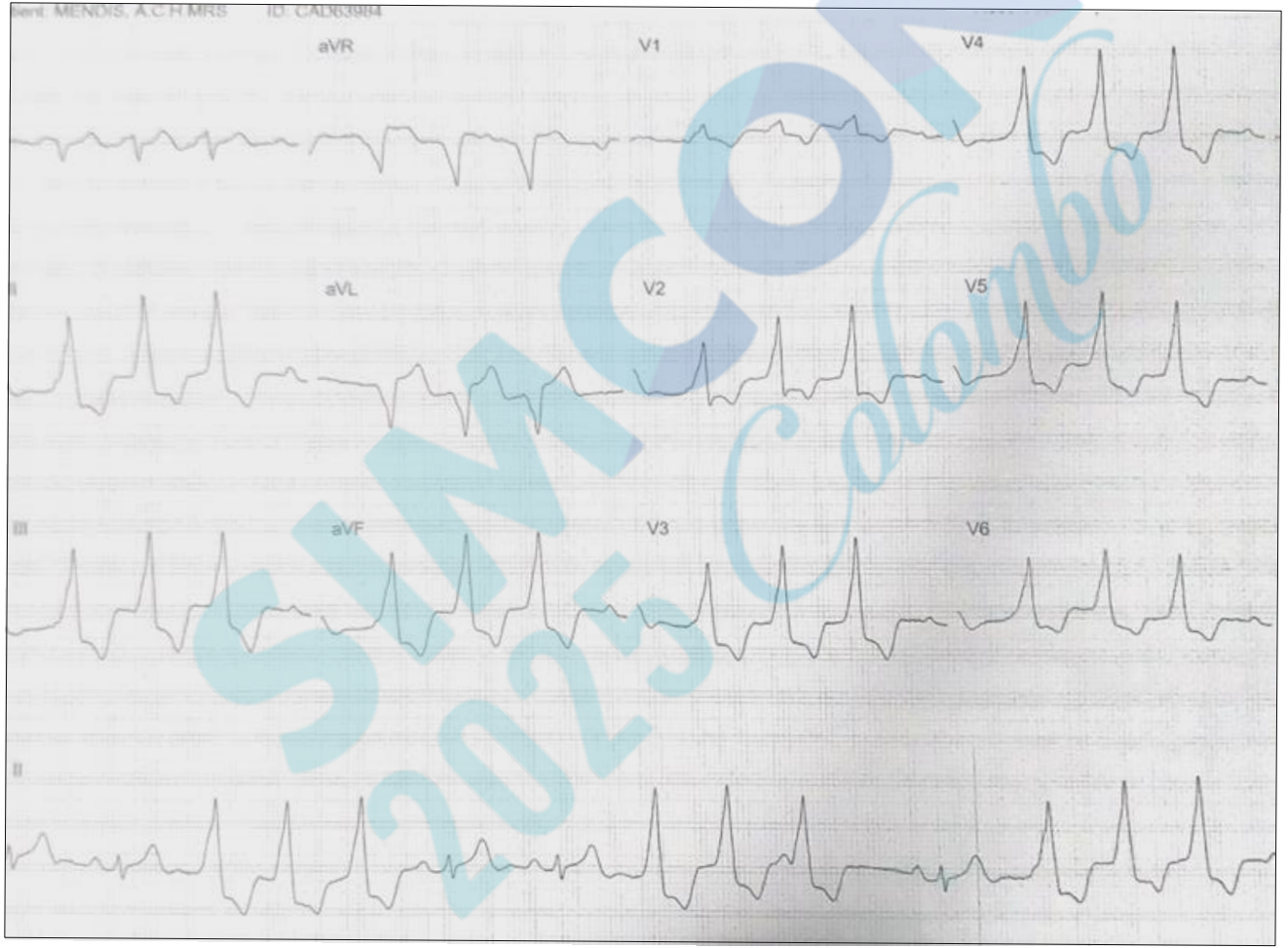

- **Dominant *terminal* R′ wave in aVR** (i.e. following a Q/S wave)
  - More likely **SVT with aberrancy**
  - Pattern is most commonly seen in TCA toxicity



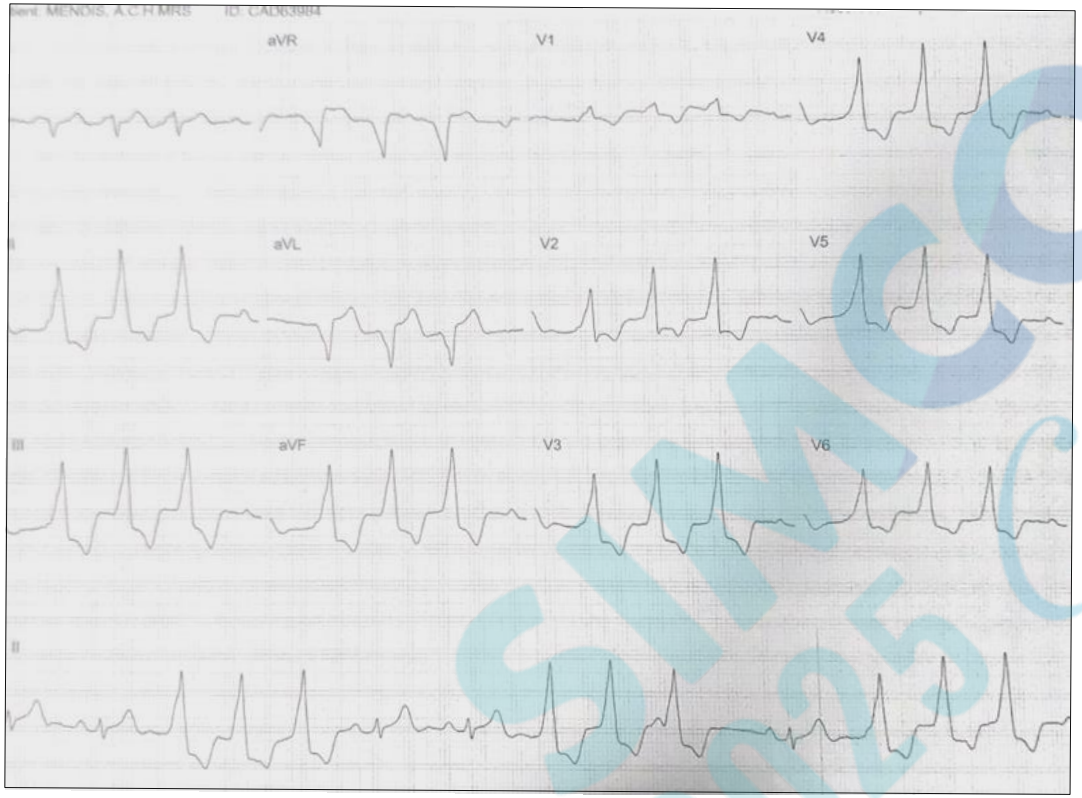

Big right rabbit ear>SVT+BBB



8. A 42yr-old female presented with intermittent palpitations and atypical chest pain

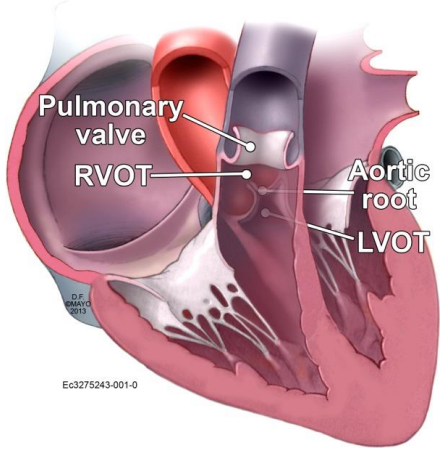


# LVOT VE triplets/NSVT

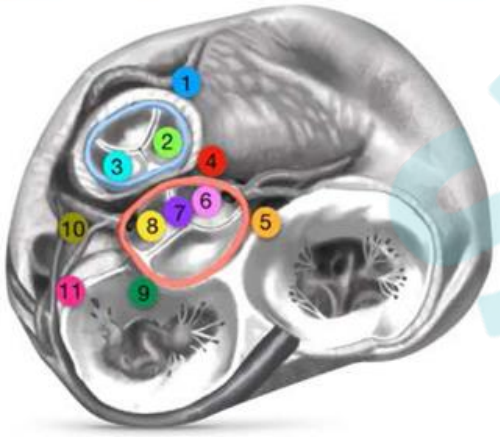


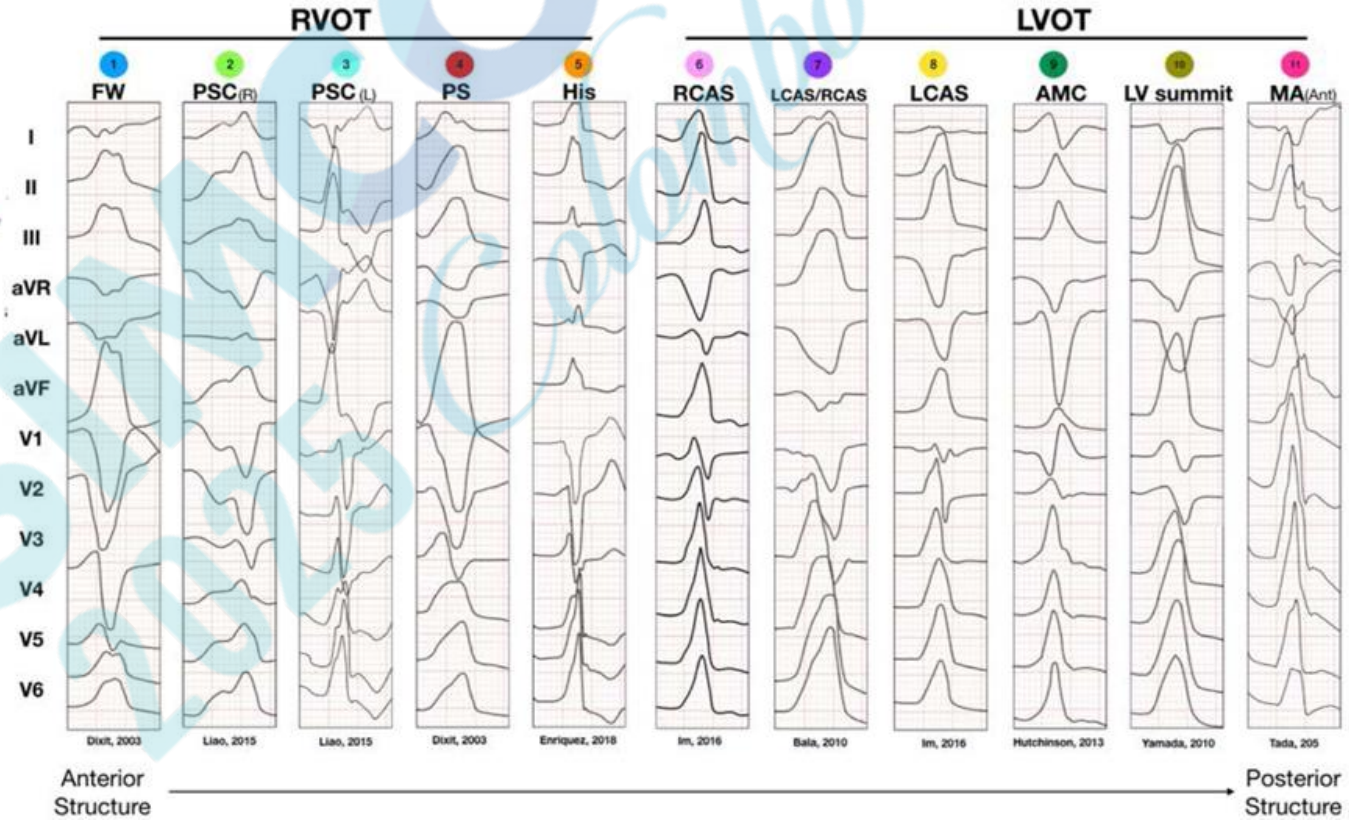

- Intermittent Borad complexes (triplets)
- No P waves
- +VE in Inferior leads
- Positive R in V1,2

# Differentiation of outflow tract VES(LVOT vs RVOT)

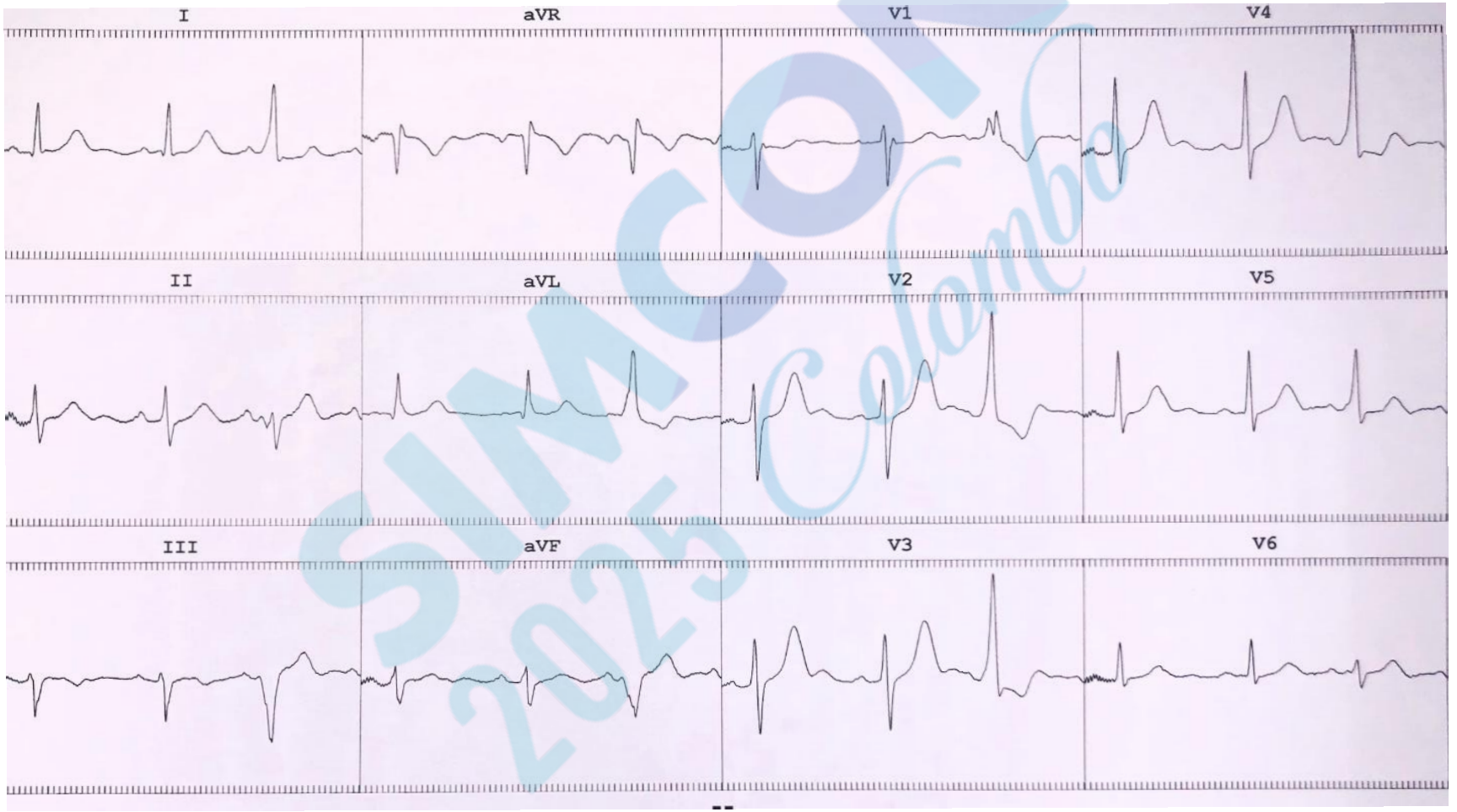




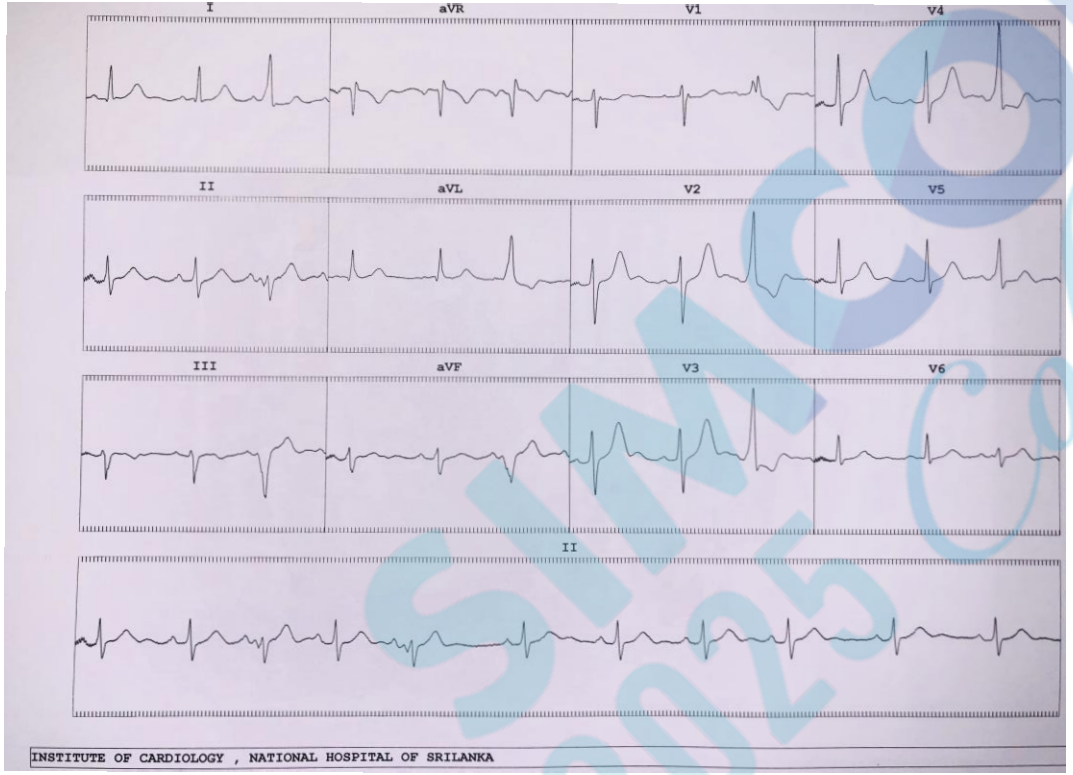


9. A 18yr-old male athlete presented with palpitations and presyncope during exercise

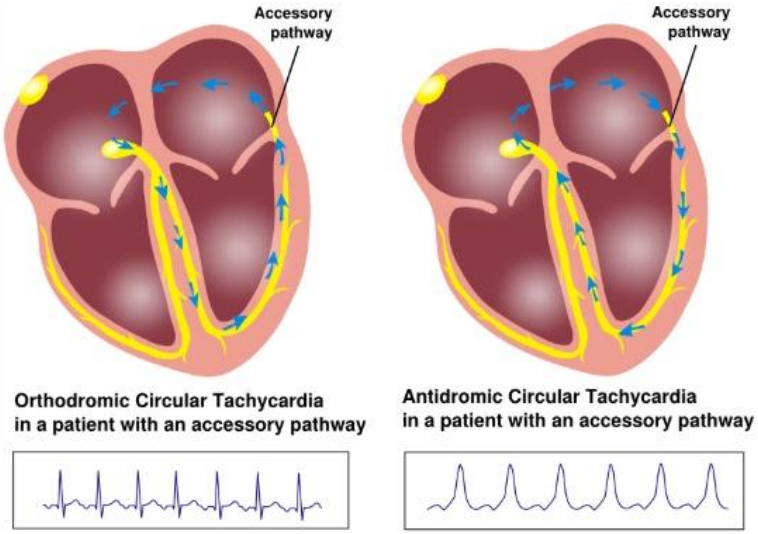


# Intermittent pre-excitation -presence of AP

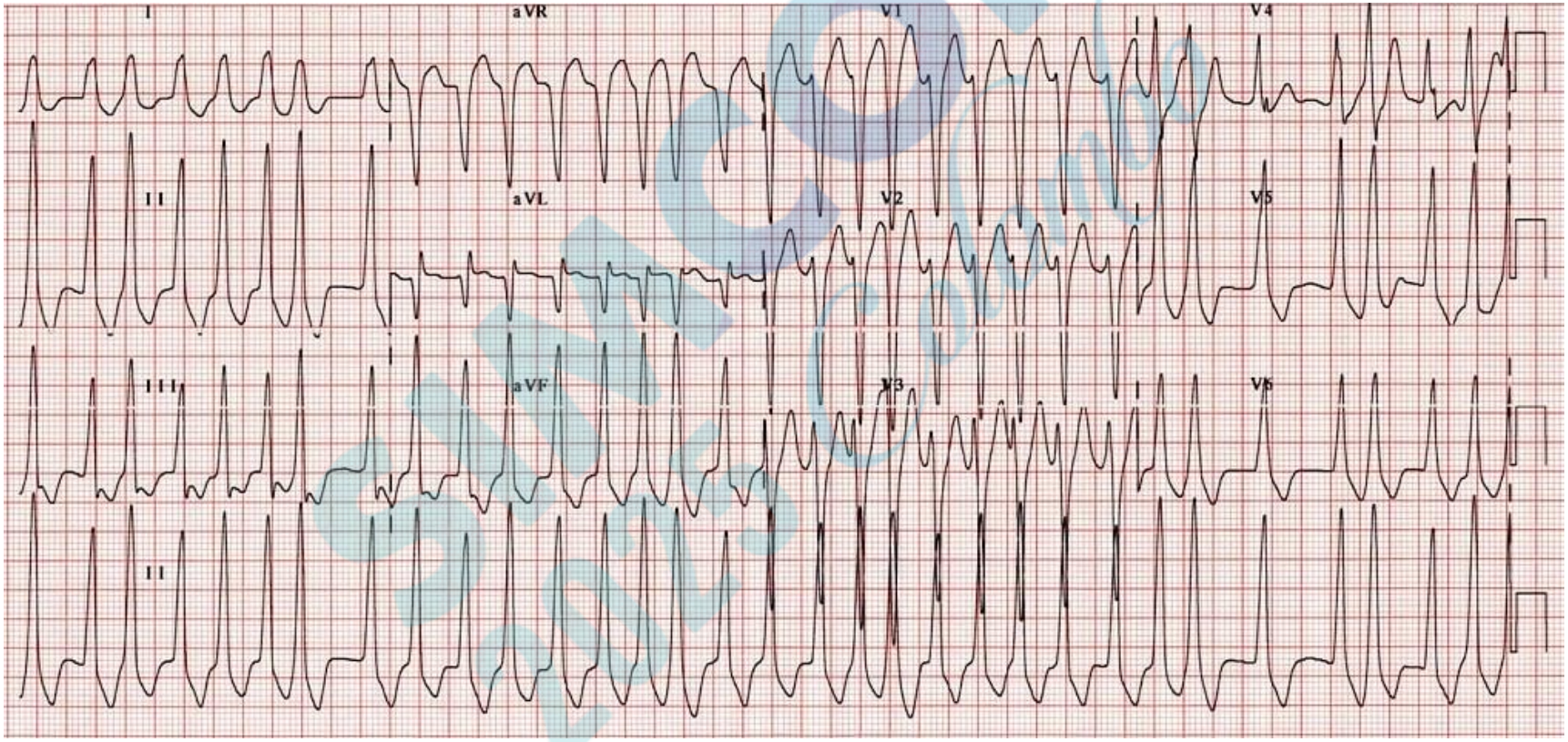



- Intermittent broad QRS complexes
- Preceding P and Delta waves
- +Ve delta in V1 V2,L1

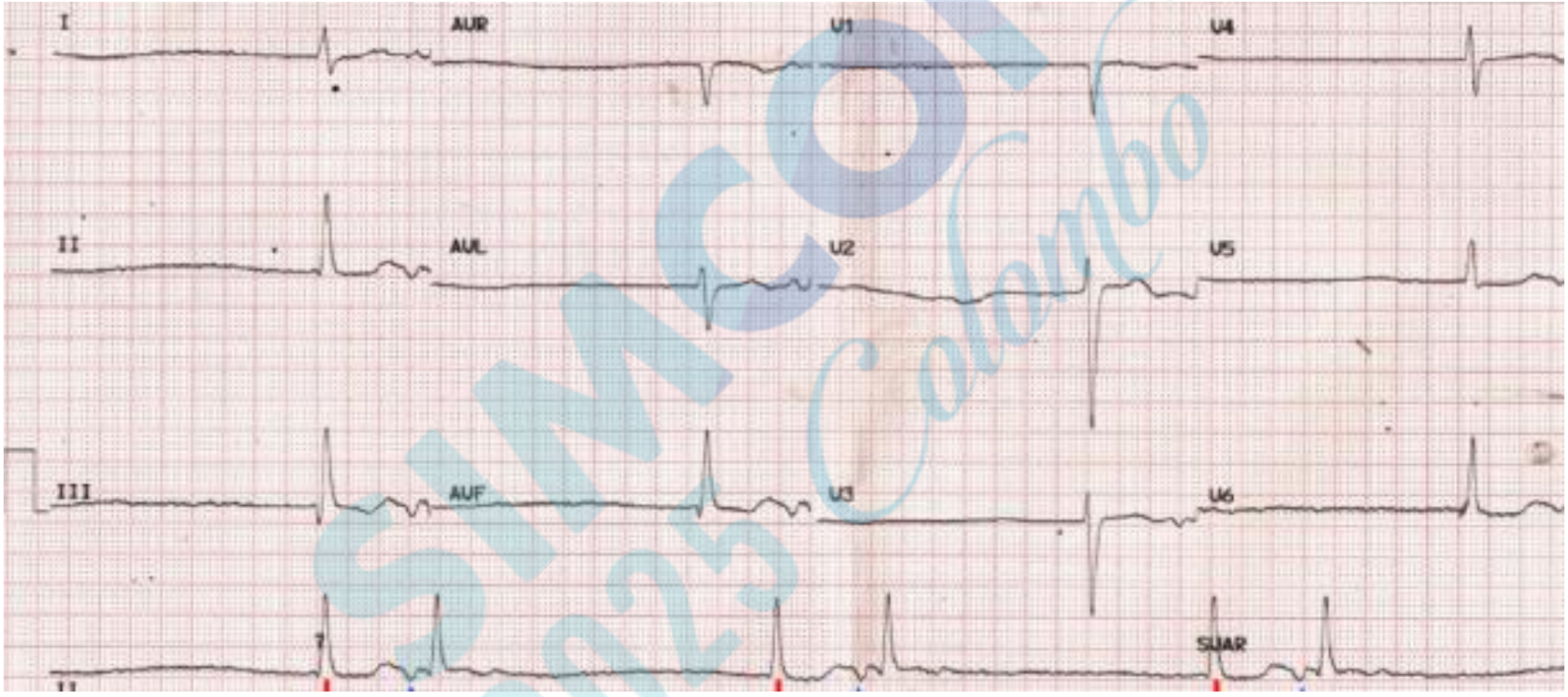
## L/S AP



# Pre-excited AF

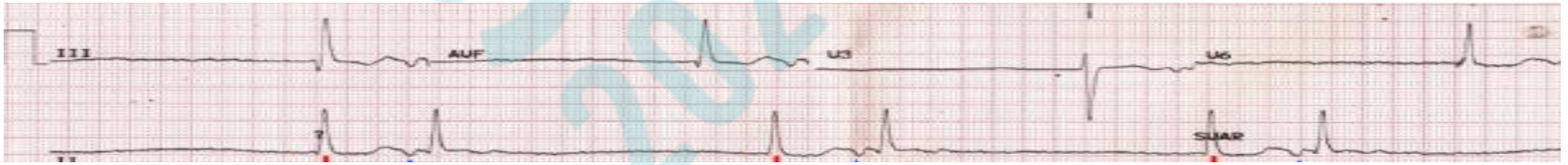


9. A 80-yrs old female with hypothyroidism and CKD ,presented with pre-syncope.

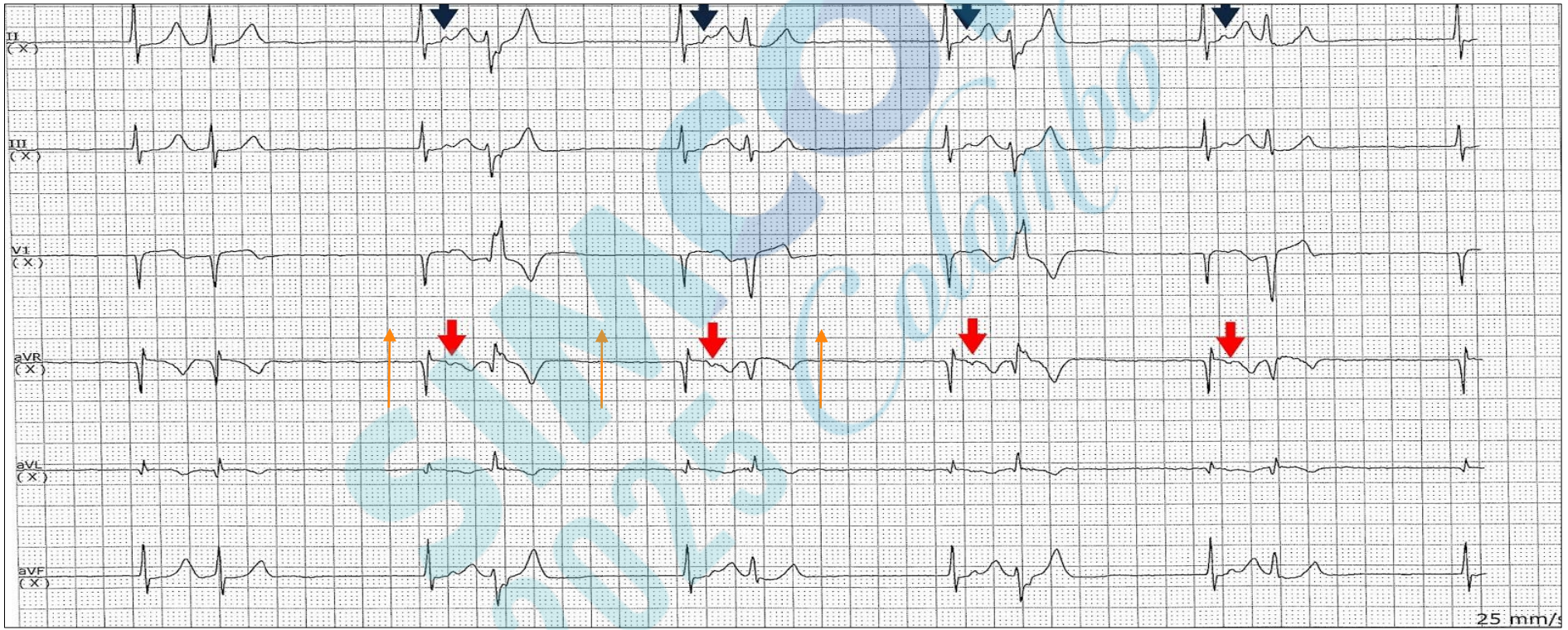


# Escape-echo bigeminy (severe SSS)

- Group beating: Repetitive sequences of two QRS complexes
- The sinoatrial node fails to initiate or conduct an impulse adequately
- AV junction acts as an escape pacemaker,with Retrograde P waves:
- Retrograde conduction from this junctional beat may activate the atria
- impulses potentially returning to the AV node and propagating antegrade to produce the subsequent QRS **(the “echo” beat)**.

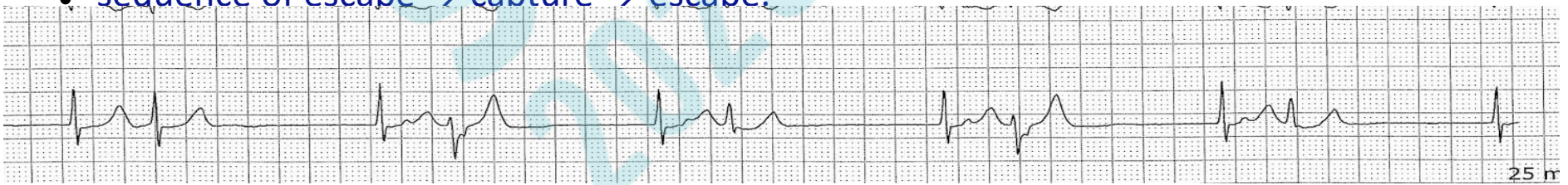


# **Escape-capture bigeminy** due SA nodal dysfunction

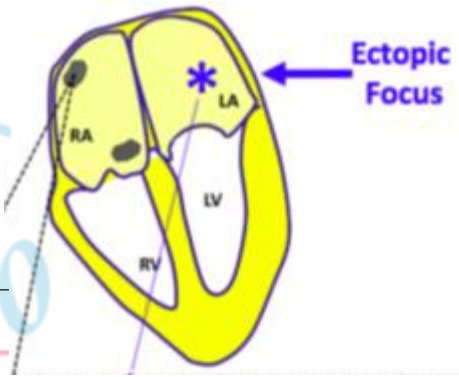


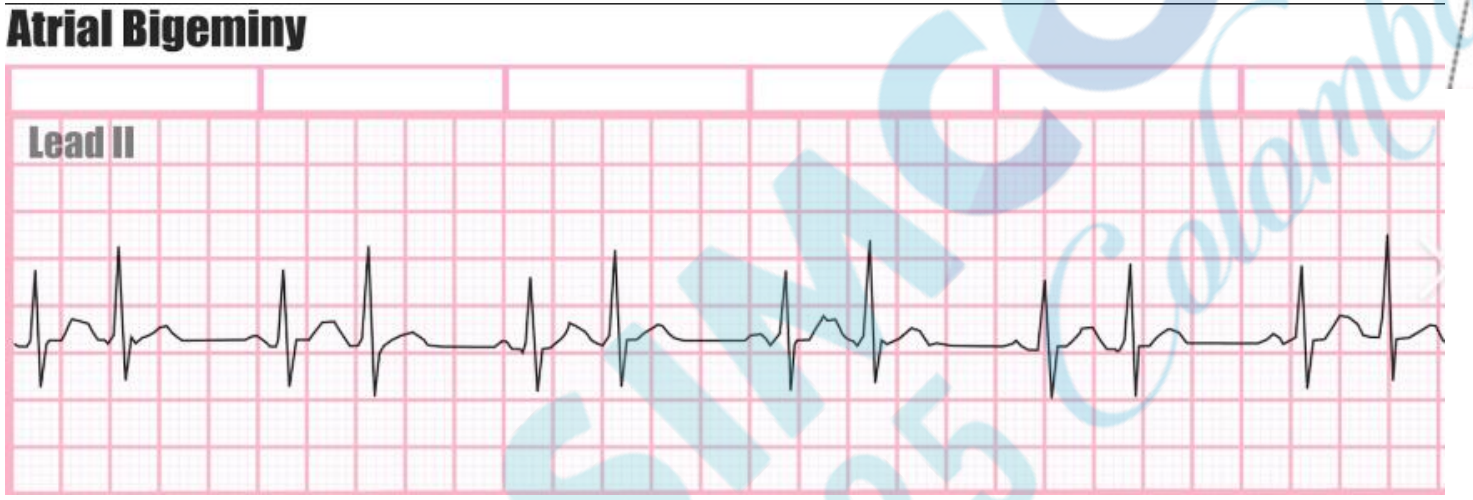
- **Junctional escape-capture bigeminy**

- producing a characteristic bigeminal pairing on the ECG.
- Slow Sinus Rhythm:
- Junctional Escape Beat:occurs at a fixed escape interval, independent of sinus activity,
- Sinus Capture Beat:subsequent sinus impulse reaches the ventricles normally,
- For this rhythm to persist, the sinus cycle length must exceed:Escape interval+refractory per iod of escape beat
- sequence of escape → capture → escape.



# How to differentiate from A .bigemini

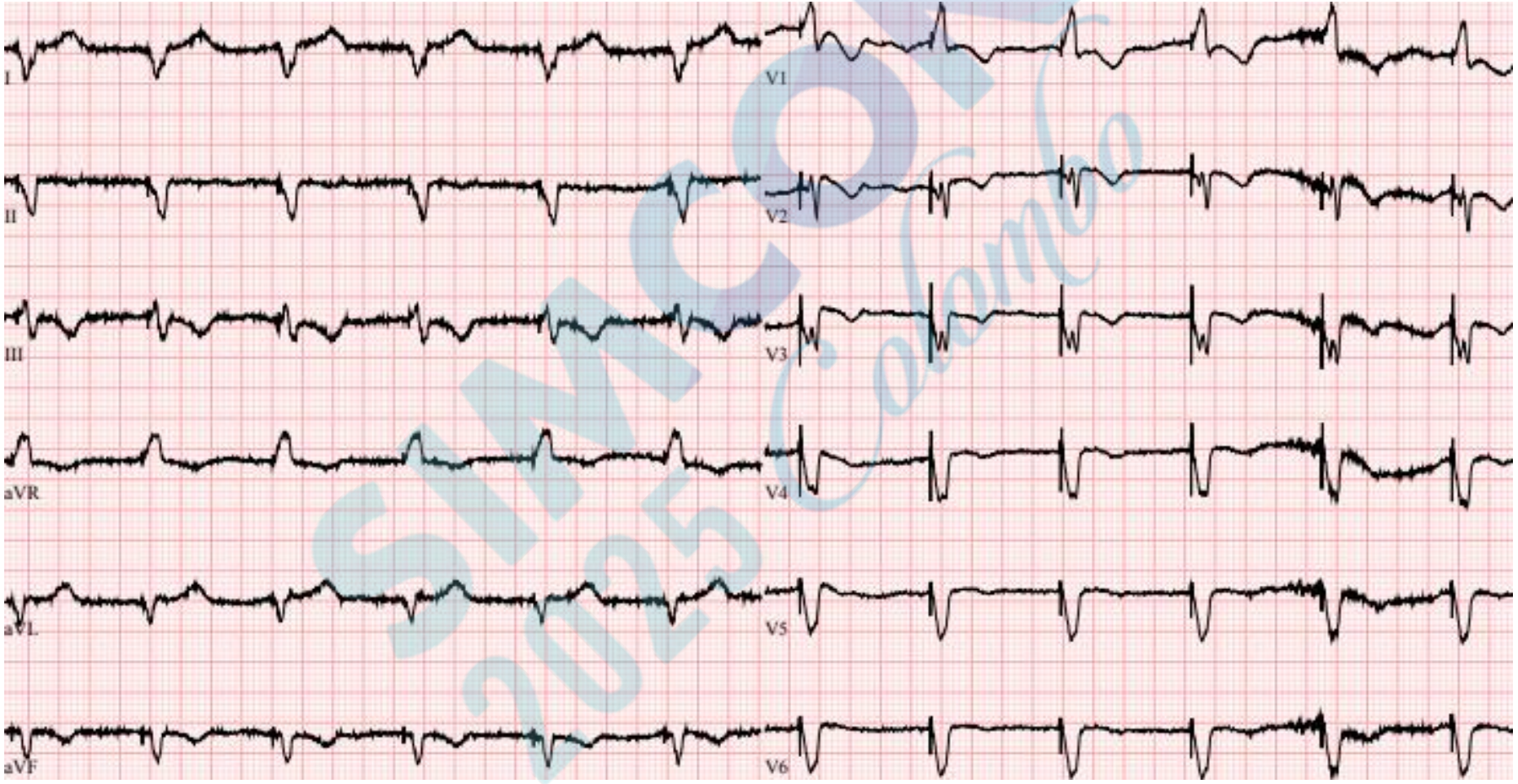


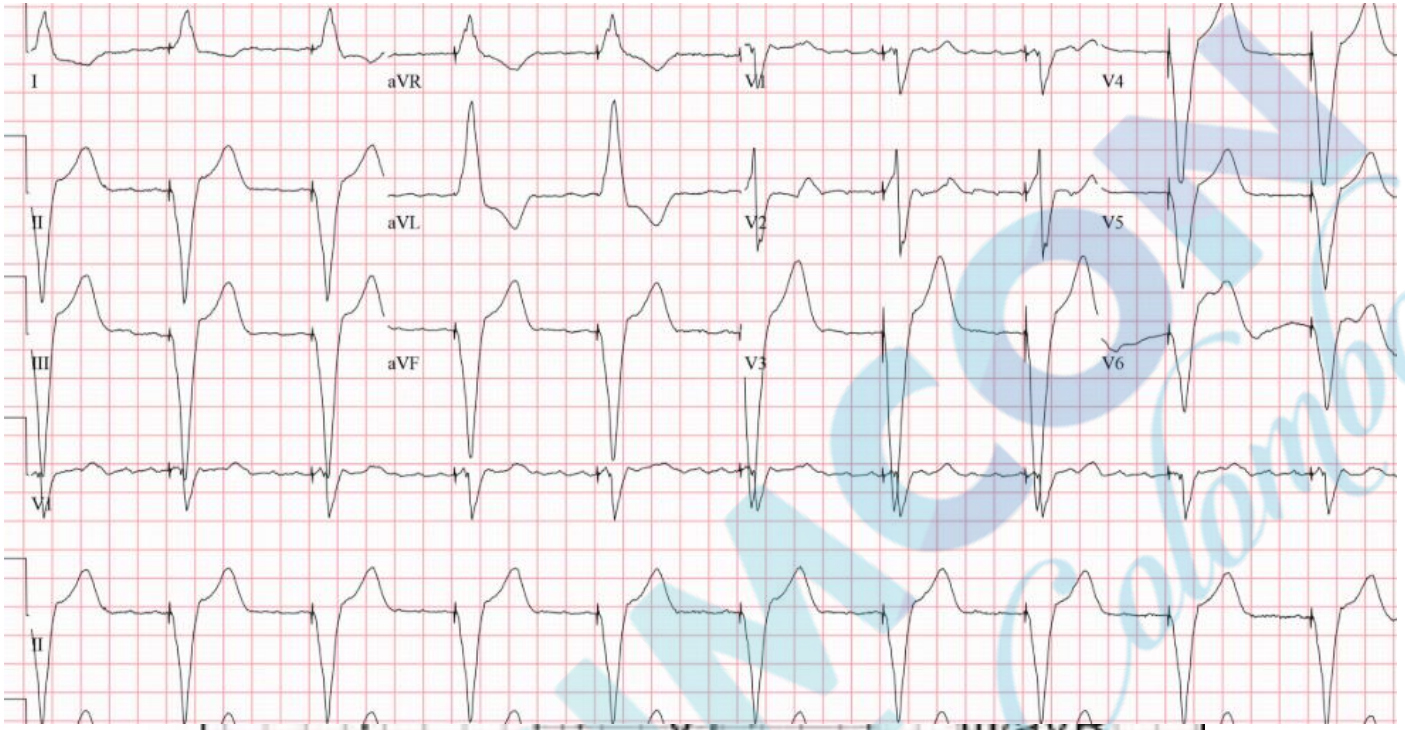



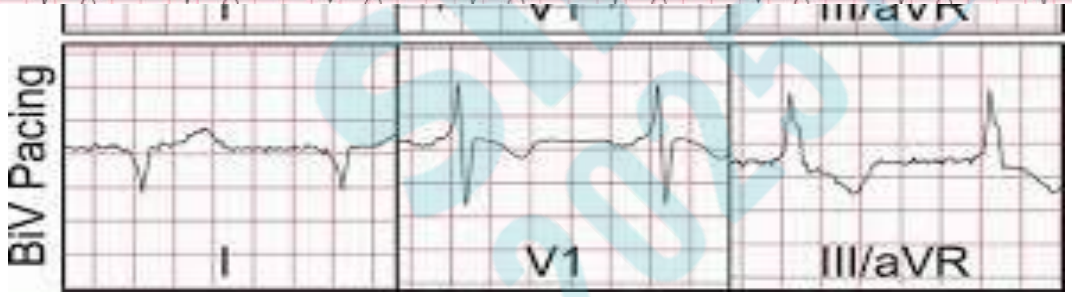

Management

- Beta-blocker
- Monitoring of ectopic burden/AF

# 10. A 55yr-old male with compensated heart failure,admitted with continuous hiccups

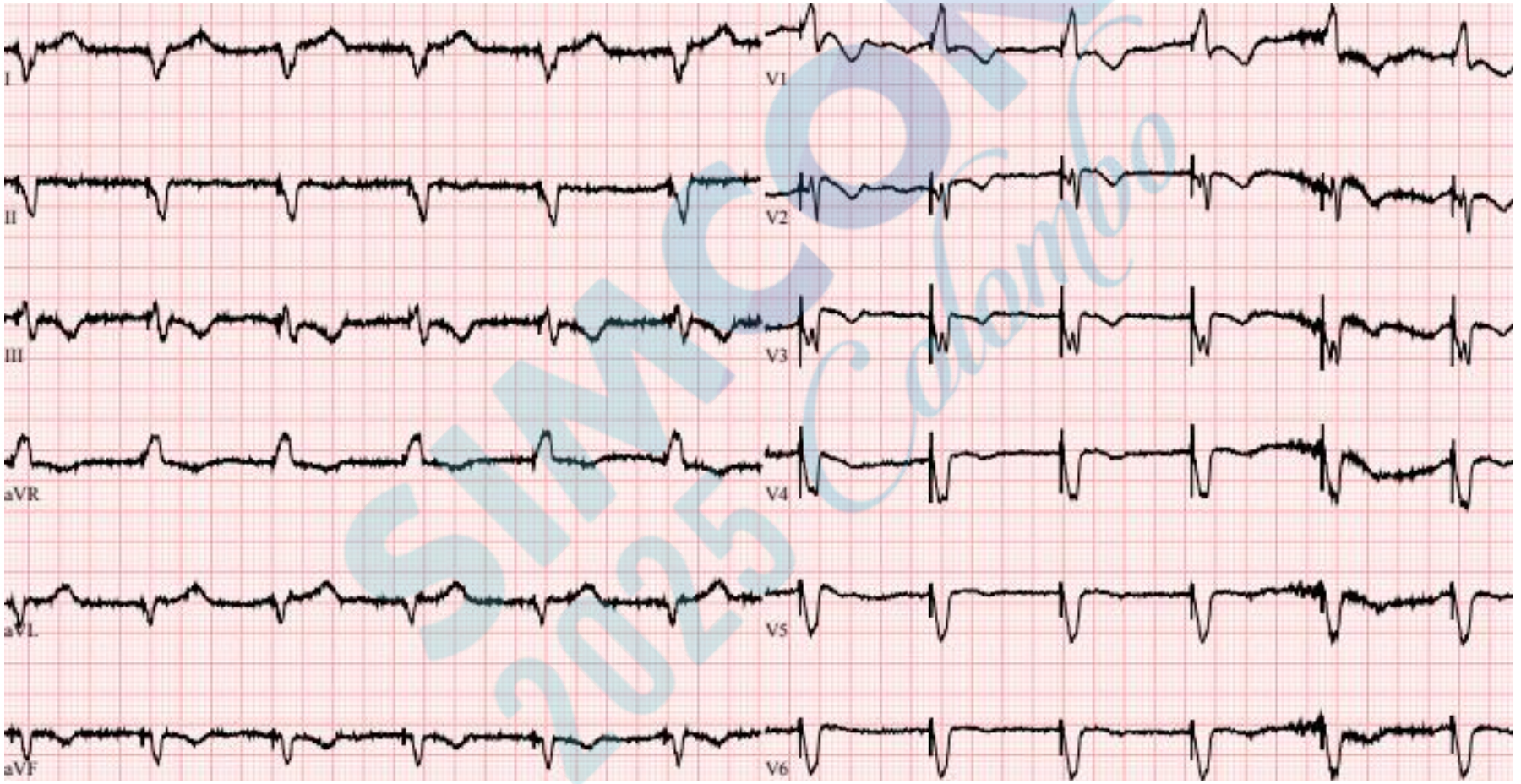




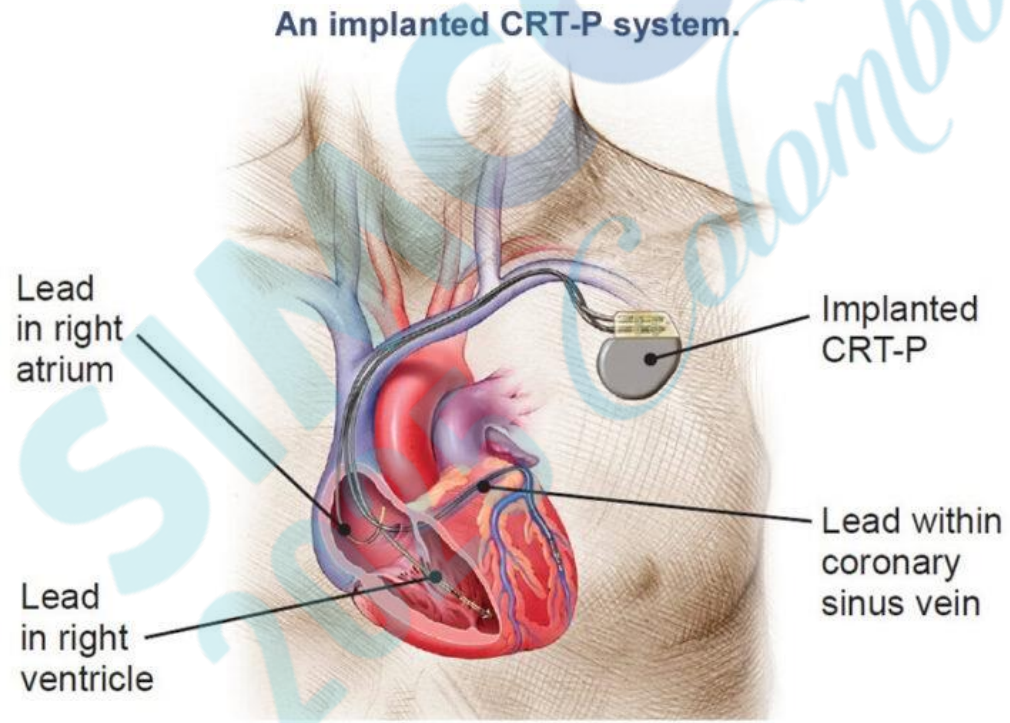




- RV pacing
- LBBB pattern
- Wide QRS

# CRT device -dominant LV pacing

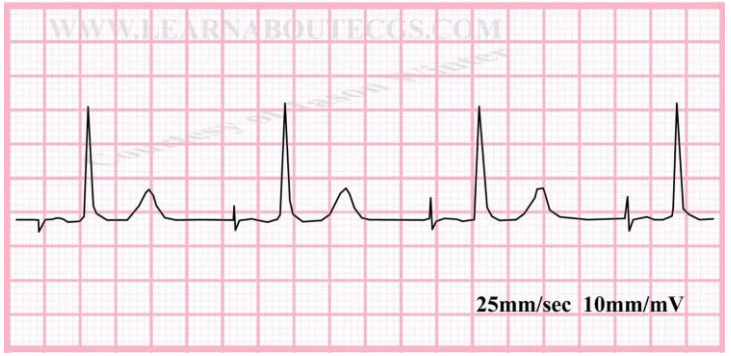


- anatomical proximity of the left phrenic nerve to the left ventricular (LV) lead,
- phrenic nerve stimulation (PNS), unintended diaphragmatic contractions or hiccups.

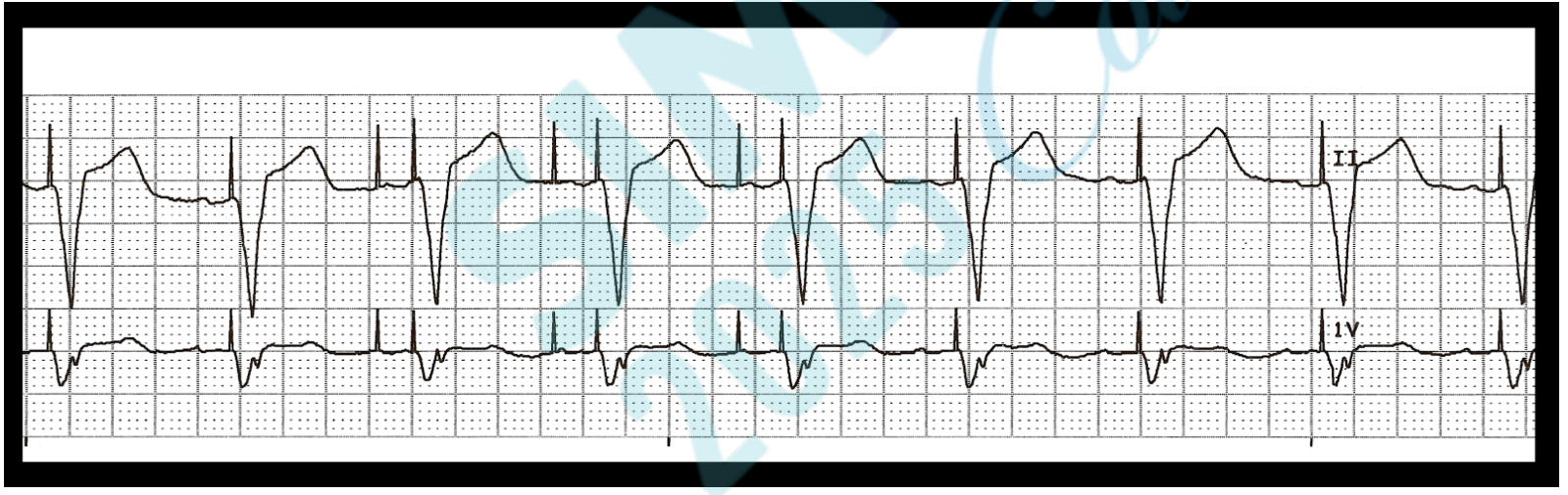



source:https://www.bostonscientific.com/en-US/patients/about-your-device/crt-devices/how-crts-work.html

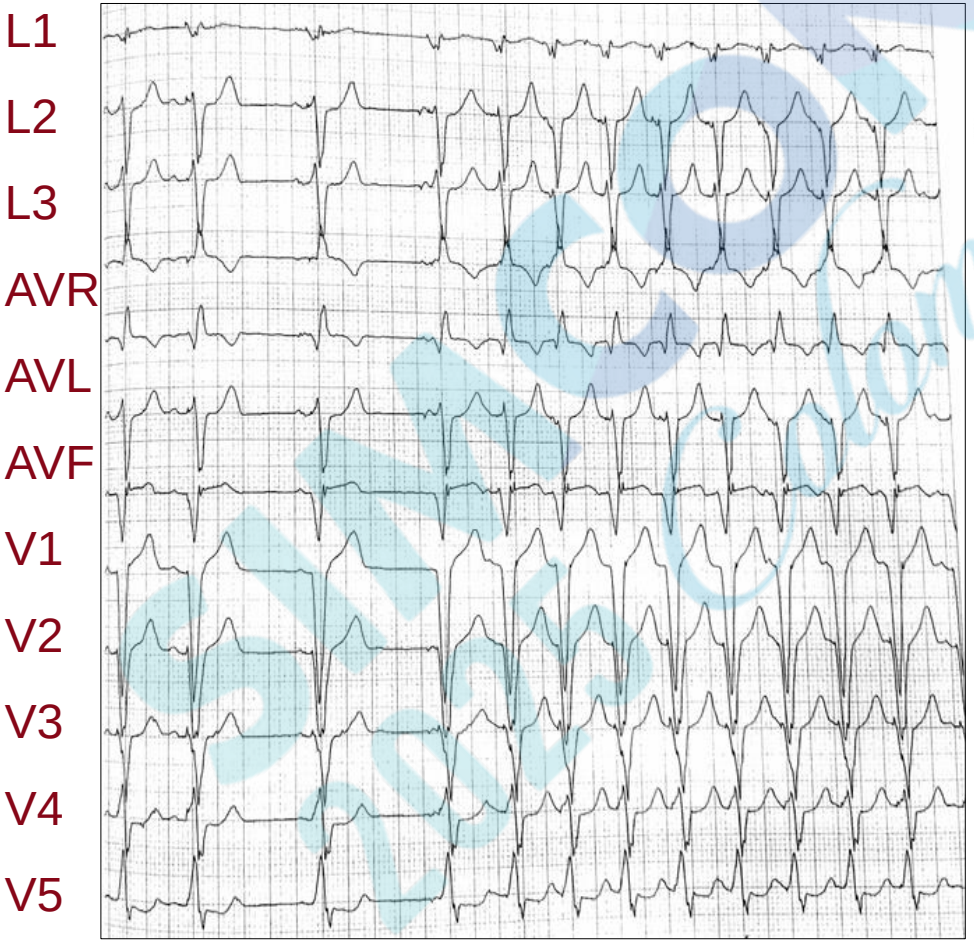
## Single Chamber (Atrial) Pacing Spikes



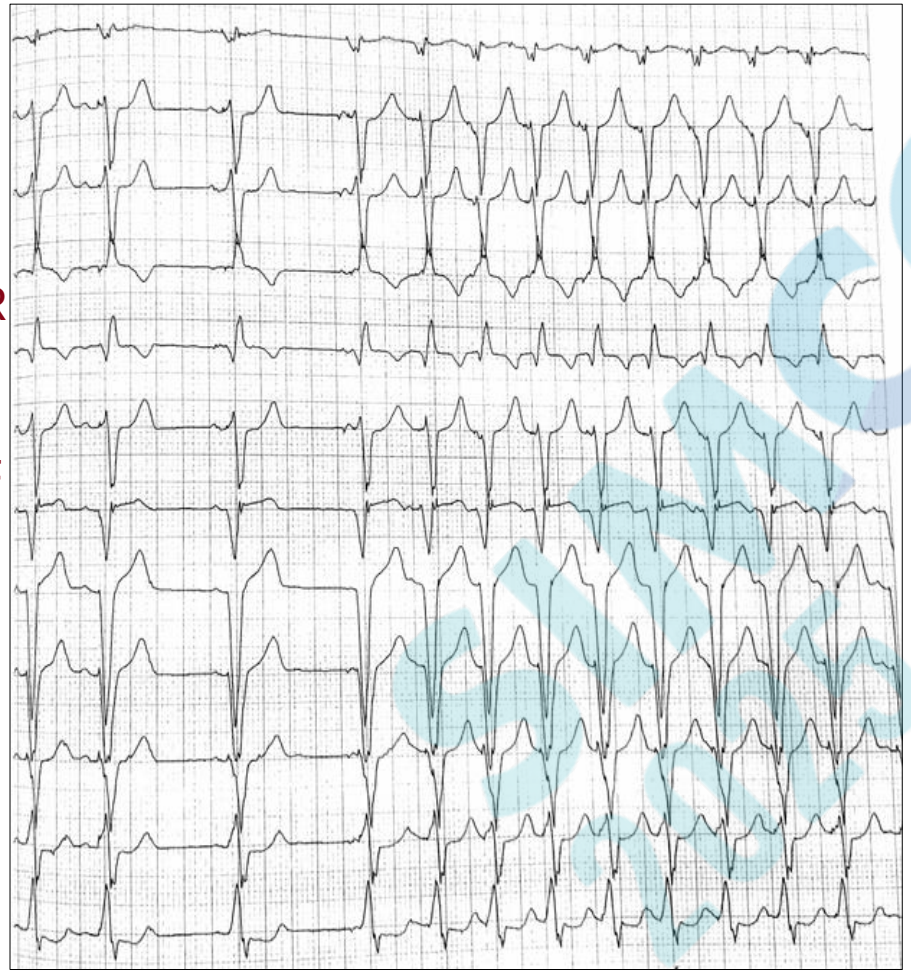

## Dual chamber PPM- AP-VP and AS-VP



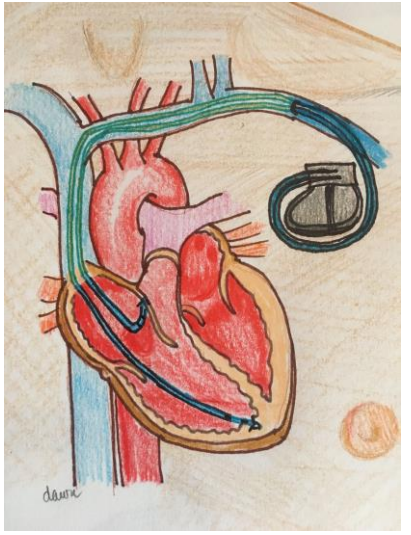
11. A 62yr female with HTN and on PPM for CHB,presented with intermittent palpitations



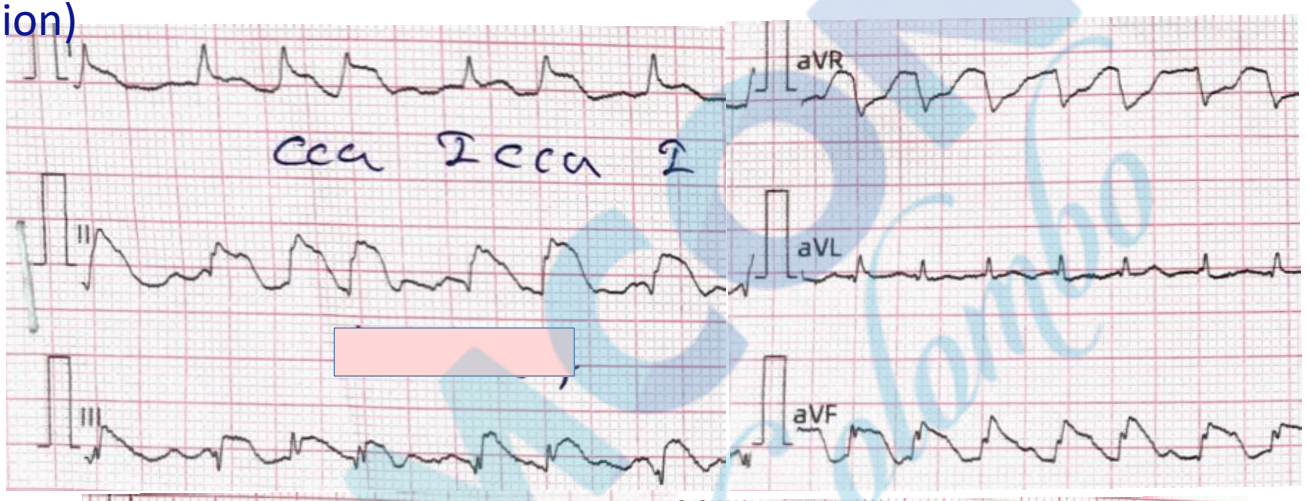
# Short AT run Tracked and RV paced

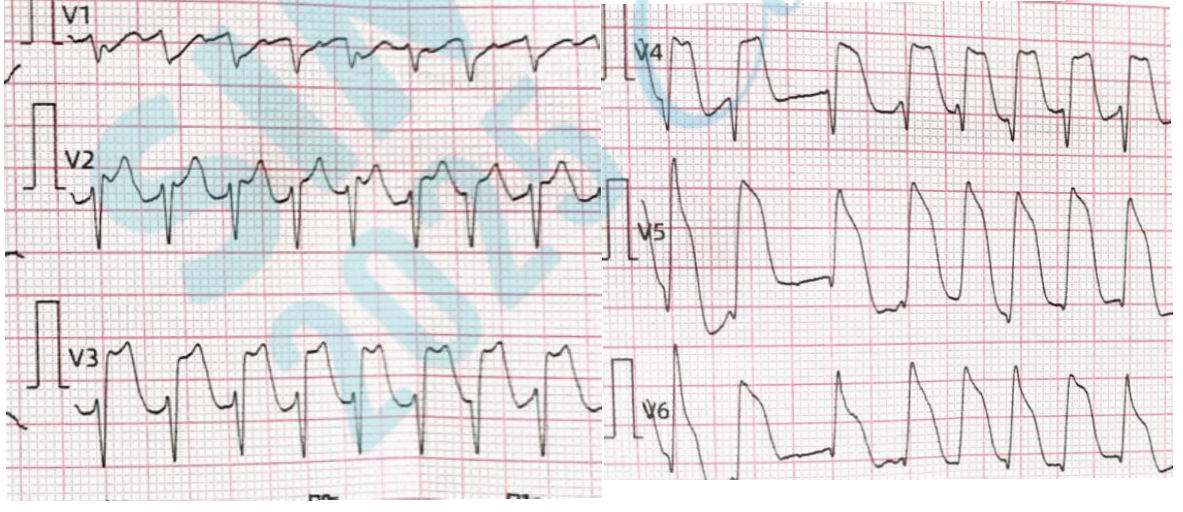


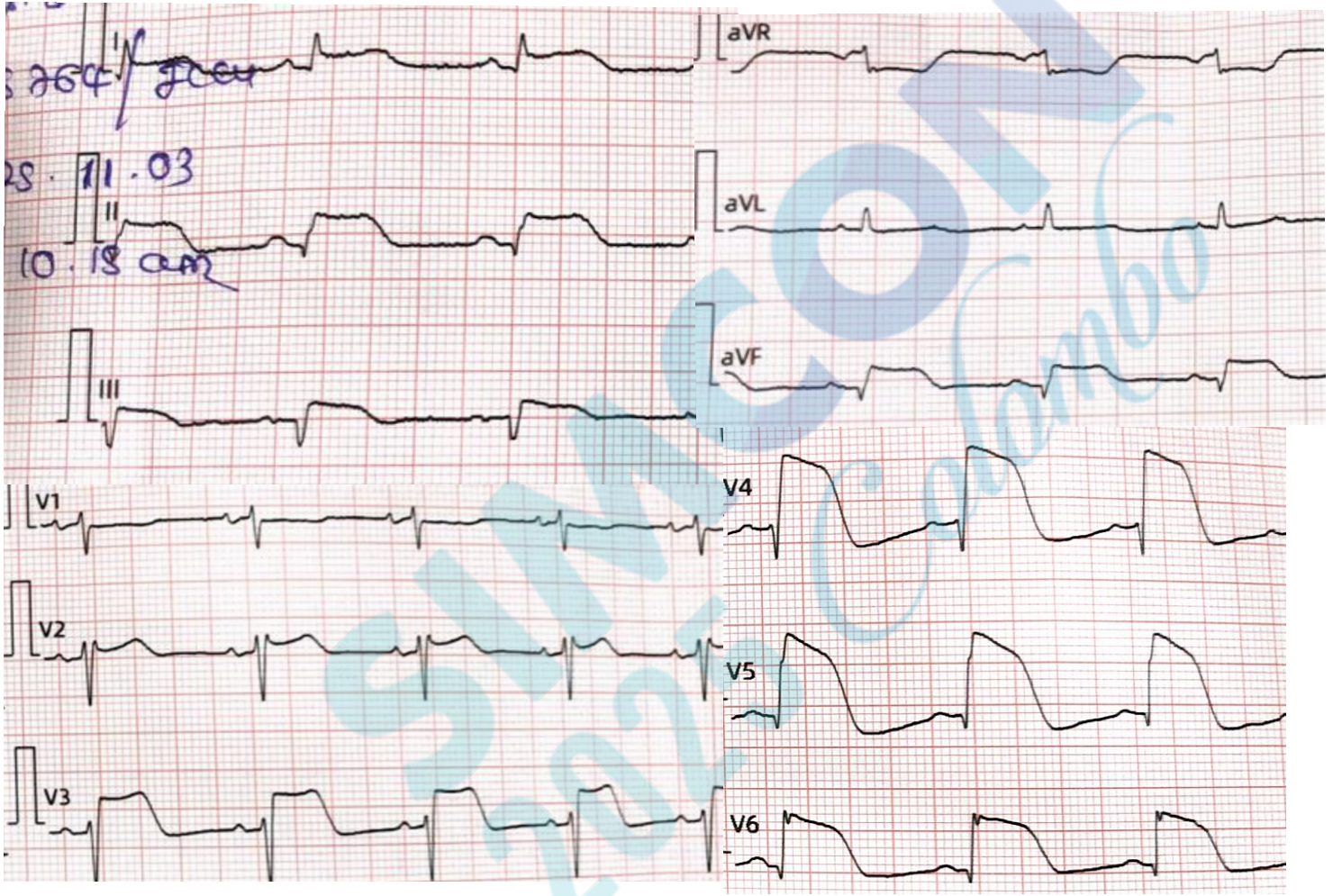

- Initial beats>sinus AS-VP
- Broad complex tachycardia
- LBBB pattern,pacing spike+
- Preceded by P wave of different morphology.

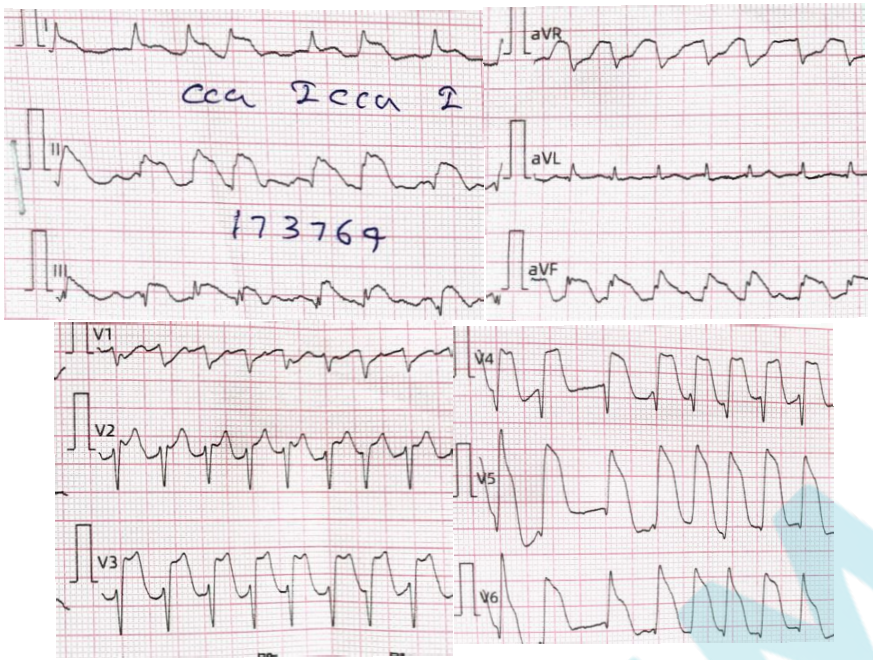


12. A 70yr-old female admitted with chest pain worse with lying down position after a viral flu,admitted with SOB,TropI 3500,NO RWMA,CAG-minor CAD (no acute occlusion)

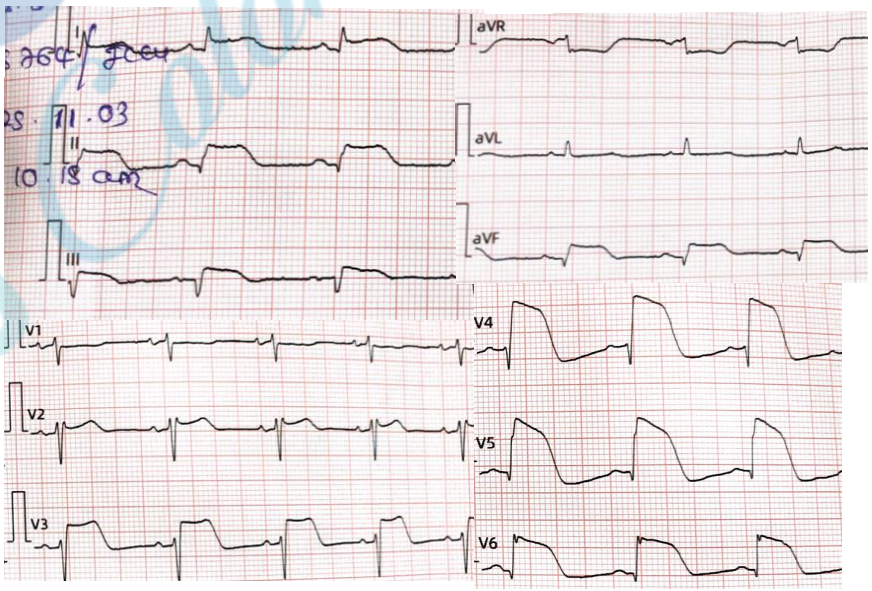



I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6

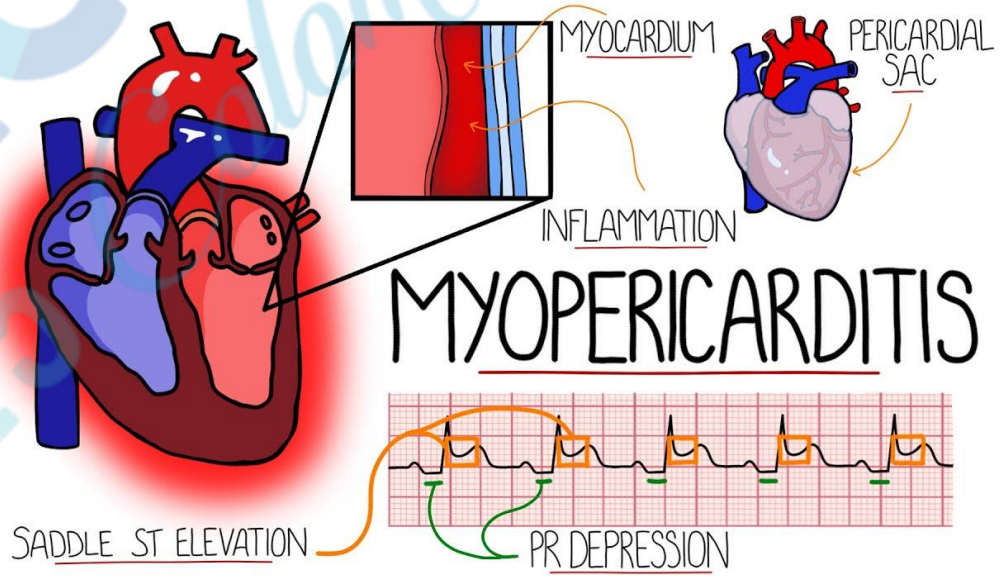



- Irregular R-R with absent P>AF
- Diffuse ST elevation and depression in aVR/V1
- **In sinus rhythm**
- mild PR segment depression
- Saddle shape ST elevation

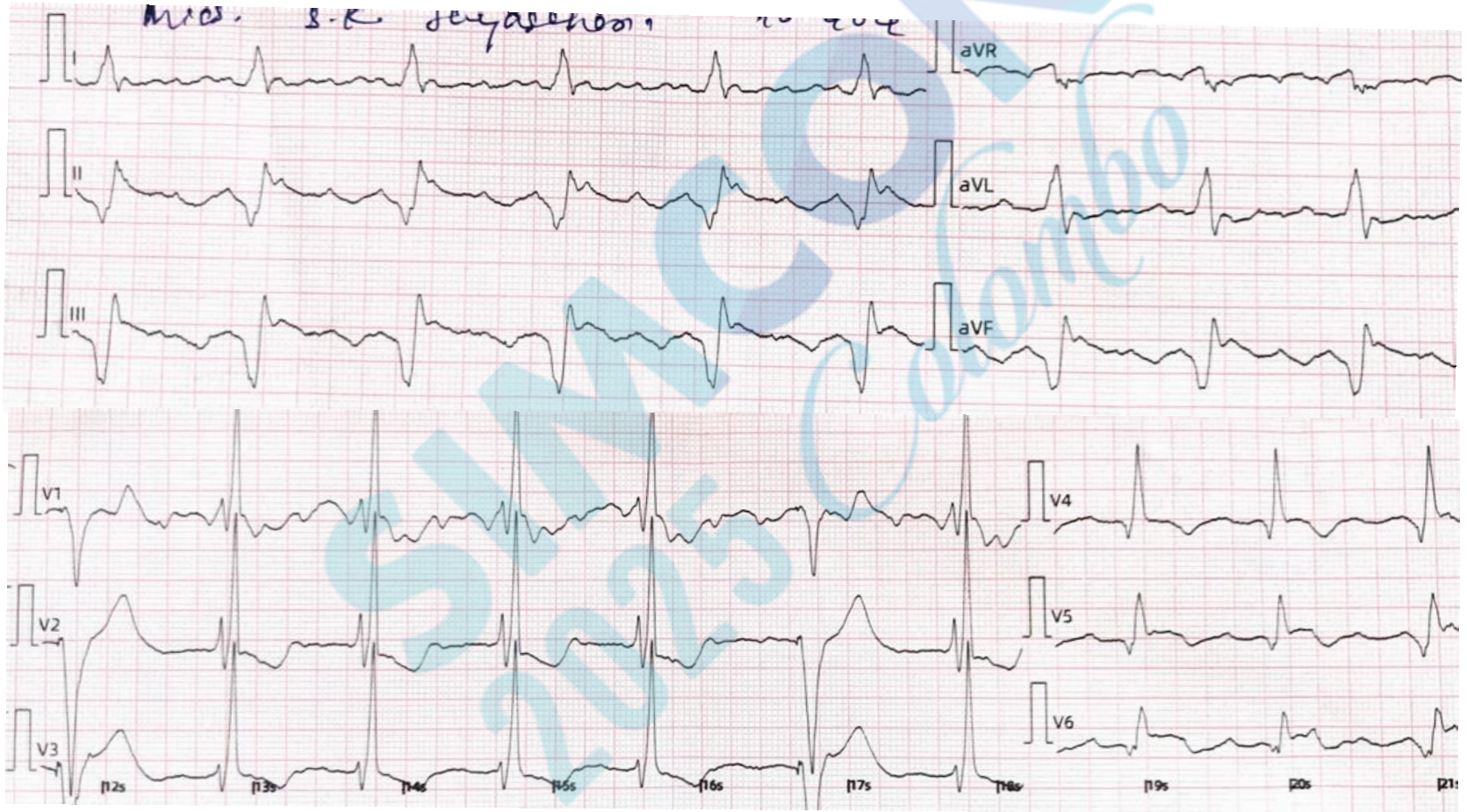


# Myopericarditis

- Inflammation of the pericardium and myocardium.
- Infectious and non-infectious causes.-Most of the infectious causes are viral,
- Myopericarditis -
  - primarily pericarditis symptoms
  - cardiac biomarker elevation
  - 2DE normal wall motion.

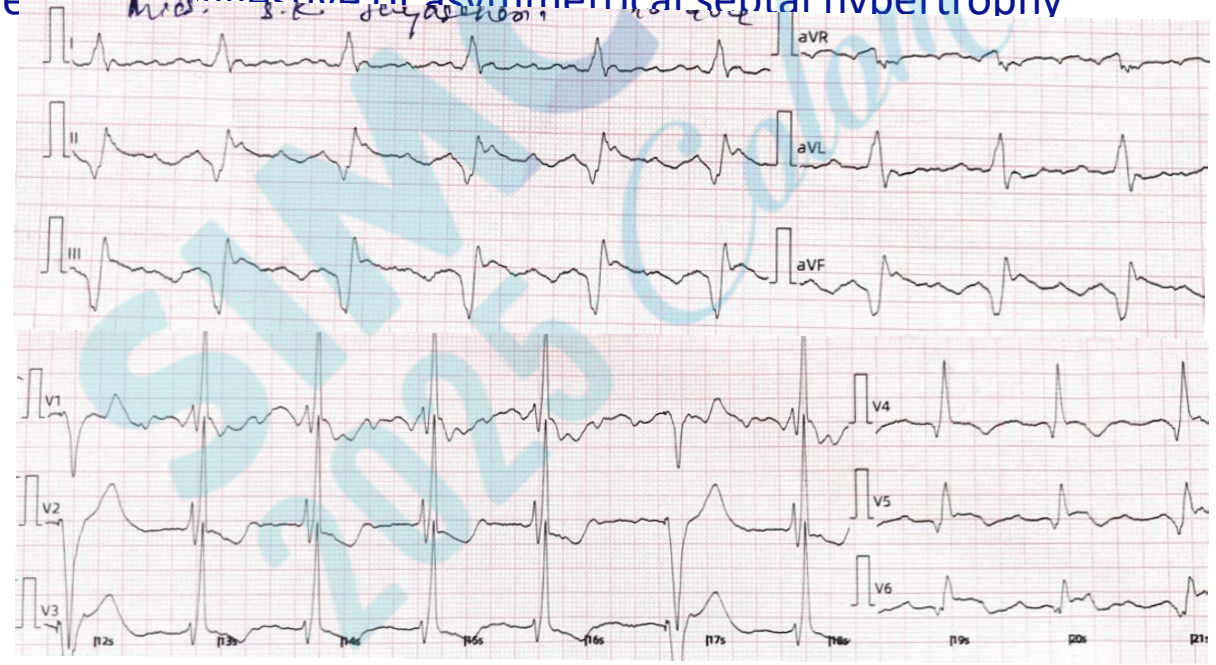


13. A 22yr old female who is having CHF and ICD admitted with  with a recent LRTI and evidence of fluid overload.



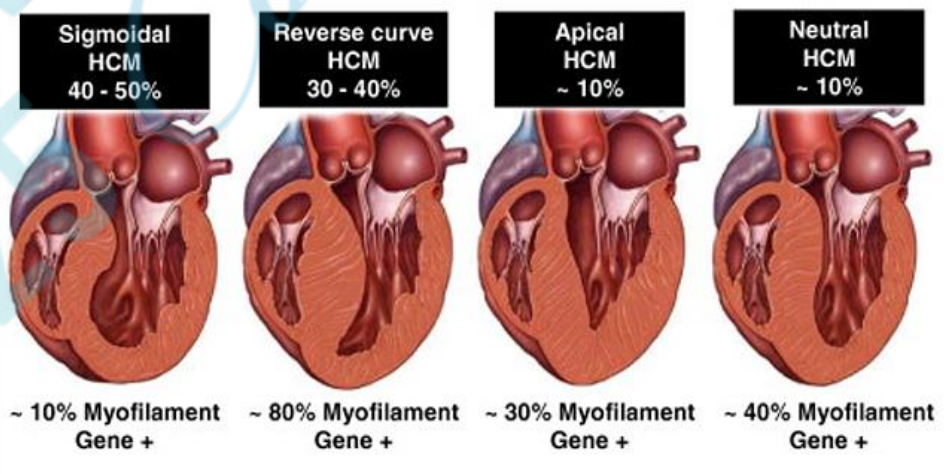
# HCM with A flutter and intermittent RV pacing

- A flutter> flutter waves+ in the baseline with slow AV conduction with RBBB patter and LAD (Bi-fascicular block)
- Intermittent RV pacing captures due to slow AV conduction with a pause.
- Tall septal R waves V2-4 suggestive of asymmetrical septal hypertrophy



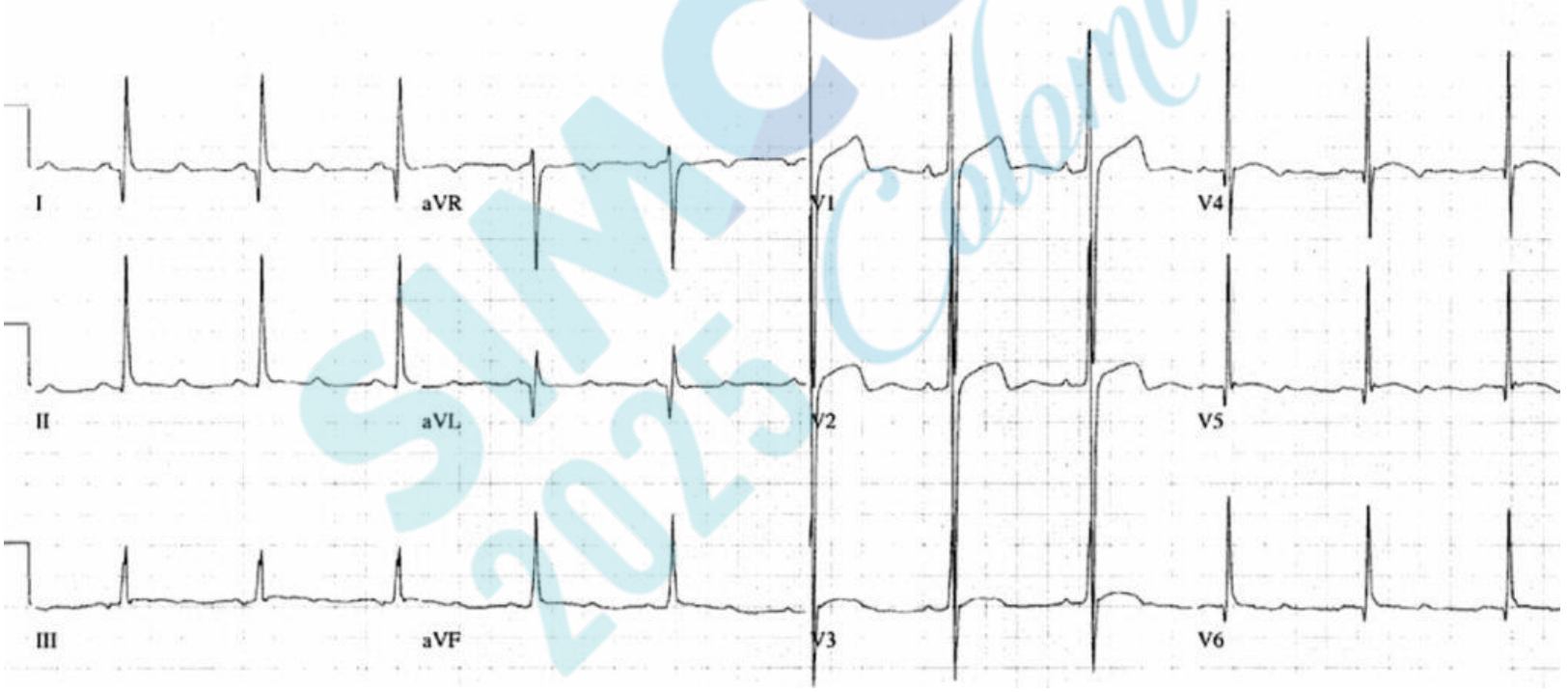
# Hypertrophic cardiomyopathy

- most common inherited cardiac disorders:
- Prevalence ~1 in 500 people
- Annual mortality ~1-2%
- Number one cause of sudden cardiac death in young people
- heterogenous disorder produced by r
  sarcomeric proteins



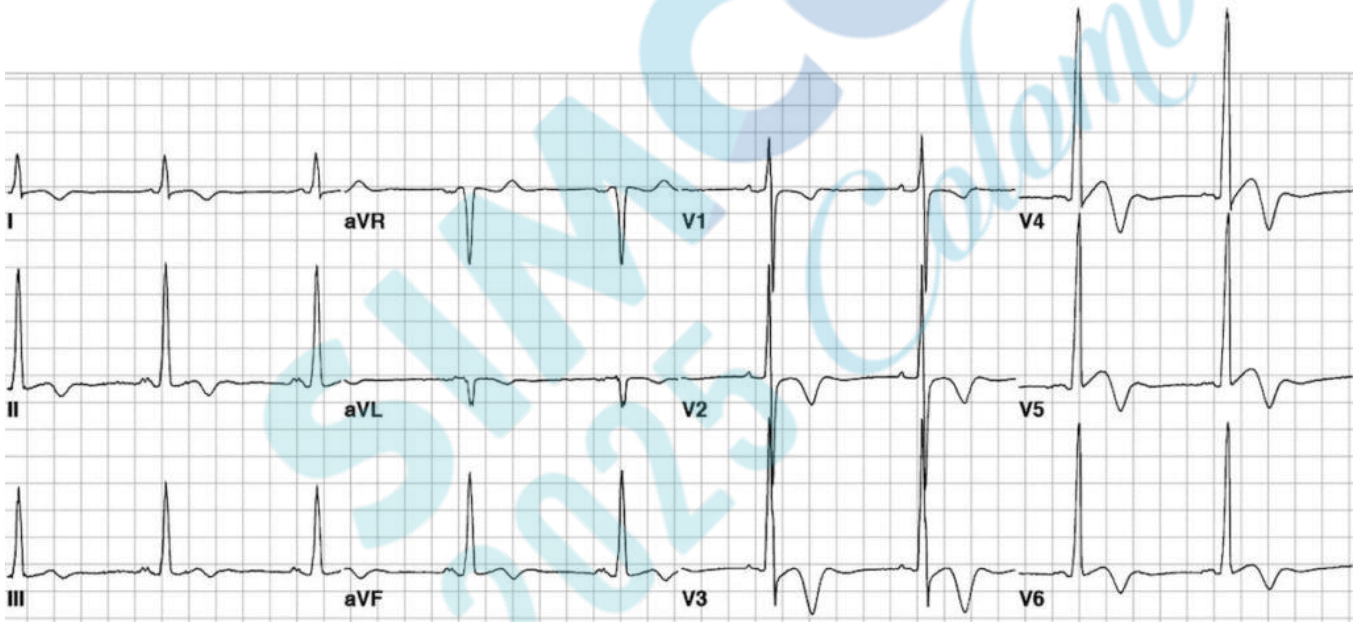
**HCM showing features of asymmetrical septal hypertrophy:**

- Large precordial voltages.
- Deep, narrow, septal Q waves most prominent in leads I and aVL; also seen in V5-6.

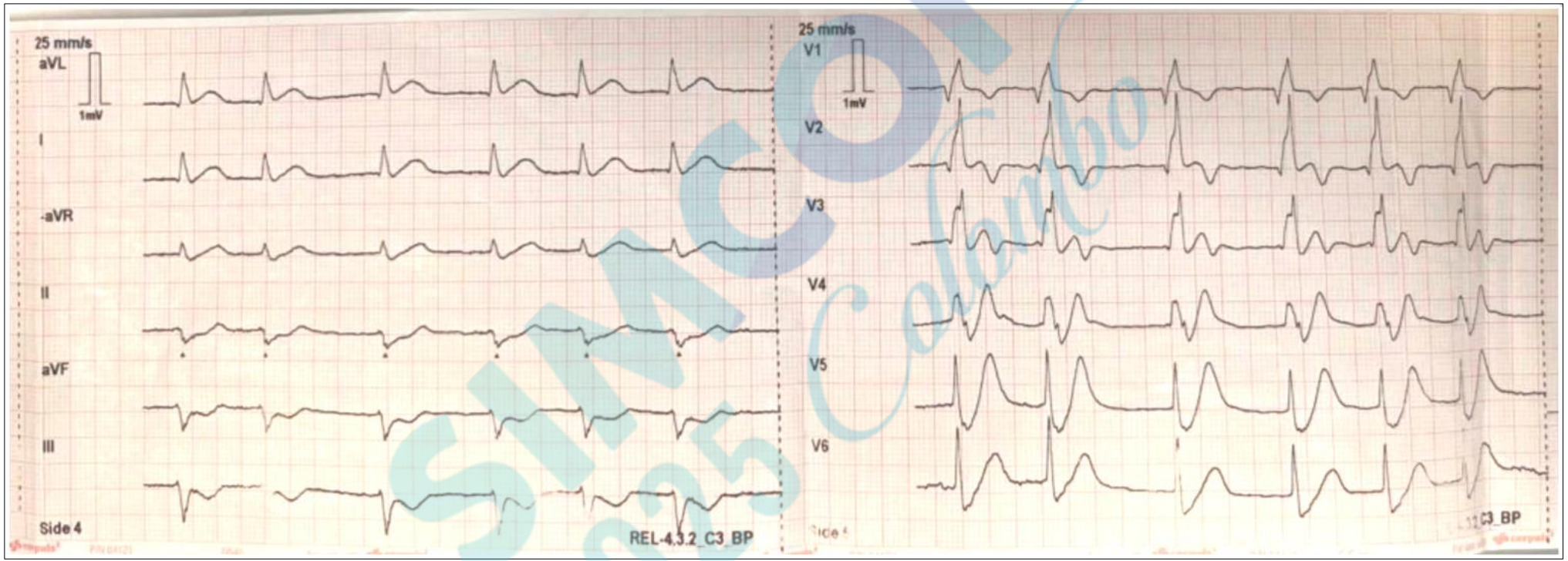


This ECG shows the typical pattern of **apical HCM**:

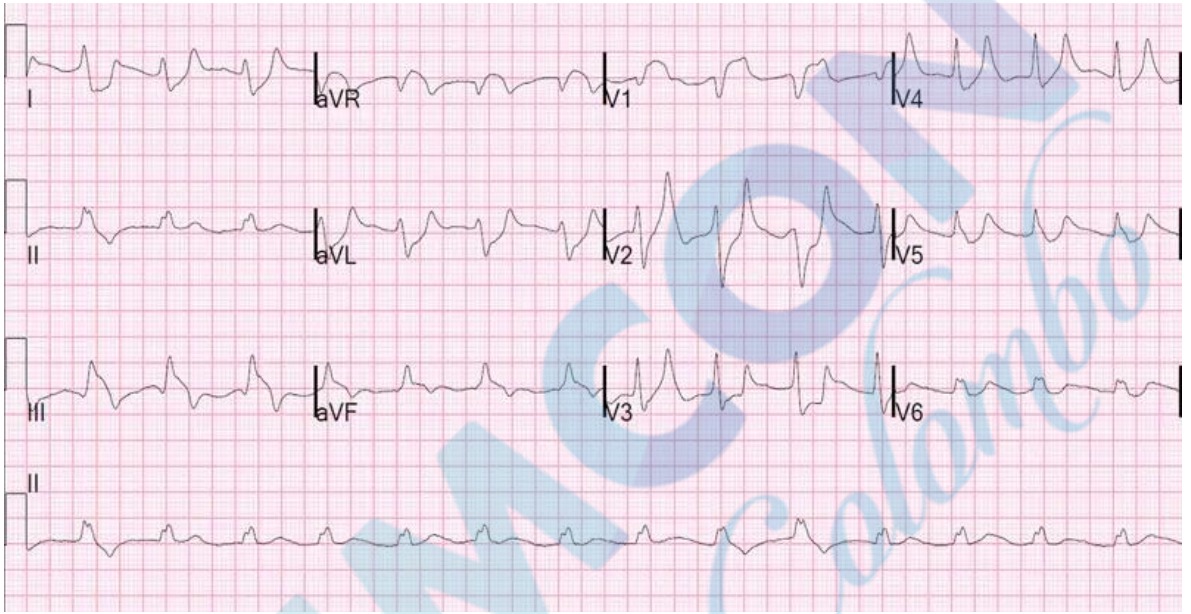
- Large precordial voltages.
- Giant T wave inversions in the precordial leads
- Inverted T waves are also seen in the inferior and lateral leads.



# 14. A 66yr-old male with a permanent AF with RBBB admitted with a sudden onset central tightening chest pain and sweating



# De Winter T Wave- anterior STEMI equivalent



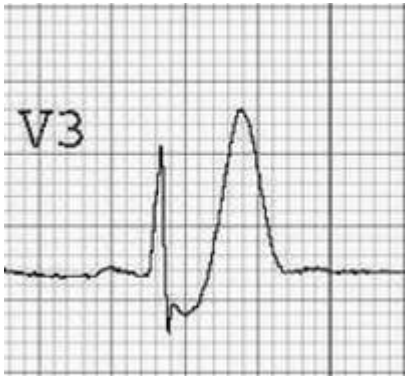

- Tall, prominent, symmetrical T waves in the precordial leads
- Upsloping ST segment depression > 1mm at the J point in the precordial leads
- Absence of ST elevation in the precordial leads
- Reciprocal ST segment elevation (0.5mm – 1mm) in aVR

# De Winter pattern- anterior STEMI equivalent

- First reported by Dutch Professor of Cardiology Robbert J. de Winter, in 2008
- de Winter pattern is seen in ~2% of acute LAD occlusions

  **electrophysiological explanation**

- the absence of ST elevation - related to the lack of activation of sarcolemmal ATP-sensitive potassium (KATP) channels by ischemic ATP depletion

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## A New ECG Sign of Proximal LAD Occlusion

Published November 6, 2008 | N Engl J Med 2008;359:2071-2073 | DOI: 10.1056/NEJMc0804737

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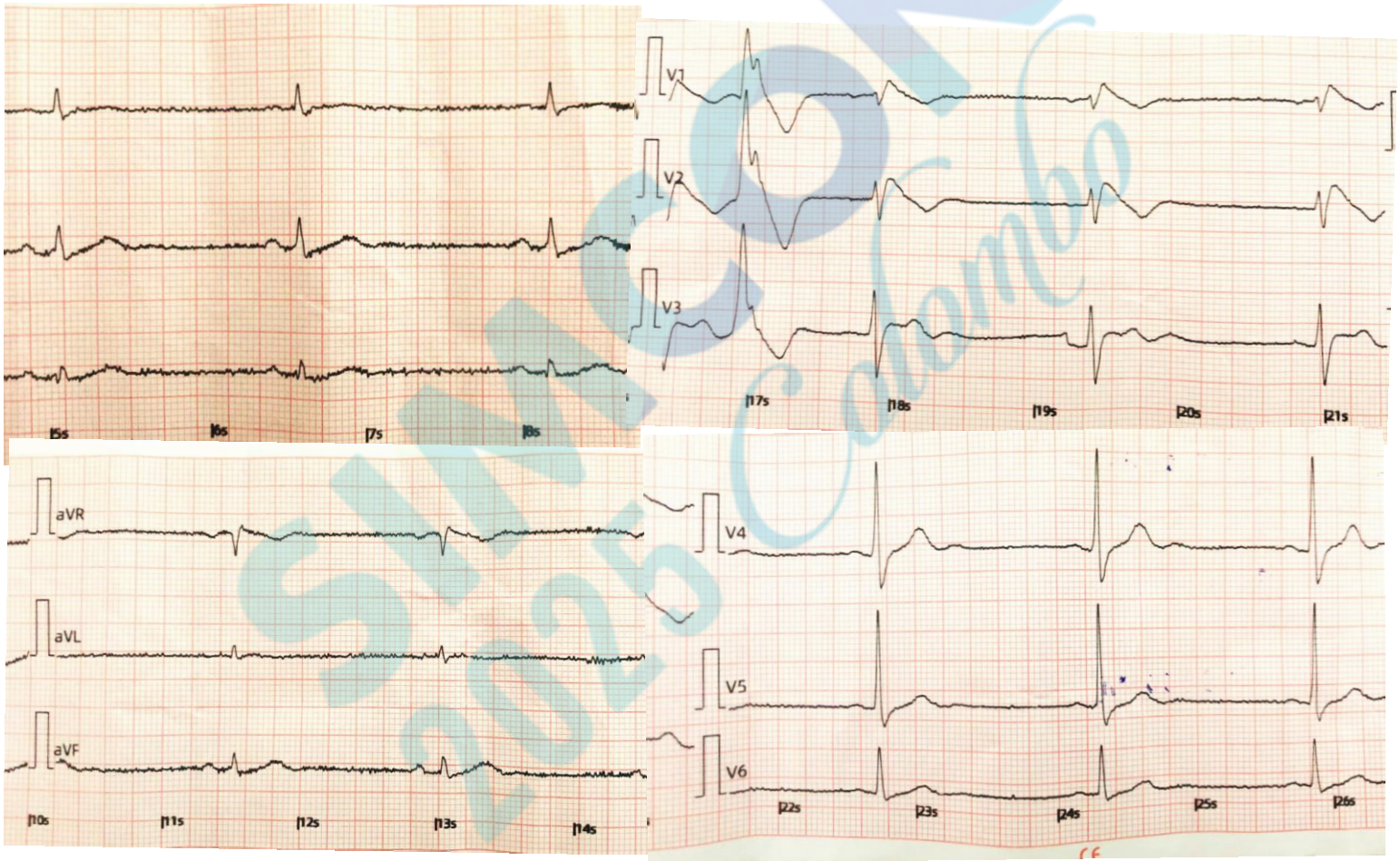
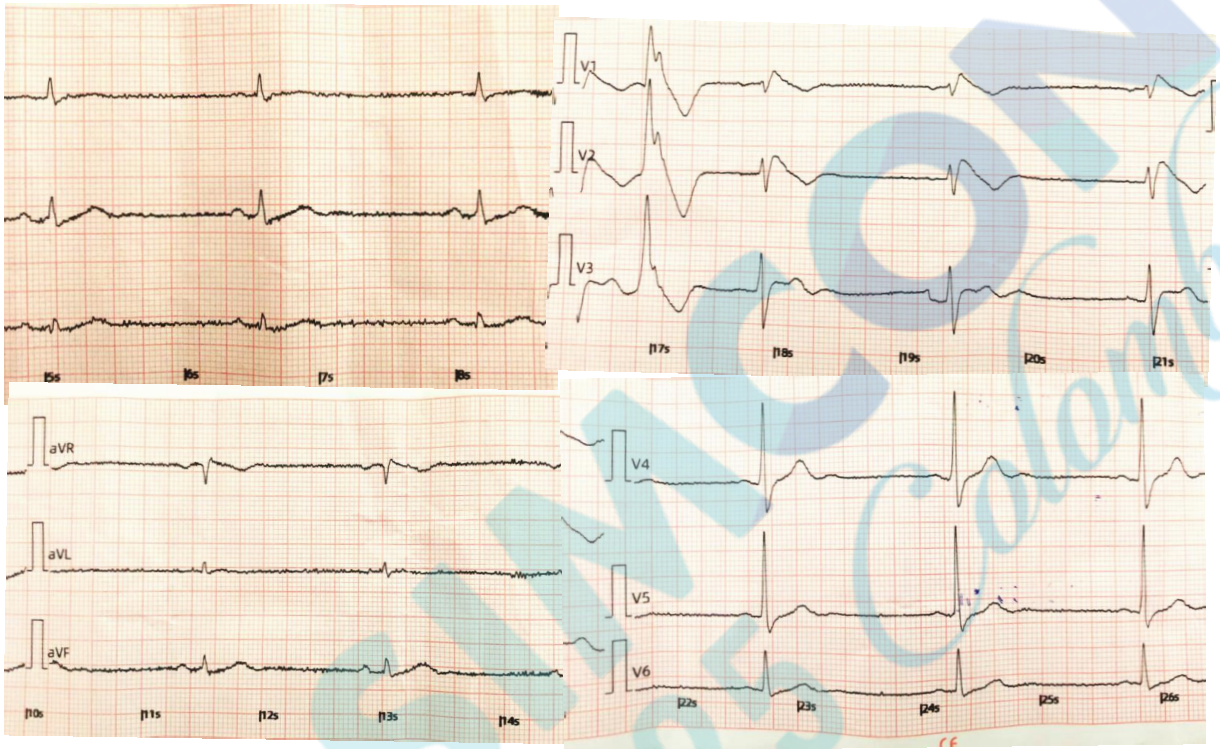
15.

A 54yr-old male(B/G IHD)admitted with a chest pain and presyncope.
Was on beta-blocker,2DE NO RWMA,CAG-minor CAD



# Type1 Brugada with drug induced SSS




- Sinus bradycardia
- Type 1 brugada pattern in V1-2
- Post VE short coupled VE(pro-arrhythmic)

# Type 1 Brugada syndrome

- Type1 brugada pattern is very common in SL.
- Majority -asymptomatic/minor symptoms(atypical CP)
- High risk of SCD when there is bradycardia.
- Bradycardia induced Ves can trigger VT/VF.
- Need to avoid betablockers if bradycardia.
- If there is syncope/VT/VF need to start isoprenaline infusion to prevent incessent arrythmia storms
- Need to offer ICD for high risk group for 1ry/2ry prevention of SCD

# THANK YOU


Time for Q& A