AVNRT

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HEAD OF CLINICAL CARDIAC PHYSIOLOGY

WEST HERTFORDSHIRE HOSPITALS NHS TRUST

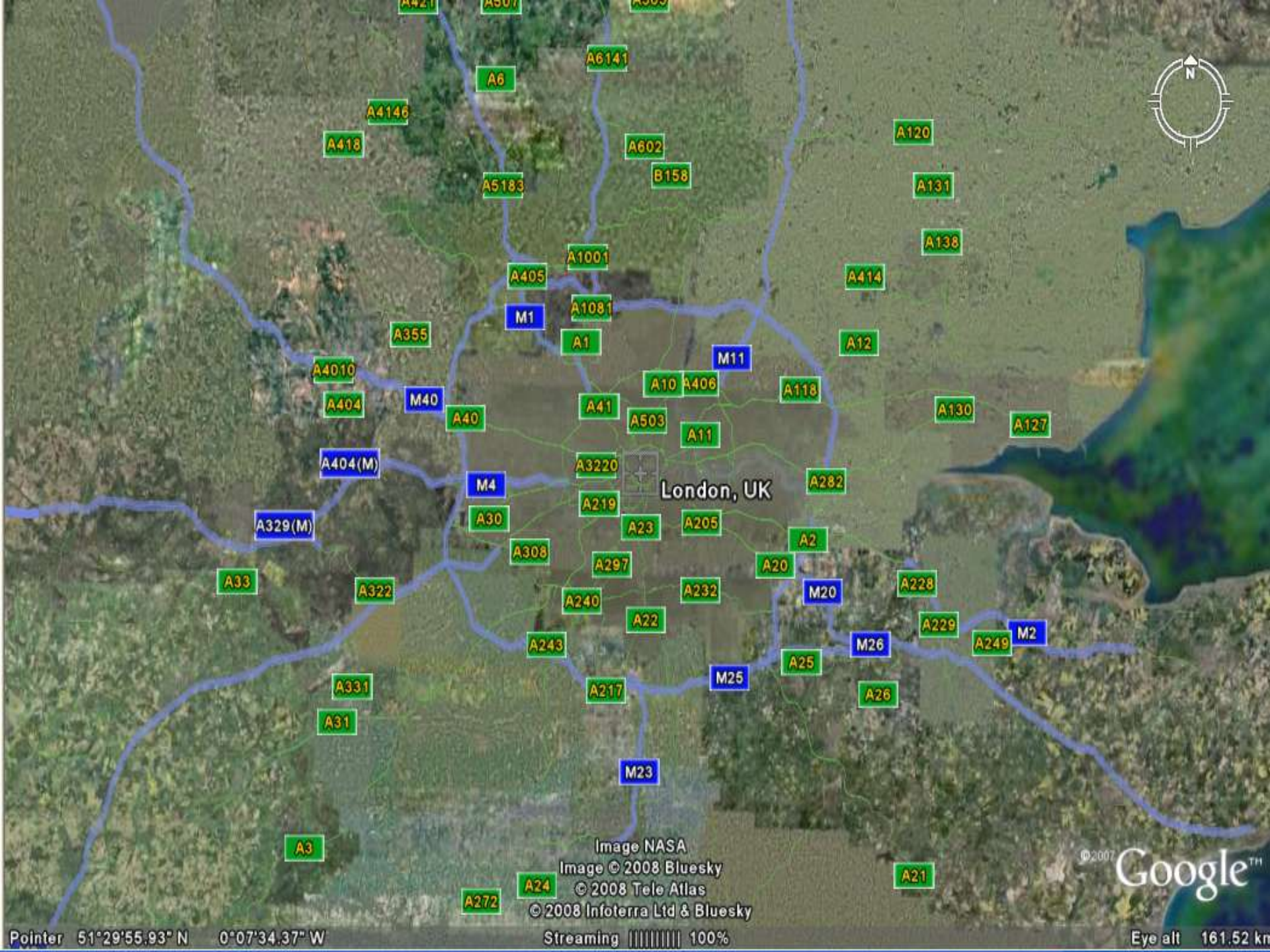
AV Nodal Re-entrant Tachycardia

- Re-entrant rhythm confined to the AV node

- The most common regular tachycardia
- Seen in all age groups although symptoms typically start after 20 years of age
- Seen in both genders but more common in females
- Usually occurs in the absence of structural heart disease
- Rates 150 – 250 bpm

AV Node

- First described in 1906
- Remains somewhat ill understood
- The AV node consists of a complex of fibres interposed between true atrial fibres and the His bundle.


A6141
A6
A4146
A418
A602
B158
A5183
A120
A131
A138
A1001
A405
A414
M1
A1081
A355
A1
A12
M11
A4010
A10
A406
A118
A404
M40
A41
A130
A40
A503
A127
A11
A404(M)
A3220
M4
London, UK
A282
A219
A329(M)
A30
A23
A205
A2
A308
A297
A20
A33
A322
A232
M20
A228
A240
A22
A229
M2
A243
M26
A249
A25
M25
A331
A217
A26
A31
M23
A3
A24
A21
A272
Image NASA
Image © 2008 Bluesky
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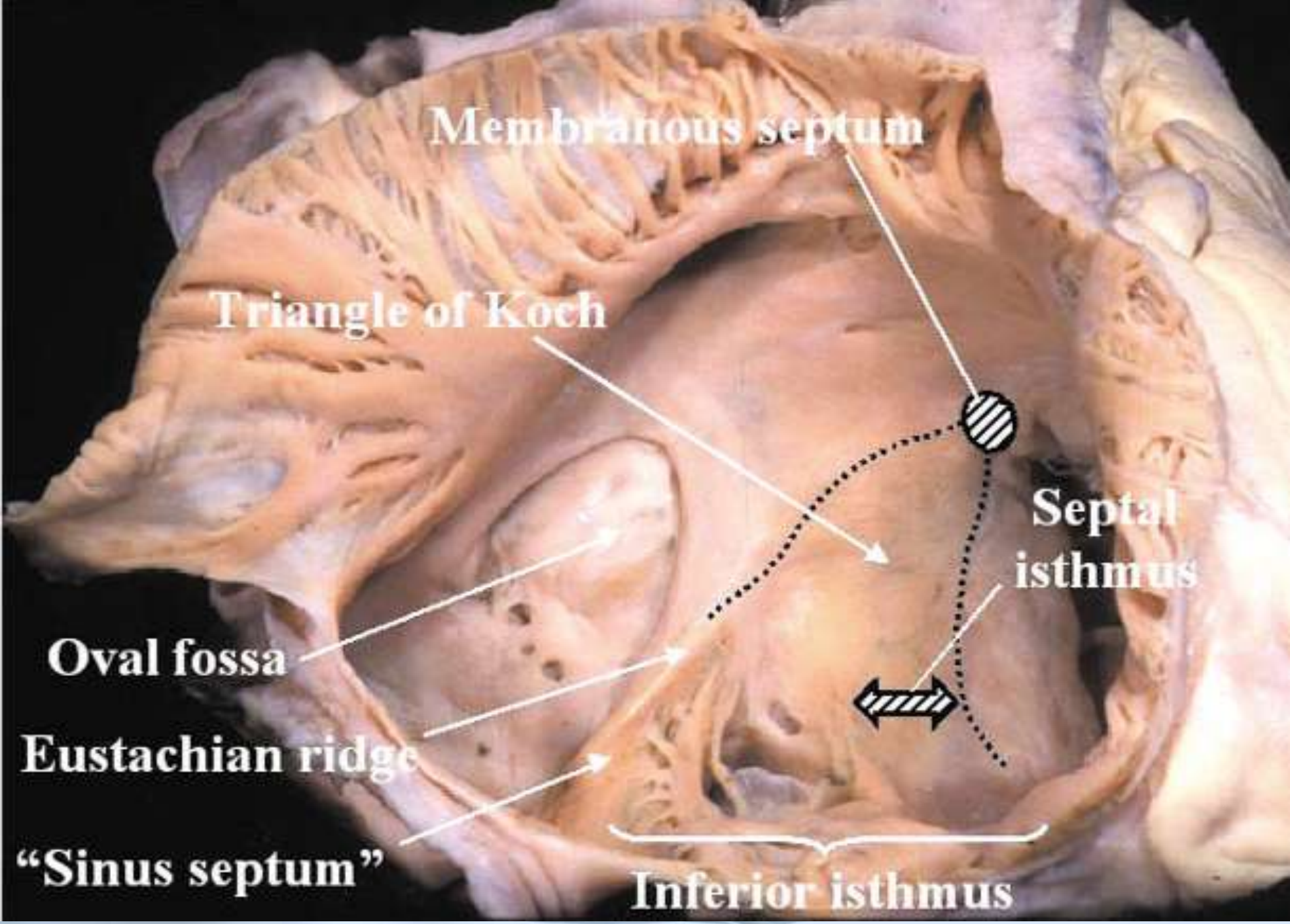
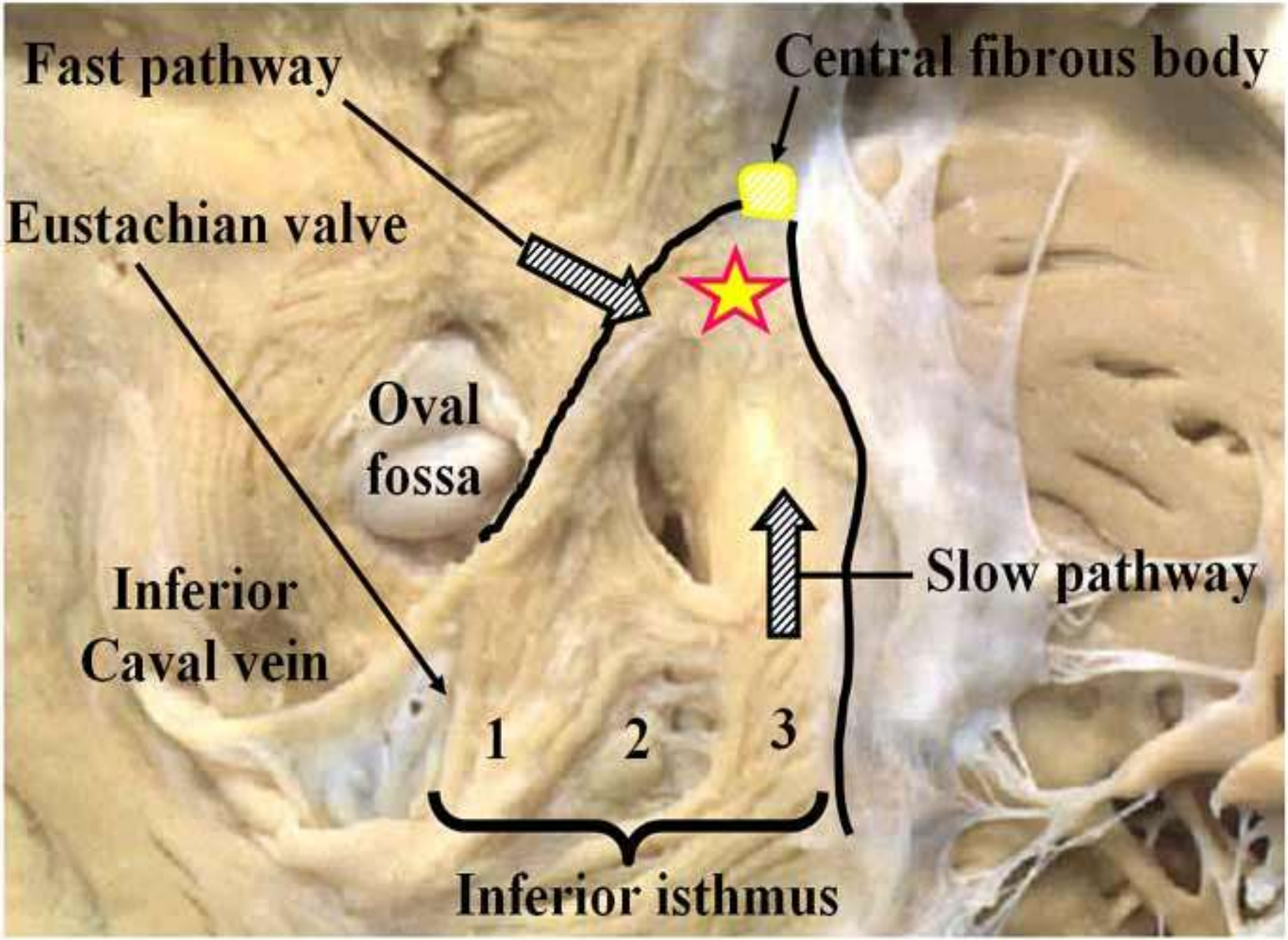
Pointer 51°29'55.93" N 0°07'34.37" W
Streaming 100%
Eye alt 161.52 km

- Two types of fibres known as the **fast pathway** and the **slow pathway** are responsible for two modes of AV transmission.

- **Fast pathway**
  Fast conduction, long refractory period

- **Slow Pathway**
  Slow conduction, short refractory period


Membranous septum
Triangle of Koch
Septal isthmus
Oval fossa
Eustachian ridge
"Sinus septum"
Inferior isthmus



Induction Mechanism

- Known as dual AV nodal physiology
- The fast and slow fibres form the circuit for AVNRT
- Atrial premature stimuli conduct first via the fast pathway but then switch to the slow pathway when very premature.

Speed: 25 mm/sec 10 mm/mV

12 Lead ECG

St. MARY'S HOSPITAL. LONDON. W2.

Differential Diagnosis

- Atrial tachycardia
- AVNRT
- AV re-entrant tachycardia (AVRT)
- Atrial flutter

The 12-Lead ECG in AVNRT

- **Narrow complex tachycardia**.

  A narrow QRS is produced when the ventricles are activated rapidly by the specialised His-Purkinje system.

- Each revolution of the circuit generates an impulse that exits the AV node via the His bundle to activate the ventricles.

Exceptions

The QRS in AVNRT can occasionally be broad if:

- Part of the His-Purkinje system fails to cope with the high rate (rate related bundle branch block)
- or where there is pre-existing conduction system disease.

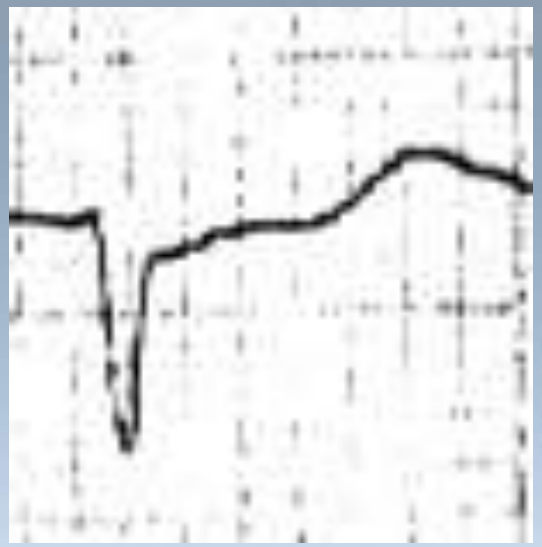
P waves in AVNRT

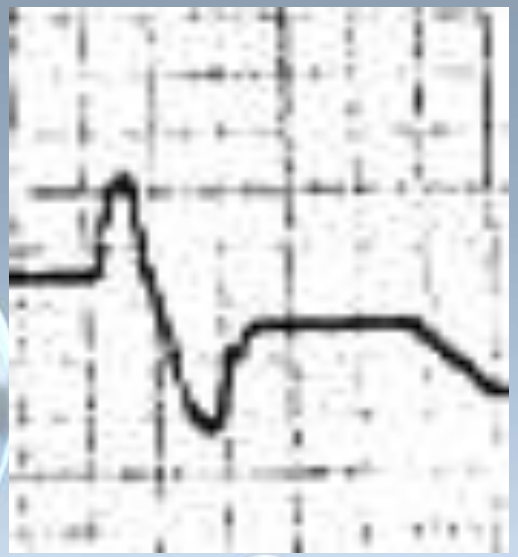
- Because atria and ventricles are activated simultaneously the P wave is either **buried within the QRS complex** or **inscribed just after it**

- The P wave is narrower than in sinus rhythm because left and right atria are activated simultaneously not sequentially

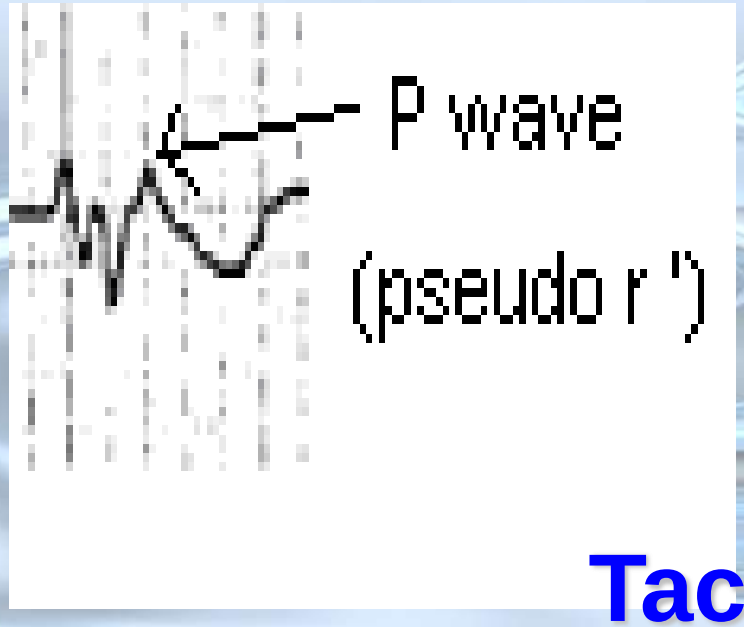
- Usually visible at the end of the QRS complex as a small negative deflection in the inferior leads and a small positive deflection in V1 – an appearance similar to incomplete RBBB.

Sinus rhythm

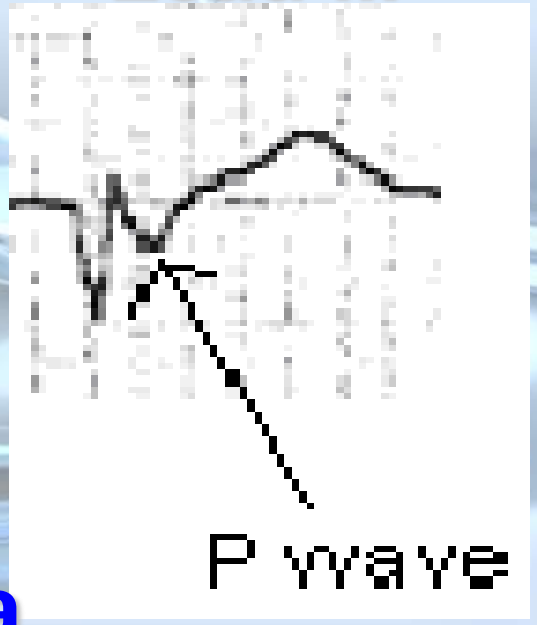




Lead V1



Lead III



Tachycardia

Canon Waves

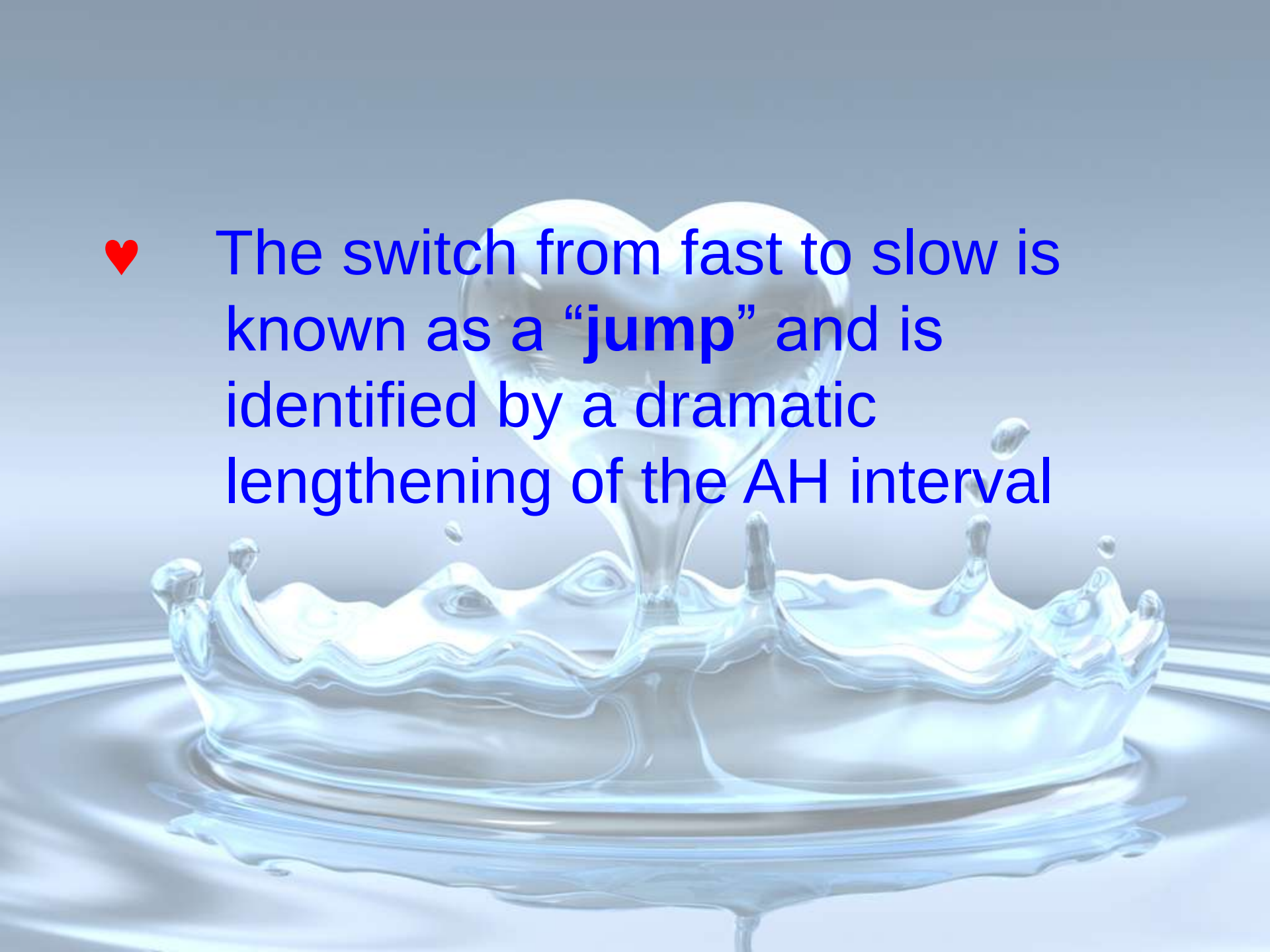
- In typical AVNRT simultaneous atrial and ventricular activation causes contraction of the atria against closed AV valves

- Produces retrograde pulses called **cannon waves** that patients feel as pulsing or pounding in the neck.

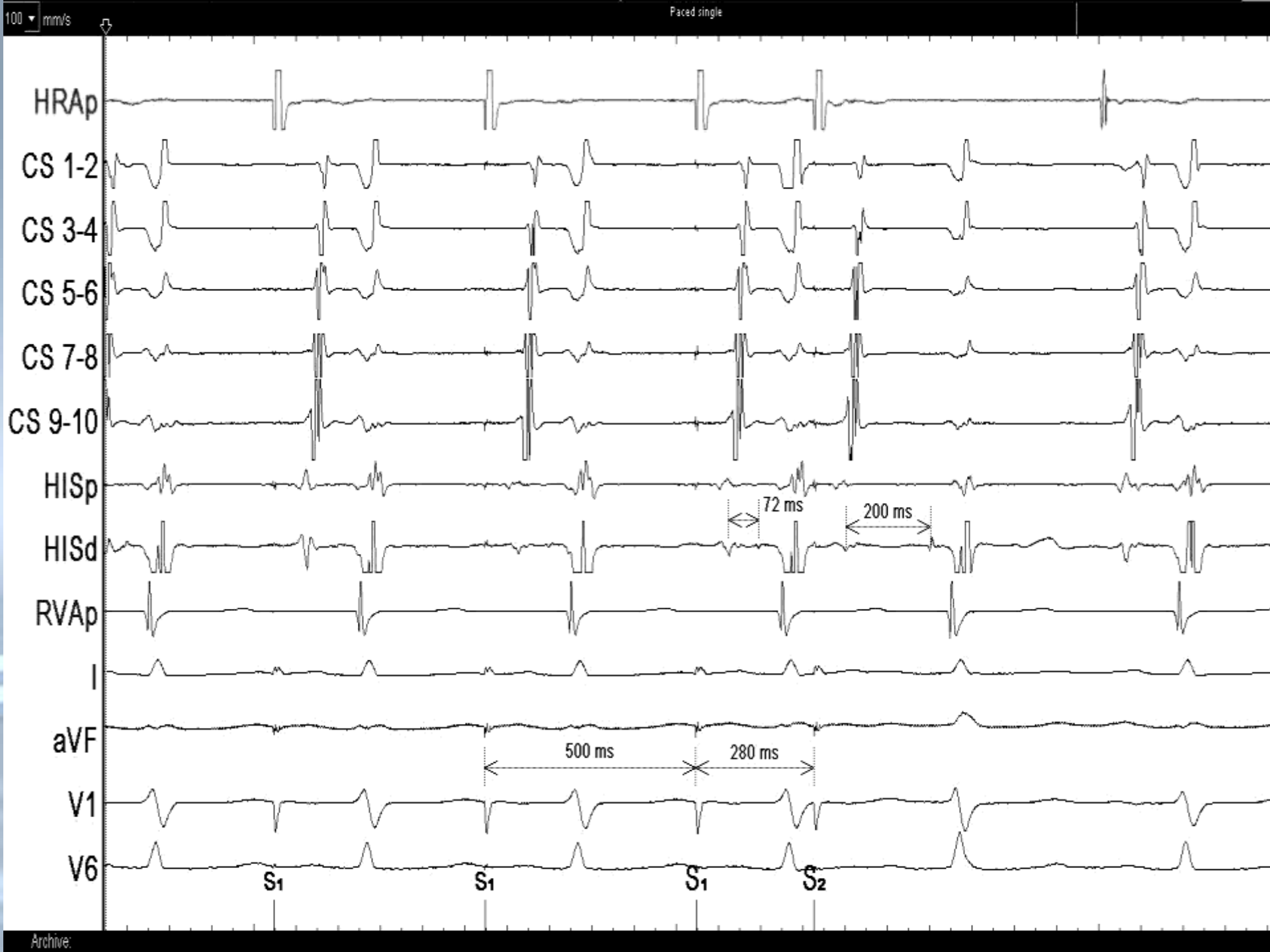
AVNRT and EP

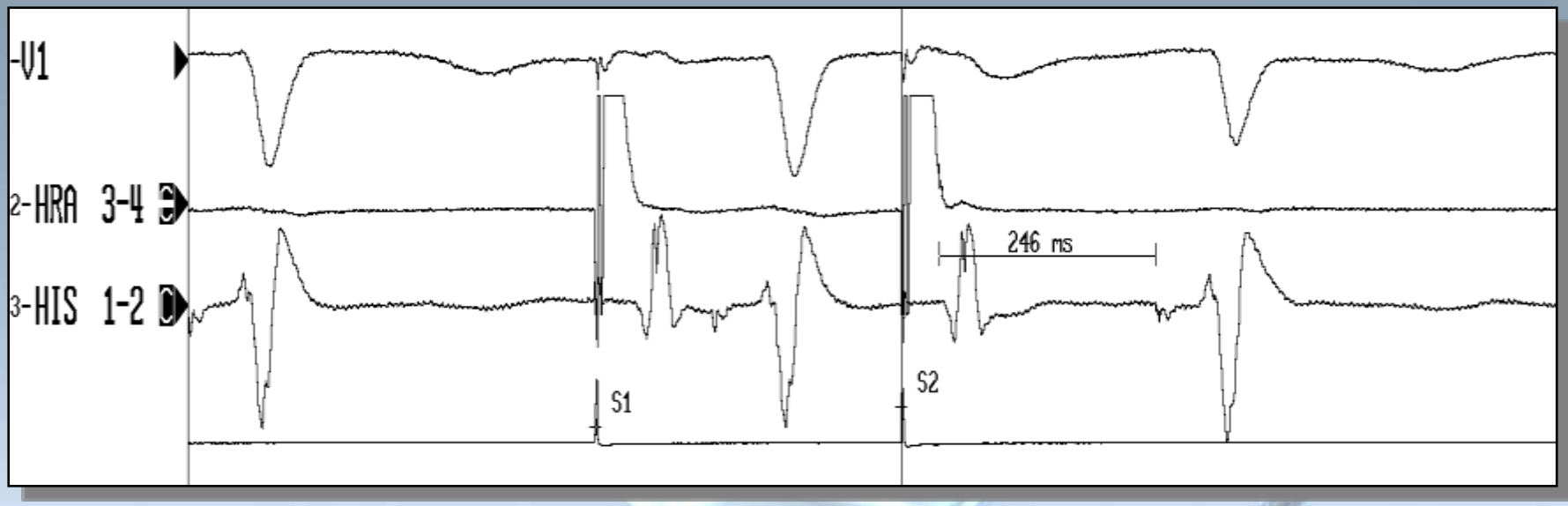
- Dual AV nodal physiology
- Initiation from premature atrial ectopic
- Simultaneous activation of atria and ventricles

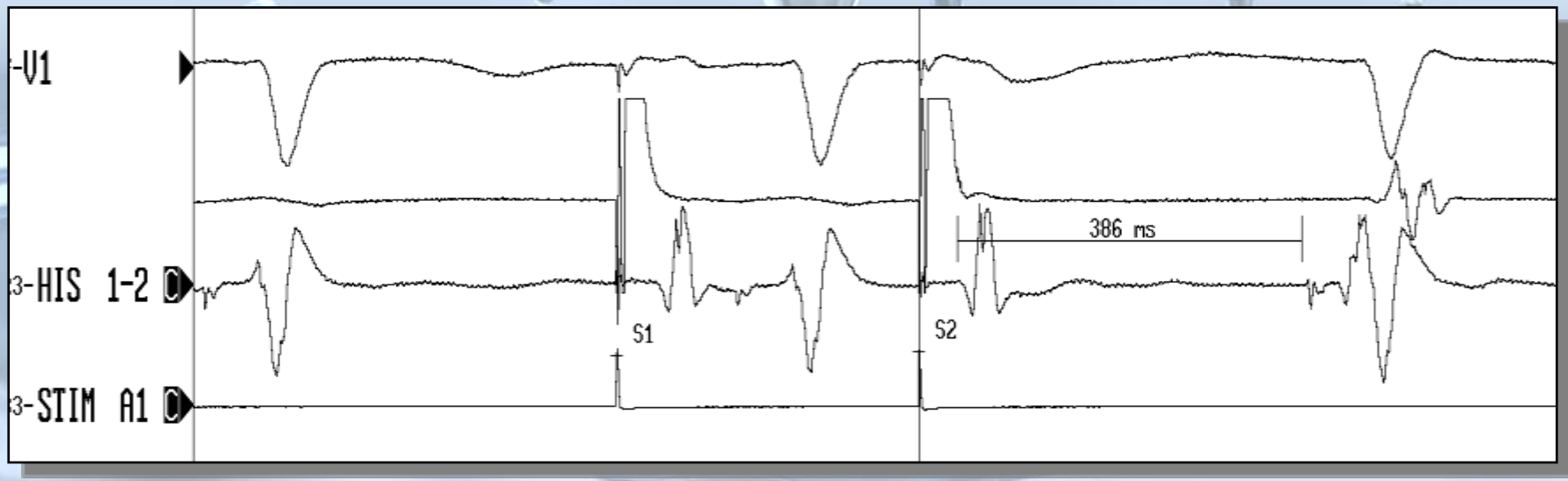

28
29
30
HRAp
CS 1-2
CS 3-4
CS 5-6
CS 7-8
CS 9-10
HISp
HISd
RVAp
I
aVF
V1
V6
Wires Speed: 100 mm/s



- The switch from fast to slow is known as a “**jump**” and is identified by a dramatic lengthening of the AH interval


100 mm/s
Paced single
HRAp
CS 1-2
CS 3-4
CS 5-6
CS 7-8
CS 9-10
HISp
HISd
RVAp
I
aVF
V1
V6
72 ms
200 ms
500 ms
280 ms
S1
S1
S1
S2
Archive:





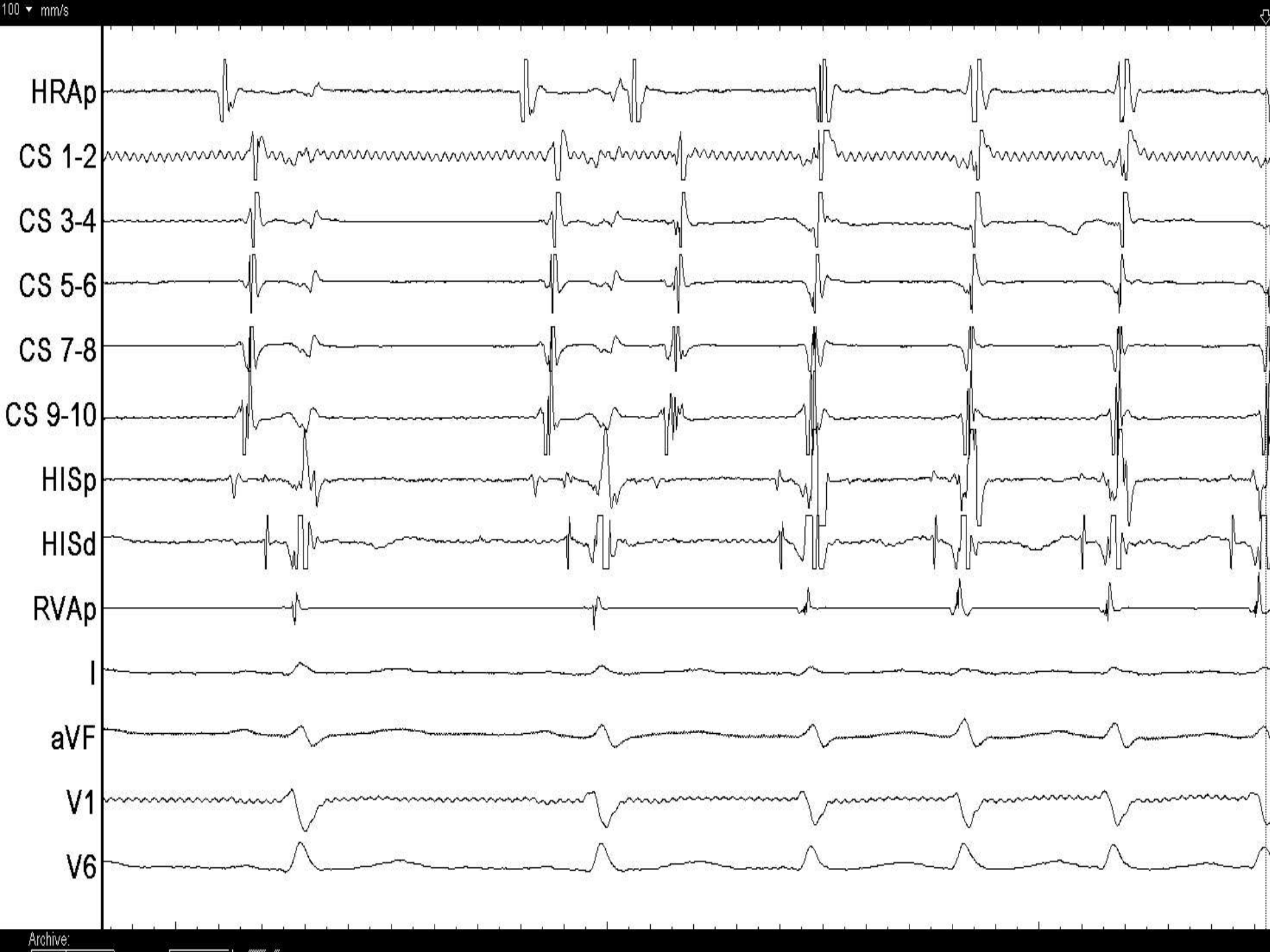
Courtesy of SJM

AV Nodal Echo

- Under the right conditions an impulse conducted via the slow pathway may retrogradely enter the fast pathway and re-activate the atria.
- This represents half a circuit of AVNRT and is known as an **echo**.

Typical AVNRT – the complete circuit

- A premature atrial beat “blocks” in the fast pathway but is conducted toward the compact AV node by the slow pathway.
- The impulse emerges from the compact node via the His bundle to activate the ventricles
- Simultaneously activates the atria via the fast pathway and completes the circuit by re-entering the slow pathway.


100 mm/s
HRAp
CS 1-2
CS 3-4
CS 5-6
CS 7-8
CS 9-10
HISp
HISd
RVAp
I
aVF
V1
V6
Archive:

Reset and Entrainment

- Using these manoeuvres you can identify whether the ventricles are part of the circuit
- AVNRT is confined to the AV node
- If ventricles are remote from the circuit you can eliminate AVRT
- VAAV response indicates Atrial Tachycardia

Termination of AVNRT

- Interventions that affect AV conduction can help terminate AVNRT.

  E.g. Carotid sinus massage or Valsalva manoeuvres.

- Drugs that cause AV block such as Adenosine

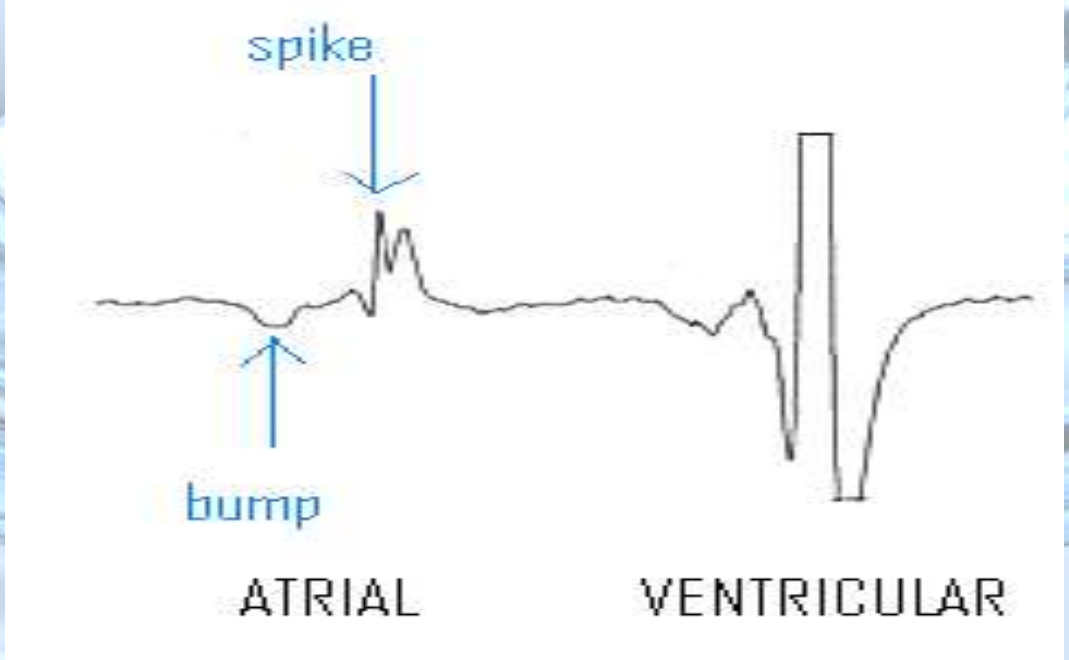
- These manoeuvres terminate other tachycardias that involve the AV node such as AV re-entry tachycardia (AVRT).

- Patients often develop their own techniques for stopping attacks, such as breath holding, straining or crouching.

Treatment

- Modification of the AV node - Slow pathway ablation
- The slow-pathway is located in the infero-posterior septum, close to the coronary sinus ostium.

- Ablation may be guided by **slow pathway potentials** also referred to as “bump and spike”.
- These correlate with sites of successful ablation but it is not certain exactly what the bump and spike represent.



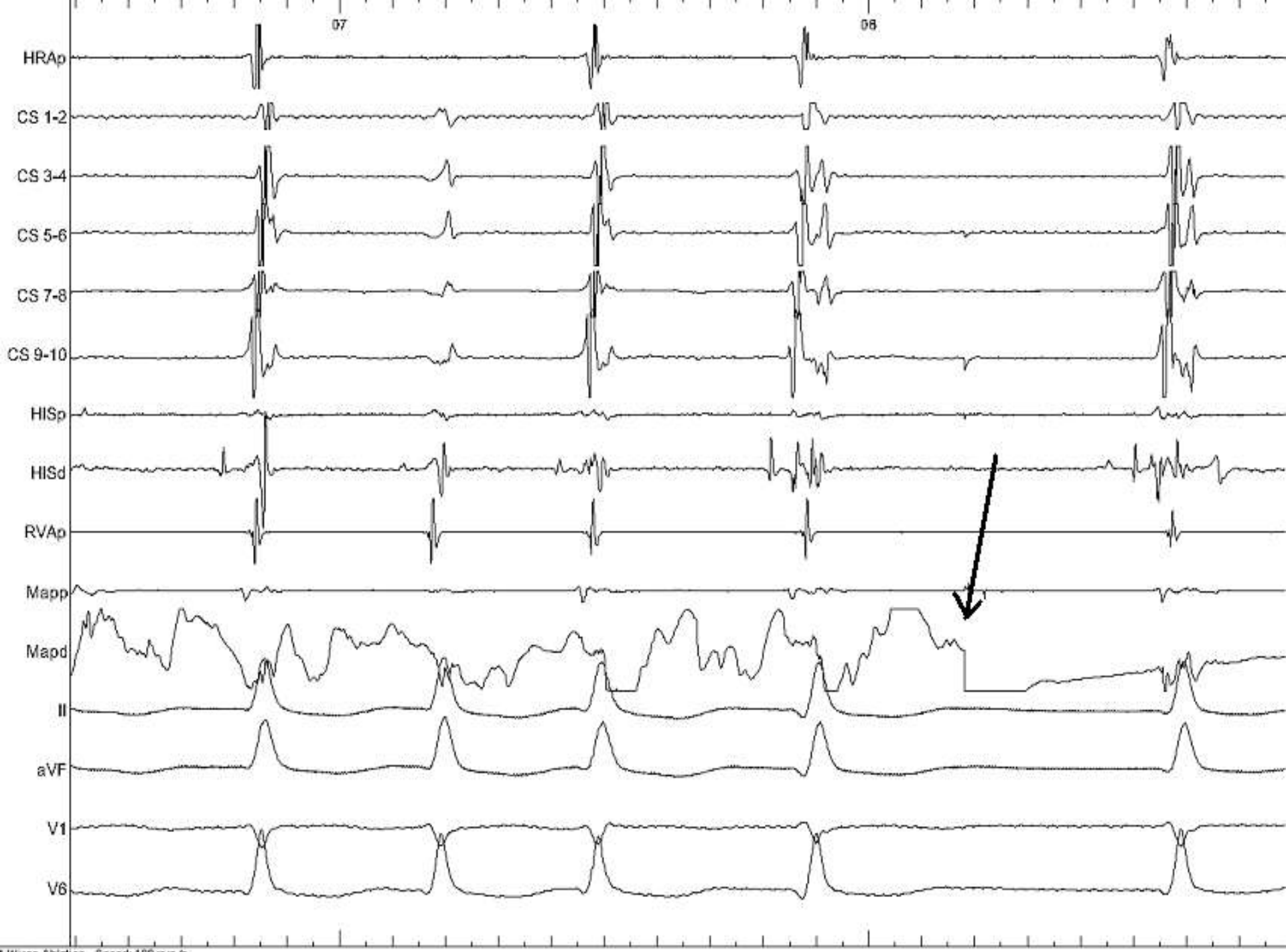
- Heat generated by ablation usually provokes an accelerated junctional rhythm - each junctional beat is preceded by a His spike.
- Slow **junctional rhythm** during ablation correlates with procedural success.
- Fast junctional activity may be associated with AV node damage.


24
25
HRAp
CS 1-2
CS 3-4
CS 5-6
CS 7-8
CS 9-10
HISp
HISd
RVAp
Mapp
Mapd
II
aVF
V1
V6
4 Wires Ablation Speed: 100 mm/s

- The most significant complication of ablation is AV block requiring a **permanent pacemaker** – a risk usually quoted at around one percent.

- During ablation the operator(s) must scrutinise the signals for any sign of impaired AV node function.

- Ablation is stopped immediately if this occurs or if interpreting the signals becomes difficult.


07
08
HRAp
CS 1-2
CS 3-4
CS 5-6
CS 7-8
CS 9-10
HISp
HISd
RVAp
Mapp
Mapd
II
aVF
V1
V6
4 Wires Ablation Speed: 100 mm/s