AVNRT: AtrioVentricular Nodal Reentrant Tachycardia or reentrant paroxysmal junctional tachycardia by double nodal or intra-nodal pathway

Other names:

1) Atrioventricular nodal reentrant tachycardia (AVNRT)

2) Reciprocating tachycardia** of the AV junction.

* It beings and ends abruptly
** Return of any impulse to its place of origin.

Tachycardia by atrioventricular nodal reentrant tachycardia (AVNRT)

Concept: Paroxysmal tachyarrhythmia (sudden onset and end), with anatomical base in the intranodal reentry or in perinodal atrial tissue by double conduction in the junction region (longitudinal dissociation) by the existence of two pathways with different electrophysiological properties with differential refractoriness (patways α and β) that determine a rapid pathway (β) and a slow one (α) that causes functional unidirectional block initially in the β pathway by haivng a more prolonged refractory period and greater velocity: rapid pathway or reciprocal way: as we see, this is a reciprocal rhythm the initial impulse of which may originate either in the sinus node, the atria, the junction or the ventricles, which establishes an atriovetnricular activation motion as a consequence of the double nodal pathway.

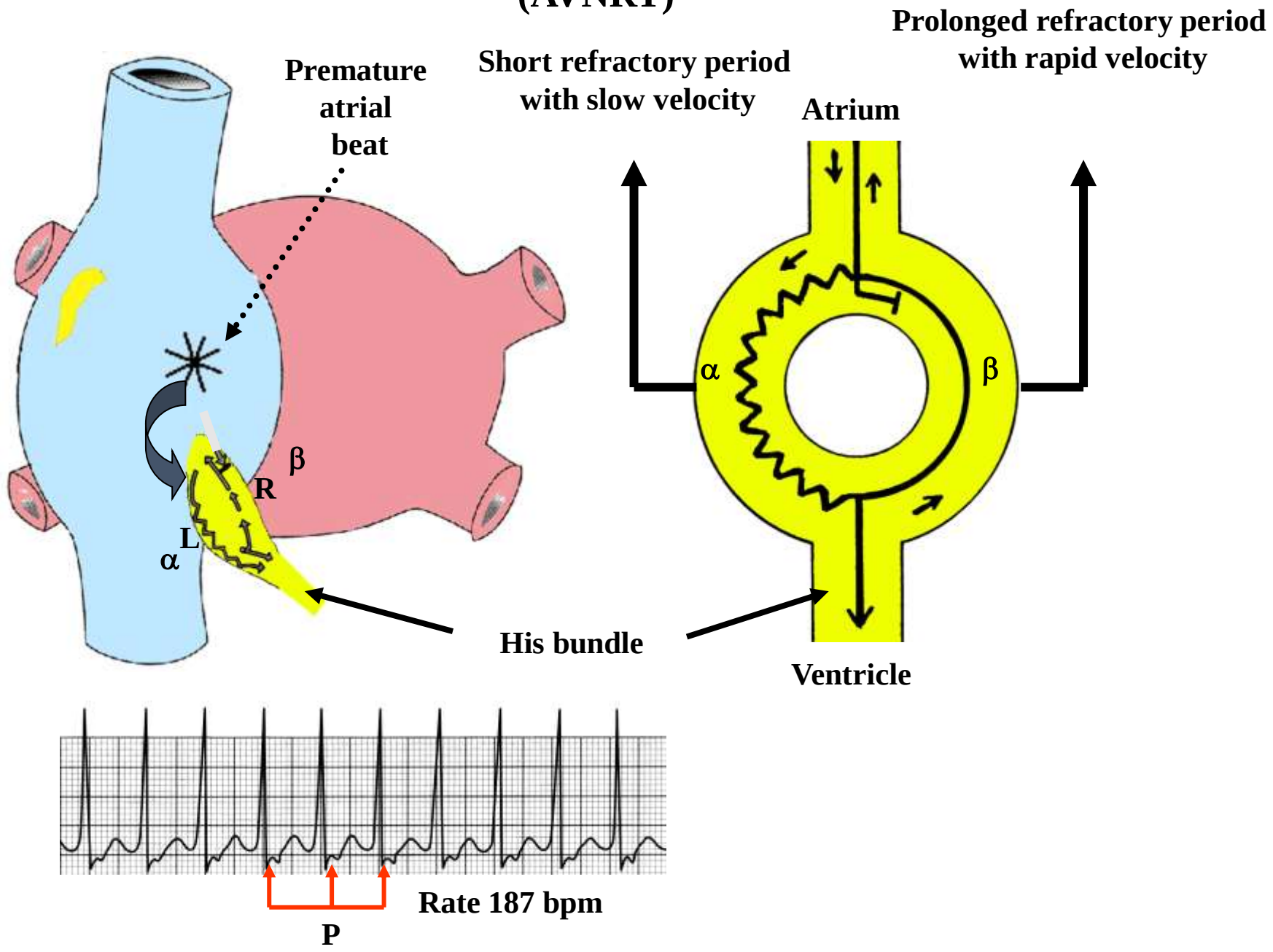
Etiologies

1) No underlying heart disease. The most frequent one;
2) Mitral valve prolapse;
3) Hyperthyroidism;
4) Athrosclerotic coronary insufficiency;
5) Hypertensive heart disease;
6) Cardiomyopathies;
7) Pericarditis;
8) Hydroelectrolytic alterations;
9) Congenital heart diseases: ASD, Eisenmenger complex;
10) Gestational: pregnancy may trigger runs of PSVT as first event in 34% of the cases or may increase the rate of the crises in 28%.

Gender: female predominance (75% of all cases). Age: 20 to 50 years.

Estrogens, by increasing the number of peripheral autonomic receptors, increase sensitivity to catecholamines, which are released in a greater degree in pregnancy, fostering nodal reentry in 60% and macroreentry by concealed or manifest accessory pathway (WPW) in 15% to 30%.

Physiopathogenic mechanism of atrioventricular nodal reentrant tachycardia (AVNRT)



Physiopathogenic mechanism by atrioventricular nodal reentrant tachycardia (AVNRT)

A premature atrial contraction reaches the junction where it finds the fast β pathway even in the refractory period, getting blocked. On the contrary, the early atrial stimulus finds the α pathway outside the refractory period, which allows the slow passage of the stimulus, being able to return in a retrograde fashion, penetrating into the fast β pathway –now outside the refractory period- perpetuating the event in a repatitive way (successive reentries); a run of reciprocating tachycardia by junctional reentry. In the AN region of the AV node, two trajectories or pathways are described by the presence of cells with different refractory periods: α β responsible for the appearance of functional longitudinal dissociation.

α or slow pathway: of posterior location, near the coronary sinus. Characterized by having a short refractory period and less velocity: slow pathway. The supraventricular stimulus advances slowly in an anterograde fashion by this pathway in 80% of the cases.

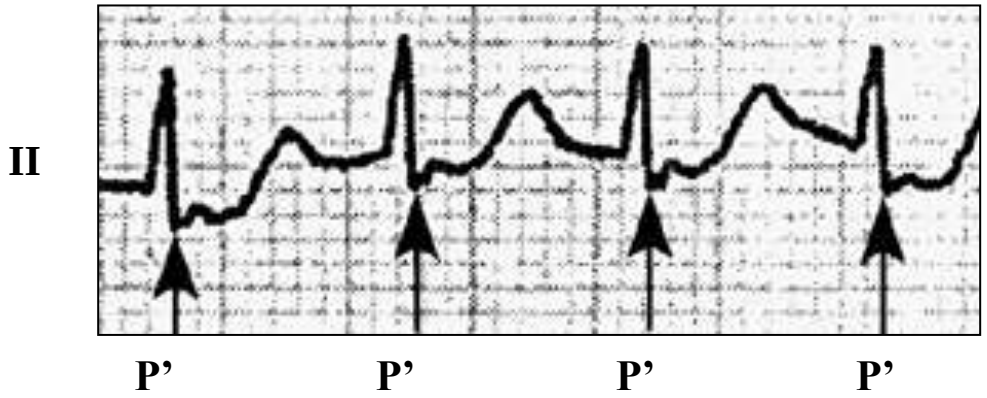
β or fast pathway: usually located anteriorly along the septal portion of the tricuspid annulus in the antero-superior portion of the AV node, with prolonged refractory period and greater velocity: fast pathway. The stimulus from the atrium is initially blocked by the meeting of cells in the refractory period; however, it may return to the atrium in a retrograde manner, using this pathway: atrial echo.
The fast pathway is usually anteriorly situated along the septal portion of the tricuspid annulus with the slow pathway situated posteriorly, close to the coronary sinus ostium.

Classification of AVNRT

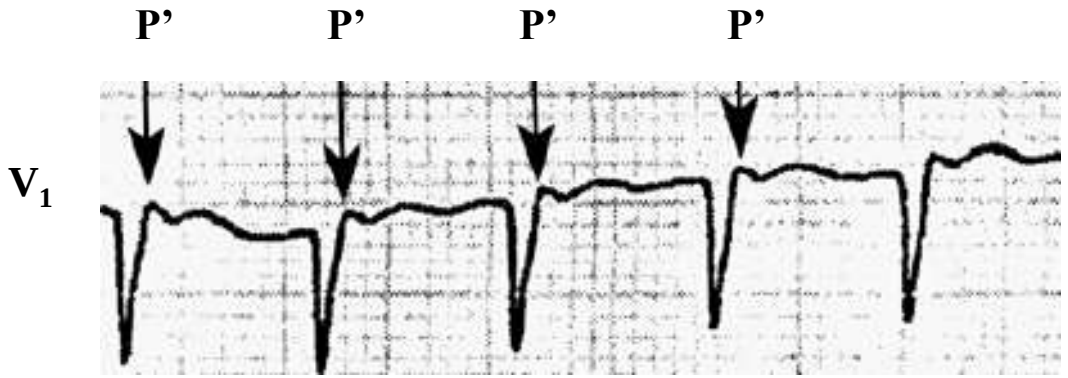
I) Typical variety or “slow-fast”: 80% of cases.
II) Atypical varieties (**Dasso2012**)

- “Fast-slow”
- “Slow-slow”
- “Slow-intermediate”

I) Typical, common or “slow-fast” AVNRT: In this variety, a premature atrial stimulus is blocked in the fast pathway, but is conducted slowly to the ventricles reentering into the atrium in a retrograde manner by the fast pathway already recovered, which could be perpetuated. The reentrant circuit is in the AV node and the surrounding atrial myocardium. In this regular tachycardia of narrow QRS, the P wave could be concealed behind QRS but it eventually forms a pseudo r’ wave in V1 or pseudo S in inferior leads.



In inferior leads, P’ may distort the end of QRS originating a false S.



In V1, the P’ wave may distort the end of QRS, simulating an R’ during the event, not being observed during sinus rhythm. The ventriculo-atrial time is very short in this variety.

In brief, in this typical, common or “slow-fast” variety, the impulse travels toward the ventricles using the slow pathway and returns to the atria by the fast pathway. Retrograde P (P´) or atrial echo occurs at the end of QRS and represents 90% of all cases. Spontaneous ending often occurs in the fast pathway with the vagal stimulus as a massage on the carotid sinus or adenosine, with the latter acting in the slow pathway.

- **II) Atypical, uncommon or “ fast-slow ” AVNRT:** In this case, the impulse travels through the fast pathway toward the ventricles and returns to the atria by the slow pathway. Retrograde P’ is concealed behind the QRS complex. This variety represents only 6% of all cases.
- **III) A third and even more rare variety (only 4% of all cases) is called “slow-slow” AVNRT**. In this case, the impulse follows a complex pathway through the AV node and the surrounding area.
- IV) Finally, there is a “slow-intermediate” form.

Electrocardiographic characterization

Heart rate: between 150 and 250 bpm (usually less than 200 bpm)
Atrial rate equal to ventricular rate.
QRS duration: ≥100 ms and normal aspect is most frequent.
Onset and end: paroxysmal. The first, generally after premature atrial (or ventricular) contraction that conducts with prolonged PR, which precipitates nodal reentry: reciprocal rhythm with impulses of atrial origin. The sudden end is determined by retrograde P followed occasionally by a short period of asystole or bradycardia. Occasionally the reciprocal rhythm may originate at the junction or be ventricular.

The polarity of ectopic P that triggers tachycadia (the first) is different from the rest of the posterior Ps: if of atrial origin, polarity is positive in inferior leads, while posterior Ps are of inverted polarity by retrograde activation. This element is significant to differentiate from automatic paroxysmal tachycardia.

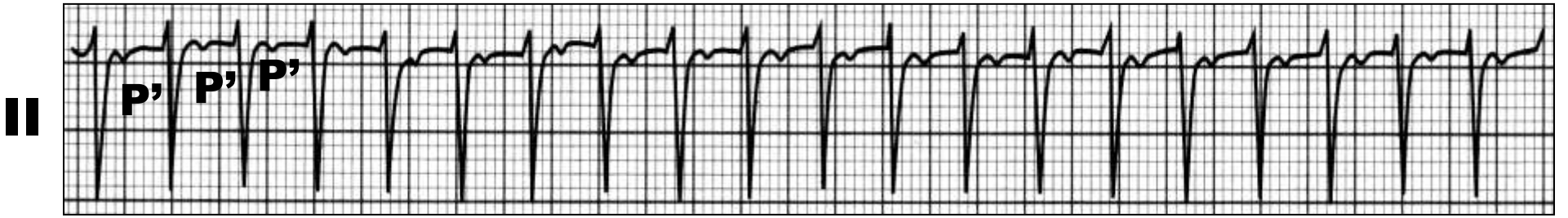
The time relation of P/QRS is very important and could be: P preceding QRS: 3%.

P waves of retrograde activation precede QRS complexes, and may simulate q waves in inferior leads. Concomitant P with QRS: 60% of cases. Atria and ventricles activated simultaneously.

P remains concealed by QRS or may modify the onset of the complex (30%). In these cases, the esophageal lead may identify the P wave and the R-P’ interval (V-A time) always <70 ms.

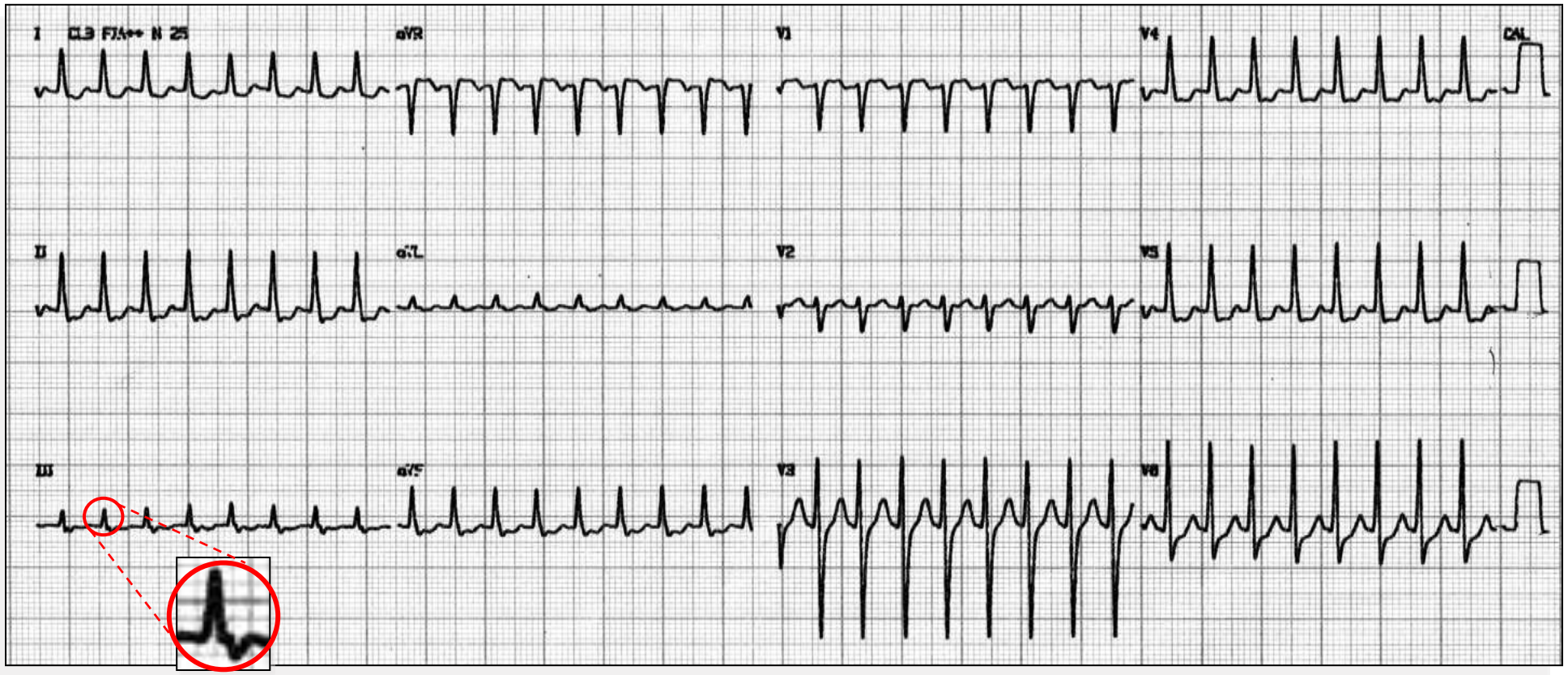
This estimation is useful to differentiate from accessory bundle reentry, which is >70 ms; that is to say, the patients with reciprocal tachycardia that use extra-nodal accessory pathway present an earlier time from the onset of ventricular depolarization until atrial activation; always >70 ms, and using the esophageal lead >95 ms.

Atrioventricular nodal reentrant tachycardia (AVNRT)



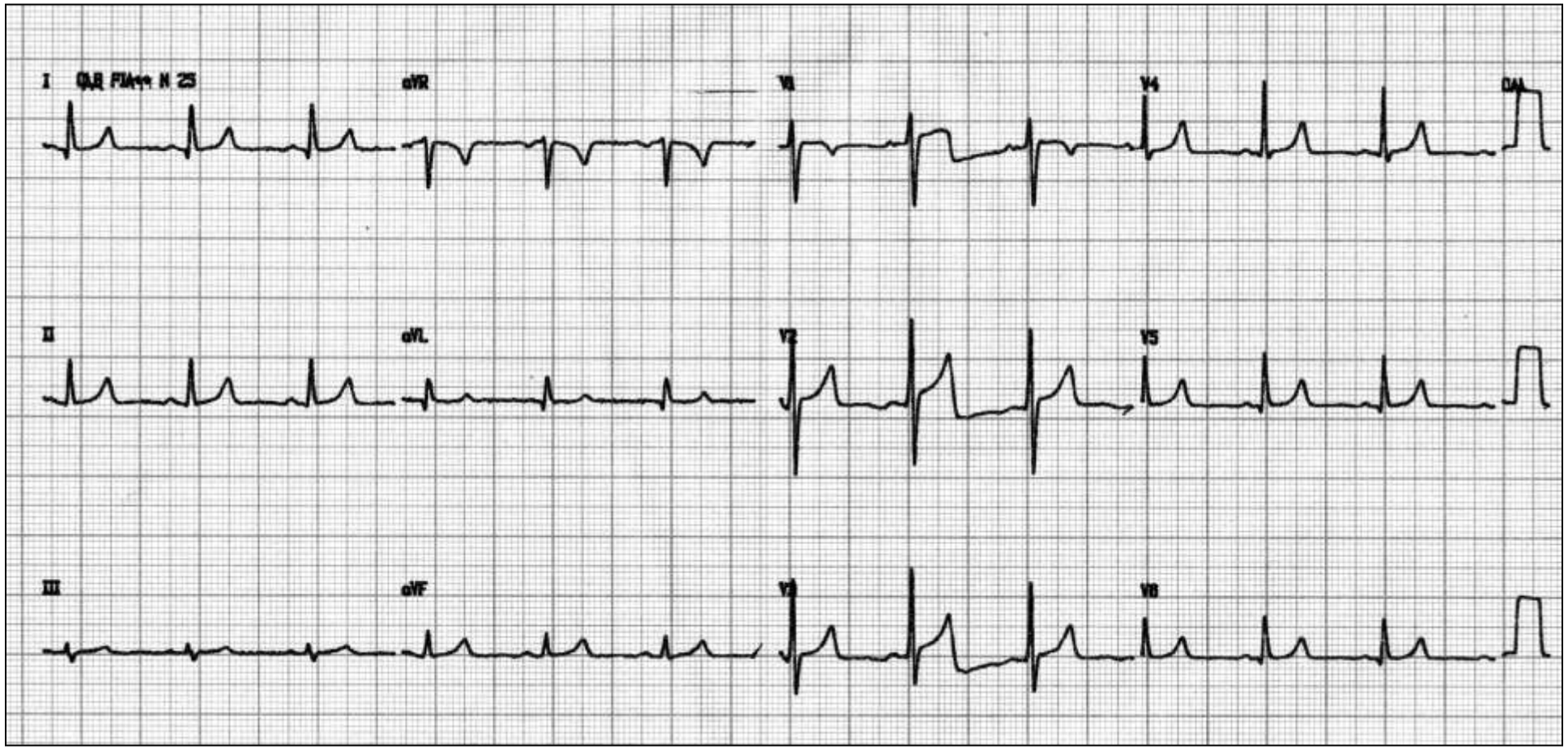
Check the retrograde P wave next, of QRS and with the same heart rate of 187 bpm.

Atrioventricular nodal reentrant tachycardia (AVNRT)



Narrow, regular QRS complexes (<100 ms), HR: 214 bpm. S wave is in III (presence of P wave in the ST segment).

The same patient minutes after the event of atrioventricular nodal reentrant tachycardia (AVNRT)



Positive predictive value and prevalence of basal observations and the characteristics of tachycardia by its mechanisms during electrophysiology study for paroxysmal supraventricular tachycardia				
Basal observations and characteristics of tachycardia	**Prevalence (%)**	**Positive predictive value (%)**		
		AVNRT	ORT	AT
Preexcitation present during sinus rhythm	15	10	86	3
Extranodal response to para-Hisian stimulation	18	17	83	0
Cycle length of VA block >600 ms at the basal moment	11	41	5	55
Interval septal VA >70 ms	53	17	59	24
Eccentric atrial activation	31	0	76	24
Eccentric atrial activation	10	60	0	40
Spontaneous termination with AV block	28	66	34	0
Development of left bundle branch block	12	4	92	4
Increase of VA interval >20 ms with branch block	7	0	100	0

AVNRT: Atrioventricular nodal reentrant tachycardia
ORT: Orthodromic reciprocating tachycardia
AT: Atrial tachycardia

Differential diagnosis between atrioventricular nodal reentrant tachycardia (AVNRT) and by anomalous pathway through accessory bundle (ORT/CMT)

ECG signs	AVNRT	CMT/ORT
Alternating QRS complexes	Rare	Common
Initial P´R	Prolonged	Normal
Location of P' wave	Within QRS. It may cause pseudo S wave in inferior leads or pseudo r' wave in V1	Always separate from QRS
P' wave polarity	Negative in II, III and aVF.	Variable depending on the location of the accessory bundle. If the P wave is negative in I, the diagnosis is left accessory bundle
Aberration	Rare	Common
Heart rate during aberration compared to non-aberration	It doesn't change	It may decrease with aberration, bundle branch block at the same side as the accessory bundle
AV conduction	Usually 1:1	Always 1:1

Prognosis: usually good in absence of structural heart disease. Most patients respond to medication. Radiofrequency therapy is healing in approximately 95% of cases with low risk of complications, and it is the method of choice in most patients. Cryoablation is safe and efficient in children and young people.

Complications

1. Hemodynamic compromise
2. Congestive heart failure
3. Syncope
4. Angina induced by tachycardia
5. Myocardiopathy
6. Myocardial ischemia
7. Myocardial infarction

Management (Blomström-Lundqvist 2003; Femenia 2012)

The patients should be instructed about vagal maneuvers which may end events, such as carotid sinus massage and forced expiration against a closed glottis. Other alternatives include: adenosine, beta-blockers and calcium antagonists that block or slow down the slow pathway. Cardioversion is rarely used, unless marked hypotension or cardiac failure occurs.

The therapy with radiofrequency is indicated in patients with frequent attacks and loss of quality of life and in whom the drugs prove to be inefficient. Energy is applied in the slow pathway. The success of the procedure is more than 90%. Supra-hisian complete AV block is a rare complication of 0.2% to 1%.

Radiofrequency therapy could be by the anatomical technique that considers only the X-ray image or guided by intracavitary electrograms. The success criterion of slow pathway ablation is the impossibility of inducing AVNRT with the same protocol of simulation as before the ablation.

In children and young adults there is greater danger of AV block. Cryoablation is a low risk and efficient option. (Hanninen 2013).