

Case report from:



Adrian Baranchuk, M.D. FACC FRCPC

Associate Professor of Medicine and Physiology - Cardiac Electrophysiology and Pacing - Director, EP Training Program - Kingston General Hospital - FAPC 3, 76 Stuart Street K7L 2V7, Kingston ON Queen's University - Canada

ECG analysis from:



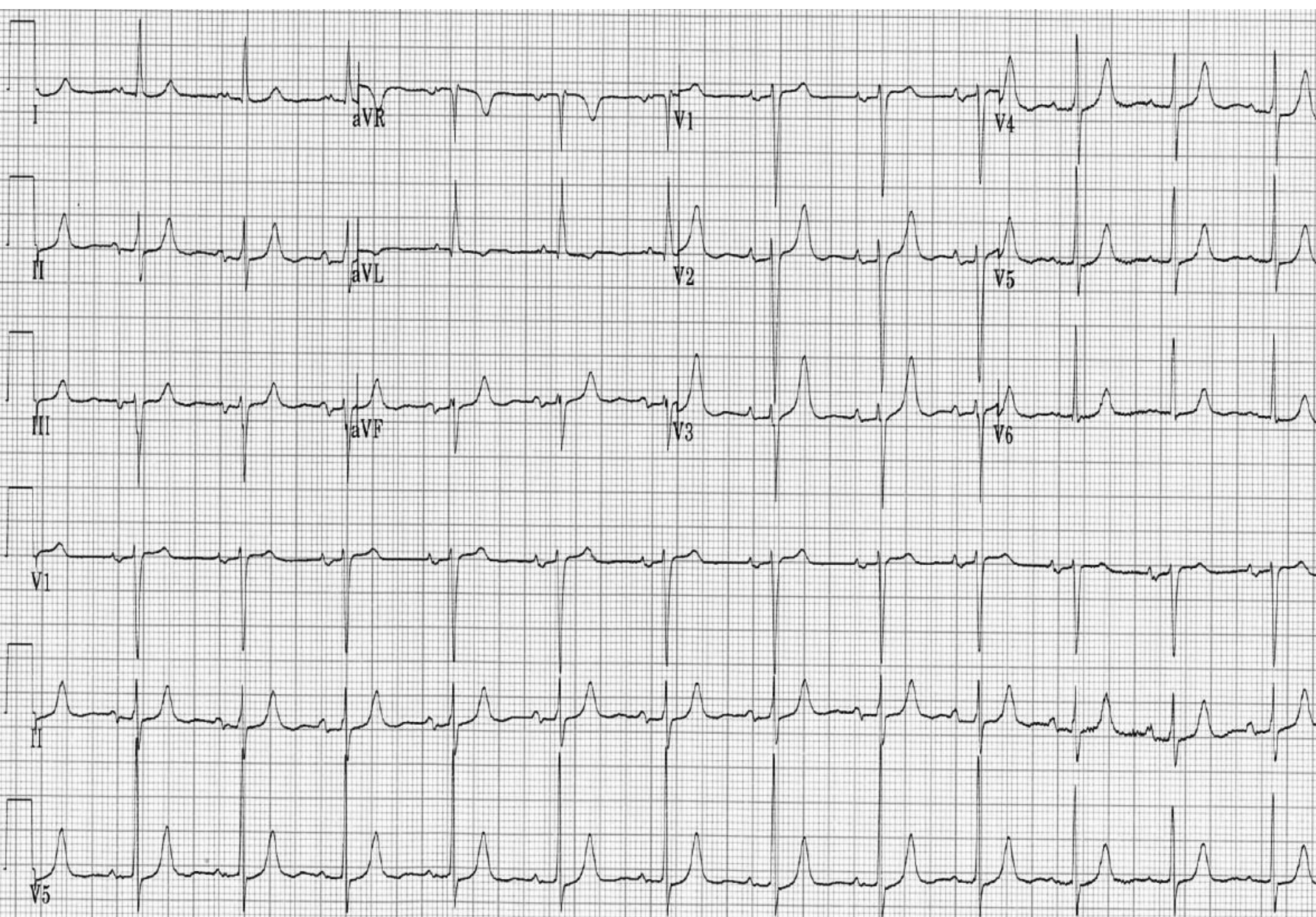
Andrés Ricardo Pérez-Riera, M.D.Ph.D.

In charge of the Electro-vectorcardiography Sector – Cardiology Discipline ABC Faculty of Medicine - ABC Foundation - Santo André – São Paulo – Brazil

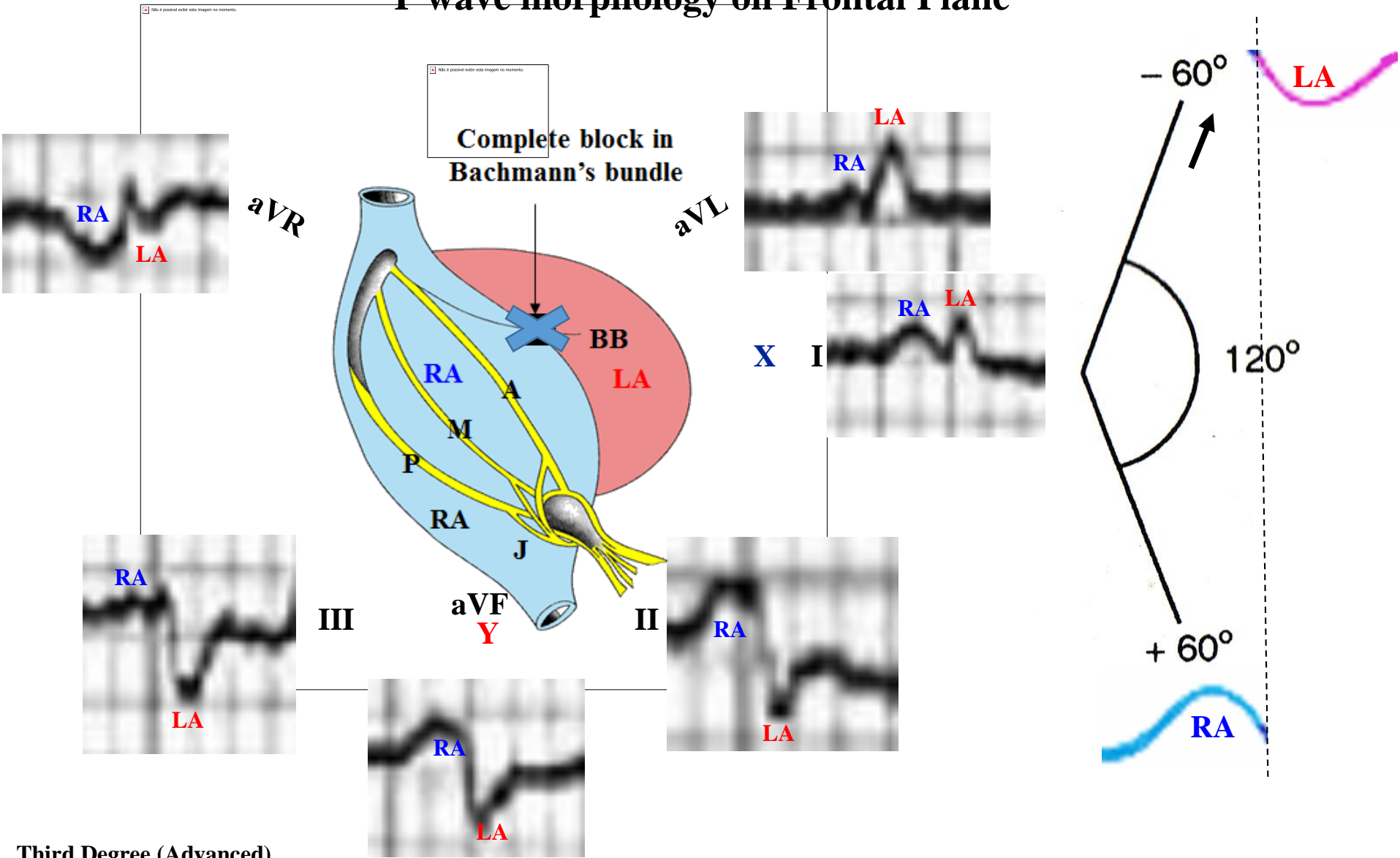
Raimundo Barbosa-Barros, M.D.

Specialist in Cardiology by the Brazilian Society of Cardiology (SBC)
Specialist in Intensive Care by the Sociedade Brasileira de Terapia Intensiva
Chief of the Coronary Center of the Hospital de Messejana Dr. Carlos Alberto Studart Gomes. Fortaleza - Brazil

Which is the ECG diagnosis? Case from Adrian Baranchuk.



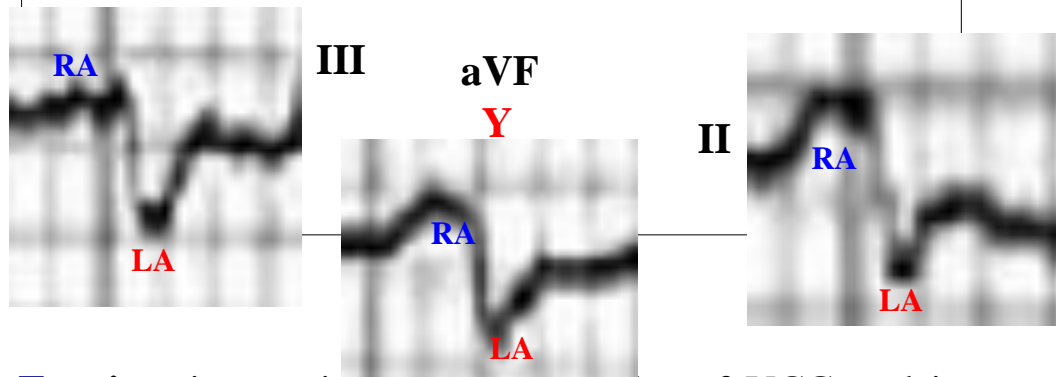
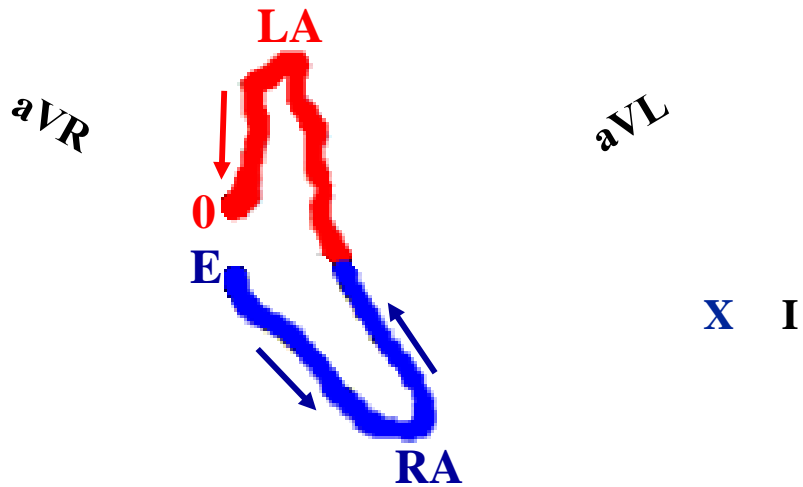
P wave morphology on Frontal Plane



Third Degree (Advanced)

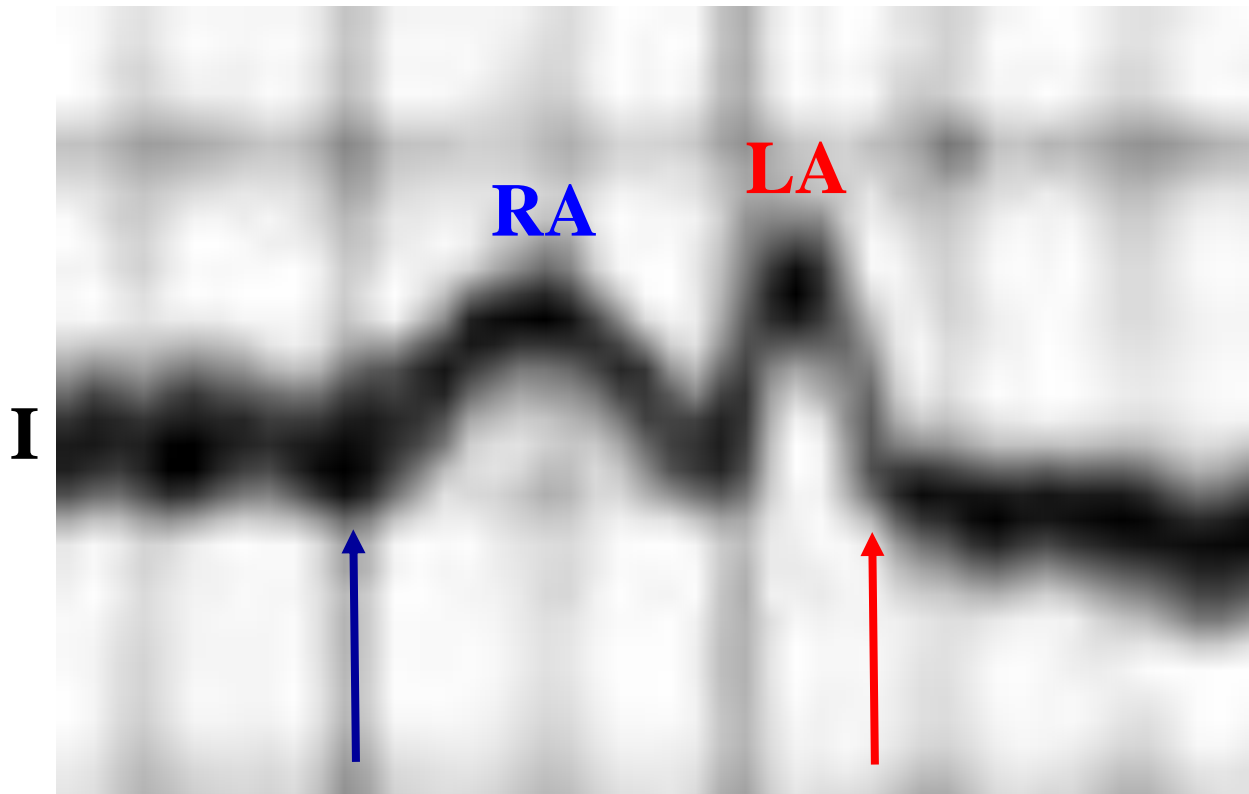
Electrical impulse is blocked/delayed in Bachmann's muscular interatrial bundle (BB), but retrograde left atrial activation usually occurs. (Ariyarajah 2005) Note the existence of an open angle between the vector of the first portion of P wave (RA) and the last portion (LA). Electrophysiological study demonstrates retrograde activation of the LA. Consequently P loop/wave in orthogonal lead "Y", aVF and III is biphasic plus-minus \pm . LA activation occurs by an alternate route rather than proceeding from right to left via the BB (Spodick 2007).

Hypothetical P loop on Frontal Plane



E point: it constitutes the zero point of VCG and it remains stationary before the onset of the P loop. It corresponds to the isoelectric line between the T wave and the P wave of ECG. The E letter corresponds to the cardiac dipole. E point indicates the onset of heart activation in the RA. In this point, the intersection of three orthogonal leads occurs (X, Z and Y).

O point: it corresponds to the end of biatrial chamber activation, QRS loop onset (because PR segment does not exist, it is only a point) and the end of ventricular repolarization (T loop).



**P duration = 55 ms !!!!! Extreme broad P wave.
Five times greater than the normal upper limit of the P wave duration!!!**

Conclusion: Bayés' syndrome (Conde 2014) advanced or third degree AV block: P duration \geq 120 ms, plus-minus P wave in II, III and aVF, high tendency of supraventricular arrhythmias, such as atrial fibrillation.

Reasons why interatrial atrial blocks are little known

1. Most of the literature studies employ only lead II or a combination of 2 or 3 leads (**Stefanadis 2001**)
2. Any of the 12 leads of the standard ECG may have the widest P waves, which establish the magnitude of block. Given the high prevalence of IAB in hospital patients and its ominous portents (LA enlargement, thrombosis and embolism, arrhythmias), physicians should be aware of its frequency and computer software should be programmed to recognize it. (**Jairath 2001**).
3. Much of the literature concerning IAB has loosely named it for one of its correlates in nearly every case; in IAB an abnormally wide P is seen on ECG and IAB should be named by its precise name
4. ECGs encoding systems do not have a code for IAB

Bayés de Luna A et al. (**Bayés de Luna 1988**) studied 16 patients with ECG evidence of advanced interatrial block with retrograde activation of the left atrium (LA): P duration ≥ 120 ms, and plus-minus (+/-) biphasic P waves in inferior leads II, III, and VF.

Eight patients had valvular heart disease, four had dilated cardiomyopathy and four had other forms of heart disease. Patients with valvular heart disease and cardiomyopathy were compared with a control group of 22 patients with similar clinical and echocardiographic characteristics, but without this type of interatrial block.

Patients with advanced interatrial block and retrograde activation of the LA had a much higher incidence of paroxysmal supraventricular tachyarrhythmias (93.7%) during follow-up than did the control group. Eleven of 16 patients (68.7%) with advanced interatrial block and retrograde activation of LA had atrial flutter (atypical in seven cases, typical in two cases, and with two or more morphologies in two cases). Six patients from the control group (27.7%) had sustained atrial tachyarrhythmias (five atrial fibrillation and one typical atrial flutter). The atrial tachyarrhythmias were due more to advanced interatrial block and retrograde activation of LA and frequent PACs than to LAE, because the control group with a LA of the same size, but without advanced interatrial block and retrograde activation of LA and with less incidence of PACs, had a much lower incidence of paroxysmal tachycardia.

Bayés de Luna et al. (**Bayés de Luna 1989**) demonstrated the value of preventive antiarrhythmic treatment in patients with advanced interatrial block. In this population LAE is present in 90% of cases. Using drugs (amiodarone, quinidine or verapamil) this percentage was greatly lowered (25%).

Atrial tachyarrhythmias such as atrial fibrillation and atrial flutter in advanced IAB is observed in >90% of cases.

- From 81,000 ECGs, Bayes de Luna et al ([Bayes de Luna 1985](#)) collected 83 cases that fulfilled the criteria of Interatrial Conduction Disturbances with Left Atrial Retrograde Activation (IACD-LARA) (P +/- in II, III and VF with P width ≥ 120 ms).
- The authors present the detailed study of 35 cases with surface ECG and VCG and 29 cases with orthogonal ECG leads.
- The results are then compared against two control groups: with cardiopathy (30 cases) and without cardiopathy (25 cases).
- The prevalence of IACD-LARA was nearly 1% globally, and 2% among patients with valvular heart disease.
- The diagnostic criteria for Interatrial Conduction Disturbances with Left Atrial Retrograde Activation (IACD-LARA) are:
 1. ECG: P +/- in II, III and VF with P ≥ 120 ms.
 2. Open angle $>90^\circ$ between the first and the second part of the P.
 3. Orthogonal ECG: P +/- in Y lead with a negative mode greater than 40 m.
 4. VCG: More than 50 ms above the X or Z axis
 5. Duration of the P loop ≥ 110 ms
 6. Open angle between the two parts of the P loop in both the frontal and right sagittal planes
 7. Presence of notches and slurring in the last part of the P loop.

Treatment Options (**Spodick 2004**)

Reduction of interatrial block

Prevention of atrial fibrillation and other arrhythmias

Pacemaker

- Biatrial: DD pacemakers with dual atrial leads with synchronous biatrial pacing correct inter-atrial asynchrony and also prevent arrhythmia recurrence. (**Daubert 1994**)
- Pacing
- Right atrial
- Atrial multisite
- Atrial septal
- Bachmann bundle (**Bailing 2005**) in patients undergoing coronary artery bypass surgery (CABGS). Bachmann bundle pacing is superior to right atrial / no pacing in the post operative period for preventing occurrence of AF and reducing intensive care unit stay, commensurate with a reduction in mean P wave duration on surface ECG. (**Chavan 1011**)
- Ventricular.

Nonelectric approach

- Reduction of contributory commorbidities
- Myocardial failure: LV disorders; correcting these disorders may reverse the LA abnormalities.
- Inflammatory markers (e.g. high-sensitivity C-reactive protein)
- Ectopic beats
- Valve abnormalities
- Metabolic abnormalities
- Anticoagulation
- Angiotensin converting enzyme inhibition
- Angiotensin receptor blockers (**Mehrzad 2014**)
- Antiarrhythmic: Bayés de Luna et al, (**Bayés de Luna 1989**) demonstrated the value of preventive antiarrhythmic treatment in patients with advanced IAB. In this population LAE is present in 90% of cases. Using drugs (amiodarone, quinidine or verapamil) this percentage was greatly lowered (25%)

Observation: All suggested modalities should undergo appropriately designed, prospective randomized clinical trials with sufficient statistical power.

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