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**Bayés syndrome and acute cardioembolic ischemic stroke**

Arboix A *et al*. Bayés syndrome and acute stroke

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**Abstract**

Bayés syndrome is an under-recognized clinical condition characterized by advanced interatrial block. Bayés syndrome is a subclinical disease that manifests electrocardiographically as a prolonged *P* wave duration > 120 ms with biphasic morphology ± in the inferior leads. The clinical relevance of Bayés syndrome lies in the fact that is a clear arrhythmological syndrome and has a strong association with supraventricular arrhythmias, particularly atypical atrial flutter and atrial fibrillation. Likewise, Bayés syndrome has been recently identified as a novel risk factor for non-lacunar cardioembolic ischemic stroke and vascular dementia. Advanced interatrial block can be a risk for embolic stroke due to its known sequelae of left atrial dilation, left atrial electromechanical dysfunction or atrial tachyarrhythmia (paroxysmal or persistent atrial fibrillation), conditions predisposing to thromboembolism. Bayés syndrome may be responsible for some of the unexplained ischemic strokes and shall be considered and investigated as a possible cause for cryptogenetic stroke. In summary, Bayés syndrome is a poorly recognized cardiac rhythm disorder with important cardiologic and neurologic implications.

**Key words:** Bayés syndrome; Cardioembolic stroke; Electrophysiological processes; Cardiovascular risk factors; Heart conduction system

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**Core tip:** Bayés syndrome is an under-recognized cardiac rhythm disorder with significant cardiologic and neurologic implications. It constitutes a genuine arrhythmological syndrome characterized by advanced interatrial block. Bayés syndrome is a key predictor of higher risk of new-onset atrial fibrillation and it is independently associated with an increased risk for non-lacunar cardioembolic stroke. Likewise, can be the cause of some cryptogenic strokes, and be related to clinically silent cerebral ischemia and vascular cognitive impairment, or even, vascular dementia.

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**INTRODUCTION**

Bayés syndrome is an under-recognized cardiological condition characterized by advanced interatrial block. Although it has yet to receive adequate coverage in textbooks and remains poorly perceived in clinical practice, Bayés syndrome represents a novel risk factor for cardioembolic ischemic stroke[1,2].

The principal goal of this mini-review is to expand and update knowledge of the little-known relationship between Bayés syndrome and acute ischemic cardioembolic stroke.

It should be noted that cardioembolic ischemic stroke accounts for one-quarter of all cerebral infarcts[3], is the most severe ischemic stroke subtype with a low prevalence of absence of neurological dysfunction at hospital discharge and a non-negligible risk of early embolic recurrence (1%-10%)[4-7], and has the highest in-hospital mortality (6%-27%)[3,4,8].

 Compared to non-cardioembolic stroke, the percentage of female sex (54.3% *vs* 34.6%) and very old patients (≥ 85 years) (28.5% *vs* 18.3%) is more frequent. This may be explained by the increasing prevalence of atrial fibrillation with age. In the Framingham study, a growing population attributable risk of stroke due to atrial fibrillation with age was found, with a prevalence of atrial fibrillation of 1.8% in patients aged 60-69 years, 4.8% in those aged 70-79 years, and 8.8% in the 80 to 90 year group[9]. Similarly, the increased frequency of cardioembolic infarcts in women compared to non cardioembolic, which are more frequent in men, may also be related to increasing age observed in the industrialized societies, where women represent the majority of elderly people due to their higher life expectancy[10].

In the Sagrat Cor Hospital of Barcelona Stroke Registry (Table 1), which is one of the first stroke data banks of Catalonia and Spain, the short prognosis of patients with cardioembolic cerebral infarction is poorer compared to other subtypes of cerebral infarction with higher in-hospital mortality (21.9% vs 8.2%), whereas symptom free at discharge are less frequent (14.3% *vs* 19.9%)[7].

Recent studies have shown that Bayés syndrome is a key independent factor of cardioembolic cerebral ischemia[1,2], although there is still a need of high level of clinical suspicion in order to diagnose it. Early and proper diagnosis of Bayés syndrome is desirable and necessary, since patients will require closer clinical surveillance, and possibly accompanying antiarrhythmic and antithrombotic preventive therapies.

**CONCEPT AND DEFINITIONS**

In analogy to other cardiac conduction delays, atrial conduction abnormalities should be divided into partial and advanced interatrial blocks (aIAB) or Bayés syndrome. The syndrome of advanced interatrial conduction block due to conduction impairment in Bachmann’s bundle, results in delayed and retrograde activation of the left atrium that signifies a conduction delay between the left and right atria, and it is associated with a high incidence of atrial tachyarrhythmias, especially a particular and specific form of atypical atrial flutter or atrial fibrillation[11,12].

The first case of inter-atrial block was described by Bachmann in 1941[13]. Later, in 1971, Castillo and Vernant emphasized that when a *P* wave with plus/min (biphasic) morphology is observed in leads II, III, and avF, the atrial stimulus is blocked in the upper part of the septum[14]. Finally, between 1979 and 1985, Bayés *et al*[15,16] precisely analyzed the prevalence, pathological associations, and profile of the arrhythmias associated with aIAB, thereby defining a distinct and well-defined anatomo-electrical entity. Dr Bayés de Luna contribution was fundamental in demonstrating the association between advanced interatrial block and supraventricular arrhythmias, thus confirming a well-defined arrhythmic syndrome. The consensus of naming this association with the eponymous Bayés syndrome has recently been accepted by the scientific community in honor of Dr Antoni Bayés de Luna, the great Catalan master of clinical electrocardiography[1,17,18], for his contribution to the understanding of the natural history of this cardiac syndrome. However, Bayés syndrome remains an under-recognized clinical condition.

Bayés de Luna described the electrocardiographic pattern for identifying IAB and classified the types of block that occur at the atrial level. The distinction is based on the *P*-wave duration, and more important, the *P*-wave morphology: a partial block, indicated by a *P*-wave duration of 120 ms or more, and bifid *P* wave (notched *P*-wave) in leads II, III and aVF (Figure 1). If the interatrial block is advanced, also, the *P* wave is prolonged (duration 120 ms or more), but the second part of the P wave in inferior leads becomes negative (biphasic pattern or *P*-wave plus/min morphology) because of the retrograde activation of the left atrium (*P*-wave ± in II, III, and aVF) (Figure 2)[19-21].

It should be noted that, initially, IAB may occur transiently and may be reversible. It may be classified as first-degree (partial), second-degree (transient interatrial block or atrial aberrancy), or third-degree (advanced).There is consensus on considering transient interatrial block as a marker of electromechanical dysfunction of the left atrium and a risk factor for recurrence of atrial fibrillation[11,15].

Although the diagnosis of interatrial block is frequently associated with left atrial enlargement (LAE), there are some cases, especially of first-degree IAB, without this association. Therefore, it should be noted that IAB is a separate entity from atrial enlargement[11,22].

The prevalence of interatrial block is age-dependent, increasing from 5.4% at < 20 years old to 60% at > 50; in the same way, advanced IAB increases from 0.1% to 2% in patients with heart valve disease and cardiomyopathy[23,24]. The increased age-related risk may be probably due to atrial fibrosis which would result in impaired atrioventricular conduction through the atria. However, the exact pathogenesis has not been elucidated and various comorbidities, including coronary heart disease, arterial hypertension, and diabetes mellitus, have been proposed. The cause of IAB may be likely degenerative because of the increased incidence with age[11].

**ASSOCIATION OF INTERATRIAL BLOCK WITH SUPRAVENTRICULAR ARRHYTHMIAS**

The Bayés syndrome is a clear arrhythmological syndrome. Advanced IAB is a key predictor for high risk of new-onset atrial fibrillation after a successful cavo-tricuspid isthmus ablation in patients with typical atrial flutter[11,25].

A clinical study reported that 90% of patients with atrial fibrillation recurrence at one year had advanced IAB, and multivariate analysis demonstrated that persistent IAB was a predictor of AF recurrence. Advanced IAB is a useful marker to identify subjects who are at high risk for developing atrial fibrillation, and is a pre-atrial fibrillation condition associated with premature atrial beats[24].

Practical consequences and clinical implications of Bayés syndrome are the high incidence of atrial extrasystoles and paroxysmal supraventricular tachyarrhythmia, especially in patients with valvular heart disease or cardiomyopathy. A control group of patients with similar clinical states and left atrial size by echocardiography showed much lower incidence of these arrhythmias[11]. Bayés *et al*[26] also suggested that antiarrhythmic treatment prevents recurrences of atrial tachyarrhythmia in these cases.

There are currently no evidence-based recommendations on the most appropriate therapeutic approach for Bayés syndrome in any of the different cardiologic or neurologic guidelines for primary or secondary prevention of cerebral ischemia. A clinical case of a patient with Bayés syndrome reported antiarrhythmic treatment with amiodarone and anticoagulant administration with acenocoumarol[27].

Prolonged QRS duration is an independent predictor of cardiovascular mortality in patients with underlying structural heart disease. Similarly, the relation between sudden death and QT prolongation is an established fact[11]. Increased P wave duration is the only P wave index significantly associated with increased cardiovascular mortality. Therefore, IAB as a subclinical disease merits elucidation as a marker of risk for adverse outcomes.

**A NEW RISK FACTOR FOR CEREBRAL INFARCT AND VASCULAR DEMENTIA**

Recently, Bayés syndrome has been shown to be a predictor of cardioembolic stroke[28]. There are three main consequences of advanced IAB: Firstly, IAB is a substrate for sustained AF, and the association between AF and advanced IAB has been demonstrated. Secondly, IAB results in poor left atrium (LA) contractility due to a delayed depolarization which can result in LA dysfunction. Such a delay has hemodynamic consequences including raised LA pressure and LA dilatation, which again is a substrate for AF. Thirdly, IAB may be associated with structural factors as a result of left atrium enlargement, although it may occur in patients with normal left atrium size[11].

As a result, advanced IAB could be a risk for embolic stroke due to its known sequelae of left atrial dilation, LA electromechanical dysfunction or atrial tachyarrhythmias, conditions which predispose to the formation of echocontrast, and may serve as a nidus for thrombi or microthrombi, and thus increase the risk for cardioembolic events. Because IAB predicts atrial fibrillation, patients with IAB may intermittently be in atrial fibrillation (paroxysmal atrial fibrillation), causing embolization[3,11].

Ariyarajah *et al*[2] analyzed 293 patients with cerebral infarct, 85 of them cardioembolic, and reported that 88% of cardioembolic infarcts showed sinus rhythm and 61% of these had advanced IAB, concluding that IAB could be a novel risk factor for embolic stroke.

In an analysis of ARIC (Atherosclerosis risk in Communities Study) advanced IAB was independently associated with an increased risk for ischemic stroke, thus definitively confirming IAB as a novel risk factor for cardioembolic ischemic stroke[29].

Cotter *et al*[30] reported an increased incidence of interatrial block in younger adults with cryptogenic stroke and patent foramen ovale, suggesting atrial arrhythmias as a possible cause of unexplained ischemic stroke in these patients. In another study, atrial fibrillation detected by implantable loop recorders in unexplained stroke was identified in 25.5% of cases, and AF was independently associated with interatrial conduction block[31].

In a clinical study the CHADS2 and CHADS2DS2-VASCc scores could predict the risk of ischemic stroke or TIA in patients with IAB without atrial fibrillation[32].

However, the association of Bayés syndrome and ischemic stroke is limited to non-lacunar cardioembolic infarcts[33,34]. Lacunar infarcts are an ischemic stroke subtype related mainly to hypertension and diabetes[35,36]. Ischemic stroke of unusual causes accounted for 5% of ischemic strokes and the association of advanced IAB in this ischemic stroke subtype is improbable[37].

By contrast, it is important to highlight that about 10%-30% of ischemic strokes remain cryptogenic despite reasonably thorough evaluations[38,39]. A possible explanation for this is that IAB may be responsible for some of the unexplained strokes.

Furthermore, atrial fibrillation is independently associated with an increased risk of vascular dementia. In a clinical study conducted in centenarians, the rate of dementia was 48% in subjects with a normal P wave, 60%in those with partial IAB, and 81% in those with advanced IAB and 90% in those with atrial fibrillation[40].

Table 2 shows the most relevant published studies about IAB as a cardiovascular risk factor and acute ischemic stroke[41-43].

**FUTURE RESEARCH**

Recognition of Bayés syndrome is not merely an academic issue. It allows selecting high-risk patients for which pharmacological therapy could be beneficial. Open questions remain to be addressed with well-designed clinical trials including whether antiarrhythmic and/or anticoagulant drugs could be used in patients with advanced IAB without atrial tachyarrhythmias to prevent both AF and embolic stroke.

Additional epidemiological studies would be needed to define the possible connection between Bayés syndrome and clinically silent cerebral infarctions, small vessel disease, cognitive impairment of vascular type or dementia.

**CONCLUSION**

Bayés syndrome is a poorly recognized cardiac rhythm disorder with important clinical implications. Bayés syndrome is a pre-atrial fibrillation condition and should be considered a novel and important risk factor for cardioembolic stroke and vascular cognitive impairment.

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**Table 1 Demographic, cerebrovascular risk factors, neuroimaging and outcome in the first-ever cardioembolic stroke versus first-ever non-cardioembolic cerebral infarct population**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Cardioembolic stroke** ***n* = 575** | **Non-cardioembolic cerebral infarct1** ***n* = 1.507** | ***P* value** |
| Age, years, mean (SD) | 78.96 (9.39) | 73.45 (12.8) | 0.0001 |
| Age strata, yr |  |  | 0.0001 |
| < 65  | 44 (7.6) | 285 (18.9) |  |
| 65-74 | 116 (20.2) | 405 (26.9) |  |
| 75-84 | 251 (43.7) | 557 (37.0) |  |
| ≥ 85 | 164 (28.5) | 260 (17.3) |  |
| Sex |  |  | 0.0001 |
| Males | 199 (34.6) | 788 (52.3) |  |
| Females | 373 (65.4) | 719 (47.7) |  |
| Hypertension | 291 (50.6) | 835 (55.4) | 0.049 |
| Diabetes | 103 (17.9) | 368 (24.4) | 0.002 |
| Atrial fibrillation | 433 (75.3) | 176 (11.7) | 0.0001 |
| Heavy smoking (> 20 cigarettes/day) | 23 (4.0) | 184 (12.2) | 0.0001 |
| ACM vascular topography | 391 (68.0) | 703 (46.6) | 0.0001 |
| Ecocardiography | 363 (63.1) | 598 (39.7) | 0.0001 |
| Symptom-free at discharge | 82 (14.3) | 300 (19.9) | 0.003 |
| In-hospital death | 126 (21.9) | 123 (8.2) | 0.0001 |
| Transfer to convalescent/rehabilitation units | 89 (15.5) | 154 (10.2) | 0.001 |
| Length of stay, days, median (interquartile range) | 15 (10-24) | 11 (8-19) | 0.0001 |
| Prolonged hospital stay > 12 d | 330 (57.4) | 650 (43.1) | 0.0001 |

Data expressed as numbers and percentages in parenthesis. **1**Atherothrombotic, *n* = 565; lacunar, *n* = 566; essential, *n* = 280; unusual, *n* = 96.

**Table 2 Main studies of Interatrial Block as a cerebrovascular risk factor or as a predictor for acute ischemic stroke (period 1979-2016)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Ref.** | **Study type** | **n** | **Age****(yr)** | **Gender** | **Inclusion criteria** | **Exclusion criteria** | **Confounding factors** | **Parameters evaluated** | **Results** |
| Wu *et al*[32]  | Retrospective cohort | 1,046 | 63 ± 10 | 612 males434 females | - Patients hospitalized in Zhengzhou University People's Hospital for diagnosis and treatment between March 1 and March 31 of 2010- ECG - Presence of IAB | - History of AF- Patients under anticoagulant treatment- Missing data for calculation of CHADS₂ and CHA₂DS₂-VASc scores- Lost to follow-up | - Congestive Heart Failure- Hypertension- Diabetes Mellitus- Previous strokes/ TIA- Coronary Artery Disease- PCI during index admission- CABG during index admission- Tobacco consumption- LVEF- LA diameter- Medication Use  | - Conduction lengths- CHADS₂ and CHA₂DS₂-VASc scores- Apparition of Stroke (Hemorrhagic or Ischemic) | - Mean follow-up of 4.9 ± 0.7 years - 0.8% hemorrhagic stroke- 5.3% presented ischemic stroke or TIA- Ischemic stroke or TIA increased with CHADS₂ score: 0.37, 0.85, 0.96 and 1.92 per 100-person years for scores of 0, 1, 2, and > 3 respectively.- CHA₂DS₂-VASc scores correlated with Ischemic stroke or TIA (0.19, 0.59, 0.76, 0.88, and 2.0 for scores of 0, 1, 2, 3, and > 4 respectively)- Cut-off points: > 3 for CHADS₂, > 4 for CHA₂DS₂-VAScConclusion: CHADS₂ and CHA₂DS₂-VASc scores may be predictors of risk of ischemic stroke or TIA in patients with IAB without atrial fibrillation |
| Martinez-Selles *et al*[40] | Case-control | 80 | 101.4 ± 1.5 | 21 males59 females | - Patients from the Cardiac and Clinical Characterization of Centenarians (4C) Registry | - Hospitalized patients | - Dementia- Perceived health status score- Previous stroke- Mitral regurgitation- Systolic Dysfunction- Left atrial diameter > 40mm | - Conduction lengths- ECG measurements- Short Portable Mental Status Questionnaire- Premature atrial beats | - IAB group showed higher rate of previous stroke than normal P wave and AF groups- Premature atrial beats were more frequent in advanced IAB than normal *P*-wave- Mitral regurgitation could play an important role in IABConclusion: advanced IAB is a pre-atrial fibrillation condition associated with premature atrial beats. Atrial arrhythmias and IAB occurred more frequently in centenarians than in septuagenarians.  |
| O'Neal *et al*[24] | Retrospective cohort | 14,716 | 54 ± 5.8 | 6,622 males8,094 females | - Patients enrolled in the Atherosclerosis Risk in Communities (ARIC) Study- Recruited between 1987 and 1989 | - Patients with prevalent stroke or AF at baseline- Race other than black or white- Black participants from Washington County and Minneapolis | - Black- Tobacco use- Diabetes- LDL cholesterol level- BMI- Hypertension- Antihypertensive medication- Coronary heart disease- Heart failure | - Conduction lengths- Presence of stroke- Stroke type | - Incidence rate of ischemic stroke was higher in aIAB (8.05/1000 person-years *vs* 3.14; *P* < 0.0001)Conclusion: aIAB was associated with incident ischemic stroke |
| O'Neal *et al*[29] | Retrospective cohort | 14,625 | 54 ± 5.8 | 6,581 males8,044 females | - Patients enrolled in the Atherosclerosis Risk in Communities (ARIC) Study- Recruited between 1987 and 1989 | - Participants with AF at baseline- Missing baseline covariates- Missing follow-up data- Race other than black or white- Black participants from Washington County and Minneapolis | - Black- Tobacco consumption- Diabetes- LDL cholesterol level- BMI- Hypertension- Antihypertensive medication- Coronary heart disease- Heart failure | - Conduction lengths | - Total of 262 aIAB (69 baseline, 193 new)- 1,929 AF cases were identified- aIAB patients presented an AF incidence of 29.8/1000 *vs* 6.8/1000 of non-aIAB; HR = 3.09 (*P* < 0.0001)Conclusion: aIAB is a useful marker to identify high risk subjects for developing atrial fibrillation |
| Pirinen *et al*[41] | Case-control | 690 | 15 - 49 | 438 males252 females | - Correct diagnosis of IS- Part of the Helsinki Young Stroke Study | - Unknown stroke date- Outpatient treatment only- No ECG OR only take on the day of stroke in ER OR no ECG between day of stroke and 14 d after | - Obesity- Hypertension- Tobacco use- Dyslipidemia- CHF- Preexisting AF- DM1, DM2- Composite of Cardiovascular Disease | - Arrhythmia types- Conduction lengths- Stroke etiology | Most Common ECG abnormalities: - T-wave inversion (LVH (14%), - prolonged *P*-wave (13%), - prolonged QTc (12%).- Most ECG abnormalities in the Stroke Etiology Subgroups: HRCE, LAA and SVDConclusion: Routine ECG provides useful information for directing the work-up of a young IS patient. In addition to AF, P-terminal force in particular showed a strong association with etiology of high-risk source of cardioembolism |
| Enriquez *et al*[42] | Prospective cohort | 187 | 67 ± 10.7 | *not reported* | - Patients with typical atrial flutter (AFI) with no prior history of AF referred for CTI ablation | - Patients that had received repeat ablations or did not demonstrate a bidirectional block | *not reported* | - Conduction lengths- Ejection fraction- Holter monitoring- Device interrogations | - Advanced IAB was detected in 18.2% of patients- Left atrium was larger in aIAB (46.2 ± 5.9 *vs* 43.1 ± 6.0 mm; *P* = 0.01)- 35.8% of patients developed new-onset AF- AF was greater in patients with aIAB (64.7% *vs* 29.4%; *P* < 0.001)Conclusion: Advanced interatrial block is a key predictor for high risk of new-onset AF after a successful CTI ablation in patients with typical AFl. |
| Cotter *et al*[31] | Retrospectivecohort | 51 | 17 - 73 | 28 males23 females | - ILR implanted after unexplained ischemic stroke- Brain imaging consistent with embolism- Arterial imaging- Structural cardiac imaging and rhythm monitoring- 50 d of continuous monitoring | - TIA- Documented cause of stroke before ILR implantation- Intrinsic small-vessel disease cause- Atheromatosis stenosis > 50% or dissection- High-risk cardiac embolic source- No AF detected in 24h - Holter | *not reported* | - Rhythm monitoring- ECG - Conduction lengths- CHADS₂ and CHA₂DS₂-VASc scores | - 25.5% of cases had AF- IAB more prevalent in patients with AF (*P* = 0.02)- AF patients larger LA volumes (*P* =0.025)- Mean AF duration was 6 minutes.Conclusion: In patients with unexplained stroke atrial fibrillation was detected by implantable loop recorders in 25.5%. IAB was an independent predictor of AF. |
| Cotter *et al*[30]  | Case-control | 78 | 24 - 55 | 49 males29 females | - ≤ 55 years at time of stroke- index cerebral infarct with no cause found- CT or MRI imaging, cervical vascular imaging, ECG and rhythm monitoring | - Poor quality data | *not reported* | - Conduction lengths- PFO status- A-S-C-O Classification | - IAB more frequent in cases than controls (40 *vs* 13%) (*P* < 0.05).- 74.6% of stroke showed PFO (70.3% large)- No statistical difference of *P*-wave length (with *vs* without PFO)Conclusion: In young patients with unexplained stroke, particularly those with patent foramen ovale atria l dysfunction is a possible mechanism of stroke |
| Ariyarajah *et al*[43] | Case-control | 66 | 60 - 87 | 39 males27 females | - Definitive acute or subacute cerebral infarct- Probable embolic origin | - No 12-lead ECG during 14 d post infarct- Non-sinusal rhythm detected in ECG | - Hypertension- Valvulopathies- Cardiomyopathies- Tobacco Use- Dyslipidemia- Diabetes Mellitus- Hyper/Hypothyroidism- COPD- Florid Heart Failure- Cardiac Catheterization- Myocardial Infection- Valvuloplasty- Previous strokes/ TIA- History of AF/Flutter- CAD | - Echocardiogram- Conduction lengths | - 61% IAB prevalence- CAD paroxistically more present in control, perhaps due to atherosclerotic origin- LA more prevalent in IAB group, with greater LA thrombi (83% *vs* 0%) Conclusion: IAB could be a risk factor for embolic stroke due to its known sequelae of left atrial dilation and electromechanical dysfunction that predispose to thrombosis. |
| Ariyarajah *et al*[2] | Case-control | 228 | 30 - 102 | 118 males110 females | - Studied for suspicion of stroke\* with CT Scan and MRI | - No 12-lead ECG during 14 d post infarct | - Hypertension- Valvulopathies- Cardiomyopathies- Tobacco Use- Dyslipidemia- Diabetes Mellitus- Hyper/Hypothyroidism- COPD- Florid Heart Failure- Cardiac Catheterization- Myocardial Infection- Valvuloplasty- Previous strokes/ TIA- History of AF/Flutter- CAD | - Conduction lengths- Stroke etiology | - 61% IAB embolic *vs* 40% non-embolic (*P* = 0.006)- Hypertension for embolic stroke (*P* < 0.0001)Conclusion: IAB could be a novel risk for embolic stroke |
| Ariyarajah *et al*[12] | Prospective cohort | 32 | 66 - 94 | 15 males17 females | - Saint Vincent Hospital general patients (Dec. 15, 2004 to Jan. 14, 2005)- Resting ECG obtained on admission- Existing 2-dimensional transthoracic echocardiograms- Sinus rhythm | *not reported* | - Mitral or tricuspid valvular disease- Hypertension- Coronary artery disease- Hyperlipidemia- Diabetes mellitus- History of AF/Flutter- ACEI use- Beta-blocker use- Statins use | - Conduction lengths- LA dimension- LVEF- Cardiovascular events (heart failure, peripheral embolism, transient ischemic attack, stroke, atrial tachyarrhythmias) | - Coronary disease was more prevalent in the IAB group- Cardiovascular events were overall most significant in IAB, except for stroke, TIA, peripheral arterial embolism and atrial flutterConclusion: In patients with comparable echocardiographic parameters, IAB remained associated with atrial fibrillation after 15-months follow-up. |
| Lorbar *et al*[33] | Retrospectivecohort | 104 | 22 - 101 | 58 males46 females | - St Vincent Hospital (Jan. 2000 to Dec. 2001) patients with ICD codes for embolic stroke- Diagnosis of embolic ischemic stroke or TIA by a neurologist with or without imaging techniques | - Cerebrovascular events non ICD codes - Dementia, seizure, hypertensive encephalopathy, subdural hematoma, dizziness, vertigo, psychosis, and headache | not reported | - Conduction lengths- ECG patterns | - 41% history of AF, or newly diagnosed AF- 80% normal sinus rhythm patients showed IAB on concurrent ECGConclusion: IAB may represent a new factor for stroke. |
| Jairat *et al*[23] | Prospective cohort | 1000 | 24-94 | 585 males415 females | - Saint Vincent Hospital general patients | not reported | not reported | - Conduction lengths- ECG patterns | - 32.8% of all patients showed IAB- 41.1% of sinus rhythm patients showed IABConclusion: Patients with IAB must be followed for atrial enlargement, potential thrombosis, and the onset of atrial fibrillation |

ACEI: Angiotensin converting enzyme inhibitor; AF: Atrial fibrillation; aIAB: Advanced intraatrial block; BMI: Body Mass Index; CABG: Coronary artery bypass grafting; CAD: Coronary artery disease; COPD: Chronic obstructive pulmonary disease; CHF: Chronic heart failure; CT: Computed tomography; CTI: Cavotricuspid isthmus; DM1: Diabetes mellitus 1; DM2: Diabetes mellitus 2; ECG: Electrocardiogram; ER: Emergency room; HR: Hazard Ratio; HRCE: High-risk source of cardioembolism; IAB: Intraatrial block; ILR: Implantable loop recorder; IS: Ischemic stroke; LA: Left atrium; LAA: Large artery atherosclerosis; LDL: Low density lipoprotein; LVEF: Left ventricular ejection fraction; LVH: Left ventricle hypertrophy; MRI: Magnetic resonance imaging; PCI: Percutaneous coronary intervention; PFO: Permeable foramen ovale; SVD: Small-vessel disease; TIA: Transient ischemic attack.

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**Figure 1 Scheme of the anatomo-electrophysiologic features of the Bayés syndrome[27].** AVN: AV node; BB: Bachmann bundle; IAB: Interatrial block; LBB: Left bundle branch; RBB: Right bundle branch; SN: Sinus node.



**Figure 2 A 55-year-old male diagnosed with Bayés syndrome, with a history of paroxysmal atrial fibrillation showing normal values of echocardiographic measurements, except for a discrete left atrial enlargement (40 mm).** ECG shows the presence of advanced interatrial block. *P*-wave duration is wide (120 ms) and biphasic in inferior leads (II, III and aVF). ECG: Electrocardiogram.