World Journal of Clinical Cases

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World J Clin Cases 2017 March 16; 5(3): 93-101

DOI: 10.12998/wjcc.v5.i3.93

ISSN 2307-8960 (online)

MINIREVIEWS

Bayés syndrome and acute cardioembolic ischemic stroke

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Author contributions: All the authors contributed to the manuscript.

Conflict-of-interest statement: The authors declare no conflicts of interest regarding this manuscript.

Manuscript source: Invited manuscript

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Received: September 2, 2016
Peer-review started: September 6, 2016
First decision: September 29, 2016
Revised: October 10, 2016
Accepted: December 7, 2016
Article in press: December 9, 2016
Published online: March 16, 2017

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

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.

Arboix A, Martí L, Dorison S, Sánchez MJ. Bayés syndrome and acute cardioembolic ischemic stroke. *World J Clin Cases* 2017; 5(3):

93-101 Available from: URL: http://www.wjgnet.com/2307-8960/full/v5/i3/93.htm DOI: http://dx.doi.org/10.12998/wjcc.v5.i3.93

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].

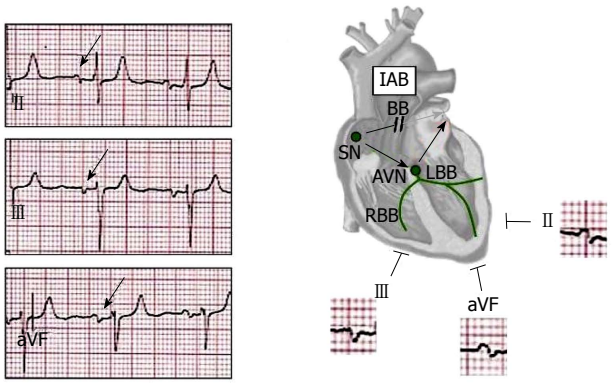

Figure 1 Scheme of the anatomo-electrophysiologic features of the Bayés syndrome[27]. AVN: AV node; BB: Bachmann bundle; IAB: Interatrial block; LBB: Left bundle branch; RBB: Right bundle branch; SN: Sinus node.

The first case of inter-atrial block was described by Bachmann[13] in 1941. Later, in 1971, Castillo and Vernant[14] 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. Finally, between 1979 and 1985, Bayes de Luna *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

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

Variable	Cardioembolic stroke *n* = 575	Non-cardioembolic cerebral infarct[1] *n* = 1507	*P* value
Age, yr, 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/d)	23 (4.0)	184 (12.2)	0.0001
ACM vascular topography	391 (68.0)	703 (46.6)	0.0001
Echocardiography	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.

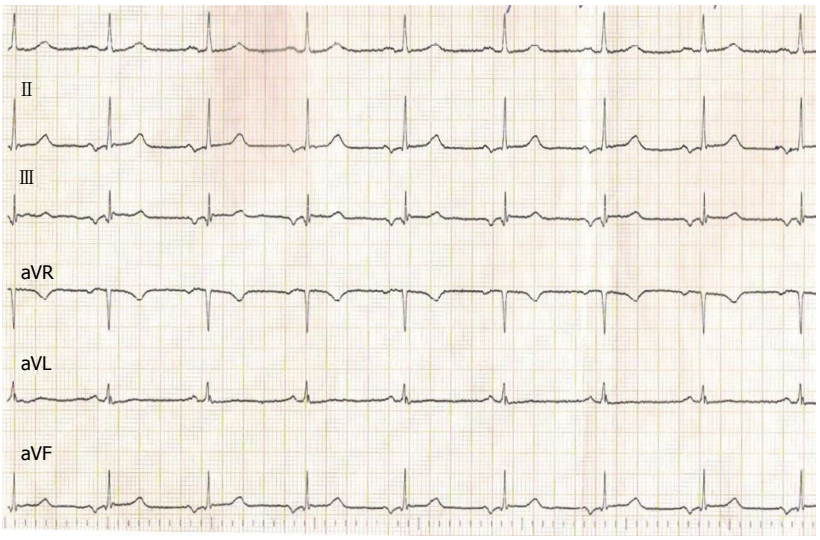

Figure 2 A 55-year-old male diagnosed with Bayés syndrome, with a history of paroxysmal atrial fibrillation showing normal values of echocardiographic measurements, except for a discrete left atrial enlargement (40 mm). ECG shows the presence of advanced interatrial block. *P*-wave duration is wide (120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

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 syn-

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	1046	63 ± 10	612 males 434 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 $CHADS_2$ and CHA_2DS_2-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 $CHADS_2$ and CHA_2DS_2-VASc scores Apparition of Stroke (Hemorrhagic or Ischemic)	Mean follow-up of 4.9 ± 0.7 yr 0.8% hemorrhagic stroke 5.3% presented ischemic stroke or TIA Ischemic stroke or TIA increased with $CHADS_2$ score: 0.37, 0.85, 0.96 and 1.92 per 100-person years for scores of 0, 1, 2, and > 3 respectively CHA_2DS_2-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 $CHADS_2$, > 4 for CHA_2DS_2-VASc Conclusion: $CHADS_2$ and CHA_2DS_2-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 males 59 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 > 40 mm	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 IAB Conclusion: 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	14716	54 ± 5.8	6622 males 8094 females	Patients enrolled in the 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	14625	54 ± 5.8	6581 males 8044 females	Patients enrolled in the 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	Conduction lengths	Total of 262 aIAB (69 baseline, 193 new) 1929 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 males 252 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	Coronary heart disease Heart failure Obesity Hypertension Tobacco use Dyslipidemia CHF Preexisting AF #VALUE	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 SVD Conclusion: 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	Composite of Cardiovascular Disease not reported	Conduction lengths Ejection fraction Holter monitoring	Advanced IAB was detected in 18.2% of patients Left atrium was larger in aIAB (46.2 ± 5.9 mm *vs* 43.1 ± 6.0 mm; P = 0.01) 35.8% of patients developed new-onset AF
Cotter *et al*[31]	Retrospective cohort	51	17-73	28 males 23 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 24 h - Holter	Not reported	Rhythm monitoring ECG Conduction lengths $CHADS_2$ and CHA_2DS_2-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 min 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 males 29 females	⩽ 55 yr at time of stroke Index cerebral infarct with no cause found	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)

					CT or MRI imaging, cervical vascular imaging, ECG and rhythm monitoring				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 males 27 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 males 110 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 males 17 females	Saint Vincent Hospital general patients (December 15, 2004 to January 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 flutter Conclusion: In patients with comparable echocardiographic parameters, IAB remained associated with atrial fibrillation after 15-mo follow-up

Lorbar *et al*[33]	Retrospective cohort	104	22-101	58 males 46 females	St Vincent Hospital (January 2000 to December 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 ECG Conclusion: IAB may represent a new factor for stroke
Jairat *et al*[23]	Prospective cohort	1000	24-94	585 males 415 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 IAB Conclusion: 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; ARIC: Atherosclerosis Risk in Communities.

drome. 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 de Luna *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 echo-contrast, 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 $CHADS_2$ and $CHADS_2DS_2$-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.

ACKNOWLEDGMENTS

We thank Drs Massons J, Comes E, Oliveres M, for their assistance in this study and Dr. Antoni Bayés-Genís for allowing us to use the illustrative ECG of Figure 1 and the scheme of the anatomo-electrophysiologic features of the Bayés syndrome of Figure 2.

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P- Reviewer: Aggarwal A, Petix NR, Petretta M, Said SAM
S- Editor: Qiu S **L- Editor**: A **E- Editor**: Lu YJ

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