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ARE CARDIOVASCULAR RISK FACTORS ASSOCIATED WITH THE RISK OF ATRIOVENTRICULAR BLOCK?

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ABSTRACT

Pacemaker implantations as a treatment for atrioventricular (AV) block are increasing worldwide. Implantation are still an invasive intervention associated with complications particular in elderly. Prevention strategies for AV block are lacking because the causality between risk factors have not yet been established. **Aim of the study:** identify risk factors leading to AV block; particulary in a Moroccan populations. **Design of the study:** Retrospective, descriptive study conducted over a 12-month period from January 2022 to December 2022. Clinical and para-clinical characteristics, early and medium-term complications were evaluated. A total of 190 patients were selected for the analysis. **Results:** Among the 190 participants (107 [56%] women; 83 [44%] male, Sex ratio: 0, 77 Mean age: 72 years with 90 % of patients were older than 60 years Lipothymia and syncope were the most encountered symptoms. (46% and 43%); dyspnea in the third position (36%), only 5% of patients were asymptomatic. ECG identified in 61 % a cardiac Frequency between 28 – 39, atrial fibrillation occurred in 19% of cases, 54% had a QRS larger than 120 ms. 19% of patients had paroxysmal AV block. History of heart failure with reduced ejection fraction was identified only in 6 % cases, 10% with mild reduced EF 25% of patients had a AV block associated with myocardial infarction. Two modifiable risk factors were also independently associated with AV block: High blood pressure and hyperglycemia: 69% of patients had hypertension, followed by 34% cases of diabetes, smoking and dyslipidemia in 20% each, with obesity in 6% of cases. **Conclusions:** In this analysis of data from a small Moroccan population-based study, results suggest that a large proportion of AV blocks are associated with hypertension and diabetes. Elevated blood pressure and blood glucose levels were associated with the development of AV block. Optimizing blood pressure and glucose level

control might be an effective prevention's strategy for conduction disease pacemaker implantation.

INTRODUCTION

Atrioventricular (AV) block typically occurs in elderly in absence of major heart disease present and is usually, linked to fibrosis of the heart's conduction system. Pathophysiology of fibrosis remain not clearly identified by literature.

While hypertension and diabetes, are known to increase the risk of mild conduction problems (Left ventricular Bundle block, Right ventricular bundle, PR prolongation): there's currently no clear evidence indicating a direct connection between these modifiable risk factors and AV block itself.[1]

Despite of pacemaker implantation is generally low risk, it can carry a potential of serious complications (Infection, endocarditis, pneumothorax, cardiac tamponade), with a need of long term follow up. Identifying risk factors leading to AV block, may prevent a lot of procedural complications and better outcome.

Methods

Study design

Our study is Retrospective, descriptive study conducted over a 12-month period from January 2022 to December 2022. A total of 190 patients were selected for the analysis from 190 patients of cardiology B department, enrolled in the study from 1568 patients.

Participants were excluded from the study if they were deceased before ascertainment of AV block occurred, if they had missing or poor datas in their medical files, and whom had already a pacemaker.

All participants were informed about the study and the possible use of their informations for medical research. Verbal consent was obtained.

Demographics measurements

Age and sex were self-reported by study patients Height and weight were directly measured by nurses using a calibrated scale with participants in light clothing. Blood pressure was taken using an automatic sphygmomanometer in a seated and comfortable position. Two

blood pressure measurements were obtained during a 2 minute interval. Systolic blood pressure was used in this analysis.

ECG evaluation

A resting ECG was recorded using CARDIOMATE 12 SPENGLER with a paper speed of 50 mm/s and a calibration of 10 mm/mV. All ECGs were manually analyzed by trained cardiologists.

Laboratory tests

Patients run for blood samples after 10 hours of fasting. Levels of serum cholesterol, high-density lipoprotein cholesterol, triglycerides, and plasma glucose were, glycated hemoglobin measured in a single laboratory using standard laboratory techniques.

Cardiovascular comorbidities

Hypertension was defined on a base of systolic blood pressure higher than 140 mm Hg, or a history of hypertension with the use of blood pressure-lowering medication. Diabetes was defined as a fasting glucose exeeding 1,26 mg/dL in two measurements, or Glycated Hemoglobin > 6,5% ; or the use of medication to lower glucose levels.

All participants had a standard 12-lead ECG chest X-rays, and echocardiography. Myocardial infarction (MI) was defined by the presence of pathologic Q waves on ECG, ECG findings consistent with ischemia and previous hospitalization with elevated cardiac enzyme levels, or previous hospitalization for MI.

RESULTS

- Among the 190 participants (107 [56%] women; 83 [44%] male, Sex ratio: 0,77.

Table 1: Distribution by sex.

	Patients	%
F	107	56%
M	83	44%
Total	190	100%

- Mean age, 72 years with 90 % of patients were older than 60 years.

Table 2: Distribution by age.

AGE	Patients	%
[15 -15- 39]	3	2
[40 - 49]	5	3
[50 - 59]	11	6
[60 - 69]	55	29
[70 - 79]	49	26
[80 - 89]	59	31
[90 and more]	8	4

- Lipothymia and Syncope were the most encountered symptoms. (46% and 43%); dyspnea in the third position (36%), only 5% were asymptomatic.
- ECG identified in 61 % a cardiac Frequency between 28 – 39, atrial fibrillation occurred in 19% of cases, 54% had a QRS larger than 120 ms. 19% of patients had paroxysmal AV block.

Table 3: Distribution of patients according to heart beat.

Heart beat	Patients	%
[<25]	15	8
[28 - 39]	117	61
[40 - 50]	58	30

- Atrial fibrillation occurred in 8%

Table 4: Distribution of patients by their rhythm abnormalities.

Rythm abnormalties	Patient	%
Atrial fibrillation	14	8.37
Ventricular premature Beat (R/T)	13 (2)	6.83
Long QT	1	0.53
Ventricular tachycardia	1	0.53
Ventricular fibrillation	2	1.05
Torsade de pointe	1	0.53

- History of heart failure with reduced ejection fraction was identified in 6 % cases, 10% with mild reduced EF
- 25% of patients had a AV block associated with myocardial infarction
- Two modifiable risk factors were also independently associated with AV block: High blood pressure and hyperglycemia: 69% of patients had hypertension, followed by 34% cases of diabetes, smoking and dyslipidemia in 20% each, with obesity in 6% of cases

Table 5: Distribution of patients according to their cardiovascular factors.

CV risk factor	Patients	%
Hypertension	131	64
Diabetes	64	34
Dyslipidemia	41	22
Smoking	40	21
Coronary history	5	6
Obesity	12	3

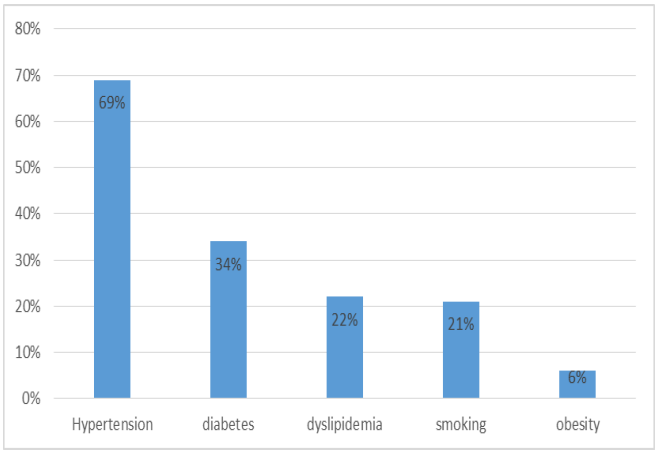

Figure 1: Distribution of patients according to their cardiovascular risk.

DISCUSSION

Not surprisingly, MI was associated with the incidence of AV block. Temporary AV block associated with vagal effects and permanent AV block associated with structural damage of the conduction system are both known to occur as a result of MI. We similarly found that structural heart disease in the form of a history of MI or CHF was independently associated with AV block, but most AV blocks (69.0%) occurred without a preceding history of MI or MACE.

Blood pressure

High systolic blood pressure is linked to AV block independetly of myocardial infarction and MACE. It's a predisposing factor on their own, leading to an acceleration of fibrosis mechanisms, leading to degeneration of conduction system: LEV disease. Its postulated cause is a hastening of the aging process by hypertension and arteriosclerosis of the blood vessels supplying the conduction system. The fibrosis might be local as well, Hypertension causes left ventricular hypertrophy, leading possibly to local fibrosis infiltrating the AV conduction system.[2]

Regardless of the mechanism, the association between elevated systolic blood pressure and AV block is well established, our population-attributable risk calculations suggests that about half of all AV blocks could be attributed to elevated systolic blood pressure. Cohorts studying the outcome of lowering blood pressure in order to prevent conduction disease and AV block may be interesting, and emphasize the utility of severe control of hypertension patients.

Fasting glucose level

Diabetes were linked with AV block in all analyses, and 11% of AV blocks could be linked to it after considering cardiovascular diseases and risks. Conditions like hyperglycemia, insulin resistance, and type 2 diabetes are known to increase the risk of coronary disease and heart attacks, which could explain this association. However, similar to high systolic blood pressure, the link between high glucose levels and AV block remained even after adjusting for coronary events, suggesting that the actual impact might be much greater than observed. Diabetes also triggers various changes in cardiomyocytes metabolism, including increased harmful effects from fatty acids and higher production of reactive oxygen species, both of which can cause cardiomyocyte damage and inflammation leading to fibrosis. These processes may all contribute to conduction disease, by inflammation and fibrosis.[3]

It's worth noting that both hypertension and diabetes were statistically significantly linked to incident AV block. However, these associations didn't remain significant in the multivariable models. This was likely due to collinearity with the raw measurements of systolic blood pressure and blood glucose levels, which likely had more influence due to their continuous nature, offering greater statistical power and precision. However, since these diagnoses and measurements largely represent the same underlying pathophysiology, it would be incorrect to conclude, for instance, that a diagnosis of hypertension or diabetes isn't an important risk factor for AV block.[4]

CONCLUSION

Atrioventricular block is well associated with numerous cardiovascular risk factors and cardiac conditions. This study found that modifiable factors like high systolic blood pressure and diabetes were independently connected with AV block. When considering both of these variables together, they potentially account for more than half of all AV blocks in a community-based population. Treating hypertension and equilibrating blood glucose levels could be important strategies in preventing AV block.

Competing interests

In terms of our authors, we certify to take all public responsibility for the contents, and all the authors have contributed substantially to the drafting and have approved the final version. None of the authors has any conflicts of interest with the contents.

Author contributions

E.R is responsible for creation, editing and writing of manuscript including submission. F.J and Z.G are responsible for data collection, editing and writing of manuscript. F.I and C.M are responsible for final editing, proof reading and revision of manuscript.

Patient consent

Not applicable.

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