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Original Research Article

His- Ventricle (HV) Interval And Syncope As Predictor For Pacemaker Implantation In Patients With Bifascicular Block (BFB)

Ameen Al-Alwany[1*] Ghazi Farhan Haji[2] Zainab Falah .Hassan[1]
[1] College of Medicine, University of Babylon, Hilla, IRAQ
[2] College of Medicine ,University of Baghdad, Baghdad, IRAQ

[*]E-mail:ameenalalwany@yahoo.com

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Abstract

Transient drop in the heart beat or transient heart block (AVB) may be consider the main cause of syncope or presyncope inpatients with bifascicular block and syncope According to the Guidelines for cardiac pacing pacemaker consider part of treatment. Aims of our study were to evaluate whether there is role for EPS in patients BFB and to evaluate the symptoms after pacing.

42 patients were enrolled in this study, with mean age value (63.4± 12.2years), suffer from interventricular conductive defect and syncope; patients underwent EPS on admission time, and pacemaker implantation accordingly and programmed follow up for the device in the last four years.

Our patients were 25 (59.5%) male and 17 (40.5%)female, all of them with syncope or presncope and good left ventricular systolic function and the left ventricular ejection fraction (LVEF ≥55%). Left bundle branch block was found in 28 (66.71%) patients, while right bundle branch block were found in,14 (33.3) of them, the result of the EPS was find the cut of HV interval for pacing which represent that that the threshold at level of 75 have a sensitivity of 91% and specificity of 80%. The greater HV intervals gave more successful results for pacing. Pacemaker was implanted in 27 (64.3%) of the patients, with significant relation between pacing and syncope disappeared after pacemaker implantation (p value 000) and in 15 (35.7%) no pacemaker was implanted with persistent symptoms. Pacing were more between patients with coronary artery disease and LBBB with abnormal EPS finding. Permanent pacemaker implantation can implant directly in those old patients with syncope and bifascicular block that associated with LBBB and coronaries artery diseases without or before EP study.

Key Words: Syncope, Atrioventricular block, electrophysiological study, bundle branch block, permanent pacemaker implantation.

الخلاصة

أنقطاع الحزمه الكهربائية الثنائي او الثلاثي احد الاسباب الرئيسيه لنوبات السقوط القصيره المتكرره ، لذلك درا سة كهربائية القلب التشخيصية التي تهدف الى معرفة سرعة انتقال التيار من حزمة هز الى البطين وبالاعتماد على هذه المسافه يتقرر فيما اذا يتم زرع جهاز منظم ضربات القلب الدئمي من عدمه ،حيث ثبت ان سبب السقوط في هولاء المرضى هو توقف النبض المفاج ئ لفترة قصيره واختفاء اعرا ض السقوط المفاجئ في اغلبية المرضى بعد زرع منظم ضربات القلب الدائمي ،و تم الاستنتاح من خلال الدراسة بالامكان زرع منظم ضربات القلب للمرضى الذين لديهم قطع بالحزمه اليسرى الثنائي او الثلاثي مع وجود قصور في الشرايين التاجيه دون عم ل قسطره تشخيصية لكهربائية القلب.

Introduction

Bifascicular block by definition refers to conduction defect below the atrioventricular (AV) node in which the right bundle branch and one of the two fascicles (anterior or posterior) of the left bundle branch are involved. This definition is according to the guideline of pacing in American College of Cardiology (ACC/AHA/HRS[1].While the European Society of Cardiology (ESC), in management of syncope

consider left bundle branch block (LBBB) as a type bifascicular block [1, 2].

Regarding trifasicular block still the term widely used although it is confused because of PR interval prolongation may be occur due to defect above or below the His and this mostly manifested as complete heart block. There are no unique anatomic and pathologic substrates in Trifascicular block; A 2009 AHA/ACCF/HRS had scientific explanation and interpretation of the electrocardiogram in bifascicular and trifascicular block [3].

HV interval started to be widely used after invasive recording of the His potential measurement in seventies and intraventricular conduction defect was establish as well known phenomena. and HV interval became used [4], and in old study if this defect value increase more than 55ms, that mean the risk of complete heart block in trifascicular also increase [5]. While the risk of complete heart block less than 2% if HV interval less than 55ms [6].

In our study we discuss the role of electrophysiology in patient with BFB before pacemaker implantation and weather the symptoms disappeared or not after pacing.

His bundle electrogram duration:

The normal duration of His bundle interval is normally short, 15 to 25 ms and that refer to conduction within His bundle [7].

Fractionation and prolongation, or even splitting of the His bundle potential, is seen with disturbances of His bundle conduction [8].

HV interval:

Represent conduction time from the proximal His bundle to the ventricular myocardium. The measurement of the interval is taken from starting His bundle potential deflected to the beginning onset of QRS complex of surface ECG leads or myocardial ventricular activation [9]. Reported normal value in the adults range from 25 to 55msec.they is shorter in children [8].

Unlike the AH interval, the His Ventricular interval is not changed or not associated with autonomic variation. So any disease or defect that affected the area under the His may lead to a prolongation of HV interval [5].

While shortor below normal HV interval can be seen in ventricular preexcitation via an AV bypass tract. The only other explanation for a short HV interval is a tachyarrhythmia of ventricular origin, A spurious explanation for a short HV interval is the inadvertent recording of a RBBB potential rather than a His potential .

Materials and Methods

Study protocol

42 consecutive patients referred to EPS with symptomatic BFB corresponding to complete interventricular conduction defect weather left or right bundle branch block associated with any type of hemi block left or Right, were included in this study. Pacemaker was implanted in 27 patients whereas in 15 patients there is no pacing. Diagnosis was confirmed by surface 12 lead ECG.

The patient admitted one day before the intervention procedure to explanation the procedure and to take his agreement and his signature for electrophysiological (EPS) and pacemaker implantation accordingly.

The procedure performed in the unsedated state, if necessary, diazepam iv (2 mg). By use Sildenger technique with three femoral access through the femoral vein three type of catheters were used in each study to take signal from three area in the heart (Atrium, His and Ventricular)

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1) In Right atrial appendage the electrode catheters with 5F and 4 mm spacing between electrode.
2) His electrode for Bundle potential.
3) Right ventricular apex electrode.

After advancing this catheter in the heart with fluoroscopy guide connected cable were used for each catheter to reach to conventional EP

system with 64 channels for display the intercardial signal on the screen. And then setting was done with two screen paper from intercardiac and surface ECG.

After setting complete baseline basic electrophysiological study was done by measured all interval AH (beginning of A signal in the high right atrium catheter to the His potential in His electrode). And then we assess the HV interval at baseline and after the stimulation by used stimulator built in conventional system Programmed stimulation protocol included the following:

- Sinus node assessment to see the sinus node function if there is dysfunction (SNRT> 1400ms) exclude from study.
- Programmed stimulation for both atria and ventricle in two direction to assess AV nodal function, and if arrhythmia induced patient excluded from study.

After baseline assessment of His bundle to the ventricle (HV) interval (the conduction time from the HV), re assessment of His-Purkinje block demonstrated after incremental atrial pacing, The EPS included measurement of corrected SNRT; HV interval at baseline and under stress by incremental atrial pacing.

Results

Results of this study were shown and expressed as two groups; patients with a pacemaker implantation and patients without pacemaker that depending on assessment of HV interval by electrophysiological study (EPS), by used of Basic EPS measurement and after stress by programmed stimulation. . Table (1) shows the demographic data for all patients in this study.

Forty two patients with symptomatic Bifascicular block (BFB) were enrolled in this study there were 25 male (59.5 %) and 17 female (40.5%). with mean age 63.4±12.2. Left Bundle branch block was diagnose in 28 patients (66.7%) and 14 patients (33.3%) were right bundle branch block.

Table1: Distribution of the study groups according to their demographic data

Patients		No.	%
Sex	Male	25	59.5%
	Female	17	40.5%
BBB	LBBB	28	66.7%
	RBBB	14	33.3%
IHD	Present	27	64.3%
	Absent	15	35.7%
Pacemaker	Done	27	64.3%
	Not	15	35.7%
Symptom	resolve	22	52.4%
	Not	20	47.6%

The clinical and electrophysiological data were shown in table (2), After HV interval Measurement at base line and after programmed stimulation for all patients in the study, there is no significant changes in HV interval pre (85.3±11.7 ms) and post (87.6±11.6 ms) stimulation. Pacemaker was implanted in patients with symptoms and HV interval more than 80 ms.

27 (64.3%) patients with mean HV interval (85.33±11.75 ms), implantation occur while in 15(35.7%), with mean HV interval (68.26±4.55 ms) no pacemaker implantation. So patients divided into two groups those with pacemaker implanted and without pacemaker implantation.

There is no significant difference between male and female in all study but there clear correlation between male and pacemaker implantation and P value < o.o5. (20 male versus 7 female).

Table 2a: Clinical and Electrophysiological Data.

Variable		Patients with PM (n= 27)	Without PM (n=15)	P value
Gender	male	20	5	<0.05
	female	7	10	
BBB	RBBB	9	5	>0.05
	LBBB	18	10	
IHD	Present	21	6	<0.05
	Absent	6	9	
Age		63.4±12.2	51.4±10	>0.05
AH1		85.3±11.7	68.2±4.5	<0.01
		87.6±11.6	69.6.± 4.8	

The age and HV intervals data presented as mean ± SD
AH1 Before stimulation AH2 After stimulation

Also as we see in table 2, 3 the type of bundle branch block weather it is left bundle block (LBBB) or right bundle branch block (RBBB), there is no significant effect to the type of BBB on pacemaker implantation. P value > 0.05. But what is clear that ischemia as IHD with symptomatic BFB significant relation with pacemaker implantation P value < 0.05.

Table 2b: BBB * Symptom * PM Cross tabulation

PM				Symptom		Total
				abcent	present	
done	BBB	LBBB	Count	*16*	*2*	*18*
			% within BBB	*88.9%*	*11.1%*	*100.0%*
			% within Symptom	*72.7%*	*40.0%*	*66.7%*
		RBBB	Count	*6*	*3*	*9*
			% within BBB	*66.7%*	*33.3%*	*100.0%*
			% within Symptom	*27.3%*	*60.0%*	*33.3%*
	Total		Count	*22*	*5*	*27*
			% within BBB	*81.5%*	*18.5%*	*100.0%*
			% within Symptom	*100.0%*	*100.0%*	*100.0%*
not	BBB	LBBB	Count		*10*	*10*
			% within BBB		*100.0%*	*100.0%*
			% within Symptom		*66.7%*	*66.7%*
		RBBB	Count		*5*	*5*
			% within BBB		*100.0%*	*100.0%*
			% within Symptom		*33.3%*	*33.3%*
	Total		Count		*15*	*15*
			% within BBB		*100.0%*	*100.0%*
			% within Symptom		*100.0%*	*100.0%*

P>0.05

Pacemaker and symptoms:

Pacemaker has great effect on the Symptoms as in figure (1), so the presence and absence of the symptoms were compared between patients with and without pacemaker implantation and it was clear that a pacemaker had significantly disappeared of symptoms after pacing in comparison with the patients without pacemaker (P<0.05).

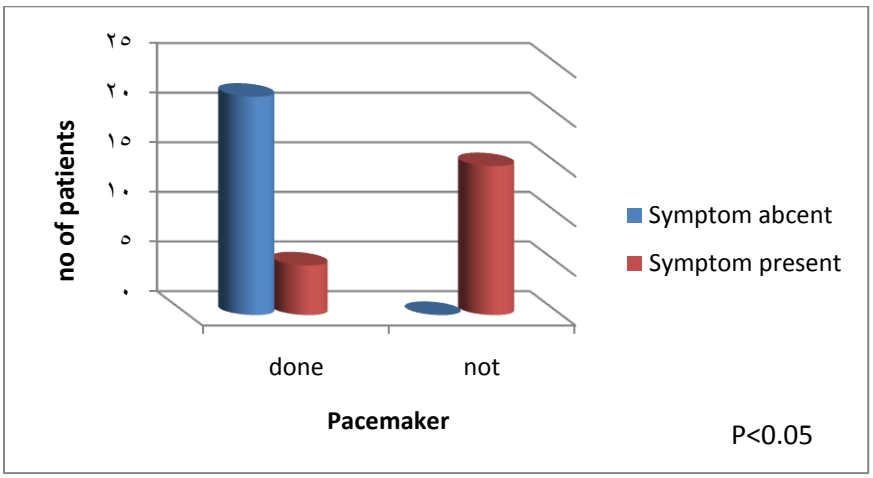
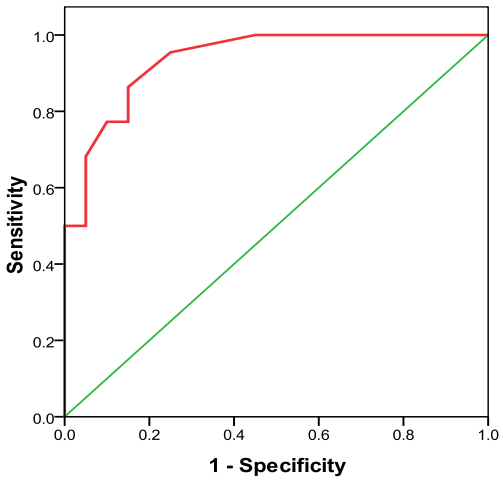


Figure 1: Effect of pacemaker on symptoms.

HV intervals assessment:

The ROC curve was done for all the patients; in whom the area under the curve for HV intervals was estimated between patients with a persistent symptom after pacemaker and patients without symptom. In which ROC curve shows that the area under the curve for HV intervals was 0.936, which represent that that the threshold at level of 75 have a sensitivity of 91% and specificity of 80%.The greater HV intervals gave more successful results. As shown in figure (2).



Area Under the curve	Cut off value of HV interval	Sensitivity	Specificity	**P value**	**Asymptotic 95% Confidence Interval**	
					Lower Bound	**Upper Bound**
.936	75	91%	80%	***.000***	***.858***	***1.000***

CI confidence interval.

Figure 2: HV assessment (sensitivity and specificity) by used (ROC) curve.

Correlation between HV intervals and age:

There was significant direct correlation between age and the HV intervals in which the HV interval increases as the age of the patients increase (R= 0.007) (Figure-3).

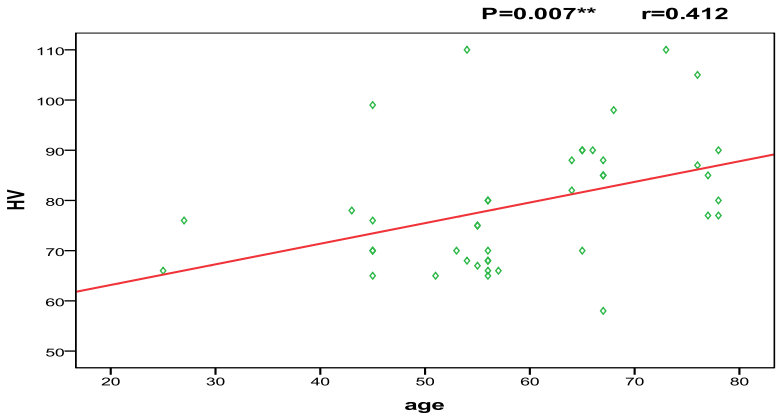


Figure 3: Correlation between age and HV intervals

Figure (4) show significant difference in HV interval between in those patients with pacemaker versus patients without pacing, as HV interval longer that why pacemaker was implanted.(P< 0.01).

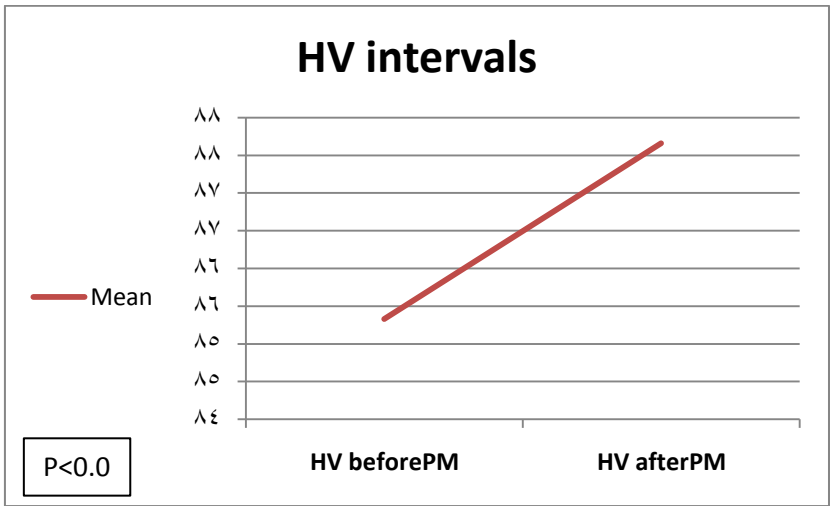


Figure 4 : HV intervals and pacemaker implantation

Discussion

In this study and before we discuss the result , high percentage of our patients where with left Bundle Branch block (66.7%) in compare with Right type (33.3%).without significant difference in gender distribution in all patients enrolls in this study, males were (59.5 %%) and females were (40.5%).

As we see in patients with BFB syncope occurred frequently, all patients in this study where with recurrent syncope and negative result of Holter study regarding transient block or any other disarrhythmia. And patients selected with good LV function by Echo study.

HV interval assessment by invasive EP study was done and pacemaker decision done for all patients with abnormal EP study and have HV interval more than > 80ms with patients agreement for implantation.

So pacemaker was implanted in (64.3%) patients with mean HV interval (85.33±11.75 ms), and no pacemaker in (35.7%), they have mean HV interval (68.26±4.55 ms). So patients divided into two groups those with pacemaker implanted and without pacemaker implantation and the clinical and electrophysiological data were comparing between two groups.

Pacemaker was implanted in male more than female (20 Vs 7) that clear significant regarding pacemaker and male gender, that may be because the number of patients in this study or most of female patients refused the intervention weather EP study or pacemaker implantation.

The presence of ischemia,(IHD), mainly in patients with LBBB type of BFB increase the risk of heart block and the frequency of syncope more in those patients, in our study pacemaker implanted more in patients with LBBB and IHD, with abnormal EP study. In 77.8% of IHD patients pacemaker was implanted. These data are in agreement with Martí-Almor et al [10**]**, regarding the association diseases that increase the risk of heart block in patients with BFB. And also with Nazari et al [11], study with little difference regarding LV dysfunction.

AV block is the most important cause of syncope in BFB around (32%-36%) [12**]**, That clear in our study the pacemaker of significant value in disappearance of symptoms after implantation according to the time of follow up, the syncope compares in all patients weather presence or absence and clear that pacemaker had significantly disappeared of syncope during follow up period less than one year in 81.5% versus 18.5% the syncope still occur frequently. So the pacemaker improved the intraventricular conductive defect and this in agreement with study of Carsten Israel [13**]** regarding syncope and BFB, which need pacemaker.

The ROC curve was done for the definition of HV interval; in which the area under the curve for HV intervals was estimated between patients with a persistent symptom after pacemaker and patients without symptom. In which ROC curve shows that the area under the curve for HV intervals was 0.936, which represent that that the threshold at level of 75 have a sensitivity of 91% and specificity of 80%. The greater HV intervals gave more successful results while other study that used this curve with an optimal sensitivity and specificity relationship a maximum value of 64 ms may be more effective than 70 ms in this respect [12, 13].

What we notice in this study that clear relation between syncope and age and the result of our study show that the older people have longer HV interval so the risk of block in those people get higher since the defect blow His was clear as HV interval prolonged with age.

So arrhythmias are occurring transient and thus difficult to document [14]. And in older patients arrhythmias is a main cause for syncope that why pacemaker improve symptoms in most our patients after implantation [14, 15].

According to our result the used of pacemaker had significant reduction in syncope in bifascicular block patients, in

those patients they have no explain cause for syncope, and that the same with PRESS study of Santini [16], that implanted DDD with pace rate of 60pbm with clear reduction of syncope in such patients.

Conclusions

The electrophysiological studies determined the risk of heart block in patients having syncope and intraventricular conductive defect of undetermined origin, most patients developing complete infra-His defect have prolong HV interval, assessment of HV interval consider as a predictor of subsequent heart block, so pacemaker implantation after abnormal EPS lead to significant reduction of syncope or symptomatic events.

Ventricular arrhythmia considers a rare electrophysiological finding in patients having infrahisian defect and syncope, with good LVEF. According to our findings, pacemaker or implantable loop recorder (ILR) implantation is suggested and may not necessary to perform EPS before pacemaker implantation in symptomatic Bifascicular block and coronary artery diseases. Moreover, permanent pacemaker implantation has relieved symptoms potentially due to heart block but never has been shown to prevent sudden death or alter mortality.

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