ORIGINAL ARTICLE

Incidence Of Atrial Fibrillation in Patients With VVI Pacemaker

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Background
In the majority of patients with pacemakers, when AF develops it is “clinically silent” both because traditional symptoms are absent and because atrial rhythm diagnosis on a single-lead ECG may be difficult.

Aim
To assess the prevalence of atrial fibrillation in patients with high degree heart block after implantation of VVI(R) mode pacemaker.

Methods
This study included 122 patients attending Benha University Hospitals and Nasr City Insurance Hospital pacemaker clinics for follow up to assess the incidence of AF. (all patients were not in AF at time of pacemaker implantation), Patients were divided according to their atrial rhythm at the time of follow up into two groups: Group I included (89) patients with sinus rhythm at the time offollow up, Group II included (33) patients with AF at the time offollow up. All patients were suspected to full clinical data, resting twelve electrocardiogram and transthoracic Echocardiographic study to detect LA dimension, LV end diastolic dimension, LV end systolic dimension, LV EF and presence of MR.

Results
We found that 33(27.5%) of 122 Consecutive patients attending for routine follow up have AF, there were 37(30.3%) patients with IHD, 42(34.4%) patients with hypertension, 18(14.7%) patients with DM, there was no statistically significant relationship between the two groups, the longer duration of pacing the more incidence of atrial fibrillation (in the pacing period above 5 years p= 0.001). The mean value of left atrial dimensions in group I was 36.81±4.52 versus 43.73±3.63 in group II and there was highly significant P value= 0.001. The presence of mitral regurge is highly statistically increased in groupII.Theonly 3(9 %) patients who had AF were anticoagulated, and 25(75.7%) out of 33 patients met the high risk criteria for thromboembolism.

Conclusions
The prevalence of AF were 27.5%, there is a significant relationship between occurrence of AF after VVI(R) pacemaker and MR, LA dimension and duration of pacing, Only 3(9%) of the patients who had AF were anticoagulated.

Keywords
AF incidence, VVI pacemaker.

INTRODUCTION
Atrial fibrillation (AF) is a supraventricular tachyarrhythmia characterized by uncoordinated atrial activation with consequent deterioration of atrial mechanical function it is the most common sustained rhythm disturbance.AF is a common arrhythmia found in 1% of persons older than 65 years. Hemodynamic impairment and thromboembolic events related to AF result in significant morbidity, mortality, and cost (1).

AF is common in patients with permanently implanted pacemakers attending pacemaker follow up clinics. In the majority of patients with pacemakers, when AF develops it is “clinically silent” both because traditional symptoms are absent and because atrial rhythm diagnosis on a single-lead ECG may be difficult. As a result, a large proportion of these patients are inadequately treated to reduce the risk of thromboembolic stroke (2).

AIM OF THE WORK
To determine the incidence of atrial fibrillation in patients with high degree heart block after implantation of VVI(R) mode pacemakers in relation to time of pacing.
METHODS

This study included 122 patients attending Benha University Hospitals and Nasr City Insurance Hospital’s pacemaker clinics for follow up (during the period from June 2008 to June 2009). All patients were not in AF at time of pacemaker implantation.

Exclusion Criteria
1. Patients with atrial fibrillation before implantation of pacemaker.
2. Patients with sino atrial node disease.
3. Patients with heart failure as detected clinically and by preimplantation ECHO.
4. Patients with rheumatic heart disease.
5. Patients with thyrotoxicosis.

All Patients were Subjected to the Following
1. Full history taking with emphasis on chest pain and risk factors as DM, hypertension, obesity, cigarette smoking, and history of ischemic heart.
2. History of warfarin or aspirin intake after pacemaker implantation and its indication if possible.
3. Full clinical examination.
4. Twelve lead surface ECG: standard 12 leads surface ECG was done to all patients to diagnose the underlying atrial rhythm.
5. Revision of medical reports for the site of pacing.
6. Transthoracic Echocardiography was done for all patients to determine:
   - LA size (normal value up to 40mm).
   - LV systolic function by calculation of LV EF by m-modemethod (3), Where the ejection fraction (EF%) is defined as the percent of change in left ventricular volume between systole and diastole with normal range 50-75% (4).

\[
\text{%EF} = \frac{(LVEDd)^3 - (LVESd)^3}{(LVEDd)^3} \times 100
\]

- Assessment of mitral valve for mitral regurge by 2D and Doppler.
The Echocardiographic machine model used was ATL HDI 5000 with a 3.5 MHz transducer, with all measurements and examinations made according to the recommendations of the American society of Echocardiography.
7. Interrogation of pacemaker parameters using an external programmer (duration of pacing, battery longevity, pulse amplitude, pulse width, lead impedance and battery impedance).

Patients were divided according to their atrial rhythm at the time of follow up into:
- **Group I:** Included patients with atrial sinus rhythm at the time of follow up.
- **Group II:** Included patients with AF at the time of follow up.

Statistical Analysis

Data were tabulated, statistically analyzed and compared to other studies:
- Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) for Windows (version 13.0; SPSS Inc., Chicago, IL, USA).
- Continuous variables were summarized as mean±standard deviation if normally distributed.
- Normal data were presented as frequencies and percentages.
- Continuous variables were compared by unpaired student t-test.
- Associations among categorical variables were compared by Pearson’s chi² test, continuity correction or two-sided fisher exact test as appropriate when the value of any of the cells was less than 5.
- P <0.05 was considered significant (5).
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Patients were divided according to their atrial rhythm into two groups:

**Group I**: included patients with atrial sinus rhythm at the time of follow up. They were 89(72.5%) patients 47 of them (52.8%) were males, 42(47.2%) were females, and their main age was (68±10).

**Group II**: included patients with AF at the time of follow up. They were 33(27.5%) patients, 16 of them (48.5%) were males, 17(51.5%) were females, and their mean age was (66.1±11) (Table 1).

Table (1): shows that there were 26(29.2%) patients with IHD in group I versus 11(33.3%) patients in group II, 32(36%) patients with hypertension in group I versus 10(30.3%) patients in group II, 12(13.5%) patients were diabetic in group I versus 6(18.2%) patients in group II, 30(33.7%) patients in group I were cigarette smokers versus 15(45.5%) patients in group II, and also in group I there were 11(12.4%) patients with new onset H.F versus 7(21.2%) patients in group II.

Table (2): shows that the mean value of LV ejection fraction in group I was 53.52±11.18 versus 55.42±9.88 in group II and there was no statistical significance. (P value= 0.21), also the mean value of LVEDd in group I was 54.7±8.2 versus 56.9±10 in group II and there was no statistical significance. (P value= 0.49), while the mean value of LVESd in group I was 45.1±8.5 versus 47.73±9.8 in group II and there was no statistical significance. (P value= 0.08).

The mean value of left atrial dimension in group I was 36.81±4.52 versus 43.73±3.63 in group II and there was highly significant (P value= 0.001).

Mitral regurge was found in 7(7.9%) patients in group I versus 13(39.4%) in group II and there was high statistical significance (P value= 0.001).

Table (3): shows that there were 13 patients who were paced for less than 1 year, 11(12.4%) of them in group I, 2(6.1%) in group II, while 76 patients were paced for a period of 1-5 years, 63(70.7%) of them were in group I and 13(39.4%) patients in group II, and only 33 patients were paced for more than 5 years, 15(16.9%) of them were in group I and 18(54.5%) patients in group II.

The mean duration of pacing was 3.6±2.6 years in group I versus 7.0±4.7 years in group II.

There was no statistical significance regarding the duration of pacing in patients paced for less than 1 year (p= 0.34) and for patients paced for 1 to 5 years (p= 0.12), however there was a high statistical significance regarding the duration of pacing in the pacing period above 5 years.
(p= 0.025), also there was a high statistical significance for the mean duration of pacing (p= 0.001).

In Group I there were 65 patients (73%) with the site of pacing at RV apex versus 27 patients (81.8%) in group II, and only 24 patients (27%) at RVOT pacing versus 6(18.2%) in groupII and these is statistically insignificant (p value= 0.08).

The mean value of pulse amplitude in group I was (3.7±0.8) mV, versus (3.6±0.8) mV in group II, and these is statistically insignificant (P value= 0.97).

Table (1): shows that the only 3(9%) patients out of 33 patients in group II(patients with AF) were anticoagulated.

<table>
<thead>
<tr>
<th>Duration of pacing</th>
<th>Group I(89)</th>
<th>Group II(33)</th>
<th>Total122(100%)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early &lt;1 yr</td>
<td>11</td>
<td>2</td>
<td>13(11%)</td>
<td>0.34</td>
</tr>
<tr>
<td>Intermediate [1-5] yrs</td>
<td>63</td>
<td>13</td>
<td>76(62%)</td>
<td>0.12</td>
</tr>
<tr>
<td>Late ≥5 yrs</td>
<td>15</td>
<td>18</td>
<td>33(27%)</td>
<td>0.025*</td>
</tr>
<tr>
<td>Mean duration of pacing</td>
<td>3.6±2.6</td>
<td>7.0±4.7</td>
<td>92(75.4%)</td>
<td>0.001*</td>
</tr>
<tr>
<td>Site of pacing:</td>
<td>RV apex</td>
<td>RVOT</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>65(73%)</td>
<td>27(81.8%)</td>
<td>92(75.4%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24(27%)</td>
<td>6(18.2%)</td>
<td>30(24.6%)</td>
<td></td>
</tr>
<tr>
<td>Pulse amplitude</td>
<td>3.7±0.8</td>
<td>3.6±0.8</td>
<td>3.7±0.8</td>
<td>0.97</td>
</tr>
</tbody>
</table>

DISCUSSION

Atrial fibrillation is a common arrhythmia found in 1% of persons older than 60 years. The overall incidence of atrial fibrillation developing over 2 decades in patients more than 30 years old according to the Framingham study is 2%, the incidence increases with age and in people with underlying heart disease. The same study indicated a double risk of cardiovascular mortality in patients with chronic atrial fibrillation, while was eight times more according to other authors (1).

In the present study, we evaluated the incidence of AF in patients after implantation of VVI permanent pacemakers who have regular pulses and QRS complexes.

The present study has demonstrated that AF is common in patients with permanently implanted pacemakers attending pacemaker follow up clinics. We found that 33(27.5%) of 122 Consecutive patients attending for routine follow up have AF (All of whom were not in AF at the time of pacemaker implantation as shown by preimplantation ECG).

Because these patients had underlying conduction disease (high degree heart block), they had neither symptoms suggestive of AF nor irregular pulse so the diagnosis of AF could not be based on symptoms alone, and it had to be specifically diagnosed by clinical examination and ECG.

In the majority of patients with pacemakers, when AF develops it is “clinically silent” both because traditional symptoms are absent and because atrial rhythm diagnosis on a single-lead ECG may be difficult. As a result, a large proportion of these patients are inadequately treated to reduce the risk of thromboembolic stroke (6).

Our results in agreement with the results of Fored et al. (2008) who found that following pacemaker implantation, there were 387 patients (14%) with AAI mode and 1017 DDD patients (17%) were admitted to hospital care for atrial fibrillation or flutter also he found that reducing ventricular pacing during DDD pacing caused less atrial fibrillation than standard DDD pacing (7).

Also our results are concordant with the results of PACE trial 1998, a prospective multicenter randomized comparison of VVIR with DDDR in 407 patients for AF developing after pacemaker implantation. It was found that AF developed in 11 out of 102(10.7%) patients with AV block treated with VVIR pacemakers. In a prospective analysis of 110 consecutive patients attending the pacemaker clinics (8). Folino et al. (1998) found that AF occurred in 40 patients (21%) during a mean follow up of 5.5 years. The incidence in patients with VVI stimulation was 27% (28 patients out of 105) (2).

Our study showed that there were 37(30.3%) patients with IHD, 42(34.4%) patients with hypertension, 18(14.7%) patients with DM, there was no statistically significant relationship between atrial rhythm and DM, HTN or IHD (Table 1).

These results agree with the results of Fored et al. (2008) in a large cohort study of Swedish pacemaker registry involving 8777 patients, which was designed to study the adverse effects of ventricular pacing and found no statistical difference in the incidence of post implant AF as regard the hypertension, IHD or DM (7).

In our study we found that 18 patients (14.7%) out of 122 patients developed clinical heart failure, but with no statistical significance between both groups (Table 1).
These results agree with Gebauer et al. (2009) who studied the risk of developing heart failure post implantation and found that clinical heart failure developed in 11 out of 82 of patients (13%) post implantation at variable durations of pacing regardless of the development of AF (9).

In our study we reclassified both groups according to duration of pacing, and we found that, there were 13(11%) patients paced for less than 1 year and 76 patients (62%) paced for [1-5] years, with no significant increase in the incidence of AF, on the contrary there were 33(27%) patients paced for more than 5 years, they were associated with increased incidence of post implantation AF and thus we concluded that the longer the duration of pacing the more the incidence of atrial fibrillation (Table 3).

In the PACE trial 1998, AF developed in 73(17%) out of 407 patients treated with either VVIR or DDDR pacemakers. 5(6%) of the 73 patients developed AF within 1 day after implantation, 13(17%) patients developed AF by day 30, and 55(75%) patients after the day 30. This may support our results regardless of the mode of pacing (8).

Our results also agree with Kristensen et al. (2004) who found that there is a considerable delay after pacemaker implantation before a possible deleterious effect of ventricular pacing or a beneficial effect of atrial pacing or physiological pacing becomes evident in a randomized trial of atrial versus dual chamber pacing in 177 patients with high degree AV block (10).

Also these results are in agreement with the results of Folino et al. (1998) who found that AF occurred in 40 patients (21%) during a mean follow up period of 5.5 years and he also concluded that duration of pacing was a predictor of AF in patients with RV pacing in all modes pacing (2).

Our study showed no statistically significant relationship between atrial rhythm at follow up and LV dimensions and systolic function (Table 2).

This finding agree with Gebauer et al. (2009) who found that the incidence of LV dilatation and dysfunction in patients with RV apical pacing was found to increase significantly from 1.3% prior to pacemaker implantation and 1.6% immediately after implantation to 13.4% (11 out of 82 patients) at last follow-up with no significant relation to the development to post implantation AF (9).

Our study showed a statistical highly significant relationship between LA size and atrial rhythm at the time of follow up; as we found that the mean LA dimension in patients with AF was 43.73mm (Table 2).

Our results agree with the results of Nielsen (2002), who evaluated serial changes in left atrial diameter over a mean follow up of 5.5 years in patients treated with VVI and AAI pacemakers. They found that the left atrial diameter increased significantly regardless of the pacemaker mode (11).

However this finding did not agree with Cho et al. (1997), who studied the risk factors for atrial fibrillation in 80 patients with permanent VVI pacemakers, they reported that there was no significant difference in LA size, this difference is probably because of the lower number of patients included in Cho study and because of shorter duration of follow up for 2 years, and a smaller percent of hypertensive patients (12%) in contrast to our study we had a larger percent of hypertensive patients (34.4%) (12).

In the present study, among the 33 patients with AF, there were 13(39.4%) patients had mitral regurge (MR), and we found a statistically significant relationship between MR and atrial rhythm (Table 2).

This finding agrees with the result of Núñez et al. (2002), who found that a significant number of patients with post implant AF had MR (9.5%) and he suggested that ventricular desynchronization may cause severe mitral regurgitation that may precipitate AF (13).

In our study we found that there was no significance as regard the site of pacing and the development of AF (Table 3).

This result agree with Stambler et al. (2003) who found that RVOT pacing though associated with a lesser QRS duration but it still activate the atria and ventricles at the same time which leads to contraction of the atria against closed AV valves and distention of the atria which is the suggested mechanism for development of AF in patients with VVI pacemaker (14).

In our study we found that 26 out of 33 Patients (78%) in group II who developed AF after implantation of their pacemakers met the high risk criteria for thromboembolism according to CHADS2 score (15), we found that: 22 patients were older than 65 years old, 6 patients were diabetics, 11 patients were ischemic and 10 patients were hypertensive. Only 3(9%) patients were anticoagulated by warfarin and there was nothing denoting contraindication to anticoagulant either by history or in their medical records (Table 1).

These results agree with the results of Langenfeld et al. (1988), who reported the rare use of anticoagulants in a group of 246 paced patients, 63 patients (26%) in this group had developed AF, of whom only one received warfarin (16).

Also this finding agree with results of Sparks et al. (1998), who reported that only 8 of 53 patients with AF (15%) were anticoagulated with warfarin, and all 53 patients with AF would be considered candidates for anticoagulation due to the presence of associated high risk factors for thromboembolism (8).

Andersen et al. (1998), reported that, warfarin use in 7 out 0f 222 patients (3%) randomized to atrial-or ventricular-based pacing, but no details are given regarding the atrial rhythms of these patients receiving anticoagulation (17).
Therefore the present study demonstrated that the main predictors of AF were large LA diameters, presence of MR and longer duration of pacing.

Also the present study found, that anticoagulation is underutilized in paced patients who developed AF after pacemaker implantation. These low rates of anticoagulation relate to the failure of diagnosing AF as those patients were usually asymptomatic with regular pulse on examination, and it needs special care to detect AF during routine Pacemaker follow up visits, also most of those patients didn’t follow up there pacemakers regularly with a long lag interval between visits which makes AF in those patients hard to diagnose, also the treating physicians did not search for AF in such patients.

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**REFERENCE**