Is diastolic function altered in pacemaker carrying patients?

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Premio a trabajos realizados por médicos residentes.

Resumen

It seems not probable that pacemakers (PM) interfere in diastolic function, at least according to studies based on classical measure systems. We wonder whether diastolic function remains unchanged in patients with pacemaker after the introduction of tissue Doppler. Aims. Determine if there are differences between two physiological stimulation systems: PM in VDD mode and DDD, also observing the relation between different diastolic function measuring systems: traditional and new techniques as colour-M mode Doppler and tissular Doppler (DTI). Methods. Two-observer echocardiogram to 65 PM patients, 36 DDD mode and 29 VDD. Evolution time with PM was 4.2 years for group DDD and 2.3 years for VDD (p < 0.01). Isovolumetric relaxation time (IRT), deceleration time, E/A wave relation and wave E slope with colour-M Doppler were used as traditional diastolic function parameters. They were also compared to maximum wave E speed obtained with pulse tissular Doppler in septum and lateral wall, measured at 1 cm from the mitral annulus in the TT apical access of 4 chambers. Results. No significant differences in diastolic function classical parameters were found between both DDD and VDD stimulation groups. Minimal differences found in deceleration time were non significant. Neither significant differences in tissular Doppler wave E speed between both stimulation systems were detected, With mean E peak higher than 8.8, excepting the septum, with a minor value. Conclusions. 1) There are no differences in diastolic function between both stimulation systems. 2) Evolution time with PM does not modify diastolic function.

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The diastolic function in patients endowed with pacemakers (PM) has not been widely studied. Presently, a new technique (Doppler tissue-DTI) constitutes an appropriate tool for studying this diastolic function. The technique is based on the detection of myocardial walls motility by a pulsed Doppler. The sensor is placed in the myocardial of the ventricular wall and the movements of this corresponding to the different phases of the cardiac cycle are monitored.

There are at present a number of patients provided with pacemakers; so the knowledge of the following aspects could be of great interest:

a) The differences, if exist, between two stimulation modes; namely, bicameral stimulation (DDD) and ventricular monomeral stimulation with auricular sensing (VDD). The interest in this case is due to the potential indirect influence of auricular stimulation on the conventional systems for measurement of diastolic function.
b) The correlation between conventional parameters for calculation of the diastolic function and the new way for this assessment provided by DTI. Patterns for normal relaxation could be distinguished from others with reduced or anomalous relaxation.
c) Differences between the values found in patients with pacemakers and those taken as normal in general population after monitoring for an averaged time longer than three years.

OBJECTIVES
The aims of this study were as follows:
1) To check the differences between two systems for physiological stimulation: pacemakers in VDD and DDD
2) To demonstrate the good correlation between the different systems for measurement of the diastolic function in patients provided with pacemakers; namely, conventional systems and those based on new techniques such as color-M mode Doppler and Doppler tissue.

3) To support the theory that pacemakers do not produce deterioration of the diastolic function, at least in patients with 3 years of average monitoring.

MATERIALS AND METHODS

Sixty five patients (36 of them with pacemakers based on bicameral stimulation with dual electrode for auricle and ventricle, and 29 of them with auricular sensing and ventricular stimulation with a single electrode within the ventricular cavity).

The studies were performed by two observers. Patients with anomalous echogenic window were deleted. An ATL 5000 echocardiograph was used for obtaining transthoracic echocardiograms (ETT).

The usual epidemiological data (namely, risk factors, cardiopathy and pharmaceutical treatment) were analysed. During the ETT study the following data were also collected: ejection and shortening fractions, cavity diameters, isovolumetric relaxation time, deceleration time for wave E, E/A wave ratio, presence of mitral insufficiency, hypertrophy degree and filling mitral pattern with colour-M mode. In addition, the wave E speed, systolic peak and E/A wave ratio in the septum and lateral walls in the apical access of 4 chambers at 1 cm from the mitral ring were obtained by DTI.

For the correlation study between the conventional systems for assessing of the diastolic function and the DTI system, the patients were divided into two groups depending on the results of the diastolic function obtained by the conventional system: patients with normal diastolic pattern (normal relaxation) and those with altered pattern (anomalous relaxation). Then, the results obtained by DTI in each group were analysed. It is worth pointing out that diastole alteration can be produced in patients with arterial hypertension, ischemic cardiopathy, hypertrophy of the myocardial walls, etc.

The statistical analysis was made using the parameters c2 and Mann-Whitney U as a function of the variables under study.

RESULTS

The average time for monitoring patients with pacemakers by the stimulation mode DDD was 4.2 years, meanwhile the time was 2.3 years for patients monitored by VDD, the time difference being statistically significant.

No statistically significant differences referred to risk factors were found (Table 1). A higher number of patients with ischemiocardio-pathy was found within the group with VDD stimulation, but the difference was in the significance limit. Neither significant differences were found between the two groups as regards pharmaceutical treatment at the time of performing the echocardiogram (Table 2).

<table>
<thead>
<tr>
<th></th>
<th>DDD</th>
<th>VDD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>54%</td>
<td>65%</td>
</tr>
<tr>
<td>Men</td>
<td>60%</td>
<td>82%</td>
</tr>
<tr>
<td>Women</td>
<td>59%</td>
<td>37%</td>
</tr>
<tr>
<td>HTA</td>
<td>33%</td>
<td>44%</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>14%</td>
<td>17%</td>
</tr>
<tr>
<td>Smokers</td>
<td>30%</td>
<td>27%</td>
</tr>
<tr>
<td>DM</td>
<td>11%</td>
<td>7%</td>
</tr>
<tr>
<td>Valvulopathy</td>
<td>5.8%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Ischemic cardiopathy</td>
<td>2.9%</td>
<td>10%</td>
</tr>
<tr>
<td>Dilated cardiomyopathy</td>
<td>1.8%</td>
<td>0%</td>
</tr>
</tbody>
</table>
No differences in cardiac frequency were found, as this parameter was within 72 lpm and 73 lpm in both groups. Neither significant differences were found in the presence of myocardial hypertrophynor mitral regurgitation.

Concerning the ETT findings, not significant differences between the results from typical Doppler parameters, nor from the data obtained by DTI were found (Table 3).

When the correlation between DTI and the conventional system for assessing the diastolic function was studied, the difference between the values obtained in the lateral and septum walls in both groups (normal and altered relaxation) was significant (p < 0.05) both in the maximum speed of wave E and E/A wave ratio, but not for the rate of the systolic wave (Table 4). These results show that, (a) the values of the DTI change depending on the diastolic patterns and (b) the existence of differences in the results of DTI depending on heart relaxation. In addition to these significant differences, other findings were as follows:

1) The average of the speed for wave E in normal relaxation was higher than 8.5 cm/s for the lateral wall and higher than 6.5 cm/s for the septum. In the case of reduced relaxation, the average was lower. The results obtained are similar to those in the literature and they are given as intersection between normal and anomalous relaxation.

2) The E/A wave ratio was lower than 1 for anomalous relaxation both in the septum and lateral walls.

In order to assess the theory that pacemakers do not deteriorate the diastolic function both groups were analysed together (independently of the stimulation type). The results obtained enable to conclude that pacemakers do not modify the diastolic function in a medium-term period (2-3 years). The values provided by DTI were within the normal values, in agreement with other authors.

DISCUSSION
The two groups under study were very homogeneous as regards age and risk factors and, attending to the
results, the auricular stimulation would not alter the ventricular filling pattern.

After consulting a number of data in the literature referring values taken as normal at present, the calculation of the diastolic function by DTI does not show overall and regional filling patterns for patients with pacemakers different from those of healthy population.

Taking into account the above-commented results and according to the usual values for calculation of diastolic function with DTI, this technique can be used for identification of altered and normal relaxation in patients with pacemakers. This aspect is of interest for potential application of this technique in the study of patients with ischemic cardiopathy in whose most of the tests for ischemy detection are not conclusive. In this way, ill segments could be related with altered DTI parameters.

CONCLUSIONS
The diastolic function is not altered with pacemakers use, at least in the case of pacemakers with physiological stimulation. The results provided by Doppler tissue do not differ significantly from the values of healthy population. There are no differences in the diastolic function between both stimulation modes (DDD and VDD).

Doppler tissue enables identification of both normal and altered patterns both in an overall sense and by segments. This fact is of great interest for being used as diagnostic test in a potential ischemic pathology.

Nevertheless, more in depth studies with a higher number of patients are mandatory in order to assess these findings.

RESUMEN
¿SE ALTERA LA FUNCION DIASTOLICA EN PACIENTES PORTADORES DE MARCAPASOS?
Introducción. Parece poco probable que los marcapasos interfieran en la función diastólica, al menos según los sistemas de medida clásicos. Hay trabajos recogidos en la literatura. Con la introducción del Doppler de tejidos nos preguntamos si continúa sin haber modificaciones en la función diastólica.
Objetivos. Por un lado, comprobar si hay diferencias entre dos sistemas de estimulación fisiológica: MP en modo VDD y DDD, observando además la relación entre los distintos sistemas de medida de la función diastólica: los tradicionales y las técnicas nuevas, como el Doppler modo M-color, con el Doppler tisular (DTI).
Métodos. Realizamos un ecocardiograma por dos observadores a 65 pacientes portadores de MP, 36 en modo DDD y 29 en VDD. El tiempo de evolución con MP fue de 4,2 años para el grupo DDD y de 2,3 años para el VDD (p < 0,01). Se recogieron, como parámetros tradicionales de función diastólica, el tiempo de relajación isovolumétrica (IRTV), el tiempo de deceleración (TDE), la relación onda E/A y la pendiente de la onda E con el Doppler M-color. Además se compararon con la velocidad máxima de la onda E obtenida con el Doppler tisular pulsado en septo y pared lateral, medido éste a 1 cm del anillo mitral en el acceso TT apical de 4 cámaras.
Resultados. No hubo diferencias significativas en ningún parámetro de la función diastólica clásica entre los dos grupos de estimulación DDD y VDD, y mínimas diferencias en el TDE que no fueron significativas. Tampoco se registraron diferencias significativas en la velocidad de la onda E del Doppler tisular entre ambos sistemas de estimulación con pico de E medio superior a 8,8 salvo en el septo que fue más baja.
Conclusiones. 1) No hay diferencias en la función diastólica entre ambos modos de estimulación. 2) El tiempo de evolución con el MP no produce modificaciones en la función diastólica.

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