should generate many questions regarding appropriateness, training, safety, and impact on medical care[12]. Today, the temptation to view these new devices as echocardiographic machines should be resisted. Rather, they should be seen as tools to enhance and complement the physical examination allowing more rapid assessment of cardiovascular anatomy, function, and physiology, particularly in an era where detection of ‘pre-clinical’, often asymptomatic disease is of paramount importance.

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References


The effectiveness of serial cardioversion therapy for recurrence of atrial fibrillation

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Atrial fibrillation is a difficult arrhythmia to treat. Despite various therapeutic approaches to this common problem, and new advances in different treatment modalities, there is, in the vast majority of cases, no long-term cure. This contrasts with many of the other commonly encountered arrhythmias, for which a ‘cure’, usually by means of radiofrequency ablation, can now be confidently offered to patients[1].

Patients with the paroxysmal form of atrial fibrillation often progress to the persistent form[2]. In patients with persistent atrial fibrillation, although we are quite adept at restoring sinus rhythm, either by electrical or chemical means, such ‘success’ often represents only a temporary state of affairs, with a return of the arrhythmia at a later stage (usually within a week of the cardioversion)[3]. Consequently, many studies have assessed the capability of various antiarrhythmic drugs to prevent the recurrence of atrial fibrillation. However, even the most rigorously designed clinical trials, using the ‘best’ drugs we have at our disposal for prevention of atrial fibrillation recurrence, still show an inexorable return of the arrhythmia as time progresses[4].

In addition to using antiarrhythmic drugs to prevent atrial fibrillation recurrence, others have attempted a policy of repeated electrical cardioversion in an effort to improve the chances of maintaining long-term sinus rhythm. The first study to do this in a randomized fashion is published in this issue of the
were shown to be reversible during sinus rhythm[9–11]. The results of Bertaglia et al. are in keeping with the first study to assess a policy of serial cardioversion therapy in patients with persistent atrial fibrillation, which was performed by Van Gelder and colleagues[6]. In this study, patients could have up to a maximum of four cardioversions (with the addition of antiarrhythmic drugs) and were followed-up at 1, 3 and 6 months post cardioversion. The serial cardioversion approach was effective, increasing the time spent in sinus rhythm, but this study also showed that a prolonged period of atrial fibrillation prior to cardioversion significantly reduced the likelihood of subsequent sinus rhythm. These authors therefore concluded that, if the serial cardioversion approach was to afford maximum benefit to the patient, early cardioversion should be aimed for once recurrence of atrial fibrillation had been detected.

It was with this aim in mind that Fynn et al.[7] assessed the efficacy of a policy of serial cardioversion in which patients were monitored on a daily basis after the initial cardioversion of atrial fibrillation, and in the event of atrial fibrillation recurrence they were admitted as rapidly as possible for a repeat cardioversion (up to a maximum of three). Prior to this study, there had been much experimental work to suggest that such a clinical policy would be successful. Electrophysiological changes induced by atrial fibrillation (termed atrial electrical remodelling), which had been shown to propagate further atrial fibrillation (‘atrial fibrillation begets atrial fibrillation’) [8], were shown to be reversible during sinus rhythm [9–11].

It was therefore logical to believe that if sinus rhythm could be maintained during this ‘reverse-remodelling’ phase, the chances of long-term maintenance of sinus rhythm could be enhanced. However, despite achieving early repeated cardioversion (patients were in atrial fibrillation for a matter of hours prior to repeat cardioversion), the results were rather disappointing, with only 17% of those undergoing repeated cardioversion maintaining sinus rhythm for the duration of the 1 month follow-up[7]. These results contrast with those of Bertaglia et al.[5], although comparison regarding the role of atrial electrical remodelling in the two studies cannot be made, since the mean period in atrial fibrillation prior to the repeat cardioversions in Bertaglia’s study[5] was approximately 30 days, long enough for the atria to have completely reversed[8,12]. The most likely explanation for the different outcome lies in the patient selection which is detailed in Table 1. It can be seen that Bertaglia et al.[5] selected only patients with a relatively short history of atrial fibrillation, all of whom were on a Class I or Class III antiarrhythmic drug. The patients in the study by Fynn et al.[7] had been in atrial fibrillation for significantly longer, and only a minority were taking antiarrhythmic medication. However, hidden within both of these studies is a similar message. In the Bertaglia study[5], the better outcome of the group undergoing the repeat cardioversion therapy was, in the main, due to those patients who underwent the second cardioversion and maintained sinus rhythm for 12 months (this represented 43% of the patients undergoing the second cardioversion). All of the remainder had atrial fibrillation recurrence, and of these patients who underwent the third cardioversion, only 14% remained in sinus rhythm for a significant period. Similarly, in the study by Fynn et al.[7], only 9% of those patients undergoing a third cardioversion remained in sinus rhythm for the 1 month follow-up. These studies therefore imply that if a second cardioversion is ultimately unsuccessful in patients who have a recurrence of atrial fibrillation, there is little to be gained from a third cardioversion, a fact acknowledged by Bertaglia et al.[5].

What else can we learn from the study by Bertaglia et al.[5]? As with all important studies, we are left with more questions than answers. Within a group of patients with persistent atrial fibrillation undergoing

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Comparison of characteristics of patients undergoing repeat cardioversion in the studies of Fynn et al.[7] and Bertaglia et al.[5]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fynn et al.[7] (n=59)</td>
</tr>
<tr>
<td>Age (years ± SD)</td>
<td>60 ± 10</td>
</tr>
<tr>
<td>Male/Female (%)</td>
<td>71/29</td>
</tr>
<tr>
<td>Duration of AF (months ± SD)</td>
<td>38 ± 47</td>
</tr>
<tr>
<td>Aetiology of AF (%)</td>
<td>15</td>
</tr>
<tr>
<td>Ischaemia</td>
<td>20</td>
</tr>
<tr>
<td>Hypertension</td>
<td>10</td>
</tr>
<tr>
<td>Valvular</td>
<td>39</td>
</tr>
<tr>
<td>Lone</td>
<td>16</td>
</tr>
<tr>
<td>Other Medications (%)</td>
<td>8*</td>
</tr>
<tr>
<td>Amiodarone/sotalol</td>
<td>0</td>
</tr>
<tr>
<td>Propafenone/flecainide</td>
<td>15</td>
</tr>
<tr>
<td>Beta-blockers</td>
<td>0</td>
</tr>
<tr>
<td>Verapamil</td>
<td></td>
</tr>
<tr>
<td>Echocardiographic data</td>
<td></td>
</tr>
<tr>
<td>Left atrial size (cm)</td>
<td>4·04 ± 0·5</td>
</tr>
<tr>
<td>Left ventricular ejection fraction (%)</td>
<td>58 ± 8</td>
</tr>
</tbody>
</table>

*Amiodarone in all cases.
AF=atrial fibrillation.
serial cardioversion therapy, there appears to exist a certain number who will benefit from a second cardioversion in the event of atrial fibrillation recurrence. In this study there were no obvious clinical characteristics that distinguished these patients, and so the question of how to detect such patients, thereby avoiding subjecting all patients with persistent atrial fibrillation to further and ultimately, unsuccessful, cardioversions, remains unanswered. These authors also showed that maintaining sinus rhythm improved both the function of the left ventricle and the quality of life score, although these issues are presently the subject of a much larger, multicentre study[13].

For reasons discussed above, precise conclusions regarding the role of atrial electrical remodelling in the recurrence of atrial fibrillation after cardioversion cannot be drawn from Bertaglia’s study[5] (no effort was made to repeat the cardioversions soon after the onset of atrial fibrillation recurrence). On this issue, these authors make the point that focal ‘triggers’, rather than electrical remodelling, may be more relevant to the group of patients who had early recurrences of atrial fibrillation after each of the three cardioversions. It remains likely, however, that these triggers are more effective at inducing atrial fibrillation in atria that are already remodelled i.e. both factors play a role. In addition, it could be hypothesised that in those patients with longstanding atrial fibrillation (as in Fynn’s study[10]), atrial electrical remodelling gives way to permanent structural changes which are irreversible, and render the patient permanently susceptible to further atrial fibrillation[14].

Before recommendations regarding the most effective strategy for the management of atrial fibrillation recurrence can be made, the role of atrial electrical remodelling, ‘triggers’ (most likely from the pulmonary veins[15]) and atrial fibrillation-induced electrical changes in atrial structure need to be further studied. Only when we have increased understanding of these areas, will we be able to tailor therapy more specifically and manage our patients with more confidence.

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References