Between Scylla and Charybdis: a choice between equally dreadful alternatives

On his long journey from Troy, Ulysses had to navigate the Strait of Messina. On the Italian side was the rock monster Scylla, on the Sicilian side was the whirlpool Charybdis. To navigate between these obstacles in this perilous passage, it was essential that Ulysses would steer a steady course, lest he, his ship, and all his sailors either be sucked to a watery grave by coming too close to the whirlpool Charybdis or be devoured by the monster Scylla.

His ablation or persistent conducted arrhythmia?

The classic dilemma above often illustrates the situation of physicians who are forced to select between treatment options for palliation of patients with chronic long lasting diseases. In guarding against one danger we often come close to, or succumb to, another. The path of safety is seldom easily found. Obviously, a similar analogy can be drawn by choosing between options such as rate control and rhythm control and/or drug therapy and non-pharmacological interventions when treating patients with highly symptomatic atrial fibrillation.

Atrial fibrillation, which is the most common supraventricular arrhythmia, can lead to cardiac dilatation and dysfunction[1]. Theoretically, restoration of sinus rhythm should result in an improvement in the patient’s symptoms as well as in cardiac function. A comparable but not completely similar effect is proposed to be obtained by a regular ventricular paced rhythm[2]. This can be achieved by ablating the atrio-ventricular (AV) junction followed by right ventricular (RV) apical pacing[3]. The reversibility of cardiac dysfunction after such an intervention was one of the reasons that the concept of tachycardio-myopathy was introduced[4]. However, it is clear that when atrial function is lost, the ventricular performance will suffer in the long term. Furthermore, ablation does not influence the embolic risk and the natural history, with respect to ischaemic stroke, is not necessarily modified. On the other hand, AV-junctional ablation is an easy way to control ventricular rate and symptoms of patients referred with atrial fibrillation[5]. Compared with more time consuming approaches such as focal and/or linear ablations to modify triggers and/or substrate, it is fast, and has a high success rate, even in inexperienced hands. Therefore, it can be done in almost every intervention laboratory (provided that an ECG machine with a simple amplifier and an energy generator for radio-frequency generation are available). A real training for electrophysiology (from a technical point of view) is not necessary to complete this task, but in some patients unexpected events may occur. After ablation, pacemaker dependency is the rule requiring implantation of a VVIR system and orderly atrial electrical activity is no longer thought to be present. This is a disadvantage as it introduces device-related complications in to a patient’s life. This trade-off between pacing and the original arrhythmia should be well balanced.

Drugs or non-pharmacological intervention for rate or rhythm control?

Inappropriately fast heart rates occur even during minor exercise in patients with atrial fibrillation. This is accompanied by depressed heart rate at peak exercise in cases of left ventricular dysfunction. Therefore, the aims of improving the patients’ functional ability can be reached by adequately controlling the rate. This attitude is supported by two recent...
multicentre studies. These randomized trials presented at the Annual meeting of the American College of Cardiology, Atlanta, 2002 suggest that indeed rate control is equal to rhythm control in some atrial fibrillation patients. The AFFIRM trial randomized patients to medical therapy either to restore atrial rhythm or to control ventricular rate, whereas the RACES trial compared rate control (achieved by drugs) with rhythm control by electrical cardioversions. Basically, neither of these studies demonstrated any benefit for rhythm control. It, therefore, can be believed that rate control alone is sufficient.

Patients often feel better in sinus rhythm. This is certainly one of the reasons why novel non-pharmacological approaches were developed for treating patients with atrial fibrillation. These interventions vary from ‘minor invasive’ approaches such as implantation of an atrioverter, to complex, long lasting interventional procedures such as pulmonary vein and linear ablations. In the light of the results of RACES and AFFIRM trials, however, it becomes clearly more difficult to defend these interventions unless the success rate will substantially rise. On the other hand evidence has been presented that rhythm control with antiarrhythmic drugs in heart failure has disadvantages\(^6\). It seems therefore, that the above mentioned complex interventions should be preserved for patients who are highly symptomatic.

### Survival or function: are the potential advantages counterbalanced by increased mortality?

The natural course of patients treated by AV-junctional ablation is still not known. Sudden death has been reported in some subgroups of patients. It was first attributed to the technique of DC shock ablation\(^7\) but, it was also observed after RF ablation\(^8\). In a meta-analysis of 21 studies with a total of 1181 patients, Wood et al. showed that the calculated 1-year mortality of ablation and pacing was comparable with medical therapy\(^5\). A considerable proportion of these deaths can be related to the acute effects of AV-junctional ablation with QT prolongation and slow pacing rate and/or unreliable escape rhythms\(^8,9\). Another subgroup of deaths was reported late after AV-junctional ablation, mainly in patients with heart failure\(^8\). The deterioration of pump function late after AV-junctional ablation may play a role in this mortality. Therefore, careful adjustment of the medical therapy for these patients with LV dysfunction is very important including β-blocker therapy, ACE inhibitors, adjustment of electrolytes and avoidance of antiarrhythmic therapy\(^7,10\).

### Symptoms and function: do we improve or do we just palliate?

It is now generally accepted that supraventricular incessant arrhythmias can lead to myocardial dysfunction and dilatation. Factors contributing to heart failure when atrial arrhythmias are present are the loss of an effective, well-timed atrial contraction and the fast and irregular ventricular response. These factors impair diastolic function and finally may lead to tachycardiomyopathy. Although the advantage of a regular ventricular response is important, RV apical stimulation is not physiological because normal ventricular activation along the natural conduction system is not present or bypassed and the ventricles are activated in an abnormal sequence. Despite these theoretical disadvantages, several investigators reported improvement in LV function after AV-junctional ablation in patients with permanent AF. Interestingly enough this improvement was also seen in patients without cardiomyopathy\(^11\). In contrast to these findings, in recent studies left ventricular performance did not improve or deteriorated after this treatment including the study by Bourke and colleagues\(^12,13\). Studies are convincingly showing that quality of life indices significantly improved after ablation of the atrio-ventricular junction. In the prospective multicentre randomized study of Brignole and co-workers, a mixed population of patients with atrial fibrillation and heart failure were recruited\(^14\). The ‘ablate and pace’ therapy was superior to drug therapy in controlling symptoms, but the efficacy appeared to be less than was observed in the previously cited uncontrolled studies. Importantly, objective cardiac performance did not show any improvement with the treatment. This could be an indication that different patients were investigated in the above mentioned studies as left ventricular dysfunction could be a primary as well as a secondary problem. Nevertheless, and this is important for health care economy, less hospital admissions and less doctor visits were necessary after ablation. So, it seems that we do more than just palliation.

### Do haemodynamics deteriorate or improve after ablation?

That real tachycardiomyopathy will improve after AV-junctional ablation in the short term is not a surprise. That this improvement will be sustained for several decades is still unproven. However, the majority of patients treated by AV junctional ablation have no real tachycardiomyopathy, but long standing or symptomatic atrial fibrillation. They will
develop fibrotic tissue in the ventricles associated with dilatation and it is not likely that they are going to improve their function as the disease process is not reversible. The evaluation of such deterioration is still an issue, which should be clarified. Deterioration was not shown by other investigators, as they measured left ventricular function before ablation, and took this as baseline, probably with serious technical limitations. In the study of Bourke et al., as well as in our former study the LV ejection fraction (LVEF) was measured several days after AV-junctional ablation and was compared with a measurement taken months later[12,13]. This approach allows measurements to be performed under exactly the same conditions regarding heart rate and regularity. Furthermore, LVEF measured by means of radionuclide ventriculography (RNV) is more reproducible and has an error of less than 3%. RNV seems less sensitive to the errors caused by the deformed right ventricular geometry during RV pacing because measurement is based on planimetry.

Right ventricular apex or alternative pacing sites?

The results showing the deleterious effect of right ventricular apex pacing prompted the investigation of alternative pacing sites, to preserve ventricular performance. Although the advantage of a regular ventricular response seems to be important[2], RV apical stimulation is not physiological because normal ventricular activation along the natural conduction system is bypassed and the ventricles are activated in an abnormal sequence. Chronic apical ventricular pacing is associated with myocardial cellular changes and leads to dysfunction of the left ventricle[15]. Diastolic function improved in studies with right ventricular outflow pacing, when the function was diminished at baseline[16]. In contrast, Bourke and colleagues demonstrated slight deterioration of diastolic function[13]. This suggests that not all patients will benefit from this pacing modality. Theoretically, multisite, or biventricular pacing may resynchronize the contraction pattern of the ventricles, in patients with heart failure and ventricular dyssynchrony. Re-coordination of the activation pattern can normalize the so called functional mitral regurgitation and may optimize left ventricular filling. Indeed, recent data confirmed that patients in atrial fibrillation may also benefit, but to achieve sufficient pacing time catheter ablation of the atrioventricular node is often required[17].

Although Ulysses survived one of the obstacles a whirlpool called Charybdis, he came too close to Scylla, a dreadful sea monster and lost six of his sailors from the ship.

Since AV-junctional ablation is an alternative way of rate control it still can be considered as a potential treatment for symptomatic patients or for patients when the primary aim is to improve quality of life as addressed by the AIRCRAFT investigators[18]. However, it seems that cardiac function does not improve or may decline in a considerable proportion of the patients. Therefore, approaches, which may preselect these patients or offer alternative pacing strategies for preserving ventricular performance, would have a role in their treatment. Until we understand how and when to do this, we will certainly lose some of the benefit for some of the patients.

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References


