Effective treatment of recurrent drug-refractory ventricular tachycardia is difficult, and conventional pharmacological and interventional approaches are often ineffective. We present a novel case report illustrating the potential use of omega-3 fatty acid supplementation in such patients.

The management of patients with recurrent drug refractory ventricular tachycardia is difficult. Both conventional anti-arrhythmic drugs and anti-tachycardia pacing often provide only partial control, and some patients with implantable cardioverter defibrillators (ICDs) may be subjected to frequent and distressing shocks. Radiofrequency ablation, the mainstay of treatment is technically challenging, restricted to specific centres, and associated with significant procedural risks. We present a novel case report illustrating the potential use of omega-3 fatty acid supplementation in such patients.

Case report

A previously well 66-year-old man presented with hypotensive sustained monomorphic ventricular tachycardia with a cycle length of 300 ms (Figure 1). Sinus rhythm was restored by DC cardioversion. Echocardiography revealed marked left ventricular chamber dilatation with severely impaired global systolic function. Coronary angiography demonstrated normal coronary arteries, and a diagnosis of idiopathic dilated cardiomyopathy was established. Intravenous and then oral amiodarone were administered and he was commenced on ramipril and bisoprolol. A dual-chamber ICD was implanted, and programmed to deliver tiered therapy, including anti-tachycardia pacing within a heart rate zone of 170–200 bpm, initially at 84% and then at 81% of the tachycardia cycle length.

In the early weeks following implantation, device interrogation revealed infrequent episodes of ventricular tachycardia terminated successfully by anti-tachycardia pacing. However, 2 months later he represented after having received a series of shocks following a storm of ventricular tachycardia (typical electrogram shown in Figure 2). Serum potassium was 4.1 mmol/L and serum magnesium was 0.9 mmol/L. He received intravenous magnesium along with additional intravenous amiodarone, the maintenance dose of oral amiodarone was increased to 400 mg per day (without significant prolongation of the QT-interval), and the doses of bisoprolol and ramipril were optimized. He continued to experience frequent episodes of monomorphic sustained ventricular tachycardia, though the cycle length slowed to be approximately 370 ms and anti-tachycardia pacing generally proved effective at restoring sinus rhythm, albeit with some further shocks from the device. Mexilitine was added to a total dosage of 750 mg daily, but had little effect on the frequency of ongoing ventricular tachycardia. Radiofrequency ablation was felt to be high risk, and in view of the limited available options he was discharged. Further outpatient review, however, revealed frequent bouts of sustained ventricular tachycardia. As a last resort prior to radiofrequency ablation, and in view of his poor diet (less than one portion of oily fish per week), he was commenced on treatment with omega-3 fatty acid supplementation (Omacor 1 g/day, Solvay Healthcare Ltd). At further review 4 weeks later, he felt well and, dramatically, there had been only one further episode of sustained ventricular tachycardia, which had occurred in the first 24 h following drug commencement. Prior to the initiation of omega-3 fatty acid supplementation, he had been experiencing 25–40 documented episodes of sustained ventricular tachycardia per day over a 3-month period (Figure 3).
He has remained well for the past 6 months, since the introduction of omega-3 fatty acid supplementation, and there have been no further episodes of sustained ventricular tachycardia, such that radiofrequency ablation has not been required to date.

Discussion

Epidemiological studies have established that populations which consume diets high in oily fish, a rich source of the omega-3 fatty acids eicosapentaenoic acid and docosahexaenoic acid, have reduced mortality rates from coronary heart disease. In 1999, the landmark GISSI-Prevention Study demonstrated that daily dietary supplementation with 850 mg of marine-derived omega-3 fatty acids (as the commercial preparation ‘Omacor’, Solvay Healthcare) resulted in a 15% reduction in a primary combined endpoint of death, non-fatal myocardial infarction, and non-fatal stroke at 3-year follow-up. Importantly, the study revealed a highly significant 45% reduction in sudden death in the group receiving omega-3 fatty acid supplementation. Earlier observational studies had also suggested that fish oil might protect against sudden cardiac death, and subsequent work has shown that omega-3 fatty acids exert multiple anti-arrhythmic effects through novel cellular mechanisms. These include the prevention of calcium overload by maintenance of L-type calcium channels during cellular stress, increased activity of cardiac microsomal Ca\(^{2+}/Mg^{2+}\)-ATPase, and potent inhibition of voltage-gated sodium channels.

Figure 1  Presenting electrocardiogram (25 mm/s, 10 mV/s).

Figure 2  Typical intra-cardiac electrogram during ventricular tachycardia (from top: atrial electrogram, ventricular electrogram, composite electrogram, and event markers).
Recently, a clinical study found that the intravenous administration of 3.8 g omega-3 marine triglycerides (Omegaven, Fresenius Ltd) resulted in complete suppression of ventricular tachycardia following programmed stimulation in five of seven patients with inducible ventricular tachycardia at baseline. Another study also showed that ICD therapy was delivered more frequently in patients with low serum levels of omega-3 fatty acids, but a subsequent randomized trial failed to show a reduction in episodes of ventricular tachyarrhythmia following routine omega-3 supplementation, and in contrast to earlier studies, suggested that this might be proarrhythmic in those patients with a history of previous myocardial infarction and prior sustained ventricular tachycardia. In contrast, a larger randomized trial of 546 patients with secondary prevention ICDs (the SOFA study) recently reported a non-significant trend towards event-free survival in a subgroup with prior myocardial infarction randomized to 2 g of fish oil per day. Similarly, a further recent randomized trial reported an increase in the time to death or first ICD event in the group receiving fish oil supplementation.

These inconsistencies between clinical trials may in part reflect differences in underlying arrhythmia substrate and triggering factors within study populations, and supplementation may be of limited efficacy in those patients with a relatively fixed arrhythmia substrate owing to scar-based re-entry. The patient under discussion had dilated cardiomyopathy, and suffered a prolonged and unexplained electrical storm, presumably reflecting a more dynamic electrical substrate, perhaps more sensitive to omega-3 fatty acid supplementation. The patient did not want to be subjected to drug withdrawal and re-challenge to confirm the effect, omega-3 fatty acid concentrations before and after treatment were not measured, and the effects of supplementation were surprisingly rapid. The conclusions must therefore be considered speculative, though the clear temporal association with drug commencement, the observed dramatic benefit sustained over 6 months of follow-up, and the lack of response to alternative therapies suggest a genuine effect. Omega-3 fatty acid supplementation may be of use in similar patients, but until more supportive data becomes available, this approach should only be tried in-hospital in ICD patients with refractory ventricular tachycardia.

References