Integrative medicine and arrhythmias

Avni Sali
MBBS, PhD, FACS, FRACS, FACNEM, is Director, National Institute of Integrative Medicine, and Vice President, the AIMA. avnisali@bigpond.net.au

Luis Vitetta
PhD, GradDipIntgrMed, GradDipNutr/EnvironMed, is Associate Professor, School of Medicine, and Principal Research Fellow, Unit of Health Integration, University of Queensland.

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Abnormalities of cardiac arrhythmias and conduction can be lethal (sudden cardiac death and stroke) or symptomatic (dizziness or palpitations). This article reviews the role of nutrients in the treatment of arrhythmias.

Omega-3 fish oils and arrhythmia

It has been well documented that populations that have a high fish intake have a low incidence of coronary heart disease and death.[1] Omega-3 oils have been demonstrated to reduce sudden death from ventricular fibrillation, presumably by stabilising the electrical activity at the cell membrane. Experimental in vitro and animal studies suggest that fish oil has direct cardiac electrophysiological effects.[2]

In animal experiments infused fish oils slow heart rate (HR) and alter the QT interval, both HR and abnormal QT interval predict arrhythmic events in humans.[3] Mozaffarian et al[4] have previously shown that fish oil lowers HR.

More recently the associations between usual consumption of fish and marine omega-3 fish oil and electrocardiograph (ECG) measures among 5096 women and men aged 65 years and over enrolled in the Cardiovascular Health Study (CHS) have been investigated.[5] The aim of the study was to investigate if fish consumption could reduce the incidence of sudden death and atrial fibrillation possible related to antiarrhythmic effects.

A cross sectional cohort analysis among participants in the CHS (who were randomly selected) was performed, evaluating usual dietary fish intake and ECG measures of heart rate, atrioventricular conduction (PR interval), ventricular repolarisation (QT interval) and ventricular conduction (QRS interval). Multi-variant models were adjusted for age, gender, race, education, smoking, body mass index, diabetes, coronary heart disease, physical activity and intakes of beef or pork, fried fish, fruits, vegetables, alcohol and total calories.

Consumption of fish (comparing the highest to the lower intake) was associated with lower heart rate (–3.2 bpm, 95% CI: –1.3–5.1, $p<0.001$), slower atrioventricular conduction (PR interval plus 7.2 ms, 95% CI: 1.4–12.9, $p=0.03$) and subsequently lower likelihood of prolonged QT (RR: 0.50, 95% CI: 0.27–0.25, $p=0.03$).

Fish intake was not associated with ventricular conduction ($p=0.60$). The findings were similar to estimated intake of omega-3 fatty acids: a 1 g/day intake was associated with 2.3 bpm lower heart rate (95% CI: 0.9–3.7), 7.6 ms longer PR interval (95% CI: 3.3–11.9) and 46% lower likelihood of prolonged QT (RR: 0.54, 95% CI: 0.33–0.88).

This large population based study suggested that dietary intake was associated with cardiac electrophysiology in humans, including heart rate, atrioventricular conduction, and ventricular repolarisation, with potential implications for arrhythmic risk.[5]

Omega-3 fatty acids and the prevention of AF following coronary artery bypass surgery

Atrial fibrillation (AF) is the most common complication associated with coronary artery bypass surgery (CABG). Postoperative AF can increase the risk of other major complications following cardiac surgery, as well as prolonging hospital length of stay, and increasing costs.

Several studies have shown that omega-3 fish fats may be effective in preventing cardiac arrhythmias and sudden death.[6,7] A 12 year follow up study investigating human fish consumption has been associated with a lower incidence of AF.[6] The aim of this prospective randomised study of 160 patients was to test if pre- and post-operative treatment with omega-3 fatty acids prevented the occurrence of AF after CABG. Patients were given fish fat at a dose of 2 g/day for at least 5 days before elective CABG and until the day of discharge from hospital. The primary endpoint was the development of AF in the postoperative period. The secondary endpoint was the hospital length of stay after surgery.

The clinical and surgical characteristics of the patients in the two groups were similar. Postoperative AF developed in 27 patients of the control group (33.3%), and in 12 patients of the omega-3 fatty acid group (15.2%) ($p=0.013$). There was no significant difference in the incidence of nonfatal postoperative complications, and postoperative mortality was similar in the omega-3 fatty acid treated patients (1.3%) versus controls (2.5%). After CABG, the omega-3 fatty acid patients were hospitalised for

significantly fewer days than controls (7.3 ± 2.1 days vs. 8.2 ± 2.6 days, p=0.017). This was the first study to demonstrate that omega-3 fatty acid administration during hospitalisation in patients undergoing CABG substantially reduced the incidence of postoperative AF (54.4%) and was associated with a shorter hospital stay.

It would be of interest to compare the efficacy of fish oils against drug therapies for postoperative fibrillation. Another interesting study would be to combine fish oils and magnesium in the hope of better control of arrhythmias.

Potassium and magnesium in the treatment of arrhythmia

Potassium and magnesium are very important minerals involved in the generation and regulation of myocyte cellular excitability, impulse propagation and regular ventricular excitability.

Studies demonstrate that low plasma concentrations of these minerals increase the risk of ventricular arrhythmia.[8] Administration of magnesium in most, but not all studies, of patients with cardiac arrhythmias resulting from chronic heart failure,[9] or an acute ischaemic syndrome associated with coronary bypass graft surgery,[10] has been effective in reducing tachyarrhythmia.

A double blind randomised placebo controlled study has investigated a large series of 232 patients with frequent and stable ventricular tachyarrhythmia to assess the antiarrhythmic benefit of an increase in the daily oral intake of magnesium and potassium in patients presenting with frequent and stable ventricular tachyarrhythmia. The antiarrhythmic benefit of increasing the daily recommended minimal dietary intake of magnesium and potassium by 50% over a 3 week treatment period was assessed.[11]

Patients with frequent ventricular arrhythmias (>720 ventricular premature beats [VPBs] per 24 h) confirmed at baseline and after 1 week of placebo therapy were subsequently treated over 3 weeks with either 6 mmol magnesium per 12 mmol potassium dl-hydrogenaspartate daily or placebo. The results showed that compared with placebo pretreatment active therapy led to a median reduction of VPBs by –17.4% (p=0.001); the suppression rate was 2.4 times greater than that in patients randomised to 3 weeks of placebo therapy (–7.4%, p=0.038).

The likelihood of ≥60% (predefined criterion) or ≥70% suppression rate (calculated from the placebo controlled run in period) was 1.7 (25 vs. 15%, p=0.044) and 1.5 times greater in the active than placebo group (20 vs. 13%, p=0.085) respectively. No effect of magnesium and potassium administration was observed on incidence of repetitive and supraventricular arrhythmias and clinical symptoms of patients.

This is the first controlled study to show antiarrhythmic effect of oral administration of magnesium and potassium salts when directed to patients with frequent and stable ventricular tachyarrhythmia. The significant antiarrhythmic effect was found when the recommended minimal daily dietary intake of the two minerals was increased over the 3 week period.[11]

It is known that it can take several weeks to increase magnesium levels in humans and hence a study of longer duration may have produced even more positive results.

Many cardiac patients take diuretics that can deplete magnesium and potassium levels, and this could enhance the probability of arrhythmias. Potassium levels are generally monitored in patients but not magnesium levels which are more difficult to assess. A meta-analysis of magnesium prophylaxis for arrhythmia after cardiac surgery decreased the risk of supraventricular and ventricular arrhythmias.[12]

Other techniques and nutritional options

There is evidence from smaller studies that mind/body techniques involving relaxation influence the autonomic nervous system and could play a role in the prevention and treatment or arrhythmia.[13] Nutritional supplements such as co-enzyme Q10, L-carnitine and selenium, plus a number of herbal medicines, may also be useful.[13]

Conclusion

Millions of deaths are attributed to arrhythmias. Given that several trials in humans have strengthened the evidence that omega-3 fatty acids may prevent arrhythmias, these supplements could have the potential of influencing heart death due to arrhythmia and could have a considerable role to play in benefiting public health. The role of potassium and magnesium in the treatment of arrhythmia is very promising based on current data.

Conflict of interest: none declared.

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afp CORRESPONDENCE email: afp@racgp.org.au