Antiarrhythmic effects of eicosapentaenoic acid during myocardial infarction--enhanced cardiac microsomal (Ca(2+)-Mg2+)-ATPase activity.

Kinoshita I, **Itoh K**, **Nishida-Nakai M**, **Hirota H**, **Otsuji S**, **Shibata N**.

Department of Cardiology, Center for Adult Diseases, Osaka, Japan.

The effects of dietary supplementation with eicosapentaenoic acid (EPA) on ventricular arrhythmias during myocardial infarction were examined in a canine model. EPA was incorporated into cellular membranes after ingestion of EPA-ester (100 mg/kg body weight/day) for 8 weeks. The ratio of EPA to arachidonic acid (AA) in platelet cell membranes and myocardial microsomes was significantly increased (7% to 37% in platelet cell membranes; $p < 0.01$, 3% to 12% in non-infarcted cardiac microsomes; $p < 0.01$, and from 2% to 8% in infarcted cardiac microsomes; $p < 0.01$). Dietary supplementation with EPA significantly reduced the incidence and severity of arrhythmias during coronary artery occlusion. Immediately after coronary artery occlusion, all of the animals in the control group that were given a toxic dose of digitalis developed ventricular tachycardia (VT) or ventricular fibrillation (Vf), whereas none of the animals in the EPA-supplement group developed VT or Vf within 15 min after administration of digitalis. Regardless of the presence of an infarcted area, the specific activity of the Ca(2+)-pump enzyme ((Ca(2+)-Mg2+)-ATPase) within the myocardial microsomal fraction of the EPA-supplemented group was significantly higher than in that of the control group (Vmax: 140.5 +/- 19.1 vs 94.8 +/- 28.9 nmol/mg/min in non-infarcted cardiac microsomes, $p < 0.01$, 130.9 +/- 18.4 vs 90.2 +/- 26.4 nmol/mg/min in infarcted cardiac microsomes, $p < 0.01$, EPA vs control group, respectively). The specific activities of the Na(+)-pump enzyme ((Na(+)-K+)-ATPase) and NADPH-dependent cytochrome C reductase in infarcted and non-infarcted cardiac microsomes did not differ between these groups. These results indicate that EPA supplementation increases the (Ca(2+)-Mg2+)-ATPase activity within myocardial membranes that is involved in Ca2+ metabolism in myocardial cells by increasing the ratio of EPA to AA within cellular membranes. These cellular alterations are likely to reduce the severity of ventricular arrhythmias by inhibiting the rapid accumulation of intracellular Ca2+ following ischemia.

PMID: 7699737 [PubMed - indexed for MEDLINE]