Preventing Sudden Cardiac Death by Nerve Sprouting from Right Stellate Ganglion

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Technology description

Sudden cardiac death (SCD) is a major public health problem that accounts for more than half of all cardiovascular deaths. Most cases of SCD are due to ventricular arrhythmias, such as ventricular tachycardia (VT) and ventricular fibrillation (VF).

In most cases of SCD:

1) the victim has had a previous myocardial infarction (MI);

2) for several days immediately subsequent to the occurrence of an MI, numerous episodes of VT — referred to as phase one episodes — occur;

3) eventually, the phase one VT episodes largely disappear;

4) several days or weeks later additional episodes of VT — referred to as phase two episodes — begin to occur. It is the phase two episodes of VT that often transition to cases of VF that result in SCD.

One technique employed in an attempt to prevent VT from occurring is overdrive pacing of the heart. If VF nevertheless occurs, one or more stronger electrical defibrillation pulses are typically applied to the heart in an attempt to terminate the VF thereby preventing SCD. Hence, for patients that have an MI, particularly a significant one, an implantable cardioverter-defibrillator (ICD) is often implanted into the patient. The ICD includes components for overdrive pacing the heart, detecting VT or VF, and administering the appropriate therapy.

However, the need to frequently overdrive pace the heart and to deliver cardioversion or defibrillation pulses can quickly deplete the battery power of the ICD requiring frequent replacement. Also, the therapies administered by the ICD, particularly the application of cardioversion pulses, may be extremely painful to the patient. Moreover, in some cases, the conventional therapy provided by the ICD is not sufficient to prevent or terminate VF and, accordingly, the patient still succumbs to SCD. Hence, it would also be highly desirable to develop new and more effective techniques for preventing VT or VF from occurring; particularly VT prevention techniques that do not require overdrive pacing and VF prevention techniques that do not require the administration of cardioversion or defibrillation shocks.

To fulfill this unmet need, Dr. Chen from the Cedars-Sinai Medical Center has developed a method in which a neuro-stimulator is implanted in the patient and positioned for applying stimulation to the right stellate ganglion of the patient. Neuro-stimulation is applied to nerve sprouting within portions of the myocardium supplied by nerves from the right stellate ganglion. Stimulation of nerve growth in

the myocardium via the right stellate ganglion can result in hyperinnervation of the sinus node and right ventricle of the heart which, in turn, reduces the occurrence of phase-2 VT and VF in the patient, and hence reduces the risk of SCD. The neuro-stimulator applies a neurotrophic vector such as Nerve Growth Factor (NGF), neurotrophic chemicals, neurotrophic substances, or neurotrophic hormones to the right stellate ganglion.

Application area

Reducing risk of SCD

Advantages

This method could greatly reduce need for overdrive pacing or shock therapy, thereby substantially extending the lifetime of the power supply of the ICD and eliminating the need for frequent surgical replacement of the battery supply.

Institution

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