USE OF PLATELET RICH PLASMA COMPOSITION IN THE TREATMENT OF CARDIAC CONDUCTION ABNORMALITIES

RELATED APPLICATIONS

This application is a divisional of U.S. application Ser. No. 12/575,314 filed Oct. 7, 2009 which claims priority to U.S. Provisional Application No. 61/103,464, filed Oct. 7, 2008. Both applications are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to treatment of cardiac conditions and more specifically to treatment of a cardiac conduction abnormality (e.g., arrhythmia) using a composition comprising platelet rich plasma.

2. Description of the Related Art

Arrhythmias are a common disorder where the regular electric pacemaker activity of the heart may be disturbed. The disturbance may be caused by a blockage, delay, or misfiring of the electrical conduction system of the heart that controls the contraction and relaxation of the cardiac muscle. Arrhythmias may vary in severity, from asymptomatic disease to sudden cardiac death, and may lead to heart disease and stroke. According to the American Heart Association, about 2.2 million Americans suffer from atrial fibrillation, one type of arrhythmia.

To maintain regular, rhythmic beating, the heart comprises an electrical conduction system that controls the contraction of the cardiac muscle. FIG. **1** is a depiction of the electrical conduction system of a heart (**100**). In a normal rhythm, an impulse begins in the sino-atrial (SA) node (**102**) and is ultimately propagated to the myocardium to maintain blood flow through the heart. The SA node (**102**) is located adjacent to the right atrium (RA) and initiates an impulse. The impulse is then propagated to the left atrium (LA) via the intra-atrial pathway (**104**) and via the internodal pathways (**106**) to the atrioventricular (AV) node (**108**). This first propagation causes the atria to contract so that the blood flows from the atria into the ventricles. After a delay at the AV node (**108**), the impulse propagates to the left ventricle (LV) and the right ventricle (RV) through the Bundle of His (**110**) to the left bundle branches (**112**) and the right bundle branches (**114**). The ventricles contract when the impulse reaches the Purkinje fibers (**116**). In a medical setting, this sequence may be measured in an electrocardiogram (ECG or EKG) that records the electrical activity of the heart over time and may be recognized as a PQRST-wave.

Any disturbance in the electrical conduction of the heart may be typically considered to be an arrhythmia. Arrhythmias may be acute, chronic, and/or a combination of various arrhythmias. Disturbances in electrical conduction may classified by rate, mechanism, and/or site of origin. The mechanisms that may cause an arrhythmia include, for example, pre-excitation (e.g. from a bypass tract), automaticity, reentry, and triggered activity. The site of origin of the arrhythmia may be anywhere in the electrical conduction system and may be, for example, atrial, junctional, atrio-ventricular, and/or ventricular.

Arrhythmias may result in irregular rhythms, reduced heart rates (bradycardia), accelerated heart rates (tachycardia), or desynchronized heart muscle contractions which may reduce the mechanical function of the heart. For example, atrio-ventricular dyssynchrony, may cause the loss of the "atrial kick" which facilitates ventricular filling, or result in an atrium contracting against a closed atrio-ventricular valve. Ventricular dyssynchrony, where the left and right ventricles contract at different times, may reduce contractile efficiency when one ventricle is contracting while the other ventricle is relaxed, and may result in interventricular septal displacement that reduces the net forward blood flow of the ventricle. In still another example, atrial fibrillation results in a disorganized quivering of the atrial muscle and a loss of forward flow, which may predispose the patient to blood clot formation and a higher risk of stroke.

Arrhythmias may be treated in several ways, including, for example, physical maneuvers, anti-arrhythmic agents, other drugs, electrical pacing, radiofrequency ablation, and/or cryo-cautery. The treatment is typically selected based on a diagnosis that identifies the rate, site, and/or mechanism of the arrhythmia(s) to be treated. While some treatments may relieve some arrhythmias, the same treatments may aggravate or have no effect on other arrhythmias. For example, a physical maneuver such as a Valsalva maneuver or carotid sinus massage may be used to treat a superventricular tachycardia, but may not affect a ventricular tachycardia or a bradycardia.

Drug treatments that may be used to treat arrhythmias may have undesirable side effects and/or may be required for months if not years in order to maintain a regular heart rate. Indeed, some anti-arrhythmic agents even predispose a patient to an increased risk of certain arrhythmias. Hemodynamically unstable patients suffering an acute arrhythmia may be treated with electrical shocks using an automatic external defibrillator (AED) or manual defibrillator, but electrical shocks are not always successful in ending an arrhythmia and may cause significant discomfort or even burn the skin. Patients with a chronic arrhythmia may be treated with implantable cardiac rhythm management devices such as a pacemaker and/or defibrillator. However, these devices are subject to malfunction and may be difficult to implant in certain patients. Ablation of abnormal conduction pathways, or the formation of scar tissue to control the propagation of electrical activity, such as the Maze procedure used for atrial fibrillation, also requires invasive procedures and may only be effective in treating a narrow range of arrhythmias and while also increasing the patient's arrhythmia risk during the procedure or surgery.

As such, additional treatments for arrhythmias are desirable. Kits for treating arrhythmias are also desirable.

SUMMARY

Methods for treating cardiac conduction abnormalities (e.g., arrhythmias) are provided. Generally, the methods may include identifying a patient with a cardiac arrhythmia or an arrhythmia risk and delivering a platelet rich plasma (PRP) composition comprising PRP to treat the cardiac conduction abnormality. The cardiac conduction abnormality may be determined based on an abnormal heart beat, an electrocardiogram (ECG), electrophysiology study or by any other suitable mechanism. The functional effect of the conduction abnormality may also be assessed using electrocardiography, echocardiography, cardiac catheterization, cardiac magnetic resonance imaging, or cardiac nuclear medicine imaging. The cardiac abnormality or a heightened risk of a cardiac abnormality may be documented in, for example, a medical history, test results, patient file, procedure log, or other electronic or paper record. The PRP composition may be delivered to cardiac tissue in an amount sufficient to treat the conduction abnormality. For example, the amount may be about one to about three cubic centimeters, about three to about five cubic centimeters, about five to about seven cubic centimeters, or