Biomechanics of the heart

TOO SHORT

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Biomechanical of the heart

The heart is an essential muscular organ to human life, it's part of the cardiovascular system together with blood vessels and blood. The main function of this system is the transport of blood in order to nourish the rest of the organism and excretion of certain components. The heart's main function is the pumping of blood throughout the vessels, this function is considered mechanical.

Anatomy of the heart: We can anatomically divide the heart in 4 main cavities: right and left atria, right and left ventricles. The atria pump the blood into the ventricles in a movement called atrial systole and the ventricular systole is characterized by the pumping of blood from the ventricles to the arteries. Between the atria and the ventricles there are the atrioventricular valves (tricuspid and mitral). The semilunar valves are found between the ventricles and their respective arteries. Finally, there's the chordae tendinae that are connected to the atrioventricular valves and to the papillary muscles.

Ventricular Hemodynamics: The ventricle wall is usually thick although it's thickness changes depending on the location of the ventricles (eg. The left ventricle wall is thicker than the right one), and has a complex muscle fiber architecture consisting of short myocytes. Blood pressure and volume flowrate are the most basic mechanical parameters of the heart especially in the ventricles, so that ventricular pressure is the most important boundary condition. We can say that initial ventricular filling after the opening of mitral valve is quick because the relaxing myocardium muscle causes the ventricles to produce a diastolic suction that sucks the blood from the atria. The later ventricular filling is caused by the atrial systole.

Muscle contractile properties: Cardiac muscle cannot be stimulated to produce sustained tetanic contractions due to the absolute refractory period of the myocyte cell membrane. Cardiac muscle also shows a mechanical property similar to the relative refractory period of excitation. After a single isometric contraction, some recovery time is required before another contraction of equal amplitude can be activated. The time constant for this mechanical restitution property of cardiac muscle is about 1 second.

References: http://nbcr.ucsd.edu/data/archives/si/training/2006/track4/Cardiac_Biomechanics_CRC.pdf