



Robotic Cardiovascular Surgery

Mitra M*

Alumnus with Electrical Engineering Department, University of Bridgeport, USA

*Corresponding author: Mitra M, Alumnus with Electrical Engineering Department, University of Bridgeport, USA; E-mail: mmitra@my.bridgeport.edu

Abstract

In a robotic cardiovascular surgery; most likely cardiac surgeon's specialization will be in treatment of heart valve disorders, atrial fibrillation coronary artery disease, and other cardiac diseases. Advantages of robotic cardiovascular surgery are less invasive methods to reduce pain, disability, and recovery time. Some robotic heart surgeries are performed without use of heart-lung bypass machine, hence minimizing risk of stroke and other neurological complications. Few medical robotic cardiovascular surgeries are reviewed.

Keywords: Cardiac; Heart; Robot; Surgery; Robotic cardiovascular surgery

Robotic Surgery for Mitral Valve

Although having steep learning curves and added cost involved for mitral valve repair for robotic surgery and fact is that common heart operations are performed using robot aided surgery. The robotic process for mitral valve surgery took 224 minutes. Robotic method for mitral valve surgery had similar outcomes comparatively with conventional approach except that there were half number of onward discharges to further care 7% to 15% and one day less spent in hospital. Since all the cases were reviewed after surgery had taken place, findings cannot establish cause and caution. Advantages and disadvantages to each of the techniques resulted to authors to conclude: "From a patient perspective, all techniques provide better outcomes, hence patient preference and surgeon experience should dictate the method for mitral valve surgery" [1-2].

Robotic Surgery for Coronary Arteries

This study depicts patients with multi-vessel coronary disease including obstruction of the left anterior descending coronary artery, the main artery in front of the heart. Robotic surgery encompasses making three small incisions, each about 1 cm (1/2 inch) long in the left side of the patient's chest. To view a 3-dimensional scope with 10x magnification was included in the middle port with robotic right and left arms in other ports. The mechanical system has a powerful computer interface that allows surgeons to sit at the console with full vision of the operative

Received date: 21 December 2022; **Accepted date:** 27 December 2022; **Published date:** 30 December 2022

Citation: Mitra M (2022). Robotic Cardiovascular Surgery. SunText Rev Cardiovasc Sci 2(1): 112.

DOI: <https://doi.org/10.51737/cardiovascular.2022.012>

Copyright: © 2022 Mitra M. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

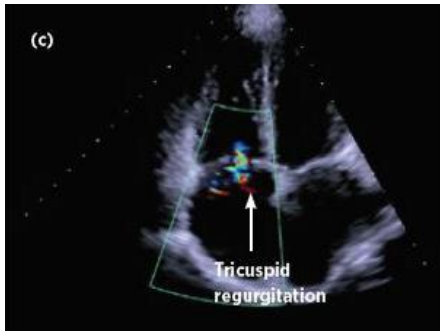
field. Surgeon's as usual surgical hand movements are rendered through the tiny robotic arms inside the patient. Robotic arms with identical instruments at their tips, precisely follow surgeon's hand movements [3-4].



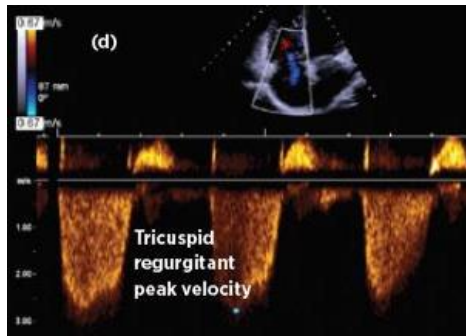
Figures 1a): Left ventricle chamber measurement in the parasternal long-axis view [3].



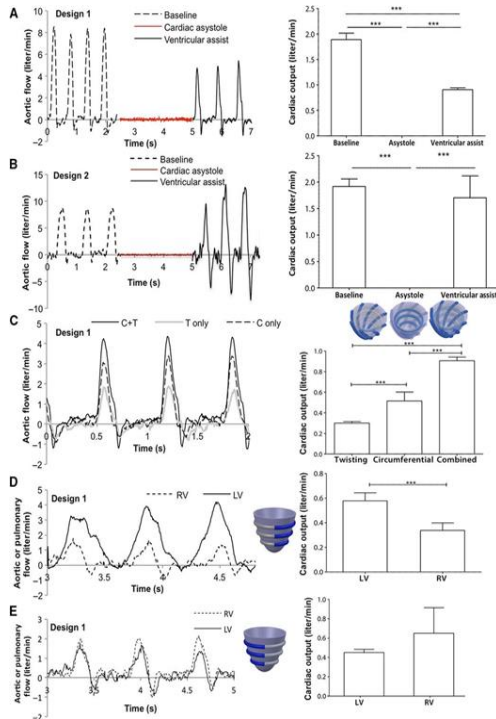
Figures 1b): Color doppler demonstrating central aortic regurgitation [3].



Figures 1c): Tricuspid regurgitant jet evident on color Doppler imaging [3].



Figures 1d): Peak velocity of the tricuspid regurgitant jet (used to estimate pulmonary artery systolic pressure) – this is unable to be adequately detected in approximately 30% of patients undergoing echocardiography [3].



Figures 2: Illustrates Soft Robotic Heart Graphs [6].

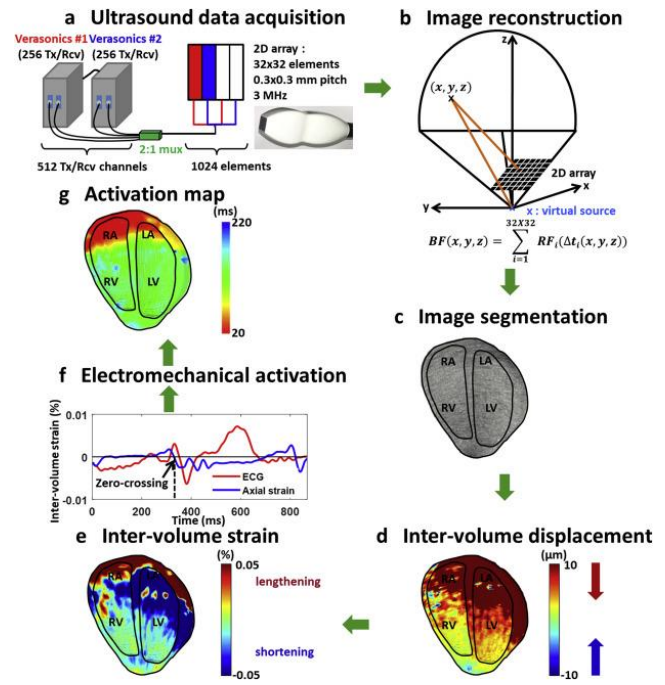


Figure 3: Illustrates 4D cardiac electromechanical activation imaging [8].

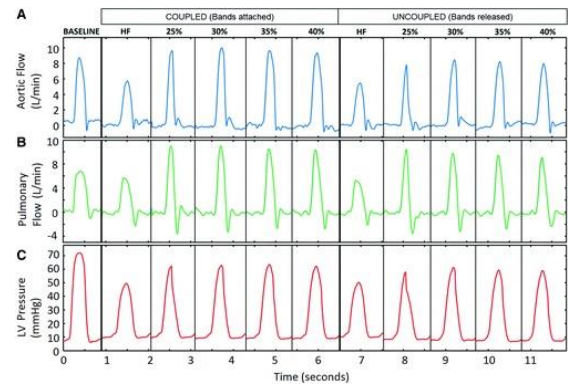


Figure 4: An Implantable Extracardiac Soft Robotic Device for the Failing Heart Mechanical Coupling and Synchronization [10].

Robotic Operation for Heart Valve

A potentially lethal bacterial disease of heart that often affects heart’s tricuspid valve, frequently resulting permanent tissue damage. But a reconstructive method in which valve can be repaired with a bio scaffold on which new tissue can nurture and can give some patients a new hope of life. Dr. Guy is one of only about a dodecahedral of cardiovascular surgeon in the United States who performed complete valve repair procedures. He became one of the first surgeon to perform reconstruction endoscopically using robotic methods. Dr. Guy performed a robotic repair by first removing nearly all damaged valve from the patient’s heart, later he then used ‘cylinder technique’ to repair



the damaged tissue with a sheet of bio scaffolding that had been shaped into the tube. The cylinder duct effectively served as a new valve. Dr. Guy explained bio scaffolds consist of sheets of ECM – an acellular meshwork of fibers and carbohydrate polymers that enables reconstruction by giving patient’s own cells a framework to build a new tissue. Because ECM is made of natural materials, sooner or later it is replaced by patient’s own cells and absorbed by the body. It also has low likelihood of rejection since it doesn’t contain foreign cells or proteins that could precipitate immune response [5].

Robotic Surgery Techniques for Cardiac Cell

Scientists at University of Minnesota effectively performed robotic surgery to deliver stem cell treatment to damaged heart. Cells were effectively transplanted in six of seven cases. Successive Magnetic Resonance Imaging (MRI) studies demonstrated that cells took hold in the heart and function improved. They used a combination of skeletal myoblasts that give rise to muscle and bone marrow derived cells. Both cell types demonstrated to recover the development of new blood vessels and recover function of injured heart muscle. It is worth to take note that human clinical trials were successful. Skeletal and bone marrow cells that were injected into damaged tissue revealed to recover function in the left ventricle, the chamber of the heart that pumps into the aorta, the main artery of the heart through which oxygen – rich blood flows from the heart to the body [6-7].

Robots Has Gone Where No Surgeon Has Gone Before

The aim of research was to create safe and coronary surgery, a lifesaving procedure in which blood vessels from chest are used to route blood around blocked sections of heart arteries. In traditional bypass surgery, chest cavity is cut open and bones are “spread” requiring a lengthy and often painful recovery for patients. The robotics bypass surgery leaves the patient with only tiny scars and are much faster and less painful recovery time. The robotic surgery required making three small holes in the chest. Endoscopic surgery uses two surgical instruments and a tiny camera and light combination. In Penn State procedure, a separate robotic arm holds each of the two instruments and camera light assembly. At that time, US Food and Drug Administration allowed Penn State team to operate only one clogged artery in each bypass patient using its robotic system [8-9].

References

1. Hawkins RB, Mehaffey JH, Mullen MG, Nifong WL, Chitwood WR, Katz MR, et al. A propensity matched analysis of robotic, minimally invasive and conventional mitral valve surgery. *Heart*. 2018; 104: 1970-1975.

2. BMJ. Keyhole may trump robotic surgery for mitral valve repair: Lower rates of subsequent heart flutter and transfusion and shorter hospital stay. *Sci*. 2021.
3. Stokes MB, Roberts-Thomson R. The role of cardiac imaging in clinical practice. *Australian prescriber*. 2017; 40: 151-155.
4. American Heart Association. Robotic Surgery-stenting Combo Opens Coronary Arteries, Speeds Recovery. *Sci*. 2021.
5. Temple University Health System. Robotic operation for heart valve reconstruction holds promise. *Sci*. 2021.
6. Song SE, Whyte W, Machaidze Z, Payne CJ, Weaver JC, Fishbein G, et al. Soft robotic sleeve supports heart function. *Sci Transl Med*. 2017; 373.
7. University of Minnesota. Robotic Surgery Techniques Used In Cardiac Cell Therapy Research. *Sci*. 2021.
8. Grondin J, Wang D, Grubb CS, Trayanova N, Konofagou EE. 4D cardiac electromechanical activation imaging. *Computers Biology Med*. 2019; 103113-103382.
9. American Heart Association. Robotics Go Where No Surgeon Has Gone Before. *Sci*. 2021.
10. Payne CJ, Wamala I, Abah C, Thalhofer T, Saeed M, Bautista-Salinas D, et al. An implantable extra cardiac soft robotic device for the failing heart: mechanical coupling and synchronization. *Soft robotics*. 2017; 4: 241-250.