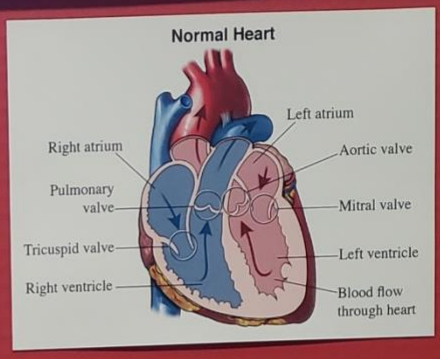
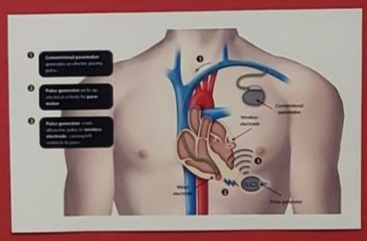
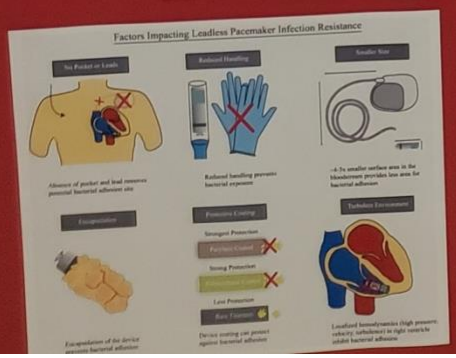
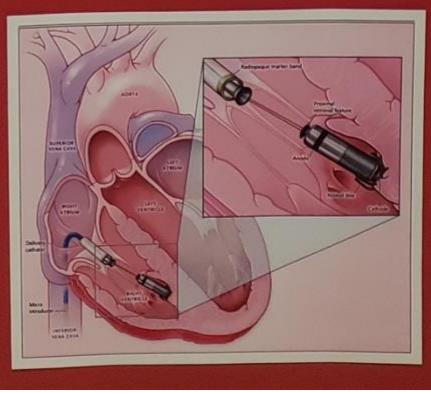
PACEMAKERS


Normal Heart
Left atrium
Right atrium
Aortic valve
Pulmonary valve
Mitral valve
Tricuspid valve
Left ventricle
Right ventricle
Blood flow through heart




Electrodes
Stimulation of heart muscle


Factors Impacting Leadless Pacemaker Infection Resistance
No Pocket or Leads
Reduced Handling
Smaller Size
Encapsulation
Pressure Casing
Turbulent Environment
Strongest Protection
Strong Protection
Low Protection

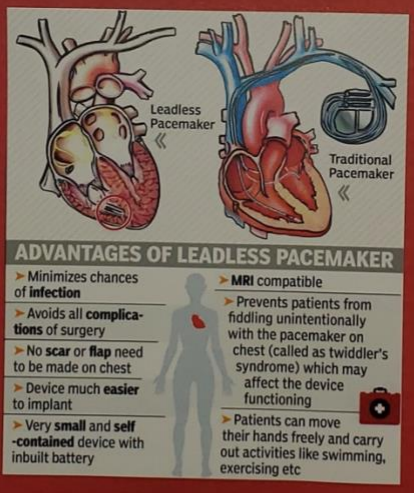


Pacemakers

The leadless pacemaker is a generator and an electrode device inserted directly into the right ventricle and is 90 percent smaller than a transvenous pacemaker. The system is implanted through a transcatheter femoral vein approach. chest incision or subcutaneous generator pocket is necessary. The key benefit of a leadless pacemaker is that most problems associated with transvenous pacemakers and leads are eliminated: pocket infections, hematoma, dislodgement of lead, and fracture of lead. Since there is no chest incision or visible pacemaker pocket, the leadless pacemaker also has aesthetic appeal. Leadless pacemakers only have single-chamber ventricular pacing and lack the ability to defibrillate. For patients with chronic atrial fibrillation with bradycardia or bradycardia-tachycardia syndrome or those who rarely need pacing, leadless pacemakers may be suitable. For patients who need dual-chamber pacing, such as patients with some types of heart block or sinus node dysfunction, leadless pacemakers are unacceptable. Just one leadless pacemaker has been approved for use in the United States by the US Food and Drug Administration Micra Medtronic PLC Minneapolis, MN a second Nanostim Abbott Laboratories; Abbott Park, IL is awaiting approval.

Improvement to Health Care

Pacemakers have changed health care in a tremendous way. A pacemaker helps regulate your heart beat for people who are hearts are too slow. Pacemakers adjust peoples heart rate automatically to match your level of physical activity. The leadless pacemaker allows people to get back to their regular activates and does not limit them from doing activities. The innovation of pacemakers has changed health care in many ways and will continue to improve and help more people in the future.



Benefits and Challenges

The benefits that leadless pacemakers give are an extended lifetime, small, and no scars. It takes less time to perform the procedure with no wires or generator in newer leadless pacemakers. They do not limit upper-body activity less long-term complications. Leadless pacemakers have a long battery, about 12 years long, and lower your chance to get blood clots. Some Challenges and complications are the devices moving out of place and internal bleeding. Infections can happen but are very rare.

Cost

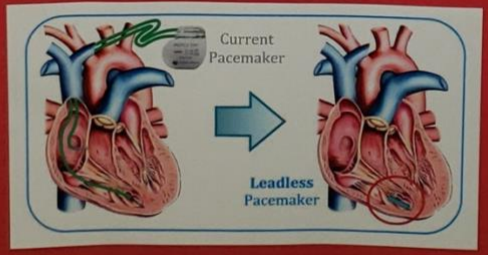
The average cost for a leadless pacemaker to be implanted is $4,937 to $26,000. How much the fees for a leadless pacemaker fees are hospital serveries, Physician services, and Anesthesia. Hospital services are $23,000 Physicians services are $1,291 and Anesthesia is $918. Additional cost is EKG test to monitor your heart chest X-rays. The EKG cost $400-$500 and the X-rays cost $200-$400.

History of the Pacemaker

During the 1780's Luigi Galvani was the first scientist to see a muscle contraction with the application of an electrical currents to the limbs of a dead frog. Ever since this observation, scientists researched and applied electrical currents for clinical use. Ever since then, many scientists and biomedical engineers have extended the research using electrical currents for clinical use. In the late 1920's Dr. Albert Hyman was working on developing the cardiac pacemaker. He named his first model the artificial pacemaker and that was patented during 1930. Dr. Hyman made three assorted designs of the artificial pacemaker and he tested the models by experimenting on different animals. Although there was no industrial interest in the product in the United States, a German company called Siemens-Halske and tested by Dr. Siegfried. Then in 1948, William Bradly Shockley, Walter Houser Brattain, and John Bardeen developed a divide called the transistor which revolutionized the pacemaker industry. This caused electrical units to be significantly smaller and this was a breakthrough for the pacemaker. This then caused the 1950's and the early 1960's to be the best years of pacemaker development. Going backwards to viewing the 1950's, during that time pacemakers were large and had to be plugged into electrical outlets. But later scientists were able to develop implantable pacemakers. In the 1960's, which was after the breakthrough of the implantable pacemaker, the initial estimate of global sales was about 10,000 units. Following into the 1990's, pacemaker sales increased by more than 3000%, over 20 companies produce 350,000 pacemakers worldwide. Ever since the innovation of the pacemaker it has only improved and will continue to. Pacemakers are a great innovation that has reduced the risk of death in many lives.

Career Implications

There are many different careers correlated with the production of pacemakers and the insertion of them into the body. The production of Pacemakers is primary relied on the work of biomedical scientists and biomedical engineers. A biomedical scientist is a scientist that is trained in and studies biology, they work specially in the context of medicine. The role of biomedical scientists investigating and diagnosing patient illnesses and most of their work is laboratory based. Biomedical engineers provide, install, and maintain biomedical equipment. Biomedical engineers use medical and biological sciences, with engineering principles to make equipment, computer systems, and software to be used in healthcare. Biomedical Scientists' role in pacemaker production is to research the different heart rhythms and different disorders that would cause someone to need a pacemaker. The role of biomedical engineers in the production of pacemakers is to make them so that surgeon can implant them into the body. The people that can install the pacemakers into the body are cardiologists/ cardiac surgeons, and physicians specialized in cardiac electrophysiology. Cardiologists are doctors who specialize in the treatment and diagnoses of different conditions of the heart and blood vessels. Some of these conditions consist of chest pain (angina), Irregular heart rhythms, high blood pressure, heart failure, and heart attacks. Cardiac physicians are remarkably like cardiologists and are the same. Lastly, like said previously, cardiologists implant pacemakers into the body. Now moving on to the salaries of the different jobs, a biomedical scientist makes an average of $81,500 per year, and a max salary of $132,500. Biomedical engineers make an average salary of $60,000 per year, and a max salary of $116,150 per year. Lastly, cardiologists make an average of $310,000 per year.



Why We Chose the Innovation

Lucas: I chose this innovation because when I first heard of pacemakers, I did not think much of it. But after doing some research into its history and how it evolved, and where it originated, I found it to be an interesting subject. Another reason I chose this as the innovation of this project is because I have always had an interest in electronics and how they work.

Andrew: I chose this innovation because when I had read about it and what it does, I found the pacemaker to be an interesting subject. Another reason that I chose this innovation is because it involves the heart. I like this because I am thinking about being cardiovascular surgeon one day. Finally, I think that the leadless pacemaker is a neat and interesting innovation.

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