Artificial Heart Valves

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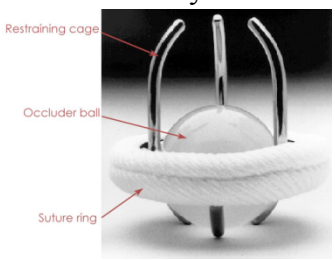
***Abstract*—Artificial Heart Valves and their functions, along with the types of patients that require them, will be addressed in this paper. The technology that is currently available as well as what is being developed will also be discussed.**

I. Introduction

Artificial Heart Valves, just like natural heart valves, control the flow of blood from one chamber of the heart to the next. They are implanted on individuals who suffer from various valvular heart diseases. Depending on the actual disease of the patient, either a mechanical or a biological heart valve may be implanted through open-heart surgery.

II. Methods

The first artificial heart valve was mechanical and it was invented by Dr. Charles Hufnagel in 1952. This ball valve was implanted in a thirty year old woman and, after the surgery, she was able to continue living as she had before. The only downside to this implantation was that it was not placed in the heart itself, but in the descending aorta, which did not fix the problem of the malfunctioning heart valve but instead, dealt with the symptoms.



Eight years later, in 1960, the Starr-Edwards ball valve was created which was based off of Hufnagel's design but was smaller, being able to be placed inside of the heart. In the later 1960's, tilting discs were created which allowed the blood to flow naturally but the struts tended to get damaged over time. In 1979, Bileaflet valves were introduced and allowed blood to flow through the center. It was as natural as could be but it did allow backflow. Still, most modern artificial heart valves are based off of this design.

Biological heart valves also exist. The most common ones consist of pig tissue. The pig tissue is similar to human tissue and, as a result, the patient's own cells grow into it if they accept it. Just like with the mechanical heart valves, the rejection rate is fairly low.

III. Results

The use of biological heart valves has been increasing more and more since they are less likely to cause problems in the long run. Mechanical heart valves, being a machine, will tend to wear out and need replacement. Not only that, but the mechanical heart valves tend to also cause blood clots in some patients after they have been in use for several years. The biological heart valves, since they are in fact very similar to a human heart valve, act as a human's and, in turn, don't cause the problems that can be found in the mechanical ones.

IV. Discussion

The problems that are associated with both the mechanical and biological heart valves cause researchers to further develop newer models in order to deal with rejection in both types, and blood clots and blood infection in the mechanical heart valves. In the future, the blood valves will hopefully become durable enough to last a lifetime so that patients will not need open-heart surgery more than once. The biological heart valve rejection rate will hopefully also go down and allow more patients to be able to get them implanted.

References

1. "Artificial Heart Valve." Wikipedia. N.p.. Web. 14 Oct 2012. <http://en.wikipedia.org/wiki/Artificial_heart_valve>
2. "Biological Heart Valves." Cedars-Sinai. N.p., n.d. Web. 14 Oct 2012. <http://www.cedars-sinai.edu/Patients/Programs-and-Services/Heart-Institute/Centers-and-Programs/Cardiothoracic-Surgery-Services/Heart-Valve-Repair-and-Replacement/Biological-Heart-Valves.aspx;
3. Dance, Amber. "Slide Show: 7 Artificial Valves That Lend Hearts a Helping Hand." Scientific American. 25 2009: n. page. Web. 14 Oct. 2012. <http://www.scientificamerican.com/article.cfm?id=artificial-heart-valves
4. >"Mechanical Heart Valve." drexel.edu. N.p., 17 2008. Web. 14 Oct 2012. <http://www.pages.drexel.edu/~nag38/History.html>