Internal Prostheses: Artificial Limbs and Organs

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Internal Prostheses are manmade devices that are surgically implanted into a patient. These devices can assist preexisting organs and limbs in performing their expected functions, or can even replace their biological counterpart entirely. Prostheses exist today that can either aid and/or replace many vital organs, or replace several major joints. For organs this includes, but is not limited to: the heart, the liver, and the lungs. For joints, artificial hips, knees, and shoulders are the most common.

The earliest known "successful" implementation of artificial organs was in 1913, when J.J. Abel, L.C. Rowntree, and B.B. Turner developed an artificial kidney made of collodion. It was used for hemodialysis in rabbits and dogs. The greatest breakthrough in artificial organ technologies came in 1982, when a Seattle dentist named Barney Clark, was the first person on Earth to receive a Jarvik 7 artificial heart. Since then, countless advancements have been made in the field of artificial organs, the latest of them being the artificial liver and artificial lung.

The most widely used artificial heart today is the CardioWest TAH-t, or Total Artificial Heart. To date, it has been used in over 800 patients with a survival rate of 79%. The only downside to the TAH is that it requires an external pump, making the incision sites prone to infection. Another artificial heart exists, called the AbioCor, it is the world's first self-contained artificial heart. It can function for up to 17 months on its own and has currently been used in 14 patients.

The HepaMate, still in the process of clinical trial, is the world's first artificial liver. It is an extracorporeal cell-based bioartificial liver system. Over 12 billion porcine (pig) liver cells are used in the system's bioreactor. Another new advancement in artificial organ technology is the BioLung by MC3. The BioLung "is an artificial lung that can replace the gas exchange function of a [patient] during recover from injury or illness, or until donor lungs are available for transplantation."

The modern artificial hip is comprised of three parts: a metal femoral component, a teflon acetabular component, and acrylic bone cement. It is the second most common joint replacement in the world, next to the knee. Artificial knees are constructed by shaving down the distal end of the femur and the proximal end of the tibia and replacing them with metal, interlocking components. Artificial shoulders replace the glenohumeral join with a highly polished metal ball attached to a metal stem, and a plastic socket.

The future of internal prostheses is full of promise. The AbioCor II self-contained artificial heart is currently under development, with a patient life expectancy of over 5 years. In the next decade or so, joint replacement may become a thing of the past, with the development of bioceramics that can actually strengthen and heal damaged bone by forming a scaffolding around and within the damaged tissue that stimulates new bone tissue to grow.

Works Cited:

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