

The Artificial Liver

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Abstract - The liver is one of the most crucial major organs of the body, and is designed to perform multiple functions required for our existence. As the largest internal organ, it is crucial in filtering blood, producing cholesterol and hormones, maintaining glucose levels, storing vitamins and minerals, and much more. Although the liver can completely regenerate itself, it can be subjected to liver disease. This can be caused by obesity, long term alcohol abuse, Hepatitis B and C or other viruses, toxins, autoimmune diseases, Acetaminophen, Prescription drugs, cancer, or other diseases. These factors can cause the liver to lose its functions, which can lead to death. Because of the liver's versatility in functions, there is no implantable or permanent man-made liver. The only current solution is a liver transplant. Human livers are not that easy to come by; the waitlist is long selective process, and approximately 2,000 people die annually while waiting for a transplant.

I. Introduction

Vital Therapies has designed an external bioartificial liver called the Extracorporeal Liver Assist Device, or ELAD®. This device does not substitute all the functions of the liver, but is able to process toxins, and synthesize proteins and metabolites, and gives patients a longer survival time while waiting for a liver transplant. This is done by filtering the blood through a set of four hollow fiber cartridges, and a glucose pump. The fiber cartridges are lined with human hepatocytes that are derived from human hepatoblastoma cells. These cells can perform most of the metabolic functions of the human liver, and these interchangeable cartridges last up to 17 days.

II. Method

The ELAD® system is comprised of a dialysis-type pump which separates plasma out of the patient's blood. The A glucose pump adds glucose to the plasma, which then goes through

the four ELAD® cartridges, and picks up the C3A cloned human liver cells. These cells metabolize the blood plasma, and produce proteins, and filter the blood. Finally, the plasma is rejoined with the patient's blood cells, and infused back into the patient's system.

III. Experiment

The ELAD® system has gone through six clinical trials, in the USA, UK, and China. It has been used to treat 123 patients to date. The treatment has been well tolerated, and has shown a significant increase in survival of patients with liver disease. The ELAD® system is regulated by the FDA's Division of Cellular, Gene, and Tissue Therapy, but has to be approved by the CTA in each country. The system is currently awaiting approval for 20 different sites.

IV. Results

Vital Therapies is currently the only available option to extend survival. HepaLife is currently developing a treatment using stem cells, but research is still in the adolescent stages. The ELAD® has already helped over a hundred patients through the transition of a liver transplant, and in the future, can possibly be used to sustain life functions long enough for the patient's own liver to regenerate without the use of a transplant.

References

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