Liver Dialysis: Molecular Adsorbent Recirculating System (MARS)

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Abstract—The liver is one of the most important organs in the human body. Currently there are no permanent artificial livers, but advancements have been made to increase the life span of patients waiting for a transplant using MARS.

I. INTRODUCTION

Every year 2000 people die each year while waiting for a liver transplant Liver Failure is caused by Hepatitis B, Hepatitis C, Long term alcohol consumption, Cirrhosis, hemochromatosis, malnutrition, Acetametaphen (Tylenol) overdose, reactions to certain prescription and herbal medications, and ingestion of poisonous wild mushrooms. Transplant research began in 1728 when John Hunter, a Scottish surgeon, performed animal transplants and tooth transplants. Then in 1890, Matheui Jaboulay, discovered vascular anastomosis with everting sutures. During 1901, Alexis Carrol implemented animal organ transplant using a triangulating vessel technique. Tom Starzl made a huge breakthrough in transplantation by performing the first liver transplant. Although the person did not survive, this was a major advancement in organ transplants. During the 1970’s Starzl and a few other surgeons executed 100 transplantations with 30% success. The success rate increased after researchers discovered ways to prevent infections. Stanford founds the Split Liver Transplant in 1996 where a liver is split and given to two people, which increases the donor pool. Germany solved the problem of patients dying while waiting for transplants by developing MARS, Molecular Adsorbent Recirculating System.

II. METHODS

The liver has many functions that are important for the body, such as clearing the blood of toxins. Since the liver is very complicated, there are currently no artificial livers, but there are Liver dialysis machines such as MARS. MARS is one of the newest dialysis machines. The blood of the patient enters the MARS machine. The water-soluble and protein-bound toxins in the blood pass through the membrane because they are attracted to the albumin solution on the other side. The albumin solution with the solutions passes through another membrane to remove water-soluble toxins. There are two adsorber cartridges filled with activated charcoal or an anion exchanger. The toxins are removed in these cartridges. The albumin solution is then returned to its beginning position to remove toxins from more blood. The following picture displays the MARS machine:

III. RESULTS

MARS has been approved in the US to extend the life of patients who suffer from acute liver failure. It cannot be used for patients who have long term liver failure. MARS has successfully increased the life span of patients waiting for transplants, such as Brandon Rice, a four year old with a malformed liver.

IV. DISCUSSION

There are a few limitations to this biomedical device. One limitation is that it is not permanent. This device can only be used for a short period. Another disadvantage is the cost. For a seven hour treatment it costs € 300 for 600 ml human serum albumin solution (20%), € 1740 for a MARS treatment kit and € 125 for disposables used by the dialysis machine. The final limitations are that it may cause infections and the patient has to go to the hospital in order to receive treatment. The future of MARS includes lowering the cost, making it portable, and making it more available. The ultimate future of liver transplantation is to design a more permanent artificial liver, which will save many patients waiting for a liver transplant.

REFERENCES