

Cardiopulmonary Bypass Machine

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I. INTRODUCTION

THE Cardiopulmonary Bypass Machine (CBM) also known as the Heart-Lung Machine or “the pump” is a machine most commonly used during open heart surgery. This machine plays the role of the heart and lungs while the heart is stopped to perform surgery. The CBM takes the oxygen-depleted blood through a tube from the heart into the machine and it oxygenates the blood before sending it back to the body. Before the CBM was made surgeons only had a 15 minute window to work on a stopped heart, but with the CBM they now have 45 minutes to finish the surgery.



II. METHODS

The biggest problem with the early model CBM's was that the test subjects were dying during surgery. Dr. Gibbon, the surgeon who first developed the machine, and Thomas Watson, an engineer and chairman of International Business Machines (IBM) and other engineers worked together to create a new model. They tested on dogs and found that many of them were dying because of blockages in a blood vessel. This is when they realized they would need to filter the blood before it could return to the body. Gibbons and his team of engineers decided to use a 300-micron mesh filter to trap the tissue particles before returning the blood to the body.

III. RESULTS

In 2001 a New England Journal of Medicine article by Mark F. Newman, chair of Duke University Medical Center's department of anesthesiology, and his colleagues found that even after five years many CBM patients still struggled with cognitive decline and mental impairments. Many previous studies only followed patients six months after surgery, describing patient's cognitive decline as 'subtle' or 'subclinical'. In Newman's study, he and his group administered five cognitive tests- recall, repetitions, visual retention for example, and other cognitive tests to 261 heart bypass patients. These tests were given the week before surgery, the week after surgery, six weeks later and six months

after that. After surgery, 53% of the patients could not match their earlier cognitive performance. Six weeks later, 36% continued to have cognitive decline and six months later 24% were still affected. Then five years after the first round of tests, Newman's team tested their subjects again and found that 42% did so poorly they were declared cognitively impaired.

IV. DISCUSSION

There are many obvious benefits that have come from the Cardiopulmonary bypass machine, the main benefit of giving more time to surgeons to complete an open heart procedure. Another benefit of the CBM besides giving surgeons more time during surgery is that the machine provides them a motionless heart with little blood in the surgical area. Patients that are on organ transplant lists can also be helped by this machine by using it while they wait for a new organ. One benefit that not many people know about is that in severe cases of hypothermia the CBM can warm the blood as it passes through the heat exchanger, and correct the patient's body temperature.

Unfortunately there are some disadvantages to the heart-lung machine. One of the biggest downfalls to this machine is a term doctor's use called “pumphead”. There have been many studies on patients after they have been on the CBM and the results showed that there can be significant cognitive declines after surgery. They are unsure of the cause, but they believe there is an incorrect amount of oxygen getting to the brain during the surgery. Another problem with the machine is that it can sometimes create a blockage in blood vessels due to air bubbles in the blood stream or other particles not being filtered properly, which leads to high stroke risks.

The future of the cardiopulmonary bypass machine is very optimistic considering they machines used today are very similar to the first machines used. They have gotten many problems worked out and are starting to work on miniature heart-lung machines to better help small children and infants. As of now only small animal are being tested, but the results are positive so far. The first portable heart-lung machine was created in 2007 and is only being used in Europe, but hopefully in the future they will be used here in the US to help patients at home.

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