Immuno-inflammatory Response of Different Surgical Approaches in Coronary Artery Revascularization under Different Anesthetic Techniques.

Thesis submitted for partial fulfillment of the M.D. Degree in Anesthesiology

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بسم الله الرحمن الرحيم

{قالوا سبحانك لا علم لنا إلا ما علمتنا إنك أنت العليم الحكيم}

صدق الله العظيم
سورة البقرة/الآية 32

Dedicated

To My Family

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Introduction and Aim of the Work

Anesthesia and surgery for coronary artery bypass grafting (CABG) can compromise the specific limb of the immune response resulting in a decrease in lymphocytes, antibody production and an inhibition of cell mediated toxicity. **(Tashiro et al., 1999)**

General anesthesia interferes with immune cell number and immune cell response. This may explain the clinically well-recognized disturbance of human immunity after surgery and general anesthesia. . (**Brand et al., 1998)**

There is an ability of some anesthetic agents (Propofol, Midazolam, Ketamine and Thiopental) to induce the release of cytokines by human monocytes and lymphocytes in vitro. The greatest Interleukin -1 alpha (IL-1 alpha) production increase was induced by Propofol. (**Rossano et al., 1992)**

Anesthesia and surgery affect the immune defense mechanisms, but it has been shown that anesthesia per se has either none, or only minor immunological effects. In contrast, surgical trauma can cause immunosuppression of clinical importance (**Rossano et al., 1992)**

Depression of all components of the immune system have been described following cardiopulmonary by-pass (CPB) whereas the serum level of immunoglobulins and complements were diminished as well as their functional capacity as defense mechanism**. (Roth et al., 2000)**

Coronary by-pass on a beating heart may provide a safer form of surgical revascularization by avoiding the well-documented side effects of cardiopulmonary by-pass. **(Davit et al., 2002)**

The aim of this study is to compare the immuno-inflammatory response of inhalational anesthesia versus total intravenous anesthesia in patients undergoing CABG operations, and to investigate the immune-inflammatory response of the CPB by comparing this effect in patients undergoing CABG operations performed by beating heart or extracorporeal circulation technique.

Cardiopulmonary Bypass : The Historical Foundation , The Future Promise

Cardiopulmonary bypass (CPB) is used so routinely in hospitals around the world that the most of the participants; surgeons, anesthesiologists, perfusionists, operating room nurses and, above all, patients forget that this landmark in clinical technology is not even 40 years old. In fact many of the pioneers are still active in the field.

Yet, so much has been done to transform a once-hazardous procedure into standard medical practice-through basic science, quality control and good manufacturing. **(Pierre and Christina., 1995)**

The application of CPB to cardiac surgery has proceeded historically in three phases. First it was used for the repair of congenital defects, the incidence of which, at that time, was inflated by the accumulated survival of patients for whom there had been no effective treatment. When Starr paved the way for the surgical replacement of valve defects, a new burst of growth took place, enhanced again by the existence of a patient pool with valvular disease dating back many years. Then came the explosive growth of aorto-coronary bypass surgery, leading to the third and biggest hump in growth curve of operation under total body perfusion. During none of these phases was the next step quantitatively anticipated. These observations should give us pause when we consider our ability to predict the future. **(Pierre and Christina., 1995)**

The advent of the heart-Lung Machine :

The development of CPB was dependant on the emergence of a number of new and, at the time, revolutionary discoveries and techniques: the feasibility of temporary interruption of the venous return to the heart; the discovery of the A, B, and O blood groups; and the effectiveness of positive pressure ventilation. Most critically, the identification of a reliable, nontoxic anticoagulant, heparin and a safe antagonist, protamine, made extracorporeal circulation possible. **(Chargraff and Olson., 1937)**

In 1934, DeBakey reported on the value of the roller pump, a reliable mechanism of displacing large volumes of blood along a flexible piece of tubing. Meanwhile the pioneers of hypothermia, Bigelow, Boerema, Lewis and Swan, demonstrated the feasibility of temporary lowering the body temperature to decrease tissue metabolism and, consequently perfusion needs during surgery. **(Swan .,1959)**

The idea of coupling extracorporeal circulation and oxygenation to permit unhurried surgical interventions in adult patients originated with Gibbon. Inspired by a tragic death of a gravid woman with a pulmonary embolism, he was the first to establish the feasibility of artificially supported circulation during temporary occlusion of the pulmonary artery. Over a period of 20 years (interrupted by World War II), Gibbon refined the technology of CPB. He was the first to succeed in using total extracorporeal circulation to facilitate cardiac surgery. On May 20, 1953, he successfully closed an atrial septal defect in a young woman, Celia Bavolek. **(Gibbon et al., 1954)**

Cross Circulation:

In 1954, Lillehei dared to pair a healthy adult donor with a blood-compatible child to repair a cardiac malformation. The procedure, named cross-circulation, linked the two circulatory systems and provided CPB in the child through the heart and lungs of the adult donor. Over a period of 16 months, 47 patients were operated on, 28 survived and none of the donors showed permanent harm. The clinical value of CPB had been demonstrated a major impetus was given to the development of appropriate machinery. **(Lillehei ., 1955)**

Deep Hypothermia:

Deep hypothermia (sometimes referred to as surface hypothermia because the patient was immersed in ice-cold water prior to cardiac surgery) served to lower body temperature and metabolism, and allowed a period of circulatory arrest. For a while it appeared to compete with CPB and it was used for hundreds of cardiac operations throughout the 1950_s. Surface hypothermia did not require advanced technology and was relatively safe. However, this technique was cumbersome, time consuming and relativity inefficient, since external cooling was slow to reach the vital organs and the surgeon had little time to proceed with