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Role of Blood Purification during Intensive Care

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ABSTRACT

Extracorporeal blood purification is a modern medical approach that involves changing the properties of blood components outside the body of the patient in order to remove harmful substances that cause or support disease. Even when traditional approaches are ineffectual, using these methods to study the pathophysiological process allows us to obtain therapeutic outcomes. Considering all of the pathophysiological characteristics of multiple organ dysfunction syndrome (MODS) and sepsis, extracorporeal blood purification is becoming increasingly relevant in intensive therapy. The severity and development of organ failure, as well as the indications detected, the method chosen, and the early commencement of blood purification are all factors that influence treatment outcomes in children, taking into account their anatomical and physiological characteristics. The goal of introducing and using blood purification nowadays is to provide multiple organ support therapy. Various extracorporeal blood purification procedures have a direct impact on the molecular and electrolyte composition of blood, as well as all human body structures, allowing us to repair, replace, and maintain homeostasis in MODS.

Keywords: Blood purification; Critical condition, Surgery; Oxygenation

INTRODUCTION

Blood purification is a therapy that involves the extracorporeal treatment of blood, and it is now commonly utilised to treat a variety of illnesses that are resistant to traditional treatments including drug administration and surgery. It works by eliminating toxins or pathogenic substances from the bloodstream using bio-separation techniques such as dialysis, filtration, adsorption, or a combination of these approaches. Blood-purification therapy is primarily used in three areas in a clinic; firstly, the critical care, such as plasmapheresis for toxicants; secondly, the life support for organ failures, such as haemodialysis for renal failure; and thirdly, the redress of metabolic and immune disorders, such as immunoadsorption for autoimmune diseases. Haemodialysis, which is used to treat patients with renal failure, is currently the most well-known application. Haemodialysis is thought to keep more than 1 million individuals alive around the world. All of these individuals would have died of renal failure within two weeks if haemodialysis hadn't been invented [1].

Techniques used in Blood Purification

Blood cleansing can be accomplished using a variety of methods. Bio-separation science is, in principle, the foundation of various therapeutic techniques. The primary part of the current blood-purification strategy is based on membrane and/or adsorption techniques. Membrane separation techniques (haemodialysis, plasmapheresis, and ultrafiltration) separate chemicals based on pore size rather than removing specific components. Toxins are removed through diffusion and/or filtration across a membrane with a specific pore size. Different blood components can be filtered by altering the permeability of filters, ranging from low-molecular-weight soluble toxins like uremic toxins to medium and bigger proteins like bilirubin-bound albumin.

Although blood-purification procedures share similar principles to bioengineering's bio-separation technologies, they have unique properties and requirements. Their hemocompatibility is the most significant consideration. Complement and leukocyte activation, as well as the release of inflammatory mediators such as cytokines, nitric oxide, oxygen free radicals,

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and platelet activating factors, can all be induced by hemo-incompatibility to varying degrees. Improved organ dysfunction (particularly cardiopulmonary and renal function), decreased need for vasopressor drugs, improved vital signs, improved acid-base homeostasis, and decreased cell toxicity of plasma and blood levels of mediators are all possible physiologic and biologic outcomes of blood purification therapy. Interleukin-6 and procalcitonin, among these mediators, appear to have the strongest connection with clinical outcome and may be particularly valuable markers in sepsis. The elimination of very big von Willebrand factors and potentially other mediators is critical for thrombotic thrombocytopenic purpura and thrombocytopenia-associated multiple-organ failure [2].

Despite the fact that available blood purification technology has not been demonstrated to be effective in sepsis, patients with refractory septic shock often benefit from blood purification, at least in terms of blood pressure improvement. Furthermore, plasma therapy can help with several humoral immunopathogenic illnesses that might worsen sepsis, such as thrombotic thrombocytopenic purpura and thrombocytopenia-associated multiple organ failure. Improved organ dysfunction (cardiopulmonary and renal function), decreased need for vasopressor drugs, improved vital signs, improved acid-base homeostasis, and decreased cell toxicity of plasma and blood levels of mediators are all possible biological and physiological consequences of blood purification therapy.

Blood purification techniques for humans with liver failure have mostly been used in clinical trials and are not yet widely used. Hemodiabsorption and the molecular adsorbent recirculating system have been used in experiments (MARS). Patients with acute-on-chronic hepatic failure, the hepatorenal syndrome and even fulminant hepatic failure benefited from small studies using these approaches in the therapy of hepatic failure. However, until additional rigorous evidence is available to back up these findings, no suggestion can be made to support their frequent usage in clinical practise. In cardio-surgery patients, the success of any blood purification treatment is dependent on the proper correction of electrolyte (hyperkalemia, hyper- and/or hyponatremia), metabolic (lactatemia, acidosis, alkalosis), and azotemia disorders. Acute renal damage, catabolism, rhabdomyolysis, reperfusion after crash syndrome, haemolysis and disseminated intravascular coagulation are all causes of hyperkalaemia. Concomitant metabolic acidosis aggravates it, making it an extra cardio-toxic component [3, 4].

CONCLUSION

In the present article, the various factors of blood purification in a heart surgery hospital's intensive care unit and the use of extracorporeal therapy for critically ill patients has changed dramatically during the previous few decades. This is due to the approaches' shown efficacy in a variety of pathological illnesses, as well as the advent of new potential technology. Extracorporeal blood purification is no longer limited by a lack of proper equipment and skilled medical personnel, especially in paediatric intensive care, where it appears to be so hard.

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CONFLICT OF INTEREST

The author has nothing to disclose and also state no conflict of interest in the submission of this manuscript.

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