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Red Blood Cell Transfusion in Open Heart Surgery: Are we all Ready for Bloodless Medicine and Surgery?

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INTRODUCTION

A Danish scientist, Niels Jerne, 1984 Nobel Prize winner in medicine mentioned that "our own blood is like our digital prints: there are not two types of blood that are identical". It is very interesting that he said so in response to why did he refuse to receive blood transfusion (BT). This assumption resumes quite nicely why most patients present at least mild allergic reaction to BT. The red blood cell membrane is extremely complex and has over 400 antigens already described. Hence, the more people know about BT reactions, disease transmission, and negative influence in clinical outcomes, the more they reject red blood cell transfusión in the context of surgery. Besides, it is getting more difficult to find qualified blood donors since less people meet the requirements for blood transfusion donors. This fact has resulted in a shortage of blood supply in blood banks worldwide which makes it necessary to seek out new treatment options [1-6]. This compelling fact and evidence has impulse scientific medicine to look for newer drug agents, techniques, medical products and methods, as alternative procedures to BT [7-11]. Although, alternatives to BT and other treatment options exist and there are medicine based evidence of their good results, they are seldom utilized. However, it is not the aim of this editorial to elaborate on the numerous alternatives that exist to BT. There are several clinical and surgical strategies that can be used to optimize hemoglobin and hematocrit levels and coagulation status. Additionally, these measures minimize blood loss, and improve anemia tolerance. In order to improve clinical outcomes in open heart surgery, and to diminish morbidity and mortality, as well as, reducing hospital costs, these treatment strategies should be incorporated into medical practice worldwide [12-16].

Despite of all this interesting facts, about 14 million units of blood are donated annually in the USA, and about 4 million people receive BT every year [1, 2]. There is a great variation in the incidence of BT utilization in different hospitals. For example, blood transfusion administration in surgical and critical care settings varies among 30% to 100% of patients.

Open heart surgery is still associated with the risks of bleeding and thrombotic events despite contemporary medical maneuvers. More than five decades ago, it was arbitrarily decided to transfuse patients with a hemoglobin level of 10 g/dl or less [17], and since then is relatively frequent to observe a medical indication of BT in a similar situation. It is not infrequent to observe a decrease in plasma hemoglobin values under 10 g/dL in the immediate period after open heart surgery [18-22]. Although it seems that there is a clear evidence of "winds of change", it is still believed by many physicians that patients would benefit from a BT that increases the hemoglobin levels beyond 10 g/dL and the hematocrit levels beyond 30%. The transfused whole blood is an excellent plasma volume expander and stays in the intravascular space much longer than any other volume expander. It is undeniable that BT induces an increase in the plasma volume, a hemodynamic improvement, and an increase in the cardiac output and diuresis. However, there is strong medicine based evidence that these mentioned clinical improvements are not correlated with decreased morbidity and lesser mortality in open heart surgery. It was clearly demonstrated that there is no benefit from BT for patients with hematocrits as low as 21% (hemoglobin of 7 g/dL) who underwent open heart surgery. The risk of death within 30 days of surgery was

almost 6 times greater for patients who received blood [18]. Moreover, red blood cell transfusion in these open heart surgery patients was linked as an independent variable to an increase in infections and ischemic complications. There were significantly higher incidence of myocardial infarction, renal compromise and failure, and stroke in those surgical patients who received BT. A pro-inflammatory effect and storage defects contribute to these ischemic complications of BT. Stored red blood cells are known to have decreased 2,3 DPG in the cell membrane, hence, they are less deformable, less likely to deliver oxygen to the tissues, and with greater tendency to produce capillary obstruction [19]. Additionally, transfused patients had prolonged mechanical ventilation, higher incidence of atrial fibrillation, longer hospital length of stay, and higher morbidity and mortality [18].

This is not an isolated finding. Similar results were demonstrated in several observational studies showing clear association between red blood cell transfusion and adverse outcomes in open heart surgery [18-21]. This negative influence is because BT is in essence a transplant of allogeneic cells, consisting of the infusion of multiple foreign antigens in great quantities in the recipient´s circulation, resulting in several inflammatory and immunological reactions. This adverse association between BT and cardiac surgery has been shown through decades in several studies and clinical observations [22-32]. Indeed, Denton Cooley demonstrated similar findings almost four decades ago [28]. Therefore, these negative outcomes with BT should be a call of attention to our routine medical practice pointing directly to the risks of BT. Therefore, unnecessary blood transfusions should be avoided to further reduce the risk for ischemic events and other complications. The evidence that BT carries significant risks points out to avoid BT when possible. Moreover; it was also shown that a single unit of red blood cell transfusion to a cardiac surgery patient is associated to a decreased survival at 10 years after the BT [32]. The guidelines emphasize that the benefits of transfusion have not been adequately demonstrated and that existing evidence is an imperfect guide to transfusion decisions, hence it was suggested a transfusion trigger of hemoglobin less than 7 g/dL in postoperative cardiac surgery patients with a class IIa level of indication [33].

In conclusion, red blood cell transfusion in the context of open heart surgery has been shown to be significantly associated with immediate and long-term adverse clinical outcomes. There is a significantly higher incidence of infection, myocardial infarction, stroke, renal failure, atrial fibrillation, multi-organ failure and death associated with BT. In addition, there is a prolonged ventilation and hospital stay, and increased overall healthcare costs. Are these results strongly enough to make us change our routine daily medical practice? Are we ready to implement bloodless medicine and surgery within our heart team? The light abundantly shed by medicine based evidence clearly shows we should!

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