Blood: a very special juice. The good and the evil

Katharina Rose Luise Schmitt, Oliver Miera and Felix Berger*

Department of Congenital Heart Disease and Pediatric Cardiology, Deutsches Herzzentrum Berlin, Berlin, Germany

* Corresponding author. Department of Congenital Heart Disease and Pediatric Cardiology, Deutsches Herzzentrum Berlin, Augustenburger Platz 1, 13353 Berlin, Germany. Tel: +49-30-45932800; fax: +49-30-45932900; e-mail: berger@dhv.de (F. Berger).

Keywords: Blood • Transfusion • Mortality

In Goethe’s Faust, Mephistopheles stated, ‘Blood is a juice of very special kind.’ As illustrated in this famous German folklore, blood is the essence of life but it can also lead to the destruction of life if improperly used. The human heart constantly pumps on average between 5 and 6 l of blood throughout the body to maintain the supply of nutrients and oxygen to organs and cells, which is essential for life. Indeed, Mephistopheles was correct in his observation that when we start to talk about blood, we are talking about something very special.

The question to initiate red blood cells (RBCs) is a daily clinical decision in the operating theatre, as the most secure strategy for managing patients with low haemoglobin has not yet been properly established. Moreover, the definition of low haemoglobin concentration thresholds remains controversial [1]. It is with certainty that markers are needed to help clinicians identify whether a patient would benefit from blood transfusion. This remains a relevant research topic and is in line with the fact that we definitely have a lot to learn about erythrocyte transfusion.

Willems et al. [2] investigated this important issue in a large retrospective study, looking at the outcome of children after cardiac surgery. They hypothesized that the timing of blood transfusion plays a key role in the difference in patient outcomes. The conclusion of the study showed that transfusions administered therapeutically were associated with increased morbidity and mortality, compared with transfusions administered simply to avoid a low haematocrit during cardiopulmonary bypass (CPB). On the other hand, higher preoperative weight was associated with a lower risk of severe postoperative morbidity or mortality. The important finding of this study was that it is the reason for transfusion rather than the transfusion itself that increased the perioperative risk.

Although an association between erythrocyte transfusion and increased perioperative mortality is usually observed, unmeasured confounding factors may also excessively influence this association. One of these unmeasured confounding factors might be the indication for transfusion and might, therefore, directly influence increased perioperative morbidity and mortality itself.

This remotely drawn conclusion is extensively discussed in the limitation section of the presented study. However, the relationship between the indication for transfusion and postoperative morbidity and mortality should be interpreted with caution.

Due to the retrospective design of the study, important variables that have a major impact on postoperative morbidity and mortality may not have been taken into account in the multivariable analysis.

The study was conducted in a single centre and there is strong evidence of a wide variability among centres regarding bypass and post-CPB transfusion management. Karkouti et al. [3] analysed in a large population-based study cohort (162 190 patients in 66 hospitals) the impact of erythrocyte transfusion on mortality. The results differed substantially when comparing outcomes at hospitals with dissimilar transfusion rates and a huge discrepancy was also documented comparing patients who were with those who were not transfused, raising the question about the true relationship between transfusion and mortality.

There has been a vast amount of research that has contributed to the field of perioperative RBC transfusion, demonstrating that it is a very interesting as well as complex subject. In most of the observational studies, it has been demonstrated that the transfusion of RBCs is associated with poor outcomes [4].

Furthermore, we demonstrated in our clinic that a restrictive strategy for blood transfusion during CPB surgery in children can lead to a better clinical outcome in the paediatric population [5]. According to these findings, it is important to note that major cardiovascular surgery can be safely performed without the need for blood transfusion in selected cases even in infants and neonates [6].

A Canadian randomized controlled trial suggested that a restrictive strategy of erythrocyte transfusion is just as effective as, and probably superior to, a liberal transfusion strategy in critically ill patients [7].

The influence of RBC transfusion on outcomes should be addressed in future studies by comparing patients receiving blood during CPB and those not receiving any. There are possibilities to minimize or even avoid blood transfusions in the settings of cardiac surgery. The interesting issues concerning blood transfusion are the new strategies to avoid transfusion all together, thereby improving patient outcomes after cardiac surgery.

Weber et al. [8] underlined in their current publication that a point-of-care orientated approach based on fast and detailed diagnostics as well as early and specific therapy of perioperative coagulopathy can decrease blood transfusion rates and moreover, postoperative morbidity.

Another very elegant way to reduce the requirement for blood transfusion is cell salvage during and after cardiac surgery. The aim of cell salvage is to reduce or eliminate the need for blood transfusion and the associated risks of complications. Cell salvage has been demonstrated to reduce blood transfusion rates in infants (<10 kg) undergoing cardiac surgery. It was also proved to be a safe and effective method to reduce postoperative blood transfusion [9].
Interpreting the results in the field of perioperative erythrocyte transfusion remains a big challenge. Therefore, the interesting areas of future transfusion research in children should focus on the safety of transfusion-saving strategies as well as on analysing the impact of the quality, storage and age of blood.

REFERENCES