

Perspectives and Evolution of Intraoperative Transfusion Goal Directed Protocols with Viscoelastic Methods and Perioperative Outcomes in Children

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Abstract

Background: A recent systematic review and meta-analysis was realized to determine the impact of intraoperative transfusion goal directed protocols with viscoelastic methods on postoperative outcome in children. This study is part of a vast and extended Thesis Project concerning the impact of Goal Directed therapies on postoperative outcome in the pediatric population.

Objective of this Editorial: To analyze the results, conclusions and future perspective of this recent systematic review and meta-analysis on the impact of intraoperative transfusion goal directed protocols with viscoelastic methods on perioperative outcome in children.

Result and conclusion: This systematic review and meta-analysis of 9 randomized and non-randomized controlled trials in 1365 children in trauma, cardiac, craniosynostosis and liver transplantation demonstrated that mortality, morbidity (organ dysfunction), Packed Red Blood Cells (PRBC) and platelet transfusion were not different between the two groups. However, the trial revealed that the number of patients transfused with fresh frozen plasma (FFP) and Length of Hospital Stay (LOS) were lower in the group (experimental group) where blood product administration was guided with thromboelastography (TEG) or rotational thromboelastometry (ROTEM). It was also evidenced that the number of patients who received intraoperatively cryoprecipitate or fibrinogen was higher in the experimental group. These results are not surprising. Mortality and morbidity in these patients included in this study were explained by other factors than transfusion. However, FFP administration and LOS were reduced. This is not surprising either because the device helps to detect coagulation disorders which can be corrected rapidly once diagnosed. The reduction in LOS in this setting was explained by the reduction in FFP administration since the latter has been shown in other studies to increase LOS and other adverse outcomes. The results of this study encourage the use of TEG/ROTEM to guide blood product administration to reduce FFP transfusion and LOS related to the latter.

Keywords: Goal directed transfusion; Thromboelastography; Thromboelastometry; Children; Postoperative outcome

Introduction

The purpose of systematic reviews and meta-analyses is to find evidence needed to implement improvement in clinical practice [1]. The ideal systematic reviews and meta-analyses include well conducted randomized controlled trials. This study included randomized and non-randomized trials. Randomized controlled trials are not always easy to realize in children especially in a setting of hemorrhage. The recent systematic review and meta-analysis on transfusion goal directed protocols in children [2,3] is part of a vast and extended Thesis Project concerning the impact of Goal Directed Therapies on postoperative outcome in the pediatric population [4-16]. This Thesis in development is registered at

<http://www.theses.fr/s232762>. This systematic review and meta-analysis which concerned 9 non randomized and randomized trials in 1365 pediatric trauma, cardiac, craniosynostosis and transplantation surgery showed no difference in terms of mortality, organ dysfunction, packed red blood cells (PRBC) and platelet transfusion, this is not surprising because morbi-mortality in this trial was not transfusion related as it has been evidenced elsewhere that predictors of this outcome were multifactorial [6].

Fresh Frozen Plasma (FFP), length of hospital stays (LOS) were decreased and cryoprecipitate and fibrinogen administration were increased in the experimental group. This is not surprising either because Thromboelastography/ Rotational Thromboelastometry (TEG/ROTEM) were designed to detect coagulation disorders which if diagnosed earlier, can be treated rapidly to correct the alteration. Even if the primary outcomes were not impacted with the goal directed transfusion therapy in this trial, it does not imply to minimize the interest of these devices because transfusion with all kinds of labile blood products has been demonstrated in other studies to be an independent predictor of adverse outcome in terms of organ dysfunction, transfusion related acute lung injury (TRALI), transfusion associated circulatory overload (TACO), immunomodulation, infections, LOS, length of mechanical ventilation (LMV) and length of intensive care unit stay (LOSICU) [6]. The results of this systematic review encourage the use of TEG/ROTEM to guide transfusion with the purpose to reduce FFP administration in potential hemorrhagic surgery and to decrease LOS. Even if primary outcome was not improved, FFP transfusion and LOS were diminished. This finding is important since FFP was found to be correlated to and predictive of LOS [6].

The future perspective and evolution of transfusion in hemorrhagic settings are directed in developing practices and protocols where viscoelastic methods will be integrated. Practices using these methods are not yet established everywhere. Some hospitals have adopted them since several years and some have not yet. The purpose of integrating viscoelastic methods is to optimize transfusion needs and administrate the right product at the right time. Doing this, reduces the risk to administer unnecessary blood products which expose the patient to adverse outcome. Goal directed transfusion protocols are part of goal directed therapies [5] where a treatment is given with a precise goal. The precise goal depending on the therapy can be to reduce fresh frozen plasma transfusion which can be related to some adverse outcome like TRALI, TACO which can be related to LMV and LOS. The goal can be fluid and hemodynamic status optimization in case of hemorrhagic shock; using parameters or techniques to measure or quantify the optimal fluid and hemodynamic status has the objective to improve patient outcome.

Another goal directed therapy is enhanced recovery after surgery (ERAS) which has demonstrated reduction in postoperative LOS and morbidity; transfusion goal directed protocols can be integrated in ERAS to reduce LOS. In adults all these goals directed therapies have demonstrated improvement in postoperative outcome in terms of mortality, complications and LOS. In children

these therapies are still to be developed and to be established everywhere whenever possible. We have reached the Era of developing goal directed therapies in children with the purpose to improve postoperative outcome in this population [4]. Many questions are still unanswered and continuing research in this field will help to bring some answers. Promoting research in the pediatric and neonatal settings is of great importance for scientific progress in a Niche where there are still a lot of domains to investigate.

Future Practical and Concrete Perspectives

To put into practice the conclusions of the recent systematic review and meta-analysis, we are elaborating a transfusion protocol with bedside point of care viscoelastic method namely ROTEM Sigma. In this protocol, transfusion in pediatric potential hemorrhagic surgery, will be guided using ROTEM sigma point of care device to optimize blood product administration. Since the actual ROTEM parameters were validated with ROTEM delta [17], we have elaborated a study protocol to validate pediatric ROTEM sigma parameters [15]. Once these parameters are validated, they will be integrated in the transfusion goal directed protocol with ROTEM sigma in pediatric potential hemorrhagic surgery.

Conclusion

RCT protocols with these devices to guide transfusion should continue to be developed. The results and the conclusion of this trial concerned trauma, cardiac, craniosynostosis and liver transplantation surgery, that is to say major hemorrhagic surgeries. It is important to emphasize that the interest of these devices are potential major hemorrhagic situations. Since the actual ROTEM parameters were defined with the previous point of care device ROTEM delta, we have elaborated a study protocol to validate pediatric parameters with the new generation point of care device ROTEM sigma which will be integrated in a pediatric transfusion protocol in potential hemorrhagic surgery.

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