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LETTER TO THE EDITOR - BRAIN TRAUMA

Letter to the editor regarding "A retrospective study of the effect of fibrinogen levels during fresh frozen plasma transfusion in patients with traumatic brain injury"

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Dear Editor,

We read with great interest the recent article by Nakae et al. entitled "A retrospective study of the effect of fibrinogen levels during fresh frozen plasma transfusion in patients with traumatic brain injury" [8]. The authors conclude that the outcomes of TBI (traumatic brain injury) patients are significantly better in the high-fibrinogen subgroup (concentration 3 h after injury ≥ 150 mg/dL) than in the low-fibrinogen subgroup (< 150 mg/dL). Moreover, they recommend FFP transfusion to maintain fibrinogen concentrations at ≥ 150 mg/dL to improve the outcomes in TBI patients.

A first aspect is whether the difference in outcomes of patients between subgroups was caused by the plasma fibrinogen concentration. Hypofibrinogenemia after TBI partly results from consumption for generating hematoma and blood loss requiring fluid resuscitation [4]. Larger baseline intracranial hematoma and higher blood loss indicate more severe injury, which may lead to the worse outcomes [9]. However, the authors assessed only Glasgow Coma Scale and Abbreviated Injury Score to characterize the severity of injury. Hematoma volume and blood loss (or fluid resuscitation) were not included when authors performed multivariate analysis. Thus, we cannot exclude the possibility that the worse outcomes of TBI patients in low-fibrinogen subgroup result from more severe injury rather than hypofibrinogenaemia, which may be the result of larger hematoma and higher blood loss. Moreover, as mentioned in the article, the association between the fibrinogen concentration and hematoma progression was not accurately evaluated because the authors performed surgery in some patients. So how fibrinogen levels affect the prognosis remains unclear in the study.

A second aspect is whether FFP (fresh frozen plasma) transfusions can improve outcomes in TBI patients. The authors recommend FFP transfusion to maintain fibrinogen concentrations at ≥ 150 mg/dL to improve the outcomes in TBI patients. Although they identify decreased fibrinogen level as an independent predictor of poor prognosis, only when they find that outcomes are better among patients who receive FFP transfusion than those who do not receive FFP transfusion, can they recommend the treatment, because FFP transfusion may cause some complications [11]. Moreover, as mentioned in the article, some studies have reported a lack of improvement in the outcomes among patients with TBI who receiving FFP transfusion [2, 3, 10, 11]. Therefore, application of FFP in TBI patients should still be carefully evaluated.

The last aspect and more important is that FFP transfusion is not the best choice to restore coagulation factors for TBI patients with hyperfibrinolysis and hyperfibrinogenolysis. Fibrinogen concentrate or the combination of fibrinogen concentrate and prothrombin complex concentrate (PCC) is increasingly recommended in the literature for the patients with hypofibrinogenemia because their advantages over FFP are manifold [5, 6]. First, fibrinogen concentrate and PCC are concentrated. On the one hand, they have minimal effect on fluid balance; on the other hand, they can be administered in a short time, so coagulopathy can be reversed more rapidly. Second, cases who receive FFP transfusions have increased incidence of overall complications, acute respiratory distress syndrome, and pneumonia [11] while fibrinogen concentrate and PCC are not associated with these complications. Third, FFP requires blood-type matching. Finally, fibrinogen concentrate and PCC are easily stored while FFP requires special conditions. Moreover, studies focusing on comparison of the effect of fibrinogen concentrate with FFP have reported better

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This article is part of the Topical Collection on *Brain trauma*

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prognosis among patients who received fibrinogen concentrate administration [1, 7].

In our opinion, it remains unclear whether FFP transfusion can improve the prognosis of TBI patients. Application of FFP in TBI patients should still be carefully evaluated. We recommend fibrinogen concentrate or the combination of fibrinogen concentrate and PCC to restore coagulation factors for TBI patients with hyperfibrinolysis and hyperfibrinogenolysis.

Compliance with ethical standards

The authors declare that they have no conflict of interest.

References

1. Akbari E, Safari S, Hatamabadi H (2018) The effect of fibrinogen concentrate and fresh frozen plasma on the outcome of patients with acute traumatic coagulopathy: a quasi-experimental study. Am J Emerg Med 36:1947–1950
2. Anglin CO, Spence JS, Warner MA, Paliotta C, Harper C, Moore C, Sarode R, Madden C, Diaz-Arrastia R (2013) Effects of platelet and plasma transfusion on outcome in traumatic brain injury patients with moderate bleeding diatheses. J Neurosurg 118:676–686
3. Etemadrezaie H, Baharvahdat H, Shariati Z, Lari SM, Shakeri MT, Ganjeifar B (2007) The effect of fresh frozen plasma in severe closed head injury. Clin Neurol Neurosurg 109:166–171
4. Gando S (2015) Hemostasis and thrombosis in trauma patients. Semin Thromb Hemost 41:26–34
5. González-Guerrero C, Lozano-Andreu T, Roch-Santed M, Rivera-Sánchez L, Brandariz-Núñez D, Pastó-Cardona L, Juárez-Giménez JC, Montoro-Ronsano JB (2017) Evaluation of the efficiency under current use of human fibrinogen concentrate in trauma patients with life-threatening hemorrhagic disorders. Blood Coagul Fibrinolysis 28:66–71
6. Kozek-Langenecker SA, Afshari A, Albaladejo P, Santullano CA, DeRobertis E, Filipescu DC, Fries D, Görlinger K, Haas T, Imberger G, Jacob M, Lancé M, Llau J, Mallett S, Meier J, Rahe-Meyer N, Samama CM, Smith A, Solomon C, Van der Linden P, Wikkelsø AJ, Wouters P, Wyffels P (2013) Management of severe perioperative bleeding: guidelines from the European Society of Anaesthesiology. Eur J Anaesthesiol 30:270–382
7. Kozek-Langenecker S, Sørensen B, Hess JR, Spahn DR (2011) Clinical effectiveness of fresh frozen plasma compared with fibrinogen concentrate: a systematic review. Crit Care 15:R239
8. Nakae R, Yokobori S, Takayama Y, Kanaya T, Fujiki Y, Igarashi Y, Suzuki G, Naoe Y, Fuse A, Yokota H (2019) A retrospective study of the effect of fibrinogen levels during fresh frozen plasma transfusion in patients with traumatic brain injury. Acta Neurochir. https://doi.org/10.1007/s00701-019-04010-3
9. Siegel JH (1995) The effect of associated injuries, blood loss, and oxygen debt on death and disability in blunt traumatic brain injury: the need for early physiologic predictors of severity. J Neurotrauma 12:579–590
10. Winter JP, Plummer D, Bottini A, Rockswold GR, Ray D (1989) Early fresh frozen plasma prophylaxis of abnormal coagulation parameters in the severely head-injured patient is not effective. Ann Emerg Med 18:553–555
11. Zhang LM, Li R, Zhao XC, Zhang Q, Luo XL (2017) Increased transfusion of fresh frozen plasma is associated with mortality or worse functional outcomes after severe traumatic brain injury: a retrospective study. World Neurosurg 104:381–389