B8. TPAYMA UPDATE

B8.A. TRAUMATIC INDUCED COAGULOPATHY

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INTRODUCTION

Mortality from major trauma continues to be a worldwide problem and massive hemorrhage remains a major cause in 40% of potentially preventable trauma deaths.[1,2] Development of coagulopathy challenges 25–35% of trauma patients already at hospital arrival, further increasing mortality and morbidity but can be further complicated by coagulopathy related to resuscitation.[3]

Over the last 10 years, the management of major hemorrhage in trauma patients has changed radically. This is mainly due to the recognition that many patients who are bleeding when they come to the emergency department have an established coagulopathy before the dilutional effects of fluid resuscitation. Traumatic coagulopathy has been demonstrated in patients who received little or no intravenous fluid therapy, negating the long-held belief that iatrogenic haemodilution is the main causative factor in traumatic coagulopathy.[2, 3]

PATHOPHYSIOLOGY

The syndrome of trauma-induced coagulopathy (TIC) can occur anytime following injury, particularly in response to coagulation factor dilution, as a result of the infusion of resuscitation fluids, acidosis, sepsis, or hypothermia; it can continue for several days.[4] When presenting early (as soon as 30 minutes after trauma prior to intervention), the phenomenon is termed acute traumatic coagulopathy (ATC).[5-8] It remains unknown whether patients are preconditioned for ATC or whether specific injury patterns may predispose patients to particular coagulopathies.[9]

The mechanisms underlying ATC remain an active area of research because of the implications this diagnosis has for outcomes. ATC is a multifactorial failure of the coagulation system to sustain normal haemostasis.[10]

The pathophysiology of TIC can be separated into two main categories: acute traumatic coagulopathy (ATC) and coagulopathy associated with resuscitation, which often exist in varying degrees independently as single entities or coexist with the potential to develop further in the bleeding trauma patient dependent on several factors.

HAEMOSTATIC RESUSCITATION: BASIC VOLUME THERAPY FOR BLEEDING PATIENTS

Along with the discovery and initial characterization of ATC, the second and concurrent discovery that has revolutionized trauma resuscitation is the rediscovery of plasma-based resuscitation. The trauma community has embraced a resuscitative conduct that seeks to attenuate ATC and limit crystalloid use while aiming for a balanced 1:1 ratio of plasma and PRBCs.

The combination of a high plasma and high platelet to PRBC ratio was found to be additively protective and conferred higher 6-hour and 30-day survival, reduced truncal hemorrhage, and reduced ICU and hospital days.[11]

In addition, other work has suggested that the mortality benefits shown after high ratio resuscitation may be independent of the effects of measurable coagulation. A high FFP to PRBC ratio provides a mortality benefit independent of admission coagulopathy. Mechanistic examination of the effect of plasma has shown that plasma-based resuscitation may result in improved cellular survival and reduced permeability. Together, these new data suggest a potential role for plasma-based resuscitation independent of the correction or attenuation of coagulopathy. Further work continues to elucidate the mechanisms underlying the benefits of balanced ratio, plasma-based resuscitation.[11]

INDIVIDUALIZED GOAL-DIRECTED CARE: GOAL OF NORMAL HAEMOSTATIC COMPETENCE

This approach seeks to avoid any use of blood products and performs viscoelastic haemostatic assay (VHA) monitoring of the existing and developing coagulopathy, with the purpose of goal-directed reversal of coagulopathy with use of off-label use of coagulation factor concentrates such as fibrinogen concentrate, PCC, recombinant factor VIIa and factor XIII concentrate.[1]

This strategy, initiated in Austria and Switzerland and has shown to reduce bleeding, transfusions of RBC, plasma and PLT, and also mortality in mixed surgical populations.[1]

THE COPENHAGEN CONCEPT: COMBINING HAEMOSTATIC RESUSCITATION AND GOAL-DIRECTEDTHERAPY

In 2005, the Copenhagen Concept was introduced, comprising of balanced transfusion therapy aiming at a ratio 1:1:1 of RBC, plasma and PLT in the early phase of massive bleeding, and then adjustment of therapy according to a VHA-based algorithm.

In this hybrid model of hemostatic resuscitation it is recognized that massive bleeding is a dynamic condition wherein treatment is to be adjusted rapidly and repeatedly. VHA testing is suggested to initiate on patient arrival allowing for early goal-directed treatment of coagulopathy.[1] Initially a ratio 1:1:1 driven therapy is applied , with an early shift towards an individualized goal-directed therapy adjusting the ratios, using blood components and coagulation factor concentrates such as fibrinogen concentrate and cryoprecipitate to normalize haemostasis.

Conclusion

While the understanding of ATC continues to improve and better tests are developed, it is, in the meantime, prudent to seek restoration of both tissue perfusion and coagulation homeostasis as the foundation of damage control resuscitation.

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