How to Reduce Perioperative Transfusion and Improve Hemostasis

—Three Conditions of Point-of-Care: Trigger, Evidence, and Speed—

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[Abstract]
On entering the 21st century, coagulation management that includes fibrinogen has increasingly been regarded as important. By using a coagulation point-of-care monitor in this study, we report a practical method to reduce allogenic blood transfusion by setting a trigger level of fibrinogen (130 mg/dL) for administration of fresh frozen plasma (FFP).

We explain the essential point-of-care conditions (trigger level, medical evidence, and measuring speed) to introduce a new approach for reducing blood transfusion by “Fibrinogen level simulation” and “The checklist of the transfusion algorithm in cardiac and thoracic aortic surgery.”1)

Key words: Coagulation, transfusion, point-of-care monitor, Fuji-san classification, fibrinogen, fibrin

1) Trigger level set at 130 mg/dL for FFP stratification
Fibrinogen replacement therapy is essential for hemostasis. We stratify the starting amount of FFP by following “Fuji-san classification” with a trigger level of fibrinogen set at 130 mg/dL and the lower limit set at 150 mg/dL.

[Fuji-san classification]: fibrinogen level [mg/dL]: FFP [mL]

<table>
<thead>
<tr>
<th>Fibrinogen level (mg/dL)</th>
<th>Planned FFP (mL)</th>
</tr>
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<tbody>
<tr>
<td>&lt; 130</td>
<td>480 mL</td>
</tr>
<tr>
<td>130–149</td>
<td>0 mL</td>
</tr>
<tr>
<td>≥ 150</td>
<td>0 mL</td>
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</tbody>
</table>

2) How to use “Fibrinogen level simulation” (Figure 1)
Objects: Laparotomy, AAA, craniotomy, spine surgery, etc.
- Enter body weight, fibrinogen level, bleeding volume.
- “Simulation with consumption” is closer to a measure.
- Twice the volume from Cell Savor is bleeding volume.

1) Definition of a trigger level set at 130 mg/dL
Fibrinogen is activated to form fibrin polymerization. Fibrin polymerization is reflected by FIBTEM(A10) with thromboelastometry (ROTEM®). The trigger level giving FFP for FIBTEM(A10) is 6 mm,2) and its cutoff value of fibrinogen is 130 mg/dL (95% confidence interval; 125–135).3,4) Hence, we determined a fibrinogen 130 mg/dL as the trigger level for starting the administration of FFP.

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3) How to use “The checklist of transfusion algorithm in cardiac and thoracic aortic surgery” (Figure 2)

Objects: Cardiac and thoracic aortic surgery
(1) Measure the blood counts and fibrinogen level before surgery (after induction), at warming in cardiopulmonary bypass (CPB), and in intensive care unit (ICU) as checklist.
(2) Determine the starting amounts of FFP based on the fibrinogen level at CPB with the Fuji-san classification.
(3) In thoracic aortic surgery, consider administering fibrinogen concentrate 2-3g when fibrinogen is <130 mg/dL, and give FFP based on Fuji-san classification.4)(6)
(4) In bleeding in ICU, consider transfusion with a checklist.

Figure 2

Fibrinogen level < 180

480 mL

< 150:

RBC concentrate transfusion:
□

< 130

Starting amount of FFP (mL),
□

≥

Platelets count:
□

< 6

Assessment (n=173)
1000

Within postoperative 24 hours (p<0.01). The efficacy of "Fibrinogen level simulation" is demonstrated.

2. Medical evidences

(1) In laparotomy, AAA, spine surgery (n=57) in this study, the necessity of FFP was related to a nadir of fibrinogen but not to bleeding volume. Efficacy of transfusion strategy with "Fibrinogen level simulation" is demonstrated. (Figure 3)

(2) In cardiac and thoracic aortic surgery (n=331) in this study, coagulation assessment with point-of-care reduced fibrinogen level (A10) (Figures; mean ± SD) is as accurate as the "Clauss" method for one measurement and allows rapid diagnosis of hypo-fibrinogenemia.8)

4) Application of “Clauss” and “Dry Hematology”

(1) "Clauss" method level simulation"

· "Clauss": Before surgery, or when no rush for transfusion.
· "Clauss" needs time for transfusion decision / preparation.
(2) "The checklist in cardiac and thoracic aortic surgery"

· "Clauss": Before surgery or after induction, and in ICU.
· "Dry Hematology": Quick decision at warming in CPB.
· "Clauss" needs time for decision making. When using it, blood sample is taken 1-1.5 hours before terminating CPB.

References

1) Hamamatsu Rosai Hospital. Copyright©2014
7) Takatoku, K et al.; Japan Society of Cardiovascular Surgery (47th) Tokyo

Conflict of interest: None to declare.

Reprint (PDF-portfolio) with “Fibrinogen level simulation” (EXCEL), “The checklist of transfusion algorithm in cardiac and thoracic aortic surgery” (PowerPoint) are available. We do not assume any responsibility for individual use; therefore, please use it only at the responsibility of the user.

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(Reference)