Retrospective Study to Investigate the Effect of Fixed Ratio Management of Packed Red Blood Cell to Fresh Frozen Plasma on Transfusion Requirements in Postpartum Hemorrhage

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Background: Postpartum hemorrhage (PPH) is a major cause of maternal morbidity, and often necessitates blood product transfusion. Outcome and survival is improved among trauma victims using a transfusion protocol of 1:1 fixed ratio for packed red blood cells (PRBC) to fresh frozen plasma (FFP), and 1:1 fixed ratio has been recommended for PPH despite poor evidence.(1) Our primary aim was to study transfusion requirements among women with PPH managed with a 1:1 fixed ratio PRBC:FFP versus nonfixed ratio.

Methods: Retrospective IRB approved study in 2 neighboring tertiary centers that cover 80% of labors in the metropolitan area. We identified PPH cases, ≥ 3 PRBC within 24hr of delivery, from blood bank records. We focused on the active bleeding period (blood products transfused continuously until a 4hr break without blood product administration was identified). Massive transfusion protocol (MTP) affirming 1:1 fixed ratio PRBC:FFP was introduced in 2010 in both centers. Demographic, obstetric, and blood management data were retrieved. We compared estimated blood loss (EBL), blood product administration, and hematologic variables for PPH managed by 1:1 fixed ratio PRBC:FFP versus nonfixed ratio, using descriptive statistics.

Results: We identified 273 women (2004-2014) with PPH ≥ 3 PRBC within 24hr of delivery. 1:1 fixed ratio PRBC:FFP management was used for 41/161 (26%) women since 2010 vs. 23/112 (21%) prior to 2010, $p=0.34$. EBL among women managed with 1:1 fixed ratio was 2.3 ± 0.7 L vs. 2.9 ± 1.9 L with nonfixed ratio, $p=0.04$. PPH managed with 1:1 fixed ratio received less PRBC units, median(IQR) 5(4-6) vs. 6(4-10) with nonfixed ratio, $p=0.013$, Table 1. Nadir fibrinogen levels for 1:1 fixed ratio were significantly higher, 324.0 ± 131.3 mg/dl vs. 264.6 ± 113.5 mg/dl with nonfixed ratio, $p=0.003$, despite similar baseline values, Table 2. PPH management with nonfixed ratio PRBC:FFP was associated with a higher likelihood of receiving massive transfusion (≥ 8 PC units), Odds Ratio 2.88 95%CI 1.376.06.

Table 1: Blood transfusion management for 1:1 fixed ratio PRBC:FFP versus nonfixed ratio among women with postpartum hemorrhage

	Fixed ratio PRBC:FFP 1:1 (n=64)	Nonfixed ratio PRBC:FFP 1 $\neq$ 1 (n=209)	p-value
Total estimated blood loss (L) ⁱ	2.26 $\pm$ 0.74	2.91 $\pm$ 1.93	0.04*
Blood products transfused during active bleeding period ²			
PRBC (no.)	5 (4-6)	6 (4-10)	0.013*
FFP (no.)	5 (4-6)	6 (3-9)	0.44
PLT (no.)	0 (0-1)	1 (0-2)	0.016*
CRYO (no.)	10 (0-10)	10 (0-20)	0.40
Total blood products ²			
PRBC (no.)	5.5 (4-7)	7 (4-11)	0.004*
FFP (no.)	4 (4-6)	6 (3-9)	0.09
PLT (no.)	0 (0-6)	10 (0-20)	0.007*
CRYO (no.)	10 (0-10)	5 (0-12)	0.29

Key: PRBC=Packed red blood cells, FFP=Fresh frozen plasma, CRYO=Cryoprecipitate, PLT=Platelets; no.=number of units;

ⁱMean $\pm$ SD, ²Median (IQR); *= $p<0.05$, significant difference

Table 2: Hematologic values for 1:1 fixed ratio PRBC:FFP versus nonfixed ratio among women with postpartum hemorrhage

	Fixed ratio PRBC:FFP 1:1 (n=64)	Nonfixed ratio PRBC:FFP 1 $\neq$ 1 (n=209)	p-value
Fibrinogen (mg/dl)ⁱ			
Baseline	498.5 $\pm$ 180.7	481.5 $\pm$ 154.7	0.75
First during active bleeding period	360.1 $\pm$ 134.6	311.7 $\pm$ 131.2	0.050
Nadir	324.0 $\pm$ 131.3	264.6 $\pm$ 113.5	0.003*
Hemoglobin (g/dl)ⁱ			
Baseline	11.5 $\pm$ 1.4	11.6 $\pm$ 1.4	0.59
First during active bleeding period	9.1 $\pm$ 1.8	9.2 $\pm$ 1.7	0.67
Nadir	7.8 $\pm$ 1.5	7.4 $\pm$ 1.5	0.07
Hematocrit (%)ⁱ			
Baseline	34.1 $\pm$ 3.9	34.7 $\pm$ 3.8	0.32
First during active bleeding period	27.1 $\pm$ 5.3	27.2 $\pm$ 5.1	0.84
Nadir	23.1 $\pm$ 4.6	21.9 $\pm$ 4.3	0.06

Key: PRBC=Packed red blood cells, FFP=Fresh frozen plasma;

ⁱMean $\pm$ SD; *= $p<0.05$, significant difference

Conclusion: Introduction of the MTP did not increase use of 1:1 fixed ratio PRBC:FFP for PPH management. Management of PPH using a 1:1 fixed ratio PRBC:FFP strategy was associated with significantly lower EBL and less PRBC and platelets, lower likelihood of massive transfusion and higher nadir fibrinogen levels. Our study findings support using 1:1 fixed ratio PRBC:FFP administration for PPH management. (1,2)

1)Shaylor. Anesth Analg 2017;124:216. 2)Pasquier. Anesth Analg 2013;16:155