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Low-Titer Type O Whole Blood for Transfusing Perinatal Patients after Acute Hemorrhage: A Case Series

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Abstract

Objective Acute and massive blood loss is fortunately a rare occurrence in perinatal/neonatal practice. When it occurs, typical transfusion paradigms utilize sequential administration of blood components. However, an alternative approach, transfusing type O whole blood with low anti-A and anti-B titers, (LTOWB) has recently been approved and utilized in trauma surgery.

Study Design Retrospective analysis of all perinatal patients who have received LTOWB after acute massive hemorrhage at the Intermountain Medical Center.

Results LTOWB was the initial transfusion product we used to resuscitate/treat 25 women with acute and massive postpartum hemorrhage and five infants with acute hemorrhage in the first hours/days after birth. We encountered no problems obtaining or transfusing this product and we recognized no adverse effects of this treatment.

Conclusion Transfusing LTOWB to perinatal patients after acute blood loss is feasible and appears at least as safe a serial component transfusion. Its use has subsequently been expanded to multiple hospitals in our region as first-line transfusion treatment for acute perinatal hemorrhage.

Keywords
- transfusion
- whole blood
- perinatal
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- hemorrhage

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Key Points

Low-titer type O whole blood (LTOWB) was our initial transfusion product for 30 perinatal patients with acute hemorrhage. Twenty-five of these were obstetrical patients and five were neonatal patients. We encountered no problems with, or adverse effects from LTOWB in any of these patients. LTOWB transfusions to women were ten days since donor draw (interquartile range, 8-13) and to neonates was six days (5-8).

In perinatal/neonatal medicine, massive blood loss is a low-incidence but high-acuity event for which better treatment strategies are needed.[1,2] Sequential transfusion of blood components (packed red blood cells [RBCs], fresh frozen plasma, platelets; 1:1:1 or 2:1:1, often with cryoprecipitate) is a usual treatment.[1,2] However, there are advantages of an alternative transfusion product; low-titer, cold-stored, type O whole blood (LTOWB). These advantages are resulting in its increasing use for victims of life-threatening blood loss.[3,4]

Transfusing type O whole blood that has been determined to have low titers of anti-A and anti-B (and thus is less likely to cause hemolysis if emergently transfused to a type A, B, or AB recipient) gives the recipient all blood components immediately, rather than sequentially. This hastens the synergistic effects of plasma, platelets, and erythrocytes received together. It also requires less anticoagulant/preservative solution than does serial component transfusion.[3,4] More rapid cessation of bleeding, more rapid correction of coagulopathies, less volume overload, and better outcomes have all been reported using LTOWB, compared with sequential components in the treatment of patients after acute massive blood loss.[3–6]

In 2019, in partnership with the American National Red Cross, Salt Lake City, we made LTOWB available at the Intermountain Medical Center. Soon thereafter, we reported the first case where this product was used to transfuse a mother with life-threatening postpartum hemorrhage.[7] Subsequently, we reported the first case where LTOWB was used to transfuse a preterm infant after life-threatening hemorrhage.[8] Our LTOWB product is prepared by the American National Red Cross. It is leukoreduced using a platelet-sparing leukoreduction filter, thus considered "cytomegalovirus safe," has maximum allowable anti-A and anti-B titers of 1:200 and undergoes all FDA required testing. If a LTOWB unit is not transfused by 14 days, it is modified into a packed RBC unit and used in the blood bank inventory. Its relative ease of use, apparent lack of adverse effects, and good outcomes have encouraged our preferential use of this product in cases of acute perinatal blood loss, and we now report a small case series of the perinatal patients at our hospital who have been transfused with LTOWB.

Methods

The Institutional Review Board of the Intermountain Healthcare approved collecting this information into a case series as a data-only retrospective analysis and determined the research involves no more than minimal risk to the privacy of the subjects. We used our SafeTrace Tx System (Haemonetics, Corp, Boston, MA) to identify all perinatal patients who received LTOWB at the Intermountain Medical Center. The transfusion records were then linked with data in the Intermountain Health Enterprise Data Warehouse. The time period covered by this series is April 2019 through December 2022.

Table 1 Obstetrical patients who received low-titer type O whole blood for massive hemorrhage

Obstetric patients transfused with whole blood ($n = 25$)		
Characteristics	**Median**	**Range**
Age (y)	30.8	19–57
Gestational age (wk)	36.5	4–42.4[a]
Length of hospital stay	4	1–4
Indications	*N*	%
Uterine atony	8	32
Coagulopathy/DIC	5	20
Accreta/percreta/increta	3	12
Amniotic fluid/pulmonary embolism	3	12
Uterine rupture	2	8
Ruptured ectopic pregnancy[a]	2	8
Outcomes	*N*	%
ICU admission	19	76
Hysterectomy	4	16
Cardiac arrest	4	16
ECMO support	1	4
Maternal death	2	8
Neonatal death	5	20
Transfusions	Median	Range
Estimated blood loss (mL)	3,250	800–12,000
Units of LTOWB transfused	3	1–8
Age of the LTOWB at transfusion[b]	10	(8–13) IQR
Units of components transfused	7	2–44

Abbreviations: DIC, disseminated intravascular coagulopathy; ECMO, extracorporeal membrane oxygenation; ICU, intensive care unit; IQR, interquartile range; LTOWB, low-titer type O whole blood.
Note: Some patients had more than one of the selected outcomes; thus, the total number of outcomes exceeds 25.
[a]Two were ruptured ectopic at 4 and 8 weeks.
[b]Days since donor draw. IQR (25^{th}–75^{th} percentile).

Table 2 Neonatal patients who received low-titer type O whole blood for massive hemorrhage

Neonatal patients transfused with whole blood ($n = 5$)		
Characteristics	**Median**	**Range**
Gestational age (wk)	26.3	25.1–36.1
Apgar (5 min)	5	2–8
Lowest pH	6.91	6.64–7.04
Maximum total bilirubin (mg/dL)	7	2.9–9.5
Indications	*N*	%
Fetomaternal hemorrhage	2	40
TRAP (donor)	1	20
Intestinal perforation/ hemorrhagic shock	1	20
Maternal motor vehicle accident	1	20
Outcomes	*N*	%
No or grade 1 IVH	3	60
IVH grade 2	1	20
IVH grade 3 or 4	0	0
Diagnosis of HIE (moderate/severe)	1	20
Died (redirection of care)	1	20
Transfusions	Median	Range
Volume of LTOWB transfused (mL/kg)	20	10–40
Age of the LTOWB at transfusion[a]	6	(4.5–8) IQR
Number of components transfused	2	1–6

Abbreviations: HIE, hypoxic/ischemic encephalopathy; IQR, interquartile range; IVH, intraventricular hemorrhage; LTOWB, low-titer type O whole blood; TRAP, twin reversed arterial perfusion.
[a]Days since donor draw. IQR, 25th–75th percentile.

Results

Results of the 25 obstetric patients treated with LTOWB are shown in ►**Table 1**. All of these women were transfused with RhD type-specific O whole blood. The median number of whole blood units transfused/patient was 3 (range: 1–8); these units were a median of 10 days since donor draw (interquartile range [IQR]: 8–13 days). Results of the five neonatal patients treated with LTOWB are shown in ►**Table 2**. Male neonates received RhD positive whole blood. Female neonates known to be RhD positive were given RhD positive whole blood. Female neonates with unknown RhD type or who were known to be RhD negative were transfused with RhD negative whole blood. The median volume of whole blood transfused/patient was 20 mL/kg (range: 10–40); these whole-blood aliquots were a median of 6 days since donor-draw (IQR: 4.5–8 days).

We encountered no problems in obtaining or transfusing the product. Each transfusion was given via a blood warmer to bring the temperature of the blood to approximately 37°C at patient entry.[7,8] We recognized no adverse effects of these transfusions. Following initial stabilization with LTOWB, all 30 patients received some additional blood products. The most common subsequent transfusion was packed RBC to increase the blood hemoglobin concentration (►**Tables 1** and **2**).

Discussion

Whole-blood transfusion offers several advantages in the management of acute hemorrhage. It provides an immediate source of RBCs, platelets, and clotting factors. It helps restore adequate tissue perfusion and oxygenation, preventing complications associated with inadequate oxygen delivery. Additionally, it is a simple and efficient method to quickly replace significant blood loss.[3–6]

In this small case series, we present our experience using LTOWB in obstetrical and neonatal patients. Although this is not a randomized experimental study, we interpret our observations to be quite positive. Based on our experience, we believe that transfusing this product to perinatal patients after acute blood loss is feasible and can be considered a first-line option to treat acute symptomatic perinatal blood loss. Future research should focus on elucidating optimal indications, dosing, and long-term outcomes of LTOWB transfusions of perinatal patients to refine practice and improve outcomes.

Author Contributions

N.R.C., T.M.B., R.K.O., S.J.I., W.E.K., and R.D.C. contributed in conception and design, assembly of data, manuscript writing, final approval of the manuscript. S.M.T., D.S.M., and T.R., contributed in conception and design and final approval of the manuscript.

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Conflict of Interest

None declared.

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