

Cost Comparison of Methods for Preparation of Neonatal Red Cell Aliquots

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OBJECTIVE: The purpose of this study was to compare the preparation costs of two common methods used for neonatal red blood cell transfusion aliquots.

METHODS: Three months of data from a Level 2 and Level 3 neonatal intensive care unit (NICU) were used to determine the comparative cost for red cell aliquot transfusions using an eight bag aliquot/transfer system or the syringe set system. Using leuko-poor red blood cell blood collected in Adsol and containing approximately 320 ml of red blood cells and supernatant solution, the average cost of neonatal transfusion aliquots was determined using the Charter Medical syringe set and the Charter Medical eight bag aliquot/transfer system.

RESULTS: A total of 126 red blood cell transfusion aliquots were used over the three month period. The amount transfused with each aliquot ranged from 5.0 ml – 55.0 ml with an average of 24.0 ml per aliquot. The cost per aliquot using the eight aliquot/transfer set was calculated as \$36.25 and the cost per aliquot using the syringe set cost was calculated as \$30.71. Additional benefits observed with the syringe set included decreased blood waste.

CONCLUSION: When comparing Charter Medical multiple aliquot bag sets and the Charter Medical syringe aliquot system to provide neonatal transfusions, the use of the syringe system decreased blood waste and proved more cost effective.

ABBREVIATIONS: NICU = neonatal intensive care unit; TSCD = Terumo Sterile Connecting Device.

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INDEX TERMS: neonatal red cell aliquots; neonatal transfusions; red cell aliquots; red cell aliquot cost analysis.

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Small, premature infants are frequently transfused with aliquots of red blood cells to replace blood loss from phlebotomy, to correct anemia associated with prematurity, and to sustain their rapid growth. To reduce the exposure to multiple donors, Wang suggested using a donor unit for an extended period of time and assigning a single blood donor unit to neonates predicted have to high blood usage.¹ Since that time, several researchers have established the safety of transfusing small aliquots of donor blood to neonates during the entire shelf life of the donor unit.²⁻⁵ The aliquots were obtained from the original packed red cell unit using a multiple aliquot bag set and transfused to the neonate through an infusion pump or infusion chamber. In recent years, a syringe system used with a sterile docking device has become an alternative method to provide a variable amount of red cells.⁶

The purpose of this study is to compare the cost of providing red blood cell aliquots using the Charter Medical eight bag aliquot set with the Charter Medical syringe aliquot system for neonatal red blood cell transfusions.

MATERIALS AND METHODS

Data were collected during a three month period from a Level 2 and Level 3 Neonatal Intensive Care Unit (NICU) at a 200 bed hospital with 36 neonatal beds in two different nurseries. The analysis used data on the cost of the leuko-poor red blood cells provided through the local blood center, the number of aliquots made, the volume of each aliquot dispensed, and the cost of the Terumo Sterile Connecting Device (TSCD) wafer. These costs were added either to the cost of the syringe aliquot set or to the cost of the eight bag aliquot/transfer set. The eight bag aliquot set provides eight aliquots of 30 ml each from each unit of blood.

RESULTS

A total of 126 red blood cell transfusion aliquots were used over the three month period. During the three month period, 13 neonates were transfused. Each was assigned a single unit of blood during the length of stay and aliquots were provided using the syringe system. The total transfusion amount for the neonates ranged from 79.0 ml – 244.0 ml and the amount transfused with each aliquot ranged from 5.0 ml – 55.0 ml with an average of 24.0 ml. The number of aliquots per blood donor unit ranged from three to 18. Since the eight bag aliquot set provides eight aliquots of 30 ml each from a single unit of blood, evaluation of the transfusion require-

ments for each neonate showed that 20 eight bag aliquot sets would be required for the transfusions and 126 syringe sets were required. Seven of the 13 neonates required more than eight aliquots. Those neonates would be exposed to an additional unit of blood and seven additional units of blood would be required using the multiple bag system. Table 1 shows the transfusion summary and aliquot requirements for the 13 neonates. The total cost for transfusions with the eight bag aliquot set would be \$4567 or \$36.25 per aliquot. The total cost for transfusions using the aliquot syringe would be \$3870 or \$30.71 per aliquot. Since the NICU uses a syringe for the pump infusion, the eight bag aliquot set would require additional disposables to transfer the blood for infusion. The cost comparisons for the aliquot transfusions are shown in Table 2.

DISCUSSION

Strauss and others demonstrated the amount of additives infused with small volume transfusions (15 mL/kg) were well below the toxic level² and the small amount of potassium in the supernatant of stored donor red blood cells did not cause hyperkalemia.^{3,4} Additional research showed that low levels of 2,3 DPG in stored red blood cells did not affect the oxygen carrying capacity in neonates transfused with small aliquots of blood (>15 mL/kg).³ Discussion with international experts demonstrated that it was common practice to use extended storage for donor units to reduce donor exposure to multiply transfused neonates,⁵ and Hisenrath demonstrated cost effectiveness with a limited donor program.⁷ Transfusion amounts vary with the size and health status of the neonate and assigning a donor to a single infant with a fixed volume in aliquots has demonstrated blood waste. Mangle found significant blood waste associated with splitting the donor unit into four packs and suggested additional division of the

Table 1. Transfusion summary

Patient	Number of transfusions	ml range	Total ml
1	3	35-45	117
2	11	11-25	199
3	12	15-23	196
4	8	15-37	130
5	10	10-35	205
6	3	20-34	79
7	13	5-55	206
8	14	10-30	232
9	16	10-23	244
10	13	12-35	244
11	4	31-58	169
12	9	15-35	228
13	10	13-42	233

Table 2. Cost comparison

	Bag system	Syringe system
Blood cost	\$3960	\$2474
Aliquot sets	\$567 (20 sets)	\$1144 (126 sets)
TSCD wafers	\$40 (20 wafers)	\$252 (126 wafers)
Total	\$4567*	\$3870

*Additional cost for syringe required for infusion pump in the NICU

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four small packs.⁸ Gupta determined that the number of transfusions and weight were inversely proportional and split a donor unit into four transfer packs for infants over 1000 gm and eight transfer packs for infants under 1000 gm.⁹

In her chapter "Pediatric Blood Collection and Transfusion Technology", Roseff discussed the problems associated with transfer packs and the several advantages associated with the use of a syringe aliquot set when providing small red blood cell transfusions to neonates.¹⁰ The size of neonatal red blood cell transfusions vary with the size and status of the individual infant and transfer packs cannot be tailored for individual transfusion because the individual packs are the same size. In addition, many nurseries use syringe pumps to infuse the blood cells requiring nursing personnel to transfer blood from the transfer pack. She described advantages using a newer syringe aliquot set which included avoiding the transfer of blood from a "pedipack" to the infusion syringe by the nursing staff with the possibility of spilling or losing blood, mislabeling at the bedside, or introducing contaminants. She stated that a disadvantage of the syringe set was the increased cost of the syringe set compared with the eight bag transfer set.

CONCLUSION

This study demonstrates that the syringe set is a more cost effective method to provide red blood cell aliquots to neonates because of the additional blood required to provide the same number of aliquots using the eight bag aliquot system. The study also verifies the previous observations that the syringe aliquot system decreases blood waste and donor exposure for the neonate.

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The illustration shows two pieces of medical equipment. On the left is a syringe aliquot set, consisting of a syringe with a needle, a drip chamber, and a filter. On the right is a transfer pack, which is a plastic bag with a syringe attached to it by a tube and a connector.

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