

APHERESIS ILLUSTRATED

Mystery Solved: Acquired Hemoglobin After Red Cell Exchange on Sickle Cell Patient

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ABSTRACT

We report a case of an acquired Hb after an RBCEx.

A mid-30s male with homozygous sickle cell disease (HbSS), blood type O Positive, receives monthly automated RBC exchanges (RBCEx) using Spectra Optia apheresis device (Terumo BCT, Lakewood CO) since the age of 20 given stroke history. He has antibodies to C, E, and low prevalence antigens (Js(a) and V). His pre- and post-HbS have been maintained at around 40% and 15%, respectively, by RBCEx using an average of 10 RBC units (C, E, K, sickle negative, and crossmatch compatible).

To optimize RBCEx parameters, our standard practice is to obtain HbS pre- and post-procedure by high-performance

liquid chromatography (HPLC, Variant II, Bio-Rad). This patient's pre-RBCEx HPLC showed HbA1, HbA2, HbF, and HbS (Figure 1A) as usual. However, post-RBCEx HPLC showed an additional peak of 1.5% eluting at 4.54 min after the HbS peak (Figure 1B). The post-RBCEx blood sample was also tested by capillary electrophoresis (CE, Capillarys 2 Flex Piercing, Sebia, Figure 2A). Compared to HPLC, capillary electrophoresis showed an increase in HbS by 0.6% and HbA1 by 1.5%, identical to the HPLC measurement of the variant peak (1.5%) suggesting that the variant is comigrating with HbA1 (Table 1). To further investigate these unexpected results, segments from donor

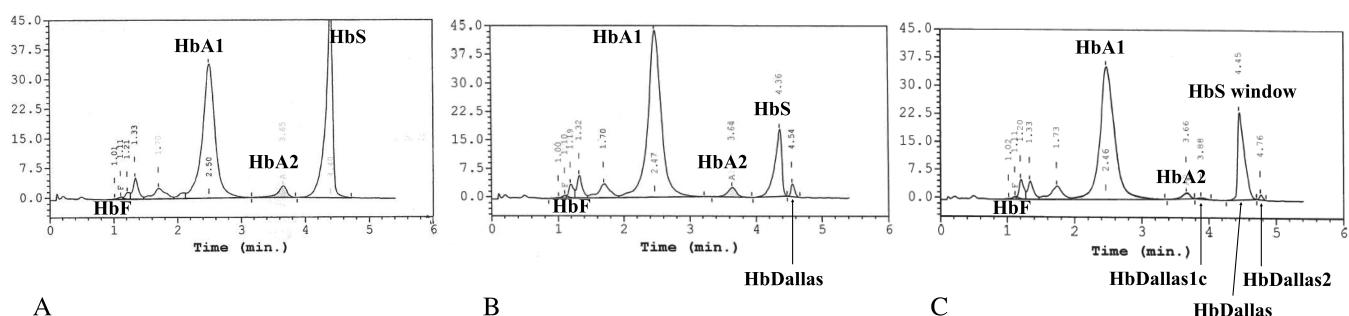


FIGURE 1 | Acquired hemoglobin pre and post-red cell exchange. (A) Pre-RBCEx HPLC. (B) Post-RBCEx HPLC. (C) RBC unit HPLC.

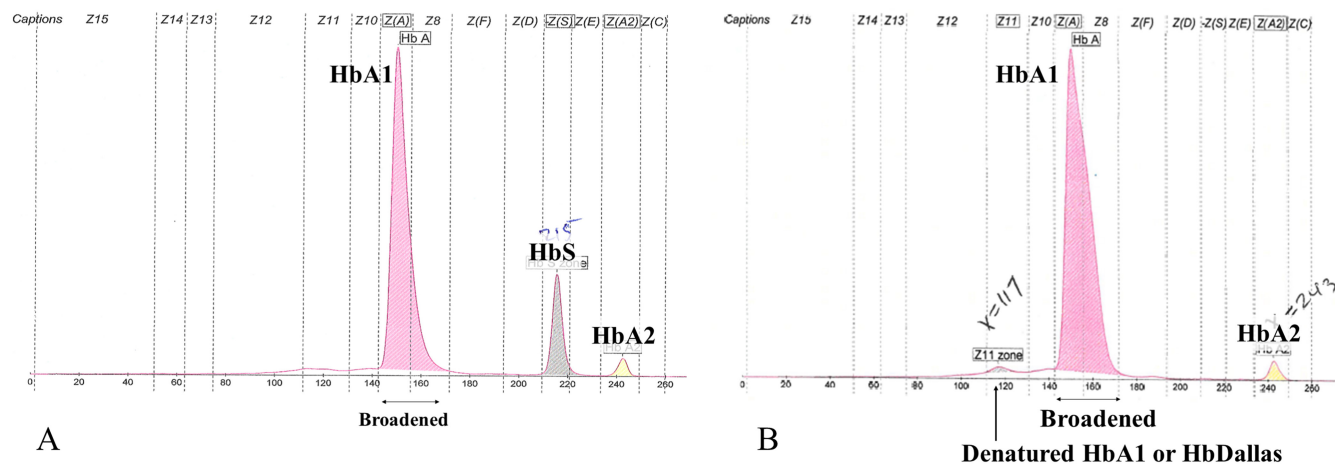


FIGURE 2 | Acquired hemoglobin pre and post-red cell exchange. (A) Post-RBCEx CE. (B) RBC unit CE.

TABLE 1 | Figure legend with Hb percentage of each sample (%).

	Method	Sample	A1	A2	F	S	Variant
Figure 1A	HPLC	Pre-RBCEx	58.0	2.9	0	39.1	—
Figure 1B	HPLC	Post-RBCEx	80.5	2.5	0.6	14.9	1.5
Figure 1C	HPLC	RBC unit	77.6	1.6	0.6	—	20.2
Figure 2A	CE	Post-RBCEx	82.0	2.5	—	15.5	—
Figure 2B	CE	RBC unit	96.5	2.5	—	—	1.0

RBC units were tested by HPLC. One of the units demonstrated one large peak and two small peaks within the HbS window (Figure 1C). Given that the units should be negative for HbS, these peaks represent products of a different variant. The HPLC findings are consistent with an alpha chain variant because the peak in the HbS window measured only 19.4%, HbA2 was low (1.6%), and there was a distinct band at 4.76 min accounting for the delta chain variant product (HbDallas2). The broad small band after HbA2 peak represents the glycated form of the variant (counterpart of HbA1c). The elution time of the major band by HPLC and its comigration with HbA1 as a broadened band on CE (Figure 2B) are consistent with HbDallas (substitution of lysine for asparagine at position 97). The small peak at position 117 on CE represents aged or denatured HbA1 or HbDallas1c (Figure 2B).

Although screening for HbSS has been implemented for blood donors, screening for other hemoglobin variants is not routine practice. Therefore, a donor RBC unit may contain an unusual Hb. However, recipients of these units may not manifest clinically significant symptoms. Previous reports show hemoglobin C as the most acquired Hb variant after transfusion [1–3]. HbDallas is a high oxygen affinity Hb and has been reported to affect properties of deoxyhemoglobin [4]; however, no clinical significance has been reported thus far. This patient did not experience any symptoms after RBCEx with this unit. His blood did not show HbDallas on his RBCEx visit in 1 month. He continues to receive monthly RBCEx and has been doing well.

In summary, this is a case of an acquired Hb after a RBCEx. The source of this Hb was ultimately made clear, after additional Hb electrophoresis testing on the donor RBC units, as a rare HbDallas.

Ethics Statement

Per the University of Michigan's IRB Review Process, IRB approval is not required for case studies without directly identifiable information.

Consent

The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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