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Lessons Relearned: Peripheral IV Placement and Recirculation

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Lessons Relearned: Peripheral IV Placement and Recirculation

A 21-year-old, 70 kg male donor was approved for peripheral blood hematopoietic progenitor cell (HPC) donation for a matched, unrelated, 40 kg, international pediatric patient. He was right-hand dominant and assessed to have adequate veins for peripheral IV (PIV) access one week prior to HPC collection (HPCC). It was noted the donor was "needle-phobic", expressing anxiety about phlebotomy, HPCC and G-CSF administration. At donation, an 18G PIV was placed in the right lower cephalic vein for return without difficulty (Figure 1A). For draw, an 18G antecubital PIV was placed in the contralateral left arm but was lost within minutes of initiating HPCC. Over the next two hours, four attempts were made to place a left arm PIV without success, despite topical anesthetics and oral lorazepam for anxiety. At each attempt, the donor would become diaphoretic and tense with extensive torso and upper extremity muscular contractions, accompanied by loud cursing. The donor ultimately threatened to leave but was persuaded to allow one last attempt to place a return PIV in the ipsilateral right arm antecubital vein, which was successful. Because the donor mobilized well (CD34=98/μL) and was 30 kg heavier than the recipient, the inlet volume was reduced from the requested 24L to 17L, which was calculated to yield 674.2×10^6 CD34 cells or nearly 17×10^6 CD34/kg recipient weight. HPCC was performed on the SPECTRA Optia™ using the CMNC program and was completed without further incident.

Much to our surprise, the collected product had a very low WBC count (47×10^6/mL, 95% MNC) with only 25% of the predicted CD34 yield (183.5×10^6 total CD34; 4.6×10^6CD34/kg). Likewise, the collection efficiency (CE) was exceedingly low for both MNC (CE=10.3%) and CD34 (CE=11%). There were no recorded alarms during the procedure

although it was noted that the collection preference was unsteady with autonomous re-establishment of the interface twice for unclear reasons. A comparison of all other HPCC within the same month showed acceptable CD34-CE (40±10%), regardless of instrument or type of venous access (PIV, n=15; [CD34-CE=39±8%], central venous catheter [CVC, n=17; CD34-CE=42±10%]; Figure 1B).

After a thorough investigation, it was determined that the poor CD34-CE was the result of recirculation. As shown in Figure 1A, the draw line PIV was placed in the right antecubital basilic vein *above* the return line PIV in the forearm cephalic vein. There is an old apheresis adage that if both draw and return lines must be placed in the same arm, always place the draw line PIV *below* the return PIV to avoid the risk of recirculation.[1] Published reports describing recirculation associated with apheresis, however, are notably lacking. We share our case as a clear, quantifiable example of recirculation due to poorly placed PIV in the same arm. We estimate that there was 75% recirculation based on the calculated CD34-CE, which was significantly lower than the CD34-CE in other HPCC during the same 30-day period (Figure 1B). We also believe that recirculation accounts for the unsteady collection preference and need to re-establish the interface observed during the procedure.

Data Availability Statement:
Not applicable

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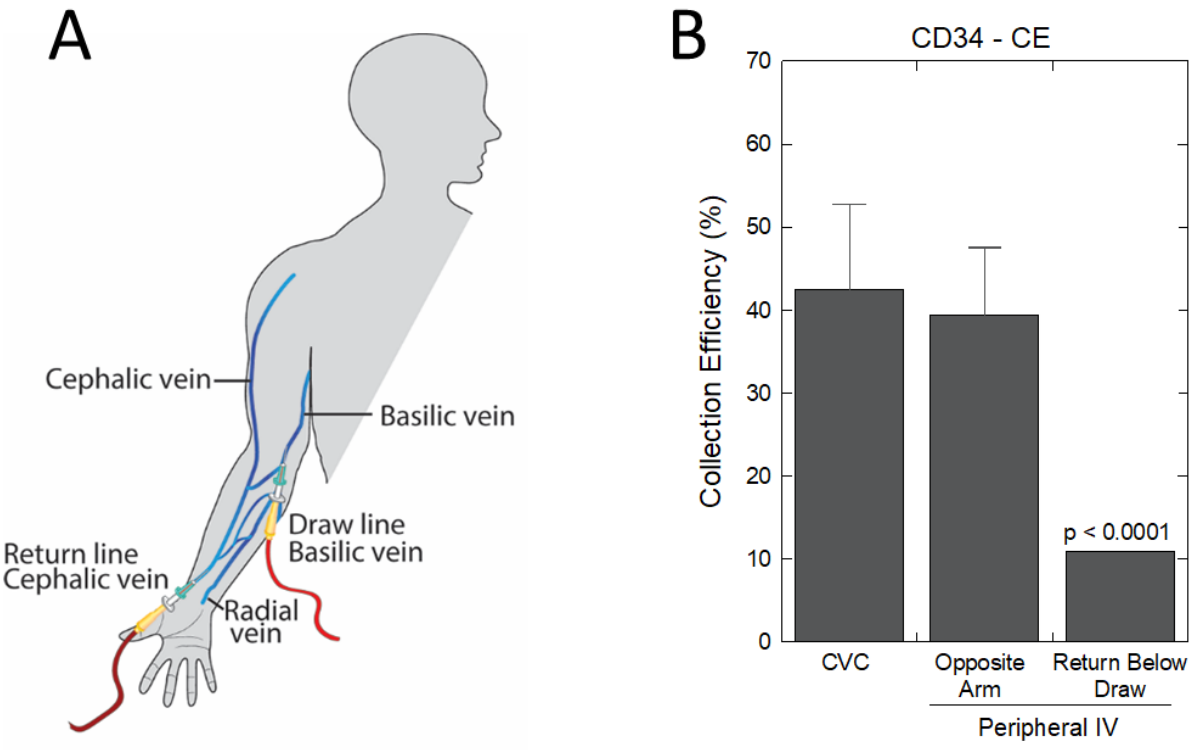
Figure Legend. A, Schematic showing the ipsilateral anatomic placement of draw line PIV (antecubital basilic vein) and return line PIV (lower cephalic vein) in the donor, resulting in recirculation. Processed, diluted blood was returned to the venous circulation line via the forearm and flowed anteriorly toward the draw line PIV, where it could be immediately withdrawn and re-processed. B, Comparison of the percent CD34-CE (± SD) by vascular access type (CVC, PIV) and anatomic placement (Opposite; return and draw PIV in opposite arms; Donor, where return PIV is below the draw line PIV).



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