A CASE FOR INDIVIDUALIZED CARE IN THE ICU SETTING

Blood loss management in surgical ICU: How severe is the patient's anemia?

Confidently identify and manage anemia with direct blood volume analysis (BVA)

Tony, 31 years

Presentation

Intra-abdominal blood loss estimated at 2 L during Roux-en-Y cyst-jejunostomy for chronic/recurrent pancreatic pseudocyst, identified based on postoperative hypotension, lethargy, and tachycardia

History and data

- Pancreatitis secondary to gallstones and/or substance abuse, hypertension, gastroesophageal reflux disease; drainage of ruptured pseudocyst and gall bladder removal 15 months ago, followed by sepsis, recurrence, cyst gastrostomy
- Preoperative medications included irbesartan, metoprolol, and hydrochlorothiazide

BP	Hct	BUN	Cr
79/40	20%	15	1.0

Weight	Height
235 lb	71"

Status

Over 1 L clotted blood was evacuated from abdomen the day following jejunostomy with 1 unit packed red blood cells (RBC) infused intraoperatively

To better understand Tony's fluid and red blood cell management needs, a BVA is performed

Blood Volume Analysis Results

	BVA Result	Patient Ideal	Deviation from Ideal	Excess / Deficit %
Total Blood Volume	5479 mL	6206 mL	-727 mL	-11.7%
Red Blood Cell Volume	997 mL	2516 mL	-1519 mL	-60.4%
Plasma Volume	4482 mL	3690 mL	+792 mL	+21.5%

Blood Volume Interpretation Guideline

	Normal	Mild	Moderate	Severe	Extreme
BV, PV Deviation (± %):	0 to 8	>8 to 16	>16 to 24	>24 to 32	>32
RCV Deviation (± %):	0 to 10	>10 to 20	>20 to 30	>30 to 40	>40

Hematocrit Analysis

	Patient Result	Normal (Male)
Peripheral Venous Hct	20%	40%-46%
Normalized Hct (nHct)	18%	40%-46%

BVA reveals that although he received 1 unit of packed RBCs the day after his jejunostomy, Tony is still severely anemic with a –60.4% red blood cell volume (RBCV) deficit

- This degree of depletion is also expressible as a normalized Hct of 18%
- Tony also has a small total blood volume (TBV) deficit driven by his severe RBC deficiency. The moderate plasma volume (PV) excess observed is likely related to IV fluid administration

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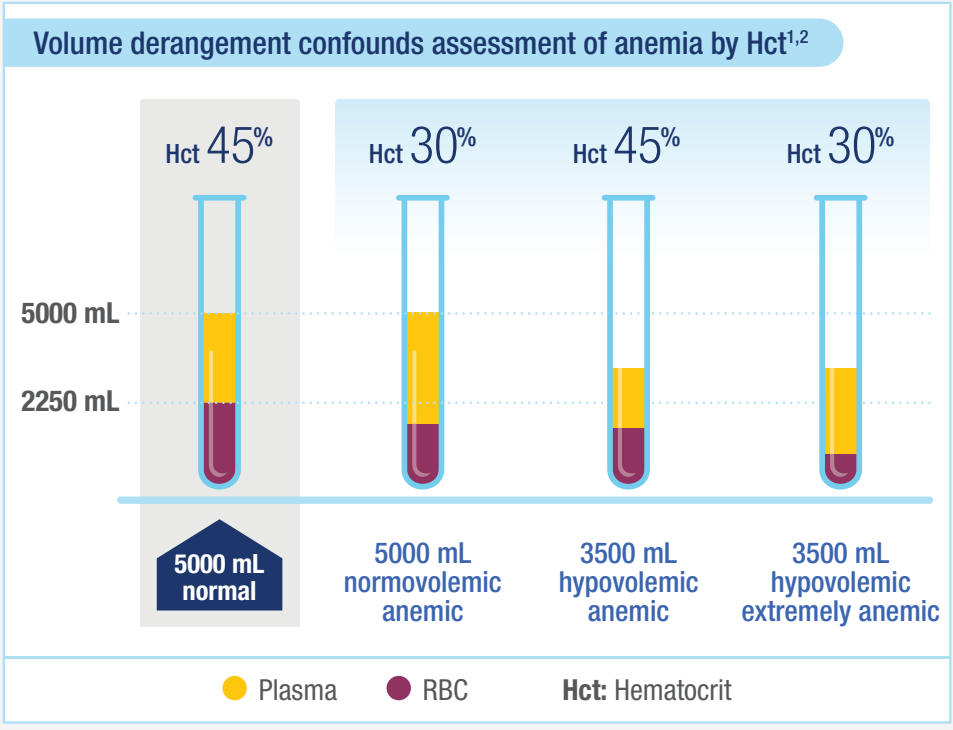
Direct BVA can help guide individualized care in surgical ICU

Management strategy for Tony based on BVA results

- Tony is given 2 units of packed RBCs and carefully assessed for evidence of acute kidney injury; as his TBV remains stable, subsequent RBC monitoring is done via change in Hct
- Tachycardia subsides immediately; albumin levels are normal (3.5 g/dL) at 4 days after surgery
- Antihypertensive medication is resumed slowly and cautiously with close attention to systolic pressure and renal function
- At 3-week follow-up, Tony demonstrates a marked improvement in pancreatitis with complete resolution of the previously observed large pancreatic pseudocyst

Managing blood loss in surgical ICU: the need for individualized care



Courtesy of Mihae Yu, MD, FACS (adapted).

- Acute plasma expansion due to IV fluid administered in the OR may result in a normal or near-normal Hct that masks a significant RBCV deficit
- Acute blood loss may likewise confound Hct: the same Hct result will indicate a greater RBCV deficit in a more hypovolemic patient
- Unlike Hct, direct BVA will quantify RBCV accurately even in volume-deranged settings[3]

Not an actual patient.

References: 1. Takanishi DM, et al. Peripheral blood hematocrit in critically ill surgical patients: an imprecise surrogate of true red blood cell volume. *Anesth Analg* 2008;106:1808–1812. **2.** Feldschuh J. Blood volume measurements in critical care. Ch. 25 in *Givetta, Taylor & Kirby's Critical Care*, ed., Gabrielli A, et al. Philadelphia, PA: Lippincott, Williams & Wilkins; 2009 (4th ed.), pp 283-295. **3.** Dworkin HJ, et al. Comparison of red cell and whole blood volume as performed using both chromium-51–tagged red cells and iodine-125–tagged albumin and using I-131–tagged albumin and extrapolated red cell volume. *Am J Med Sci* 2007;334(1):37-40.

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