Volume-Guided Venous To Venous Ultrafiltration In Hospitalized Heart Failure Patients

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ABSTRACT

While the synergy of combining Blood Volume Analysis (BVA) with Ultrafiltration (UF) has been envisioned for more than a decade, limited information is available to understand the optimal use and define the value of combining these valuable tools. We report below two cases of heart failure patients co-managed using BVA and UF. The accurate assessment of blood volume coupled with the controlled approach of ultrafiltration offers a unique opportunity to thoughtfully volume unload patients and avoid hemodynamic compromise and potentially acute kidney injury. Furthermore, the strategy offers an object of set of data in establishing euvolemic prior to discharge.

INTRODUCTION

Patients with heart failure (HF) often have wide variations in intravascular volume (Total Blood Volume (TBV) and Red Blood Cell Volume (RBCV)) that are part of the pathophysiology, symptomatology, and disease progression of their syndrome. Indirect volume measurements cannot measure intravascular volume with precision, often leaving clinicians without clear volume-guided treatment strategies. Furthermore, pharmacologic treatments for congestion have not reduced HF events, renal dysfunction, or mortality[1]. BVA provides several patient specific metrics including TBV, plasma volume (PV), and RBCV as well as providing a normalized hematocrit (nHct), a reflection of the anticipated pHct after volume correction. UF is a treatment capable of removing fluid from the body without changing RBCV or removing serum proteins and large molecules. UF is associated with higher fluid removal and weight loss, as well as reduced 90 days HF readmission[2]. Goals of using combined BVA and UF are safe removal of fluid without creation of hypovolemia and without exceeding the plasma refill rate.

METHODS

Two men aged 83 and 64 years were admitted to the hospital for volume overload and management. Each was initially treated with intense IV diuresis which produced worsening renal insufficiency. At that time BVA confirmed increased total intravascular volume for which UF was initiated. Monitoring of the gap between the peripheral hematocrit and the normalized hematocrit allowed safe and adequate decongestion.

RESULTS

Significant volume removal correlated with clinical improvement and the patients were discharged 3-4 days following combined use of BVA and UF. Table 1 summarizes these outcomes and documents the rise in pHct (Patient 2) as it approaches the nHct, signaling sufficient volume removal. A graph of pHct and nHct can be seen in Figure 1.

Table 1

Patient #	Age	Gender	Days in Hosp BEFORE UF/ BVA	Days in Hosp AFTER UF/ BVA	Weight (lbs)		
					Admission	Start UF/BVA	Discharge
1	83	M	8		197	193	167
2	64	M	3		239	235.5	210

Patient #	Blood Volume (excess/deficit) %			Hematocrit Analysis (%)	
	TBV	Plasma Volume	RBCV	pHct	nHct
1	33.7		-17.4	23	37.2
2	72.9	123	Normal		

RESULTS (Continued)

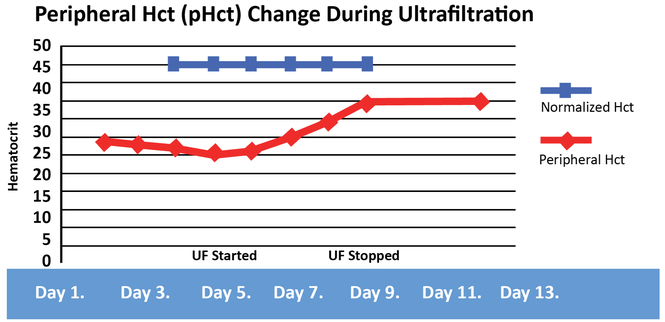

Figure 1

CONCLUSIONS

Earlier use of BVA in these two patients could have prevented acute renal injury from intensified diuresis, and by instituting UF, the kidneys could be provided with a 'diuretic holiday'. Further, the normalized hematocrit, determined by BVA, provides clinicians with a specific metric to monitor UF progress and adequacy. Combined use of BVA and UF should improve outcomes in hospitalized diuretic-resistant or renal insufficient patients. Clinical trials of their combination need to be designed and completed.

REFERENCES

1.Costanzo M, et al. JACC HF. 2016 Apr;4(2):95-105.

2.Siddiqui WJ, et al. Heart Fail Rev. 2017 Nov;22(6):685-698.

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