



## Blood Volume Analysis (BVA) Clinical Case Study

### Congestive Heart Failure, Anemia, Pleural Effusions Elevated BNP Part I

#### History:

This eighty four year old female, 70" height and 124 lbs. complains of respiratory distress. Chest X-ray suggests pulmonary vascular congestion. Physical exam positive for jugular venous distention. Her past medical history includes COPD, CHF and chronic anticoagulation post valve replacements. She has had repeated admissions for pleural effusions and respiratory distress.

#### BVA Results: 07/08/02

<b>Blood Vol.</b>	3861cc	<b>Ideal Blood Vol.</b>	4516cc	<b>Deficit</b>	654cc	<b>Devtn.</b>	<b>-14.5%</b>
<b>Red Cell Vol.</b>	929cc	<b>Ideal Red Cell Vol.</b>	1628cc	<b>Deficit</b>	699cc	<b>Devtn.</b>	<b>-42.9%</b>
<b>Plasma Vol.</b>	2933cc	<b>Ideal Plasma Vol.</b>	2888cc	<b>Excess</b>	44cc	<b>Devtn.</b>	<b>1.5%</b>

Normal  
0 to 8%

Mild  
8 to 16%

Moderate  
16 to 24%

Severe  
24 to 32%

Extreme  
>32%

Hematocrit: 26%

BNP: 146 (NYHA Class I-II)

#### Clinical Analysis:

This patient has mild hypovolemia. The discrepancy between the BNP and the clinical findings of pulmonary congestion and plural effusion was resolved with the BVA. **Diuretic therapy in this patient would have produced further volume depletion and increased potential for pre-renal azotemia.** Analysis suggests thoracentesis as the approach to relieve respiratory distress. Patient is also anemic, and an evaluation for possible blood loss secondary to anticoagulants should be considered, as well as treatment to increase red cell volume.

#### Technical Analysis:

Technical analysis consists of an evaluation of five separate blood volume collection points with mathematical evaluation of consistency. Technical evaluation is reported as acceptable or unacceptable. All five individual sampling points, tested in duplicate, were internally consistent with no significant deviations. Therefore, the results are technically acceptable.



## Blood Volume Analysis (BVA) Clinical Case Study

### Congestive Heart Failure, Anemia, Pleural Effusions Elevated BNP Part II

#### History:

This is the second admission for this eighty four year old female, 70" height and 124 lbs. Cardiodynamics at this time is volume overload based on systemic vascular resistance and thoracic fluid content increase. Normal cardiac output and diminished LV work.

#### BVA Results: 08/09/02

<b>Blood Vol.</b>	3815cc	<b>Ideal Blood Vol.</b>	4448cc	<b>Deficit</b>	633cc	<b>Devtn.</b>	<b>-14.2%</b>
<b>Red Cell Vol.</b>	1103cc	<b>Ideal Red Cell Vol.</b>	1603cc	<b>Deficit</b>	500cc	<b>Devtn.</b>	<b>-31.2%</b>
<b>Plasma Vol.</b>	2712cc	<b>Ideal Plasma Vol.</b>	2845cc	<b>Deficit</b>	134cc	<b>Devtn.</b>	<b>-4.7%</b>

**Normal**  
0 to 8%

**Mild**  
8 to 16%

**Moderate**  
16 to 24%

**Severe**  
24 to 32%

**Extreme**  
>32%

Hematocrit: 32%

BNP: 753 (NYHA Class III)

#### Clinical Analysis:

This patient has a mild hypovolemia with a decreased red cell mass, which has improved compared to 07/08/02. Chest X-ray shows cardiac enlargement, bilateral pleural effusions, and possible pulmonary edema. CT scan supports all these findings. The patient has an additional marked increase in BNP compared to 07/08/02. The patient's hypovolemia has not been corrected and the severe anemia only partially corrected. The patient has a normal cardiac output, suggesting diastolic failure, which may be related to hypovolemia and over diuresis. The rise in BNP correlates with the patient's cardiac status, but not with the patient's volume status. Despite the further elevation of BNP, the BVA shows the patient is still hypovolemic and 31% red cell depleted. Diuretic therapy in this patient would further increase the potential for pre-renal azotemia. Therapy to increase the red cell volume and repeat thoracentesis may be necessary.

#### Technical Analysis:

Technical analysis consists of an evaluation of five separate blood volume collection points with mathematical evaluation of consistency. Technical evaluation is reported as acceptable or unacceptable. The fourth data set is excluded from the calculation. The standard deviation was 1.86%. Therefore, the results are technically acceptable.