Crit-Line® III Monitor
Frequently Asked Questions
What is the indication for use of the Crit-Line III monitor?

The Crit-Line III monitor is used to non-invasively measure hematocrit, percent change in blood volume and oxygen saturation in real time for the application in the treatment of dialysis patients with the intended purpose of providing a more effective treatment for both the dialysis patient and the dialysis clinician. In addition, the Crit-Line III monitor estimates the amount of blood that is recirculated back into the dialysis circuit instead of the patient’s circulating volume. Based on the data the monitor provides, the dialysis technician may intervene (i.e., increases or decreases the rate at which fluid is removed from the body) in order to potentially remove the maximum amount of fluid from the dialysis patient without the patient experiencing the common symptoms of dialysis which include nausea, cramping and vomiting.
How does the Crit-Line III monitor make its measurements?

The Crit-Line III monitor has a sensor clip that emits multiple wavelengths of light through a disposable viewing window that is called a Crit-Line blood chamber. The Crit-Line blood chamber is indicated for use with the Crit-Line III monitor. The blood is trans-illuminated by multiple wavelengths of light and the differences in blood absorption between blood constituents allow for identification and measurement of hematocrit and oxygen saturation.
What is the range and accuracy of the Crit-Line III monitor?

Hct Range: 10-60 Hct
Hct Accuracy: ±1.0 Hct

O₂ Sat Range: 55-100%
O₂ Sat Accuracy: ±2%
**Where is the blood chamber placed?**

The Crit-Line blood chamber is attached to the arterial side of the dialyzer.

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**How does the Crit-Line III monitor calculate percent change in blood volume?**

There is an inverse relationship between hematocrit and blood volume change. As hematocrit goes up, blood volume goes down and vice versa. Blood volume is calculated using the following formula:

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\%\Delta \text{BV} = \left\{ \frac{H_2}{H_1} - 1 \right\} \times 100
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- \(H_2\) = beginning Hct
- \(H_1\) = current Hct

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\text{Hct} = \frac{\text{RCV}}{\text{BV}} \times 100
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Why is measuring intravascular blood volume helpful?

Measuring intravascular blood volume is helpful because it assists the caregiver in determining the net difference between the total amount of fluid removed from the patient and the vascular refill rate. Achieving the right balance between ultrafiltration (UF) rate and vascular refill rate is important to optimize fluid removal without causing intradialytic symptoms:

• A low UF rate combined with a high refill rate potentially misses the opportunity for more effective fluid removal.

• A high UF rate combined with a slow refill rate can lead to symptoms like dizziness, nausea and hypotension.

The Crit-Line III monitor provides the caregiver with information about the patient’s relative blood volume and vascular refill rate during dialysis in order to make timely interventions.
What information is on the Crit-Line III monitor screen?

- Time elapsed since beginning of treatment.
- BV Percent Change (displayed in increments of 5%)
- Current Hct Value
- Current Hgb Value (estimated)
- BV Percent Volume Change Graph
- Current BV Percent Change Value
- Current O₂ Sat Value

The event marker (entered by user) is an arrow used to show when an intervention or symptom occurred.

What happens if the treatment goes longer than four hours?

If the treatment goes longer than four hours, the Crit-Line III monitor display will rescale to up to ten hours.
How are the various blood volume profiles interpreted?

**Note:** Always assess the patient’s condition before making any interventions.

**Profile A:** With the ultrafiltration rate above minimum, a flat or positive profile indicates that the patient’s plasma refill rate is occurring at the same or a greater rate than ultrafiltration. A blood volume Profile A suggests that the ultrafiltration rate might be increased without immediate risk of intradialytic symptoms.

Please note that a Profile A might be acceptable in some patients but not others. Thus, the clinician should always assess the patient’s condition before making any interventions.

**Profile B:** A Profile B, or gradual slope, has been targeted to find the best compromise between a high ultrafiltration rate and the prevention of intradialytic symptoms. The ideal slope is not a fixed percentage of the change in BV and will vary from patient to patient. Typical published values range from -3% to -8% per hour depending on patient characteristics and algorithm. As a precaution, patients should be more closely monitored if they approach or exceed a BV change of -6.5% per hour.

**Profile C:** A steep slope represents a rapid decrease in blood volume and bears a higher risk for intradialytic symptoms. Literature indicates that this might occur at a BV change of ≥-8% per hour or at a total BV change of ≥-16% at the end of a 3-4 hour dialysis session. However, some patients may have a lower or higher tolerance depending on cardiovascular status and other comorbidities.
Does the Crit-Line III monitor tell the user what intervention should be made?

The Crit-Line III monitor does not tell the user what to do, but provides information on how the patient is tolerating the UF rate. The Crit-Line III monitor is not intended to replace the judgment or experience of the attending physician or other medical professional. The hemodialysis treatment prescription is the responsibility of the attending physician.

How can the Crit-Line III monitor help prevent common dialysis-related symptoms?

If the Crit-Line III monitor is showing a Profile C indicating that the fluid is being removed too quickly, the caregiver can reduce the UF rate to help prevent a hypovolemic event from occurring. Sometimes a patient has a lot of fluid to remove but the fluid has not yet shifted into the intravascular space. Fluid can only be removed from the intravascular space and the Crit-Line III monitor can indicate whether there is or is not fluid to remove. Knowing when to remove and the rate of removal can help the caregiver prevent hypovolemic symptoms from occurring.
Are there any publications on the use of the Crit-Line III monitor?

There are numerous publications on the use of the Crit-Line III monitor.

How is plasma refill assessed? How does one verify if there is more fluid to remove?

The plasma refill check can be performed at any time during the treatment but is usually performed during the last 10 minutes of treatment. To perform a refill check, the UF is put into minimum or OFF and the Hct, as displayed on the Crit-Line III monitor, is recorded. After 10 minutes, the hematocrit is recorded again. If the hematocrit has decreased by ≥0.5 or more, then additional fluid may be available for removal.

A positive or negative refill test alone does not necessarily indicate whether patients are fluid overloaded or at dry weight. The Crit-Line III monitor is a tool and does not measure dry weight. Determination of dry weight should always be based on a comprehensive clinical assessment by the physician. Longer dialysis at slower UF rates may be necessary if no refill is present but dry weight is not reached.
How does one prescribe Crit-Line III monitor use?

See below for some examples of how Crit-Line III monitor use can be prescribed:

Prescribing Fluid Removal by Crit-Line III Monitor:

- Ultra-filter ________ cc as guided by Crit-Line III monitor.

- Remove ________ cc by ultra-filtration as tolerated with Crit-Line III monitor guidance.


- Do “refill check” per Crit-Line III monitor policy.

All Crit-Line III monitor parameters must be considered in conjunction with the patient’s clinical assessment, comorbidities and existing medical history before prescribing or changing a dialysis treatment. Any decision regarding patient treatment is the responsibility of the attending physician.

Does the Crit-Line III monitor have to be calibrated before each use?

Each Crit-Line III monitor comes with its own verification filter. A “verify accuracy” routine can be performed as often as desired to ensure the accuracy of the monitor but the monitor’s software will require that this test be performed once every 30 days. This routine takes one minute to perform. When the test is completed, the Crit-Line III monitor will notify the user if it is ready for clinical use or if additional tests are necessary.
References: