

Blood Volume Monitoring: Taking the Guesswork out of Fluid Removal For the Dialysis Nurse

By Elisabeth Harman, RN, CNN

Over the last three decades, significant advances in dialysis-related pharmaceuticals, technology, and protocols have enabled patients to better manage End-Stage Renal Disease (ESRD) while living longer and healthier lives. Today, computer-controlled dialysis equipment, efficient dialyzers, access management programs, anemia management, bone disease control, and more flexible scheduling allow patients to have a “life” as they “live” with ESRD.

“Keeping Patients On Track”

Similarly, these improvements have aided nephrology nurses in delivering care and keeping patients on track for positive outcomes. Individual fluid supply systems, blood pumps, hollow-fiber dialyzers, and internal accesses enable clinicians to provide more individualized care to ESRD patients. But, while declotting Scribner shunts, handling 12-hour runs and maneuvering mini-Kiil and D4 dialyzers no longer burden dialysis nurses, clinicians face additional challenges.

Other factors such as increasing co-morbidities, staffing shortages, and cost pressures squeeze the limited resources available to dialysis clinics. In order to offset the impact of these factors, dialysis clinics should consider the multi-pronged benefits of blood volume monitoring (BVM) to patient care and the nurse’s role in dialysis treatment.

One Clinic’s Experience

Central Valley Dialysis (CVD) in Salt Lake City, UT, began utilizing the CritLine system from Hemametrics, Inc., for BVM six years ago. The clinic conducts BVM with a



CritLine III™—This device from Hemametrics has been called the “gold standard” in fluid management via blood volume monitoring.

non-invasive device that uses photo-optical technology to measure absolute hematocrit (Hct), percent blood volume change, continuous oxygen saturation, and access recirculation all together. The device provides graphical representation of these values on a monitor, providing a window into the client’s vascular system and allowing nurses to “see” blood volume and visually track a patient’s response to dialysis treatment as it occurs.

This BVM methodology has since become a standard of care at our clinic due to the dramatic, positive results realized by both our patients and staff. CVD currently uses

BVM in the dialysis treatment programs of all our patients, who benefit from our nurses' enhanced capability to determine and make necessary essential adjustments in filtration or fluid removal. This absolute control through real-time monitoring has enabled our staff to attain more accurate dry weights, educate patients to achieve better compliance, and virtually eliminate problematic episodes during hemodialysis (HD).

“An Essential Component of Treatment”

A variety of traditional methods exist for dialysis nurses to guide fluid removal in patients. Blood pressure (BP), pulse, and breathing are used to evaluate fluid status during dialysis. Additionally, sodium modeling, ultrafiltration (UF) modeling and patient position may be manipulated to maximize the efficacy of dialysis treatments. However, these protocols on their own are not adequate to counteract the impact of each patient's unique dry weight, co-morbidities, and the body's dynamic response to HD on patient safety and comfort during treatment.

It is for this reason that real-time BVM is an essential component of treatment. When using BVM in conjunction with the aforementioned methods, nurses gain unparalleled clinical insight regarding the exact status of the patient during each phase of HD, leading to safer, more effective treatments.

An Ounce of Prevention...

By incorporating BVM into dialysis treatments, nurses can achieve maximum fluid removal without morbidity. BVM goes a long way to prevent the costly, life-threatening episodes that often plague ESRD patients, causing missed dialysis treatments for chronic patients or lengthy hospitalizations for acute patients. More accurate dry weights are attained with greater patient safety and comfort during dialysis treatments, leading to better patient satisfaction and compliance, not to mention enriched well-being and improved quality of life between dialysis treatments.

By avoiding “crashing” episodes, nurses also alleviate the associated drain on staff time, supplies and other clinic resources that can't be recovered. Additionally, by avoiding fluid overload and the resulting congestive heart failure or pulmonary edema, clinicians can help keep patients on their treatment schedules, preventing hospitalizations and any negative economic impact to clinics related to missed treatments.

Dry Weight

When CVD initiated BVM, we found it to be a very useful tool in demonstrating the process of fluid removal to patients, particularly those who were fixated on a specific dry weight. Using the device, nurses can show patients that excess fluid is still being retained and persuade them to continue removing fluid.

The accuracy of the blood volume figures, combined with patient cooperation and confidence, helps our nurses to gradually lower dry weights until patients obtain a “B profile” or gentle 3%-5% per hour weight loss during treatment. By carefully monitoring and decreasing weight over a period of 2-3 weeks, dialysis nurses could optimize fluid removal while avoiding morbid events. What’s more, many of our clients reduced their dry weights by up to six kilograms during this time while also reducing shortness of breath, nausea, dizziness, and other conditions to improve their overall feeling of health and well-being.

The UF Factor

BVM also assisted with the UF of those patients who still have considerable urine output. We are able to dialyze them and very gently ultrafiltrate or administer a saline bolus as needed to maintain an “A profile.”

By eliminating the guesswork as to whether these patients had achieved dry weight, we prevented excess UF. We also avoided the associated cramping, lightheadedness or dizziness, and nausea—providing the patients with a more comfortable treatment experience while preventing hypertension from too little removal of fluid.

Patient Compliance

While blood volume monitoring has been an indispensable tool in keeping our clients safe and comfortable during treatments, it also has served to impress upon patients the importance of intradialytic fluid and dietary control. Now, we can show patients the impact of their lifestyle choices and disease management compliance.

With BVM, patients can actually “see”—on the device’s graphical chart—that excessive salt or fluid intake makes it difficult to achieve their dry weights safely. This impresses upon them their own responsibility in optimizing dialysis treatments and their role in staying healthy. The figures and measurements provided by BVM are indisputable, further driving home the notion that the efficacy of dialysis begins with the patient.

Morbidity Events

All dialysis clinicians understand the negative impact of hypotensive episodes during treatments and seek to avoid these crisis-nursing situations. Before our use of BVM, Central Valley Dialysis worked as many clinics around the country do—making UF decisions based on gut feeling, patient history, and professional experience. Unfortunately, none of these techniques can be counted upon as being reliable or accurate. But, with the BVM device, UF rates can be more accurately determined.

The device measures Hct several hundred times per minute, allowing our nurses to observe plasma refilling and—in the same glance—patients’ status by viewing the real-time changes in blood volume as they are graphically charted and displayed at each station. They then can choose the

ideal UF rate for that particular treatment or time segment within the treatment.

“Percent Blood Volume Change”

For instance, nurses can determine by the graphical curve of percent blood volume change if adjustments in UF rates are necessary. If the curve is too steep, indicating large blood volume changes and possible intolerability to a low dry weight set point, we are able to make adjustments before BP drops and a patient experiences “crashing.” The UF rate can be brought down or positional changes (*e.g.*, Trendelenburg) or pharmaceuticals (*e.g.*, Mannitol, albumin) can increase plasma refill, which may allow continued use of the higher UF rate.

If blood volume does not change during the treatment, it is an indication that more fluid can be removed because the UF rate may be set too low or the dry weight too high. Our nurses can assess whether UF should be increased to maximize fluid removal and attain ideal dry weight. Overall, UF rates are crucial to patients’ ongoing safety. Each patient has a specific blood volume level below which he or she will become symptomatic. With the benefits of BVM, UF and sodium modeling can be evaluated immediately for effectiveness, and interventions can occur before the onset of hypovolemia and hypotension.

“Cardiovascular Events”/“A Pregnant Patient”

Additionally, most of our dialysis clients suffer from comorbid conditions, particularly cardiovascular disease (CVD). But with careful BVM, we have nearly eliminated CV events in our unit, experiencing only one cardiac arrest in the past three years. Prior to using BVM, the average was two cardiac arrest episodes per year.

Through the clinic’s extensive use of BVM, we also achieved extraordinary results for a pregnant patient who successfully delivered a healthy baby boy. The monitoring of her blood volumes during 5-6 treatments each week throughout her pregnancy prevented hypotension and any adverse affects to her unborn child.

Conclusion

Overall, BVM has become an essential part of caring for the patients at CVD. It has proven that the tenuous, ever-changing state of ESRD patients requires the adoption of this diagnostic tool to ensure patients’ safety and comfort during HD. It has also proven to be a major factor in positive outcomes over the long term. Additionally, our nurses have benefited from the ability to treat patients with confidence, derived from leveraging clinical knowledge to definitively answer important questions and eliminate doubt and speculation in dialysis treatment.

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