# BIOIMPEDANCE SPECTROSCOPY IN CRITICAL CARE

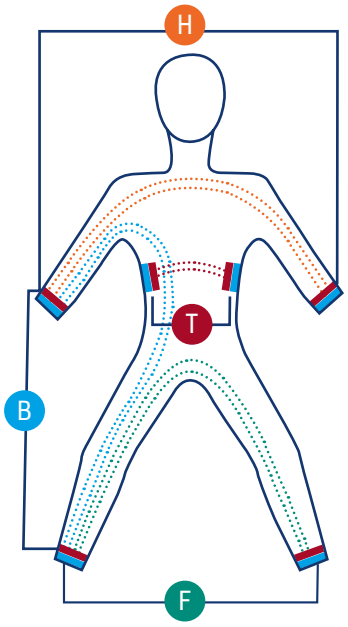
Early detection through Bioimpedance Spectroscopy (BIS) can improve patient outcomes and save lives.

Tracking fluid can be vital in the monitoring of patients in Critical Care as subtle fluid shifts can be the difference between life and death [1]. Ongoing assessment of fluid status is vital for critically ill patients, as it requires careful monitoring of clinical signs, fluid balance, and hemodynamic parameters [2].

In instances of hypovolemia or shock, NICE (2023) recommends immediate fluid resuscitation. It is essential to carefully manage the volume and rate of fluid administration to prevent fluid overload [2]. The existing methods for guiding fluid management in the ICU are increasingly regarded as inadequate, insufficient and dynamic tests for predicting fluid responsiveness are not always possible in this setting [1,3].

Studies have demonstrated that there is a direct correlation between fluid overload, and increased mortality as well as adverse outcomes in critically ill patients [4,5,6].

BIS can be applied as an early warning system and a monitoring tool with the potential to improve patient care and outcomes.


- **B - Electrodes placed on foot and hand:** Measures whole body.
- **T - Electrodes placed on ribs:** Transthoracic measurement (central oedema).
- **F - Electrodes placed on two legs:** Measures lower limbs only.
- **H - Electrodes placed on two hands:** Measures upper limbs.

The Prediction Marker, Phase Angle, and Characteristic Frequency are highly reliable indicators of fluid overload and should function effectively even in the context of segmental measurements.

## HOW FLUID BALANCE IS CURRENTLY MEASURED IN CLINICAL SETTINGS

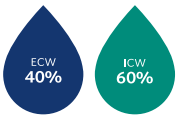

FLUID BALANCE CHARTS

PHYSICAL ASSESSMENT OF FLUID BALANCE

MONITORING OF BLOOD RESULTS

## HOW CAN CLINICIANS ENHANCE FLUID BALANCE MONITORING WITH MULTISCAN 5000?


TBW




ICW ECW

OHY

PREDICTION MARKER INFINITY

NUTRITIONAL INDEX

Bodystat®
BODY COMPOSITION TECHNOLOGY

# THE MULTISCAN 5000 IS NON-INVASIVE, PORTABLE, HANDHELD AND CAN PROVIDE FREQUENT MONITORING.

The Multiscan 5000 distinguishes ICW (Intracellular Water) and ECW (extracellular Water) separately, helping to build an accurate **Total Body Water (TBW)**. Monitoring TBW is essential for assessing overall hydration status. The analyser is capable of detecting fluid shifts between these compartments (e.g., from ICW to ECW) and evaluating the equilibrium between fluid intake and output.

The **OHY** (Overhydration) parameter is a critical measure used to assess and quantify the excess fluid in the body, beyond what is physiologically necessary. This parameter plays a significant role in evaluating fluid balance in clinical settings where fluid overload can be a concern. The OHY parameter estimates the volume of excess fluid retained in the body by comparing the measured Total Body Water (TBW) with the expected normal hydration level for an individual, based on their body composition.

**Bodystat's BIS Multiscan 5000 can assist the adjustment of nutritional, physical and medical intervention. This approach can aid in preventing complications such as oedema, fluid overload and malnutrition in ICU patients, thereby enhancing overall patient outcomes in critical care settings.**

## IMPORTANT PARAMETERS

### PHASE ANGLE

Phase angle, which is directly measured has been shown to be a valuable prognostic tool in critical care settings. Lower phase angles are correlated with higher mortality rates and adverse outcomes in critically ill patients.

PhA offers critical insights into both patient health and disease status.

Evidence shows PhA can be used for monitoring treatment of patients with disease-related fluid imbalance and malnutrition.

Inflammation with potential oxidative damage is a common mechanism affecting PhA in health and pathology [7].

Phase angle is a valuable tool in critical care, offering insights into cellular health, nutritional status, and overall prognosis. It aids in early identification of at-risk patients and helps guide effective treatment strategies, ultimately aiming to improve patient outcomes in the ICU.

### BIVA

BIVA is an accurate, non-invasive, accessible and cost-effective tool that assesses fluid balance. It shows high specificity and positive predictive value for detecting peripheral oedema and effectively predicts length of stay and all-cause mortality in these patients [8,9].

Fluid overload on admission evaluated by BIVA was significantly related to mortality (1). 32% of patients admitted to the emergency departments with fluid overload identified by BIVA died [1].

BIVA provides detailed insights into both fluid balance and nutritional status, which are critical when managing ICU patients who often struggle with fluid overload.

### OHY

The OHY parameter estimates the volume of excess fluid retained in the body by processing the ECW, ICW and other body parameters.

Increased OHY on day 1 and hyper OHY on day 3 of ICU admissions are associated with greater risk of hospital mortality.

Volume status on day 3 is also associated with duration of ventilator use and the length of stay in ICU.

The OHY parameter is critical to assess and quantify the excess fluid in the body, beyond what is physiologically necessary. Making OHY a valuable prognostic marker for assessing the severity of the disease and the likelihood of complications.

### PREDICTION MARKER INFINITY (PM∞ ) (TBW/ECW)

In critically ill patients, an expansion of extracellular water (ECW) and a retraction of intracellular water (ICW) are frequently observed.

PM∞ allows the monitoring of the TBW and ECW ratio, based off raw data.

The PM∞ is seen to be exaggerated post surgery in patients who develop oedema.

The PM∞ and extracellular water parameters are useful in monitoring fluid overload (1,3).

Tracking these changes over time can help to identify when a patients is at risk. Elevated ECW levels have been associated with poor outcomes in patients. Higher ECW often correlates with more severe disease and a higher risk of adverse events, including hospitalisation and mortality [10,11].

## REFERENCES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