BIOIMPEDANCE SPECTROSCOPY (BIS) IN RESPIRATORY DISEASES

Poor nutritional status is associated with declining lung function in patients with respiratory conditions such as Cystic Fibrosis (CF) and Chronic Obstructive Pulmonary Disease (COPD)[1].

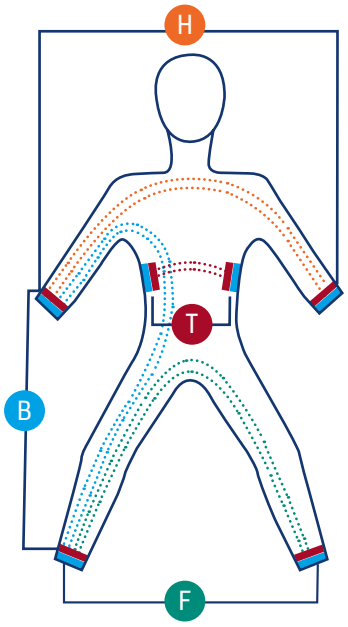
For individuals with CF, it is advised to perform regular assessments of body composition, specifically estimating fat mass (FM) and fat-free mass (FFM), rather than relying solely on BMI. This is because FM and FFM are more strongly associated with respiratory outcomes, and a normal or low BMI can sometimes hide underlying high FM or low FFM (ESPEN, 2023). Bio-electrical impedance analysis (BIA) is recommended by ESPEN as a non-invasive, simple, and bedside technique for assessing body composition in patients with CF. It is preferable to use specific prediction equations or raw values for resistance and reactance in these assessments [2].

Phase Angle (PhA) is a prognostic marker in the field of clinical nutrition and reflects the integrity and function of cell membranes [3]. There is an inverse relationship between phase angle and patients' nutritional status [4]. PhA correlates with recognised prognostic markers of BMI and FEV1. It also correlates with body composition derived via BIA[3] .

Since PhA is a direct measure of raw data it avoids the need to rely on population and disease specific body composition reference values. Therefore may prove to be a useful biomarker of nutritional status in adult patients with CF [3,4].

The NICE guidelines for COPD acknowledge that muscle loss, or muscle atrophy, is a common issue among patients, especially in the later stages of the disease. This muscle wasting is attributed to a range of factors, including decreased physical activity, malnutrition, systemic inflammation, and the catabolic impact of the condition. Similarly, individuals with cystic fibrosis are also susceptible to muscle loss, primarily due to chronic inflammation, nutrient malabsorption, and the elevated metabolic demands associated with the disease. Muscle atrophy in these patients is a significant concern, as it can lead to diminished physical function, a lower quality of life, and worsened clinical outcomes[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

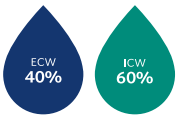
FLUID BALANCE CHARTS

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

Resources can be found on our website

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 interventions. This approach can aid in preventing complications such as oedema, fluid overload, malnutrition, and muscle wastage.

IMPORTANT PARAMETERS

PHASE ANGLE

Phase angle relates to markers of function, disease severity and prognosis in patients with COPD.

As phase angle is a direct measure, it avoids the need to rely on population and disease specific body composition reference values. Therefore may prove to be a useful biomarker of nutritional status in adults with respiratory conditions

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]. This is because phase angle reflects cell membrane integrity and body cell mass, which are often compromised in individuals with respiratory conditions [1,7].

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.

By identifying cachexia early, BIVA can provide crucial prognostic insights, enabling timely interventions to improve patient outomes.

BIVA provides detailed insights into both fluid balance and nutritional status, which are critical in managing individuals with respiratory diseases who often struggle with fluid overload and malnutrition.

OHY

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

The OHY parameter is a critical measure used to assess and quantify the excess fluid in the body, beyond what is physiologically necessary

This makes OHY a valuable prognostic marker for assessing the severity of the disease and the likelihood of complications.

Evidence of increased volume overload can be seen in patients with COPD or CF.

PREDICTION MARKER INFINITY (TBW/ECW)

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

For instance, the expansion of ECW and loss of ICW are typically features of systemic illness, arising from protein leakages into the extracellular space and loss of intracellular protein.

PM∞ and extracellular water parameters are useful in monitoring fluid overload.

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 [2].

LEAN MASS

Skeletal muscle dysfunction is a well recognised extrapulmonary complication of COPD, with loss of lean body mass identified as a key determinant of disability and an independent predictor of mortality.

Lean mass (muscle, bone and water), Dry Lean (muscle and bone), Appendicular lean mass and Skeletal Muscle Mass are a great way to track these changes overtime.

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