

# Bioelectric Impedance Analysis: What is it and how is it utilized?

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## Abstract

Wound healing requires protein synthesis and increases energy demands. A wound activates a systemic hypermetabolic and catabolic state which further increases metabolic demand. Protein-energy malnutrition can impede wound healing and it is often under diagnosed and under treated. Rehabilitation of these compromised protein stores may be accomplished in many ways including nutritional intervention, activity, and anabolic medications. Bioelectric impedance analysis (BIA) allows providers to identify patients with, or at high risk for, protein-energy malnutrition and to monitor rehabilitation efforts. Electrically-based BIA utilizes recently developed equations that have been validated for use in populations undergoing physiologic stress to quantify the three major functional body compartments: body cell mass, extracellular mass, and fat. Body cell mass (BCM) is responsible for nearly all of the metabolic processes in the body, including medication metabolism and wound healing. The body requires 100% or greater of the ideal expected level of body cell mass to heal. At <95% of the ideal BCM there is functional compromise and wound healing is impaired. At <55% of the ideal BCM death may occur. For wound healing to occur, energy and protein substrates (BCM) must be available in the form of good nutrition and normal body composition. We describe our algorithm for utilization of BIA in the management of patients with compromised wound healing.

## BIA Procedure

1. Patient lying flat in supine position on non-conductive surface.
2. Remove unilateral sock and shoe.
3. Swab areas for the electrode placement with alcohol to remove sweat, lotion, etc.
4. Place electrodes: Dorsal surface of hand centered just proximal to fingers
  - Center of wrist across from the styloid process
  - Dorsal surface of ankle between the lateral and medial malleolus
  - Dorsal surface of foot centered just proximal to toes.
5. Attach electrodes: Red leads proximal; black leads distal
6. Turn machine on and obtain resistance and reactance.
7. Input resistance, reactance, height, weight, age, gender, and wrist circumference into spreadsheet to obtain BIA results.

## Case Summary

F.W. is a 75 year old white female with IDDM, CAD (s/p CABG), CHF who is s/p flap closure of a chronic, nonhealing sternal wound on 4/16/02. The patient underwent surgical incision and drainage of sternal incision after seroma developed on 10/02. Negative pressure therapy was initiated post operatively. Patient made little progress in spite of aggressive wound care. Multivitamin, Vitamin C and zinc supplementation was initiated. Discussion with patient and family revealed patient not eating well. BIA testing on 2/6/03 revealed an ideal

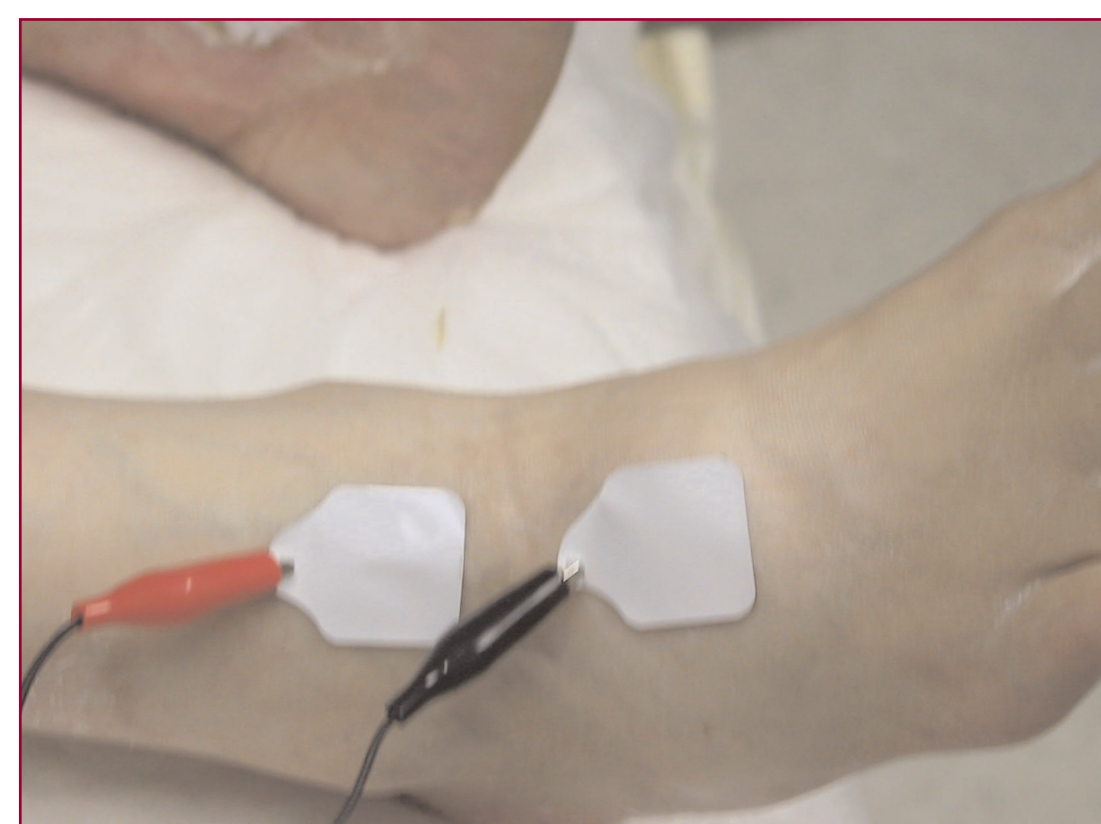
body cell mass (IBCM) of 93% (prealbumin=17.1). Patient was ordered to keep food diaries and start protein supplementation. After review of the food diary, the patient was referred to nutritional medicine for counseling and dietary intervention. Oxandrolone therapy was also initiated. Repeat BIA testing on 3/4/03 found the IBCM was 114.1% (prealbumin=41). The patient was continued on oxandrolone therapy until fully healed.



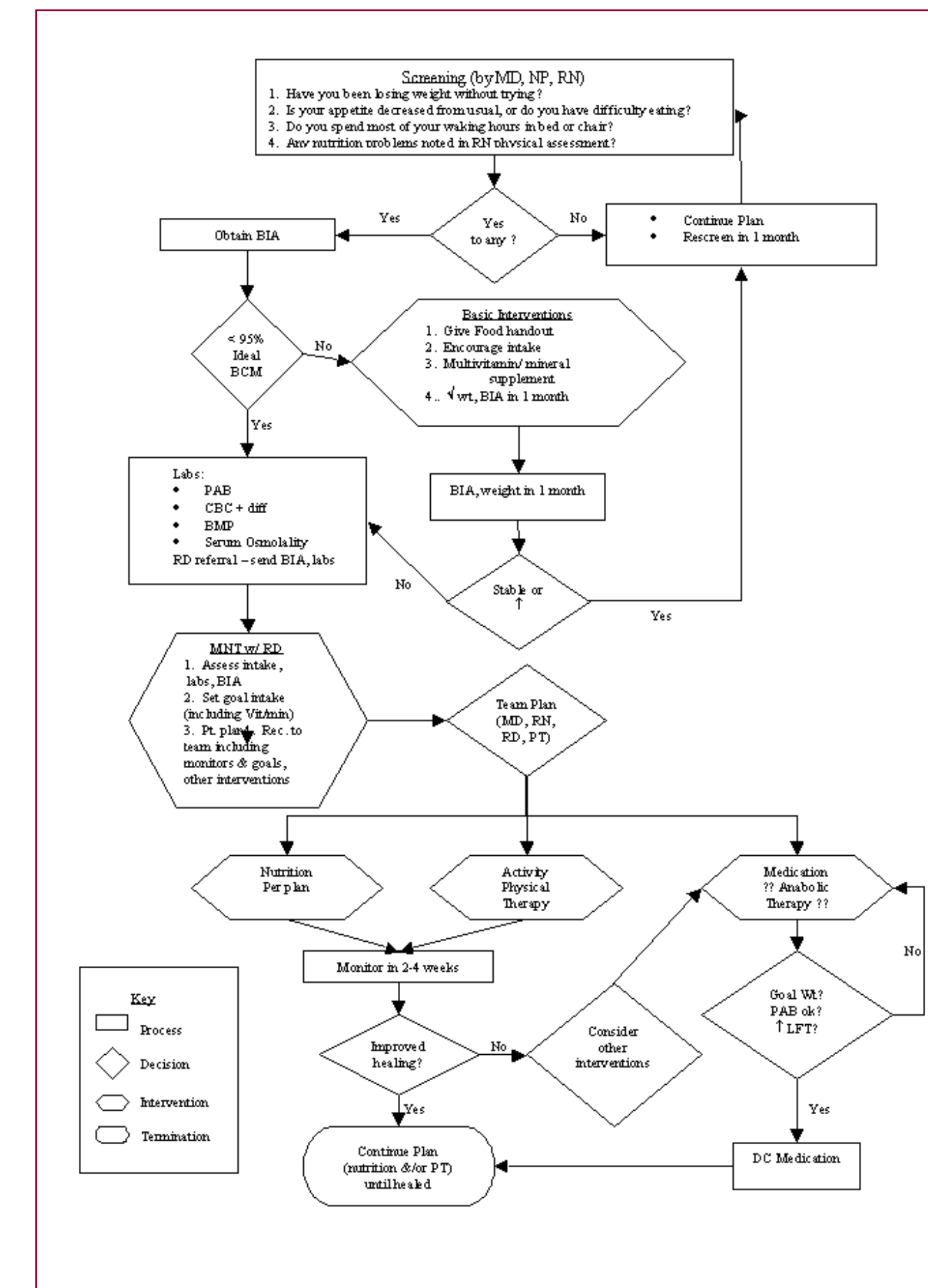
Patient in supine position



Electrodes placed



Readings obtained



Algorithm

## Discussion

Protein-energy malnutrition impedes wound healing and is a factor that is often under diagnosed and under treated. For healing to occur, energy and protein substrates (BCM) must be available in the form of good nutrition and normal body composition. We have developed a multidisciplinary nutrition algorithm utilizing electrically-based bioelectric impedance analysis as a guideline to 1) identify patients that have or at high risk for nutritional compromise/ protein energy malnutrition, 2) initiate appropriate and timely interventions, and 3) monitor the effects of treatments and interventions. The use of BIA allows us to obtain immediate insight regarding the patient's nutritional state. Laboratory testing is typically not immediately available. In addition, the usual nutritional tests, prealbumin (half life 48-72 hours) and albumin (half life 12-21 days) levels are historical nutrition markers, and can only be utilized in extrapolation of the patient's current nutritional status.

## Summary

We have described our multidisciplinary nutrition algorithm and how electrically-based bioelectric impedance analysis may be utilized to: identify patients that have or at high risk for nutritional compromise/ protein energy malnutrition; initiate appropriate and timely interventions; and monitor the effects of treatments and interventions.

## References

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