Bioelectrical impedance analysis as a tool for nutritional status evaluation in chronically ill patients

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Background

Malnutrition:

- is known to be associated with more infections, higher morbidity, mortality and longer length of hospital stay;
- increased therapeutic hospital cost and ultimately the cost of patient rehabilitation (Barker et al. 2011, Poulia et al. 2012).

Body impedance analysis (BIA) is the most commonly used method:

- to calculate body composition;
- has high accuracy, safety, portability and low costs;
- provides information on fat mass, muscle mass and hydration status, which is especially useful in chronic kidney disease and heart failure patients (Caravaca et al. 2011, Kyle et al. 2013).

Phase angle (PA) value determined by BIA:

- is an indicator of cell membrane damage and body cell mass;
- lower PA values are associated with increased nutritional risk, higher morbidity and mortality in chronic diseases, cancer and surgical patients (Norman et al. 2012, Varan 2016).

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The aim of this study was to use different methods of nutritional status analysis, including basic anthropometric data, laboratory data and BIA with PA in patients with different chronic diseases, who were at risk for malnutrition according to the NRS 2002 screening tool.

Methods

We included 30 patients (mean age 70.8±17.2 years, 67% men, 93% with CKD) that were hospitalized in the Department of Nephrology of University Clinical Centre Maribor from November 1st 2016 to January 31st 2017.

The inclusion criteria were the presence of a chronic disease (including CKD) and increased nutritional risk (≥1 fulfilled NRS 2002 criterion).

We measured serum albumin level with standard laboratory method, calculated BMI and we used multi-frequency segmental body composition analyser Tanita, MC780. The measurements were made on an empty stomach, between 8-12 AM, by the nurses of our department.

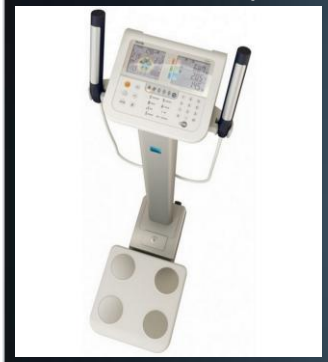

Figure 1: Body composition analyzer Tanita, MC780

Figure 2: Sample Printout from Printer

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Results

Mean serum albumin was 33.6±5.7 g/L, mean BMI was 25.6±4.4 kg/m^2 and mean PA was 4.4±1.2°. Half of the patients (N=15) had serum albumin levels below 35 g/L, 73.3% of them (N=11) had low PA (men ≤5°, women ≤4.6°) and only one of them had BMI below 20.5 kg/m^2.

No correlation between serum albumin and BMI was found.

Lower PA was associated with lower serum albumin (p=0.045).

The nurses of our department performed a nutritional education for all the patients included in the study.

Those with low PA received dietary supplements.

Parameter	Minimum value	Maximum value	Mean value ± SD
Age (years)	31	94	70.8 ± 17.2
NRS 2002	1	3	1.1 ± 0.4
Serum creatinine (µmol/L)	62	763	172.1 ± 185.7
eGFR (CKD-EPI equation; ml/min/1.73m^2)	6	90	53.4 ± 26
Serum albumin level (g/L)	17.8	44.4	33.6 ± 5.7
Body mass index (kg/m^2)	18	35	25.6 ± 4.4
Phase angle (˚)	3	7	4.4 ± 1.2

Table 1: Basic descriptive statistics of our included patients.
Legend: SD – standard deviation; eGFR – estimated glomerular filtration rate; CKD-EPI equation - Chronic Kidney Disease Epidemiology equation

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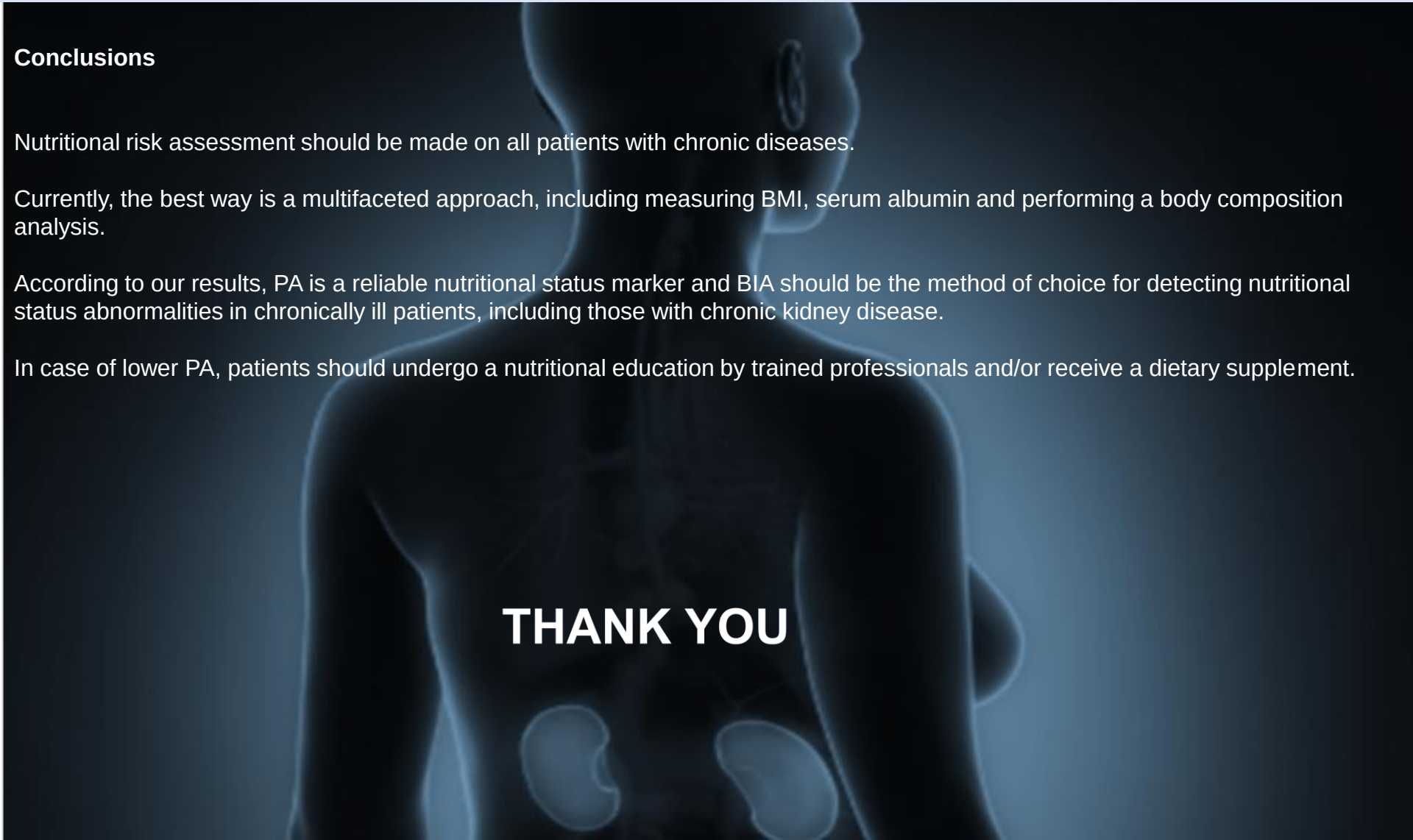

Conclusions

Nutritional risk assessment should be made on all patients with chronic diseases.

Currently, the best way is a multifaceted approach, including measuring BMI, serum albumin and performing a body composition analysis.

According to our results, PA is a reliable nutritional status marker and BIA should be the method of choice for detecting nutritional status abnormalities in chronically ill patients, including those with chronic kidney disease.

In case of lower PA, patients should undergo a nutritional education by trained professionals and/or receive a dietary supplement.