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Bioelectrical Impedance Analyzes Offers Clinically Relevant Appraisal of Body Composition, but Fails to Recognize Nutritional Risk or Differences between Surgery and Percutaneous Coronary Interventions Treatments – A Non-Randomized Cohort

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A B S T R A C T

Our aim was to evaluate the adipose tissue percentage content appraised with BIA in patients recently treated for cardiovascular disorders by means of surgery or percutaneous coronary interventions. Study included 208 consecutive patients, in age range 25–84 years, 176 male and 32 female. There were 108 (51.9%) percutaneous coronary interventions and 100 (48.1%) operations. Adipose tissue share appraised by BIA in our settings was 28.6±6.7% with significant differences in relation with gender ($p<0.001$) and no relations with the age of patients. Intermediate levels of correlations were found in relation to the body mass index (Rho: 0.521, $p<0.001$), waist-circumference (Rho: 0.450; $p<0.001$) and hip-circumference (Rho: 0.393; $p<0.001$). ROC-analyzes revealed diagnostic cutoff point of BIA at 29.5% for predicting the obesity (AUC=0.761; $p<0.001$) and 27% for metabolic syndrome (AUC=0.715; $p<0.001$). There were no relations of BIA to nutritional status, laboratory or echocardiography diagnostic. BIA offered clinically relevant appraisal of anthropometrically and metabolic related risks from cardiovascular continuum. Diagnostic yields solely on impedance analyze bases seem limited, particularly in investigational settings with composited endpoints.

***Key words**: BIA-bioelectrical impedance analyzes, postoperative rehabilitation, ischemic heart disease, valvular heart disease, coronary artery bypass graft, PCI-percutaneous coronary intervention, nutritional risk*

Introduction

The concept of bioelectrical analyzes is known in medicine for over a 140 years. However, technical advancements in last few decades lead to development of non-invasive and more sensitive diagnostic devices with supplementary functions to relatively accurate predict body composition[1]. Applying of electricity that is insensible to body receptors, having satisfying safety profile and not being expensive made it widely available bedside diagnostics[2].

Bioelectrical impedance analyzes (BIA) measures the resistance of body tissues, to flow of weak alternating electrical currents, typically less than 1 mA and 50 kHz frequencies. Impedance represents the summation of the tissue resistances and reactance due to capacitance of the membranes, tissue interfaces and non-ionic tissue share. Resistance is dominantly due to through muscles flow. In general BIA offers reliable estimation of body water contents. Appraisal of fat free mass and adipose tissue share

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in body consents is done indirectly through the body water content and standardization with known values of tested populations[3]. Reproducibility of bioelectrical impendences analyzes for body compositions depends on several factors as hydration status including edema and ascites, eating and drinking, recent vigorous muscle activity, air humidity or temperature[4]. The exact pathophysiology of bioelectrical impedance analyzes content is not known and could change within various perspectives of considerations as cellular, tissue, multi-organ, inter-individual or clinical[5]. Effects of tissue reparation, inflammation or invasive treatments as surgery were not studied so far. Furthermore analyzes in relation to prevalence and extent of different chronic underlying diseases backgrounds are uncommon[6]. Diagnostic profits of numerous and widely available commercial devices for bioelectrical impedance analyzes are not entirely evident[7].

Due to global epidemic of cardiovascular diseases most of the adult and senior populations from the community represent common yet non-physiological reference range[8]. Non-negligible deal of health related adverse effects within cardiovascular risks continuum is mediated through body composition and subsequent pathophysiological changes[9,10]. Studies have established relations of the free fat or muscle mass or it's lost with adverse clinical and health related outcomes in more than a several diseases[11–14]. Our aim was to evaluate the bioelectrical impedance analyzes of adipose tissue share in patients with known cardiovascular disease and relation to invasiveness of treatment previous to rehabilitation. Secondarily, assessment of bioelectrical impendences clinical behavior was done in connections with anthropometrics, comorbidities, nutritional status, laboratory and functional cardiovascular diagnostics.

Patients and Methods

Study course

Patients sample included population of Mediterranean Caucasians scheduled for cardiovascular rehabilitation program after completing acute settings treatment for ischemic or valvular heart disease. Medical records on treatments previous to rehabilitation were available for the entire studied population. The timeline of rehabilitation commencements was 1–6 months after acute treatment, protocol included single routine cardiovascular rehabilitation reevaluation and there was no follow up. Diagnostic evaluation comprised of anthropometrics, laboratory tests, echocardiography and nutritional risk screening.

Individuals with known contraindications for cardiac rehabilitation, including intense acute illnesses or advanced chronic disease, including malignant diseases, disorders of thyroid, uncompensated heart failure, with clinically overt presence of edema or anasarca were not included.

Main outcome measures

Bioelectrical impedance analyzes: Body adipose share was appraised by commercially available hand held impedance analyzer using tetra-polar electrode method (8 touch electrodes, frequency ranges 5, 50, 250 kHz) and expressed as percentages (%). Technical characteristics of the device: Current 500 μA; Input height 100~200 cm; Measuring range 100~950 Ω; Measuring weight 10~250 kg; BMI calculation; Waist circumference in cm; Hip circumference in cm; Percentage of body adipose tissue; Applicable age: 5~89 years old; Measuring time within 30 seconds; Operation ambient-Temperature 10~40°C; Humidity 30~75% (non-condensing); Storage ambient: Temperature –20~60°C. Power consumption: 30 VA; Power supply: AC 100~230 V, 50/60 Hz; Display: Graphic liquid crystal display (320 x 480 pixel); Printing device: 25 pin parallel printer.

Anthropometrics and nutritional status

Body mass index (BMI; kg/m^2) was calculated using standard formula and body type classifications. Waist and hip circumferences (WC, HC) were measured by one trained nurse using tape-meter expressed in centimeters including calculation of circumferences ratios (WHR). Nutritional risk was calculated using the NRS-2002 screening tool validated by the European Society for Clinical Nutrition and Metabolism (ESPEN)[15]. NRS-2002 includes in the calculation extent and timeline of involuntary weight loss, disease severity and age >70 years. Nutritional risk score appraisal ranges between 0 and 7. Conventional grades of nutritional risk include: no risk (NRS-2002=0), low risk (NRS-2002=1–3) and high risk (NRS-2002≥3).

Laboratory diagnostics

Blood samples were obtained in morning hours 07:30–08:30 from brachial vein after overnight fasting. The following parameters were assessed: complete blood count (CBC) with number of erythrocytes (ERC) multiplied by 10^{12}, hematocrit (HCT) in L/L, mean corpuscular erythrocyte volume (MCV) in fL, number of thrombocytes (TRC) multiplied by 10^9; leukocyte count (LKC) multiplied by 10^9 with differential subpopulation analysis. Biochemical analysis included alanine aminotransferase (ALT) in IU/L at 37°C, aspartate aminotransferase (AST) in IU/L at 37°C, gamma glutamyl transferase (GGT) in IU/L at 37°C, serum glucose in mmol/L, total cholesterol (CHOL) in mmol/L, low density lipoprotein (LDL) in mmol/L, high density lipoprotein (HDL) in mmol/L, triglycerides (TG) in mmol/L, creatinine (CR) in μmol/L, urea in mmol/L, uric acid (UA) in μmol/L and thyrotropine i.e. thyroid stimulating hormone in mIU/L. Selected data were presented in the tables, with notion of clinical relevance.

Transthoracic echocardiography

Echocardiography was performed by two high throughput cardiologists following guidelines of the European Society for Cardiology and European Association

TABLE 1
CHARACTERISTICS OF THE PATIENTS SAMPLE, STUDIED GROUPS OF TREATMENTS AND BIOELECTRICAL IMPENDENCES MEASUREMENTS

	N (total)=208	Treatments		χ^2	Bioelectrical impedance (%)	Kruskal--Wallis ANOVA by ranks
	N (%)	N/(PCI)=108	N/(surgery) =100=%		$\bar{X}$±SD	
Age						
<45	14 (6.73%)	11 (10.19%)	3	0.085	26.6±6.9	0.108
45<65	107 (51.44%)	69 (63.89%)	38	<0.001	29.1±5.3	0.375
≥65	87 (40.38%)	28 (25.93%)	59	<0.001	28.4±8.1	0.979
Gender						
Male	176 (84.62%)	93 (86.11%)	83	0.534	27.5±6.1	<0.001
Female	32 (15.38%)	15 (13.89%)	17		34.9±6.5	
Systolic function						
LVEF ≥50	136 (67.33%)	69 (63.89%)	70	0.569	29.1±6.9	0.200
LVEF ≥41	163 (80.69%)	84 (77.78%)	83	0.068	29.0±6.9	0.070
BMI grade						
20<25	31 (14.90%)	13 (12.04%)	18	0.276	22.8±5.9	<0.001
25<30	105 (50.48%)	54 (50.00%)	51		28.0±5.6	
30<35	71 (34.13%)	41 (37.96%)	30		32.2±6.6	
≥35	1 (0.48%)	0 (0.00%)	1		35.1±n/a	
Nutritional risk						
No risk (NRS 0)	3 (1.44%)	2 (1.85%)	1	<0.001	26.5±4.6	0.397
Mild risk (NRS 1<3)	41 (19.71%)	40 (37.04%)	1		28.0±4.5	
High risk (NRS ≥3)	164 (78.75%)	66 (61.11%)	98		28.8±7.2	
Smoking						
Never	73 (36.14%)	29 (26.85%)	45	<0.001	27.9±7.3	0.768
Active	54 (26.73%)	42 (38.89%)	14		28.9±8.0	
Former	75 (37.13%)	37 (34.26%)	41		29.1±6.7	
Cardiovascular risk						
Hypertension	189 (90.87%)	102 (94.44%)	93	0.667	28.8±6.8	0.127
Hypercholesterolemia	189 (90.87%)	104 (96.30%)	91	0.115	28.7±6.8	0.328
Metabolic syndrome	177 (85.10%)	96 (88.89%)	87	0.676	29.2±6.6	0.005
Obese	64 (30.77%)	41 (37.96%)	26	0.072	32.6±6.5	<0.001
Diabetes	63 (30.29%)	33 (30.56%)	34	0.595	29.9±8.1	0.056
Glucose intolerance	41 (19.71%)	17 (15.74%)	25	0.097	27.7±7.3	0.623
Chronic renal disease	57 (27.40%)	16 (14.81%)	45	<0.001	28.3±7.3	0.405
COPD	36 (17.31%)	14 (12.96%)	25	0.026	29.4±6.7	0.248
Atrial fibrillation	23 (11.06%)	8 (7.41%)	15	0.081	27.8±7.1	0.971

SD – standard deviations; LVEF – left ventricle ejection fraction; BMI – body mass index; NRS – nutritional risk screen (NRS-2002); COPD – chronic obstructive pulmonary disease; APD – any psychological disturbance. Differences within groups of treatment were assessed using Chi square. Kruskal-Wallis ANOVA for ranks was used to test the differences of adipose tissue percentage appraised with BIA to clinical paramters. Statistical significance defined with $p<0.05$.

of Echocardiography, on Toshiba »Artida« device applying the PST30BT 3 MHz cardiology transducer. For the purposes of this study, targeted diagnostics included assessment of left ventricle dimensions, regional and global systolic function, global left ventricle ejection fraction (LVEF) using biplane Simpson modified calculation. Classes of left ventricle systolic dysfunction included endpoint points of left ventricle systolic function set at 41% and 50%. Doppler analysis included velocity and pressures of transaortic flow, transmitral flow evaluation

TABLE 2
BIOELECTRICAL IMPEDANCE ANALYZES APPRAISED ADIPOSE TISSUE SHARE (%) IN RELATION WITH PATIENT CHARACTERISTICS AND STUDIED GROUPS OF TREATMENT

	N (patients) =208	Adipose tissue (%) using bioelectrical impedance		Treatments		
				N/(PCI)=108	N/(surgery)=100	Mann Whitney
Patients characteristics	Mean±SD	Spearman Rho	p	$\bar{X}$±SD	$\bar{X}$±SD	
Age (years)	61.9±11.3	0.024	0.733	58.1±10.8	66.0±10.5	<0.001
Height (m)	1.74±0.09	–0.295	<0.001	1.75±0.08	1.72±0.09	0.031
Weight (kg)	86.6±14.7	0.228	0.001	89.4±14.7	83.6±14.2	<0.001
BMI (kg/m^2)	28.62±3.86	0.521	<0.001	29.08±3.86	28.10±3.82	0.031
Waist circumference (cm)	102.0±9.9	0.450	<0.001	103.5±9.6	100.4±9.9	0.008
Hip circumference (cm)	102.6±7.9	0.393	<0.001	103.2±6.6	101.9±9.2	0.032
WH ratio (n/n)	0.99±0.09	0.158	0.025	1.00±0.08	0.98±0.09	0.133
Adipose tissue(%)– by BIA	28.6±6.7	1.000	n/a	29.8±5.1	27.3±7.9	0.009
Nutritional risk (NRS-2002)	3.7±1.6	–0.040	0.574	2.6±1.0	5.0±1.0	<0.001
Cardiovascular diagnostics						
ECG-frq (min)	69.6±11.2	–0.092	0.192	65.8±9.3	73.8±11.6	<0.001
Hematocrit	0.40±0.05	0.144	0.040	0.42±0.04	0.37±0.04	<0.001
Serum glucose (mmol/L)	6.9±1.9	0.211	0.003	6.9±2.1	7.0±1.9	0.102
Bilirubine (umol/L)	13.2±6.8	–0.174	0.013	13.3±7.1	13.1±6.6	0.852
Urea (umol/L)	7.11±2.35	0.116	0.100	6.78±2.50	7.46±2.13	0.002
Creatinine (mmol/L)	110.3±40.6	–0.121	0.086	99.8±28.9	121.6±47.9	<0.001
Cholesterol (mmol/L)	4.50±2.54	0.131	0.064	3.95±1.03	5.12±3.43	<0.001
LDL (mmol/L)	2.40±1.04	0.021	0.770	2.08±0.87	2.75±1.11	<0.001
LVEDd (mm)	53.7±6.0	0.038	0.596	54.7±6.2	52.78±5.6	0.038
LVEF (%)	50.3±8.0	0.027	0.704	49.7±8.57	50.9±7.4	0.342
AV PG (mmHg)	11.7±8.8	–0.006	0.935	8.89±4.80	14.8±10.8	<0.001

PCI – percutaneous coronary intervention; BMI – body mass index; WH – waist over hip ratio; ECG – electrocardiography; LDL – low density lipoprotein; LVEDd – left ventricle end diastolic dimension; LVEF – left ventricle systolic function; AVPG – aortic valve peak flow gradient.

of diastolic function and indirect quantification of pulmonary artery systolic pressure (PAP).

Other investigations: Standard supine resting 12–led electrocardiogram (ECG) with assessment of heart rate and rhythm in terms of sinus or atrial fibrillation was performed in all patients. Pulmonary status and chronic obstructive pulmonary disease (COPD) prevalence and severity were evaluated using a spirometer.

Ethical issues

Study was permitted by the University Hospital »Thalassotherapia Opatija« ethical committee in line with the good clinical practice. Patients were included after signing the informed consent. There were no grants or financial compensations for patients and investigators involved in the study.

Statistical analyses

Statistical analyses were performed by a statistician using Statistica 10 for Windows. Data were analyzed with descriptive statistic and are presented as mean ± standard deviation. Population demographics, comorbidities, and nutritional risk scores were compared between groups using Pearson's Chi square test. Numeric data as anthropometrics, laboratory, and echocardiography were analyzed by Mann-Whitney U-test. Numeric difference of BIA within studied groups was explored by Kruskal-Wallis ANOVA by ranks. Correlation of NRS-2002 score with clinical outcomes was investigated by Spearman Rho. Receiver operating curve analyzes was done on MedCalc for windows version 12.2.1.0.A $p<0.05$ was considered statistically significant.

Results

Patients

Two hundred and eight successive patients, in range 25–85 years, average age 61.9±11.3. Females represented 15.4% of the cohort (N=31) and males 84.6% (N=171). Patients' characteristics are presented in Table 1.

Cardiologic treatments prior to rehabilitation

108 patients (52%) underwent percutaneous coronary intervention (PCI) and 100 patients (48%) underwent

surgery (χ^2 p=0.579). Surgical procedures included coronary artery bypass graft (CABG; N=83) and valvular surgery (VS; N=28) p=0.013 and p<0.001 respectively). Eleven of valvular operations were accompanied by CABG due to clinically relevant coronary artery disease. Age group distribution (i.e., <45 years, 45–65 years, and ≥65 years) was similarly distributed in other than younger of 45 years (χ^2 p<0.001; p=0.677; p=0.085;), and there were noticed significant differences in terms of patients age distributions within treatments for middle and older age-groups (p<0.001). Left ventricle ejection fraction was in range of 25–65%, without significant differences between the studied treatments.

There were no differences between treatment groups in body mass index grades (p=0.276), gender (p=0.534), tested anthropometrics and cardiovascular comorbidities/risk factors whilst difference was found in: chronic renal disease (p<0.001), nutritional risk (p<0.001), smoking status (p<0.001) and chronic obstructive pulmonary disease (p<0.026). Prevalence of atrial fibrillation, diabetes, grades of left ventricle systolic functions were also not of significant difference between treatment groups (p=0.081; p=0.595; p=0.569; p=0.068 respectively). Average nutritional risk by NRS-2002 score was 3.7±1.6 with significant difference in relation to treatments (Mann Whitney U-test p<0.001) and nutritional risk grades groups in relation to treatments (Pearson χ^2 p<0.001). Single clinically relevant difference of studied diagnostics between treatment groups was with creatinine (p=0.002); Table 2.

Bioelectrical impedance analyzes appraised adipose tissue share was 28.6%±6.7%, in range 7.3 to 48.9%. Table 1 and 2. Statistically significant differences in relation to gender (p<0.001); and statistically significant and clinically irrelevant (p=0.009) difference between treatments. There were no significant differences in adipose mass percentage according to bioelectrical impedance analyzes within nutritional risk grades (Kruskal-Wallis ANOVA by ranks; p=0.397) or studied groups of age <45 (p=0.108); 45–65 years (p=0.375) and ≥65 years (p=0.979). Difference was significant in relation to the body mass index grades (Kruskal-Wallis ANOVA by ranks; p<0.001) and metabolic syndrome prevalence (p=0.005).

Adipose tissue percentage appraised by bioelectrical impedance analyzes clinically correlated with the body mass index (Rho 0.521; p<0.001), waist circumferences (Rho 0.450; p<0.001) and hip circumferences (Rho 0.393; p<0.001). There were no clinically relevant correlations with studied laboratory or echocardiography recordings. Significant but weak discordance in correlations of adipose tissue percentage by BIA was observed in between percutaneous coronary interventions (Rho=0.185; p=0.009) and the surgery group(Rho=–0.185; p=0.009). No significant correlations of BIA to valvular surgeries were established (Rho=–0.067; p=0.344).

Receiver operating curve analyzes (ROC) revealed diagnostic potential of bioelectrical impedance analyzes for detecting the prevalence of obesity (AUC 0.761; p<0.001) and metabolic syndrome (AUC 0.715; p<0.001) (Figure 1 and 2).

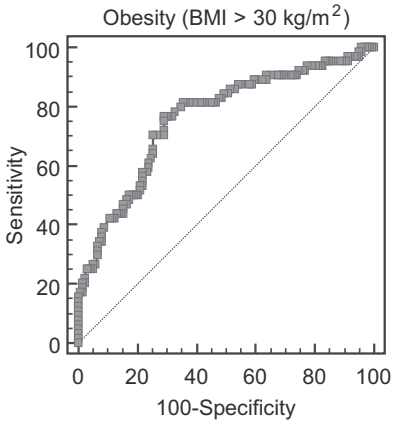

Fig. 1. Diagnostic accuracy of bioelectrial impedance for obesity using ROC analyzis. Statistical significance p<0.001; AUC=0.761. Value 29.5%; sensitivity 76.56% (95%CI: 64.3–86.2); specificity 71.01% (95%CI: 62.7–78.4); positive likelihood ratio 2.64 (95%CI: 2.2–3.1); negative likelihood ratio 0.33 (95%CI: 0.2–0.6).

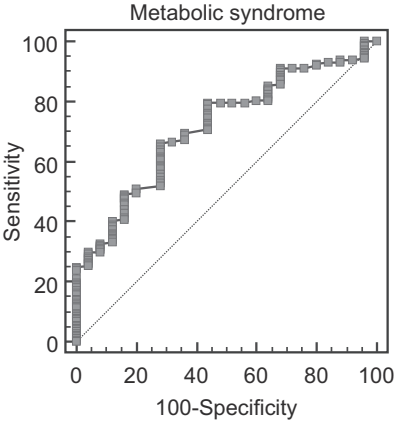

Fig. 2. Diagnostic accuracy of bioelectrical impedance for detection of metabolic syndrome using ROC analysis. Statistical significance p<0.001; AUC=0.715. Critical cutoff value 27%; sensitivity 66.10% (95%CI: 58.6–73.0); specificity 72.00% (95%CI: 50.6–87.9); positive likelihood ratio 2.36 (95%CI: 1.8–3.1); negative likelihood ratio 0.47 (95%CI: 0.2–0.9).

Traditional anthropometrics were also significantly connected with prevalence of obesity and of similar diagnostic accuracy as bioelectrical impedance analyzes. ROC analysis of waist circumference (WC) found critical cutoff point of 105 cm implicative for diagnosing the obesity. Statistical significance p<0.001; AUC=0.876. Sensitivity 78.46% (95%CI: 66.5–87.7); specificity 86.33% (95%CI: 79.5–91.6); positive likelihood ratio 5.74 (95%CI: 5.0–6.6); negative likelihood ratio 0.25 (95%CI: 0.1–0.5).

ROC analysis of hip circumference (HC) found critical cutoff point of 104 cm suggestive for diagnosing the obesity. Statistical significance p<0.001; AUC=0.763. Sensitivity 70.31% (95%CI: 57.6–81.1); specificity 76.98% (95%CI: 69.1–83.7); positive likelihood ratio 3.05 (95%CI: 2.5–3.7); negative likelihood ratio 0.39 (95%CI: 0.2–0.6).

Discussion

Appraisal of body configuration and nutritional risk came to focus of investigations due to confirmed clinical value and correlations with health-related outcomes[16,17]. Several of body configurations indexes were earlier found to be the landmark of adverse prognosis in patients with myocardial infarction and chronic heart failure[18,19]. However, abundance of various devices in the market makes recognition of clinical relevance rather difficult. Our study appraised bioelectrical impedance analyzes of body adipose tissue share in relation with comorbidities, clinical diagnostics, nutritional risk, ischemic or valvular heart disease backgrounds and invasiveness of treatments prior to rehabilitation.

Adipose tissue share appraised by BIA in our settings was 28.6±6.7% and showed significant differences in relation with gender and anthropometrically based cardiovascular risks, and there were no relation with age of patients. Intermediate levels of correlations were found in relation to the body mass index average values[20]. Significant differences with weaker and incongruent correlation trends were found between body mass index inputs. Body weight was positively correlated with BIA outcomes, whilst body height showed significantly negative trends[20]. Output range of BIA was similar and corresponding with body types within standardized BMI grades. Highly significant correlations of ranks of bioelectrical impedance judged body adipose tissue share were found in relation with traditional anthropometrics as waist circumference, hip circumference and their ratios[21]. Later implies noteworthy dubious on presumed body adipose share prediction by bioelectrical impedance analyzes per se since named anthropometrics are the device based inputs and of results conceptualized on mathematical approximations to the reference populations. Interesting relations in BIA outcomes were found with prevalence of metabolic syndrome, occurrence of which was not differently distributed between the treatment group analyzes. Cutoff point of adipose share estimated at 27% by bioelectrical impedance diagnostic device made significant model of predicting the metabolic syndrome, while cutoff point of 29.5% made significant prediction of obesity prevalence[22]. Other studied cardiovascular risk factors, beside the obesity were not of significant differences in terms of BIA outcomes. One must not disregard relatively high prevalence of cardiovascular risks was still nowadays found in our patients, particularly smoking which raises the questions for further health initiatives[23,24]. Typical cardiovascular rehabilitation laboratory and echocardiography diagnostic did not reveal differences in terms of bioelectrical impedance appraisal of adipose tissue contents. Left ventricle systolic function dynamics within tested set of patients or studied groups was not differently distributed and there were no relations with BIA outcomes.

The differences of BIA in relation with bases of acute treatments prior to rehabilitation were significant but of close output range, hence with minor clinical or diagnostic implications. Those seemed to be for the most influenced by difference in weight of 5.8 kg between the groups of treatments and in the amounts corresponding to slight difference of 0.98 BMI units. Interestingly patients treated with percutaneous coronary interventions were of clinically relevant higher average weights than patients with surgical treatments, although on expected bases of diabetes, metabolic syndrome and joined coronary risk factors that made them indirectly more prone to surgical revascularizations one would expect the opposite trend. On the other hand surgical patients displayed meaningfully higher nutritional risks, attributable with invasiveness of acute treatments and in great part responsible for the observed mean weight difference[25]. Higher nutritive risk in surgical patients was also in line with greater prevalence and overt clinical diagnostics differences of chronic renal and chronic obstructive pulmonary diseases, which both are established nutritional risk factors[26]. Clinically relevant connections to the nutritional risk appraised by the standardized NRS-2002 questionnaire were failed to be recognized in the BIA diagnostics[27]. Differences in BIA outcomes in relation with post-surgical healing and alternated tissue characteristics were of weakly opposite correlation trends, however diagnostic implications on these bases would be rhetorical, mainly due to noted weight and body mass index differences that showed greater influence on impedance appraisal of body adipose tissue share[28]. Observed laboratory differences between the treatment groups did not have implications on the BIA outcomes, were within or close to referral ranges representing unspecific reparatory response in the post-surgical period.

There were no adverse reactions or symptoms suggestive for ischemic chest pain as well as the sensations of the electricity were reported during testing of patients with bioelectrical impedance analyzes.

Although diagnostic yields of bioelectrical impedance analyzes devices seem limited on sole bases of impedance analyzes, devices of similar characteristics seems to offer fair and clinically relevant appraisal of anthropometrically and metabolic related risks from cardiovascular continuum[29]. However, data on bioelectrical impedance analyzes could frequently be found included as inputs in various clinical studies which might be challenging issue for conclusions and reproducibility. BIA outcome data do not seem to be influenced in significant manner by the invasiveness of treatment and testing does not bring conspicuous health related risks. Bioelectrical impedance analyzes devices with combined anthropometrical inputs contribute relevantly to appraisal of general cardiovascular risk in terms of primary and secondary prevention facilities, particularly for the periodic follow up of individual patients[10,19].

Conflict of interest

None declared

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ANALIZA BIOELEKTRIČNE IMPEDANCE NUDI KLINIČKI RELEVANTNU PROCJENU TJELESNE GRAĐE, NO SUBOPTIMALNA JE ZA PROCJENU NUTRITIVNOG RIZIKA ILI RAZLIKA IZMEĐU KIRUŠKIH BOLESNIKA I LIJEČENIH PCI-OM

SAŽETAK

Cilj istraživanja bio je analizirati udio masnog tkiva u ukupnoj masi tijela, procijenjen metodom bioelektrične impedance(otpora) (BIA) kod bolesnika koji su zbog kardiovaskularne bolesti liječeni operativnim putem ili perkutanom koronarnom intervencijom (PCI). Uključeno je 208 uzapstopnih bolesnika, u dobi 25–84 godine, 176 muških i 32 žene. Od toga je bilo 108 (51,9%) liječenih PCI i 100 (48,1%) operiranih. Procjena udjela masnog tkiva u ukupnoj masi procijenjena pomoću BIA je iznosila 28,6±6,7%, uz značajne razlike prema spolu ($p<0,001$), dok nije bilo značajnosti u pogledu dobi. Intermedijarni stupanj korelacije pronađen je prema indeksu tjelesne mase (Rho: 0,521; $p<0,001$), opsegu struka (Rho: 0,450; $p<0,001$), opsegu bokova (Rho: 0,393; $p<0,001$). Pomoću ROC analize vrijednosti udjela adipoznog tkiva ≥29,5% bile su prijelomne za dijagnosticiranje pretilosti (AUC=0,761; $p<0,001$), dok su iznosi ≥27% bili dijagnostički za metabolički sindrom (AUC=0,715; $p<0,001$). Nije bilo statistički značajnih odnosa BIA s nutritivnim statusom, laboratorijskom ili ehokardiografskom dijagnostikom. U zaključku, testiranje pomoću BIA nudilo je relevantnu kliničku procjenu antropološki i metabolički povezanih rizika iz kardiovaskularnog kontinuuma. No, dijagnostička pouzdanost BIA u pogledu kompleksnih kliničkih ishoda čini se limitirana.