Accuracy of simple methods to estimate body composition in cystic fibrosis patients

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Background: Fat free mass (FFM) depletion was reported in CF pts and is associated with worse pulmonary function. These findings suggest that monitoring of body composition (BC) should be introduced in clinical practice. However, the accuracy of simple methods to predict BC, such as skinfold thickness (SFT) measurements and bioimpedance (BIA), has been poorly investigated in CF.

Aims: To evaluate the accuracy of equations based on SFT and BIA parameters for estimation of 2-compartment BC model (FFM & FM).

Methods: Dual energy X-ray absorptiometry (DXA), 50 kHz BIA (Akern 101) and SFT measurements were performed on 138 CF pts (median age = 16 yrs, range = 8–47 yrs, 62 males). DXA was used as the criterion method for the estimation of FFM and FM. The equations developed by Slaughter (pts <17 yrs) and by Durnin (pts ≥17 yrs) based on SFT and the equations provided by the manufacturer of BIA device (Bodygram PRO 3.0) were used to estimate percentage of fat mass (%FM).

Results: The difference between estimated and measured values by DXA (bias), and the limits of agreement (Bland–Altman 95% limits of agreement) (LA) were calculated to compare accuracy of estimations. In pts aged <17 yrs Slaughter equation significantly underestimated %FM (p < 0.0001). Mean bias was −3.7% (−10.9, 3.4) using Slaughter equation and −0.2% (−9.3, 8.9) using BIA. In pts aged ≥17 yrs, mean bias was −0.5% (−6.9, 5.9) using Durnin equation and −1.0% (−9.1, 7.2) using BIA.

Conclusions: The estimation of BC by simple methods should be used with caution in CF patients, due to wide intra-individual differences. Population specific equations should be provided to make these methods of clinical usefulness.

Body composition: expect the unexpected!

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Background: Optimising nutrition and lung function are core elements of treatment in CF. Current practice recommends monitoring body mass index (BMI) as an indicator of nutritional status. However, BMI does not recognise body composition such as fat free mass (FFM). Research suggests a low FEV1 in combination with a low FFM as a predictor of higher mortality rate in CF.

Aim: To map our CF population identifying subjects with hidden depleted FFM using bioelectrical impedance (BIA).

Method: BIA was used at annual review in 117 adult CF patients. Age, gender, BMI, FFM, calculated as BMI index (FFMI) were correlated with pancreatic status, genotype, FEV1% predicted and methods of nutritional support. Data was compared against published values for healthy age- and gender-matched population (n = 4463).

Results: Low FFM was defined as a FFMI <5th percentile of this control group.

Conclusions: BMI alone does not identify patients with hidden depleted fat free mass, with more than half those patients with low BMI not being identified using BMI alone. BIA is a safe and practical tool and appears able to identify hidden low FFM in CF patients allowing specific nutritional and exercise advice to be provided.

Phase angle (PA) from bioelectrical impedance analysis (BIA) in children with cystic fibrosis (CF)

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Objectives: Malnutrition in CF patients is associated with severe lung disease and worse survival. Body mass index (BMI) is a well-known marker of nutritional status. PA is the most established impedance parameter for the diagnosis of malnutrition and clinical prognosis in different diseases; it documentsthe quality of soft tissue mass. The aim of this study was to investigate which is the better indicator of nutritional status in children with CF.

Methods: A prospective study was evaluated BMI Z-score, PA Z-score, FEV1, exercise capacity (EC; peak cycle exercise testing, Godfrey protocol) and daily PA Z-score, exercise sensor “Sensewear armband” for 7 days) from all CF patients (6 to 17 years) coming routinely in our CF centre.

Results: We analysed the following data (MW+SD) from 156 patients (78 males, 78 females), aged 11.3±3.4 years: BMI Z-score 0.5±0.9; PA Z-score 0.4±1.0; FEV1 90±19.6%; EC 93±5.0±6.0% of norm, DA (daily time with high activity) (DF) Z-score 85±48.3 minutes. While the PA correlates with BMI Z-score (r=−0.186, p=0.022) we found good correlations from BMI Z-score with FEV1 (r=−0.326, p<0.001) and DA (r=−0.299, p<0.001) and only a correlation between PA and EC (r=−0.289, p=0.001). No correlations were found between BMI Z-score or PA on daily activity.

Conclusions: Our results confirm the association between nutritional status and lung disease in children with CF. Patients in better nutritional status demonstrate higher EC. Increased activity doesn’t influence the body composition in our young patients. It seems that measurement of PA from BIA isn’t a better indicator for nutritional status and prognosis in CF children in good clinical status.

Measurement of hand grip strength in adult cystic fibrosis patients; a new initiative

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Background: Patients with CF are at risk of muscle mass depletion as a consequence of malnutrition, chronic inflammation and recurrent infection. Body Mass Index (BMI) is routinely used to monitor nutritional status but gives no information about body composition. Studies have highlighted that weight-based indicators underestimate the prevalence of malnutrition in CF (McNaughton SA, 2000). Body composition measurements of fat and lean body mass using DEXA are time consuming and costly. However, an alternative approach (validated in other conditions) is to assess peripheral muscle function by testing hand grip strength (HGS), which is rapid, easy to perform and reliable (Innes E, 1999). HGS is not currently routinely measured in CF.

Patients and Methods: HGS, BMI and FEV1% predicted were measured in 139 sequential adult patients attending CF annual review. A dietitian measured HGS using a Jamar digital dynamometer and a standardised protocol. Results were compared to data for age and gender-matched controls (Khidjiam AM et al., 1982). Patients were divided into those with HGS >85% predicted and those with HGS <85% predicted.

Results: Low HGS was associated with lower BMI and FEV1% predicted (Table 1).

Table 1

<table>
<thead>
<tr>
<th></th>
<th>HGS &gt;85% predicted</th>
<th>HGS &lt;85% predicted</th>
<th>P value (unpaired t test)</th>
</tr>
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<tbody>
<tr>
<td>Male</td>
<td>30/57 (53%)</td>
<td>39/82 (48%)</td>
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<tr>
<td>Mean HGS (kg)</td>
<td>36.3 (SD ±10.1)</td>
<td>23.2 (SD ±6.8)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Mean BMI (kg/m²)</td>
<td>23.2 (SD ±2.7)</td>
<td>21.3 (SD ±3.1)</td>
<td>0.0002</td>
</tr>
<tr>
<td>Mean FEV1 (% predicted)</td>
<td>74.5 (SD ±22.4)</td>
<td>55.0 (SD ±21.2)</td>
<td>0.0001</td>
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</tbody>
</table>

Conclusion: HGS is a new functional outcome measure in CF. Further research is required to demonstrate its clinical utility in CF. Patients with HGS <85% normal are likely to have lower BMI and FEV1% predicted.