Introduction

• It has been proposed that adults with Peripheral Arterial Disease (PAD) have alterations in body composition, with higher fat mass common in early stages of PAD and a decline or atrophy in skeletal muscle mass (SMM) as PAD progresses.1

• Accurate and feasible methods of measuring SMM in these patients in the clinical setting are required to facilitate a more comprehensive nutritional assessment.

• Assessing SMM in the clinical setting is challenging as dual-energy X-ray Absorptiometry (DEXA) and bioelectrical impedance assay are impractical for use in everyday practice.

• Corrected arm muscle area (CAMA), derived from measures of mid-upper arm circumference (MUAC) and tricep skin fold (TSF), is predictive of poor health outcomes in vascular and rehabilitation patients1 and can be converted to total SMM using predictive equations.4 These measures are more feasible in the clinical setting.

• The aim of this study is to compare SMM derived from CAMA with SMM derived from DEXA in a heterogeneous group of vascular patients to determine if it is a valid field technique for assessing SMM in this patient group.

Methods

• Adults aged ≥18 years with intermittent claudication (IC) (n=27) or critical limb ischaemia (CLI) (n=25) were recruited from Southern Adelaide Health Service Department of Vascular Surgery outpatient and inpatient services between July 2011 and May 2012. Ethical approval was obtained from the Southern Adelaide Human Research and Ethics Committee.

• Standing height was measured using a stadiometer to the nearest 0.1cm and weight to the nearest 0.1kg using the Lunar Prodigy Pro DEXA. Lean mass was determined using the DEXA in conjunction with Encore software version 7.5 and converted to SMM (kg) according to the equation of Kim et al.1

• MUAC was measured to the nearest 0.1cm and TSF was measured to the nearest 0.2mm according to standard procedures and used to calculate CAMA.

• CAMA was converted to total SMM (kg) according to standard equations.4

• Data are presented as mean ± standard deviation (SD) unless stated otherwise. Pearson’s correlation coefficients, paired samples t-tests and Bland Altman analyses were carried out to explore associations and agreement between the two methods.

Results

• Fifty-two participants were involved in this study, 27 with intermittent claudication and 25 with critical limb ischaemia and mean (SD) age of 69.9 (11.8) years. The descriptive characteristics for all participants are shown in Table 1.

Table 1: Characteristics of the 52 participants

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (SD) Age, years</td>
<td>68.6 (10.8)</td>
<td>72.7 (13.6)</td>
<td>69.9 (11.8)</td>
<td>0.255</td>
</tr>
<tr>
<td>Rutherford’s Classification</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1-3: Intermittent claudication</td>
<td>18</td>
<td>9</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>4-6: Critical limb ischemia</td>
<td>18</td>
<td>7</td>
<td>25</td>
<td>0.677</td>
</tr>
<tr>
<td>Mean (SD) Weight, kg</td>
<td>86.2 (18.7)</td>
<td>67.4 (19.3)</td>
<td>80.4 (20.6)</td>
<td>0.002</td>
</tr>
<tr>
<td>Mean (SD) Height, cm</td>
<td>173.0 (6.3)</td>
<td>156.9 (4.3)</td>
<td>168.2 (9.4)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mean (SD)BMI, kg/m²</td>
<td>28.8 (6.0)</td>
<td>27.6 (7.3)</td>
<td>28.5 (6.3)</td>
<td>0.522</td>
</tr>
<tr>
<td>Mean (SD)SMMDEXA, kg</td>
<td>27.7 (4.8)</td>
<td>16.9 (3.3)</td>
<td>23.7 (6.3)</td>
<td>0.005</td>
</tr>
<tr>
<td>Mean (SD)SMMMCAMA, kg</td>
<td>22.3 (5.1)</td>
<td>15.4 (3.8)</td>
<td>20.3 (6.0)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

• Mean (SD) SMMDEXA was 24.2 (6.3) kg for participants with IC versus 23.1 (6.4) kg for participants with CLI, P=0.534.

• Mean (SD) SMMMCAMA was 20.7 (5.7) kg for participants with IC versus 19.8 (5.7) kg for participants with CLI, P=0.585.

• Independently, those with IC (SMMMMCAMA: mean 20.7 5.7 kg versus SMMDEXA: mean 24.2 6.3 kg, P<0.001) and those with CLI (SMMMMCAMA: mean 19.8 5.7 kg versus SMMDEXA: mean 23.1 6.4 kg, P<0.001) were significantly different for SMM when measured by both methods.

• Combining all participants (IC and CLI), a strong correlation was evident between SMMMMCAMA and SMMDEXA (r=0.854 and P<0.001), however there was a statistically significant difference between mean (SD) SMMDEXA and SMMMCAMA 23.8 (6.7) kg versus 20.3 (5.7), P<0.001.

• Figure 1 illustrates mean bias and LOA for SMM estimated from DEXA and SMM estimated from CAMA. Mean bias was 3.5 (3.3) kg and LOA -3.1, 10.1 kg.

Discussion

• A strong correlation was observed between SMMMMCAMA and SMMDEXA, however there was a statistically significant and clinically meaningful difference between the mean SMMMMCAMA compared to SMMDEXA.

• The magnitude of the bias between the mean SMMMMCAMA compared to SMMDEXA was 3.5 (3.3) kg, so at the individual level, there is the potential to underestimate SMM by 6.6kg.

• The mean SMMDEXA was 24.2 (6.3) kg for IC participants and 23.1 (6.4) kg for those with CLI. An error of up to 6.6kg in SMM would result in a 30% under or over-estimate in SMM at an individual level which could lead to significant investment of resources for maintenance or gain of SMM that may not be warranted.

• CAMA may perform differently according to the stage of disease. However, no statistically significant difference was found when comparing the SMM of the IC and the CLI participants despite a trend for IC participants having a higher SMM according to both DEXA and CAMA.

• These findings are preliminary and further work in this area with a larger sample size is warranted. Further work to include other stages of PAD including minor and major tissue loss, would be valuable.

• With further work CAMA might be able to be used as part of an algorithm to predict SMM with greater accuracy but for now it would be prudent for clinicians to be cautious of this field technique.

References


