Sarcopenia and outcomes in Vascular Surgery

Julian Scott

Leeds Vascular Institute, Leeds General Infirmary
West Yorkshire, UK
Disclosure

Speaker name:

Julian Scott

I have the following potential conflicts of interest to report:

☐ Consulting
☐ Employment in industry
☐ Stockholder of a healthcare company
☐ Owner of a healthcare company
☐ Other(s)

☐ I do not have any potential conflict of interest
Molecular Muscle Experiment
• ESVS Guidelines 2018
• Point 62;
• Limited Life Expectancy elective AAA is not recommended (IIb)
• Germany No assessment of Frailty
• NICE – Validated tools for Assessment lacking
Europe’s ageing population

**PROJECTED OLD-AGE DEPENDENCY RATIO**

Number of persons aged 65 as a percentage of number of persons aged between 15 and 64.

<table>
<thead>
<tr>
<th>Country</th>
<th>2010</th>
<th>2060</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latvia</td>
<td>68</td>
<td>64.8</td>
</tr>
<tr>
<td>Romania</td>
<td>64.8</td>
<td>64.6</td>
</tr>
<tr>
<td>Poland</td>
<td>64.6</td>
<td>61.8</td>
</tr>
<tr>
<td>Slovakia</td>
<td>61.8</td>
<td>60.3</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>60.3</td>
<td>59.9</td>
</tr>
<tr>
<td>Germany</td>
<td>59.9</td>
<td>57.8</td>
</tr>
<tr>
<td>Hungary</td>
<td>57.8</td>
<td>57.6</td>
</tr>
<tr>
<td>Slovenia</td>
<td>57.6</td>
<td>57.2</td>
</tr>
<tr>
<td>Portugal</td>
<td>57.2</td>
<td>56.7</td>
</tr>
<tr>
<td>Greece</td>
<td>56.7</td>
<td>56.7</td>
</tr>
<tr>
<td>Italy</td>
<td>56.7</td>
<td>56.7</td>
</tr>
<tr>
<td>Lithuania</td>
<td>56.7</td>
<td>56.4</td>
</tr>
<tr>
<td>Spain</td>
<td>56.4</td>
<td>55.6</td>
</tr>
<tr>
<td>Malta</td>
<td>55.6</td>
<td>55.5</td>
</tr>
<tr>
<td>Estonia</td>
<td>55.5</td>
<td>55</td>
</tr>
<tr>
<td>Czech Rep.</td>
<td>55</td>
<td>50.7</td>
</tr>
<tr>
<td>Austria</td>
<td>50.7</td>
<td>47.6</td>
</tr>
<tr>
<td>Cyprus</td>
<td>47.6</td>
<td>47.4</td>
</tr>
<tr>
<td>Netherlands</td>
<td>47.4</td>
<td>46.6</td>
</tr>
<tr>
<td>France</td>
<td>46.6</td>
<td>46.2</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>46.2</td>
<td>45.1</td>
</tr>
<tr>
<td>Belgium</td>
<td>45.1</td>
<td>43.8</td>
</tr>
<tr>
<td>Denmark</td>
<td>43.8</td>
<td>43.5</td>
</tr>
<tr>
<td>U.K.</td>
<td>43.5</td>
<td>42.1</td>
</tr>
<tr>
<td>Ireland</td>
<td>42.1</td>
<td>36.7</td>
</tr>
</tbody>
</table>

Source: Eurostat

---

**SARCOPENIA STATISTICS**

Roughly 45% of the U.S. population is sarcopenic

Health care expenditures due to sarcopenia cost roughly $900 per person per year

In the U.S., an estimated 53% of men and 43% of women over 80 are sarcopenic

1 in 4 adults either engage in a low level of activity or are never active at all

An 80-year-old might have 30% less muscle mass than a 20-year-old

Most adult humans achieve their peak muscle mass sometime during their late 20s to early 40s.

People who are physically inactive can lose as much as 3%-5% of their muscle mass per decade after age 60.

---

**EUROPE'S AGEING POPULATION**

- **2017:** 19.5% of total in EU
- **2020:** 20.4% of total in EU
- **2030:** 23.9% of total in EU

“...years are being added to our lives, life is not being added to our years: the extra years are being added at the very end of our lives and are of poor quality”

Figure 1. Percentage of people in England & Wales 2011 reporting ‘Good health’, or ‘Disability’ in different age ranges (www.ons.gov.uk/ons/dcp171776_353238.pdf).
Sarcopenia

European consensus:

“Sarcopenia is a syndrome characterised by progressive and generalised loss of skeletal muscle mass and strength...”

Cruz-Jentoft AJ Age and Ageing 2010;39:412-423
Ageing and Muscle Mass
End of the Bed Test
International Academy on Nutrition and Aging (IANA): International working group on sarcopenia; EWGSOP, European working group on sarcopenia in older people; AWGS, Asian working group for sarcopenia; FNIH, Foundation for the National Institutes of Health Sarcopenia project.
European Working Group on Sarcopenia in Older People (EWGSOP)
Elective Open AAA Surgery Jay Lee JVS 2011

Table 1. Characteristics of subjects (n = 262)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at repair (yrs)</td>
<td>69.5 ± 10.5</td>
</tr>
<tr>
<td>Height (in)</td>
<td>68.1 ± 5.2</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>82.1 ± 19.6</td>
</tr>
<tr>
<td>AAA diameter (cm)</td>
<td>6.0 ± 1.5</td>
</tr>
<tr>
<td>Albumin</td>
<td>4.0 ± 0.5</td>
</tr>
<tr>
<td>Total psoas area (mm²)</td>
<td>2166.8 ± 727.3</td>
</tr>
<tr>
<td>Psoas muscle density</td>
<td>48.2 ± 8.1</td>
</tr>
<tr>
<td>Race</td>
<td>N (%)</td>
</tr>
<tr>
<td>White</td>
<td>232 (88.5)</td>
</tr>
<tr>
<td>African American</td>
<td>14 (5.3)</td>
</tr>
<tr>
<td>Other</td>
<td>13 (5.0)</td>
</tr>
<tr>
<td>Event</td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td>55 (21.0)</td>
</tr>
<tr>
<td>Censored at last follow-up</td>
<td>207 (79.0)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>61 (23.2)</td>
</tr>
<tr>
<td>Male</td>
<td>201 (76.7)</td>
</tr>
<tr>
<td>AAA class</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>56 (21.4)</td>
</tr>
<tr>
<td>2</td>
<td>21 (8.0)</td>
</tr>
<tr>
<td>3</td>
<td>126 (48.1)</td>
</tr>
<tr>
<td>4</td>
<td>49 (18.7)</td>
</tr>
<tr>
<td>Comorbid disease</td>
<td></td>
</tr>
<tr>
<td>CAD</td>
<td>129 (49.0)</td>
</tr>
<tr>
<td>CHF</td>
<td>35 (13.4)</td>
</tr>
<tr>
<td>COPD</td>
<td>100 (38.2)</td>
</tr>
<tr>
<td>CRT</td>
<td>63 (24.0)</td>
</tr>
<tr>
<td>DM</td>
<td>53 (12.6)</td>
</tr>
<tr>
<td>HTN</td>
<td>206 (78.6)</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>168 (64.1)</td>
</tr>
<tr>
<td>CVA</td>
<td>23 (9.1)</td>
</tr>
<tr>
<td>Tobacco</td>
<td>240 (91.6)</td>
</tr>
</tbody>
</table>

University of Michigan, Ann Arbor
Low total psoas area as scored in the clinic setting independently predicts mid-term mortality after endovascular aneurysm repair in male patients

Benjamin Thurston, BMBCh, MA, MSc, VRCS, a, b Ghilmer N. Fena, MD, c, d Stuart Howell, PhD, c
Prue Cowse, BSc (Hons), PhD, a, b and Robert Fitridge, MBBS, WS, FRACS, a, b Adelaide, South Australia, Australia

ABSTRACT

Objective: Preoperative sarcopenia is an established risk factor for poor outcomes after surgery. Methods for assessing sarcopenia are either complex, time consuming, or poorly validated. We aimed to assess the interobserver reliability of scoring psoas area at the level of the L3 vertebra and to evaluate whether sarcopenia scored by this simple and rapid method correlated with other fitness scoring methods or impacted on mortality and duration of stay for patients undergoing endovascular aneurysm repair (EVAR).

Methods: We had access to 191 preoperative computed tomography scans of patients who underwent EVAR. For each scan the axial slice at the most caudal level of the L3 vertebra was extracted. Three observers independently calculated the combined cross-sectional area of the left and right psoas muscle at this level. Interobserver reliability was calculated as per Landis and Altman. Psoas area was normalized for patient height with sarcopenia defined as total psoas area of <500 mm²/m². The effect of sarcopenia on patient survival was assessed using Cox proportional hazards models. Kaplan-Meier curves are also presented.

Results: Interobserver reliability of scoring psoas area was acceptable (reproducibility coefficient as percent of mean for each observer pair: 92.9%, 93.5%, and 93.4%). Sarcopenic patients had poorer survival (hazard ratio, 2.37; P = 0.011) and an increased hospital duration of stay (40 days vs 30 days, P = 0.008) when compared with nonsarcopenic patients. Sarcopenic patients were more likely to self-report as unfit (32.4% vs 33.3%, P = 0.04). Sarcopenia did not correlate with an increased rate of postprocedure complications.

Conclusions: Psoas area scoring has good interobserver reliability. Preoperative sarcopenia as defined by psoas area was associated with poorer survival and of longer length of stay. As all patients being worked up for an endovascular aortic aneurysm repair will undergo a computed tomography scan, this method is a rapid and effective way to highlight patients in the clinic setting who may have an increased risk of morbidity and mortality after EVAR. J Vasc Surg 2018;67:460-71

Fig. Kaplan-Meier plot showing percent survival against number of months after endovascular aneurysm repair (EVAR), comparing patients with low total psoas area (TPA) score with those patients who did not have a low score.
Psoas Muscle Area as a Prognostic Factor for Survival in Patients with an Asymptomatic Infrarenal Abdominal Aortic Aneurysm: A Retrospective Cohort Study

Resa Indruskasara, Jendëi Zijlman, Hamid Jalalzadeh, R. Nils Planien, Ron Balm, Mark J.W. Neteleinay

WHAT THIS PAPER ADDS
The present study aimed to test whether an association between low psoas muscle area (PMA) and poor survival exists in patients with an asymptomatic infrarenal abdominal aortic aneurysm (AAA). Contrary to previous studies, the results show that there is no such association among the patients in this study. It may therefore be somewhat premature to include measurements of PMA in the risk assessment of patients with an asymptomatic AAA.

OBJECTIVES: Loss of muscle mass has been associated with poor survival in several surgical patient populations, including those with an abdominal aortic aneurysm (AAA). We wanted to replicate these findings and assess the association between psoas muscle area (PMA) and survival in patients with an asymptomatic AAA.

METHODS: Patients with an asymptomatic infrarenal AAA who underwent computed tomography (CT) scanning between January 1, 2007 and December 31, 2012, were included in this single-center retrospective cohort study. PMA was measured with thresholding on an axial image at the centroid level of the third lumbar vertebra. The lowest tertile of PMA in all patients was used as a cutoff value for low PMA. Then, in separate analyses for conservatively and surgically managed patients, survival was estimated with the Kaplan–Meier method.

DIFFERENCES IN SURVIVAL BETWEEN PATIENTS WITH AND WITHOUT A LOW PMA WERE TESTED WITH THE LOG-RANK TEST.

RESULTS: Of 228 patients, 104 were managed conservatively and 124 underwent AAA repair. Seventy-seven patients (66/144) had an endovascular repair. In these 128 patients, the median PMA was 15.83 cm², while the cutoff value for low PMA was 14.58 cm². Patients who were managed conservatively were more often classified as having low PMA (57/104, 54.7% vs. 21/124, 16.7%) and were significantly older (mean 73.45 ± 9.65 years vs. 69.03 ± 7.46 years; p < 0.01). Low PMA was not associated with survival, either in patients managed conservatively, or in those who underwent AAA repair (p = 0.512 and p = 0.311, respectively).

CONCLUSIONS: The association between low PMA and poor survival could not be replicated in this study; low PMA was not associated with survival in patients with an asymptomatic AAA. Further research is recommended before PMA can be used for pre-operative risk stratification.

© 2017 European Society for Vascular Surgery. Published by Elsevier Ltd. All rights reserved.
Article history: Received 23 May 2017; Accepted 12 October 2017; Available online 26 November 2017
Keywords: Abdominal aortic aneurysm, Mortality, Survival, Psoas muscle area, AAA
Single Slice versus Volumetric measurements

Relationship between single slice and volumetric measurements of psoas muscle
Does the method of assessment or observer matter?

Manual tracing

Semi-automated

## Sarcopaenia in AAA disease; Leeds Cohort; BJS In Press

### Demographic

<table>
<thead>
<tr>
<th></th>
<th>EVAR N = 253</th>
<th>OSR N = 129</th>
<th>p-value</th>
<th>Overall N = 382</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age [years] (mean, SD)</td>
<td>76.4 ± 7.4</td>
<td>72.3 ± 7.2</td>
<td>&lt;0.001</td>
<td>75.0 ± 7.6</td>
</tr>
<tr>
<td>Male (N, %)</td>
<td>221 (87.4%)</td>
<td>112 (86.8%)</td>
<td>0.873</td>
<td>333 (87.2%)</td>
</tr>
<tr>
<td>Weight [kilograms] (mean, SD)</td>
<td>83.8 ± 18.3</td>
<td>83.8 ± 21.6</td>
<td>0.997</td>
<td>83.8 ± 19.3</td>
</tr>
<tr>
<td>Height [meters] (mean, SD)</td>
<td>1.74 ± 0.08</td>
<td>1.75 ± 0.07</td>
<td>0.359</td>
<td>1.74 ± 0.08</td>
</tr>
<tr>
<td>AAA diameter [millimetres] (mean, SD)</td>
<td>61.5 ± 6.8</td>
<td>64.9 ± 10.5</td>
<td>0.002</td>
<td>62.6 ± 8.4</td>
</tr>
<tr>
<td>ASA [1-5] (median, interquartile range)</td>
<td>3 (2-3)</td>
<td>3 (2-3)</td>
<td>0.005</td>
<td>3 (2-3)</td>
</tr>
</tbody>
</table>

### Smoking status

- Smoker (N, %) | 42 (16.6%) | 40 (31.0%) | 0.001 | 82 (21.5%) |
- Ex-smoker (N, %) | 88 (34.8%) | 27 (20.9%) | 0.004 | 115 (30.1%) |

### Comorbidities

- Diabetes (N, %) | 36 (14.2%) | 9 (7.0%) | 0.044 | 45 (11.8%) |
- Hypertension (N, %) | 103 (40.7%) | 34 (26.4%) | 0.007 | 137 (35.9%) |
- Ischaemic heart disease (N, %) | 84 (33.2%) | 16 (12.4%) | <0.001 | 100 (26.2%) |
- Chronic heart failure (N, %) | 10 (4.0%) | 2 (1.6%) | 0.352 | 12 (3.1%) |
- Chronic kidney disease (N, %) | 26 (10.3%) | 4 (3.1%) | 0.015 | 30 (7.9%) |
- Cerebrovascular disease (N, %) | 11 (4.3%) | 3 (2.3%) | 0.399 | 14 (3.7%) |
- Chronic pulmonary disease (N, %) | 45 (17.8%) | 6 (4.7%) | <0.001 | 49 (12.8%) |

### Sarcopenia

- TPMA | 20.0 ± 6.0 | 17.4 ± 6.0 | <0.001 | 19.1 ± 6.1 |
- Standardised TPMA | 6.6 ± 1.8 | 5.7 ± 1.9 | <0.001 | 6.3 ± 1.9 |
Sarcopaenia in relation to age; Leeds Cohort
Sarcopaenia in AAA disease; Leeds Cohort

<table>
<thead>
<tr>
<th>Time Interval</th>
<th>Standardised TPMA</th>
<th>Cox-regression p-value</th>
<th>Adjusted HR (95% CI)</th>
<th>Cox-regression p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unadjusted HR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(95% CI)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 days</td>
<td>0.73 (0.45 - 1.20)</td>
<td>0.221</td>
<td>0.80 (0.44 - 1.46)</td>
<td>0.468</td>
</tr>
<tr>
<td>1 year</td>
<td>0.92 (0.75 - 1.14)</td>
<td>0.458</td>
<td>0.92 (0.73 - 1.15)</td>
<td>0.455</td>
</tr>
<tr>
<td>4 years</td>
<td>0.94 (0.83 - 1.07)</td>
<td>0.361</td>
<td>0.96 (0.83 - 1.11)</td>
<td>0.580</td>
</tr>
<tr>
<td>Overall</td>
<td>0.99 (0.89 - 1.09)</td>
<td>0.769</td>
<td>0.97 (0.87 - 1.08)</td>
<td>0.603</td>
</tr>
</tbody>
</table>

†Adjusted for age, gender and intervention type.
Sarcopenia in AAA; Leeds Cohort

- 253 patients EVAR
- 221 patients suitable imaging
- 361 days
- Significant reduction in TPMA
- 0.6+/− 1.4cm²/m² p< 0.0001
- Not associated with increased mortality

<table>
<thead>
<tr>
<th></th>
<th>TPMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Intervention (mean, 95% CI)</td>
<td>20.4 (19.6 – 21.2)</td>
</tr>
<tr>
<td>Post-Intervention (mean, 95% CI)</td>
<td>18.6 (17.8 – 19.5)</td>
</tr>
<tr>
<td>Change in TPMA (mean, 95% CI)</td>
<td>1.8 (0.6 – 2.9)</td>
</tr>
</tbody>
</table>
Sarcopenia in AAA patients; - Leeds Cohort

- Age > 80 yrs
- 104 patients
- Mean TPMA $6.0\text{cm}^2/\text{m}^2$ compared to $6.4\text{cm}^2/\text{m}^2$ in the < 80 group
- TPMA failed to predict mortality in the > 80 yr group

- TPMA
- Not predictive of higher level of care
- Not predictive of length of stay
- Not predictive of readmission
Conclusion

- Sarcopenia as defined by TPMA may not predictive of outcome in AAA cases with high rates of co morbidity
- Tertiles
- Cutoff’s
- Issues around gender

- Markers of Frailty
  - Grip Strength
  - Gait Speed, Timed Up and Go
  - Edmonton Frailty Scale

- Markers of Cognitive Impairment
  - Montreal Objective Cognitive Assessment (MoCA)
Conclusions

Engaging in multiple healthy behaviours may be important in preventing low muscle mass in late life.
So What Next?
Larger datasets
Share methodology
julianscott@nhs.net
Surgical teams

Systematic assessment of frailty and cognitive assessment
10% Patients are harmed

75% of patients prior to a cardiac arrest have abnormal vital signs
Fit: eFl score = 0-0.12
Mild frailty: eFl score = 0.13-0.24
Moderate frailty: eFl score = 0.25-0.36
Severe frailty: eFl score = > 0.36
Acknowledgments

Mohammed A Waduud (BHF Clinical Research Fellow)
Benjamin Wood (Core Surgical Trainee)
Pabale Keleabetswe (5th Year medical Student)
James Manning (3rd Year medical Student)
Emma Linton (GP trainee)
Michael Drozd (BHF Clinical Research Fellow)
Christopher J Hammond (Consultant Interventional Radiologist)
Marc A Bailey (BHF Intermediate Clinical Research Fellow)
Pratik Adusumilli (Radiology Trainee)
Akshitha Kesharaju (Foundation Year Trainee)
Marilena Giannoudi (Core Medical Trainee)
Daniel Blackman (Consultant Cardiologist)
Pennelope Sucharitkul (2nd Year medical student)
Electronic Frailty Index (eFI)

- Primary Care Tool
- No added cost
- 36 deficits ('2,000 Read Codes')
- Higher scores relate to increasing frailty and greater risk of adverse outcomes
- eFI > 0.36
- Six-fold increase risk of admission to a care home in next 12 months
- Five fold increased mortality risk.
Unpublished data: TAVI


CT imaging performed N = 386

No pre-TAVI CT imaging performed N = 34

Images analysed N = 348

No pre-TAVI CT imaging performed N = 34

Imaging inaccessible N = 38

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Morphometric sarcopenia [N=348]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of frailty assessment</td>
<td>Objective</td>
</tr>
<tr>
<td>Age (years) [mean ± SD]</td>
<td>79.9 ± 7.4</td>
</tr>
<tr>
<td>Gender [N (%)]</td>
<td>182 (52.3%)</td>
</tr>
<tr>
<td>Height (meters) [mean ± SD]</td>
<td>1.6 ± 0.1</td>
</tr>
<tr>
<td>Weight (kilograms) [mean ± SD]</td>
<td>76.0 ± 17.3</td>
</tr>
<tr>
<td>Smoking history [N (%)]</td>
<td>172 (49.4%)</td>
</tr>
<tr>
<td>Co-morbidities</td>
<td></td>
</tr>
<tr>
<td>- Diabetes mellitus [N (%)]</td>
<td>78 (22.4%)</td>
</tr>
<tr>
<td>- Ischaemic heart disease [N (%)]</td>
<td>111 (31.9%)</td>
</tr>
<tr>
<td>- Myocardial infarction [N (%)]</td>
<td>57 (16.4%)</td>
</tr>
<tr>
<td>- Heart failure [N (%)]</td>
<td>337 (96.8%)</td>
</tr>
<tr>
<td>- Cerebrovascular disease [N (%)]</td>
<td>47 (13.8%)</td>
</tr>
<tr>
<td>- Peripheral vascular disease [N (%)]</td>
<td>54 (15.5%)</td>
</tr>
<tr>
<td>- Chronic kidney disease [N (%)]</td>
<td>3 (0.9%)</td>
</tr>
<tr>
<td>- Liver disease [N (%)]</td>
<td>3 (0.9%)</td>
</tr>
<tr>
<td>- Chronic lung disease [N (%)]</td>
<td>94 (27.0%)</td>
</tr>
</tbody>
</table>
Unpublished TAVI data; SAFE Score; End of the bed; Qualitative
- Overall survival

Log-rank = <0.001
Unpublished data: TAVI

Male cut-off < 5.5 cm²/m²
Female cut-off TPMA < 4 cm²/m²
Outcome = time to death

Predefined cut-offs did not predict outcome.

These cut-offs are from curative cancer resection patients. Appropriate

Log-rank = 0.353
Treatment for Sarcopenia

- Beta hydroxyl-beta methylbutyrate (HMB)
- Regular Resistance exercise (Bands)
- Strength Training (Weights)
- High Protein Diets
Measurement of Psoas Muscle

A. Manual tracing: Intra-observer differences

B. Manual tracing: Inter-observer differences

C. Semi-automated technique: Intra-observer differences

D. Semi-automated technique: Inter-observer differences
Measurement of Psoas Muscle
Interventions to improve the outcomes of frail people having surgery: A systematic review

Daniel I. Michaela1,*, Tim Jan1,*, Nikhilie Mockei2, Abhisheca Pathal1, Jianou M. Lalu1,2,3
1. Department of Anaesthesiology and Pain Medicine, University of Ottawa, Ottawa, Ontario, Canada.
2. Department of Anesthesiology and Pain Medicine, The Ottawa Hospital, Ottawa, Ontario, Canada.
3. Clinical Epidemiology Program, Ottawa Hospital Research Institute, Ottawa, Ontario, Canada.
4. Faculty of Medicine, University of Ottawa, Ottawa, Ontario, Canada.
※ These authors contributed equally to this work.
* These authors also contributed equally to this work.

Abstract

Background

Frailty is an important prognostic factor for adverse outcomes and increased resource use in the growing population of older surgical patients. We identified and appraised studies that tested interventions in populations of frail surgical patients to improve perioperative outcomes.

Methods

We systematically searched Cochrane, CENTRAL, EMBASE and Medline to identify studies that tested interventions in populations of frail patients having surgery. All phases of study selection, data extraction, and risk of bias assessment were done in duplicate. Results were synthesized qualitatively per a prespecified protocol (CRD42018039999).

Results

We identified 2503 titles; 11 were included for final analysis, representing 1,668 participants in orthopaedic, general, cardiac, and mixed surgical populations. Only one study was multi-center and risk of bias was moderate to high in all studies. Interventions were applied pre- or postoperatively, and included exercise therapy (n = 4), multiple component geriatric care protocols (n = 5), and blood transfusion triggers (n = 1). No specific surgical techniques were compared. Exercise therapy, applied pre- or post-operatively, was associated with significant improvements in functional outcomes and improved quality of life. Multicomponent protocols suffered from poor compliance and difficulties in implementation. Transfusion triggers had no significant impact on mortality or other outcomes.

Conclusions

Despite a growing literature that demonstrates strong independent associations between frailty and adverse outcomes, few interventions have been tested to improve the outcomes...
Association of Frailty and 1 year Postoperative Mortality following Major Elective Non cardiac Surgery (McIssac)

Figure 2. Impact of Frailty on Postoperative Mortality by Patient Age

This plot presents the hazard ratio (adjusted for patient sex, neighborhood income, and surgical type) and 95% CIs for the association between frailty and 1-year mortality following surgery. The hazard ratio was determined for all patient ages. Hazard ratios above 1 indicate an increased risk of death in frail patients. The horizontal dotted line indicates the null value of the hazard ratio (1.0).

Figure 3. Hazard Ratio for Effect of Interaction Between Frailty and Surgery Type on 1-Year Mortality Risk

The hazard ratio (adjusted for patient age, sex, and neighborhood income) measuring the association between frailty and 1-year mortality is presented for each surgical type. Hazard ratios whose lower 95% CI excludes 1 indicate a significantly increased risk of 1-year death in frail patients.
The prevalence of sarcopenia in a vascular surgical patient cohort and its impact on outcome

Rachel Heard, Douglas Black, George Ramsay, Neil Scott, Diane Hildebrand

Article Info

Article history:
Received: 12 October 2017
Revised: 22 January 2018
Accepted: 7 March 2018
Available online 14 April 2018

Keywords:
Sarcopenia
Vascular surgery
Muscle assessment
Risk assessment

Abstract

Background: Sarcopenia, loss of lean muscle mass and quality, has prognostic significance and can be used to guide the management of oncology patients. However, there is limited research into the prevalence and effect of sarcopenia in vascular populations. We aim to investigate the prevalence of this measure of physiological reserve in a vascular patient group.

Methods: All patients admitted to a vascular vascular unit in a single year were enrolled for the study. Patients with an abdominal CT scan available for analysis within 12 months of admission were included. Patient data were extracted from electronic patient records and hospital case notes. CT scans were analysed at 1.5 abdominal levels to calculate body composition indices as previously described. Sarcopenia was defined as total muscle mass of ≤441 cm²/m² in female patients and non-obese males and ≤516 cm²/m² in obese males. Outcome at 3 years was ascertainment.

Results: Of 334 patients, 149 (44.1%) were sarcopenic. Female patients were more likely to be sarcopenic (p = 0.000). The prevalence of sarcopenia increased with age (p < 0.001). Some of sarcopenia didn’t differ between smokers and non-smokers, diabetes. In a potentially unique finding in vascular literature to date, mortality and non-home discharge were not significantly different between the groups. On multivariate analysis, sarcopenia was not significantly associated with earlier death (p = 0.04).

Conclusions: Sarcopenia is highly prevalent in vascular surgical patients in our analysis, sarcopenia was not independently associated with mortality. Potentially the unassociated cardiovascular risk of patients with end-stage vascular disease may impact the additional risk of altered body composition.

© 2018 Royal College of Surgeons of Edinburgh (Scottish charity number 0005152) and Royal College of Surgeons in Ireland. Published by Elsevier Ltd. All rights reserved.
Radiologically determined Sarcopenia predicts morbidity and mortality following abdominal surgery; a systematic review and meta analysis.
Association of Frailty and 1-Year Postoperative Mortality Following Major Elective Noncardiac Surgery: A Population-Based Cohort Study

Daniel L. McIsaac, MD, MPH, FRCP; Gregory L. Bryson, MD, FRCP; MS; Carl van Walraven, MD, FRCP, MS

Original Investigation

Importance: Single-center studies identify frailty as a risk factor for 30-day postoperative mortality. The long-term and population-level effect of frailty on postoperative mortality is, to our knowledge, poorly described, as are the interactions of frailty with important predictors of mortality.

Objective: To measure the population-level effect of patient frailty on and its association with 1-year postoperative mortality.

Design, Setting, and Participants: Population-based retrospective cohort study in Ontario, Canada, with data collected between April 1, 2002 and March 31, 2012. Analysis was performed from December 2014 to March 2015. All patients were community-dwelling individuals aged 65 years or older on the day of elective major noncardiac surgery.

Exposure: Frailty, as defined by the Johns Hopkins Adjusted Clinical Groups (ACG) frailty-defining diagnoses indicator. The ACG frailty-defining diagnoses indicator is a binary variable that uses 12 clusters of frailty-defining diagnoses.

Main Outcomes and Measures: One-year all-cause postoperative mortality.

Results: Of 202,811 patients, 6289 (3.1%) were frail (mean [SD] age, 71 ± 1 years). Within 1 year, 13.6% (n = 855) of frail and 4.8% (n = 9433) of nonfrail patients died. Adjusted for sociodemographic and surgical confounders resulted in a hazard ratio of 2.23 (95% CI, 2.08-2.40). The interaction between frailty and postoperative time demonstrated an increased relative hazard for death in frail patients (hazard ratio, 35.58; 95% CI, 29.78-40.19) on postoperative day 3. The association between frailty and increased risk of death decreased with patient age (HR, 2.66; 95% CI, 2.28-3.40 at age 65; HR, 1.63; 95% CI, 1.36-1.95 at age 90). Significant variations in the increased risk for death in frail patients existed between different surgery types and was strongest after total joint arthroplasty (HR, 3.79; 95% CI, 3.21-4.47 for hip replacement; HR, 2.68; 95% CI, 2.10-3.42 for knee replacement).

Conclusions and Relevance: At a population level, preoperative frailty-defining diagnoses were associated with a significantly increased risk of 1-year mortality that was particularly notable in the early postoperative period, in younger patients, and after joint arthroplasty.

Author Affiliations: University of Ottawa, Ottawa, Ontario, Canada (McIsaac, Bryson, van Walraven); Institute for Clinical Evaluative Sciences, Ottawa, Ontario, Canada (McIsaac); Department of Anesthesiology, The Ottawa Hospital, Ottawa, Ontario, Canada (McIsaac, Bryson, van Walraven); Ottawa Hospital Research Institute, Ottawa, Ontario, Canada (McIsaac, Bryson, van Walraven).

Corresponding Author: Daniel L. McIsaac, MD, MPH, FRCP, Department of Anesthesiology, The Ottawa Hospital, Civic Campus, Room B8-2, 306 Confederation Ave, Ottawa, ON K1Y 4E3, Canada (daniel.mcisaac@toh.ca).