A Study of Normative Handgrip Strength Values for Patients on Haemodialysis

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27th May 2015
Background: Handgrip Study

- Method for detecting malnutrition
- Used as a longitudinal tool to monitor change
- In practice handgrip strength (HGS) values are lower for the HD population
- Normative values exist for non renal population
Handgrip and Muscle

- 40% of body weight is made up of muscle
- 20-30% loss of muscle strength between 60 to 75 years
- 12-15% loss of muscle mass – 1% loss of muscle mass per year (Frontera, 2000)
- Studies have found that age and gender influence muscle strength
- HGS values are found to be significantly higher in men.
- Ethnic differences among men and women
Handgrip and Muscle

"And you say you check your e-mail on average three or four hundred times a day?"
Handgrip, Ethnicity & Mortality

- Prospective Urban Rural Epidemiology (PURE) Study
- Grip strength measurement in people of diverse economic and sociocultural backgrounds
- Large population study carried out in 17 countries
- Low grip strength has a strong association with cardiovascular mortality
Kidney function as a Predictor of Loss of Lean Mass

- Lower kidney function was associated with loss of lean mass in older men.
- Loss of lean mass was more pronounced in black men than in white men.

50% of Hdx patients in the study had Lean Tissue Indices below the 10\textsuperscript{th} percentile of an age and sex matched healthy population

- Lean Body mass is associated with poorer survival

Marcelli, 2015, CJASN
Handgrip and Muscle in Haemodialysis patients

- Isoyama, 2014 found that low muscle strength was more strongly associated with the risk of mortality than low muscle mass in dialysis patients
Handgrip Study

- **Aim:** Compile normative data for handgrip strength in people on haemodialysis
- **Design:** Cross sectional
- **Methods:** Single HGS measurement, before HD, dominant and non-dominant arm
- **Exclusions:** pain on grip, fistula arm, BMI ≤18.5kg/m² and SGA <6
- **Objective:**
  - Part 1: determine factors that independently affect HGS
  - Part 2: compile normative values
Handgrip Study - Method

• American Society of Hand Therapists recommend that the elbow is flexed at 90° in a seated position
• The method in PENG is to extend the arm down the side of the body
• Different measuring positions will give different results
• Standardised testing method to ensure reliability and comparability
Handgrip Study - Method

- 1 versus 3 measurements
- Preferred method to obtain the maximum handgrip is to use the mean of three trials
- Evidence suggests the reliability of 1 maximal grip strength
- Discomfort on gripping may yield sub-maximal force and render the mean of 3 trials less reliable
- “warm up” period to allow time for the patient to become familiar with the Jamar® dynanometer handgrip
- 1 measurement from dominant and non dominant arm

Nutrition Assessment – SGA & BMI

• The Renal Association recommends the use of 3 or 7 point Subjective Global Assessment
• KDOQI guidelines (2000) support SGA as a useful measurement of protein-energy nutritional status in dialysis patients
• Steiber et al, 2007 found the 7 point SGA in Hdx patients to be reliable
• BMI most widely used tool for nutritional status
• BMI categories are set by World Health Organisation guidelines. Underweight (≤ 18.5kg/m²)
Handgrip Study – Part 1

- n= 571 (including exclusions)
- 56% male (n=221)
- 36.5% White, 34.5% Asian, 29% Black
- 13% vegetarian (51/394)
- 24.4% had a fistula in non-dominant arm
- 52% less than 65 years old (n=206)
- 27% malnourished (SGA <6)

- Independent influences on HGS: age, gender, ethnicity, SGA, height, weight, albumin
Dominant versus Non dominant

• Is there a difference in dominant and non dominant?

• Mean difference between dominant and non dominant arm (n= 292, excluding SGA )

  = 1.707kg  p<-0.0001
Handgrip Study – Part 1
Nutritional Status and HGS

- $P < 0.0001$ (difference between means of HGS between different SGA groups).
Handgrip Study – Part 1

• European Working Group on Sarcopenia in Older People suggest HGS
  • <30kg in men
  • <20kg in women

• From our HGS study
  • 60.6% of males had a HGS of less than 30kgs
  • 63.1% of females had a HGS less than 20kgs
## Differences in Ethnicity

- Analysis of age, ethnic background and HGS

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male &lt;65</td>
</tr>
<tr>
<td>White and Asian</td>
<td>0.001</td>
</tr>
<tr>
<td>White and Black</td>
<td>0.693</td>
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<tr>
<td>Asian and Black</td>
<td>&lt;0.0001</td>
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</table>
# Handgrip Study – Part 2 Norms

<table>
<thead>
<tr>
<th>Age group</th>
<th>Male</th>
<th></th>
<th>Female</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>N</td>
<td>HGS mean</td>
<td>95% confidence interval</td>
<td>N</td>
</tr>
<tr>
<td>White</td>
<td>&lt; 65</td>
<td>34</td>
<td>35.4</td>
<td>31.2-39.6</td>
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<tr>
<td></td>
<td>≥ 65</td>
<td>43</td>
<td>25.8</td>
<td>23.6-28.0</td>
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<tr>
<td>Asian</td>
<td>&lt; 65</td>
<td>37</td>
<td>26.4</td>
<td>23.4-29.4</td>
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<tr>
<td></td>
<td>≥ 65</td>
<td>36</td>
<td>23.8</td>
<td>21.8-25.9</td>
</tr>
<tr>
<td>Black</td>
<td>&lt; 65</td>
<td>39</td>
<td>36.5</td>
<td>32.6-40.5</td>
</tr>
<tr>
<td></td>
<td>≥ 65</td>
<td>28</td>
<td>26.8</td>
<td>23.3-30.2</td>
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</tbody>
</table>
Handgrip Study – Comparing Norms

<table>
<thead>
<tr>
<th></th>
<th>MALES</th>
<th>95% CI</th>
<th>FEMALEs</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male &lt;65 HD</td>
<td>23.4-40.5</td>
<td>Female &lt;65 HD</td>
<td>14.0-22.8</td>
<td></td>
</tr>
<tr>
<td>Male &lt;65</td>
<td>36.7-63.6</td>
<td>Female &lt;65</td>
<td>22.2-39.0</td>
<td></td>
</tr>
<tr>
<td>Male ≥65 HD</td>
<td>21.8-30.2</td>
<td>Female ≥65 HD</td>
<td>15.9-20.3</td>
<td></td>
</tr>
<tr>
<td>Male ≥65</td>
<td>24.8-35.4</td>
<td>Female ≥65</td>
<td>16.0-28.8</td>
<td></td>
</tr>
</tbody>
</table>
Conclusions

- Study almost complete – aim is for 30 patients per category
- Practical uses of HGS normative data
  - Monitor strength over time
  - Use as an assessment tool
  - Objective and quick marker of nutritional status
  - Reliable if same method used
- Next phase is to validate
  - Explore mortality data
  - Compare malnourished patients to see if their values fall below