Multiparametric Ultrasound Imaging of the Flexor Carpi Radialis Brevis (FCRB)

Théa Voser, T. Christen, F. Becce, S. Durand
Department of Hand Surgery, CHUV - Switzerland
GEM Congress 2019 - Paris
Introduction - Anatomy

Fig. 3. Anatomical illustration of the flexor carpi radialis brevis (FCRB).

Lee 2014

Dodds 2006
Introduction - Epidemiology

• Literature: 1.6 - 8.7% \(^{(1,2)}\)

Our experience:
• Intra-op: 5 cases between 2017 - 2019, CHUV
• Embryo: 5.5% (1/18, Saints-Pères collection, Paris)
• MRI: Systematic revue of wrist imaging between 2005-2015, CHUV : 1.9% (11/592)

2. Ho SY, Hand Surg, 2011
Our study

• **Purpose:** Multiparametric ultrasound imaging of the FCRB
  • B-mode
  • Doppler US
  • Elastography

• **Population:**
  • 5 FCRB in 3 patients
  • Mean age: 43.6y (21 - 63)
Shear-Wave Ultrasound Elastography

- Non-invasive imaging technique
- Determine the stiffness/elasticity of soft tissue
- Shear waves velocity (m/s)
- Young modulus (kPa)
Results - B-mode

Table 1:

<table>
<thead>
<tr>
<th>Shape, side</th>
<th>CSA (cm²)</th>
<th>Thickness (cm)</th>
<th>Width (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 1, right</td>
<td>0.88</td>
<td>0.69</td>
<td>1.28</td>
</tr>
<tr>
<td>Case 2, left</td>
<td>0.81</td>
<td>0.79</td>
<td>1.18</td>
</tr>
<tr>
<td>Case 3, right</td>
<td>1.10</td>
<td>0.89</td>
<td>1.53</td>
</tr>
<tr>
<td>Case 4, left</td>
<td>0.61</td>
<td>0.60</td>
<td>1.21</td>
</tr>
<tr>
<td>Case 5, right</td>
<td>0.48</td>
<td>0.49</td>
<td>1.15</td>
</tr>
<tr>
<td>Mean ± standard error</td>
<td>0.77 ± 0.21</td>
<td>0.69 ± 0.14</td>
<td>1.27 ± 0.13</td>
</tr>
</tbody>
</table>

CSA: Cross sectional area.
Results: Doppler US

Arterial supply: radial artery
Results - Shear-Wave Elastography

Table 2:

<table>
<thead>
<tr>
<th>Case</th>
<th>Young modulus in Rest position kPa (m.s(^{-1}))</th>
<th>Young modulus in Active flexion kPa (m.s(^{-1}))</th>
<th>Young modulus in Passive extension kPa (m.s(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20.7 (2.6)</td>
<td>249.8 (9.1)</td>
<td>138.3 (6.8)</td>
</tr>
<tr>
<td>2</td>
<td>28.8 (3.1)</td>
<td>197.6 (8.1)</td>
<td>144.8 (6.9)</td>
</tr>
<tr>
<td>3</td>
<td>16.1 (2.3)</td>
<td>58.3 (4.4)</td>
<td>110.1 (5.9)</td>
</tr>
<tr>
<td>4</td>
<td>26.7 (3)</td>
<td>52.5 (4.2)</td>
<td>151.8 (7.1)</td>
</tr>
<tr>
<td>5</td>
<td>15.5 (2.3)</td>
<td>158.2 (7.3)</td>
<td>121.8 (6.4)</td>
</tr>
<tr>
<td>Mean (kPa) ± SE</td>
<td>21.5 ± 5.4</td>
<td>143.3 ± 77.4 (p&lt;0.02)</td>
<td>133.3 ± 15.3 (p&lt;0.02)</td>
</tr>
</tbody>
</table>
Clinical significance

- Standardization of volar plating for distal radius fractures

- Symptomatic FCRB:
  - Tenosynovitis, tendon tear, intersection syndrome, nerve compression, ...

- Role in tendon graft/transfer?
Phylogenesis

• In Great Apes: double origin of FCR (Humerus + Radius)

• In Humans: single origin (Humerus)

Hypothesis:
• Loss of radial head due to evolutionary transition from quadrupeds to bipeds?

• FCRB remnant radial head of FCR? Active wrist stabilizer?
Conclusion

- Can be detected by US

- Function assessed by pulling on the FCRB: wrist flexion without finger flexion

- Elastography: *effective contraction* of the FCRB during active wrist flexion
Thank you for attention!