Magnetic resonance study of vastus medialis: comparison between patellar instability and controls.

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Patellofemoral Joint

INTRODUCTION

• Complex anatomy

OBJECTIVE

• Complex biomechanics

METHODS

• Complex clinical presentations
  – Pain
  – Instability

RESULTS

DISCUSSION

CONCLUSION

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Patellofemoral Joint

INTRODUCTION

- Main risk factors for PF pathology
  - Q angle
  - Patellar height
  - Trochlear dysplasia
  - Quadriceps dysplasia??

CONCLUSION
Vastus medialis

- Vastus medialis longus/obliquus (VMO)
  - Lieb, JBJS Am, 1968.

- VMO: individual nerve supply
  - From femoral and saphenous nerves

- VMO: central patellar insertion, 50º
  - Pagnano, CORR, 2006.
Vastus medialis

**INTRODUCTION**

- Vastus medialis obliquus weakness leads to lateral patellar shift and tilt, and pain

- Relation to MPFL dynamics
  - Panagiotopoulos, KSSTA, 2006.
Vastus medialis

- Deserves investigation

- VM patellar instability x controls ???
  - MRI 20 patients
  - VM insertion higher in patients with instability
Objective

• Compare the anatomy of vastus medialis origin at the femur and insertion at the patella in patients with patellar instability and controls.
Methods

• Patellar instability group
  – At least 1 complete dislocation

• Control group
  – ACL, meniscal lesions or sprains

• Groups matched for sex, only age>15 (mature)

<table>
<thead>
<tr>
<th></th>
<th>Instability N=78</th>
<th>Control N=78</th>
<th>P=0.001 Wilcoxon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>25.6 ± 7.5</td>
<td>30.2 ± 7.8</td>
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<tr>
<td></td>
<td>Range 15-47</td>
<td>Range 15-49</td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>48 (61.5%)</td>
<td>48 (61.5%)</td>
<td>P=1 Chi square</td>
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</table>
Methods

• Measurements
  – VASTUS ORIGIN-CONDYLAR DISTANCE
    • Sagital image, more distal vastus medialis insertion at fêmur to proximal end of medial condyle cartilage
• Measurements

  - VASTUS PATELLAR INSERTION FROM PROXIMAL POLE RATIO
    - Sagital image, patellar articular surface length, distance from proximal pole to the last axial cut with vastus medialis muscle

Lenght: 1.51cm
Methods

- Measurements
  - VASTUS MUSCLE INSERTION SITE:
    - DIRECT PATELLAR INSERTION (A and B)
    - MEDIAL RETINACULUM (C and D)
  - Axial image, check if vastus MUSCLE touches patella at any cut
Methods

• Measurements
  – All made in HOROS free DICOM medical image viewer
  – Interobserver analysis
    – ICC calculated for linear variables
    – Kappa calculated for categorical variable
## Results

### Data analysis

<table>
<thead>
<tr>
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<th>Instability N=78</th>
<th>Control N=78</th>
<th>p</th>
<th>ICC / Kappa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vastus origin – condylar distance</td>
<td>26.59mm ± 3.43 95% CI 25.8-27.4</td>
<td>27.52mm ± 3.49 95% CI 26.7-28.3</td>
<td>0.041 Wilcoxon</td>
<td>0.59 Fair 95% CI 0.29-0.78</td>
</tr>
<tr>
<td>Vastus patellar insertion</td>
<td>15.02mm ± 4.18 95% CI 14.1-15.9</td>
<td>17.59mm ± 5.54 95% CI 16.3-18.8</td>
<td>&lt;0.001 Wilcoxon</td>
<td>0.69 Good 95% CI 0.43-0.84</td>
</tr>
<tr>
<td>Vastus patellar insertion ratio</td>
<td>0.48 ± 0.13 95% CI 0.45-0.51</td>
<td>0.59 ± 0.18 95% CI 0.54-0.63</td>
<td>&lt;0.001 T test</td>
<td>-</td>
</tr>
<tr>
<td>Retinacular insertion</td>
<td>59 (75.6%)</td>
<td>41 (52.6%)</td>
<td>0.003 (x²) Odds ratio = 2.8</td>
<td>0.8 Excellent Kappa</td>
</tr>
</tbody>
</table>
Discussion

- First study (to extent our knowledge) to clearly show vastus medialis anatomic differences between instability x controls

- Confirms hypothesis of “dysplastic muscle”
  - More proximal insertion
    - 48% (proximal half) x 59% (distal half)
  - More often not attaching directly to patella
    - 75.6% x 52.6%
Discussion

• Balcarek et al, Biomed Res Int, 2014
  – 30 acute primary dislocation
  – 30 recurrent dislocations
  – 22 controls
  – Cross sectional area VMO, muscle fiber angulation and distance of patellar insertion from proximal pole (not the ratio!)
  – No significant differences
Discussion

• Vastus origin condylar distance
  – Attempt to evaluate vastus medialis inclination
    • (higher femoral origin would mean more vertical fibres)
  – Results against this assumption (higher in controls)
  – ICC 0.59 (fair)
  – Authors did not consider it an adequate parameter

• Vastus patellar ratio and direct muscle insertion at patella
  – more patellar coverage by muscle mean increased medial pull in theory
Discussion

• Limitations

– Effect on patellar positioning not evaluated

– Does not investigate clinical relevance

– Does not define normal values for general population

– Cannot determine if vastus difference is cause or consequence of dislocation (case-control study)
Discussion

• Possible clinical implications

– Patients with more distal and direct patellar insertion of vastus medialis may respond better to physical therapy?

– Adds to current knowledge for adequate vastus medialis insertion repair after patellofemoral surgery
  • Consider normalization of vastus insertion
    – below half the patellar chondral surface
    – bony instead of retinacular insertion of muscle fibers
  • Normalization is not excessive lateralization such as Insall procedure
Conclusion / Take home message

- Vastus medialis distal insertion differed significantly in patellar instability patients, with a more proximal insertion with less patellar coverage, and a more frequent insertion of the muscle fibers to the retinaculum and not directly to the bone.
THANK YOU