The Anatomy of Varus Ankle Arthritis

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Introduction

- We have observed apparent hypertrophy of the medial malleolus in varus ankle arthritis.

- We hypothesise the medial malleolus is subjected to increased mechanical forces in varus ankle arthritis.

- Thus subsequent hypertrophy of the malleolus occurs in accordance with Wolfe’s Law.
Materials and Methods

• Between March 2010 and 2012, 76 consecutive patients undergoing ankle fusion were included in the study.

• Alignment was classified according to talar tilt on a plain AP radiograph
  • >5 degrees valgus,
  • -4 and +4 degrees neutral
  • >5 degrees varus
Radiographic Assessment

- Digital radiographic images were used to measure (fig 1.):
  - Medial malleolus width at the joint line (black line)
  - Tibial plafond width at the joint line (White line)
  - The medial malleoli/tibial width was then calculated to provide a ratio to assess the proportion of tibia occupied by the medial malleolus.
Statistical Analysis

• The Shapiro-Wilkes test to assess the normal distribution of results within each alignment group;

• A student T-test was used to assess the difference between the 3 alignment groups

• A paired T-test to assess pre and post-operative differences within each alignment group.
Results: Demographics and Medial Malleolus Size

<table>
<thead>
<tr>
<th>Ankle Type</th>
<th>Varus</th>
<th>Neutral</th>
<th>Valgus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex (M:F)</td>
<td>14:7</td>
<td>18:17</td>
<td>11:8</td>
</tr>
<tr>
<td>Age in Years</td>
<td>57 (36-67)</td>
<td>59 (46-81)</td>
<td>64(39-77)</td>
</tr>
<tr>
<td>Pathology</td>
<td>OA, Post-traumatic, Neuropathic</td>
<td>OA, post traumatic tibialis posterior deficiency, RA</td>
<td>OA, post traumatic</td>
</tr>
<tr>
<td>Mean Coronal plane Deformity in Degrees. Mean (range)</td>
<td>17.4 (12-25.3)</td>
<td>15.3 (9.1-19.9)</td>
<td>3.8 (0-7.6)</td>
</tr>
<tr>
<td>Width of Malleolus Mean (range)</td>
<td>18.6mm* (14.3-22.6mm)</td>
<td>13.3mm (10.4-14.7mm)</td>
<td>11.9mm (9.2-13.9mm)</td>
</tr>
<tr>
<td>Pre –Operative Ratio of Medial Malleolus Width to Tibial Plafond</td>
<td>0.43*</td>
<td>0.33</td>
<td>0.31</td>
</tr>
</tbody>
</table>

Table of demographics and pre-operative digital radiographic image measurements from our patient group. Varus ankles have larger mean medial malleoli and the ratio of medial malleolus width suggests this reduces the tibial joint line when compared to neutral ankle group (p<0.05*).
Results:

• Each group of medial malleolus measurements was normally distributed around their mean.

• The mean width of the medial malleolus was greater in the varus ankle group at 18.6mm than all other groups (p<0.05).

• The mean ratio of tibial plafond width to medial malleolus width was greater in the varus ankle group at 0.42 in the varus ankle (p<0.05).

• Following surgery there was no significant difference between the groups in these indices (p<0.05).
The Effect of Operative Surgical correction Treatment on Medial Malleolus Size?

<table>
<thead>
<tr>
<th>Clinical Ankle Alignment</th>
<th>Varus</th>
<th>Neutral</th>
<th>Valgus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre operative Medial malleolus width</td>
<td>18.6mm (15.3-22.6mm)</td>
<td>13.3mm (10.4-14.7mm)</td>
<td>11.9mm (9.2-12.9mm)</td>
</tr>
<tr>
<td>Post-operative medial malleolus width</td>
<td>13.5mm (10.3-17.6mm)</td>
<td>12.3mm (10.1-12.9mm)</td>
<td>11.4mm (9.1-12.4mm)</td>
</tr>
<tr>
<td>Pre- operative Tibial plafond ratio</td>
<td>0.43</td>
<td>0.33</td>
<td>0.31</td>
</tr>
<tr>
<td>Post operative tibial plafond ratio</td>
<td>0.31</td>
<td>0.30</td>
<td>0.30</td>
</tr>
</tbody>
</table>

Table showing the post operative measurements of medial malleolus width and malleoli plafond ratio. Our findings indicate a reduction in size of the medial malleolus after surgery with no observed or statistical difference between the alignment groups in these measurements after surgical correction and re-alignment.
Conclusion

- The medial malleolus undergoes hypertrophy in varus ankle arthritis presumably due to increased mechanical loading.

- When preparing the varus ankle for fusion or ankle replacement the medial malleolus must be partially resected.

- This partial resection will ensure the midpoint of the talus aligns with the midpoint of the tibial plafond restoring physiological alignment.