Evaluation of Posterior Malleolar Fractures and the Posterior Pilon Variant in Operatively Treated Ankle Fractures

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Paul Switaj, MD

- My disclosure is in the Final AOFAS Mobile App.
- I have no potential conflicts with this presentation.
Posterior Malleolus Fracture

- Significant attention focused recently on fractures of the posterior malleolus
- **Wide range in the reported prevalence** in ankle fractures → 7% to 44%
- Relevance and operative management continues to be a source of controversy
- **Morphology of the fracture has received far less consideration** in classification and treatment algorithms
Posterior Pilon Variant

- Increasingly recognized fracture pattern with *posteromedial involvement and variable articular impaction*

- *Critical for talar stability* and prevention of posteromedial subluxation

- May change surgical approach

- Current classification *systems fail to account for this pattern*

- Relative frequency, associated characteristics, and reliability of diagnosis has not been reported in large series
Purpose

• Report the relative frequency of the posterior malleolar fracture and posterior pilon variant in a large consecutive series of operative ankle fractures

• Assess the interobserver reliability in identifying the posterior pilon based on plain radiographs

• Investigate the patient and fracture characteristics associated with these fractures

• Assess its relationship to two commonly used classification systems
Methods

• Retrospective cohort of 270 patients that met inclusion criteria (no prior fracture, surgery, deformity)
• Basic demographic data collected

Two independent fellowship-trained reviewers:
1) Classified fractures according to Lauge-Hansen and AO/OTA
2) Determined whether:
   • Fractures involved posterior malleolus
   • Represented a posterior pilon variant → defined by:
     A) Medial malleolar double-contour sign
     B) Posterior malleolus fracture in the sagittal plane
     C) Posterior malleolar impaction
Results

<table>
<thead>
<tr>
<th>Relative Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior Malleolar Fracture</td>
</tr>
<tr>
<td>Posterior Pilon Variant</td>
</tr>
</tbody>
</table>

- 40% of posterior malleolar fractures represented posterior pilon variants

<table>
<thead>
<tr>
<th></th>
<th>Kappa</th>
<th>Observed Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior Malleolar Fracture</td>
<td>0.79</td>
<td>91.1%</td>
</tr>
<tr>
<td>Posterior Pilon Fracture</td>
<td>0.74</td>
<td>89.3%</td>
</tr>
</tbody>
</table>

- “Substantial” agreement for posterior malleolar fractures and posterior pilon variants
### Results

<table>
<thead>
<tr>
<th></th>
<th>Overall Distribution (%)</th>
<th>Posterior Malleolar Fracture Distribution (%) *</th>
<th>Pilon Variant Fracture Distribution (%) †</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAB</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>PER</td>
<td>13</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>SAD</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SER</td>
<td>80</td>
<td>83</td>
<td>88</td>
</tr>
<tr>
<td>AO/OTA A</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>AO/OTA B</td>
<td>81</td>
<td>83</td>
<td>92</td>
</tr>
<tr>
<td>AO/OTA C</td>
<td>19</td>
<td>17</td>
<td>8</td>
</tr>
</tbody>
</table>

- **No significant difference** in frequency of posterior fractures*† between the AO/OTA and Lauge Hansen classification systems when compared to the overall fracture distribution
- **Trend toward increased frequency** of SER and AO/OTA B type patterns
# Results

<table>
<thead>
<tr>
<th></th>
<th>Without Posterior Malleolar (Mean)</th>
<th>With Posterior Malleolar (Mean)</th>
<th>Without Posterior Pilon (Mean)</th>
<th>With Posterior Pilon (Mean)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td>42.8</td>
<td>49.0*</td>
<td>44.3</td>
<td>52.1†</td>
</tr>
<tr>
<td><strong>BMI (kg/m²)</strong></td>
<td>29.3</td>
<td>30.1</td>
<td>29.7</td>
<td>30.0</td>
</tr>
</tbody>
</table>

- Patients with *posterior malleolar fractures and posterior pilon variants were significantly older*
- **No significant difference was found based on BMI**

<table>
<thead>
<tr>
<th></th>
<th>Posterior Malleolar (Relative Risk 95% CI)</th>
<th>Posterior Pilon (Relative Risk 95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Female Gender</strong></td>
<td>1.3 (1.0-1.7)</td>
<td>1.8 (1.0-3.3)</td>
</tr>
<tr>
<td><strong>Diabetes</strong></td>
<td>1.4 (0.9-1.9)</td>
<td>1.9 (0.9-3.5)</td>
</tr>
</tbody>
</table>

- **Females were significantly more likely than men** to sustain posterior malleolar fractures and posterior pilon variants
- Patients with *diabetes trended toward a greater risk of both types of fractures*
Results

- CT available for 21 patients:
  - **Confirmed posterior pilon variant in 12 of 12 who met consensus classification**
  - Confirmed a posterior malleolar fracture without characteristics of the pilon variant in 3 of 3
  - One posterior malleolar fracture missed on plain radiographs → did not represent a posterior pilon variant
Conclusion

- Data represents the highest reported rate of posterior malleolar involvement (50%) and the posterior pilon variant (20%) in operatively treated ankle fractures in a large series.

- Identification of these fractures demonstrates:
  - Substantial interobserver reliability
  - High level of CT correlation

- Based on our study, the posterior pilon variant and posterior malleolar fractures:
  - Occur in all fracture types across all traditional mechanisms \(\rightarrow\) not accounted for by conventional systems
  - May occur with increased frequency in older, diabetic female patients