Financial Impact of MRI in the Treatment of Foot and Ankle Osteomyelitis

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Disclosure

NO CONFLICTS TO DISCLOSE

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Our disclosures are in the Final AOFAS Mobile App.

We have no potential conflicts with this presentation.
Introduction

- Osteomyelitis (OM) of the foot and ankle is a common condition with a high economic burden, especially in the context of diabetes mellitus

- Timely and accurate diagnosis of OM is important for treatment initiation and for the reduction of healthcare costs

- MRI is considered the most sensitive imaging modality for OM of the foot and ankle, but is associated with significant cost and variable treatment impact when compared to plain radiographs
Objectives

- The purpose of this study is to determine:
  1) the proportion of patients with a diagnosis of osteomyelitis that underwent an MRI
  2) the rate of operative procedures in the MRI cohort and non-MRI (NMRI) cohort
  3) the proportion of MRIs that changed clinical treatment leading to an operative procedure (impact study)
  4) the effective cost of MRI for osteomyelitis of the foot and ankle
Materials and Methods

- Patients were retrospectively identified at a single tertiary care, academic medical center and included if:
  - treated between January 2009 and September 2015
  - diagnosed with OM using ICD-9 codes 730.07, 730.17, 730.27 (acute, chronic, and unspecified osteomyelitis of the foot and ankle)

- Demographic data, patient comorbidities, use of imaging, and any operative procedures were identified

- Impact MRI was defined as MRI that led to an operative procedure within the same admission encounter

- Cost of impact MRI was estimated using the following equation:

  \[ Cost(\$) = \text{average MRI cost}(\$) \times \left( \frac{\text{total MRIs}}{\text{impact MRIs}} \right) \]

- Student’s t-test and Chi-squared test were used to statistically compare the MRI and NMRI cohorts

- Exclusion criteria: 1) patients <18 years old; 2) patients with <2 weeks of follow-up
Results

• Patient flowchart

543 pts

+ MRIs (144 pts)
220 MRIs
83 impact MRIs
137 non-impact MRIs

- MRIs (399 pts)

+ procedures (102 pts)
- procedures (42 pts)

+ procedures (281 pts)
- procedures (118 pts)
Results

• No statistically significant differences between the two cohorts with regards to age, sex, race or ethnicity

• No significant difference in operative rates between the two cohorts (MRI=70.8% vs. NMRI=70.4%, p=0.93)

• MRI cohort had greater mean Charlson Comorbidity Index value (MRI=3.4±2.2 vs. NMRI=2.7±2.1, p<0.05) and longer mean follow-up time (MRI=98.7±82.1 vs. NMRI=74.9±68.8, p<0.05)
Results

- Types of procedures performed between groups were different (Chi-squared, p<0.05)
- NMRI group had slightly higher amputation rates (amputation through foot, ankle disarticulation, BKA, and AKA)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>MRI</th>
<th>No MRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>I&amp;D, soft tissue only</td>
<td>157 (36.8%)</td>
<td>169 (23.5%)</td>
</tr>
<tr>
<td>I&amp;D, bony involvement</td>
<td>95 (22.2%)</td>
<td>184 (25.6%)</td>
</tr>
<tr>
<td>Amputation of toe</td>
<td>92 (21.5%)</td>
<td>159 (22.1%)</td>
</tr>
<tr>
<td>Amputation through foot</td>
<td>29 (6.8%)</td>
<td>68 (9.5%)</td>
</tr>
<tr>
<td>Ankle disarticulation</td>
<td>4 (0.9%)</td>
<td>13 (1.8%)</td>
</tr>
<tr>
<td>Below knee amputation</td>
<td>27 (6.3%)</td>
<td>74 (10.3%)</td>
</tr>
<tr>
<td>Above knee amputation</td>
<td>5 (1.2%)</td>
<td>23 (3.2%)</td>
</tr>
<tr>
<td>Revision of amputation stump</td>
<td>18 (4.2%)</td>
<td>29 (4.0%)</td>
</tr>
<tr>
<td>Total # procedures</td>
<td>427</td>
<td>719</td>
</tr>
</tbody>
</table>
Results

- 83 of 220 (37.7%) MRIs were impactful
- Significant increasing trend identified for total MRIs ordered over time (p=0.012), as well as for impact MRIs (p=0.020)
- The proportion of impact MRIs to total MRIs remained similar year-to-year (p=0.43)

### MRIs over time

<table>
<thead>
<tr>
<th>Year</th>
<th>Total MRIs</th>
<th>Impact MRIs</th>
<th>MRI cost (avg.)</th>
<th>Effective Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>14</td>
<td>4</td>
<td>3476.62</td>
<td>12168.17</td>
</tr>
<tr>
<td>2010</td>
<td>20</td>
<td>4</td>
<td>3770.66</td>
<td>18853.30</td>
</tr>
<tr>
<td>2011</td>
<td>30</td>
<td>14</td>
<td>3998.40</td>
<td>8568.00</td>
</tr>
<tr>
<td>2012</td>
<td>31</td>
<td>11</td>
<td>4207.31</td>
<td>11856.96</td>
</tr>
<tr>
<td>2013</td>
<td>22</td>
<td>12</td>
<td>4905.33</td>
<td>8993.11</td>
</tr>
<tr>
<td>2014</td>
<td>59</td>
<td>25</td>
<td>5161.31</td>
<td>12180.69</td>
</tr>
<tr>
<td>2015</td>
<td>58.7</td>
<td>17.3</td>
<td>4991.62</td>
<td>16936.88</td>
</tr>
</tbody>
</table>
Results

- Average MRI cost increased significantly ($p=0.037$)
- No significant trend found for effective MRI cost ($p=0.950$)
Conclusions

• 144 out of 543 patients diagnosed with osteomyelitis of the foot and ankle underwent MRI

• No significant difference found in operative rate between MRI and non-MRI cohorts

• 83 out of 220 performed MRIs were impactful

• Effective cost of impact MRI ranged from $8,568.00 to $18,853.30, roughly 2 to 5 times the average MRI cost

• This study suggests that the use of MRI adds cost while not necessarily changing treatment in patients diagnosed with foot and ankle osteomyelitis
References


