Impact of Resident Training Level on Radiation Exposure During Fixation of Proximal Femur Fractures

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INTRODUCTION

• Exposure to ionizing radiation has been linked to multiple adverse health effects and is an accepted occupational risk in the healthcare industry, especially among orthopaedic surgeons and trainees.
• Residents on an orthopaedic trauma service get up to 4x more radiation than any other subspecialty.1
• Minimally invasive techniques using fluoroscopy improving surgeon techniques but exposes to risk of radiation.2,3,4
• The ICRP recommends annual maximum whole body exposure of 2000 mrem and the NCRP recommends a maximum of 5000 mrem per year.3,4,10,11
• Until recently, no study has shown fluoroscopy exposed based on resident level in the operating room.

MATERIALS & METHODS

• We analyzed 866 cases of extra-capsular proximal femur fracture fixation with cephalomedullary nail implant at one academic institution from May 2011 – October 2018.
• Inclusion Criteria: All proximal femur fractures fixed with cephalomedullary nail implant.
• Exclusion Criteria: Intra-capsular fractures, fractures treated by other means (i.e. plate and screw construct, cannulated screws, etc.), and those fractures treated by other means (i.e. plate and screw construct, cannulated screws, etc.), and those
• Fluoroscopy times during fixation of subtrochanteric fractures (207.70 seconds), were longer than intertrochanteric (113.55 secs) and basicervical fractures (86.08 secs) (p < 0.001).
• PGY-4 residents (133.3 secs) were the longest on average, while cases with no residents were the shortest (94.91 secs).
• The attending only cases used significantly less fluoroscopy than those with PGY-2, PGY-4, and junior and senior resident combinations (p < 0.001).
• PGY-4, Combo Junior and Combo Senior groups all took significantly longer than PGY-3 (p = 0.04, p = 0.03, and p < 0.001 respectively)
• Junior residents (PGY-1 to 3) alone took significantly less fluoroscopy (116.9 ± 4.22 secs) when compared to the senior combination (131.1 ± 6.00, p = 0.016).

RESULTS

• 866 extra-capsular proximal femur fractures fixed by cephalomedullary nail construct.
• Fluoroscopy times during fixation of subtrochanteric fractures (207.70 seconds), were longer than intertrochanteric (113.55 secs) and basicervical fractures (86.08 secs) (p < 0.001).
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<table>
<thead>
<tr>
<th>Resident Involvement</th>
<th>Cases</th>
<th>Average Fluoro Time (secs)</th>
<th>vs. No Resident (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGY-1</td>
<td>22</td>
<td>129.0 ± 25.57</td>
<td>&gt; 0.999</td>
</tr>
<tr>
<td>PGY-2</td>
<td>178</td>
<td>123.9 ± 15.34</td>
<td>&gt; 0.999</td>
</tr>
<tr>
<td>PGY-4</td>
<td>128</td>
<td>104.4 ± 5.39</td>
<td>&gt; 0.999</td>
</tr>
<tr>
<td>PGY-5</td>
<td>68</td>
<td>133.3 ± 4.14</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Combo Junior</td>
<td>48</td>
<td>115.3 ± 6.27</td>
<td>0.124</td>
</tr>
<tr>
<td>Combo Senior</td>
<td>87</td>
<td>130.0 ± 7.66</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>No Resident</td>
<td>222</td>
<td>121.0 ± 6.01</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Junior</td>
<td>123</td>
<td>94.91 ± 9.9</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

Table & Figure 1. Number of cases performed by resident level and average fluoroscopy time by resident level

• One-way and two-way ANOVA tests were used for the statistical analysis. P-values less than 0.05 were considered statistically significant.

CONCLUSION

• Is radiation exposure putting our residents at risk?
• Long cephalomedullary nails and subtrochanteric fracture patterns required the most fluoroscopy.
• When two or more residents that collaborated to implant a cephalomedullary nail, fluoroscopy times were increased.
• More experienced residents and attending surgeons should be prepared to take more active roles in more complex cases to help reduce radiation exposure.
• Advocate and educate for more judicious use of fluoroscopy during cases.
• Future studies that include calibrated radiation measurements as well as measuring personal protective equipment’s impact can help to better identify further safety measures that should be used to better protect our residents and other operating room personnel.

REFERENCES