Damage Control Orthopaedics: Variability of Construct Design for External Fixation of the Lower Extremity and Implications on Cost

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Disclosures

Presentation Title: Damage Control Orthopaedics: Variability of Construct Design for External Fixation of the Lower Extremity and Implications on Cost

Presenter’s Name: John Y. Kwon, MD

My disclosure is in the Final AOFAS Mobile App.

I have no potential conflicts with this presentation.
Background

• A common use of external fixation is for the expeditious, temporary stabilization of long bone fractures in the setting of “damage-control” orthopaedics (DCO)

• A countless number of constructs exist & the requirements for external fixation in the setting of DCO differ from definitive fixation

• In an era of increasing awareness of cost containment, an external fixator construct should be adequately constructed for its intended purpose without the additional of unnecessary components which may only increase cost without any additional benefit
Objective

• To evaluate the relative cost of external fixator constructs applied for DCO purposes
• We also sought to evaluate physicians’ understanding of external fixator component cost

Hypothesis

• There is a wide range of external fixator constructs applied in the DCO setting
• A knowledge gap in physician understanding of external fixator component cost exists
Methods

• Participants were asked to apply an external fixator for 3 separate fracture patterns in DCO setting on a full length lower extremity Sawbones model (Sawbones, Vashon Island, Washington)

• 19 physicians (9 PGY-4 residents, 5 PGY-5 residents, 2 orthopaedic trauma fellows and 3 orthopaedic staff traumatologists) participated

• Each participant was provided a Synthes large external fixator set (Synthes, Inc, West Chester, PA)

• Total construct cost was calculated

• Participants provided an estimate of the cost of each component in a fill-in format survey

• All constructs were evaluated by an orthopaedic staff traumatologist for minimal adequacy of construct stability
Results

Construct Cost

• Average total cost of external fixator construct per fracture was $5252 (± $1798).

• The tibial plafond construct cost the most ($5622 ± $1545), followed by the tibial plateau construct ($5161 ± 2109) and femur fracture construct ($4974 ± $1729).

• The large ex-fix combination clamp was the major contributor to cost for each construct.

A. Multi-pin clamp

B. Combination clamp
<table>
<thead>
<tr>
<th>Construct</th>
<th>Minimum Spent ($)</th>
<th>Maximum Spent ($)</th>
<th>Average Cost ($)</th>
<th>Standard Deviation ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0mm Self-drilling schanz screw 80mm thrd/200mm</td>
<td>506</td>
<td>1012</td>
<td>817</td>
<td>249</td>
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<tr>
<td>6.0mm transfixation pin 225mm</td>
<td>0</td>
<td>386</td>
<td>68</td>
<td>100</td>
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<tr>
<td>Large ex-fix 11mm crbn fbr rod 300mm / mr-conditional</td>
<td>348</td>
<td>1392</td>
<td>684</td>
<td>279</td>
</tr>
<tr>
<td>Large ex-fix pin clamp mr-conditional / 6-position</td>
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<td>1346</td>
<td>35</td>
<td>198</td>
</tr>
<tr>
<td>Large ex-fix multi-pin clamp mr-conditional / 4-position</td>
<td>0</td>
<td>4052</td>
<td>960</td>
<td>1002</td>
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<tr>
<td>Large ex-fix combination clamp mr-conditional</td>
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<td>7568</td>
<td>2689</td>
<td>2295</td>
</tr>
<tr>
<td>Total Cost</td>
<td>$1898</td>
<td>$9311</td>
<td>$5252</td>
<td>$1798</td>
</tr>
</tbody>
</table>

Table 1. The largest contributor to external fixator construct cost was the Large Ex-Fix Combination Clamp mr-conditional
Results

Cost Survey

• The respondents’ cost estimations to the actual cost of components was compared

• The cost of the 5.0mm self-drilling Schanz pin and the large ex-fix combination clamp were the most highly underestimated components
  – 25% and 22% of their actual cost, respectively

• Respondents most closely estimated the cost of the 11mm carbon fiber rods
  – The average estimate was 61% of the actual cost
Component Selection and Cost Savings

Significant cost savings can be obtained when the combination clamp is substituted for multi-pin clamp

Knee-spanning ex fix with Combo Clamps ($7732)

Knee-spanning ex fix substituting Multi Pin Clamps ($3386)
Conclusion

• In both damage control and definitive fixation situations, innumerous construct designs exist

• Minor changes in component selection can significantly impact construct cost

• Once adequate stability is achieved, additional components may only increase cost without any additional benefit

• Knowledge of component cost is low among orthopaedic surgery staff surgeons and trainees.