An Analysis of Cost for Autologous Bone Graft For Foot and Ankle Surgery
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Introduction
- Autogenous bone graft is currently the gold standard for augmenting bone repair and fusion procedures of the foot and ankle.
- The incidence of complications and postoperative morbidity following bone graft harvest are high and can result in increased surgical time and hospital stays.
- Bone healing/regeneration requires 3 essential cellular qualities:
  - Osteoconduction = a bony surface/matrix scaffold that permits new bone growth on the surface and/or into its structure.
  - Osteoinduction = recruiting and stimulating stem cells and progenitor cells necessary to achieve the critical mass of cells necessary to form a repair callus.
  - Osteogenesis = the process whereby new bone is formed by osteoblastic stem cell activity and differentiation of progenitor cells into osteoblasts along an osteoblastic pathway.

Balancing Patient Outcomes and Costs

"We have gone from believing that financial considerations should have no bearing on doctors’ clinical judgment to thinking that they should be central to it."

Disclosures
- Nicholas Abidi, MD, presenting author
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Introduction
- Current “gold-standard” utilizes autogenous bone graft harvest for foot and ankle procedures
  - Iliac crest bone graft (ICBG)
  - Proximal tibia
  - Distal tibia
  - Calcaneus
  - Local bone graft (LBG)
- No multicenter studies currently assess the incremental costs and budgetary impact of ICBG or LBG harvest in foot and ankle procedures

Study Purpose and Goal
- This study applies an interactive budget impact model (BIM) to assist surgeons and hospitals with cost/benefit analyses of:
  - Incremental costs associated with ICBG and LBG
  - Additional costs associated with graft site enhancers
  - Utilization of an orthobiologic bone graft substitute
- Facilitating informed decision-making through the application of comparative clinical and economic value assessments of competing interventions.
Materials and Methods

- Development of the interactive budget impact model included:
  - Critical review of literature related to bone graft harvest in foot and ankle procedures
  - Survey of 10 US-based AOFAS/AAOS surgeons in academic and private practice
  - Results from a 434-patient clinical study
  - Review by six end-users representing 15 hospitals to incorporate the Canadian hospital perspective; the country for which the model was developed

- The Canadian health care system represents a generalized hospital budgetary model due to the relative absence of a privatized health insurance system.

### Ten US Surgeon Survey Resource Inputs

<table>
<thead>
<tr>
<th>Medical Resource</th>
<th>Blue Crest (N=7)</th>
<th>Local Donor Site (N=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating room time (minutes)</td>
<td>37.9 (17.0)</td>
<td>22.1 (21.6)</td>
</tr>
<tr>
<td>Recovery room time (minutes)</td>
<td>25.0 (12.3)</td>
<td>3.5 (0.4)</td>
</tr>
<tr>
<td>Room &amp; board time, inpatient (days)</td>
<td>0.8 (0.6)</td>
<td>0.0 (0.0)</td>
</tr>
<tr>
<td>Room &amp; board time, outpatient (hours)</td>
<td>—</td>
<td>0.4 (0.7)</td>
</tr>
<tr>
<td>% of patients requiring backfill of donor site</td>
<td>7.9 (10.8)</td>
<td>38.5 (33.1)</td>
</tr>
<tr>
<td>% of patients requiring autograft extender</td>
<td>8.9 (11.6)</td>
<td>17.7 (18.1)</td>
</tr>
</tbody>
</table>

### Incremental Costs of Bone Graft Harvest

**Calculating the Cost Impact of Complications**

- **Complication Costs**
  - Calculation of costs for bone graft harvest with autograft, allograft, and synthetic bone substitutes.
  - Cost analysis for complications such as postoperative infection, nonunion, and graft failure.

### Budget Impact Comparison

**Autograft Harvest vs. Orthobiologic Graft Substitute**

- **Inputs and Results**
  - Comparison of costs between autograft harvest and orthobiologic graft substitute.
  - Cost savings and budget impact analysis for different replacement scenarios.
Conclusions

- Must weigh many factors when deciding between autograft bone harvest vs. orthobiological bone graft substitute vs. allograft/synthetic bone graft substitute.
- Both ICBG and LGB carry notable incremental costs related to OR time, length of stay, complications, and short- and long-term patient experience with graft harvest site issues.
  - Autograft is not free.
  - Base incremental costs associated with ICBG and LGB harvest from the budget impact model begin at $3,601 CAD and $1,155 CAD, and can likely be higher depending on actual surgeon practice and actual hospital costs.
  - Supplemental material, which should be considered in all fusion cases, adds to the overall cost, yet may not provide the full cost complement of bone healing triad elements.
- Orthobiologic bone graft substitute may carry a higher up front acquisition cost, but overcomes the disadvantages of supplemental bone graft materials and autograft bone harvest, yet can yield per-case and annualized cost savings when all component costs are considered.