The Hidden Cost of Wound Healing Treatments: A Cost Analysis of Epidermal Harvester, Unna Boot Wraps, and Minced Tissue Grafting

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Abstract

Background: Chronic wound care is a growing industry expected to reach $15 to $22 billion by 2024. New approaches are continually introduced and many incur a high hidden cost to the hospital and healthcare system.

Objective: To determine the true costs of three wound healing approaches by analyzing the cost, reimbursement, and net hospital proceeds of: traditional Unna boot wraps, minced grafting, and Cellutome™ (KCI, San Antonio TX) epidermal harvester.

Methods: A cost analysis of 3 studies (n=141), each using a different wound treatment method: Epidermal harvester (n=99), Unna boot (n=12), minced grafting (n=30). Healing times and results are obtained from those studies, reimbursement to the hospital is based on CPT codes, cost of equipment and autoclaving is based from the DHMC cost center, and cost of nurses is based on a combination of the National Bureau of Labor and the average nurse time for that visit type at DHMC.

Results: The profit to the hospital for epidermal harvester, minced graft, and Unna boots are $226.00, $589.08, and $110.00 respectively. The average cost to the hospital for epidermal harvester, minced graft, and Unna boot are $488.29, $125.21, and $288.58, respectively.

Conclusion: The most economic method is minced grafting with an average profit to the hospital of $589.08, followed by the epidermal harvester with an average profit to the hospital of $226.00.

Main message

- Increasingly numerous wound healing technologies make it difficult for hospitals and physicians to select the optimal treatment methodology, both based on cost and effectiveness
- Data from our academic center indicates that the most economic method is minced grafting with an average profit to the hospital of $589.08, followed by the epidermal harvester with an average profit to the hospital of $226.00
- The profit to the hospital for epidermal harvester, minced graft, and Unna boot are $226.00, $589.08, and $110.00 respectively. The average cost to the hospital for epidermal harvester, minced graft, and Unna boots are $488.29, $125.21, and $288.58, respectively.

Research questions

- How would the cost analysis change base on different age groups?
- How would the cost analysis change based on different wound sizes?
- How will the changing healthcare system affect the cost, reimbursement, and profit to the hospital in the future?

Keywords: Wound healing; Cost analysis

Introduction

Chronic wound care is a growing industry expected to reach $15 to $22 billion by 2024 and consists of myriad epidermal grafting devices, dressings, and enzymatic agents to facilitate wound healing [1,2]. Many approaches incur a high hidden cost to the hospital and healthcare system. This study aimed to determine the true costs of three wound healing approaches by analyzing the cost, reimbursement, and net hospital proceeds of: traditional Unna boot wraps, minced grafting, and Cellutome™ (KCI, San Antonio TX) epidermal harvester.

Materials and Methods

Hospital reimbursement was determined by Common Procedural Terminology (CPT® AMA 2019) codes. Cost to the hospital included:
equipment and supply cost, cost of nursing for follow-up visits, and surgical equipment autoclave cost that account for the different hospital visits. Nursing cost was based on the U.S. Bureau of Labor Statistics average hourly wages for registered nurses. Nursing time per visit was based on historic data from our academic center. Cost of equipment and surgical tray autoclaving was derived from average cost per instrument at our academic center. Reimbursement for the epidermal harvester and minced graft is $714.29 (CPT 15110). Reimbursement for traditional Unna boot wrap is $28.47 per visit (CPT code 29580).

Results

The average cost to the hospital for epidermal harvester, minced graft, and Unna boots are $488.29, $125.21, and $288.58, respectively. Largest cost contributors to each method are: epidermal harvester consumable (72% of total cost), minced burrow graft suture (41%), Unna boot cost of nursing (56%). The profit to the hospital for epidermal harvester, minced graft, and Unna boot are $226.00, $589.08, and $110.00 respectively. The numbers of follow-up visits are based on average healing times [3-6]. Table 1 summarizes these comparisons.

Table 1: Cost analysis and study details.

<table>
<thead>
<tr>
<th>Study</th>
<th>Epidermal Harvester</th>
<th>Unna Boot</th>
<th>Minced Graft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>($488.29)</td>
<td>($288.58)</td>
<td>($125.21)</td>
</tr>
<tr>
<td>% of Minced Graft</td>
<td>39%</td>
<td>230%</td>
<td>100%</td>
</tr>
<tr>
<td>Reimbursement</td>
<td>$714.29</td>
<td>$398.58</td>
<td>$714.29</td>
</tr>
<tr>
<td>% of Minced Graft</td>
<td>100%</td>
<td>56%</td>
<td>100%</td>
</tr>
<tr>
<td>Profit</td>
<td>$226.00</td>
<td>$110.00</td>
<td>$589.08</td>
</tr>
<tr>
<td>% of Minced Graft</td>
<td>38%</td>
<td>19%</td>
<td>100%</td>
</tr>
<tr>
<td>Average Healing Time (Weeks)</td>
<td>5.91</td>
<td>14</td>
<td>3.13</td>
</tr>
<tr>
<td>% of Minced Graft</td>
<td>189%</td>
<td>447%</td>
<td>100%</td>
</tr>
<tr>
<td>Number of wounds used in analysis</td>
<td>99</td>
<td>21</td>
<td>30</td>
</tr>
<tr>
<td>Average wound size (cm²)</td>
<td>27.8</td>
<td>12.63</td>
<td>53.33</td>
</tr>
<tr>
<td>Mean age of patient</td>
<td>63.12</td>
<td>62.3</td>
<td>36.36</td>
</tr>
<tr>
<td>Number of patients</td>
<td>99</td>
<td>12</td>
<td>30</td>
</tr>
</tbody>
</table>

Discussion

Both epidermal harvester and pinch graft methods are forms of epidermal skin grafting that cause minimal to no donor site morbidity [2]. Free hand methods are used for smaller wounds, as larger wounds tend to require powered dermatomes, such as the epidermal harvester, to produce uniformly sized grafts [2]. In addition to quicker healing times, the auto grafting methods also have lower rates of graft failure: 20% compared to 28.6% with minced grafts [3].

The most economic method is minced grafting, followed by the epidermal harvester, which generates less than half of the former’s net proceeds to the hospital. The epidermal harvester (average healing time: 3.53 weeks (95% c.i. 3.18-7.88); average profit to hospital: $226.00) and minced grafting (average healing time: 3.13 weeks ± 2.42 days; average profit to hospital: $589.08) result in improved healing while maximizing profit. The former's longer healing time may be due to average patient age nearly double that of the latter, but their average wound size is only half. In fact, the methods with the shortest healing times treated the largest average wound sizes, further indicating the effectiveness of minced grafting. Due to the low cost of consumables and the few necessary follow-ups, minced grafting is the most economic ulcer treatment method (cost per patient: 26% of epidermal harvester, 43% of Unna boot), decreasing the burden on the entire system. The epidermal harvester, ranking second, may be optimal for larger wounds, but couples a high consumable cost and need for more postoperative visits (2.8 averages additional). Unna boots, the slowest method, are the least financially viable (average healing time: 14 weeks 4; average net profit to hospital: $110). This analysis is based on average wound healing times and institutional autoclaving costs, so individual variations must be taken into account when assessing treatment decisions. Another limitation to this investigation is variation in patient age among treatment methods. Large scale randomized control studies are therefore warranted to further investigate these methods.

Author Contributions

Shu Ting Liang and Brian Simmons had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Liang, Simmons, Matthew LeBoeuf. Acquisition, analysis and interpretation of data: Liang, Simmons. Drafting of the manuscript: Ting and Simmons. Critical revision of the manuscript for important intellectual content: Liang, Simmons and LeBoeuf.

Statistical analysis

Liang. Obtained funding: N/A. Administrative, technical or material support: Simmons, Liang and LeBoeuf. Study supervision: LeBoeuf

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References