Use of Integra Dermal Matrix in the Treatment of Combat-Related Upper Extremity Soft Tissue Injuries

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Introduction

• Soft tissue reconstruction of the upper extremity is a challenging task.
  • Critical to provide robust, mobile, soft tissue coverage as soon as is safe following injury
  • Limited local tissue
  • Pedicled & free flaps frequently employed

• In high-energy combat wounds (Image 1), coverage complicated by:
  • Wide zones of injury
  • Contamination
  • Impaired local perfusion
  • Metabolic disturbances
  • Coagulopathies.

• Integra Biayer (“Integra”)
  • Initially for burn treatment
  • Bovine tendon collagen and Crosslinked GAG
  • Expanded use in traumatic wounds
  • Limited reports for upper extremity injuries

• We review a cohort of patients with combat-related upper extremity injuries treated with Integra and autologous skin-grafting

Technique

1) Operative debridement
  • Every 48-72 hours
  • Negative pressure (NPWT) or sterile dressings
  • Timing of Integra placement at surgeon’s discretion

2) Integra grafting
  • Trimmed to size & secured to wound periphery
  • Dressing (NPWT where possible, fingers typically sterile dressing)
  • Extremely splinted to minimize shear stresses
  • Dressings changed every 3 days, incorporation assessed (Image 2)

3) Autologous skin graft (Image 3)
  • NPWT/sterile dressing applied
  • Take assessed POD#5

Results

• Sixty-one patients (69 wounds) met inclusion criteria
  • Mean age 24.6 years (range 19-38)
  • 100% male
  • 48% pre-injury history of tobacco use
  • 95% sustained IED blast injuries
  • Associated injuries were common (Fig 1)

• Wound size, location and treatment (Table 1)

• Infection
  • Six wounds with culture-positive infection
  • 50% polymicrobial, 33% Enterobacter, 17% Mucor

• Skin grafting
  • 16 wounds treated with FTSG – All healed
  • 53 wounds treated with STSG
    • 93% excellent graft take
    • 4% initial take 70-90%
    • Treated with local wound care & healed
    • 4% initial graft failure
    • 1 re-grafted and healed
    • 1 amputation

Conclusions

• 97% of combat-related upper extremity wounds healed after treatment with serial debreadment, Integra placement, and autologous skin grafting.

• Compares favorably with previously reported rates of 80-98% for upper extremity injuries treated with Integra & skin grafting.1,2

• Comparable to the results of two smaller series (94 & 100%) reporting Integra and skin grafting in the treatment of combat wounds.4,5

• We believe that this study validates the use of Integra in the treatment of traumatic upper extremity soft tissue wounds.

• Further study is needed to assess the long term functional outcomes of Integra treatment (Image 4) relative to traditional reconstructive procedures.

Methods

• Retrospective review of 61 active duty patients
  • Combat-related injuries of the upper extremity
  • Treated with Integra and autologous split- or full-thickness skin grafting (STSG and FTSG)

• Outcomes
  • Primary outcome: Wound healing
  • Secondary outcome: Percentage take of skin grafts
  • Effects of demographic & injury factors on healing

Table 1: Wound characteristics and treatment by region

<table>
<thead>
<tr>
<th>Wound Location</th>
<th>Distribution (n=69)</th>
<th>Size in cm (Median [range])</th>
<th>Full thickness skin grafts (n=53)</th>
<th>Partial thickness skin grafts (n=16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finger(s)</td>
<td>33 (49%)</td>
<td>6.5 (3-25)</td>
<td>1 (2%)</td>
<td>12 (75%)</td>
</tr>
<tr>
<td>Hand</td>
<td>20 (30%)</td>
<td>20.5 (16-128)</td>
<td>5 (9%)</td>
<td>3 (19%)</td>
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<tr>
<td>Forearm/wrist</td>
<td>17 (25%)</td>
<td>105 (4-374)</td>
<td>36 (68%)</td>
<td>1 (6%)</td>
</tr>
<tr>
<td>Arm/elbow</td>
<td>5 (7%)</td>
<td>500 (500-832)</td>
<td>5 (9%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Amputation</td>
<td>6 (9%)</td>
<td>26.5 (20-192)</td>
<td>6 (11%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Total</td>
<td>69 (100%)</td>
<td>56 (3-832)</td>
<td>53 (100%)</td>
<td>16 (100%)</td>
</tr>
</tbody>
</table>

Figure 1 – Associated Injuries

Figure 2: Upper extremity radiograph with multiple fractures and diffuse embedded shrapnel

Figure 3 (Left): Upper extremity soft tissue injury after Integra placement

Figure 4: Representative image, 1 year post-treatment. Finger flexion & extension.

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