Challenges of the soft tissue envelope

Joseph R. Hsu, M.D.
Orthopaedic Trauma
USAISR/SAMMC San Antonio, TX
Carolinas Medical Center Charlotte, NC
Disclaimer

- The views/opinions expressed in this presentation do not reflect the views/opinions of the United States Government, the Department of Defense, or the U.S. Army
Disclosure

Research support from a company or supplier as a PI
- Combat Casualty Care Research Program
- The Major Extremity Trauma Research Consortium (METRC)
- Clinical Rehabilitative Medicine Research Program
- The Geneva Foundation

Board member/committee appointments for a society
- Society of Military Orthopaedic Surgeons, BOD
- Limb Lengthening Research Society, BOD
- Orthopaedic Trauma Association, Military Committee
- The Major Extremity Trauma Research Consortium (METRC), Executive Committee
- Skeletal Trauma Research Consortium (STReC), Director
- AAOS, BOS Research Committee
Outline

- The problem
- Degrees of the challenge
- Reconstruction
Special Thanks
Soft tissue complications and infection common

**TABLE 2. Most Common Readmission DRG Codes in This Cohort of Injured Service Members**

<table>
<thead>
<tr>
<th>Diagnosis Related Group (DRG) Description</th>
<th>DRG</th>
<th>Number</th>
<th>Percentage</th>
<th>Extremity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wound debridement &amp; skin graft</td>
<td>217</td>
<td>54</td>
<td>8%</td>
<td>96%</td>
</tr>
<tr>
<td>Local excision and removal of internal fixation devices except hip and femur</td>
<td>538</td>
<td>33</td>
<td>5%</td>
<td>100%</td>
</tr>
<tr>
<td>Amputation for musculoskeletal system &amp; connective tissue disorders</td>
<td>213</td>
<td>31</td>
<td>5%</td>
<td>100%</td>
</tr>
<tr>
<td>Lower extremity &amp; humerus procedures except hip, foot, femur</td>
<td>219</td>
<td>29</td>
<td>4%</td>
<td>100%</td>
</tr>
<tr>
<td>Wound debridements for injuries</td>
<td>440</td>
<td>15</td>
<td>2%</td>
<td>93%</td>
</tr>
<tr>
<td>Aftercare without history of malignancy</td>
<td>466</td>
<td>14</td>
<td>2%</td>
<td>93%</td>
</tr>
<tr>
<td>Other musculoskeletal system &amp; connective tissue operating room procedures</td>
<td>234</td>
<td>14</td>
<td>2%</td>
<td>29%</td>
</tr>
<tr>
<td>Other musculoskeletal system &amp; connective tissue diagnosis</td>
<td>256</td>
<td>14</td>
<td>2%</td>
<td>93%</td>
</tr>
<tr>
<td>Other ear, nose, mouth &amp; throat operating room procedures</td>
<td>63</td>
<td>13</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td>Postoperative &amp; post-traumatic infections</td>
<td>418</td>
<td>13</td>
<td>2%</td>
<td>100%</td>
</tr>
<tr>
<td>Depressive neuroses</td>
<td>427</td>
<td>13</td>
<td>2%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Rehospitalization After Combat Injury

_Brendan D. Masini, MD, Brett D. Owens, MD, Joseph R. Hsu, MD, and Joseph C. Wenke, PhD_

_(J Trauma. 2011;71: S98–S102)_
Infectious Complications and Soft Tissue Injury Contribute to Late Amputation After Severe Lower Extremity Trauma

Jeannie Huh, MD, Daniel J. Stinner, MD, Travis C. Burns, MD, and Joseph R. Hsu, MD; Late Amputation Study Team

The Journal of TRAUMA® Injury, Infection, and Critical Care • Volume 71, Number 1, July Supplement 2011

- Type III open tibia
  - 16.9% early amputation
  - 5.2% late amputation

- Late amputations
  - More flaps
  - Higher rates infection
    - Deep soft tissue
    - Osteomyelitis
  - More re-operations
The Good, The Bad, and The Ugly

- **Good**
  - Well perfused
  - Mobile

- **Bad**
  - Compromised perfusion
  - Immobile (scar)

- **Ugly**
  - Chronic defect

Factors: Location, host
Principles of Free Tissue Transfer in Orthopaedic Practice

Journal of the American Academy of Orthopaedic Surgeons
Richard Lawson, MBBS, FRACS
L. Scott Levin, MD, FACS
Volume 15, Number 5, May 2007

Figure 4

Free tissue transfer
eg. latissimus dorsi flap

Regional flaps
eg. posterior interosseous

Local flap
eg. rotational/transposition

Skin graft

Secondary closure

Primary closure

The reconstructive ladder.
The Good

Well perfused, mobile
Compromised perfusion, immobile (scar)
The Ugly

Chronic defect
Treatment protocol for chronic osteomyelitis, modified in 1990 with the antibiotic bead pouch and, in 2002, with vacuum-assisted wound closure protocols (VAC). Delayed closure techniques include all of the techniques used in wound closure.
The Good
Ellipse out skin, ream, abx nail
The Bad
Can be unpredictable

Compromised perfusion, immobile (scar)
Compromised perfusion, immobile (scar)
R.D.
R.D.
Compromised perfusion, immobile (scar)
R.D.
The Ugly

Chronic defect
Local vs. Free flap

http://www.osteomyelitis.com/
Does the Zone of Injury in Combat-Related Type III Open Tibia Fractures Preclude the Use of Local Soft Tissue Coverage?

Travis C. Burns, MD,* Daniel J. Stinner, MD,* Daniel R.Possley, DO,* Andrew W. Mack, MD,† Tobin T. Eckel, MD,† Benjamin K. Potter, MD,† Joseph C. Wenke, PhD,‡ and Joseph R. Hsu, MD,‡ the Skeletal Trauma Research Consortium (STRReC)

<table>
<thead>
<tr>
<th>Complications</th>
<th>Rotational</th>
<th>Free</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reoperation</td>
<td>30</td>
<td>64</td>
<td>0.05</td>
</tr>
<tr>
<td>Amputation</td>
<td>9</td>
<td>36</td>
<td>0.03</td>
</tr>
<tr>
<td>Coverage failure</td>
<td>7</td>
<td>27</td>
<td>0.08</td>
</tr>
</tbody>
</table>
Pernicious Anemia -- Neuropathy
Chronic defect
Weight-Bearing X-ray
Acute Shortening and Primary Closure
Maybe Not So Smart
Infected anterolateral plate pilon
Papineau Technique


Simultaneous bone and soft tissue reconstruction

Combined Single-Stage Osseous and Soft Tissue Reconstruction of the Tibia With the Ilizarov Method and Tissue Transfer

Michael D. McKee, MD, FRCS(C),* Daniel J. Yoo, BSc, MD,* Rad Zdero, PhD,* Marc Dupere, MD,† Lisa Wild, BScN,* Emil H. Schemitsch, MD, FRCS(C),* and James Mahoney, MD, FRCS(C)†

(J Orthop Trauma 2008;22:183–189)

Simultaneous Treatment of Tibial Bone and Soft-tissue Defects With the Ilizarov Method

S. Robert Rezbruch, MD,* Adam M. Weitzman, B.A.; J. Tracey Watson, MD;‡ Paul Freudigman, MD,§ Howard V. Katz, MD,§ and Svetlana Ilizarov, MD*

(J Orthop Trauma 2006;20:197–205)

Bifocal Compression-Distraction in the Acute Treatment of Grade III Open Tibia Fractures With Bone and Soft-Tissue Loss

A Report of 24 Cases

Cengiz Sen, MD,* Mehmet Kocaoglu, MD,† Levent Erkalp, MD,‡ Mahir Gulsen, MD,‡ and Murat Cinar, MD†

(MILITARY MEDICINE, 174, 8:38, 2009)

Shortening and Angulation for Soft-Tissue Reconstruction of Extremity Wounds in a Combat Support Hospital

MAJ(P) Joseph R. Hsu, MC USA; CPT Michael J. Beltran, MC USA;† Skeletal Trauma Research Consortium (STReC)

Composite Bone and Soft Tissue Loss Treated With Distraction Histiogenesis

CPT Michael J. Beltran, MD,† CPT Leah M. Ochoa, MD,‡ MAJ Richard M. Graves, MD,‡ MAJ(P) Joseph R. Hsu, MD,‡ and the Skeletal Trauma Research Consortium

The Gradual Expansion Muscle (GEM) Flap

Michael J. Beltran, MD§, James A. Blair, MD§, Christopher R. Rathbone, PhD†, and Joseph R. Hsu, MD†

Accepted JOT
The Good, The Bad, and The Ugly

- **Good**
  - Well perfused
  - Mobile

- **Bad**
  - Compromised perfusion
  - Immobile (scar)

- **Ugly**
  - Chronic defect

Factors: Location, host
Treatment protocol for chronic osteomyelitis, modified in 1990 with the antibiotic bead pouch and, in 2002, with vacuum-assisted wound closure protocols (VAC). Delayed closure techniques include all of the techniques used in wound closure.
Thank You