Updates on Upper Extremity Amputation Rehabilitation

Jay Pyo, D.O.
January 30, 2015
Medical Director, Polytrauma Amputation Network Site (PANS)
Assistant Chief, Physical Medicine and Rehabilitation Service
VA San Diego Healthcare System
Objectives

- Scope of upper extremity amputations
- VA’s Mission
- Development of Clinical Practice Guideline
- Case Reports
Scope of UEA

• 1.9 million persons with amputations (all levels).

• Majority of civilian UEA is the result of trauma
  ▪ 65 - 75% trauma
  ▪ 3% dysvascular

Scope of UEA

• **Younger age** compared to those with dysvascular amputations
  ▪ 60% between ages of 21 and 64

• UEA estimated to comprise 35% of total amputation population
  ▪ 15-20% major limb loss

*Arch Phys Med Rehabil 2008;89:422-9.*
Scope of UEA

• More than **32,000 Veterans** with UEA
  • **18%** of the total VA amputation population (2000)
  
• **30%** of OEF/OIF/OND Service Members since 2001

VA Corporate Data Warehouse

Importance of the Upper Limb

• High visibility

• Body image

• Interaction with the environment and people (active and receptive)

• Means of communication

• Balance and coordination
Management Challenges

• Unique

• Other traumatic injuries
  • Burns
  • Fractures
  • Nerve injury
Management Challenges

• Replacement of upper limb function
  ▪ Sensory
  ▪ Fine/Gross motor

• Hand Dominance

• Pain
Management Challenges

Mental Health Considerations

- PTSD 66%
- Depression / Adjustment Disorders 46%
- Anxiety Disorders 38%
- Substance Abuse 16%

- Association with injury severity

- Longitudinal care is essential

JRRD. 2010;47(4):373-86.
• High rate of prosthetic limb dissatisfaction and abandonment

### Prosthetic Satisfaction

**Exhibit 36. Prosthetic Satisfaction of OEF/OIF/OND Veterans with Amputations.**

<table>
<thead>
<tr>
<th>Prosthetic Satisfaction</th>
<th>Lower Limb Amputation</th>
<th>Upper Limb Only Amputation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># of Participants</td>
<td>Estimates (95% C.I.) of OEF/OIF/OND Veterans (%)</td>
</tr>
<tr>
<td>Appearance</td>
<td>58</td>
<td>98.0 (94.81, 99.27)</td>
</tr>
<tr>
<td>Reliability</td>
<td>58</td>
<td>90.9 (77.01, 96.75)</td>
</tr>
<tr>
<td>Fit</td>
<td>58</td>
<td>88.3 (75.53, 94.84)</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td>58</td>
<td>90.9 (77.01, 96.75)</td>
</tr>
</tbody>
</table>

# Prosthetic Satisfaction

## # of Prosthetic Limbs Prescribed

<table>
<thead>
<tr>
<th></th>
<th>Vietnam</th>
<th>OIF/OEF</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First Year</strong></td>
<td>1.2</td>
<td>3.0</td>
</tr>
<tr>
<td><strong>Subsequent Years</strong></td>
<td>0.1</td>
<td>0.5</td>
</tr>
</tbody>
</table>

## # Prosthetic Limbs rejected

<table>
<thead>
<tr>
<th></th>
<th>Vietnam</th>
<th>OIF/OEF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>23%</td>
<td>45%</td>
</tr>
</tbody>
</table>

*JRRD, Volume 47, Number 4, 2010.*
Scope of UEA

• 10% don’t get care when needed
• 20% don’t get rehab
• Outcomes not well defined
  ▪ Long term health (medical comorbidities)
  ▪ Skin conditions
  ▪ Use of assistive devices or technologies other than prosthesis
• Higher associated cost of trauma vs. dysvascular

Care of the Combat Amputee, Chapter 22, Sandra L Hubbard Winkler, PhD
Research limitations

- Patient variables
- Treatment variables
- Lack of predictability data for prosthesis use
- Lack of outcomes data
  - Prosthesis
  - Functional
  - Long term health
- Significant disparity within UEA and among all amputees
Functional Outcomes?

• Disability of Arm, Shoulder and Hand (DASH)
  ▪ Disability questionnaire

• Trinity Amputation and Prosthetics Experience Scales (TAPES)
  ▪ Social impact

• Orthotics and Prosthetics User Survey – Upper Extremity (OPUS-UE)
  ▪ Psychosocial
  ▪ Activity restriction
  ▪ Prosthesis satisfaction
  ▪ Pain (phantom and residual limb)
• No existing CPG for UEAR within VA and DoD

• Gaps in service across VA facilities and DoD

• Variations in care
  ▪ Expertise limited
  ▪ Advances in technology require greater levels of expertise and more specialized care

• Limited evidence or consensus support clinical decision-making
CPG Scope and Goals

• Promote an interdisciplinary care team approach that is patient-centered

• Develop clinical pathways that are consistent with current evidence-based rehabilitation methods

• Describe:
  ▪ Interventions for optimization of function
  ▪ the prosthetic prescription process,
  ▪ prosthetic training,
  ▪ ADL training (with and without a prosthesis),
  ▪ physical conditioning, and
  ▪ psychosocial rehabilitation
CPG Scope and Goals

• Provide framework of rehabilitation interventions to improve:
  ▪ patient outcomes
  ▪ reduce practice variation

• Provide care providers and other stakeholders easy-to-follow algorithm for delivery of care

• Establish priorities for future research efforts
Organization of Guideline

• Designed to:
  - Provide a quick access algorithm
  - Discuss important patient care themes
  - Detail each phase of care in upper limb amputation rehabilitation
Organization of Guideline

• Four phases of care:
  ▪ Perioperative
  ▪ Pre-prosthetic
  ▪ Prosthetic Training
  ▪ Lifelong Care
Organization of Guideline

• Includes Three Core Modules:
  ▪ essential elements of care within each Phase of Care
  • Core 1: The Care Team Approach
  • Core 2: Comprehensive Interdisciplinary Assessment
  • Core 3: Patient-Centered Care
Future Research Recommendations

• Validation and collection of outcomes data

• Practice-based evidence and comparative effectiveness studies.

• Pain management initiatives

• Most effective therapeutic protocols to improve prosthesis use and minimize rejection

• Which components terminal devices are associated with the best functional outcomes?
Future Research Recommendations

• What is the impact of advances in technology and treatment on the long-term functional outcomes?
Guideline Access and Resources

• UEAR CPG and other resources can be located at:

**Products:**
1. Full Clinical Practice Guideline
2. UEAR CPG Provider Summary
3. UEAR CPG Patient Summary
4. Provider Pocket Card
Case History 1

• 21-year-old male injured by an IED blast Dec 2010.
  ▪ Camp Bastion (Aghanistan)
  ▪ LRMC (Germany)
  ▪ NNMC (Washington DC)
  ▪ NMCSD (San Diego)
    • Outpatient care initiated Feb 2011
Case History 1

• Amputations:
  - Left hip disarticulation (large disfiguring pelvic H.O.)
  - Right transfemoral amputation
  - Left transmetacarpal amputation sparing the thumb, scapular free flap

• Other injuries:
  - Rhabdo
  - Bilateral testicular trauma/loss
  - Perineal trauma
  - Bilateral arm soft tissue trauma
  - Pulmonary contusion
  - TM perf
  - Heroic resuscitation
Prosthesis trials: Lower limbs

1) “Shorty” training prosthesis over 16 weeks.
   - Build strength, endurance etc.
   - Required hemi-walker (2-4 hours daily)

2) Bilateral C-legs and bilateral power knees trials failed (~10 weeks).
   - Power Knee activation caused trunk instability, loss of balance while walking, and the device was too heavy.

3) Single-axis left hip joint and bilateral manual locking knees (quick release knee joint) with a dynamic carbon fiber feet.
   - Safer/stable walking
   - Practical (e.g., entry and exit from a car, sitting in chair).
Prosthesis trials: Lower limbs
Prosthesis trials: Lower limbs
Prosthesis trials: Upper limb
Prosthesis trials: Upper limb
Prosthesis trials: Upper limb

• 6 months of intensive OT/Plastics/Ortho Hand
  ▪ debulking of the hand flap accommodate fit prosthetic hand

• Prosthesis designs:
  ▪ thermoplastic wrist splint with a finger-like projection
    • Thumb opposition
  ▪ myoelectric device
    • Custom socket with myoelectric fingers
  ▪ Utility glove for hand cycling/weight lifting

• Ultimately rejected hand prosthetics as inefficient.
  ▪ Independently don and doff lower extremity prosthesis
  ▪ Perform ADL and gross motor tasks more efficiently without it
Outcomes at Discharge

• Independent with activities of daily living (ADLs)
• Driving car with adaptive modifications
• Lower extremity prosthetisis use 50%/wheelchair use 50%
• Transition to Missoula VA intake Dec 2012.
• Pursuing recreational goals (hand cycling and swimming) weight loss
• Pursuing educational goals.
22-year-old male injured by an IED Dec 2011.

Amputations.
- Bilateral transfemoral amputations (left BKA revision to AKA)
- Left transhumeral amputation.

Other injuries.
- Soft tissue wounds
- Perineal wounds
- Diverting colostomy
- Testicular trauma/loss
- PE
- Mild TBI
Prosthesis trials: Lower limb

• “Shorty“ prosthesis, 8 weeks

• Bilateral full-length advanced microprocessor knees (X2/X3 knees).

• Completed 9 months postinjury:
  ▪ Ramps
  ▪ Stairs
  ▪ Running/snowboarding with specialized prostheses.
Prosthesis trials: **Lower limb**
Prosthesis trials: Upper limb
Prosthesis trials: Upper limb
Prosthesis trials: Upper limb

• Arm prosthesis trials:
  ▪ Conventional hybrid prosthetic arms:
    • Myo-elbow/body-powered TD
    • Body-powered elbow/myo TD
    • too heavy.
  ▪ “elbow-less” prosthesis
    • Axial load bearing stability
    • Stability with transfers
    • Limited degrees of freedom simpler to use
    • Adjustable wrist unit
    • Myo-TD
  ▪ No longer uses prosthesis.
    • Cosmesis?
Program Discharge Outcomes

- 15 months postinjury
  - Phase 4 completion
- Independent ADLs,
- Driving a car with adaptive modifications,
- Weaning off phantom pain medications.
- He continues using devices 12 to 15 hours/day
- Continuing education
Summary

• The CPG illustrates need for multidisciplinary approach during all phases of care.

• Identify need for access to care and utilization of appropriate technologies.

• Identifies need for consensus on outcomes measures

• Continue to proactively address gaps in care
THANK YOU!