Reconstruction and Restoration of the Genitourinary System after Contemporary Battlefield Urotrauma

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This presentation contains graphic pictures of injured genital organs which may be upsetting to some viewers.
• Battlefield genitourinary injury is not a new problem
• Published data has been limited:
  – ~65,000 published studies on “war,” “military medicine,” “military personnel,” or “battlefield” since 1947*
    • 75 (0.11%) pertaining to GU trauma*
  – U.S. military operations in Iraq and Afghanistan (2001-2014)
    • 2640 OIF/OEF articles in Medline*
    • ~1% pertaining to GU trauma*

*Medline search, September 2015
Growing Interest and Support for Urotrauma Care and Research

AFIRM

Bob Woodruff Foundation
High Impact Collaboration™

Intimacy after Injury

Therapeutic advances to alleviate the devastating impact of war injury on fertility and on physical and emotional intimacy.

sex & the military

The Other Invisible Wounds


Prepared by:
USC Center for Innovation and Research on Veterans & Military Families
CIRlearn
Battlefield GU Injury in the Lay Media

The New York Times

Penis Transplants Being Planned to Help Wounded Troops

By DENISE GRADY  DEC. 6, 2015

From left: Dr. W. P. Andrew Lee, Dr. Richard J. Roddett and Dr. Gerald Brandacher at Johns Hopkins Hospital in Baltimore this month. They hope to perform what will be the first penis transplant in the United States within a year. (Leser/For The New York Times)

Daily Mail.com

Now that’s a miracle: The baby born to hero soldier who was too injured to be a dad after being blown up by the Taliban
Growing Interest in GU Injury: What has Changed?

- Increasing frequency of GU injury
- Improved survivability of comorbid injuries
- Recognition and acceptance
Rising Proportion of US Casualties with GU Injury

Source: DCBI Report
Increased Severity → Lower Mortality

Source: J Trauma Acute Care Surg 2013
GU Injury: The Burden of Survival

Fleming et al. J Urol, 2009
Recognition of Genitourinary Trauma as an Emerging Problem

• Medical community
  – Society of GU Reconstructive Surgeons
  – Fellowship training programs

• Military
  – Subspecialists at most MEDCENs
  – Pelvic protective equipment

• Public
  – Media
  – Marketing
Defining the Magnitude of the Problem:

Initial Data from the Trauma Outcomes and Urogenital Health (TOUGH) Project
TOUGH Study Objectives

• Initial:
  – How many GU injuries during OIF/OEF?
  – What are the predominant GU organs injured?
  – How severe are the injuries?
• Ongoing collaborative study (SAMMC-ISR-UCD-UTHSCSA):
  – How were the injuries ultimately managed?
  – What are the long term outcomes?
    • Sexual function
    • Urinary function
    • Reproductive function
    • Psychological/emotional
  – What reconstructive and rehabilitative needs remain?
• Department of Defense Trauma Registry
  – Largest combat injury database in existence
  – All U.S. Military services represented
  – Injury data from in-theatre and CONUS medical records
  – Includes
    • Diagnoses and procedures
    • Injury Severity Scores (ISS)
• 1,387 U.S. service members with GU injury
  – Gender:
    • Male: 98.6%
    • Female: 1.4%
  – Injury Category
    • Battle: 88.6%
    • Non-battle: 11.4%
  – Mean Age: 25 years
Age at Time of Injury

94% of U.S. Service Members with GU injuries were ≤ 35 years old!
GU Injury Characteristics

• Branch of Service
  – Army: 68%
  – Marines: 27%
  – Air Force/Navy: 5%
• Injury Mechanism
  – Explosive: 74.1%
  – Non-explosive: 25.9%
• Severe GU Injury: 36.7%
• Died of Wounds: 5.3%
Relevant Comorbid Injury: Male Survivors

- Severe GU Injury (n=502)
- Less Severe GU Injury (n=865)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Severe GU Injury (%)</th>
<th>Less Severe GU Injury (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perineum</td>
<td>16%</td>
<td>6%</td>
</tr>
<tr>
<td>Colorectal</td>
<td>31%*</td>
<td>16%</td>
</tr>
<tr>
<td>Pelvic Fracture</td>
<td>32%*</td>
<td>21%</td>
</tr>
<tr>
<td>TBI</td>
<td>42%</td>
<td>39%</td>
</tr>
</tbody>
</table>

*Chi-square test  p<0.05
32% with any limb amputation (407 of 1,291)
- 30% lower extremity (nearly 75% at/above the knee)
- 12% upper extremity

At/Above the Knee Amputation

Unilateral

Bilateral

Severe GU Injury (n=502)
Less Severe GU Injury (n=865)

All p<0.05
GU Organs Injured: Male Survivors

- Scrotum
- Testis
- Penis
- Kidney
- Bladder
- Urethra
- Ureter

Categories:
- Severe
- Less Severe
Severe Genital Injury

• Higher overall injury severity
• Higher rate of comorbid injuries
  – Lower extremity amputation(s)
    • 41% vs. 21%
  – Colorectal injury
    • 31% vs. 16%
  – Massive transfusion
    • 54% vs. 30%
• Impact of injury severity on recovery/rehabilitation is poorly defined
  
  Fleming et al., 2011
Summary of TOUGH Cohort

- ~1,300 surviving service members with GU injury
  - Mostly male
- Genital injury most common
  - 75% of males with GU injury
- ~500 SMs with severe GU injury
  - Group at highest risk for urinary, sexual, and fertility complications
    - Direct effects of anatomical GU injury
    - Indirect effects of amputation, TBI, etc.
Management of Battlefield Genitourinary Injury
Management of Battlefield GU Injury

- Initial (hours to weeks):
  - Damage Control → stabilize, temporize, and evacuate
  - Drain/divert urine
  - Debride, irrigate, and dress external GU wounds
- Delayed (weeks to years):
- Long term (years +):


Initial Management of GU Injury

Evaluate wound under anesthesia
Debride clearly non-viable tissue
Reevaluate in OR every 48 hours

Clean wound with low pressure irrigation
Apply negative pressure dressing

Courtesy of COL James R. Jezior

Management of Battlefield GU Injury

• Initial (hours to weeks):

• Delayed (weeks to years):
  – Heal wounds
  – Preserve tissue
  – Return of function→ reconstructive/restorative surgery

• Long term (years +):
Heterogeneity of wounds
Algorithmic guidelines not feasible
Overarching surgical principles:
  - Preserve native tissue
  - Restore function
  - Optimize cosmesis
• 10 slides removed due to graphic, sensitive content
Total Phallic Loss

- Rare, <1% of DoDTR series
- Conventional phallic replacement:
  - Forearm phalloplasty
- Limitations of autologous phalloplasty:
  - Multi-stage operation
  - Need for penile prosthesis
- Limited data in blast injury population
  - Largest series → 3 patients
  - Prior forearm injury/amputation
Novel Approaches to Phallic Loss

- Techniques in development:
  - Regenerative medicine
  - Penile transplant
  - Risks of immunosuppression
- Significant barriers created by devastating effects of DCBI
  - Traumatic brain injury: 42%
  - Massive transfusion: 54%
  - High LE amputation: 34%
- Very few military candidates
Consequences of Devastating Testicular Injury

• More common than penile loss
  – Unilateral: 129 (9.4%)
  – Bilateral: 17 (1.2%)
  – Underestimate?

• Lifelong pharmacologic replacement
  – Costly. Risks?

• Loss of sperm production:
  – Cannot replace!
  – Pre-deployment sperm banking
  – Post-injury sperm salvage
  – Regenerative Medicine

• All show promise for fertility preservation after injury
Unique Considerations during GU Reconstruction in Polytrauma Patients

• Rigorous rehabilitation schedule
  – Convalescence after any surgery
  – Challenges with prosthesis fit after perineal/genital surgery
  – Post-injury rehab can take months→years!
    • Any interruption is a delay
• Coordinate with other surgeries (orthopedic, plastics, CRS)
• Limited donor skin
• Restoration of sexual function:
  – Patient at peak sexual performance pre-injury
  – Hand injury/amputation?
  – Narcotics, antidepressants, etc.
  – Colorectal injury, LE amputation, depression, PTSD, etc.
  – Partner support?
Management of Battlefield GU Injury

• Initial (hours to weeks):

• Delayed (weeks to years):

• Long term (years +):
  – Sexual rehabilitation
    • Medical, device, and/or surgical assistance
    • Psychological, spousal, and interpersonal support
  – Fertility treatment → costly!
    • DoD/TRICARE coverage for wounded warriors
    • Limited VA support
  – Revision surgery for recurrent functional or cosmetic problems
    • Lifetime follow up with GU reconstructive surgeons
Outcomes Following Battlefield Genitourinary Injury
• ~65,000 published studies on “war,” “military medicine,” “military personnel,” or “battlefield” since 1947*
  – 75 (0.11%) pertaining to GU trauma*

• None have examined long-term impact of GU injury on sexual, urinary, reproductive, and psychological outcomes
  – Civilian
  – Military

*Medline search, September 2015
• Qualitative study, 13 British soldiers with GU injuries
  – All with at least 1 limb amputation (11 w/ multiple)
  – 5 men with loss of both testicles
  – 10 men with penile injuries
• High importance of sexual function prior to injury
• Negative impact of GU injury:
  – 8 of 13: GU injury was “more important than losing their legs.”
  – 5 of 13: fertility concerns creating a strain on relationships
  – 9 of 13: GU injury negatively impacted sexual function
  – 2 of 13: Totally unable to have sex
The TOUGH Project

• Multi-institutional, multi-national collaborative effort
• First ever longitudinal study of long-term effects of GU injury
  – Largest GU injury database
  – Collect patient reported outcomes (GU, non-GU, overall QOL)
  – Post-injury care needs and gaps
• Recently awarded DoD funding (~ $3 million)
• Ultimate Goals:
  – Improve the care of future GU injured patients in peacetime and in war
Genitourinary Injury

Severe non-GU injury:
- Colorectal
- Extremity
- Head/face

Neuropsychiatric Problems:
- TBI
- PTSD
- Chronic pain
- Substance abuse

Post Traumatic Sexual, Urinary, and Fertility Problems
Collaborators

- Department of Epidemiology, USA Institute of Surgical Research
- Deputy Commander, USAISR
- Urology Consultant to the U.S. Army Surgeon General
- Deputy Commander for Surgical Services, SAMMC

The Department of Defense Trauma Registry (DoDTR)