Mangled extremity and peds ortho

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Overview

• mechanism of injury
• assessment
• management
• outcomes

mechanism of injury

high energy

• lawn mower
• MCA
• MVA vs. bike
• MVA vs. pedestrian


lawn mower injuries

• common cause in children
• rider or bystander (70%)
• under 5 years old (78%)

high energy

<table>
<thead>
<tr>
<th>injury</th>
<th>Energy (foot-pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>fall from curb</td>
<td>100</td>
</tr>
<tr>
<td>skiing</td>
<td>300-500</td>
</tr>
<tr>
<td>High velocity GSW</td>
<td>2,000</td>
</tr>
<tr>
<td>20 mph bumper injury</td>
<td>100,000</td>
</tr>
</tbody>
</table>
Lawn mower injuries

- High complication rates
- >50% poor results

Lawn mower injuries

- Often result in amputation

Lawn mower injuries

- Education/prevention key
- Under 14 out of yard: do not operate
- No riders other than mower operator

Assessment

- ABCs
- Associated injuries
- Tetanus
- Antibiotics

Initial Presentation in ER - History

- Mechanism of injury (How bad is the injury?)
  - High energy vs. low energy
  - Degree of contamination
  - Crush?
  - Ischemia time (if present)
- Comorbid conditions (How well are they going to heal?)
  - DM, smoker, PVD
- Social history (How will the injury/treatment impact their life?)
  - Job, education level, access to care, support system

Antibiotics

- +/- Aminoglycoside
- +/- Pen G or Clindamycin if Pen allergic
- No Cipro alone Patzakis MJ, J Orthop Trauma Nov 2000
- 24-72hr course
Assessment

- neurologic and vascular exam of extremity
- reduce all fractures
- circumferential exam noting all abnormalities
- open wounds usually obvious as tibia, ankle, foot are subcutaneous

Classification of Open Tibia Fractures

Gustilo and Anderson open fracture classification first published in 1976 and later modified in 1984
- In one study interobserver agreement on classification only 60%

open wounds

- assessed once then covered by saline soaked sterile gauze, splint
- digital camera or cell phone for documentation
- LEAVE ALONE
- classify in OR, evolve over time

decisions

- Limb salvage vs. amputate
- Involve other services
- Trauma, plastics, vascular as needed
- Do scoring systems help?
- Any absolute indications?

Loss of plantar sensation

- IS AN INDICATION FOR AMPUTATION
- IS this TRUE OR FALSE?

Quiz time
Amputation

- Lange proposed two absolute indications for amputation of tibia fractures with arterial injury: crush injury with warm ischemia greater than 6 hours, and anatomic division of the tibial nerve*

*Lange et al. J Trauma 1985

Survey of surgeons on factors considered in decision to amputate vs. reconstruct.

Factors Influencing the Decision to Amputate or Reconstruct after High-Energy Lower Extremity Trauma


#1 factor for Orthopaedic Surgeons and #3 for General surgeons

#1 for G.S.

LEAP study group

- 55 patient with insensate extremity
- 29 insensate amputated
- 26 insensate salvaged
- Compared to sensate matched control group


LEAP study- results

- No difference in outcomes between groups
- Insensate salvage and sensate control group had similar % with normal plantar sensation at 2 years – (55%)
- Only one pt. in insensate salvage group had no sensation at 2 years


Plantar sensation

- FALSE
- NOT AN INDICATION FOR AMPUTATION

Plantar sensation

- In 1987 Dr. Sigvard Hansen challenged the orthopaedic community “to define clear, concise, acceptable guidelines to help decide which severely damaged extremities are best handled by immediate amputation”

**Mangled Extremity Severity Score**

- An attempt to help guide between primary amputation vs. limb salvage
- In one study a score of 7 or higher was predictive of amputation*
  
  * Johansen et al. J Trauma 1991

**Does a MESS of 8=amputate?**

- Retrospective and prospective arms confirmed mess > or equal to 7 should amputate


**MESS score of 8=amputate**

- TRUE OR FALSE?

**MESS >8= amputate**

- Goal of scoring systems is to help guide treatment- but do they?


**MESS of 8 = amputate**

- Scoring systems are NOT predictive of successful limb salvage

Retrospective study demonstrated that available scoring systems are not predictive of successful limb salvage

- Mangled Extremity Syndrome Index (MESS)
- Mangled Extremity Severity Score (MESS)
- Predictive Salvage Index (PSI)
- Limb Salvage Index (LSI)


**Mess of 8 = amputate**

- The LEAP Study Group performed an independent, prospective evaluation of lower-extremity injury-severity scores, i.e. best available data
MESS of 8 = amputate

LEAP Study Group
• Not predictive of amputation
• Results: The analysis did not validate the clinical utility of any of the lower extremity injury-severity scores.
• Conclusions: Lower-extremity injury-severity scores at or above the amputation threshold should be cautiously used by a surgeon who must decide the fate of a lower extremity with a high-energy injury.


MESS of 8 = amputate
• FALSE
• Scoring systems cannot be relied on to make your decisions

Study 1
• Cost comparison between 16 patients with successful limb salvage and 18 with early amputation (<3 weeks)
• Median adjusted hospital charges
  • early amputation $65,624
  • Limb salvage $109,044
• p<0.006


Cost- Study 2
• 39 type IIIb or C open tibia fractures
• 21 limb salvage
• 18 amputation
• Collected data on hospitalization, costs, and employee compensation allowances


cost
• amputations more cost effective
• TRUE OR FALSE?

Study1
• Problem....
• Only compared hospital charges....
Cost- Study 2

- Significantly higher hospitalization costs in limb salvage
- Loss of wages benefits paid to salvage group 2.5 X longer

<table>
<thead>
<tr>
<th>Amputation</th>
<th>Reconstruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital costs</td>
<td>$1,000 SF</td>
</tr>
<tr>
<td>Loss of wages benefits</td>
<td>$2,000 SF</td>
</tr>
<tr>
<td>Rehabilitation for loss of wages</td>
<td>$500 SF</td>
</tr>
<tr>
<td>Prosthetic</td>
<td>$500 SF</td>
</tr>
<tr>
<td>Total costs</td>
<td>$3,000 SF</td>
</tr>
</tbody>
</table>


Cost- LEAP Study

- 2 year costs (incl. prosthesis)
  - Salvage $81,316.00
  - Amputation $91,106.00
- Projected lifetime cost (incl. purchase/maint. prosthetics)
  - Salvage $163,282.00
  - Amputation $509,275.00


Amputation is more cost effective

- FALSE
- Amputation IS NOT more cost effective
- in pediatric population when life long prosthetic costs will be greater than those demonstrated

Do pts. With amputations have better function outcomes?

- Those undergoing limb salvage end up “drunk, demoralized, destitute and divorced” S. T. Hansen, MD


Amputations do better

- Pts with amputations have better functional outcomes?
  - TRUE OR FALSE?


Amputations have better functional outcomes

• Comparison of outcomes between groups led to recommendation for early amputation


LEAP study amputations have better outcomes

• Hypothesis- “those undergoing amputation would have better outcomes than those undergoing salvage”

• What they found….no difference in outcome at 2 and 7 years

LEAP Study
predictors of poor outcome

• Rehospitalization for a major complication, low education level, nonwhite race, poverty, lack of private health insurance, poor social-support network, low self-efficacy, smoking, and involvement in disability-compensation litigation

• Regardless of group-amputation or salvage


Amputation when...

• Significance systemic risk from extremity

• Not reconstructable

• When function would be better with prosthesis

• Social, financial, psychologic would not tolerate reconstruction

General Goals

• Retain clean, perfused tissue

• Debride all non-viable tissue

• Preserve length

• Preserve skin

• Balance forces of remaining muscles

• Ultimate goal: Return to functional level that meets the patient’s need with available anatomy

operative treatment

• urgent sharp surgical debridement of all non viable/contaminated tissue

• copious amounts of irrigation

• Skeletal stability

• NPWT

• Ideally under 6 hours from injury

• Multiple washouts a reality
True in limb salvage and amputation

If acute amputation being considered....
- Document need
- Have 2nd surgeon eval and document IN CHART
- Pictures/xrays invaluable to demonstrate severity

Primary BKA

Decision to Amputate
- When more difficult...
  - Discuss with the patient, patient’s family and other surgeons to determine best plan for the patient

salvage
- Cannot be done alone
- Trauma-to stabilize pt
- Ortho- to stabilize limb
- Vascular- to provide blood supply
- Plastics – to provide timely coverage

- Appropriate and coordinated early initial treatment key for successful outcomes
Case examples

• 16 yo male foot caught in farm equipment when working with his father

Initial care

Delayed bone graft

Case 2
2 months post injury

- Treated with below knee amputation
- Best for him functionally and with family

Employment, Sports, and Recreational Activities

- LEAP Study Group Data at 7 years
  - 58% of 423 patients had returned to work
  - 47% of amputees
  - 62% of limb salvage
  - Those who returned to work
    - limited in their ability to perform their job up to 25% of the time


Employment, Sports, and Recreational Activities

Never Say Never - You Will Be Proven Wrong

Military Experience $\rightarrow$ 16.5% Return to Duty Rate

Many Amputees Prefer Non-Impact Sports and Activities

Although Running and Impact Sports Are Possible
Many Choose Other Activities because of the Discomfort and Sores that Can Result from Repeated Impact
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