Rural Trauma Transfer
Issues: CREST Symposium

John E. Sutton, Jr. MD, FACS
Chief, Division of Trauma and
Acute Surgical Illness
Dartmouth-Hitchcock Medical Center
Objectives

- Rural Trauma System
- Clinical transfer issues
- System transfer Issues
What Is Rural Trauma?

- When optimal care of injured patients is delayed or limited by geography, weather, distance, or resources
- Often a low volume experience that demands continuous evaluation and education to maintain optimal skills

ACS Committee on Trauma, 2006
What is Rural Trauma?

... 84% of U.S. residents can reach a Level I or Level II trauma center within an hour, but only 24% of residents in rural areas have access within one hour ...

Branas et al. Health Services Research 2000
What is Rural Trauma?

... death rate in rural area is inversely related to the population density ...

Baker et al, *NEJM* 1987
What is Rural Trauma?

... nearly 60% of all trauma deaths occur in rural areas despite the fact that only 20% of the nation’s population live in these areas ...

Report on Injuries in America
National Safety Council - 2003
Trauma Systems

- Increased time to definitive care associated with higher mortality rates
- Trauma system development reduces risk of death from injury

Sampalis JS et al. Journal of Trauma, 1999
Nathens AB. J Trauma, 2000
Scope of a Trauma Care System

- Inclusive System
  - Minor
  - Moderate
  - Severe

- Exclusive System

Injury Severity

Pts.
Sutton’s Five C’s of Trauma Care

- Comprehensive
- Communication
- Consistency
- Cost
- Commitment
CHALLENGES OF RURAL PRACTICE SETTING

- Geographic distances
- Health delivery system under stress
- Supporting programs lacking
- Rural practitioners isolated
Specialty Shortages (Availability)

- Neurosurgery
- Orthopedics
- Trauma Surgeons
- Nursing personnel
Consequences of Shortages

- Lack of experience with trauma care
- Shifting of patients for definitive care
- Overloading Tertiary Resources
- Delay in definitive treatment
Clinical Transfer Issues

- Spinal immobilization
- Unstable trauma transfers
- Transfers for technology
- “Minimal” Brain trauma
- Delays in transfer
**Unconscious Patient With No Neurologic Deficit**

**Spiral Screening CT Scan of the Entire Neck (1.3 mm cuts with reconstruction)**

- Normal CT scan
  - Keep in Collar
  - Tertiary survey in a.m. Able to participate with P.E.
  - Official Staff Film Interpretation = NL
  - Done
  - Remove collar

- Abnormal/Questionable CT scan
  - Obtunded
    - MRI
      - Abnormal
        - Spine Consult

- Official Staff Film Interpretation = NL
Leave ‘em in the collar and boarded
Case Hx:
72 yo male crashed into a tree. ? Pulse at the scene. CPR started
Arrived at ED, no pulse, V Fib
Defibrillated x1, Sinus tachycardia. BP 70/
Pupils mid positioned and fixed
CXR = normal; FAST negative; abdomen soft

Call for Transfer?? DHART??
DHART called
In flight pt. develops V fib
Defibrillation x5, ACLS protocols
Arrives DHMC, full CPR
Pronounced after 5 minutes

Appropriate transfer??
Case History 1.

- 31 yo man in ATV accident, transported from a rural hospital
- History of von Willebrand’s Disease
- Blood pressure stable, but hematocrit has decreased over the last four hours
- FAST scan positive for intrabdominal fluid
Case Question

1. What is your diagnosis?
Case Question

Diagnosis: Splenic Laceration from Blunt Trauma

What is your next step in treatment?

A. Surgery
B. Embolization
C. Close Observation
Case Question

- Splenic Arteriogram performed
- Lower pole of spleen shows abnormal blush but no active bleeding
- What Now?
Case Question

- Proximal embolization of splenic artery performed
- Patient required no further treatment for internal bleeding
CASE HISTORY 2.

- 58 yo male fell 8 feet onto a basement crushed stone floor
  - P.E.
  - Chest = left chest wall tenderness; decreased B.S.
  - Abd. = soft with no guarding. Left upper quadrent
- Tenderness (? Chest wall tenderness)
OSH Evaluation:

- CT abdomen = no evidence of free fluid or visceral injury.
- H/H = 12.2/36
- CXR = “poor” quality portable film. No obvious hemopneumothorax
- Admit to ICU
48 hours later:

- Increased SOB
- HR= 130-140
- Full CT scan of chest = widened mediastinum
- Transferred to DHMC.
DHMC Arrival: What diagnostic tool to use?

- Ultrasound (Transesophageal echo)
- Fine cut dynamic CT scan
- Angiography
Outcome:

- Fine cut dynamic CT scan = confirmed evidence of rupture

- Subsequent arteriogram in OR facilitated placement of endovascular stent

- Position of stent was confirmed and visualized by TEE (Echo)

- Pt discharged the next day
Minimal Brain Injury

- Hx of amnesia (can’t remember the accident)
- Headache
- Dizziness
- GCS = 13-15
- Transfer ??
Minimal Brain Injury

- **Western Trauma Assoc.**
  - 2766 pts. GCS 13-15
  - None of 1170 with normal CT deteriorated

- **Stein and Ross**
  - 658 pts. GCS 13-15
  - 542 normal CT = no deterioration

- **Dacey et. al.**
  - 610 pts GCS 13-15
  - Discharge if CT normal

- **East Guidelines**
  - Pts. With normal CT have a 0-3% chance of deterioration usually with GCS 13-14
CASE HISTORY 3.

37 Y.O. MALE PEDESTRIAN
STRUCK BY CAR
TRAVELLING 40-50 MPH ;
LANDED IN A
SNOWBANK.
TRANSPORTED
BY CAR TO LOCAL
HOSPITAL.
V.S.  BP 70/50  P= 60  R= 22

- GEN: NON RESPONSIVE , + ETOH
- CHEST: CLEAR AND SYMMETRIC
- ABD: TENDER LOWER ABDOMEN
- PELVIS: TENDER ; LARGE SCROTAL HEMATOMA
- RECTAL: NORMAL , HEME NEG
- EXTREM.: SYMMETRIC BUT COLD
6 LITERS CRYSTALLOID; 2 UNITS PC

H/H 14/41; ONE HOUR LATER 8.6/25

CXR = NEG PELVIS = S-I DISRUPTION, WIDENED SYMPHYSIS

26 MGS. OF MSO4 GIVEN FOR PAIN

TRANSFERRED TO DHMC 3 HRS AFTER INITIAL ARRIVAL
ARRIVAL DHMC:

- BP = 80/ RAPIDLY TO ZERO
- P = 115  RR = 12
- CARDIOPULMONARY ARREST
- ASYSTOLIC, NO RESPIRATIONS
- CODE: INTUBATED; RESUSITATED
- ABG = 6.72/60/565
RESUSITATION / EVALUATION in ED

- 8.5 LITERS CRYSTALLOID; 6 UNITS O-NEG , 4 UNITS FFP
- HGB = 8.2   K+ = 4.5
- BUN/CR =12/2.1
- PT/PTT = 19/66
- ABG = 7.07/38/556
- CXR, C-SPINE, PELVIS CYSTOGRAM, RUQ FAST = NEG
- CT HEAD = NEGATIVE
DEFINITIVE TREATMENT

- O.R.:
- PROCTOSCOPY NEGATIVE
- EXTERNAL FIXATOR APPLIED
- COMPARTMENT PRESSURES
  - LLE
  - S Post = 8-10
  - D Post = 8-10
  - ANT = 15-20
  - LAT = 15-20
DEFINITIVE TREATMENT: Continued hemorrhage

- ANGIOGRAM SUITE: BLEEDING FROM THE LEFT HYPOGASTRIC ARTERY BRANCHES
- EMBOLIZATION
- THROMBOSED LEFT POPLITEAL ARTERY
RETURN TO O.R.:

- REVASCULARIZATION OF LLE
- 4 COMPARTMENT FASCIOTOMIES
- TRANSFERRED TO ICU
Delays in Interfacility Transports

DHART transfers 1/1/04-12/31/04  n = 238

- Request PTA : 19.3% ( n = 46 )
- 0-59 min: 32.5% ( n = 77 )
- 60-119 min: 23.1% ( n = 55 )
- 120-179 min: 17.6% ( n = 42 )
- > 179 min: 7.5% ( n = 18 )

No statistical correlation between frequency of CT scanning or ISS and delayed request for transfer
# Hospital Size and Time to Initiate Transfer

<table>
<thead>
<tr>
<th></th>
<th>&lt;25 (n=59)</th>
<th>25-50 (n=41)</th>
<th>51-100 (n=63)</th>
<th>&gt;100 (n=75)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PTA</strong></td>
<td>27%</td>
<td>32%</td>
<td>14%</td>
<td>13%</td>
</tr>
<tr>
<td><strong>&lt; 1 hour</strong></td>
<td>36%</td>
<td>41%</td>
<td>24%</td>
<td>29%</td>
</tr>
<tr>
<td><strong>1-2 hours</strong></td>
<td>17%</td>
<td>19%</td>
<td>25%</td>
<td>27%</td>
</tr>
<tr>
<td><strong>&gt;2 hours</strong></td>
<td>20%</td>
<td>7%</td>
<td>37%</td>
<td>31%</td>
</tr>
</tbody>
</table>
Time to Initiation (ISS 15 vs ≥15)

- PTA < 1 hour
- 1-2 hours
- > 2 hours

% of Patients

ISS <15
ISS ≥15
System Transfer Issues

- Accessing entry into the Level I center
- Available resources for transport
- Technology changes – CDs of CTs
- Lack of State Safety Support (e.g. no seat belt law)
- Follow-up / Feedback
Whom do you call?

- DHART Comm.
  - Patient’s name / DOB
  - Referring physician
  - Hospital call back number

- Connect with the Trauma Surgeon on call

- Arrange transportation if desired

1-800-650-3222
DHART-Dartmouth Hitchcock Advanced Response Team

- Air Transports 850+
- Ground 970+
- 1800+ Annual Transports
- Interhospital Transports
  - Trauma ~ 80%
  - Cardiac
  - Critical Care
  - High Risk Obstetrics
  - Neonatal
  - Pediatric
- Scene Calls 10%
Can’t Fly!

Thunderstorms

Fog

Blizzards
Alternatives?
Ambulance Service

- Availability
- Level of training
- Leaving the community “uncovered”
- Undue delay waiting for DHART ground
Technology Changes

- CT scan details the injury
- CT Reconstructions
- CT Available in all hospitals
- Newer generations with increased detail and speed
- Digital Imaging
Technology Changes:

- Splenic Trauma
  - Angiography for embolization
- Thoracic arterial injury
  - Angio with endovascular stent
- Hepatic injury
  - Interventional radiology: drains, angio, stents
- Spinal Cord injury
  - MRI
38 yo male : Severe liver injury

Procedures:
- angioembolization of hepatic artery
- ERCP / Stent
- angio / Stent
- IVC filter
- Numerous IR drainage procedures
Issues

- Technology
- Technique
- Inability to view studies
- Clinically indicated
Not Necessarily! Arrghgh!
Potential Impact

- Delays in secondary triage
- Patient safety
  - Increased radiation exposure
  - Delays in emergent care
- Cost
  - Patients billed twice
  - Burden to entire trauma system
<table>
<thead>
<tr>
<th>Exam</th>
<th>Number Performed</th>
<th>Transferring Facility CT Scans</th>
<th>DHMC ED Repeat CT Scans</th>
<th>Repeat Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>259</td>
<td></td>
<td>132</td>
<td>51%</td>
</tr>
<tr>
<td>Chest</td>
<td>108</td>
<td></td>
<td>34</td>
<td>31%</td>
</tr>
<tr>
<td>Abdomen</td>
<td>130</td>
<td></td>
<td>38</td>
<td>29%</td>
</tr>
<tr>
<td>Pelvis</td>
<td>127</td>
<td></td>
<td>45</td>
<td>35%</td>
</tr>
<tr>
<td>Cervical Spine</td>
<td>173</td>
<td></td>
<td>86</td>
<td>50%</td>
</tr>
<tr>
<td>Thoracic Spine</td>
<td>23</td>
<td></td>
<td>14</td>
<td>61%</td>
</tr>
<tr>
<td>Lumbar Spine</td>
<td>18</td>
<td></td>
<td>14</td>
<td>78%</td>
</tr>
<tr>
<td>Face</td>
<td>27</td>
<td></td>
<td>11</td>
<td>41%</td>
</tr>
</tbody>
</table>
Necessary Workup prior to Transfer

- Hx and PE.
- IV Access
- GCS < 8 = Intubate pt
- X-rays ???

Do not delay transfer for extensive (complete) x-ray evaluation!
Only State in the Union with no Adult Seat belt Law!
Known restraint use or non-use: n = 694

<table>
<thead>
<tr>
<th>Variable</th>
<th>Restrained (n =469)</th>
<th>Unrestrained (n=225)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of Collision</td>
<td>NH 43% VT 57%</td>
<td>NH 57% VT 43%</td>
<td>33% higher restraint use by VT patients</td>
</tr>
<tr>
<td>Mean Injury Severity Score</td>
<td>12.4</td>
<td>14.0</td>
<td>13% higher ISS for unrestrained</td>
</tr>
<tr>
<td>Mortality</td>
<td>4%</td>
<td>11%</td>
<td>175% higher mortality for unrestrained</td>
</tr>
<tr>
<td>Mean ICU Days</td>
<td>1.8</td>
<td>3.7</td>
<td>105% longer ICU stay for unrestrained</td>
</tr>
<tr>
<td>Mean Hospital Days</td>
<td>7.8</td>
<td>11.1</td>
<td>42% longer hospital stay for unrestrained</td>
</tr>
</tbody>
</table>
Conclusions:

- Mandatory seat belt laws seem to result in higher utilization of seat belt use in Vermont compared to NH.
- Restrained pts. are less severely injured and consume less hospital resources.
- NH legislators should reconsider a mandatory seat belt law for societal benefit.
Feedback

- HIPPA regulations
- Difficulty locating individuals
- Single contact point
- Collector data base
Pressures facing Trauma Systems

- Personnel Shortages
  - Physician
  - Nurses
- Expense
- Bed capacity/availability
- Disaster Management
Opportunities for improvement: CREST?

- Educational outreach
- Facilitate referral process
- Standardized protocols
- Telemedicine consultations
- Telemedicine remote surgery?
- Improve communication
Discussion