Beating the Odds: Emergency Department Thoracotomy to Discharge
Charlotte E. Yarrow, BSN, RN
Linda Gioncardi, BSN, RN, CPN
Children’s Healthcare of Atlanta
Atlanta, GA

Disclosure Information

The speakers have no disclosures or conflicts.

Objectives

- Identify a multidisciplinary approach to the management of pediatric gunshot trauma
- Describe the management of life threatening gunshot trauma
- State the importance of early initiation of a pediatric massive transfusion protocol
For which of the following patients is an Emergency Department Thoracotomy (EDT) NOT indicated?

1. 4 year old male who was held in a hostage standoff by his father, with multiple stab wounds to his chest with loss of vital signs on arrival to a Level 1 Pediatric Trauma Center.

2. 12 year old male, direct line drive to chest during baseball game with cardiac arrest in the stadium with an AED readily available. Arrives to Level 1 Pediatric Trauma Center 30 minutes after collapse in PEA.

3. 10 year old girl, GSW to left chest, arrives to Level 1 Pediatric Trauma Center, obtunded with BP of 60/30 with no available OR due to mass casualty event.

American College of Surgeons Committee on Trauma’s (ACS-COT) Indications for EDT

• Recent pre-hospital cardiac arrest in a patient with precordial wound

• Cardiac arrest in a trauma patient occurring on arrival in the emergency department, during resuscitation or observation

• Profound hypotension (blood pressure < 70 mm Hg) due to a truncal wound in an unconscious patient, and distant or unavailable operating room

(Melicians, 2004)

Once in a Blue Moon

• LIMITED data in pediatric population

• Mollberg, et al., 2011
  • 120 patients with penetrating trauma between January of 2003 and July 2010 underwent an EDT at an urban Level 1 Trauma Center
  • Patients were divided based on adherence to ACS-COT guidelines: adherence (group 1, n=70) and non-adherence (group 2, n=50)
  • 6 survivors in group 1 (8.7%), all of whom were neurologically intact; NO neurologically intact survivors in group 2

(Mollberg, et al., 2011)
Massive Transfusion Protocol Justification

- The most common cause of death within the first hour of arrival to a trauma center is HEMORRHAGE
- Exsanguination and coagulopathy account for greater than 80% of deaths in the OR and almost 50% of deaths in the first 24 hours after injury
- Massive transfusion protocols (MTP) have been associated with a reduction in mortality and overall blood product use in trauma centers

(The American College of Surgeons Committee on Trauma)

The American College of Surgeons (ACS) Trauma Quality Improvement Program (TQIP) Massive Transfusion Guidelines include which of the following?

1. Universal blood products should be immediately available on patient arrival to support ratio-based transfusion

2. Transfuse universal RBC and plasma in a ratio between 3:1 and 1:6 (plasma to RBC)

3. Providers should call the blood bank every time they need more blood products

4. All of the above

(ACS TQIP Massive Transfusion Guidelines)

- Universal blood products should be immediately available on patient arrival to support ratio-based transfusion
- Begin universal blood product infusion rather than crystalloids or colloids
- Transfuse universal RBC and plasma in a ratio between 1:1 and 1:2 (plasma to RBC)
- Blood products should be automatically sent by the blood bank in established ratios

(The American College of Surgeons Committee on Trauma)
Once upon a time…
A case review, highlighting our experience from Emergency Department Thoracotomy to Discharge

Emergency Department Overview
EMS report: GSW to LL abdomen, through and through, 9 mm handgun shot at short range. Worsening tachycardia and hypotension. RSI en route, BP 67/48, HR 100, ETCO₂ 23, RR 15/min on vent, 1500 mL NS.

Arrived to ED via flight from scene as Trauma Stat, intubated with CPR in progress, two ballistic wounds to abdomen.

Resuscitation according to PALS and ATLS algorithms from 1756 to 1823

Procedures Performed in ED
Bilateral Needle Decompression
Left Anterolateral Thoracotomy w/Cross Clamp of Aorta - ROSC
Right-Sided Chest Tube
Left Femoral CV

WENT TO OR 42 MINUTES AFTER ARRIVAL TO ED

Massive Transfusion Protocol (MTP) in the ED
Massive Transfusion Protocol initiated upon notification, estimated weight of 40 kg
Initial POC labs: pH 7.117, Base Deficit 8, PCO₂ 62.5, PO₂ 18, H/H 3.4/10

<table>
<thead>
<tr>
<th>Package</th>
<th>Cryo</th>
<th>RBC</th>
<th>Plasma</th>
<th>Platelets</th>
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<tbody>
<tr>
<td>1</td>
<td>3 units</td>
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<tr>
<td>2</td>
<td>6 units</td>
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<tr>
<td>5</td>
<td>3 units</td>
<td>3 units</td>
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</table>

PRBCs = 1000 mL (1st unit was hung at 1757)
Plasma = 522 mL
Cryoprecipitate = 85 mL
Platelets = 267 mL
MTP During Initial Operative Course

<table>
<thead>
<tr>
<th>Estimated Circulating Blood Volume</th>
<th>Total Volume of Blood Products Received in OR</th>
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<tbody>
<tr>
<td>70 mL x 40 kg = 2800 mL</td>
<td>16,600 mL</td>
</tr>
<tr>
<td></td>
<td>- PRBCs 8000 mL</td>
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<td>- FFP 7000 mL</td>
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<td></td>
<td>- Platelets 1200 mL</td>
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<tr>
<td></td>
<td>- Cryoprecipitate 400 mL</td>
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</tbody>
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ALMOST 6 TIMES the circulating blood volume!

The “poster-child” of MTP

CHOA Policy 29.11

“This Children’s Trauma Massive Transfusion Protocol (MTP) was developed with 3 main aims:
1. Improving mortality in trauma victims by providing a 1:1 ratio of PRBCs : plasma
2. Providing appropriate blood products in a timely manner
3. Simplifying the process of ordering and obtaining blood products during trauma resuscitation.”

“Indications for Trauma Massive Transfusion Protocol (MTP)
- Clinical massive hemorrhage in hard to control area
- Need for emergency release blood in a trauma patient located in the ER, OR, or PICU
- Ongoing blood loss >150mL/min
- Loss of 50% of blood volume in 4 hours
- Loss of 1 blood volume in 24 hours (70 mL/kg in children and adolescents, 85 mL/kg in infants)”

Initial Operative Procedure Summary

1912 on 3/30 through 0141 on 3/31
- Exploratory Laparotomy
- Sigmoid Colectomy (~4 cm)
- Packing of Pelvis
- Temporary Abdominal Closure
- Thoracotomy with Chest Tube
- Right IJ Vascath
- Venogram of left common and external iliac veins
- ~7 sheets of Surgicell®, multiple entire sheets of thrombin soaked Gelfoam®, 4" Kerlix™, laparotomy pads and temporary V.A.C® pack constructed to control hemorrhage and account for open abdomen.

A red vessel loop around the distal aorta/left common iliac artery left in place to obtain quick control in the event of ongoing bleeding.
### PICU Overview

**Tuesday, March 31st to Friday, April 17th**

- 3/31: Following some commands, leaking from V.A.C.® site placed to wall suction, most recent H/H of 11/30.5, sandbags to groin, EEG
- 4/1: Worsening of renal (BUN 41, Cr 3.3) hepatic (AST 2314) and respiratory function (PEEP 8-12), multiple transfusions and FFP drip started
- 4/2: Back to OR with Pediatric Surgery and IR for Ex-Lap, ligation of left common iliac vein, abdominal washout and temporary abdominal closure. CVVH started. EEG within normal limits. Continued blood product replacement.
- 4/3: Physical and Occupational Therapy evaluations
- 4/4: Trophic feeds started
- 4/5: Chest tubes removed

### PICU Overview continued...

- 4/6: Ex-Lap, abdominal washout and partial closure of open abdomen in PICU
- 4/9: Ex-Lap with washout, partial closure of abdomen in PICU
- 4/10: ID consulted for persistent fever
- 4/11: UTI
- 4/12: Stable off CVVH, on Lasix drip
- 4/13: Final staged closure of abdominal laparotomy incision
- 4/14: Extubated
- 4/16: First HD session
- 4/17: Speech Language Pathology evaluation and transfer to floor!

### 4 East Overview

**Friday, April 17th to Monday, April 27th**

- 4/17: GI consulted for GI bleed, continued dialysis M W F
- 4/20: Dialysis
- 4/21: OR for insertion of Permacath, Wound V.A.C.® change and removal of Vascath
- 4/22: Dialysis skipped labs improving, continued increase in po intake
- 4/24: Psychiatry evaluation for night terrors

WOCN team integral for management and care of open abdomen, wound V.A.C.® dressing changes and ostomy needs.
Comprehensive Inpatient Rehabilitation Unit (CIRU)  
Monday, April 27th to Friday, May 15th

Physical, Occupational and Speech Therapies daily  
Nutrition, Therapeutic Recreation and Music Therapy 1-2 times/week

4/27 – Neuropsychology consult

4/28 – Nephrology evaluation indicates no further need for dialysis

4/29 – Permacath removed; improved sleep patterns

5/4 – Epogen and Prevacid discontinued

5/13 – Wound V.A.C.® removed and dressing changed to Aquacel®

5/14 – Outing at World of Coca Cola®

Trauma is a TEAM sport


Radiology  Recreational Therapy  Respiratory Therapy  School Program  Social Work  Speech Language Pathology  Surgical Services  Transfusion Medicine  Trauma Services  Wound Ostomy Continence  Physical Medicine Rehabilitation  Physical Therapy  Psychiatry

The Numbers

- 36 Departments, Services and Specialties
- 13 Surgical Procedures
- 69 Inpatient Days
- 478 Notes
<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>5/20</td>
<td>Out-patient visit with Pediatric Surgery to evaluate timing and outline plan for colostomy reversal.</td>
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<td>Due to history of renal failure plan set to pre-admit for hydration during bowel prep.</td>
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<tr>
<td>7/23</td>
<td>Admit to 4 East for bowel prep, walked onto unit happy and greeting RN's</td>
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<tr>
<td>7/24</td>
<td>Closure of colostomy and exploratory laparotomy</td>
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<tr>
<td>7/25</td>
<td>Pain Medicine consult – Clonidine, Neurontin, Valium, Zoloft, PCA</td>
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<tr>
<td>7/27</td>
<td>Regular diet for breakfast. 1st stool in the afternoon.</td>
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<tr>
<td>7/28</td>
<td>POD # 4: 3 stools in past 24 hours!</td>
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<td>Special reunion and then discharge</td>
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Questions?

Thank you for allowing us to share her story!

References