Management of massive transfusion in trauma

Dr. Robert Green
Professor, Dalhousie University
Critical Care Medicine
Emergency Medicine
Trauma Nova Scotia
Objectives:

Briefly review the controversy and supporting literature for massive transfusion

Using a case, introduce the massive transfusion protocol at CDHA

Highlight key management strategies in trauma patients requiring massive transfusion
Breaking Bleeding Bad

- Bleeding leads to a reduction in preload, low cardiac output, hypotension, and global tissue hypoxia

- Hemorrhage is the second most frequent cause of death after brain injury and accounts for 30-40% of traumatic fatalities

- Autopsy review of combat trauma reveals that 15-20% of deaths were treatable if not for exanguination


The “Lethal Triad”

- Coagulopathy, hypothermia and acidosis are well known markers of mortality after traumatic hemorrhage.


"THE BLOODY VICIOUS CYCLE"

Major Torso Trauma

- Active Hemorrhage
- Progressive Coagulopathy
- Core Hypothermia
- Metabolic Acidosis
- Contact Activation
- Clotting Factor Deficiencies
- Mass Transfusion
- Tissue Injury
- Cellular Shock
- Iatrogenic Factors

Pre-existing Diseases
Epidemiology of massive transfusion

Traditional resuscitation with crystalloids cause a dilutional coagulopathy

In trauma, need for MT is 3-5% (10% in military trauma)
- but 30-60% mortality
What we used to do...

You lose blood...we give you salt water...???

Crystalloid resuscitation+++  
“Prove” that the patient doesn’t need blood

- Blood as a last resort 
- Little to no use of platelets and plasma
New paradigm: replace what you lose...

You lose blood...we give you blood

Also, you lose other “things”
- Platelets
- Coagulation factors

After we determined that blood products are good in trauma...
- we looked at systems...
- massive transfusion protocols
Don’t bore me with evidence....
Give me the best.
Prospective cohort study
10 level-1 US trauma centers
Evaluated the association of the early use of blood products on mortality
- Ratio of platelets/plasma to RBC
Primary outcome: in-hospital mortality
Results

Overall 1245 pts

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>All Enrolled Patients (N = 1245)</th>
<th>Analysis Cohort (n = 905)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median  (IQR)</td>
<td>Nonmissing, No.</td>
</tr>
<tr>
<td></td>
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<td></td>
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<tr>
<td>Time to first units transfused, min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RBCs</td>
<td>30 (12-99)</td>
<td>1222</td>
</tr>
<tr>
<td>Plasma</td>
<td>69 (35-133)</td>
<td>815^b</td>
</tr>
<tr>
<td>Platelets</td>
<td>123 (81-190)</td>
<td>357^b</td>
</tr>
<tr>
<td>Unadjusted in-hospital mortality, No. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 min to 6 h</td>
<td>102 (8.2)</td>
<td>1245</td>
</tr>
<tr>
<td>&gt;6 h to 24 h</td>
<td>46 (4.0)</td>
<td>1143</td>
</tr>
<tr>
<td>&gt;24 h to 30 d</td>
<td>112 (10.2)</td>
<td>1097</td>
</tr>
<tr>
<td>Overall cumulative</td>
<td>266 (21.4)</td>
<td>1245</td>
</tr>
</tbody>
</table>
Blood and the other stuff is good...

They found:

- Varying ratios of platelets and plasma to RBC from admission to 24 h
- Plasma:RBC and platelets:RBC ratios were associated with decreased 6 h mortality
  - Patients with ratios < 1:2 were 3-4X more likely to die (vs 1:1)
- Effect lost by 24 h

Conclusion: early plasma/platelets with blood is good in trauma!
Case: Mr. Goodtimes

70 year old male
Unbelted front seat / stationary car
Struck by large truck
Difficult extrication
SBP 70; obvious blood at the scene
Transported to QEII for Trauma Team
● (50 min post MVC)
NSTP Trauma Team

Boarded/collar
GCS 15, BP 70/30, RR 20, O2sat 99%, temp 35.9°C
Obvious bleed from scalp wound
Bilateral deformities of ankles
Trauma 101

Airway-breathing-circulation

IV crystalloids (level 1)

Difficult IV...intraossous inserted

Pelvis “loose” ... ”bound”
Should we “activate the massive transfusion protocol”?

Yes!

“patient is bleeding with the anticipation of ongoing blood loss…..”

When in doubt activate...

IDENTIFY AND TREAT ACTIVE BLEEDING
(Obstetrical, Surgical, Trauma, Medical)

STABILIZE AND TRANSPORT TO REFERRAL CENTRE
Care should be initiated within the resources and capabilities of the sending institution, which will vary depending on the hospital.
Our approach in trauma patients

Diagnosis and treat
- Primary survey
- Secondary survey
- Imaging and intervention

Avoid further bleeding
- Coagulopathy of trauma
Avoiding coagulopathy in the trauma resuscitation

Principle: don’t make the patient worse

Easy:

- keep the patient warm
  - Warm the room
  - Warm the patient
  - Warm the fluid

- Don’t “dilute” the patient
  - Use blood and minimize crystalloid
Coagulopathy in trauma

The lethal triad may be the consequence of the resuscitation strategy.

However many trauma patients arrive with the lethal triad even before resuscitation has begun.
Coagulopathy in Massive Transfusion
(not all from resuscitation…)

- 50% of patients undergoing massive transfusion will have an INR >2.0\(^1,2\)

- 33% will have thrombocytopenia <50x10\(^9\)/L\(^1\)

- 24-28% will present with trauma-induced coagulopathy\(^3-5\)
  - Consumption
  - Hyperfibrinolysis

- Severity of coagulopathy is associated with mortality\(^6\)

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Mr. Goodtimes

Unstable in trauma room

Crystalloid infused (warmed) as blood retrieved

Room warmed/Bare hugger applies

MTP activated
  ● Call to transfusion services
  ● Blood/plasma/platelets sent
  ● Porter part of TT
What we get

Blood:
- Immediately
- 6 units O-

Plasma 1.5L
- Need to thaw
- 12-22 minutes

Platelets 1 unit
Blood arrives, administered ASAP by nurse
  ● Warmed: 4U

Platelets and plasma follow: administered asap

Repeat VS BP 100/50, temp 35.5°C

“Stable” for CT
Anything else?

Tranexamic acid

Just give it…

Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial

CRASH-2 trial collaboration®
Goodtimes in the CT

“stable in CT”
To OR for pelvic stabilization

● Ongoing blood products
  ● PRBC 12 U
  ● Plates 3 units
  ● Plasma 2.5 L

“goal directed”

● Hgb> 80
● Plts> 75
● INR> 1.7
Goodtimes in the ICU

Admitted to ICU

Hgb 98/platelets 230/INR 1.6
- "ooze"

1 U PRBC/day
- No platelets or plasma required
97 Massive Transfusions at CDHA
April 1, 2013 to March 31, 2014

CDHA reported activations
- 11 Trauma, 9 Medical, 76 Surgical, 1 Other
- 28 Females, 69 Males

Tranexamic Acid - 31 patients

<table>
<thead>
<tr>
<th></th>
<th>Median (units)</th>
<th>Average (units)</th>
<th>Range (units)</th>
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</thead>
<tbody>
<tr>
<td>Fresh Frozen Plasma</td>
<td>13</td>
<td>7.2</td>
<td>2-83</td>
</tr>
<tr>
<td>Fresh Frozen Plasma</td>
<td>8</td>
<td>11.8</td>
<td>2-69</td>
</tr>
<tr>
<td>Fresh Frozen Plasma</td>
<td>2</td>
<td>2.8</td>
<td>1-14</td>
</tr>
</tbody>
</table>

67 survived (69.1% survival)
YOUR LIPS KEEP MOVING

...BUT ALL I HEAR IS

“BLAH, BLAH,”
Key points

Replace blood with blood and other good stuff in trauma patients

Know when to activate MT and activate early

Minimize secondary coagulation problems

Identify and fix surgical bleeding

Use tranexamic acid