The most accurate massive transfusion prediction score at the scene of injury: the Pre-hospital Traumatic Bleeding Severity Score (ph-TBSS)

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Back Ground

• Massive hemorrhage is a major cause of death due to traumatic injury

• Massive Transfusion (MT) is one of the important topics in trauma resuscitation

• Early administration of blood products with higher plasma and platelet ratios in trauma resuscitation are associated with decreased mortality
However.....
Every trauma resuscitation provider knows that massive and balanced transfusion improves the outcome, but ....

Nobody knows when is the appropriate timing to activate the MT Protocol.
# Traumatic Bleeding Severity Score

1. **Patient’s Age**
   - Age ≥ 60 year old = 6 points
   - Age ≤ 59 year old = 0 points

2. **Systolic Blood Pressure**
   - SBP ≥ 110 = 0 points
   - 100 ≤ SBP < 110 = 4 points
   - 90 ≤ SBP < 100 = 8 points
   - SBP < 90 = 12 points

3. **F A S T**
   - 1. Pericardium
   - 2. Rt. Thorax
   - 3. Lt. Thorax
   - 4. Perihepatic
   - 5. Perisplenic
   - 6. Pelvic
   - [ ] regions × 3 points

4. **Pelvic Fracture (AO)**
   - Type A: 3 points
   - Type B: 6 points
   - Type C: 9 points

5. **Lactate Concentration**
   - 0 ≤ Lactate < 2.5 = 0 points
   - 2.5 ≤ Lactate < 5.0 = 4 points
   - 5.0 ≤ Lactate < 7.5 = 8 points
   - 7.5 ≤ Lactate = 12 points

**Traumatic Bleeding Severity Score (TBSS)**

\[
\text{TBSS} = 1 + 2 + 3 + 4 + 5
\]

Traumatic Bleeding Severity Score

MT prediction
AUC=0.985

Traumatic Bleeding Severity Score

<table>
<thead>
<tr>
<th>TBSS</th>
<th>TASH Score</th>
<th>ABC Score</th>
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<tbody>
<tr>
<td>AUC</td>
<td>0.985 (cutoff, 15)</td>
<td>0.892 (cutoff, 8)</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>97.4%</td>
<td>81.6%</td>
</tr>
<tr>
<td>Specificity</td>
<td>96.2%</td>
<td>78.2%</td>
</tr>
<tr>
<td>TBSS vs. TASH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference in AUC</td>
<td>0.093</td>
<td>0.172</td>
</tr>
<tr>
<td>95% CI</td>
<td>0.041–0.146</td>
<td>0.097–0.248</td>
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<tr>
<td>Significance</td>
<td>$p &lt; 0.001^*$</td>
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Predictive value is higher than TASH or ABC

Traumatic Bleeding Severity Score

Convenient, early, and accurate determination of the need for MT are essential for early activation of a MT protocol…….
Predict MT,
On Scene !
Modify TBSS
Pre-Hospital TBSS !!
Methods

• A retrospective study using the registry of the Gunma Prefectural Helicopter Emergency Medical Service (HEMS)

• Records between Sep. 2012 and Apr. 2017 were reviewed

• Adult trauma patients corresponded by the HEMS were included (No cardiac arrest)

• AUC of the Pre-Hospital TBSS for the need for MT
Pre-Hospital TBSS (ph-TBSS)

1. **Patient’s Age**
   - Age ≥ 60 year old = 6 points
   - Age ≤ 59 year old = 0 points

2. **Systolic Blood Pressure**
   - SBP ≥ 110 = 0 points
   - 100 ≤ SBP < 110 = 4 points
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   - SBP < 90 = 12 points

3. **FAST**
   - 1. Pericardium
   - 2. Rt. Thorax
   - 3. Lt. Thorax
   - 4. Perihepatic
   - 5. Perisplenic
   - 6. Pelvic
   - [ ] regions × 3 points

4. **Clinical Pelvic Instability**
   - Yes = 6 points
   - No = 0 points

5. **Lactate Concentration**
   - 0 ≤ Lactate < 2.5 = 0 points
   - 2.5 ≤ Lactate < 5.0 = 4 points
   - 5.0 ≤ Lactate < 7.5 = 8 points
   - 7.5 ≤ Lactate = 12 points

**Traumatic Bleeding Severity Score (TBSS):**

1 + 2 + 3 + 4 + 5 = points
HEMS in JAPAN

• Calling HEMS:
  high energy and critical event in a situation
• Judged to need HEMS by on-scene paramedics.
• The HEMS includes a well-trained emergency physician and nurse on board.
• The primary survey including FAST and checking for pelvic instability is performed by the physician.
On Scene Lactate Measurement

**Lactate Pro™ 2**

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**Traumatic Bleeding Severity Score (TBSS):**

\[ 1 + 2 + 3 + 4 + 5 = \text{points} \]
Results

• 1039 patients were enrolled
• 14 patients were excluded (data insufficient)
• Mean age 55.0 year, Male 77.6%
• Blunt 98.1%
• Massive Transfusion 6.6%
Prehospital Plasma during Air Medical Transport in Trauma Patients at Risk for Hemorrhagic Shock


ABSTRACT
However.....

The activation criteria for the pre-hospital Damage Control Resuscitation is completely unclear.....
Prehospital Plasma during Air Medical Transport in Trauma Patients at Risk for Hemorrhagic Shock

Prehospital Plasma during Air Medical Transport in Trauma Patients at Risk for Hemorrhagic Shock

Prediction-based Treatment??

Point-of-care-based Treatment??
Prehospital Plasma during Air Medical Transport in Trauma Patients at Risk for Hemorrhagic Shock

Versatility of the ph-TBSS

• The FAST is important

• The paramedic can perform the FAST scan with high degree of accuracy

• The versatility of the ph-TBSS will be expanded

https://www.acep.org/sonoguide/ems_pre-hospital.html

Versatility of the ph-TBSS

- The portable lactate measuring equipment is not expensive (600 $)

- 0.3μL of blood is need

- Easy and quick to measure (Only 30 seconds)
Limitation

• Single prefecture retrospective study

• Sample size may not be enough

• External validation is not yet

→ *Multi-center (Multi-countries) large prospective study is warranted*
The predictive value is high

On scene prediction of MT using ph-TBSS may be feasible

Warrants further investigation