THE "SWISS" STAGING SYSTEM

IMPROVING INITIAL HYPOThERMIA ASSESSMENT

Presentation by Peter Symons EMT-P
MY DISCLOSURE

• No financial conflicts of interest
• No known other conflicts of interest
• I am at risk of hypothermia in the recreational environments that I use
WHO I AM

- Peter Symons EMT-P, Alberta, Canada
- Field Medic (R), Jasper and Banff National Parks.
- Mineral Springs Hospital, Banff Alberta Canada
- Instructor ACLS, ACLS-EP, ITLS and WEC
- Northern Alberta Institute of Technology
- WEC Instructor - Rescue Dynamics
OBJECTIVES

• Review of Hypothermia (HT)

• Compare existing HT assessment methods and terminology

• Explain HT assessment using the “Swiss Staging System”

• Explore the advantages of the “Swiss Staging System” in 3 Case reviews
HYPOTHERMIA (HT) DEFINED

- Involuntary drop in core temperature below 35 C (95F)
- Primary Hypothermia
- Secondary Hypothermia
HYPOTHERMIA STATISTICS

• ~Difficult to get world wide consistent statistics

• reporting not mandatory

• Difference between cause and contributing factor

• conflicting Data

• some reports are based on “Excessive Winter Deaths”
HYPOTHERMIA STATISTICS

- ~1500 deaths per year in USA
- Primary or Secondary

Accidental Hypothermia

Douglas J.A. Brown, M.D., Hermann Brugger, M.D., Jeff Boyd, M.B., B.S., and Peter Paal, M.D.

DOI: 10.1056/NEJMra1114208
HYPOTHERMIA DEATHS PER YEAR

• Primary or Secondary
• UK: ~ 300
• Canada: ~ 8000

http://bestpractice.bmj.com
KEY PRINCIPLES

• Getting appropriate treatment is key to survival

• Getting an accurate initial assessment with the Swiss Staging System will help in determining appropriate treatment and transport decisions
“Hypothermia can be staged clinically on the basis of vital signs with the use of the Swiss staging system of hypothermia (stages HT I to HT IV)\textsuperscript{10} (Table 2); this system is favored over traditional staging (mild, moderate, severe, and profound hypothermia) whenever the core temperature cannot be readily measured.”

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HOW DO WE MAKE AN INITIAL ASSESSMENT

• Actual Core Temperature
• Estimate Core Temperature
ESTIMATING THE PATIENT CONDITION

- Descriptive Terminology
- All attempt to give a temperature estimation
- Accurate?
- Helpful?
<table>
<thead>
<tr>
<th>Standard Name</th>
<th>Temp °C</th>
<th>Temp °F</th>
</tr>
</thead>
<tbody>
<tr>
<td>MILD</td>
<td>35-32</td>
<td>95.0-89.6</td>
</tr>
<tr>
<td>MODERATE</td>
<td>32-28</td>
<td>89.6-82.4</td>
</tr>
<tr>
<td>SEVERE</td>
<td>&lt; 28</td>
<td>82.4</td>
</tr>
</tbody>
</table>
A COMPARISON CHART OF ASSESSMENT SYSTEMS
Swiss Staging System

TEMPERATURE ESTIMATION BASED ON S/S

ICAR

International Commission for Alpine Rescue
Commission for Mountain Emergency Medicine

Recommendation REC M 0014 of the Commission for Mountain Emergency Medicine

of 1998

The Medical On Site Treatment of Hypothermia

Bruno Durrer, Hermann Brugger, David Syme

Intended for First Responders and Emergency Physicians
<table>
<thead>
<tr>
<th>SWISS SYSTEM</th>
<th>LOC</th>
<th>SHIVERING</th>
<th>VITALS</th>
<th>°C</th>
<th>°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT-1</td>
<td>CONSCIOUS</td>
<td>SHIVERING</td>
<td>PRESENT</td>
<td>35-32</td>
<td>95.0-89.6</td>
</tr>
<tr>
<td>HT-2</td>
<td>LOC IMPAIRED</td>
<td>NOT SHIVERING</td>
<td>PRESENT</td>
<td>32-28</td>
<td>89.6-82.4</td>
</tr>
<tr>
<td>HT-3</td>
<td>UNCONSCIOUS</td>
<td>NOT SHIVERING</td>
<td>PRESENT</td>
<td>28-24</td>
<td>82.4</td>
</tr>
<tr>
<td>HT-4</td>
<td>UNCONSCIOUS</td>
<td>NOT SHIVERING</td>
<td>ABSENT</td>
<td>&lt;24~</td>
<td>&lt;75.2</td>
</tr>
<tr>
<td>HT-5</td>
<td>UNCONSCIOUS</td>
<td>CHEST NOT</td>
<td>ABSENT</td>
<td>&lt;10</td>
<td>&lt;50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>COMPRESSIBLE</td>
<td>K &gt;12MMOL/L</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### SWISS STAGING SYSTEM (UPDATED)

<table>
<thead>
<tr>
<th>SWISS SYSTEM</th>
<th>LOC</th>
<th>SHIVERING</th>
<th>VITALS</th>
<th>°C</th>
<th>°F</th>
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<tbody>
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<td>HT-1</td>
<td>CONSCIOUS</td>
<td>SHIVERING</td>
<td>PRESENT</td>
<td>35-32</td>
<td>95.0-89.6</td>
</tr>
<tr>
<td>HT-2</td>
<td>LOC IMPAIRED</td>
<td>MAY/MAY NOT BE SHIVERING</td>
<td>PRESENT</td>
<td>32-28</td>
<td>89.6-82.4</td>
</tr>
<tr>
<td>HT-3</td>
<td>UNCONSCIOUS</td>
<td>NOT SHIVERING</td>
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<td>HT-4</td>
<td>UNCONSCIOUS</td>
<td>NOT SHIVERING</td>
<td>ABSENT</td>
<td>&lt;24~</td>
<td>&lt;75.2</td>
</tr>
<tr>
<td>HT-5</td>
<td>UNCONSCIOUS</td>
<td>CHEST NOT COMPRESSIBLE</td>
<td>ABSENT K &gt;12MMOL/L</td>
<td>&lt;10</td>
<td>&lt;50</td>
</tr>
</tbody>
</table>
# Swiss Staging System

<table>
<thead>
<tr>
<th>Swiss Staging</th>
<th>Standard Name</th>
<th>~Temp C</th>
<th>Temp F</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT-1</td>
<td>Mild</td>
<td>35-32</td>
<td>95.0-89.6</td>
</tr>
<tr>
<td>HT-2</td>
<td>Moderate</td>
<td>32-28</td>
<td>89.6-82.4</td>
</tr>
<tr>
<td>HT-3</td>
<td>Severe</td>
<td>28-24</td>
<td>82.4</td>
</tr>
<tr>
<td>HT-4</td>
<td>Profound</td>
<td>&lt;24</td>
<td>&lt;75.2</td>
</tr>
<tr>
<td>HT-5</td>
<td>Death</td>
<td>&lt;10</td>
<td>&lt;50</td>
</tr>
</tbody>
</table>
# Key Temperatures

<table>
<thead>
<tr>
<th>Swiss Staging</th>
<th>~Temp C</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT-1</td>
<td>35-32</td>
<td>Usually conscious and shivering</td>
</tr>
<tr>
<td>HT-2</td>
<td>32-28</td>
<td>By 32 shivering stopped or almost stopped</td>
</tr>
<tr>
<td>HT-3</td>
<td>28-24</td>
<td>Below 28 risk of cardiac instability increased</td>
</tr>
<tr>
<td>HT-4</td>
<td>&lt;24</td>
<td>Below 24 vital signs absent. Lowest survival of accidental HT 13.7C</td>
</tr>
<tr>
<td>HT-5</td>
<td>&lt;10*</td>
<td>Lowest survival of induced HT 9C</td>
</tr>
</tbody>
</table>
Assessment Treatment Overview

Accidental Hypothermia

Douglas J.A. Brown, M.D., Hermann Brugger, M.D., Jeff Boyd, M.B., B.S., and Peter Paal, M.D.

DOI: 10.1056/NEJMra1114208

Table 2. Staging and Management of Accidental Hypothermia."*

<table>
<thead>
<tr>
<th>Stage</th>
<th>Clinical Symptoms</th>
<th>Typical Core Temperature†</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT I</td>
<td>Conscious, shivering</td>
<td>35 to 32°C</td>
<td>Warm environment and clothing, warm sweet drinks, and active movement (if possible)</td>
</tr>
<tr>
<td>HT II</td>
<td>Impaired consciousness, not shivering</td>
<td>&lt;32 to 28°C</td>
<td>Cardiac monitoring, minimal and cautious movements to avoid arrhythmias, horizontal position and immobilization, full-body insulation, active external and minimally invasive rewarming techniques (warm environment; chemical, electrical, or forced-air heating packs or blankets; warm parenteral fluids)</td>
</tr>
<tr>
<td>HT III</td>
<td>Unconscious, not shivering, vital signs present</td>
<td>&lt;28 to 24°C</td>
<td>HT II management plus airway management as required; ECMO or CPB in cases with cardiac instability that is refractory to medical management</td>
</tr>
<tr>
<td>HT IV</td>
<td>No vital signs</td>
<td>&lt;24°C</td>
<td>HT II and III management plus CPR and up to three doses of epinephrine (at an intravenous or intraosseous dose of 1 mg) and defibrillation, with further dosing guided by clinical response; rewarming with ECMO or CPB (if available) or CPR with active external and alternative internal rewarming</td>
</tr>
</tbody>
</table>

* Hypothermia may be determined clinically on the basis of vital signs with the use of the Swiss staging system.¹⁰ CPB denotes cardiopulmonary bypass, CPR cardiopulmonary resuscitation, and ECMO extracorporeal membrane oxygenation.
† Measurement of body core temperature is helpful but not mandatory. The risk of cardiac arrest increases as the core temperature drops below 32°C and increases substantially if the temperature is less than 28°C.¹²,¹³ To convert values for temperature to degrees Fahrenheit, multiply by 9/5 and add 32.
TREATMENT ALGORITHM

- LOC
  - A - Airway
  - B - Breathing
  - C - Circulation
  - T - Treatment
  - T - Transport
  (Nearest Hospital or ECMO/CPB)
THREE CASE STUDIES

- Conscious - Vitals Present
- Unconscious - Vitals Present
- Unconscious - Vitals Absent
F.A.T.
FIND
ACCESS
TRIAGE, TREAT, TRANSPORT

• Step 1...always respond with an appropriate rescue team
CASE-1, THE "URBAN" AVALANCHE
BURIED IN SNOW/ AVALANCHE

HOW FAST DO WE COOL

- 10C degrees/Hr  MAX
- 18F degrees/Hr
PATIENT ASSESSMENT

• Is there Associated Trauma?

• Is there an Airway Obstruction?

• Is Hypothermia present?
WHAT LEVEL OF “HT” ARE THESE KIDS

- Conscious
- Burial Time Long
- Airway Open & Clear
- Shivering slightly
- Vitals present
- No Trauma

<table>
<thead>
<tr>
<th>Table. Swiss Staging System of Hypothermia²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>HT-1</td>
</tr>
<tr>
<td>HT-II</td>
</tr>
<tr>
<td>HT-III</td>
</tr>
<tr>
<td>HT-IV</td>
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</tbody>
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*Abbreviations: CPB, cardiopulmonary bypass; ECMO, extracorporeal membrane oxygenation.*
CONSCIOUS VITAL SIGNS PRESENT

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SHIVERING - IS VERY EFFECTIVE

- IT’s ….FREE WARMING

- NEW QUESTION: how to manage pain and not effect shivering
Case 2 - Prolonged Cold Exposure

“TINK” NEWMAN
WHAT LEVEL OF "HT" IS CHRISTINA

- Unconscious
- No Movement
- Airway Open and Clear
- Vitals Absent
- Long Exposure Time
- No Major Trauma
- Minor Trauma Frostbite
- No obvious S/S of Death

Table. Swiss Staging System of Hypothermia

<table>
<thead>
<tr>
<th>Stage</th>
<th>Clinical Findings</th>
<th>Core Temp</th>
<th>Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT-I</td>
<td>Conscious, shivering</td>
<td>35°C to 32°C</td>
<td>Warm environment, clothing, and liquids</td>
</tr>
<tr>
<td>HT-II</td>
<td>Impaired consciousness, not shivering</td>
<td>32°C to 28°C</td>
<td>Cardiac monitoring, full body insulation, and active external and minimally invasive rewarming techniques (eg, heating packs, warm parenteral fluids)</td>
</tr>
<tr>
<td>HT-III</td>
<td>Unconscious, but vital signs are present</td>
<td>28°C to 24°C</td>
<td>HT-II plus airway control; if vital signs are unstable, CPB or ECMO</td>
</tr>
<tr>
<td>HT-IV</td>
<td>No vital signs</td>
<td></td>
<td>Attempt to restore vital signs with epinephrine, defibrillation, then rewarm with ECMO or CPB</td>
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n engl j med 367;20 nejm.org 1930 november 15, 2012
UNCONSCIOUS
VITAL SIGNS
ABSENT

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TO BE... OR
NOT TO BE...

- Frozen Solid - chest not compressible
- Obvious major trauma
- K+ >12 mmol/l
- Clear H/x of CA prior to cooling
TRANSPORT
AIR OR GROUND

• Transporting the Pulseless HT Patient
• CPR - Considerations
• ACLS - Considerations
• Destination - Decision
CPR, SURVIVAL & TRANSPORTATION

- HQ-CPR Should be started immediately and continued without interruption if safe to do so
Duration of CPR is not a predictor of outcome*
OXYGEN CONSUMPTION

- O2 consumption reduced by 6% per 1 degree C
- At 28C (82.4F) =
  - Body reduced to 50%
  - Brain reduced to 35%
CPR IS INTERRUPTED!

- Intermittent or delayed CPR

"Data from surgery during deep hypothermic CA and prehospital case reports underline the feasibility of delayed and intermittent CPR in patients who have arrested due to severe hypothermia."

• “In patients with severe or profound hypothermia, CPR can be delayed (“scoop and run”) and can be given intermittently during evacuation if it is not technically possible or safe to perform continuous CPR (1C). CPR can be given for several hours, if necessary (1B).”
The study has just been published in the medical journal "Resuscitation" and was conducted by Cumbrian Mountain Rescue doctors, the Glenfield Hospital, Leicester in the UK, EURAC in Italy, the Medical University of Innsbruck in Austria and Stanford University in California, USA.

<table>
<thead>
<tr>
<th>CORE TEMP</th>
<th>DURATION OF CPR</th>
<th>DURATION OF INTERRUPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNKNOWN HT-3 HT-4</td>
<td>5 MINUTES MINIMUM</td>
<td>5 MINUTES MAXIMUM</td>
</tr>
<tr>
<td>28 - 20 (82.4 - 68.0)</td>
<td>5 MINUTES MINIMUM</td>
<td>5 MINUTES MAXIMUM</td>
</tr>
<tr>
<td>&lt; 20 (68.0)</td>
<td>5 MINUTES MINIMUM</td>
<td>10 MINUTES MAXIMUM</td>
</tr>
</tbody>
</table>
## ACLS Cardiac Arrest Medications

<table>
<thead>
<tr>
<th>AHA</th>
<th>ERC</th>
</tr>
</thead>
<tbody>
<tr>
<td>“It may be reasonable to consider administration of a vasopressor during cardiac arrest according to the standard ACLS algorithm concurrent with rewarming strategies.” (Class Iib, LOE C)</td>
<td>“Given that defibrillation and adrenaline may induce myocardial injury, it is reasonable to withhold adrenaline, other CPR drugs and shocks until the patient has been warmed to a core temperature $\geq 30^\circ C$. Once $30^\circ C$ has been reached, the intervals between drug doses should be doubled when compared to normothermia.”</td>
</tr>
</tbody>
</table>

Mike Shuster (he thinks SSS it’s a good idea.)
He stated ERC did not do a major review of hypothermia in 2015, ERC and AHA now at a major split.
ECMO / CPB- Transport Those Who will Benefit

PREVENT OVERUSE
ECMO / CPB

- For Hypothermic CA patients that get ECMO survival is 50%
- For Hypothermic CA patients who don’t get ECMO survival is 0% - 37%
Case 3 - Hospital ED

Life Threatening Hypothermia Emergency
WHAT LEVEL OF "HT" IS THIS PT.

- **Unconscious**
- **No Movement**
- **Airway - On Ventilator**
- **Vitals Present**
- **Major Trauma Noted**

---

**Table. Swiss Staging System of Hypothermia**

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<tr>
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<th>Therapy</th>
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Accidental Hypothermia & Avalanche Victims

Grand Rounds
June 9, 2016

Dr. Heather White, PGY3
Summarized by Dr. Weersink, PGY1

Hypothermia = core body temp < 35C
Gold standard = esophageal temperature probe
Second best = rectal probe

** At KGH, our std temperature probes do not read < 34C

Pre-hospital
Careful handling! (fragile myocardium)
Start rewarming
ACLS/BLS - check pulse x 60sec
Transport to appropriate center

Swiss Staging System of HT
1. MILD: conscious, shivering
   Core Temp 32-35 C
2. MODERATE: altered LOC, no shivering
   28-32 C
3. SEVERE: unconscious, no shivering
   <28 C
4. PROFOUND: no vital signs
   <24 C

Treatment depends on stage of HT!

- **HT 1**
  "Warm them, feed them, walk them"

- **HT 2**
  Active external + min invasive rewarming

- **HT 3**
  Active rewarming + transport to ECMO capable center

- **HT 4**
  "Not dead until warm + dead"
  ACLS algorithm
  + transport to ECMO/CPB capable center
  >> Stop resusc if K+ >12mmol OR if asystole with core temp >32C

Invasive rewarming
1. ECMO/CPB is the most effective!
2. Thoracic lavage if no ECMO

Avalanche Victims
Die from trauma, hypoxia, and/or hypothermia

- **<35min**
  ACLS/CPR
- **>35min**
  + patent airway
  ACLS/CPR + ECMO

Summary
QUESTIONS?