

# COMMISSION FOR MOUNTAIN EMERGENCY MEDICINE



## THE MEDICAL ON SITE TREATMENT OF HYPOTHERMIA

Bruno Durrer, Hermann Brugger, David Syme (1998)

Paper intended for first responders and emergency doctors

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## Preamble

Injured persons have an increased risk of cooling out. Due to altitude and wind exposure, hypothermia is a pathology commonly seen in the mountains.

The following recommendations apply for the European Alps with many rescue stations and generally short flight distances to hospitals. In other regions these recommendations have to be adapted to the local rescue systems and local medical facilities.

For practical rescue work and instruction of non medical rescue staff we distinguish between five stages of hypothermia. As criteria we use the degree of consciousness, the presence or absence of shivering, cardiac activity and core temperature. In mountaineering accidents the core temperature should be taken as often as possible. Should the core temperature drop abnormally fast, suspect a serious underlying injury.

|        |  |                             |
|--------|--|-----------------------------|
| HT I   | Clear consciousness with shivering       | Coretemperature C°: 35 – 32 |
| HT II  | Impaired consciousness without shivering | 32 – 28                     |
| HT III | Unconsciousness                          | 28 – 24                     |
| HT IV  | Apparent death                           | 24 - 15 ?                   |
| HT V   | Death due to irreversible Hypothermia    | < 15 ? (< 9 ?)              |

## 1. On-site triage: who is dead?

Severe hypothermic victims with asystole can be resuscitated successfully even after a few hours of cardiac arrest. Therefore, prior to establishing death in the field, the mountain rescue doctor always has to exclude a HT IV. An ECG and a field thermometer (in HT I-III: tympanic; in HT IV/V: oesophageal temperature recommended) are needed as aids. A wrongly indicated resuscitation can put the the rescue team under unnecessary risks.

After having excluded lethal injuries, the rigidity of thorax and abdominal muscles, core temperature and the ECG are decisive.

| <b>ON-SITE TRIAGE:</b>                         | <b>Exclude lethal injuries!</b>  |   |
|--|--|---|
|  | <b>HT IV:</b>  | <b>HT V:</b>  |
| <b>Clinical findings:</b>                      | No vital signs<br>Chest: compressible<br>Abdominal muscles:<br>Kneadable | No vital signs<br>Not compressible<br><br>Not kneadable |
| <b>ECG:</b>                                    | Ventricular fibrillation<br>Asystole                                     | Asystole  |
| <b>Coretemperature:</b>                        | Above 15° Celsius (?)  | Below 15°Celsius (?)                                    |
| <b>Potassium:</b><br>(in the nearest hospital) | Below 12 mmol /L   | Above 12 mmol/l   |

Serum potassium can be used as a criterion for triage only, if hypothermia is combined with asphyxia e.g. avalanche, immersion (cave: hemolysis, rhabdomyolysis). The on-site determination of the serum potassium is in evaluation at present.

Recently some clinical centres have begun to offer rewarming by cardiopulmonary bypass (CPB) without full heparinization of the patient. Consequently, rescue doctors have to decide whether there is a HT IV with additional injuries or a dead patient with lethal injuries and subsequent cooling down.

## **2. Medical on-site treatment of hypothermia**

### **HT IV:**

As soon as the diagnosis of HT IV is confirmed, resuscitation is started (including intubation and ventilation, preferably with humidified warm oxygen) as soon as its continued maintenance can be guaranteed. The frequency of heart massage is the same as in normothermic patients. Whether or not a HT IV should be prevented from further cooling out, is a matter of discussion (metabolic icebox vs. low irreversible limits of the the core temperature). During the evacuation there is always the risk of the core temperature decreasing beyond reversible limits. For this reason most rescue doctors consider a proper protection against further cooling out in HT IV as necessary.. This is usually done by insulation and heat packs on the trunk. I.V. medication and perfusions are considered not to be necessary in HT IV. Defibrillation below a core temperature of 28 degrees is supposed to be ineffective. Therefore only one attempt with 360 J should be tried in case of ventricular fibrillation. The air-transport of the victim to a hospital with CPB facilities is recommended.

### **HT III:**

Very careful handling helps to avoid life-threatening arrhythmias. In HT III peripheral vessels are difficult to locate and it takes usually some time to do an IV. If an IV-line can be established without delay (within about 5 minutes). Only NaCl 0,9% should be perfused. Whether a HT III patient has to be intubated at the site of accident or not, is still a matter of discussion. For the intubation of a patient with protective reflexes an IV line is needed for the application of medicaments. The risk of a further heat loss during the time of treatment and transport has to be evaluated in relation to the advantages of the intubation. There is an

increased risk for further cooling out in HT III and a proper protection against further heat loss is of utmost importance. ECG monitoring has to be started as soon as possible. We recommend to transport the victim to a hospital with active rewarming- / CPB facilities.

## HT II:

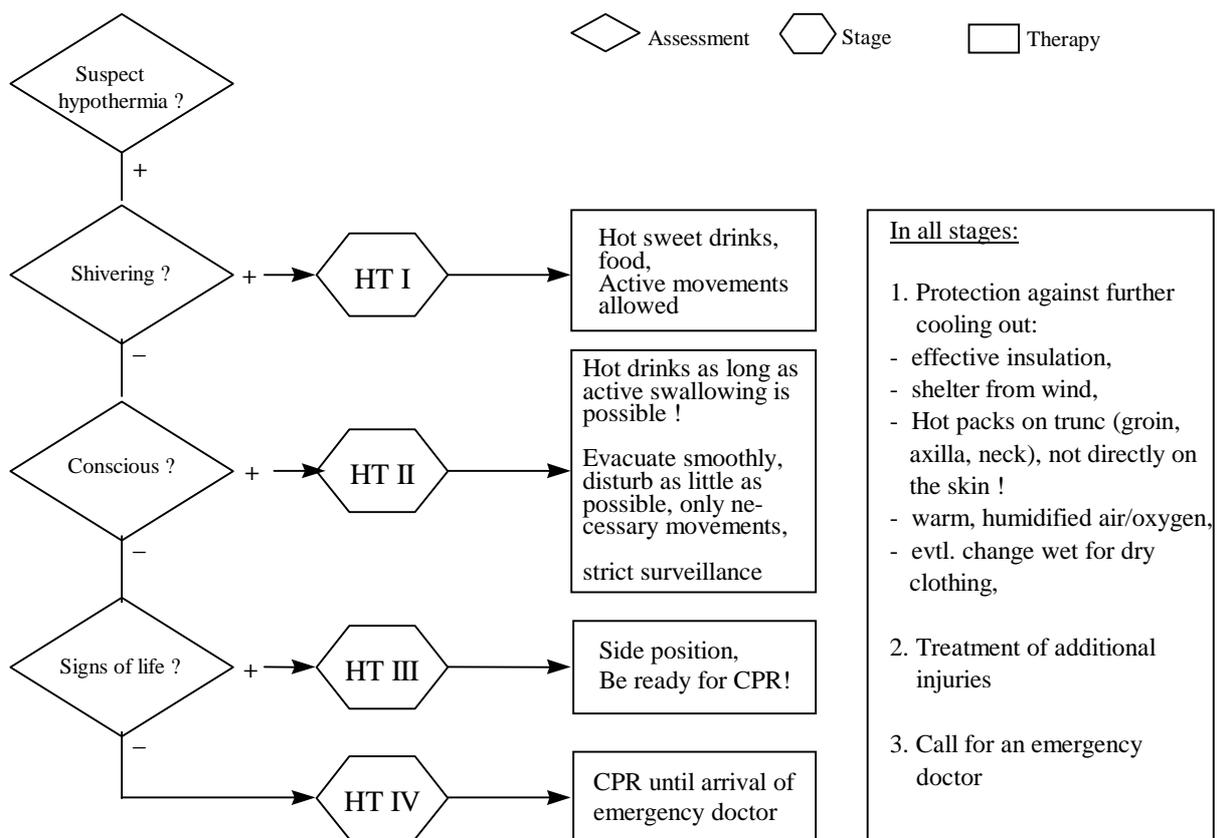
In case of a victim having an impaired consciousness very careful handling is necessary to avoid life-threatening arrhythmias. If swallowing is possible, fluid intake, preferably hot and sweet drinks are recommended. Strict supervision is necessary. We recommend to transport the victim to a hospital with Intensive care unit.

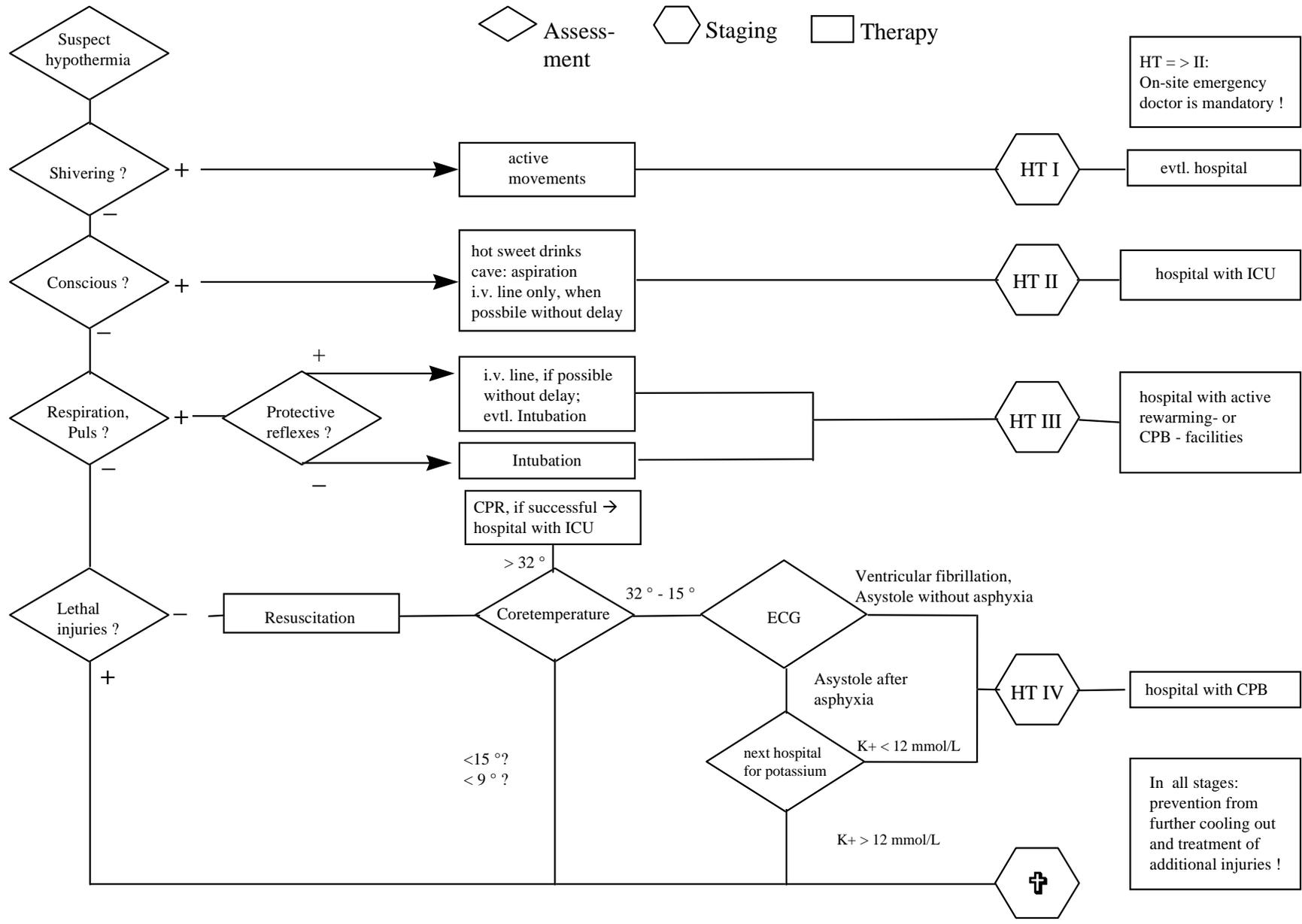
## HT I:

Injuries in the mountains are often combined with mild hypothermia. Shivering should not be used as the only clinical indicator of HT I. Changing wet for dry clothes, hot drinks and insulation help to prevent a further cooling out of the patient. Non- injured victims do not have to be transported to a hospital in all cases.

On-site treatment of hypothermia victims is the „art of the possible,,.With increasing data about on-site core temperatures, we will gather more information about the optimal preclinical treatment and the limits of the reversible core temperature.

## Algorithm hypothermia for first responders





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