



SCIENTIFIC LETTERS

Accidental hypothermia: New clinical classification with the swiss revised system



Hipotermia accidental: nueva clasificación clínica con el sistema suizo revisado

Over the last few years, we have published 2 articles on accidental hypothermia (HT) in *MEDICINA INTENSIVA*. The first one entitled “Management of severe hypothermia”¹ was published back in 2012, and the second one “Management of accidental hypothermia: narrative review”² was published in 2019. The prehospital classification of HT based on the Swiss System was discussed in both papers to help rescue teams that don’t have a proper thermometer available, cannot measure core body temperature (CBT) through minimally invasive methods or when difficulties in the rescue area make it hard or problematic. In the Swiss System, CBT is estimated through the observation of the patient’s level of consciousness, clinical signs, and identification of 5 different stages of HT and their association with CBT:³

- Mild (Stage I or HT I). Clear consciousness with shivering (35–32 °C).
- Moderate (Stage II or HT II). Impaired consciousness without shivering (32–28 °C).
- Severe (Stage III or HT III). Unconsciousness, but with present vital signs (28–24 °C).
- Deep (Stage IV or HT IV). Apparent death: no vital signs (11.8–24 °C).
- Irreversible (Stage V or HT V). Death due to irreversible hypothermia: totally frozen body (< 11.8–4 °C?). In later reviews, stage V was eliminated.⁴

The greatest limitation of the Revised Swiss System was the individual physiological variability of people to HT. And it is precisely because of this variability that the estimate of the CBT based only on the clinical signs is just an approximation. For example, in some victims, tremors can be present at temperatures <30 °C or with vital signs <24 °C, which are temperatures associated with a high risk of triggering ventricular fibrillation (VF).⁵ On the other hand, an analysis of the cases published found that 61% of the victims had been categorized properly with this system. However, significant discrepancies were found among the different stages

established with the clinical signs and CBTs measured. These discrepancies in association with CBT were overestimated in 18% of the cases and underestimated in 21% of the cases.⁶

The limitations of the Swiss System have made us think. Also, they have been improved in the latest review called the Revised Swiss System (RSS) where 3 important changes have been made to categorize the risk of cardiac arrest instead of estimating the CBT.⁷ The first one has to do with studying the level of consciousness in victims with present vital signs. A linear correlation has been established between the level of consciousness and its assessment using the Glasgow coma scale (GCS).⁸ Also, that clinical observations backed by a peer-reviewed retrospective analysis of victims with HT can estimate the risk of cardiac arrest in the management of HT indirectly for the lack of an accompanying disease that may impact the level of consciousness.⁹ To simplify the classification of HT, the level of consciousness, and assess the risk of cardiac arrest, the AVPU scale has been proposed: A-Alert, V-Verbal, P-Pain, U-Unresponsive (AVPU) for its simplicity and good correlation with the GCS. “A-Alert” corresponds to a score of 15 on the GCS; “V-Verbal” corresponds to a score between 9 and 14 on the GCS. This assessment includes victims with a confusing level of consciousness; «P-Pain» corresponds to a score < 9 and assesses victims with pain and unconscious but present vital signs; “U-Unresponsive” corresponds to a score of 3 because it assesses unconscious victims without present vital signs for the lack of them with a minimum 1-minute verification of breathing or pulse (whether carotid or femoral). The second significant change is the disappearance of chills that—although provides us with information on the victim’s state of thermogenesis—has great individual variability. The third one is a change in the estimation range of CBT due to the level of risk of HT-induced cardiac arrest.

Thanks to these 3 changes, the estimate risk of HT-induced cardiac arrest is solely based on the clinical findings provided by the AVPU scale⁷ (Table 1). Regarding this RSS scoring system 3 different clarifications should be made. The first one that suspected HT should always—if possible—be confirmed by measuring the CBT while sparing the RSS classification for cases where the CBT cannot be measured. Also, with its simplified assessment it can be used to estimate the risk of HT-induced cardiac arrest, guide treatment, hospital destination, and rewarming techniques. The second clarification that should be made here has to do with a series of conditions affecting the level of consciousness

Table 1 Adaptation of the classification of the Revised Swiss System adding the estimate of the risk of cardiac arrest, its correlation with the GCS, and the hospital transfer recommended.

Stage of HT	RSS	GCS score	Risk of CA	Transfer
Stage 1	A-Alert	15	Low	Closest hospital
Stage 2	V-Verbal	14–9	Moderate	ICU capable hospital, preferably with ECMO capabilities
Stage 3	P-Pain	<9	High	Hospital with ECMO capabilities
Stage 4	U-Unresponsive	3	CA	Hospital with ECMO capabilities

Source: Musi et al.⁷, Pasquier et al.,⁸ and Lott et al.¹⁰.

CA, cardiac arrest; GCS, Glasgow coma scale; ECMO, extracorporeal membrane oxygenation; HT, hypothermia; RSS, Revised Swiss System.

such as asphyxia, intoxication, brain swelling due to altitude or trauma that can lead to false RSS predictions of a higher risk of cardiac arrest in situations of HT. The third clarification made recommends being cautious with victims in stages of “alert” or “verbal” but accompanied with signs of hemodynamic or respiratory instability like bradycardia, bradypnea or hypotension because this instability can lead to a transition stage towards a higher risk of cardiac arrest.

Treatment, selecting the go-to hospital, and the rewarming techniques used to treat HT should follow the recommendations made on the management of cardiac arrest under special circumstances published by the European Resuscitation Council back in 2021.¹⁰

In conclusion, for the lack of reliable measures of CBT to assess HT, the RSS—that uses the AVPU scale as an assessment and classification system—can be used to estimate the risk of cardiac arrest, guide treatment, hospital destination, and need for rewarming and cardiopulmonary resuscitation with extracorporeal membrane oxygenation (ECMO) techniques.

Funding

None whatsoever.

References

- Avellanas ML, Ricart A, Botella J, Menguelle F, Soteras I, Veres T, et al. Manejo de la hipotermia severa. *Med Intensiva*. 2012;36:200–12, <http://dx.doi.org/10.1016/j.medin.2011.12.005>.
- Avellanas Chavala ML, Ayala Gallardo M, Soteras Martínez Í, Subirats Bayego E. Gestión de la hipotermia accidental: revisión narrativa. *Med Intensiva*. 2019;43:556–68, <http://dx.doi.org/10.1016/j.medin.2011.12.005>.
- Durrer B, Brugger H, Syme D, International Commission for Mountain Emergency Medicine. The medical on-site treatment of hypothermia: ICAR-MEDCOM recommendation. *High Alt Med Biol*. 2003;4:99–103, <http://dx.doi.org/10.1089/152702903321489031>.
- Paal P, Gordon L, Strapazzon G, Brodmann Maeder M, Putzer G, Walpoth B, et al. Accidental hypothermia—an update: the content of this review is endorsed by the International Commission for Mountain Emergency Medicine (ICAR MEDCOM). *Scand J Trauma Resusc Emerg Med*. 2016;24:111, <http://dx.doi.org/10.1186/s13049-016-0303-7>.
- Pasquier M, Zurrón N, Weith B, Turini P, Dami F, Carron PN, et al. Deep accidental hypothermia with core temperature below 24°C presenting with vital signs. *High Alt Med Biol*. 2014;15:58–63, <http://dx.doi.org/10.1089/ham.2013.1085>.
- Deslarzes T, Rousson V, Yersin B, Durrer B, Pasquier M. An evaluation of the Swiss staging model for hypothermia using case reports from the literature. *Scand J Trauma Resusc Emerg Med*. 2016;24:16, <http://dx.doi.org/10.1186/s13049-016-0210-y>.
- Musi ME, Sheets A, Zafren K, Brugger H, Paal P, Hölzl N, et al. Clinical staging of accidental hypothermia: the Revised Swiss System: Recommendation of the International Commission for Mountain Emergency Medicine (ICAR MedCom). *Resuscitation*. 2021;162:182–7, <http://dx.doi.org/10.1016/j.resuscitation.2021.02.038>.
- Pasquier M, Carron PN, Rodrigues A, Dami F, Frochaux V, Sartori C, et al. An evaluation of the Swiss staging model for hypothermia using hospital cases and case reports from the literature. *Scand J Trauma Resusc Emerg Med*. 2019;27:60, <http://dx.doi.org/10.1186/s13049-019-0636-0>.
- Pasquier M, Cools E, Zafren K, Carron PN, Frochaux V, Rousson V. Vitals signs in accidental hypothermia. *High Alt Med Biol*. 2021;22:142–7, <http://dx.doi.org/10.1089/ham.2020.0179>.
- Lott C, Truhlář A, Alfonso A, Barelli A, González-Salvado V, Hinkelbein J, et al. European Resuscitation Council Guidelines 2021: cardiac arrest in special circumstances. *Resuscitation*. 2021;161:152–219, <http://dx.doi.org/10.1016/j.resuscitation.2021.02.011>.

M.L. Avellanas Chavala^{a,b}

^a *Médico Especialista en Medicina Intensiva*

^b *Profesor del Master en Medicina de Urgencia y Rescate en Montaña, Universidad de Zaragoza, Huesca, Spain*
E-mail address: mlavellanas@gmail.com

<https://doi.org/10.1016/j.medine.2022.03.004>
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