

MATTERS ARISING

Open Access



A regional modification to the Revised Swiss System for clinical staging of hypothermia including confusion

Duncan Gray^{1,2*}, Mathieu Pasquier^{2,3}, Hermann Brugger^{2,4}, Martin Musi^{2,5} and Peter Paal^{2,6}

The Revised Swiss System (RSS) [1], uses conscious level as the primary element for field staging of accidental hypothermia, using the AVPU scale (Alert, Verbal, Pain and Unresponsive). The stages achieved estimate the risk of hypothermic cardiac arrest (HCA) rather than estimated core temperature (CT). After the publication of the RSS, Barrow et al. [2] conducted a retrospective study of the relationship between conscious level and the risk of HCA. They similarly used AVPU, but then divided the “Alert” group into “Alert confused” and “Alert not confused”. They found that those in their confused group had a risk of HCA (3 out of 12 patients) while the alert group had no risk of HCA (0 out of 33 patients). Despite the low numbers of patients in the confused group, this new finding reached statistical significance ($p = 0.016$). Within the

context of their study, Barrow et al. [2] concluded that “any change in cognition proved to carry a significant risk of cardiac arrest”.

The RSS, using the AVPU scale, does not reflect this new finding, however it can be accommodated by using a variation of the AVPU scale which is in use: the ACVPU scale, where C is new confusion. ACVPU was originally conceived as part of the British National Early Warning Score (NEWS) 2 system in 2017 [3]. NEWS 2 is now the standard early warning system in United Kingdom (UK) hospitals and ambulance services and is increasingly used internationally [3]. ACVPU is used by the Resuscitation Council UK, in Advance Life Support and related courses and in guidelines [4], and throughout UK mountain rescue [5]. The “C” of ACVPU is defined as new confusion and includes disorientation or any new alteration to mentation and may be subtle. This definition of confusion is very similar to that used by Barrow et al. [2]. ACVPU therefore fits well as an alternative staging framework for accidental hypothermia.

We therefore propose a regional modification to the RSS, using the ACVPU scale (Fig. 1), for use in areas where ACVPU is the norm, such as the UK. Using ACVPU, in addition to incorporating the findings by Barrow et al. [2] regarding confusion, reflects the continuum of conscious level and HCA risk.

The main concepts of the RSS, using conscious level as the primary element to achieve staging and the stages being defined using the risk of HCA rather than core temperature ranges, were reaffirmed in the study by Barrow et al. [2] They found that the risk of HCA increased directly with impairment of conscious level and even

This comment refers to the article available online at <https://doi.org/10.1186/s13049-022-01000-w>.

*Correspondence:

Duncan Gray
duncan.gray519@gmail.com

¹ Department of Emergency Medicine, Raigmore Hospital, Old Perth Road, Inverness IV2 3UJ, UK

² International Commission for Mountain Emergency Medicine (ICAR MedCom), Zürich, Switzerland

³ Department of Emergency Medicine, Lausanne University Hospital, Lausanne, Switzerland

⁴ Institute of Mountain Emergency Medicine, Eurac Research, Bolzano, Italy

⁵ Department of Emergency Medicine, University of Colorado, Anschutz Medical Campus, Mail Stop B-215, 12401 17th Avenue, Aurora, CO 800045, USA

⁶ Department of Anaesthesiology and Intensive Care Medicine, HOSPITALERS Brothers Hospital, Paracelsus Medical University, Salzburg, Austria



© The Author(s) 2024, corrected publication 2024. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated in a credit line to the data.

	Stage 1 A	Stage 1 B	Stage 2	Stage 3	Stage 4
Clinical findings ^a	“Alert” from ACVPU	“Confused” from ACVPU	“Verbal” from ACVPU	“Pain” or “Unresponsive” from ACVPU AND vital signs	“Unresponsive” from ACVPU AND no vital signs ^b
Risk of cardiac arrest ^c	None	Low	Moderate	High	HCA

Fig. 1 **a** In this regional modification to the Revised Swiss System, “Alert” corresponds to a GCS score of 15; “Confused” corresponds to a GCS score of 14, “Verbal” corresponds to a GCS score of 9–13; “Pain” and “Unresponsive” correspond to a GCS score < 9. While shivering is not used as a stage-defining sign in this regional modification to the Revised Swiss System, its presence usually means that the temperature is > 30 °C, a temperature at which hypothermic CA is unlikely to occur [6]. **b** No respiration, no palpable carotid or femoral pulse, no measurable blood pressure. Check for signs of life (pulse and, especially, respiration) for up to 1 min [7]. **c** The transition of colours between stages represents the overlap of patients within groups. The estimated risk of cardiac arrest is based on accidental hypothermia being the only cause of the clinical findings. If other conditions impair consciousness, such as asphyxia, intoxication, high altitude cerebral oedema or trauma, this regional modification to the Revised Swiss System may falsely predict a higher risk of cardiac arrest due to hypothermia. Caution should be taken if a patient remains “alert”, “confused” or “verbal” while showing signs of haemodynamic or respiratory instability such as bradycardia, bradypnoea, or hypotension because this may suggest transition to a stage with higher risk of cardiac arrest

suggest that consciousness alone may be at least as good as CT in predicting HCA risk. This regional modification builds on the formative RSS and continues the evolution of the Swiss System, by using ACVPU to provide more refinement of staging of mild hypothermia for use in areas where ACVPU is used.

Abbreviations

RSS	Revised Swiss System
AVPU	Alert, verbal, pain and unresponsive
HCA	Hypothermic cardiac arrest
CT	Core temperature
ACVPU	Alert, confused, verbal, pain and unresponsive
NEWS	National Early Warning Score
UK	United Kingdom

Author contributions

DG: conceptualisation, investigation, project administration, writing—original draft, writing—review and editing. MP: writing—review and editing. HB: writing—review and editing. MM: writing—review and editing. PP: conceptualisation, supervision, writing—review and editing. All authors read and approved the final manuscript.

Availability of data and materials

No datasets were generated or analysed during the current study.

Declarations

Competing interests

HB receives grants, as the Head of the Institute of Mountain Emergency Medicine, from Eurac Research, Bolzano, Italy. The other authors declare that they have no competing interests.

Received: 26 September 2024 Accepted: 3 October 2024

Published: 11 November 2024

References

- Musi ME, Sheets A, Zafren K, Brugger H, Paal P, Holzl N, Pasquier M. 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.
- Barrow S, Ives G. Accidental hypothermia: direct evidence for consciousness as a marker of cardiac arrest risk in the acute assessment of cold patients. *Scand J Trauma Resusc Emerg Med*. 2022;30(1):13.
- Williams B. the national early warning score: from concept to NHS implementation. *Clin Med (Lond)*. 2022;22(6):499–505.
- The ABCDE approach [<https://www.resus.org.uk/library/abcde-approach>]
- Casualty care revision in mountain rescue [<https://casualtycarebook.com/downloads>]
- Pasquier M, Hugli O, Paal P, Darocha T, Blancher M, Husby P, et al. Hypothermia outcome prediction after extracorporeal life support for hypothermic cardiac arrest patients: the HOPE score. *Resuscitation*. 2018;126:58–64.
- Lott C, Truhlar A, Alfonzo A, Barelli A, Gonzalez-Salvado V, Hinkelbein J, et al. European Resuscitation Council Guidelines 2021: Cardiac arrest in special circumstances. *Resuscitation*. 2021;161:152–219.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.