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Letter to the Editor

Simulation-based training and its effect on management of severe anaphylaxis – Are 4 Hs enough?

Sir,

Literature defines anaphylaxis as a serious and potentially lethal systemic reaction affecting two or more organs or systems, which is caused by the release of active mediators from mast cells and basophils.¹ Severity of anaphylaxis is commonly classified using a four-grade scale, with severe anaphylactic reactions – corresponding to grades 3 and 4 – affecting 1–3 per 10,000 people.^{1,2} Grade 3 anaphylaxis includes symptoms such as laryngeal angio-oedema, bronchospasm, cardiovascular collapse, and cardiac arrhythmia, while grade 4 anaphylactic reactions are associated with circulatory failure, cardiac and/or respiratory arrest.^{1,2}

In an attempt to improve practical emergency management of patients with anaphylaxis among future healthcare providers, we have implemented “The Graz’ SIMLine: Anaphylaxis”, a simulation-based elective course, for undergraduate medical students at our institution. Students are offered seminars, workshop-based part-task training, computer-based simulation, and high-fidelity simulation-based training (SBT) including video-assisted debriefing for a total of 26 h aiming at improving cognitive and technical skills in pathophysiologic mechanisms of allergic reactions, structured patient assessment, emergency airway procedures, and anaphylaxis management algorithm. Detailed course structure and contents have been published previously.³

For debriefing and evaluation purposes, we have video-recorded all high-fidelity scenarios. Students’ performance was assessed by a single evaluator using a predefined checklist based on current anaphylaxis management guidelines.^{2,4} For the present evaluation, we have focused on scenarios involving severe anaphylaxis, i.e. grades 3 and 4 according to the modified classification by Ring and Messmer.²

Eighteen scenarios from five consecutive courses were available for evaluation and included in this analysis. In scenarios involving patients with grade 3 anaphylaxis ($n=7$), students reached $77.1 \pm 9.2\%$ of available points (mean $\pm$ one standard deviation). All anaphylactic reactions (100%) were diagnosed and 85.7% were classified correctly. There was a lower performance score in scenarios involving grade 4 anaphylaxis ($n=11$), with a mean percentage of $56.8 \pm 16.0\%$. Seventy per cent of grade 4 anaphylaxis were diagnosed and 27.3% were classified correctly.

Our results show that SBT has the potential to effectively prepare undergraduate medical students to manage patients with severe anaphylaxis according to guidelines at least in the simulated environment. However, while results for grade 3 anaphylaxis scenarios have been relatively pleasing, the significant decline in practical performance for grade 4 scenarios has to be evaluated critically.

Although patients with grade 4 anaphylaxis present with cardiac and/or respiratory arrest, 30% of students did not identify anaphylaxis as the primary cause for the need for cardiopulmonary resuscitation, leading to important therapeutic strategies such as fluid resuscitation and administration of anti-allergic drugs being neglected.

Current resuscitation guidelines recommend the ‘4 Hs and 4 Ts’ mnemonic for recall of reversible causes of cardiac arrest.⁵ Based on our results and the importance of severe anaphylaxis in emergency medicine, we suggest a modified mnemonic such as ‘5 Hs’ (hypoxia; hypovolaemia; hyper-/hypokalaemia; hypothermia; **hypersensitivity**). As resuscitation guidelines recommend adrenaline (epinephrine) for patients with shockable arrhythmias (ventricular fibrillation/pulseless ventricular tachycardia) after the third shock,⁵ early identification of anaphylaxis could reduce time until adrenaline is administered in these patients.

Conflict of interest statement

Dr. Lukas P. Miledler and Dr. Thomas Wegscheider conceptualised and implemented the presented course. All authors were involved in delivery of educational interventions. Dr. Lukas S.F. Kopanik analysed video-recorded scenarios. There are no real or perceived conflicts of interest associated with this article on behalf of all authors.

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