

The 10 fundamental principles of lay resuscitation

Recommendations by the German Resuscitation Council

Bernd W. Böttiger, Burkhard Dirks, Ulrich Jost, Uwe Kreimeier, Stefan Osche, Markus Roessler, Karl Heinrich Scholz and Sabine Wingen

Sudden cardiac death due to out-of-hospital cardiac arrest is the third leading cause of mortality in industrialised nations.^{1–3} In Europe and in the USA, 800 000 people die every year despite the fact that the emergency medical services initially resuscitate them. The main problem is that emergency medical services take an average of 8 min – and often much more – before they arrive at the scene. The brain tissue, however, commences to die after 3 to 5 min. Therefore, resuscitation procedures initiated by emergency medical services will start too late in the vast majority of cases, and this is the time interval in which lay resuscitation is mandatory.^{4–7} Lay people witness an out-of-hospital cardiac arrest in more than 60% of incidents, and most of them occur at home.^{8–11} When lay people start chest compressions and other resuscitation procedures, survival is tripled or quadrupled, and also the probability of good neurological outcome will increase.^{4–7} Nevertheless in many countries, the lay resuscitation rate is below 30%, whereas in some countries, the rate is 50, 60 or 80%.^{8–11} If all countries could achieve these high lay resuscitation rates, we would be able to save several hundred thousands of patients every year worldwide.

Using an interdisciplinary and interprofessional Delphi approach, the German Resuscitation Council recommends 10 fundamental principles of resuscitation for lay people. They focus on the most important and most effective issues of lay resuscitation and help in understanding and executing them. These 10 easy and precise principles will help the facilitation of achieving lay resuscitation rates of 50% or more all over the world. They should be distributed as widely as possible.

- (1) If lay people/bystanders start resuscitation procedures immediately in sudden out-of-hospital cardiac arrest before emergency medical services arrive, this is associated with a three-fold to four-fold increase in probability of a survival in good condition.^{4–7}
- (2) The first measure is CHECK: if someone collapses, you must immediately check whether the person responds to loud speech or shaking of the shoulders and whether the person is breathing normally. If there is no reaction and the person is not breathing at all or is not breathing normally (gaspings is not normal breathing!), resuscitation procedures should be started immediately.¹²
- (3) The second measure is CALL: activate emergency medical services via emergency number [112 in all countries of the European Union and other European countries respectively, 911 in the USA (where 112 is forwarded to 911)]. At best, emergency medical services should be activated by another bystander, to start uninterrupted chest compressions immediately.¹²
- (4) The third measure is COMPRESS: most important are hard chest compressions. It works like this: the patient is lying on the back, the rescuer kneels down beside the patient's thorax, opens the shirt and puts the heels of his hands, one on the other, in the middle of the bare thorax between the nipples. Now the breastbone is pushed downwards by at least 5 cm and at maximum 6 cm in adults with straight arms and shoulders vertical above the compression point. Immediately after a compression, the pressure to the breastbone must be released

From the Department of Anaesthesiology and Intensive Care Medicine, University Hospital of Cologne, Cologne (BWB, SW), GRC (German Resuscitation Council) Ulm (BD), DLRG (German Lifesaving Association), Bad Nenndorf (UJ), Department of Anaesthesiology, University Hospital, LMU Munich, Munich (UK), German Red Cross eV, Berlin (SO), Department of Anaesthesiology, University Medicine Göttingen, Göttingen (MR) and Department of Cardiology and Intensive Care Medicine, St. Bernard Krankenhaus Hildesheim, Hildesheim, Germany (KHS)

Correspondence to Bernd W. Böttiger, MD, ML, DEAA, FESC, FERC, Director Science and Research, European Resuscitation Council (ERC); Chairman, German Resuscitation Council (GRC), Member of the Board of the German Interdisciplinary Association of Intensive Care and Emergency Medicine (DIVI); Professor and Head of the Department of Anaesthesiology and Intensive Care Medicine, University Hospital of Cologne, Kerpener Straße 62, 50937 Cologne, Germany
Tel: +49 221 478 82054; fax: +49 221 478 87811; e-mail: bernd.boettiger@uk-koeln.de

0265-0215 Copyright © 2018 The Author(s). Published by Wolters Kluwer Health, Inc. on behalf of the European Society of Anaesthesiology.

DOI:10.1097/EJA.0000000000000865

This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

completely. Now continuously change between compression and release with a frequency of 100 to 120 hard compressions per minute, that is about two per second.¹² This is – for example – the beat of ‘Stayin’ alive’ from the Bee Gees. Compressions must not be interrupted at all until emergency medical services take over. If possible, the rescuer should be changed every 2 min.¹²

- (5) CHECK–CALL–COMPRESS: this is a ‘civic duty’; everyone should know how to do it, and should do it in case of cardiac arrest. During the first minutes of out-of-hospital cardiac arrest in most cases, adults still have enough oxygen in the blood, so that the interval between collapse and arrival of emergency medical services can be effectively bridged by chest compression only.^{4–7} This facilitates oxygen containing blood to flow to the brain, and therefore, will keep the brain alive.
- (6) Additional VENTILATION by educated laypersons should be performed, if they are able and willing to do so.¹² Ventilation may further increase the chance of survival – in particular if it takes longer until emergency medical services arrive on the scene. Ventilation is of key importance if the cause of the cardiac arrest is oxygen deficiency, which is the case in almost all newborns, infants and children or in drowning.¹²
- (7) About 25% of patients with an out-of-hospital cardiac arrest may benefit from an automated external defibrillator in addition.^{8–11} If an automated external defibrillator is available, it should be sent for. But chest compressions must never ever be interrupted to get an automated external defibrillator.¹² At least two lay rescuers must stay with the patient and provide uninterrupted chest compressions until emergency medical services arrive.
- (8) If a lay rescuer does not know how to perform chest compressions or if he or she is unsure, the dispatcher of the coordination centre of the emergency medical services should guide the lay rescuer to perform chest compression until emergency medical services arrive (telephone resuscitation).¹² Lay people should be able to activate the hands-free facility/loudspeaker on their phone, so that they can be guided by the dispatcher continuously. It is possible that the coordination centre activates via a smart phone-based system – simultaneously to emergency medical services – educated first responders who are nearby.¹² This can further increase the chance of survival.¹³
- (9) The recovery position has no role in cardiac arrest. If a person is unconscious and is not breathing or is not breathing normally, he or she is in cardiac arrest and only chest compressions are helpful.¹² If an

unconscious person is breathing normally, the recovery position may help to keep the airway open. In this case, normal breathing must always be rechecked carefully and continuously and, if there is any doubt, chest compressions and resuscitation procedures must start immediately.

- (10) CHECK–CALL–COMPRESS is a ‘civic duty’ which is essential for survival and must be undertaken urgently, always, and by everyone in suspected cardiac arrest. This must be taught everywhere, and this education must start in schools.^{3,14,15} Artificial ventilation and an automated external defibrillator may also help to save lives and further increase survival rates in specific situations.

Acknowledgements relating to this article

Assistance with the Editorial: none.

Financial support and sponsorship: none.

Conflicts of interest: none.

Comment from the Editor: this Editorial was checked by the editors but was not sent for external peer review. BWB is an Associate Editor of the *European Journal of Anaesthesiology*.

Important links related to this article: www.grc-org.de; www.wiederbelebung.de; www.erc.edu; www.ilcor.org; <https://kids-save-lives.net/>.

References

- 1 Mozaffarian D, Benjamin EJ, Go AS, *et al.* Executive summary: heart disease and stroke statistics – 2016 update: a report from the American Heart Association. *Circulation* 2016; **133**:447–454.
- 2 Institute of Medicine. Strategies to improve cardiac arrest survival: a time to act Washington, DC: the National Academies Press. 2015, <https://doi.org/10.17226/21723>. [Accessed 1 June 2018].
- 3 Böttiger BW, Semeraro F, Altemeyer KH, *et al.* KIDS SAVE LIVES: school children education in resuscitation for Europe and the world. *Eur J Anaesthesiol* 2017; **34**:792–796.
- 4 Holmberg M, Holmberg S, Herlitz J. Effect of bystander cardiopulmonary resuscitation in out-of-hospital cardiac arrest patients in Sweden. *Resuscitation* 2000; **47**:59–70.
- 5 Kragholm K, Wissenberg M, Mortensen RN, *et al.* Bystander efforts and 1-year outcomes in out-of-hospital cardiac arrest. *N Engl J Med* 2017; **376**:1737–1747.
- 6 Kragholm K, Wissenberg M, Mortensen RN, *et al.* Return to work in out-of-hospital cardiac arrest survivors: a nationwide register-based follow-up study. *Circulation* 2015; **131**:1682–1690.
- 7 Wissenberg M, Lippert FK, Folke F, *et al.* Association of national initiatives to improve cardiac arrest management with rates of bystander intervention and patient survival after out-of-hospital cardiac arrest. *JAMA* 2013; **310**:1377–1384.
- 8 Beck B, Bray J, Smith K, *et al.* Establishing the Aus-ROC Australian and New Zealand out-of-hospital cardiac arrest Epistry. *BMJ Open* 2016; **6**:e011027.
- 9 Girotra S, van Diepen S, Nallamothu BK, *et al.* Regional variation in out-of-hospital cardiac arrest survival in the United States. *Circulation* 2016; **133**:2159–2168.
- 10 Gräsner JT, Lefering R, Koster RW, *et al.* EuReCa ONE-27 Nations, ONE Europe, ONE Registry: a prospective one month analysis of out-of-hospital cardiac arrest outcomes in 27 countries in Europe. *Resuscitation* 2016; **105**:188–195.
- 11 Ong ME, Shin SD, De Souza NN, *et al.* Outcomes for out-of-hospital cardiac arrests across 7 countries in Asia: the Pan Asian Resuscitation Outcomes Study (PAROS). *Resuscitation* 2015; **96**: 100–108.

- 12 Perkins GD, Handley AJ, Koster RW, *et al.* Adult basic life support and automated external defibrillation section Collaborators. European Resuscitation Council Guidelines for Resuscitation 2015: Section 2. Adult basic life support and automated external defibrillation. *Resuscitation* 2015; **95**:81–99.
- 13 Ringh M, Rosenqvist M, Hollenberg J, *et al.* Mobile-phone dispatch of laypersons for CPR in out-of-hospital cardiac arrest. *N Engl J Med* 2015; **372**:2316–2325.
- 14 Böttiger BW, Bossaert LL, Castrén M, *et al.* Board of European Resuscitation Council (ERC). Kids Save Lives – ERC position statement on school children education in CPR: 'Hands that help – training children is training for life'. *Resuscitation* 2016; **105**:A1–A3.
- 15 Böttiger BW, Van Aken H. Kids save lives – training school children in cardiopulmonary resuscitation worldwide is now endorsed by the World Health Organization (WHO). *Resuscitation* 2015; **94**:A5–A7.