



European Resuscitation Council Guidelines 2000 for Adult Basic Life Support

A statement from the Basic Life Support and Automated External Defibrillation Working Group¹ and approved by the Executive Committee of the European Resuscitation Council

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1. Introduction

The European Resuscitation Council (ERC) last issued guidelines for Basic Life Support (BLS) in 1998 [1]. These were based on the ‘Advisory Statements’ of the International Liaison Committee on Resuscitation (ILCOR) published in 1997 [2]. Following this, the American Heart Association, together with representatives from ILCOR, undertook a series of evidence based evaluations of the science of resuscitation [3] which culminated in the publication of Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care in August 2000 [4,5]. The Basic Life Support and Automated External Defibrillation Working Group (BLS & AED Group) has considered this document and the supporting scientific literature and has recommended changes to the ERC BLS Guidelines. These are presented in this paper.

2. Guidelines changes

Some of the changes are minor (e.g. duration of rescue breaths increased from 1.5–2 to 2 s) or have been made to achieve international uniformity (e.g. checking mouth for obstructing foreign body earlier in the sequence). There have also been some modifications in the wording to aid clearer understanding; an example is the introduction of the term ‘normal breathing’ in an attempt to distinguish this from agonal respiration.

The major changes in technique are: (a) lay rescuers will no longer be taught or expected to perform a pulse check to determine cardiac arrest, although this will remain for healthcare providers; (b) mouth-to-mouth ventilation volume for adults, when supplemental oxygen is not available, is increased to 700–1000 ml per breath; (c) compression:ventilation ratio for two-rescuer CPR will be 15:2 when the airway is not protected; (d) back slaps and abdominal thrusts will only be recommended for choking in the conscious adult; chest compressions will be used for unconscious victims. A brief rationale for each of these changes is discussed below.

2.1. Carotid pulse check

Most published guidelines for resuscitation emphasize that the absence of a carotid pulse is an essential diagnostic sign of cardiac arrest. Up to 10 s is normally allowed for this check.

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Several studies, however, have shown that far more than 10 s are required to diagnose reliably the presence or absence of a carotid pulse [6–10], and even with prolonged palpation significant errors in diagnosis occur [11]. As a result of these studies the ERC BLS Group recommended in 1998 that the carotid pulse check be ‘de-emphasized’ and that the expression ‘look for signs of a circulation’ should be used instead [1]. After review of the data it has been agreed that *for the lay rescuer* checking for signs of a circulation should mean the following: deliver the two initial effective rescue breaths; look, listen, and feel for normal breathing, coughing, or movement for no more than 10 s. If the rescuer is not confident that one or more of these signs of a circulation are present he or she should begin chest compressions immediately.

Healthcare providers should continue to perform a carotid pulse check, taking no more than 10 s whilst also checking the other signs of a circulation.

2.2. Ventilatory volume

Current ERC guidelines recommend that each breath of mouth-to-mouth ventilation should deliver between 400 and 600 ml [12], whilst the American Heart Association Guidelines recommend a volume of between 800 and 1200 ml [13]. A lower volume decreases the risk of gastric inflation [14] but without oxygen supplementation may result in suboptimal oxygenation [15]. As a compromise it is recommended that for adult resuscitation each rescue breath (without supplemental oxygen) should deliver a volume of 10 ml/kg which approximates to 700–1000 ml for an average male adult. This should be delivered slowly (over about 2 s) and the rescuer should take a deep breath before each ventilation to optimise the oxygen concentration in the expired air [16].

In practice, this will not result in any change in the BLS guidelines since the instruction ‘Blow...to make (the victim’s) chest rise as in normal breathing’ will remain the same. Manufacturers of resuscitation training manikins will be advised to alter the volume of the ‘lungs’.

2.3. Compression:ventilation ratio

When chest compressions are performed during

cardiac arrest the coronary perfusion pressure rises only gradually, being higher after 15 uninterrupted compressions than after five compressions [17]. With each pause for ventilation the perfusion pressure falls rapidly. It then takes several further compressions before the previous level of brain and coronary perfusion is re-established. As far as the circulation is concerned, a compression:ventilation ratio of 15:2 is, therefore, likely to be more efficient than a ratio of 5:1. There is also evidence of better outcome for the victim of cardiac arrest if a higher number of chest compressions are given during CPR, even if this is at the expense of fewer ventilations [17,18].

For these reasons, a ratio of 15 compressions to two ventilations is now recommended for one or two rescuer CPR. During advanced life support, once the airway has been secured by a cuffed endotracheal tube, an alternative compression:ventilation ratio may be used.

For the sake of reducing the number of skills to be learnt, basic life support courses for lay persons should teach only single rescuer CPR. Where two or more lay rescuers are present, each should take turns in providing resuscitation. Two-rescuer CPR is appropriate for healthcare providers and those lay persons who are members of trained teams, such as first aid and rescue organisations. Even for trained teams the ratio of compressions to ventilations remains 15:2.

2.4. Choking in the unconscious victim

Current ERC BLS guidelines recommend that a sequence of five backslaps alternating with five abdominal thrusts should be applied both to the conscious and unconscious victim. This means that separate techniques have to be taught for use when the victim is lying on the ground. It is well recognised that skill retention following training in resuscitation is poor [19–21]. Several authorities have recommended simplification of techniques to aid acquisition and retention [22,23], and it has been shown that reducing the number of steps in a sequence of skills is beneficial [24]. The risk of choking to death is significantly less than that of dying from cardiac arrest due to a myocardial infarction [25]. There are, therefore, good educational reasons for wanting to simplify the treatment algorithm of a (relatively) rare condition.

There is, in addition, evidence that chest compressions can generate higher airway pressures than abdominal thrusts and may be more effective in relieving foreign body obstruction [26].

For these reasons it is now recommended that if a victim of choking is or becomes unconscious a modified sequence of basic life support should be applied rather than backslaps and abdominal thrusts.

3. Sequence of actions for adult basic life support

The following is the agreed sequence of actions that constitute the European Resuscitation Council Guidelines 2000 for Adult Basic Life Support. In this context an adult is considered to be a person aged 8 years or over. In the text, use of the masculine includes the feminine.

1. Ensure safety of rescuer and victim

2. Check the victim and see if he responds:

- Gently shake his shoulders and ask loudly: 'Are you all right?'

3A. If he responds by answering or moving:

- Leave him in the position in which you find him (provided he is not in further danger), check his condition and get help if needed
- Send someone for help or, if you are on your own, leave the victim and go for help yourself
- Reassess him regularly

3B. If he does not respond:

- Shout for help
 - Unless you can assess him fully in the position you find him, turn the victim on to his back and then open the airway:
 - Place your hand on his forehead and gently tilt his head back keeping your thumb and index finger free to close his nose if rescue breathing is required
 - Remove any visible obstruction from the victim's mouth, including dislodged dentures, but leave well fitting dentures in place
 - With your fingertip(s) under the point of the victim's chin, lift the chin to open the airway
- Try to avoid head tilt if trauma (injury) to the neck is suspected**

4. Keeping the airway open, look, listen and feel for normal breathing (more than an occasional gasp or weak attempts at breathing):

- Look for chest movement
- Listen at the victim's mouth for breath sounds
- Feel for air on your cheek
- Look, listen, and feel for no more than **10 s** to determine if the victim is breathing normally

5A. If he is breathing normally:

- Turn him into the recovery position (see below)
- Send someone for help or, if you are on your own, leave the victim and go for help yourself
- Check for continued breathing

5B. If he is not breathing, or is only making occasional gasps or weak attempts at breathing:

- Send someone for help or, if you are on your own, leave the victim and go for help; return and start rescue breathing as below
- Turn the victim onto his back if he is not already in this position
- Give two **slow, effective** rescue breaths, each of which makes the chest rise and fall:
 - Ensure head tilt and chin lift
 - Pinch the soft part of his nose closed with the index finger and thumb of your hand on his forehead
 - Open his mouth a little, but maintain chin lift
 - Take a deep breath to fill your lungs with oxygen, and place your lips around his mouth, making sure that you have a good seal
 - Blow steadily into his mouth whilst watching his chest; take about 2 s to make his chest rise as in normal breathing
 - Maintaining head tilt and chin lift, take your mouth away from the victim and watch for his chest to fall as air comes out
- Take another breath and repeat the sequence as above to give two effective rescue breaths in all
- If you have difficulty achieving an effective breath:
 - Recheck the victim's mouth and remove any obstruction
 - Recheck that there is adequate head tilt and chin lift
 - Make up to five attempts in all to achieve two effective breaths

- Even if unsuccessful, move on to check the circulation

6. Check the victim for signs of a circulation:

- Look, listen and feel for normal breathing, coughing, or movement by the victim
- **Only if you have been trained to do so**, check the carotid pulse
- Take **no more than 10 s** to do this

7A. If you are confident that you have detected signs of a circulation:

- Continue rescue breathing until the victim starts breathing on his own
- About every ten breaths (or about every minute) recheck for signs of a circulation; take no more than 10 s each time
- If the victim starts to breathe normally on his own but remains unconscious, turn him into the recovery position. Be ready to turn him onto his back and re-start rescue breathing if he stops breathing

7B. If there are no signs of a circulation, or you are at all unsure start chest compressions:

- With your hand that is nearest to the victim's feet, locate the lower half of the sternum (breastbone):
 - Using your index and middle fingers, identify the lower rib edge nearest to you. Keeping your fingers together, slide them upwards to the point where the ribs join the sternum. With your middle finger on this point, place your index finger on the sternum itself
 - Slide the heel of your other hand down the sternum until it reaches your index finger; this should be the middle of the lower half of the sternum
 - Place the heel of the other hand on top of the first
 - Extend or interlock the fingers of both hands and lift them to ensure that pressure is not applied over the victim's ribs. Do not apply any pressure over the upper abdomen or bottom tip of the sternum
 - Position yourself vertically above the victim's chest and, with your arms straight, press down on the sternum to depress it between 4–5 cm
 - Release all the pressure without losing contact between the hand and sternum, then repeat at a rate of about 100 times a min (a little less

than two compressions a second); it may be helpful to count out aloud. Compression and release should take an equal amount of time

- Combine rescue breathing and compressions:
 - After 15 compressions tilt the head, lift the chin and give two effective breaths
 - Return your hands without delay to the correct position on the sternum and give 15 further compressions, continuing compressions and breaths in a ratio of 15:2
 - Only stop to recheck for signs of a circulation if the victim makes a movement or takes a spontaneous breath; otherwise resuscitation should not be interrupted

8. Continue resuscitation until:

- Qualified help arrives and takes over;
- The victim shows signs of recovery;
- You become exhausted

See Fig. 1.

4. Recovery position

There are a number of different recovery positions each of which has its advocates. National resuscitation councils and other major organisations should consider adopting one of the several available options so that training and practice can be consistent.

The BLS and AED Working Group of the ERC recommends that the following recovery position be used for training purposes, but that particular care is taken to ensure that during training a conscious volunteer is not left in this position for more than a few minutes. If this recovery position is used for a victim, care should be taken to monitor the peripheral circulation of the lower arm, and to ensure that the duration for which there is pressure on this arm is kept to a minimum. If the victim has to be kept in the recovery position for **more than 30 min** he should be turned to the opposite side.

- Remove the victim's spectacles
- Kneel beside the victim and make sure that both his legs are straight
- Place the arm nearest to you out at right angles to his body, elbow bent with the hand palm uppermost
- Bring his far arm across the chest, and hold the back of the hand against the victim's cheek nearest to you

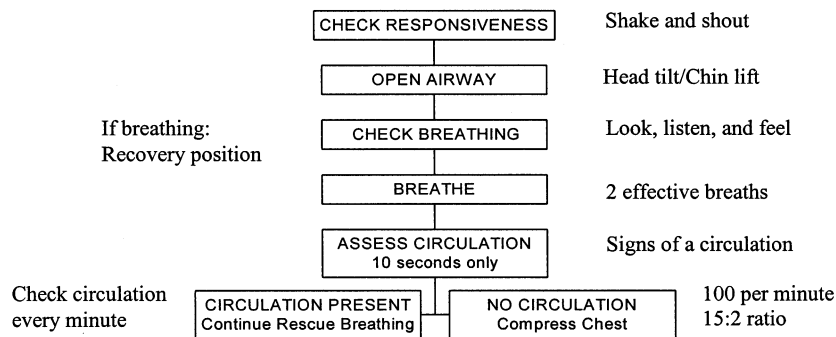


Fig. 1. Adult basic life support.

- With your other hand, grasp the far leg just above the knee and pull it up, keeping the foot on the ground
- Keeping his hand pressed against his cheek, pull on the far leg to roll the victim towards you onto his side
- Adjust the upper leg so that both the hip and knee are bent at right angles
- Tilt the head back to make sure the airway remains open
- Adjust the hand under the cheek, if necessary, to keep the head tilted
- Check breathing regularly

Finally, it must be emphasized that in spite of possible problems during training and in use, it remains above doubt that placing the unconscious, breathing victim into the recovery position can be life saving.

5. Resuscitation with two rescuers

Two-rescuer CPR is less tiring than single person CPR. However, it is important that both rescuers are proficient and practised in the technique. Therefore it is recommended that this technique is only used by trained healthcare providers and those lay persons who are members of trained teams, such as first aid and rescue organisations. The following points should be noted:

1. The first priority is to summon help. This may mean that one rescuer has to start CPR alone whilst the other leaves to find a telephone.
2. It is preferable that the rescuers work from opposite sides of the victim.
3. A ratio of 15 compressions to two inflations should be used. By the end of each series of 15 compressions, the rescuer responsible for ventilation should be positioned ready to give two inflations with the least possible delay. It is

helpful if the rescuer giving compressions counts out aloud.

4. Chin lift and head tilt should be maintained at all times. Ventilations should take 2 s each during which chest compressions should cease; they should be resumed immediately after the second inflation, waiting only for the rescuer to remove his or her lips from the victim's face.
5. If the rescuers wish to change places, usually because the one giving compressions becomes tired, this should be undertaken as quickly and smoothly as possible

6. Choking

If blockage of the airway is only partial the victim will usually be able to clear it by coughing, but if there is complete obstruction to flow of air, this may not be possible.

Diagnosis

- The victim may have been seen to be eating, or a child may have put an object into its mouth
- A victim who is choking often grips his throat with his hand
- **With partial airway obstruction** the victim will be distressed and coughing. There may be an inspiratory wheeze, a musical sound as the victim attempts to breathe in.
- **With complete airway obstruction** the victim will be unable to speak, breathe or cough, and will eventually lose consciousness.

Treatment (see Fig. 2)

1. If the victim is breathing, encourage him to continue coughing, but do nothing else

2. If the victim shows signs of becoming weak or stops breathing or coughing carry out back slapping:

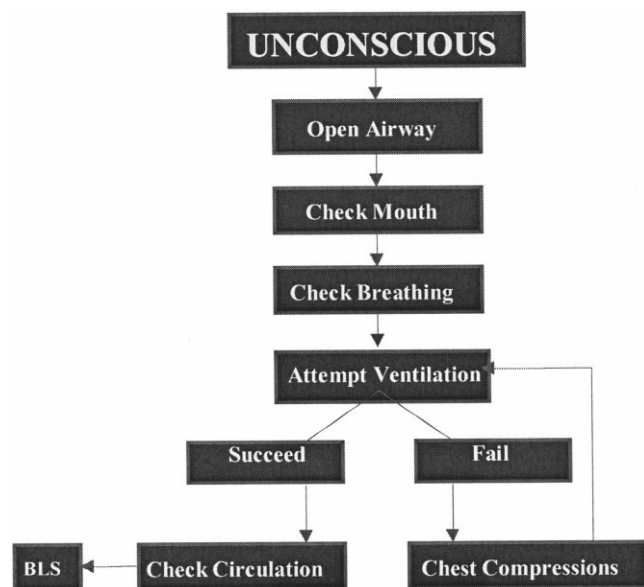


Fig. 2. Management of choking in adults.

- Remove any obvious debris or loose false teeth from the mouth
- Stand to the side and slightly behind him
- Support his chest with one hand and lean him well forwards so that when the obstructing object is dislodged it comes out of the mouth rather than goes further down the airway
- Give **up to five** sharp slaps between his shoulder blades with the heel of your other hand; the aim should be to relieve the obstruction with each slap rather than necessarily to give all five.

3. If back-slapping fails, give abdominal thrusts:

- Stand behind the victim and put both arms round the upper part of his abdomen
- Make sure the victim is bending well forwards so that when the obstructing object is dislodged it comes out of the mouth rather than goes further down the airway
- Clench your fist and place it between the umbilicus (navel) and xiphisternum (bottom tip of the sternum). Grasp it with your other hand
- Pull sharply inwards and upwards; the obstructing object should be dislodged
- If the obstruction is still not relieved, re-check the mouth for any obstruction that can be reached with a finger, and continue alter-

nating five back slaps with five abdominal thrusts

4. If the victim at any time becomes unconscious:

This may result in relaxation of the muscles around the larynx (voicebox) and allow air to pass down into the lungs. If at any time the choking victim loses consciousness carry out the following *sequence of life support*:

- Tilt the victim's head and remove any visible obstruction from the mouth
- Open his airway further by lifting his chin
- Check for breathing by looking, listening, and feeling
- Attempt to give two effective rescue breaths:
- If effective breaths **can** be achieved within five attempts:
 - Check for signs of a circulation
 - Start chest compressions and/or rescue breaths as appropriate
- If effective breaths **cannot** be achieved within five attempts:
 - Start chest compressions **immediately** to relieve the obstruction. Do not check for signs of a circulation
 - After 15 compressions, **check the mouth for any obstruction**, then attempt further rescue breaths
 - Continue to give cycles of 15 compressions followed by attempts at rescue breaths
- If at any time effective breaths **can** be achieved:
 - Check for signs of a circulation
 - Continue chest compressions and/or rescue breaths as appropriate

7. When to get help

It is vital for rescuers to get help as quickly as possible.

- When **more than one** rescuer is available, one should start resuscitation while another rescuer goes for help immediately it has been established that the victim is not breathing
- If the victim is an **adult**, the single rescuer should normally assume that he has a heart problem and go for help immediately it has been established that he is not breathing. This decision may be influenced by the availability of emergency medical services

However, if the likely cause of unconsciousness is a breathing problem, as in:

trauma (injury);

drowning;

choking;

drug or alcohol intoxication;

or if the victim is an infant or a child

the rescuer should perform resuscitation for **about 1 min** before going for help.

References

- [1] Basic Life Support Working Group of the European Resuscitation Council. The 1998 European Resuscitation Council guidelines for adult single rescuer basic life support. *Resuscitation*, 1998;37:67–80.
- [2] Handley AJ, Becker LB, Allen M, van Drenth A, Kramer EB, Montgomery WH. Single rescuer adult basic life support. An advisory statement from the Basic Life Support Working Group of the International Liaison Committee on Resuscitation (ILCOR). *Resuscitation* 1997;34:101–8.
- [3] American Heart Association in collaboration with the International Liaison Committee on Resuscitation (ILCOR). Introduction to the International Guidelines 2000 for CPR and ECC. Guidelines for cardiopulmonary resuscitation and emergency cardiovascular care — an international consensus on science. *Resuscitation* 2000;46:3–15.
- [4] American Heart Association in collaboration with the International Liaison Committee on Resuscitation (ILCOR). Guidelines 2000 for cardiopulmonary resuscitation and emergency cardiovascular care. An international consensus on science. *Circulation* 2000;102(Suppl. I):I-1–I-384.
- [5] American Heart Association in collaboration with the International Liaison Committee on Resuscitation (ILCOR). Guidelines 2000 for cardiopulmonary resuscitation and emergency cardiovascular care — An international consensus on science. *Resuscitation* 2000;46:1–447.
- [6] Flesche CW, Breuer S, Mandel LP, Brevik H, Tarnow J. The ability of health professionals to check the carotid pulse. *Circulation* 1994;90(Suppl. 1):288.
- [7] Mather C, O'Kelly S. The palpitation of pulses. *Anaesthesia* 1996;51:189–91.
- [8] Monsieurs KG, De Cauwer HG, Bossaert LL. Feeling for the carotid pulse: is five seconds enough? *Resuscitation* 1996;31:S3.
- [9] Bahr J, Klingler H, Panzer W, Rode H, Kettler D. Skills of lay people in checking the carotid pulse. *Resuscitation* 1997;35:23–6.
- [10] Ochoa FJ, Ramalle-Gomara E, Carpintero JM, Garcia A, Saralegui I. Competence of health professionals to check the carotid pulse. *Resuscitation* 1998;37:173–5.
- [11] Eberle B, Dick WF, Schneider T, Wissner G, Doetsch S, Tzanova I. Checking the carotid pulse: diagnostic accuracy of first responders in patients with and without a pulse. *Resuscitation* 1996;33:107–16.
- [12] Baskett P, Bossaert L, Carli P, Chamberlain D, Dick W, Nolan JP, Parr MJA, Scheidegger D, Zideman D. Guidelines for the basic management of the airway and ventilation during resuscitation. A statement by the Airway and Ventilation Management Working Group of the European Resuscitation Council. *Resuscitation* 1996;31:187–200.
- [13] Emergency Cardiac Care Committee and Subcommittees, American Heart Association. Guidelines for cardiopulmonary resuscitation and emergency cardiac care. *J Am Med Assoc* 1992;268:2171–295.
- [14] Idris AH, Wenzel V, Banner MJ, Melker RJ. Smaller tidal volumes minimize gastric inflation during CPR with an unprotected airway. *Circulation* 1995;92(Suppl. I):1759.
- [15] Idris AH, Gabrielli A, Caruso L. Smaller tidal volume is safe and effective for bag-valve-ventilation, but not for mouth-to-mouth. *Circulation* 1999;100(Suppl. I):1644.
- [16] Htin KJ, Birenbaum DS, Idris AH, Banner MJ, Gravenstein N. Rescuer breathing pattern significantly affects O₂ and CO₂ received by the patient during mouth-to-mouth ventilation. *Crit Care Med* 1998;26:A56–60.
- [17] Kern KB, Hilwig RW, Berg RA, Ewy GA. Efficacy of chest compression-only BLS CPR in the presence of an occluded airway. *Resuscitation* 1998;39:179–88.
- [18] Van Hoeyweghen RJ, Bossaert LL, Mullie A, Calle P, Martens P, Buylaert WA, Deloof H. Quality and efficiency of bystander CPR. *Belgian Cerebral Resuscitation* 1993;26:47–52.
- [19] Berden HJ, Bierens JJ, Willems FF, Hendrick JM, Pijls NH, Knape JT. Resuscitation skills of lay public after recent training. *Annals of Emergency Medicine* 1994;23:1003–8.
- [20] Quiney NF, Gardner J, Brampton W. Resuscitation skills amongst anaesthetists. *Resuscitation* 1995;29:215–8.
- [21] Morgan CL, Donnelly PD, Lester CA, Assar DD. Effectiveness of the BBC's 999 training roadshows on cardiopulmonary resuscitation: video performance of cohort of unforwarned participants at home six months afterwards. *British Medical Journal* 1996;313:912–6.
- [22] Kaye W, Mancini ME. Teaching adult resuscitation in the United States — time for a rethink. *Resuscitation* 1998;37:177–87.
- [23] Assar D, Chamberlain D, Colquhoun M, Donnelly P, Handley AJ, Leaves S, Kern KB, Mayor S. A rationale for staged teaching of basic life support. *Resuscitation* 1998;39:137–43.
- [24] Handley JA, Handley AJ. Four-step CPR-improving skill retention. *Resuscitation* 1998;36:3–8.
- [25] National Center for Health Statistics and National Safety Council, 1998. Data on odds of death due to choking, May 7.
- [26] Langhelle A, Sunde K, Wik L, Steen PA. Airway pressure during chest compressions versus Heimlich manoeuvre in newly dead adults with complete airway obstruction. *Resuscitation* 2000;44:105–8.