Press much more, blow much less - new international resuscitation guidelines

The new guidelines have been formulated in the light of understanding the importance of early, high-quality CPR.

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This review highlights and explains the rationale for major changes that have evolved in the development of new international guidelines for cardiopulmonary resuscitation (CPR) and emergency cardiovascular care.[1]

The review will focus on basic life support guidelines for both the lay rescuer/first aider and the trained health care provider. New guidelines emphasise simplicity and what is considered to be the most effective method for resuscitating adults, children and infants after sudden cardiac arrest from either major heart rhythm disturbances or pump failure and asphyxial arrest from prolonged hypoxia.

Rationale for change

Despite renewed worldwide interest in implementing effective resuscitation procedures in the pre-hospital environment, with emphasis on the much-acclaimed 'chain of survival', and despite increased education and awareness of the general public and the training of health care providers in the use of the automated external defibrillator (AED), an unacceptably high number of deaths from cardiac arrest still occur outside hospital. The survival rate for out-of-hospital cardiac arrest remains low worldwide, quoted as less than 6% in published studies.[2]

Although implementation of the 'chain of survival' interventions has made a difference, the one outstanding most critical factor which seems to have had the greatest effect on survival rates following cardiac arrest, is early, high-quality CPR (see the enhanced chain of survival).

Chain of survival.

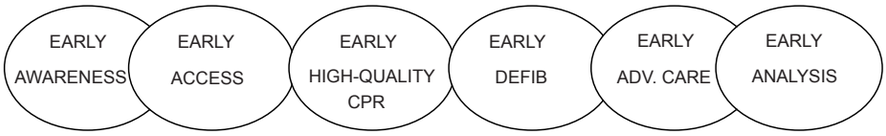
Thus, emphasis is now on improving CPR techniques to increase these poor survival rates.

What constitutes high-quality CPR? What factors need to be changed to improve CPR and still remain linked with all the other factors in the 'chain of survival'?

- Studies have shown that bystanders do not often perform CPR, that participants fail to master CPR skills during courses, and that the quality of CPR skills rapidly declines once a course has been completed. Thus simpler, more straightforward CPR training would appear to be the answer, especially for the lay person or relatively untrained first aider.
- To be effective, CPR must restore adequate coronary and cerebral blood flow in order to perfuse the heart and brain with oxygen. Any interruptions in chest compressions will lower cardiac perfusion, thus lowering cardiac output, and therefore reducing perfusion of the vital organs.

To explain why this is so, ……

Think of rural water pumps where you must pump the handle up and down a number of times until the water pours out of the tap. This is called priming the pump. Then, provided you do not stop or pause for any length of time, there will be a continuous flow of water from the tap each time you pump the handle. However, if you stop pumping the handle up and down for more than a short period, continuous flow will stop and you will have to 'prime' the pump again several times before the flow of water will resume.



The enhanced chain of surival.

The heart is very much like this rural water pump. When you start compressions after cardiac arrest, it takes a number of compressions before the blood returns to the heart (pump) and is pushed out to the body. You are thus 'priming the pump'. Continuous blood flow will begin if you then carry on with uninterrupted compressions.

If compressions are interrupted, even for a few seconds, blood will stop flowing out of the heart and will pool once again. To resume flow after a prolonged interruption in compressions you will have to do a significant number of compressions again to get it started; that is, you will have to 'prime' the heart pump again first.

- Studies revealed that in the first few minutes following sudden cardiac arrest, ventilations do not appear to be as important as chest compressions for a successful resuscitation.

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To explain why this is so …….

When we breathe, oxygen enters the lungs and crosses over into the blood. While the heart is beating, blood is flowing and delivering oxygen to all parts of the body. However, not all the oxygen will leave the blood and move across to the organs. Some of the oxygen remains in the blood as it returns to the heart. This is known as the 'oxygen reserve'. This means that even if the patient stops breathing, there is still some oxygen in the blood. If the patient continues not to breathe, more and more oxygen will move from the blood to the tissues until the reserve has been depleted. This reserve lasts approximately 4 - 5 minutes, so that following a sudden arrest there is still a fair amount of oxygen in the blood. It is therefore more important to keep blood moving by doing uninterrupted compressions to ensure that the oxygen in the blood reaches the needy tissues, especially the vital organs such as the brain, heart and kidneys.

- However, with asphyxial arrest, when the patient has been without oxygen for a prolonged time prior to cardiac arrest, as in a near-drowning event, the body's oxygen reserve will have been depleted.

In this case, it is important to get oxygen into the patient early.

When ventilating a patient, either via pocket face mask, mouthpiece or when using supplementary O_2 via a bag-valve-mask resuscitator ('Ambu-bag'), excessive amounts of air or O_2 are often given too fast. This results in a lot of air entering the stomach, causing gastric regurgitation and aspiration.

Breaths/ventilations should each be given over 1 second with sufficient volume to ensure that the chest wall visibly rises. Care should be taken however, especially with infants, not to over-inflate the lungs. 'Cheek puffs' or an appropriately sized paediatric resuscitator should preferably be used.

- Several recent studies have shown unacceptably long interruptions in chest compressions during CPR, both in the pre-hospital and in-hospital environment. Due to the need for adequate blood flow to ensure tissue oxygenation, changes to the recommended compression to ventilation ratios have been made to minimise interruptions in blood flow. A compression: ventilation ratio of 30:2 for all lone rescuers of all arrested patients, from infancy (except the newborn) to adulthood has now been adopted by all national resuscitation councils world-wide.

When there are two rescuers, for paediatrics (infants and children up to puberty), a differentiation has been made between the resuscitation recommendations for the relatively inexperienced first aider or lay person and the trained health care professional. As the lay person only ever has to perform resuscitation infrequently, these rescuers could not be expected to learn and remember different CPR sequences for different types of arrest or for different age groups. Thus, the 30:2 ratio remains the same for all lay rescuer resuscitation, regardless of the cause of arrest or numbers of rescuers, and regardless of patient age (except for the newborn). When there is more than one lay rescuer, they should swap places approximately every 2 minutes, after 5 cycles of 30 compressions to 2 ventilations, as the procedure is very tiring, and the quality of CPR will gradually drop as the rescuer doing compressions becomes tired.

As the most likely cause of arrest in children and infants is hypoxia, and not sudden cardiac arrest due to pump failure or heart rhythm disturbances, there is a more urgent need to replenish the lost oxygen in this age category. Thus, when there are two professional health care providers, well trained and experienced in resuscitation, a compression:ventilation ratio of 15:2 for children and infants (except newborns) is recommended as this will result in the delivery of more rescue breaths per minute. In the newborn, the resuscitation compression to ventilation ratio is 3:1.

- Another serious concern has been the inadequate strength, speed and depth of compressions used by both lay and professional rescuers. In order to ensure a circulation sufficient to provide oxygen perfusion to the tissues of all patients (from infant to adult), the rescuer should aim to perform 100 compressions per minute, that is almost 2 compressions per second. Compressions should be hard and fast, compressing downwards by 4 - 5 cm in adults and by up to ½ the depth of the chest in infants and children. The compression and recoil time should be equal. Allowing the chest to fully recoil after each compression is essential for adequate perfusion.

To explain the need for firm, fast compressions and complete recoil ……

To create an effective circulation, it is necessary to squeeze the heart and chest fully on each compression. Then as your hand rises as the chest recoils, a vacuum effect is created in the heart and chest, which 'sucks' venous blood

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back into the heart and chest prior to the next compression. If the chest is not compressed sufficiently, blood will not be sucked into the heart, output will drop, and the tissues will not be adequately perfused.

Summary

To be successful, CPR must be started early, as soon as the patient collapses and arrests. As the general public are often the first on scene in the pre-hospital environment, it is important that they are willing and capable of initiating effective CPR and that they call for help early.

Several recent studies have revealed that CPR, even if done by professionals, is often not done well at all. Excessive ventilation and repeated interruptions in compressions cause a decrease in cardiac output and thus poor perfusion of vital organs, which has led to low resuscitation success rates in both the pre-hospital and in-hospital environment.

The remedy is simple: *press much more, blow much less……..*

References

1. Hazinski MF, Nadkarni VM, Hickey RW, O'Connor R, Becker LB, Zaritsky A. *et al.* Major changes in the 2005 AHA Guidelines for CPR and ECC: Reaching the tipping point for change. *Circulation* 2005; 112(IV): 206-211.
2. Rea TD, Eisenberg MS, Sinibaldi G, White RD. *et al.* Incidence of EMS-treated out-of-hospital cardiac arrest in the United States. *Resuscitation* 2004; 63: 17-24.

In a nutshell

High-quality CPR is achieved by:

- pushing hard (½ the depth of the chest)
- pushing fast (almost 2 compressions per second)
- allowing full chest recoil after each compression
- minimising interruptions in chest compressions
- avoiding hyperventilation.

The greatest and most urgent priority is to provide both lay and health care professionals with the skills of high-quality CPR that are easily taught, easily remembered and easily implemented so that many more lives may be saved.

single suture

Survival with HAART

A study from Denmark suggests that the death rates in people with HIV have fallen significantly since 1995 – since the introduction of highly active antiretroviral therapy (HAART). The latest figures suggest that a 25-year-old with HIV can now expect to survive for more than 35 years, although concurrent infection with hepatitis C reduces this survival to around 32 years.

These estimates are obtained from a cohort of all Danish adults with HIV – but do depend on HAART continuing to work well through life. The authors say that they have found no evidence of HAART becoming less effective with time, despite potential problems with multidrug resistance and serious side-effects. This means that the prognosis for those with HIV – in the developed world – approaches that associated with type 1 diabetes. However, even in Denmark, the outlook for those living with HIV remains far worse than the outlook for healthy people. In this study the current mortality rates for young adults with HIV were 9 - 15 times higher than the rates for age-matched adults without HIV.

Lohse N, *et al. Ann Intern Med* 2007; 146: 87-95.