

# Should the resuscitation guidelines be changed?

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The European Resuscitation Council Guidelines 2005 [1] are based on the 2005 *International Consensus Conference*. This took place in Dallas, USA, in January 2005, and the conclusions were published as the 'CoSTR document' [2]. One of the most controversial topics discussed during the conference was the compression:ventilation ratio [3]. As is well known, the final consensus was for a universal ratio of 30 compressions to 2 ventilations for single-rescuer resuscitation of all ages of victim apart from neonates. Compression-only resuscitation was recommended for dispatcher-assisted telephone CPR and for those unable or unwilling to give rescue breaths.

The paper by the SOS-KANTO study group of Tokyo, Japan, in a recent edition of *The Lancet* [4], has re-opened the debate on the optimum balance between chest compression and ventilation when managing cardiac arrest.

## The SOS-KANTO paper

The paper reports a prospective, multicentre, observational study of victims of out-of-hospital cardiac arrest; 439 received chest compression only, and 712 received conventional, combined, compression-and-ventilation CPR.

The end point of the study was neurological outcome at 30 days after cardiac arrest. A favourable outcome was defined as a Glasgow-Pittsburgh cerebral-performance category of 1 (good performance) or 2 (moderate disability). Unfavourable outcome was defined as categories 3 (severe disability), 4 (vegetative state), or 5 (death).

The main finding was that those victims who received chest compression alone had a greater chance of a favourable outcome than those who received combined compression and ventilation.

The authors concluded that '*bystander cardiac-only resuscitation is the preferred approach to resuscitation for adult patients with witnessed out-of-hospital cardiac arrest...*'

It is important to note, however, that a statistically significant difference in outcome was found only for certain subgroups, divided according to the clinical findings on arrival of the emergency medical services: apnoea (no gasping); ven-

tricular fibrillation or pulseless ventricular tachycardia; resuscitation started within 4 minutes of collapse. There was no significant difference in the 30-day outcome between compression-only and combined CPR for the group as a whole.

The same issue of *The Lancet* contained an editorial under the title of 'Cardiac arrest – guideline changes urgently needed' [5]. In it, Gordon Ewy, from the University of Arizona College of Medicine, Tucson, USA, argued that the findings of the SOS-KANTO study '*should lead to a prompt interim revision of the guidelines for out-of-hospital cardiac arrest*'. His suggested solution was that chest compression alone should be given to adult victims of sudden, unexpected, witnessed collapse (probably cardiac in origin), and combined chest compression and ventilation should be reserved for victims of respiratory arrest, such as drowning or drug overdose.

The need for an immediate change in the guidelines is not, however, supported by the European Resuscitation Council [6,7].

So who is right, and should this new evidence lead to a change in our current practice?

## The evidence for compression-only CPR

It was demonstrated in the 1990s that animals are able to survive cardiac arrest for several minutes if they receive chest compressions without ventilation [8,9]. Subsequently, there have been several good animal studies that have shown that survival and neurological outcome after cardiac arrest is at least as good with chest compression alone as with combined compression and ventilation [10-12]. These studies have, however, sought to mimic the situation of sudden cardiac collapse in humans. There is equally good evidence that cardiac arrest due to asphyxia is better managed by combined chest compression and ventilation [13-15]. In these circumstances, compressions alone are less effective, but are better than no resuscitation at all [13,15], probably because some ventilation is produced both by chest compression and agonal gasping [16,17], provided there is at least a partially patent airway [13].

The SOS-KANTO study is important because most of the previous studies on compression-only CPR have been on animals. There are obvious reasons for this – prospective, randomised, human studies are very difficult to undertake in the field of resuscitation. The few human studies that have been published have shown that, overall, chest compression alone is better than no CPR, but that combined ventilation and compression results in the best survival rates [18-20].

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## Interruptions in chest compression

The effectiveness of CPR is greatly diminished if there are interruptions in chest compression. This has been demonstrated in several animal studies [10,21-23], and the haemodynamic disadvantages of such interruptions have been well described [24]. Compression-only CPR effectively eliminates the pauses needed for ventilation. In this context, it is worth noting that the SOS-KANTO study was carried out in 2002–2003 when the guidelines still recommended a compression:ventilation ratio of 15:2. One can speculate that, had a 30:2 ratio been used, there would have been fewer pauses for ventilation, and some of the advantage of compression-only CPR might have been lost.

Human studies have confirmed that reducing the 'hands-off' period between stopping CPR and giving a defibrillator shock increases the chance of the shock being successful [25,26]. Such pauses in CPR are very common, and can occupy nearly half the time that resuscitation is being undertaken [27,28].

## Changing the guidelines

The recommendations for guideline changes in the SOS-KANTO paper and Ewy's editorial refer to bystander resuscitation and out-of-hospital cardiac arrest respectively. There were two clinically-diagnosable sub-groups that benefited from chest-compression alone: apnoea (no gasping), and resuscitation started within 4 minutes of collapse. But identifying victims within these sub-groups can present a problem for laypeople – gasping (agonal respiration) is often misinterpreted as normal breathing [29], and the timing of events during an emergency is notoriously difficult [30].

So, what would be the consequences of changing the guidelines to recommend compression-only CPR for sudden, witnessed, cardiac arrest in an adult, and combined compression and ventilation for children, or an adult whose arrest is unwitnessed or is of respiratory origin?

First and foremost, a way would have to be found to teach laypeople how to distinguish cardiac from asphyxial arrest. This could, perhaps, be done by recommending compression alone for sudden collapse in adults, and combined CPR for all other victims. But what is 'sudden collapse', and what about unwitnessed arrests?

It is well recognized that CPR skills are poorly acquired and rapidly lost [31], particularly by laypeople. One reason for this is the complexity of the sequences of action [32,33]. The benefit, in terms of acquisition and retention, of simplifying what is taught has been well demonstrated [34,35]. Even if a satisfactory solution could be found to the problem of how accurately to diagnose the cause of cardiac arrest, such a change in the guidelines would complicate teaching and introduce undesirable decision making.

## Conclusions

The evidence in favour of short-term, compression-only CPR for witnessed adult cardiac arrest in ventricular fibrillation, where the aetiology is primarily cardiac, is strong. When the differentiation from asphyxial arrest can be made with confidence by a trained healthcare professional with clinical expertise and technical assistance, not least ECG monitoring, this may well be the correct therapeutic approach. It will be up to individual clinical groups to decide if they wish to implement such changes in their guidelines. If they do, it is important that outcomes are carefully monitored and reported, as such information will be invaluable, not least for the evidence-evaluation process that will lead up to Guidelines 2010.

When it comes to out-of-hospital cardiac arrest, attended to by lay bystanders, this is a different matter. The SOS-KANTO data showed that compression-only CPR was no better than standard CPR for the study group as a whole. To follow the authors' recommendations would necessitate introducing diagnostic steps into the CPR protocol, and fundamental changes in layperson teaching. On the strength of a single study, important as it is, it seems premature to be making such changes: let us wait for more evidence, probably as a result of changes in the practices of healthcare professionals. In the meantime, we should continue to reserve chest-compression-only CPR for dispatcher-assisted resuscitation, and for those unable or unwilling to give rescue breaths.

But there are real and important messages from the SOS-KANTO study which underline the current CPR guidelines:

- 1) Chest compression is the critical element in most cases of adult cardiac arrest and should be started as soon as possible after diagnosis.
- 2) Interruptions in compression, for whatever reason, significantly reduce the chance of a favourable outcome after cardiac arrest and should be kept to a minimum.

Attention to these two aspects of chest-compression technique would do much to improve outcome from out-of-hospital cardiac arrest; changes to the guidelines are best postponed.

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## From the Editor

**Synopsis:** SOS-KANTO study group. Cardiopulmonary resuscitation by bystanders with chest compression only (SOS-KANTO): an observational study. *Lancet*. 2007; 369: 920–926.

In this prospective observational study the authors asked if in patients with out-of-hospital cardiac arrest cardiac-only resuscitation by bystanders compared to conventional cardiopulmonary resuscitation is associated with higher probability of favourable neurological outcome 30 days after cardiac arrest and if any bystander resuscitation compared to no bystander resuscitation is associated with higher probability of favourable neurological outcome. Analysis included 4068 patients with out of hospital cardiac arrest who received or did not receive bystander resuscitation. In patients with cardiac arrest cardiac-only resuscitation by bystander compared to conventional cardiopulmonary resuscitation was associated with nonsignificantly higher probability of favourable neurological outcome 30 days after cardiac arrest (6% vs. 4%; OR: 1.5, 95% CI: 0.9–2.5) and in the authors' opinion is the preferable approach to resuscitation in this clinical situation. Instead any bystander resuscitation compared to no bystander resuscitation increases the probability of favourable neurological outcome 30 days after cardiac arrest (5% vs. 2%; OR: 2.4, 95% CI: 1.6–3.4). The authors point out that mouth-to-mouth ventilation does not bring neurological benefit in any subgroup of patients who received bystanders resuscitation.

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