EDITORIAL COMMENT

Is the Upside-down Position Better in Cardiopulmonary Resuscitation?

Huey-Wen Yien*
Surgical Intensive Care Unit, Department of Anesthesiology, Taipei Veterans General Hospital, and National Yang-Ming University School of Medicine, Taipei, Taiwan, R.O.C.

Can We Have a Better Outcome Using Standard CPR?

Over the past 2 decades, a variety of alternatives to standard cardiopulmonary resuscitation (CPR), such as interposed abdominal compression (IAC)-CPR and cough CPR, and use of devices such as the circumferential vest, have been developed in an effort to enhance ventilation or perfusion during cardiac arrest, and eventually to improve the outcome of survival. Compared with standard CPR, these techniques and devices typically require additional personnel, training, or equipment for specific settings. However, with the exception of early defibrillation, most could not be reproduced consistently, and the results were also disappointing.

Standard supine CPR has a less than 5% overall survival rate in out-of-hospital cardiac arrest. Practitioners are often reluctant to perform CPR for fear of infectious transmission from mouth-to-mouth ventilation, as well as aspiration of gastric regurgitant. CPR in the above are air embolism and hypovolemia due to hemorrhage; here, the pulseless electric activity and asystole and ventricular fibrillation are the usual patterns of EKG rhythm. There are few published case reports of successful CPR in the prone position.

Why is Prone CPR Practical?

During the past decade, the value of mouth-to-mouth ventilation, as a part of CPR, has been challenged. Compression-only CPR (without ventilation) has a significantly better outcome than CPR with ventilation for adult cardiac arrest. Providers and lay rescuers are usually reluctant to perform mouth-to-mouth ventilation on unknown sufferers of cardiac arrest. In some successful prone CPR case reports that have been published, the patients were relatively young. The first prone CPR was proposed by McNeil in 1989. Safer, in 1990, reevaluated previous practices of CPR, and Stewart reinforced use of the prone position in 2002. The “reversed precordial compressions” or “reversed CPR” has been proposed for CPR in the prone position. The first pilot study that documented a higher blood pressure using prone CPR was published by Mazer et al in 2003. The first systematic review of 16 articles, written by Brown et al in 2001, documented that there were a total of 22 intubated hospitalized patients who received CPR in the prone position, and 10 of them survived to discharge. Although Stewart emphasized that prone CPR was superior to standard CPR, there is currently no evidence to prove a beneficial outcome.

*Correspondence to: Dr. Huey-Wen Yien, Department of Anesthesiology, Taipei Veterans General Hospital, 201, Section 2, Shih-Pai Road, Taipei 112, Taiwan, R.O.C.
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Another study of prone CPR is presented by Wei et al. in this issue of the Journal of the Chinese Medical Association, and further justifies the desirable modification of standard CPR. They compared the blood pressure change between CPR in the prone and supine positions among 11 patients who died in the ICU, showing 79 ± 20/17 ± 10 mmHg in the prone position, and 55 ± 20/13 ± 7 mmHg in the supine position. The mean tidal volume was 300 ± 110 mL in normal volunteers in the prone position.

Technique and Associated Devices in Prone CPR

Favorable results of prone CPR were mostly found in young patients, with compressions in the midline, two-thirds of the way up the torso between imaginary scapulae. This maneuver needed more energy and tended to be more tiring when using mannequins, but not with humans. When prone CPR was performed, sternal support with sandbags, gel-filled pads, or 500-mL bags of IV fluid was suggested.

Mechanisms of Prone CPR

As a technique of compression for circulation enhancement, McNeil suggested that the thoracic pump model supported prone CPR more than the cardiac pump model. Mazer et al. have observed increased intrathoracic pressure and systolic blood pressure in 6 cases resuscitated with rhythmic back pressure and sternal counterpressure in the prone position. A unique mechanism to support this effect is that less anterior displacement of the abdomen during thoracic compressions could enhance the efficiency of CPR effort.

The prone technique is superior to the supine technique for ventilation augmentation and provides airway patency by extending the neck, i.e. by positioning the victim’s head in the neutral position and the forehead supported on an arm folded beneath the head, so the mandible falls forward and down.

Hypothetical Benefits and Limitations of Prone CPR

There were other potential advantages of prone CPR, including easier training, no need to be constantly alert for airway patency, less risk of aspiration pneumonia, no delay in onset of compressions, and increased willingness of bystander action than with mouth-to-mouth ventilation.

Limitations of prone CPR include: more staff needed to perform the procedure (at least 2–4 providers), undocumented efficacy of defibrillation, and positive ventilation without intubation or mask.

Clinical trials of CPR in hospitalized patients or out-of-hospital victims are challenging because interventions must frequently be implemented at a time when informed consent is almost impossible to obtain. Generally speaking, human research requires the consent of the subjects, or, in some cases, a legally authorized surrogate. This seems to be difficult in most situations of CPR.

A variety of CPR techniques and devices may improve hemodynamics or short-term survival when used by well-trained providers in selected patients. To date, no adjunct has consistently shown to be superior to standard manual CPR for out-of-hospital basic life support, and no device other than a defibrillator has consistently improved long-term survival from out-of-hospital cardiac arrest.

Current Evidences and Guidelines of 2005 ACLS

The 2005 American Heart Association (AHA) Guidelines for CPR and Emergency Cardiovascular Care (ECC) did not endorse the prone position as the standard CPR. It is accepted only as a less-than-optimal alternative to supine CPR in certain situations. The recommendation is that “when the patient cannot be placed in the supine position, rescuers may consider providing CPR with the patient in the prone position, particularly in hospitalized patients with an advanced airway in place” (Level of evidence 5; Class IIb).

Although the recommendations in the 2005 AHA Guidelines for CPR and ECC confirm the evidence-based safety and effectiveness of many treatments, these guidelines cannot apply to all rescuers and all sufferers in all situations. The leader of a resuscitation team should adapt the guidelines to specific circumstances.

Conclusion

The outcome of CPR is primarily based on the etiology of cardiac arrest and time-delay of CPR action, rather than the technique used. Evidence-based benefits of survival and restoration of spontaneous circulation
were not apparent in prone CPR except in some case reports of higher mean blood pressure and intrathoracic pressure. Prone CPR may be initiated in a well-controlled environment, such as the OR or ICU, to avoid delay in onset of CPR. As in bystander CPR for unconscious and unintubated persons, further evidence-based trials of prone CPR should be expected before becoming an alternative practice.

References