Correspondence

Improvement of cardiopulmonary resuscitation by bending and pressing the lower extremities

To the Editor,

The success rate of cardiopulmonary resuscitation (CPR) is very low. The mortality rate after reaching the hospital is still as high as 50% to 70% [1,2]. Although a variety of methods have been invented to improve the success rate [3-5], a number of factors limited their application.

In accordance with the principles of CPR and the anatomical structure of human beings, this article developed an improved method of CPR: CPR with bending and pressing both lower extremities (CPR-BPLE).

1. Two rescuers

After placing the patient in a supine position, one rescuer kneels at the side of the patient and begins chest compressions. The other rescuer kneels at the patient’s feet, crosses the patient’s lower legs, forcefully pushes the patient’s knees to the patient’s lower abdomen, and maintains pressure (Fig. 1). If the rescuer is not strong enough to maintain pressure, he/she could press his/her upper body against the patient’s shins (Fig. 2). The direction of force should be at an angle of 45° to the horizontal (Fig. 3). The rescuer should press firmly and continuously, without hindering chest compressions. The patient’s lower legs may be lowered to assist venous filling, but they should not be lowered for more than 10 seconds. The implementation of CPR-BPLE should be elevated until the return of spontaneous circulation or the end of CPR.

Rescuers can switch roles, taking turns with chest compressions and holding the lower limbs in place. The switch of positions should be done quickly and not take longer than 10 seconds. Any break between compressions should be carefully controlled.

2. One rescuer

After the patient is placed in a supine position, the patient’s lower legs should be crossed one over the other, with the outer sides of both legs touching the ground. The more the patient’s legs are bent, the better the results will be. Once the legs are crossed and in place, the rescuer can begin chest compressions (Fig. 4).

During CPR, the coronary and cerebral arteries experience only one-third of the blood perfusion [6] that they would under normal conditions. Therefore, increasing the rate of blood perfusion can improve the success of CPR [7,8].

Bending and pressing both lower extremities is based on the premise that bending and pressing the lower limbs during CPR will increase blood flow to the heart. As the patient’s hemodynamic status improves, the blood flow to the coronary and cerebral arteries increases.

When chest compressions combine with lower limbs being bended and pressed, the chest pump and/or cardiac pump mechanisms will work. As a result, the flow of venous blood from the legs toward the heart will increase, and the circulation will improve. Simultaneously, the resistance of the arterial system of the lower limbs increases under the external force. In addition, pelvic and lower abdominal pressure increases, and blood flow to the heart increases. These factors can further improve blood perfusion of the heart, brain, and other vital organs, thereby improving the recovery rate.

By reestablishing blood circulation, the hemodynamics of the CA patient further improve, and ultra-early return of spontaneous circulation could be expected. Although CPR was the basis for changing hemodynamics, extending the recovery time has both theoretical basis and clinical value. If recovery time were extended to more than 30 minutes, or even 60 minutes, more patients could have been treated.

Fig. 1  Bending and pressing both lower extremities.
Improving the quality of recovery and hemodynamics also improves the short-term and long-term prognoses of patients. Bending and pressing both lower extremities is easy to perform and does not require specialized equipment or knowledge. As with chest compressions and artificial respiration, it is convenient for nonmedical professionals to learn.

In addition to the normal requirements for CPR, the 3 essential points to CPR-BPLE are direction of flexion, amount of pressure required, and continuity. If the steps are followed properly, there will be no further damage to the patient. Precautions should be taken to avoid excessive or improper force, which may damage the abdomen.

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http://dx.doi.org/10.1016/j.ajem.2012.11.006

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