

Relationship between Left Ventricle Position and Hemodynamic Parameters during Cardiopulmonary Resuscitation in a Pig Model

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Abstract : Background: From the viewpoint of cardiac pump theory, the area of the left ventricle (LV) subjected to compression increases as the LV lies closer to the sternum, possibly resulting in higher blood flow in patients with LV closer to the sternum. However, no study has evaluated LV position during cardiac arrest or its relationship with hemodynamic parameters during cardiopulmonary resuscitation (CPR). The objectives of this study were to determine whether the position of the LV relative to the anterior-posterior axis representing the direction of chest compression shifts during cardiac arrest and to examine the relationship between LV position and hemodynamic parameters during CPR. Methods: Subcostal view echocardiograms were obtained from 15 pigs with the transducer parallel to the long axis of the sternum before inducing ventricular fibrillation (VF) and during cardiac arrest. Computed tomography was performed in three pigs to objectively observe LV position during cardiac arrest. LV position parameters including the shortest distance between the anterior-posterior axis and the mid-point of the LV chamber (DAP-MidLV), the shortest distance between the anterior-posterior axis and the LV apex (DAP-Apex), and the area fraction of the LV located on the right side of the anterior-posterior axis (LVARight/LVATotal) were measured. Results: DAP-MidLV, DAP-Apex, and LVARight/LVATotal decreased progressively during untreated VF and basic life support (BLS), and then increased during advanced cardiovascular life support (ACLS). A repeated measures analysis of variance revealed significant time effects for these parameters. During BLS, the end-tidal carbon dioxide and systolic right atrial pressure were significantly correlated with the LV position parameters. During ACLS, systolic arterial pressure and systolic right atrial pressure were significantly correlated with DAP-MidLV and DAP-Apex. Conclusions: LV position changed significantly during cardiac arrest compared to the pre-arrest baseline. LV position during CPR had significant correlations with hemodynamic parameters.

Keywords : heart arrest, cardiopulmonary resuscitation, heart ventricle, hemodynamics

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