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The effects of periodic Gz acceleration (pGz) on cardiovascular function and hemodynamics were determined in a pig model of acute cardiopulmonary resuscitation (CPR). The application of pGz (horizontal head-to-foot oscillations) at 2 Hz increased cardiac output in fibrillated animals proportional to the amplitude of the applied acceleration force that plateaued at 0.7 G. Cardiac output in fibrillating animals was restored to 20% of the values obtained before fibrillation with pGz-CPR and arterial blood gas values were normal during this period. The central vascular pressure gradient driving blood flow was only about 6 mmHg, suggesting low vascular resistance during pGz-CPR. In another study, capillary blood flow was determined before and after pGz-CPR using colored microspheres. Capillary perfusion was detected in all tissue beds studied during pGz-CPR. Significant capillary blood flow was detected in the endocardium and brain stem during pGz-CPR that represented 39 and 197% of control values before fibrillation, respectively. Thus, the cardiac output during pGz-CPR was preferentially distributed to the myocardial and brain tissues. In a final group, animals were successfully resuscitated with return of spontaneous circulation (ROSC) after pGz-CPR for 15 min following cardiac fibrillation with a 3-min non-intervention period. Following ROSC, blood pressure was maintained at pre-arrest values for 2 h without any pharmacological or mechanical support. Arterial blood gases during the pGz-CPR and the ROSC periods were normal and not different from values obtained before fibrillation. None of the control animals (18 min of fibrillation without pGz-CPR) survived the experimental protocol and only two of these six animals briefly returned to spontaneous circulation (<20 min). In conclusion, experimental pGz-CPR produces cardiac output, capillary blood flow, and ventilation sufficient to maintain fibrillating animals for 18 min with ROSC for 2 h without support.