

Closed chest compressions reduce survival in an animal model of haemorrhage-induced traumatic cardiac arrest.

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Abstract

Closed chest compressions (CCC) are recommended for medical cardiac arrest, but there is little evidence to support their inclusion for traumatic cardiac arrest (TCA). This laboratory study evaluated CCC following haemorrhage-induced TCA and whether resuscitation with blood improved survival compared to saline. The study was conducted with the authority of UK Animals (Scientific Procedures) Act 1986 (received institutional ethical approval and a Home Office Licence) using 39 terminally anaesthetised, instrumented, juvenile Large White pigs. Following baseline measurements, animals underwent captive bolt injury to the right thigh and controlled haemorrhage (30% blood volume). Sixty minutes later there was a further haemorrhage to a MAP of 20 mmHg. The randomised resuscitation protocol was initiated within 5 min: CCC (Group 1); IV whole blood (Group 2); IV 0.9% saline (Group 3); IV whole blood + CCC (Group 4); and IV saline + CCC (Group 5). Fluid was administered as 3 × 10 ml/kg boluses using the Belmont® Rapid Infuser. The LUCAS™ II Chest Compression System delivered CCC. Primary Outcome was attainment of return of spontaneous circulation (ROSC MAP ≥ 50 mmHg) at Study End (fifteen minutes post-resuscitation) and secondary outcomes included haemodynamics. Mortality (MAP ≤ 10 mmHg) was significantly higher in Group 1 compared to Groups 2 and 3 ($P < 0.0001$). Resuscitation with whole blood was significantly better than saline ($P = 0.0069$), no animals in Group 3 attained ROSC. The addition of chest compressions to fluid resuscitation resulted in a significantly worse outcome with saline resuscitation ($P = 0.0023$) but not with whole blood ($P = 0.4411$). Cardiovascular variables at the end of the Resuscitation Phase and Study End were significantly worse for Group 5 compared to Group 3. Some significant differences were present at the end of the Resuscitation Phase for Group 4 versus Group 2 but these differences were no longer present by Study End. CCC were associated with increased mortality and compromised haemodynamics compared to intravenous fluid resuscitation. Whole blood resuscitation was better than saline.