Evaluation of various strategies to improve outcome after out-of-hospital cardiac arrest with particular focus on mechanical chest compressions

Akademisk avhandling

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I. Axelsson C, Nestin J, Svensson L, Axelsson ÅB, Herlitz J. Clinical consequences of the introduction of mechanical chest compression in the EMS system for treatment of out-of-hospital cardiac arrest - A pilot study. Resuscitation 2006;71:47-55.

II. Axelsson C, Axelsson ÅB, Svensson L, Herlitz J. Characteristics and outcome among patients suffering from out-of-hospital cardiac arrest with the emphasis on availability for intervention trials. Resuscitation 2007;75:460-468.

III. Axelsson C, Borgström J, Karlsson T, Axelsson ÅB, Herlitz J. Dispatch codes of out-of-hospital cardiac arrest should be diagnosis related rather than symptom related. Eur J Emerg Med. 2009 Dec 14 (E-pub ahead of print).

IV. Axelsson C, Karlsson T, Axelsson ÅB, Herlitz J. Mechanical active compression–decompression cardiopulmonary resuscitation (ACD-CPR) versus manual CPR according to pressure of end tidal carbon dioxide ($P_{ET}CO_2$) during CPR in out-of-hospital cardiac arrest (OHCA). Resuscitation 2009;80:1099-1103.

V. Axelsson C, Holmberg S, Axelsson ÅB, Herlitz J. Passive leg raising during cardiopulmonary resuscitation in out-of-hospital cardiac arrest – does it improve circulation and outcome? Accepted for publication in Resuscitation.

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Evaluation of various strategies to improve outcome after out-of-hospital cardiac arrest with particular focus on mechanical chest compressions

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ABSTRACT

Cardiopulmonary resuscitation (CPR) skills vary among health care professionals. A previous study revealed that chest compressions were only performed half the time in out-of-hospital cardiac arrest (OHCA). Field conditions and fatigue could be possible explanations. The aim of this thesis was to study the impact of the introduction of mechanical chest compression in OHCA according to survival and its usability and b) passive leg raising (PLR), to augment the artificial circulation, during CPR.

Methods: This thesis is based on a pilot study conducted in the Gothenburg/Mölndal and Södertälje Emergency Medical Service systems in 2003-2005. Witnessed OHCA (adult $\geq$18 years) received either mechanical (n=159) or manual (n=169) chest compressions. The pressure of end-tidal carbon dioxide ($P_{ET}CO_2$) has been shown to correlate with cardiac output (CO) during CPR. To compare the effect of the different strategies, the $P_{ET}CO_2$ was measured, during CPR, with standardised ventilation.

Result: PLR during CPR increased the $P_{ET}CO_2$ value within 30 seconds. Mechanical active compression-decompression (ACD) CPR, compared with manual compressions, produced the highest mean of initial, minimum and average values of $P_{ET}CO_2$. However, mechanical chest compressions did not appear to result in improved survival. Clinical circumstances such as unidentified cardiac arrests (CAs) resulted in a large drop-out in the intervention group or a late start to the intervention in relation to CA. The late start meant that the intervention targeted a high-risk population with a low chance of survival.

The majority of identified CAs were coded by the Rescue Co-ordination Centre (RCC) according to symptoms (usually unconsciousness), while the minority were coded according to the diagnosis of CA. Patients coded according to the diagnosis of CA had an earlier start of CPR, a higher rate of bystander CPR and a tendency toward higher survival rates.

Conclusion: Since PLR during CPR appears to improve circulation after OHCA, larger studies are needed to evaluate its potential effects on survival. Compared with manual compressions, mechanical ACD CPR produces probably the most effective CPR. However, different clinical circumstances make the device difficult to study outside hospital. Coding a CA according to diagnosis rather than symptoms appears to improve the out-of-hospital care.

Key words: out-of-hospital cardiac arrest, mechanical chest compression, randomised clinical trial, dispatch code, end tidal carbon dioxide, passive leg raising

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