Improving outcomes from in-hospital cardiac arrest

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Make sure local practice is informed by the latest guidelines

Over 200 000 adults a year sustain a cardiac arrest while in hospital in the United States.1 Most trials have taken place outside hospital,2 yet the aetiology, patient characteristics, time to treatment, and outcomes are quite different to cardiac arrests occurring in inpatients. Clinical guidelines for in-hospital resuscitation are therefore mainly drawn from the extrapolation of findings from out-of-hospital trials, observational studies, and consensus of expert opinion coordinated through the International Liaison Committee for Resuscitation.3

Given the cost, logistical, and ethical challenges of conducting randomised trials in cardiac arrest, the use of high quality observational data to provide insights into the effectiveness of treatments is attractive. The main limitation of observational studies is the risk that the outcome is affected by both the treatment allocation and other factors that influence the treatment allocation. Propensity scoring methods have been growing in popularity as a way of reducing confounding related to measured variables.

In critically ill patients, well conducted propensity score analyses generally agree with findings from randomised controlled trials, although the effect size may vary.4 A key limitation nevertheless remains the bias caused by unmeasured confounders. This was illustrated in two propensity analyses using data from the same registry on the effect of adrenaline on survival from out-of-hospital cardiac arrest. The studies yielded diametrically opposing results through small differences in the variables included in the propensity scoring model.5

In The BMJ, two linked research papers6 7 use propensity score analyses of data from the American Heart Association's (AHA) Get With The Guidelines-Resuscitation (GWTG-R) registry to examine the association between different treatment strategies for cardiac arrest and patient outcomes in in-hospital patients with shock refractory ventricular fibrillation (VF) or pulseless ventricular tachycardia (VT).

Bradley and colleagues6 explored differences in outcomes between defibrillator shocks delivered in rapid succession (stacked shocks), which formed part of the AHA guidelines in 2000, and the strategy of delivering a single shock strategy followed by 2 minutes of chest compressions, which was introduced in 2005 (fig 1).8 Their analysis showed slow adoption of the single shock sequence (increase from 30% in 2006 to 60% in 2012). Although unadjusted analyses showed better hospital survival with stacked shocks, there was no difference after adjustment for propensity scoring (adjusted risk ratio 0.89, 95% confidence interval 0.78 to 1.01).

Fig 1 Difference between defibrillator shock strategies (stacked shocks v single shock sequence), as recommended in the AHA guideline before and after 2005 [A: Legend OK?] [A: The illustrator left out the chart because he thought it looked a bit superfluous, but he can add it back if necessary]

The change in shock sequence from stacked to single shocks was introduced concurrently with the recommendation that adrenaline (epinephrine) administration was deferred until after 2 minutes of cardiopulmonary resuscitation (CPR) after the time of rhythm re-analysis and close to delivery of a second shock (fig 1). The premise for deferring adrenaline was to avoid giving it blindly before determining the response to initial defibrillation and potentially precipitating refibrillation.

Andersen and colleagues7 explored the association between early (within 2 minutes) and deferred (or no) adrenaline in patients enrolled in the registry from 2006 (to avoid contamination with changes in shock sequences). In contrast to previous work from the GWTG-R group where early adrenaline seemed to improve outcomes in patients with non-shockable rhythms,9 the early administration of adrenaline to patients with shock refractory VF or VT was associated with reduced survival to hospital discharge (adjusted odds ratio 0.70, 95% confidence interval 0.59 to 0.82).

The key strength of both studies are the use of the high quality GWTG-R registry, which collates data from over 300 hospitals in the USA and serves as a rich source of high quality information on treatments and outcomes from in-hospital cardiac arrest.10 While the breadth of coverage across the USA is a major strength, its primary purpose as a quality improvement registry necessarily limits the depth and specificity of information that is available for analysis. In both studies, researchers were reliant on using timings to draw inferences on the treatments being administered rather than extracting specific information about single versus stacked shocks or about timing of adrenaline in relation to shock sequence. Without such granular information, the slow adoption of deferred shock strategy identified by Bradley and colleagues and its interaction with the timing of adrenaline and other unmeasured and potentially confounding variables (eg, changes in ratio of compressions to ventilations, CPR quality introduced in 2005) make it difficult to conclude a casual association between the studied interventions and survival.

So should the findings from these studies alter your practice? Yes, the finding of widespread non-adherence with clinical guidelines should prompt those responsible for organising or delivering advanced life support to review their practice and ensure that it is informed by the latest clinical guidelines. While the jury remains out on the overall safety or effectiveness of adrenaline in cardiac arrest,11 these data suggest that if adrenaline is given, in accordance with current guidelines, it should be deferred until at least after the second shock has been delivered.

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