

Subsequent shock delivery and outcomes in out-of-hospital cardiac arrests with initial unshockable rhythm

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Background: The conversion from initial non-shockable to shockable rhythms during cardiopulmonary resuscitation (CPR) by emergency medical service (EMS) providers may be associated with neurologically intact survival after out-of-hospital cardiac arrest (OHCA). However, the prognostic significance of rhythm conversion according to the type of initial nonshockable rhythm is unclear.

Purpose: To determine the association between shock after conversion to shockable rhythm with neurologically intact survival after OHCA and shock delivery time (time from EMS-initiated CPR to first shock delivery) in patients with two types of initial unshockable rhythm.

Methods: We analyzed the records of 90,334 adult patients with witnessed OHCA of cardiac origin who were treated by EMS providers and had an initial unshockable rhythm. Data were obtained from a prospectively recorded Japanese nationwide Utstein-style database for a 5-year period (2013–2017). The primary outcome was 1-month neurologically intact survival, defined as a cerebral performance categories score from 1 to 2. Patients were divided into initial pulseless electrical activity (PEA) (n = 37,977 [42.0%]) and initial asystole (n = 52,357 [58.0%]) groups.

Results: In the initial PEA group, the crude rate of 1-month neurologically intact survival was significantly higher in the subsequently shocked than in the non-shocked patients (4.2% [121/2,896] vs. 2.4% [857/35,081], $p < 0.0001$). After adjustment for ten prehospital variables, the adjusted odds ratios (aORs) of subsequent shock for 1-month neurologically intact survival compared to no shock delivery were as follows: shock delivery time < 10 min, 2.21 (95% confidence interval [CI], 1.77–2.77, $p < 0.0001$); 10–14 min, 1.43 (0.89–2.28, $p = 0.14$); and ≥ 15 min, 0.36 (0.16–0.81; $p = 0.013$). In the initial asystole group, the crude rate of 1-month neurologically intact survival was significantly higher in the subsequently shocked than in the non-shocked (1.7% [47/2,687] vs. 0.4% [203/49,670], $p < 0.0001$). A multivariate logistic regression model showed that subsequent shock with a shock delivery time < 10 min was associated with increased odds of neurologically intact survival compared to no shock delivery (aOR, 5.67; 95% CI, 3.92–8.18; $p < 0.0001$). However, there were no significant differences in neurological outcomes between subsequently shocked and non-shocked patients when the shock delivery time was 10–14 min ($p = 0.21$) or ≥ 15 min ($p = 0.91$).

Conclusions: In patients with witnessed OHCA of cardiac origin and initial nonshockable rhythm, subsequent shock after conversion to shockable rhythm during CPR was associated with increased odds of 1-month neurologically intact survival only when shock was delivered < 10 min from EMS-initiated CPR, regardless of the type of initial rhythm. Further, in patients with initial PEA, subsequent shock was associated with decreased odds of neurologically intact survival when shock was delivered ≥ 15 min from EMS-initiated CPR.