# Association of subsequent shock after conversion to shockable rhythm with outcomes stratified by the type of initial non-shockable rhythm in children with out-of-hospital cardiac arrest

Goto Y.[1]; Funada A.[2]; Maeda T.[1]; Goto Y.[3]

[1]Kanazawa University Hospital, Department of Emergency and Critical Care Medicine, Kanazawa, Japan
[2]Osaka Saiseikai Senri Hospital, Department of Cardiology, Osaka, Japan
[3]Yawata Medical Center, Department of Cardiology, Komatsu, Japan

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Background/Introduction: The rhythm conversion from initial non-shockable to shockable rhythm during cardiopulmonary resuscitation (CPR) by emergency medical services (EMS) providers may be associated with neurologically intact survival after out-of-hospital cardiac arrest (OHCA) in children with an initial non-shockable rhythm. However, the prognostic significance of rhythm conversion stratified by the type of initial non-shockable rhythm is still unclear.

**Purpose:** We aimed to investigate the association of subsequent shock after rhythm conversion to shockable rhythm with neurologically intact survival and shock delivery time (time from EMS-initiated CPR to first shock delivery) by the type of initial non-shockable rhythm in children with OHCA.

**Methods:** We analysed the records of 19,095 children (age <18 years) with OHCA treated by EMS providers. Data were obtained from a prospectively recorded Japanese nationwide Utstein-style database for a 13-year period (2005–2017). The primary outcome measure was 1-month neurologically intact survival, defined as cerebral performance category score of 1 to 2. Patients were divided into the initial pulseless electrical activity (PEA) (n = 3,326 [17.4%]) and initial asystole (n = 15,769 [82.6%]) groups.

**Results:** The proportion of patients who received subsequent shock after conversion to shockable rhythm was significantly higher in the initial PEA than in the initial asystole groups (3.3% [109/3,326] vs. 1.4% [227/15,769], $p < 0.0001$). The shock delivery time was significantly shorter in the initial PEA than in the initial asystole groups (median [IQR], 8 min [5 min – 12 min] vs. 10 min [6 min – 16 min], $p < 0.01$). Among the initial PEA patients, there was no significant difference between subsequently shocked (10.0% [11/109]) and subsequently non-shocked patients (6.0% [192/3,217], $p = 0.10$) regarding the rate of 1-month neurologically intact survival. However, after adjusting for 9 pre-hospital variables, subsequent shock with a delivery time of <10 min was associated with increased odds of neurologically intact survival compared with no shock delivery (adjusted odds ratio [OR], 2.45; 95% confidence interval [CI], 1.16–5.16], $p = 0.018$). Among the initial asystole patients, the rate of 1-month neurologically intact survival was significantly higher in the subsequently shocked (4.4% [10/227]) than in the subsequently non-shocked (0.7% [106/15,542], $p < 0.0001$). A multivariate logistic regression model showed that subsequent shock with a delivery time of <10 min was associated with increased odds of neurologically intact survival compared with no shock delivery (adjusted OR, 9.77 [95% CI, 4.2–22.5], $p < 0.0001$).

**Conclusions:** In children with OHCA with an initial non-shockable 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.

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