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Estimation of no-flow duration and survival in patients with an initial shockable rhythm after out-of-hospital cardiac arrest

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Funding Acknowledgements: Japan Society for the Promotion of Science (KAKENHI Grant No. 18K09999)

Background: In patients with unwitnessed out-of-hospital cardiac arrest (OHCA), the actual no-flow duration (the time with no organ perfusion) is unclear. However, when these patients have a shockable rhythm as an initial recorded rhythm, the no-flow duration may be relatively short as compared with other initial rhythms, and some patients can obtain a good functional outcome after OHCA.

Purpose: The purpose of the present study was to estimate the no-flow duration and to determine the relationship between no-flow duration and neurologically intact survival in patients with an initial shockable rhythm after OHCA.

Methods: We reviewed 82,464 patients with OHCA (aged ≥18 years, non-traumatic, witnessed, and without any bystander interventions) who were included in the All-Japan Utstein-style registry from 2013 to 2017. The study end point was 1-month neurologically intact survival (Cerebral Performance Category scale 1 or 2). No-flow duration was defined as the time from emergency call to emergency medical services (EMS) arrival at the patient site.

Results: The rate of 1-month neurologically intact survival in the patients with an initial shockable rhythm (n = 10,384, 12.6% of overall patients) was 16.5% (1718/10,384). No-flow duration was significantly and inversely associated with 1-month neurologically intact survival (adjusted odds ratios for 1-minute increments: 0.85, 95% confidence interval: 0.84–0.86). The proportion of patients with a shockable rhythm to the overall patients (y, %) had a high correlational relationship with no-flow duration (x, min), depicted by $y = 21.0 - 0.95 \times x$, $R^2 = 0.935$. In this analytical model, the number of patients with shockable rhythm reached null at 22 minutes of no-flow duration. The no-flow durations, beyond which the chance for initial shockable rhythm diminished to <10%, <5%, and <1%, were 12, 13, and 17 minutes, respectively. The rate of neurologically intact survival in the patients with shockable rhythm (y, %) and no-flow duration (x, min) were also found to have a strong correlation, depicted by $y = 0.16 \times x^2 - 5.12 \times x + 45.0$, $R^2 = 0.907$. The no-flow durations, beyond which the chance for 1-month neurologically intact survival diminished to <10%, <5%, and <1%, were 10, 11, and 15 minutes, respectively.

Conclusions: In OHCA patients without any bystander interventions before EMS personnel arrival, when a shockable rhythm is recorded by EMS personnel as an initial rhythm, the no-flow duration after cardiac arrest is highly likely to be <17 minutes regardless of the layperson witness status. The limitation of no-flow duration to obtain a 1-month neurologically intact survival after OHCA may be 15 minutes when the patients have an initial shockable rhythm.

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