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Do public-access defibrillators improve neurological outcomes after out-of-hospital cardiopulmonary resuscitation?

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Palabras clave en castellano: paro cardíaco extrahospitalario, desfibrilador, pronóstico.

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Do public-access defibrillators improve neurological outcomes after out-of-hospital cardiopulmonary resuscitation?

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Original article: Fukuda T, Ohashi-Fukuda N, Kobayashi H, Gunshin M, Sera T, Kondo Y, et al. Public access defibrillation and outcomes after pediatric out-of-hospital cardiac arrest. *Resuscitation*. 2017;111:1-7..

Abstract

Authors' conclusions: public-access defibrillation was associated with an increased chance of neurologically favorable survival in pediatric out-of-hospital cardiac arrest (aged 1–17 years) who received bystander cardiopulmonary resuscitation, except for in cases of unwitnessed or non-cardiac etiology.

Reviewers' commentary: there is a clear association between the use of publicly available defibrillators and improved outcomes in cases of pediatric cardiorespiratory arrest. Despite the limitations of the investigation to establish relations of causality, being it an observational study, a comprehensive control of possible confounding variables was performed.

Key words: out-of-hospital cardiac arrest, defibrillator, outcome.

¿Mejoran los desfibriladores de uso público el pronóstico neurológico tras la reanimación cardiopulmonar fuera del hospital?

Resumen

Conclusiones de los autores del estudio: el uso de los desfibriladores de acceso público se asocia a una mayor probabilidad de supervivencia con buena función neurológica tras la RCP extrahospitalaria de niños entre 1 y 17 años de edad, excepto en los casos sin testigo presencial o de etiología no cardíaca.

Comentario de los revisores: hay una asociación clara entre el uso de desfibriladores de acceso público y la mejoría de los resultados en casos de parada cardiorrespiratoria pediátrica. Aunque existen limitaciones a la hora de establecer la causalidad, por ser un estudio observacional, se realizó un control exhaustivo de las posibles variables de confusión.

Palabras clave: paro cardíaco extrahospitalario, desfibrilador, pronóstico.

STRUCTURED ABSTRACT

Objective: to assess the effect of public-access defibrillation (PAD) on the outcomes of children with out-of-hospital cardiac arrest (OHCA) that received CPR by a bystander.

Design: retrospective propensity-score-matched cohort study.

Setting: population registry database of the Fire and Disaster Management Agency of Japan of cases of OHCA for 2011 and 2012.

Study sample: cases of OHCA in children aged more than 1 year and less than 18 years that underwent basic cardiopulmonary resuscitation (CPR) selected from the All-Japan Utstein Registry, which includes data for every case of OHCA in all age groups.

Methodology: to control for the selection bias characteristic of observational studies, the researchers used a propensity-matching approach,¹ creating two cohorts of 50 cases, one in which PAD was used (intervention group [IG]) and another in which children received only CPR (control group [GC]), both of which were homogeneous with respect to

potential confounding variables (sex, age, type of resuscitator, witnessed arrest, aetiology of arrest and year). They also fitted a multivariate logistic regression (MLR) model to the overall cohort and separately analysed certain subgroups based on characteristics known to influence outcomes, such as age, bystander witness or cardiac aetiology.

Outcome measurement: the primary outcome was neurologically favourable survival at one month, defined as a Glasgow–Pittsburgh cerebral performance category score of 1 (good performance) or 2 (moderate disability) over 5.² The secondary outcomes were overall survival and prehospital return of spontaneous circulation. The data were recorded by trained Medical Emergency Department staff, who performed follow-up surveys to document outcomes one month after the OHCA. The effect size was estimated by means of *odds ratios* (ORs) with a 95% confidence interval (95 CI).

Main results: the authors collected data for a total of 1193 individuals that met the inclusion criteria, of which 57 had received PAD + CPR and the rest only CPR. In the analysis of the two propensity-matched cohorts, 31 of the 50 patients in the IG (62%) had a neurologically favourable survival at 1 month compared to 17 of the 50 patients in the CG (34%) (OR, 3.17 [95 CI, 1.40 to 7.17]). The IG also had a better overall survival at one month (68% versus 40%; OR: 3.19 [95 CI, 1.40 to 7.24]) and more frequent prehospital return of spontaneous circulation (68% versus 28%, OR, 5.46 [95 CI, 2.32 to 12.87]) compared to the CG. The MLR model for the overall cohort also showed enhanced neurological outcomes in patients in whom PAD was used (59.7% versus 13.6%; OR, 5.10 [95 IC, 2.01 to 13.70]). The only subgroups in which there was no evidence of improved outcomes with defibrillation were the unwitnessed subgroup (30% versus 17.7%; OR, 7.76 [95 CI, 0.75 to 81.90]) and the non-cardiac aetiology subgroup (el 30% versus 13.3%; OR, 6.65 [95 CI, 0.64 to 66.24]).

Conclusion: public-access defibrillation was associated with an increased chance of neurologically favourable survival in children aged 1 to 7 years that underwent out-of-hospital cardiac arrest who received bystander CPR, except in cases of unwitnessed arrest or non-cardiac aetiology.

Conflicts of interest: none disclosed.

Founding source: University of Tokyo.

COMMENTARY

Justification: the most recent basic CPR guidelines recommend the use of automated external defibrillators (AEDs) whenever available, especially in cases in which a child experiences a sudden and unexpected cardiac arrest and there is a bystander that witnesses the event that can provide CPR.³

Validity/scientific rigour: the population under study was well defined, and there was a low probability of cases missing from the national database, so the sample was representative of the population. An AED was used in 57 patients, but 7 of them were lost (12%) during propensity score matching. A cardiac aetiology was assumed in the absence of a different documented aetiology. The authors did not collect data for important variables, such as prehospital adrenaline administration or advanced airway management, the degree of CPR training of the bystanders or the protocol they followed. They also did not include data on hospital care. There is no documentation of blinding to membership in a given group in the assessment of outcome variables. The study found differences in many variables between the IG and the rest of the cohort. Regardless of the efforts to control for potential confounding variables, the results cannot demonstrate causality.

Clinical relevance: favourable outcomes were observed in 62% of children in the IG (defibrillation) compared to 34% in the CG, corresponding to an absolute risk reduction (ARR) of 28% (number needed to treat [NNT], 4 [95 CI, 2 to 11]).* The effect size was large, which adds to the critical relevance of reducing mortality and the incidence of severe neurologic sequelae. According to the authors, this is the first study that assesses the use of public-access defibrillation after the 2010 update of international guidelines. The propensity score-matched cohort design approximates the reduction of sources of bias to that of a clinical trial. While unknown confounding variables could be at play, the risk of this happening seems small. The secondary outcomes, early return of spontaneous circulation (ARR, 40%; NNT, 3 [95 CI, 2 to 5]) and one-month survival (ARR, 28%; NNT, 4 [95 CI, 2 to 11]),* were also improved in the IG.

Applicability to clinical practice: although the study cannot demonstrate causality on account of its retrospective observational design and the potential for uncontrolled bias, it does seem to provide evidence of an association between the use of AEDs and improved survival and neurologic outcomes in children after OHCA. Although most cases of paediatric cardiopulmonary arrest do not have a cardiac origin, perhaps it is time to recommend the use of AEDs in paediatric CPR whenever available. Further studies are required to corroborate these encouraging results to explore the possibility of installing AEDs in schools, playgrounds and other such settings and implementing resuscitation training programmes for teachers and students.

Conflicts of interest: the authors of the commentary have no conflicts of interest to declare.

* Values calculated by reviewers using the original data.

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