



ORIGINAL ARTICLE

Multiple organ failure after spontaneous return of circulation in cardiac arrest in children[☆]



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Cardiac arrest;
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Abstract

Objective: To assess the frequency of the multiple organ failure and the prognostic value of multiple organ failure scores in children who have recovered from an in-hospital cardiac arrest. **Patients and methods:** A single centre, observational, and retrospective study was conducted on children between 1 month and 16 years old who suffered an in-hospital cardiac arrest and achieved return of spontaneous circulation (ROSC). In the first 24–48 h and between the fifth and the seventh day after ROSC, a record was made of the scores on paediatric severity (PRISM and PIM II) and multiple organ failure scales (PELOD and P-MODS), along with the clinical and analytical data, and including monitoring and treatment, mortality and cause of death. **Results:** Of the total of 41 children studied, 70.7% were male, and the median age was 38 months. The overall mortality during admission was 41.5%, with 14.6% dying in the first 48 h, and 7.6% in the following 3–5 days. In the first 48 h, clinical severity and multiple organ failure scores were higher in the patients that died than in survivors (PRISM 29 vs. 21) $p=0.125$, PIM II (26.8% vs. 9.2%) $p=0.02$, PELOD (21 vs. 12) $p=0.005$, and P-MODS (9 vs. 6) $p=0.001$. Between the fifth and seventh day, the scores on the four scales were also higher in patients who died, but only those of the PELOD (20.5 vs. 11) $p=0.002$ and P-MODS (6.5 vs. 3) $p=0.003$ reached statistical significance.

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PALABRAS CLAVE

Parada cardiaca;
Reanimación
cardiopulmonar;
Recuperación de la
circulación
espontánea;
Fracaso
multiorgánico;
Pronóstico

Conclusions: Mortality in children after return of spontaneous circulation after cardiac arrest is high. The multiple organ failure after return of spontaneous circulation after cardiac arrest in children is associated with increased mortality.

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Fallo multiorgánico tras la recuperación de la circulación espontánea en la parada cardiaca en el niño

Resumen

Objetivo: Estudiar la incidencia del fallo multiorgánico (FMO) y el valor pronóstico de las puntuaciones de FMO en los niños que se han recuperado de una parada cardiaca (PC) intrahospitalaria.

Pacientes y métodos: Estudio unicéntrico, observacional, retrospectivo, en niños menores de 16 años, que presentaron una PC intrahospitalaria y alcanzaron la recuperación de la circulación espontánea (RCE). Se registraron las puntuaciones de las escalas de gravedad (PRISM y PIM II) y FMO (PELOD y P-MODS), la mortalidad y la causa del fallecimiento.

Resultados: Se estudió a 41 niños (70,7% varones), con una mediana de edad de 38 meses. Durante el ingreso falleció el 41,5% (el 14,6% en las primeras 48 h y un 7,3% en los siguientes 5 días). En las primeras 48 h, las puntuaciones de gravedad clínica y de FMO fueron más altas en los fallecidos que en los supervivientes (PRISM 29 frente a 21), $p=0,125$, PIM II (26,8% frente a 9,2%), $p=0,021$, PELOD (21 frente a 12), $p=0,005$, y P-MODS (9 frente a 6), $p=0,001$. Entre el 5.º y el 7.º día las puntuaciones de las 4 escalas fueron también mayores en los fallecidos, pero solo las escalas PELOD (20,5 frente a 11), $p=0,002$, y P-MODS (6,5 frente a 3), $p=0,003$, alcanzaron significación estadística.

Conclusiones: La mortalidad de los niños que se recuperan de una PC es elevada. El FMO tras la RCE de una PC en el niño se asocia a una mayor mortalidad.

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Introduction

Cardiac arrest (CA) is defined as a sudden, unexpected and potentially reversible stop of spontaneous blood flow and respiration.¹ The incidence of in-hospital CA in children ranges between 0.19 and 2.45 per 1000 hospital admissions.²

The goal of cardiopulmonary resuscitation (CPR) is the return of spontaneous circulation (ROSC). In adults, more than half of the patients that achieve ROSC do not survive to discharge, and the most frequent causes of death are brain death and multiple organ failure (MOF).³

Multiple organ failure is defined as failure of two or more organ systems that cannot sustain their activity spontaneously. It is the leading cause of death in intensive care units both in children and adults.⁴

Following CA, all organs are affected by an ischaemia-reperfusion phenomenon that increases the risk of MOF. Several studies in adults have reported that the development of acute kidney failure,⁵ acute adrenal insufficiency^{6,7} or disseminated intravascular coagulation, higher scores in disease severity scales such as APACHE II^{8,9} or MOF are associated with increased mortality.¹⁰ However, only one study in adults has described a high incidence of

MOF after CA associated with an increased mortality that appeared to be driven by haemodynamic dysfunction and oxygenation impairment.³

There are no studies in children analysing the prevalence of MOF after CA or whether the development of MOF post CA carries a poorer prognosis.

The aim of our study was to analyse the outcomes of children that achieve ROSC after CA, determine the incidence of MOF, and assess the predictive power of the Pediatric Risk of Mortality (PRISM)¹¹ and Pediatric Index of Mortality II (PIM II) disease severity scores, the Pediatric Multi Organ Dysfunction Score (P-MODS)¹² and Pediatric Logistic Organ Dysfunction (PELOD)¹³ paediatric MOF scores and other monitoring and laboratory parameters that may be altered following ROSC,¹⁴⁻²⁴ as well as the causes of death.²⁵

Patients and methods

We conducted a single-centre observational retrospective study in which we included children that experienced in-hospital CA and achieved ROSC between December 2007 and June 2013.

The inclusion criteria were: age 1 month to 16 years, in-hospital CA with ROSC after CPR. We excluded children

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