



Clinical paper

Patterns of multiorgan dysfunction after pediatric drowning[☆]

Haifa Mtaweh^{a,c}, Patrick M. Kochanek^{b,c}, Joseph A. Carcillo^b,
Michael J. Bell^{b,c,d}, Ericka L. Fink^{b,c,*}

^a Critical Care Department, The Hospital for Sick Children, Toronto, Canada

^b Department of Critical Care Medicine, Children's Hospital of Pittsburgh of UPMC, Pittsburgh, PA, United States

^c Safar Center for Resuscitation Research, Children's Hospital of Pittsburgh of UPMC, Pittsburgh, PA, United States

^d Department of Neurological Surgery, Children's Hospital of Pittsburgh of UPMC, Pittsburgh, PA, United States

ARTICLE INFO

Article history:

Received 26 June 2014

Received in revised form 20 January 2015

Accepted 2 February 2015

Keywords:

Drowning

Children

Multiorgan failure

Organ dysfunction

Arrest

Neurologic outcome

ABSTRACT

Aims: To evaluate patterns of multiorgan dysfunction and neurologic outcome in children with respiratory and cardiac arrest after drowning.

Methods: Single center retrospective chart review of children aged 0–21 years admitted between January 2001 and January 2012 to the pediatric intensive care unit at Children's Hospital of Pittsburgh with a diagnosis of drowning/submersion/immersion. Organ dysfunction scores were calculated for first 24 h of admission as defined by the Pediatric Logistic Organ Dysfunction Score-1 (PELOD-1) and Pediatric Multiple Organ Dysfunction Score (P-MODS). Neurologic outcome at hospital discharge was assigned Pediatric Cerebral and Overall Performance Category Scale scores.

Results: We identified 60 cases of pediatric drowning in which 21 children experienced cardiorespiratory arrest (CA) and 39 had respiratory arrest (RA). All children with CA had multiorgan failure and 81% had a poor neurologic outcome at hospital discharge while 49% of children with RA had multiorgan failure and none had an unfavorable neurological outcome ($p < 0.001$). The most common organ failures in both CA and RA groups within the first 24 h of admission were respiratory, followed by neurologic, cardiovascular, gastrointestinal, hematological, and least commonly, renal.

Conclusion: Patterns of organ failure differ in children with CA and RA due to drowning. The contribution of multiorgan failure to poor outcome and evaluation of the impact of augmenting cerebral resuscitation with MOF-targeting therapies after drowning deserves to be explored.

© 2015 Elsevier Ireland Ltd. All rights reserved.

1. Introduction

Drowning is the leading cause of unintentional injury-related death and disability worldwide between the ages of 1 and 4 years and the third leading cause in the United States between the ages of 1 and 21 years.¹ Drowning occurs from primary respiratory impairment due to submersion in a liquid medium,^{2–4} and is followed by breath-holding and involuntary laryngospasm that leads to hypercapnia, hypoxemia, and if prolonged, respiratory (RA) and or cardiorespiratory arrest (CA).^{2,5,6} Systemic hypoxemia and/or ischemia during RA or CA, respectively, increase the risk of hepatic,

renal, and neurologic organ injury and reversible or irreversible impairment of function.^{2,5,7}

Duration of submersion under water and need for cardiopulmonary resuscitation (CPR) after extraction are associated with outcome in pediatric drowning. Children who progress to CA and have generalized edema present on early brain computed tomography uniformly have poor outcomes.⁸ Children with RA are still at increased risk of disability and death.⁹ Reports on neurologic outcome and mortality after drowning-related RA are lacking but mortality in all-cause acute respiratory failure is 22–40% in children.^{10,11}

Typpo and colleagues¹² have reported on multiple organ dysfunction syndrome (MODS) on Day 1 of pediatric intensive care unit (PICU) admission and found an incidence of 18%, with 30–35% of those having an unfavorable neurologic outcome. Post-resuscitation MODS is not well described after pediatric drowning specifically. Our primary objective was to explore the severity and patterns of MODS in the first 24 h in children with CA and RA after drowning.

[☆] A Spanish translated version of the abstract of this article appears as Appendix in the final online version at <http://dx.doi.org/10.1016/j.resuscitation.2015.02.005>.

* Corresponding author at: Critical Care Medicine and Pediatrics, University of Pittsburgh, 4401 Penn Avenue, Pittsburgh, PA 15224, United States.

E-mail address: finkel@ccm.upmc.edu (E.L. Fink).

Table 1
Patient, drowning, and outcome characteristics.

	Overall	RA (n = 39)	CA (n = 21)
Age, years	2.4 (0.1–16.6)	2.9 (0.4–16.6)	1.9 (0.1–15.1)
Gender, male	36 (60)	23 (59)	13 (62)
Ethnicity			
Caucasian	50 (85)	33 (85)	17 (81)
Black	8 (14)	4 (10)	4 (19)
Other/missing	2 (1)	2 (5)	0 (0)
Location			
Home swimming pool	30 (50)	21 (54)	9 (43)
Bath tub	12 (20)	6 (15)	6 (28)
Public pool	9 (15)	7 (18)	2 (10)
Other	9 (15)	5 (13)	4 (19)
PICU LOS, days	4 (1–60)	2 (1–11)	12 (1–60)
Hospital LOS, days	5 (1–103)	3 (1–15)	21 (1–103)
Duration of resuscitation, min	N/A	N/A	30 (2–90)
Disposition of survivors			
Home	41 (68)	39 (100)	2 (10)
Rehabilitation facility	11 (18)	0 (0)	11 (52)
Unfavorable neurologic outcome	17 (28)	0 (0)	17 (81)
Mortality at hospital discharge	8 (14)	0 (0)	8 (38)

Data is expressed in median (range) or n (%). RA: Respiratory arrest, CA: Cardiac arrest, PICU: Pediatric Intensive Care Unit, LOS: Length of Stay, min: minutes.

2. Methods

This is a single center retrospective chart review of children aged 0–21 years admitted between January 2001 and January 2012 to the PICU at Children's Hospital of Pittsburgh with a diagnosis of drowning, submersion, or immersion per International Classification of Diseases, volume 9 (ICD-9) codes (994.1, E830, E830.1–830.9, E832, E910, E910.1–910.4, E910.8, E910.9, E954, E965, E984, E979.8). The Institutional Review Board of University of Pittsburgh approved the study and informed consent was waived.

Data collected included patient and incident characteristics and resuscitation, post-resuscitation details during the Emergency Medical Services, Emergency Department, and PICU care periods for the first 24 h after admission. Pediatric Logistic Organ Dysfunction Score-1 (PELOD-1) and Pediatric Multiple Organ Dysfunction Score (P-MODS) were calculated for the first 24 h of hospitalization.^{13,14} In addition, we used the first 24-h scores since the largest data set reporting on organ dysfunction in PICU patients by Typpo and colleagues¹² utilized scores on day 1. Both scoring systems assign a score based on the severity of organ dysfunction. Normal function for each organ system as defined by the PELOD-1 score is as follows: *Neurologic system* – Glasgow Coma Scale (GCS) score of 12–15 and reactive pupils; *Cardiovascular system* – age-dependent values for heart rate and systolic blood pressure; *Renal system* – age appropriate creatinine values; *Respiratory system* – $P_aO_2/F_iO_2 > 69.8$ mmHg and $P_aCO_2 \leq 87.8$ mmHg and no need for mechanical ventilation; *Hematological system* – white blood cell (WBC) count $\geq 4.5 \times 10^9/L$ and a platelet (PLT) count $\geq 35 \times 10^9/L$; and *Hepatic system* – aspartate transaminase (AST) < 950 iU/L and an international randomized ration (INR) < 1.4 . In the event of missing data, normal function was assumed as described by Graciano and colleagues.¹³ Normal function for each organ system as defined by the P-MODS system is as follows: *Cardiovascular system* – Lactic acid < 1 mmol/L; *Respiratory system* – $P_aO_2/F_iO_2 > 150$ mmHg; *Hepatic system* – Bilirubin < 0.5 mg/dL; *Hematological system* – Fibrinogen > 150 mg/dL; and *Renal system* – Blood Urea Nitrogen < 20 mg/dL. MODS was defined as two or more organ dysfunctions.¹⁵

Neurologic outcome at hospital discharge was assigned Pediatric Cerebral and Overall Performance Category Scale scores (PCPC/POPC) using clinical notes. Favorable neurologic outcome was defined as a PCPC/POPC less than or equal to 3 or no change in the baseline score. Unfavorable neurologic outcome represented patients with severe neurologic impairment with PCPC/POPC > 3 . To compare organ dysfunction in both neurologic outcome groups,

we used P-MODS as the MODS score since it lacks a neurologic component.

Drowning victims were categorized into two groups: CA and RA. CA was defined as need for CPR by healthcare personnel (Emergency Medical Services or Emergency Department) whereas RA was defined as apnea or cyanosis with palpable pulse and therefore lack of need for CPR.

Non-parametric numeric data are presented as median [interquartile range] or total number of patients (percentages), while parametric data are presented as mean \pm standard error of the mean (SEM). Fisher exact tests for categorical variables were performed for outcome groups. The Wilcoxon rank sum test was used to compare organ dysfunction scores and neurologic outcome. Spearman's rank correlation was used to test the relationship between duration of CPR and organ dysfunction in children with CA after drowning. All *p*-values were two-tailed and values less than 0.05 were considered significant. Data analysis was performed using SigmaStat 3.5 (Systat Software, Inc.).

3. Results

3.1. Patients and drowning characteristics

We identified 60 children who met study criteria over the study period with a median age of 2.4 years and 60% were males (Table 1). Fifty-seven events occurred in the summer months (May–October). Forty-one (68%) of the events were unwitnessed and the median reported submersion time was 2 min (range 0–30 min). Median CPR duration in children with CA was 2 min and ranged from 1 to 90 min. Thirty-nine (65%) children were in RA and 21 (35%) were in CA at the drowning location. Most 41 (68%) children were intubated and the initial recorded temperature on hospital arrival was 35.7 °C [24–39.3 °C]. All but 2 children were transferred by Emergency Medical Services to a referring hospital emergency department; the remaining 2 children presented to a referring hospital with family members. Children were subsequently transferred to Children's Hospital of Pittsburgh emergency department prior to PICU admission or were directly admitted to the PICU where 15/21 of children in CA group remained pulseless. Six of those 15 pulseless children died, 7 were discharged to a rehabilitation facility and 2 discharged home. Overall, 17/60 patients had severe neurological impairment and 8/60 children died. All of the children who had

Download English Version:

<https://daneshyari.com/en/article/3007941>

Download Persian Version:

<https://daneshyari.com/article/3007941>

[Daneshyari.com](https://daneshyari.com)