Incidence and Outcomes of Severe Anaphylaxis in Paediatric Patients in Atlantic Canada

Kristina Krmpotic[1,2] Caroline Weisser[3] Alexandra O'Hanley[1] Christian Soder[1,2]

[1] Department of Paediatric Critical Care, IWK Health Centre, Halifax, Canada
[2] Department of Critical Care, Faculty of Medicine, Dalhousie University, Halifax, Canada
[3] Department of Clinical Immunology and Allergy, Hospital for Sick Children, Toronto, Canada

Address for correspondence Kristina Krmpotic, MD, MSc, FRCPC, Department of Paediatric Critical Care, IWK Health Centre, P.O. Box 9700, 5850/5980 University Avenue, Halifax, NS, B3K 6R8, Canada (e-mail: kristina.krmpotic@iwk.nshealth.ca).

J Pediatr Intensive Care 2019;8:113–116.

Abstract

Little is known about severe anaphylaxis in the pediatric population. In this retrospective cohort study, we aimed to describe the characteristics of children who required admission from an outpatient setting to one of two Pediatric Intensive Care Units in Atlantic Canada with a primary diagnosis of anaphylaxis. During the 10-year study period, there were 12 admissions (58% females) for a population incidence of 2.4 per 100,000 children. Both patients who died were adolescents with a witnessed anaphylaxis event, immediately recognized as such after exposure to a known allergen, with immediate access to epinephrine that was not administered until after cardiorespiratory arrest occurred. This study highlights the high mortality associated with severe anaphylaxis and the ongoing need for education surrounding the early administration of intramuscular epinephrine.

Keywords
- anaphylaxis
- child
- critical care
- management
- pediatric

Introduction

Recent studies have reported a rise in the incidence and prevalence of anaphylaxis in adults and children, with increasing hospitalization rates for patients presenting with severe anaphylactic reactions.[1–3] Severe outcomes of anaphylaxis, including death or admission to the intensive care unit (ICU), are rare in adults.[4–6] Little is known about the incidence and outcomes of severe anaphylaxis in children, and this data come from European studies where patients are in much closer proximity to specialized pediatric tertiary care facilities.[1,2] Our objective was to describe a cohort of children with severe anaphylaxis that required admission to one of two pediatric intensive care units (PICUs) in Atlantic Canada over a 10-year period. We hypothesized that anaphylaxis requiring admission to PICU was a rare event associated with high mortality.

Methods

Following institutional ethics approval at each site, we used the administrative databases maintained by the PICUs at the IWK Health Centre in Halifax, Nova Scotia and the Janeway Children's Health and Rehabilitation Centre in St. John's, Newfoundland and Labrador to identify all patients with severe anaphylaxis, defined as admission to the PICU with a primary diagnosis of anaphylaxis, between January 1, 2006 and December 31, 2015. Patients may have been admitted to PICU for severe anaphylaxis on more than one occasion; each admission was considered a unique encounter. The administrative databases are prospectively maintained and include each patient's primary admission diagnosis. Thus, patients who experienced the onset of anaphylactic symptoms in the hospital setting (e.g., operating theater, oncology ward, medical day unit) were excluded as we could not reliably

received
December 5, 2019
accepted after revision
March 29, 2019
published online
March 25, 2019

DOI https://doi.org/10.1055/s-0039-1683869.
ISSN 2146-4618.

identify all patients who may have been transferred to the PICU with a secondary diagnosis of anaphylaxis. We conducted chart reviews to determine age, sex, medical history (including previous anaphylaxis and history of other allergic disorders), allergen exposure (if known/identified), clinical features of presentation, initial management, need for critical interventions (e.g., intubation, inotropes/vasopressors), length of stay in PICU and in hospital, and PICU mortality. Clinical characteristics and outcomes were summarized in a descriptive manner using median (range) for continuous variables and proportions for categorical variables. Incidence rate was calculated using mean aggregate Canadian census data reported by Statistics Canada for the population between 0 and 19 years of age in 2006, 2011, and 2016 for the provinces of Newfoundland and Labrador, New Brunswick, Nova Scotia, and Prince Edward Island.[7]

Results

During the 10-year study period, we identified 12 PICU admissions (five males, seven females; median age 15 years; range, 3–17 years) for severe anaphylaxis presenting from an outpatient setting, for an estimated incidence rate of 2.4 per 100,000 children, and accounting for 0.2% of all PICU admissions. A pre-existing medical history of atopy was present in two-thirds (63%) of patients, including allergy (58%), asthma (50%), allergic rhinitis (25%), and atopic dermatitis (17%). Prior history of anaphylaxis was present in five (42%) cases. A trigger for anaphylaxis was identified in six (50%) patients (allergy injection, amoxicillin, cashews, dairy, latex, and peanuts). No triggers (e.g., seasonality) were identified for the other patients.

Clinical features of anaphylaxis included facial/intraoral/perioral swelling (83%), shortness of breath (67%), rash/hives (58%), and stridor/wheezing (50%). All patients experienced some form of cardiovascular compromise, ranging from mild tachycardia to cardiovascular collapse. Continuous epinephrine infusion was required for three (25%) admissions, and two (17%) patients required intubation and mechanical ventilation. The median length of stay in PICU was 2 days (range, 2–9 days), and, for patients surviving to PICU discharge, median length of stay in hospital was three days (range, 2–10 days).

Both patients who died were adolescents exposed to known allergens, had almost immediate onset of non-cardiovascular symptoms recognized as anaphylaxis, and had immediate access to intramuscular epinephrine that was not administered until they suffered cardiorespiratory arrest. Both patients had return of spontaneous circulation and achieved hemodynamic stability postarrest, but suffered severe global hypoxic ischemic brain injury and died.

Discussion

Severe anaphylaxis requiring admission to the PICU is a rare event that is difficult to study given the small number of patients affected. A national audit of ICU admissions for anaphylaxis in the United Kingdom (U.K.) identified only 81 pediatric cases during a 5-year study period, accounting for 0.1% of all PICU admissions.[1] Composite data recently collected from each of 32 PICUs in France identified 166 pediatric cases in 11 years, accounting for 0.1% of all PICU admissions.[2] We documented similar incidence rates, and age and gender distribution in the Atlantic Canada population. Severe anaphylaxis requiring PICU admission was a rare event that occurred mainly in adolescent patients, with nearly equal gender distribution. Most patients exhibited cutaneous manifestations and all patients experienced some degree of cardiorespiratory compromise. Rates of cardiorespiratory arrest and PICU length of stay were similar to those reported in the U.K.[1] Our study is the first to report other important outcomes, such as therapies administered in PICU.

Compared with the U.K. data,[1] our cohort had slightly higher mortality rates. This was likely related to our small sample size and methods used to identify eligible patients. Gibbison et al utilized national audit data from adult and pediatric critical care units across the U.K., which allowed for the identification of patients 15 to 19 years of age with severe anaphylaxis who were admitted to adult ICUs and not captured by the PICU admissions data.[1] It is possible that we did not identify all cases of severe anaphylaxis in pediatric patients within Atlantic Canada in instances where patients were admitted to an adult ICU but never transferred to one of the two PICUs. Furthermore, our data do not include patients who may have died in other ICUs, or those who died at home or en route to hospital.

Compared with data from France,[2] our cohort had much higher mortality rates. This was likely related to our inclusion and exclusion criteria. Our study did not include patients whose anaphylaxis occurred within the hospital setting. However, these patients accounted for two-thirds of cases identified by Pouessel et al. It is likely that their cohort had better outcomes due to earlier access to medical services.[2]

Although Gibbison et al did not describe characteristics of the four pediatric patients in their cohort who did not survive to PICU discharge,[1] Pouessel et al reported that all three deaths in their cohort were in adolescent patients who were exposed to known allergens, only one of whom received intramuscular epinephrine in a timely manner. We noted that both deaths in our cohort had almost immediate onset of non-cardiovascular symptoms recognized as anaphylaxis, and had immediate access to intramuscular epinephrine that was not administered until after cardiorespiratory arrest.

In addition to describing PICU interventions and length of stay, and demonstrating high mortality rates associated with severe anaphylaxis in pediatric patients, this study highlights the importance of continued strategies to increase awareness regarding the need for early administration of intramuscular epinephrine immediately after the onset of symptoms consistent with anaphylaxis. In addition, this study highlights the need for prospective surveillance studies and multicenter collaboration in studying features and outcomes of low-frequency pediatric conditions, such as severe anaphylaxis, particularly those that occur in

otherwise healthy patients and those that are associated with high morbidity and mortality.

Financial Disclosure
The authors have no financial relationships relevant to this article to disclose.

Conflict of Interest
None declared.

References

1 Gibbison B, Sheikh A, McShane P, Haddow C, Soar J. Anaphylaxis admissions to UK critical care units between 2005 and 2009. Anaesthesia 2012;67(08):833–839
2 Pouessel G, Chagnon F, Trochu C, et al; French Group for Pediatric Intensive Care and Emergencies (GFRUP). Anaphylaxis admissions to pediatric intensive care units in France. Allergy 2018;73 (09):1902–1905
3 Ben-Shoshan M, Clarke AE. Anaphylaxis: past, present and future. Allergy 2011;66(01):1–14
4 Turner PJ, Gowland MH, Sharma V, et al. Increase in anaphylaxis-related hospitalizations but no increase in fatalities: an analysis of United Kingdom national anaphylaxis data, 1992-2012. J Allergy Clin Immunol 2015;135(04):956–63.e1
5 Tejedor Alonso MA, Moro Moro M, Múgica García MV. Epidemiology of anaphylaxis. Clin Exp Allergy 2015;45(06): 1027–1039
6 Poulos LM, Waters AM, Correll PK, Loblay RH, Marks GB. Trends in hospitalizations for anaphylaxis, angioedema, and urticaria in Australia, 1993-1994 to 2004-2005. J Allergy Clin Immunol 2007; 120(04):878–884
7 Statistics Canada. 2017. Census Profile. 2016 Census. Released November 29, 2017. Available at: https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E. Accessed October 2, 2018