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Original Article

Comparison of pandemic and seasonal influenza A infections in pediatric patients: were they different?

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This retrospective cohort study revealed that the presence of pandemic H1N1 influenza resulted in a 77.7% increase of patient visits in the emergency department for influenza like illnesses and a 67.2% increase of hospital days in our hospital by comparing to a regular influenza season (2008–2009 season). However, median length of hospital stay was no different in either period (pandemic: 3 days versus seasonal: 4 days, $P = 0.06$). Except for the patients hospitalized for pandemic H1N1 influenza ($n = 111$) were older (median age: 4.7 years versus 1.6 years, $P = 0.04$) and tended to have pre-existing asthma (21.6% versus 9.0%, $P = 0.07$) than those hospitalized for seasonal influenza A infections ($n = 44$), this study found no significant difference between the two comparison groups with regards of other clinical and epidemiological features.

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Introduction

During the pandemic H1N1 influenza A infection outbreak in U.S., children and young adults from 5 to 24 years of age suffered highest attack rates[1] and were noted to have the highest incidence of influenza related complications, including severe pneumonia and death.[2,3] This was in distinct contrast to the pattern observed in seasonal influenza outbreaks.[2] However, studies that compared clinical characteristics of pediatric patients hospitalized for pandemic H1N1 influenza with those hospitalized for seasonal influenza had reported controversial findings.[4–7] This study was to provide further evaluation of pandemic H1N1 influenza with regards of its impact on emergency department (ED) and its epidemiological and clinical characteristics in pediatric patients.

Methods

Study setting

This study was conducted at Children's National Medical Center (CNMC) in Washington, DC. As the only exclusive provider of pediatric care in the metropolitan Washington area, CNMC serves as the regional referral center for pediatric emergency, trauma, cancer, cardiac and critical care as well as neonatology, orthopedic surgery, neurology, and neurosurgery.

Study design and population

We compared number of patients who visited our ED for influenza like illnesses (ILIs) from June through July 2009 to the same time period in 2008. ILIs were identified if discharge codes contained one or more of the following key diagnoses: fever, influenza, viral respiratory infections, congestion, cold, febrile, and upper respiratory infection.

Additional study patients were those hospitalized between June and July of 2009 for pandemic H1N1 influenza infections and between December 2008 and March 2009 for seasonal influenza A infections. Patients were identified from laboratory microbiology database and medical records. Pandemic H1N influenza A virus was detected using Real-time PCR method (ProFlu Plus; Prodesse Inc., Milwaukee, WI, USA), while seasonal influenza A virus was detected by one or more of the following three methods: rapid antigen testing for influenza A and B (BinaxNow Influenza A & B test; Inverness, Waltham, MA, USA), respiratory viral antigen panel, and/or respiratory viral culture.

Data collection and analysis

We reviewed electronic medical records (Cerner Millennium; Cerner Corporation, Kansas City, MO, USA) for study patients and extracted information on demographics, pre-existing medical conditions, clinical symptoms upon admission, hospitalization course including intensive care if required, and death.

Categorical variables such as gender and pre-existing medical conditions were compared using the chi-square test. Continuous variables such as age and length of stay were compared using the Student's *t*-test for parametric data and the Mann–Whitney rank sum test for non-parametric variables. All analyses were conducted using STATA (Stata Corp., College Station, TX, USA).

The study was approved by the Institutional Review Board for human subject research.

Results

Surge of ED patient-visits

From June through July 2009, 1119 patients presented in our ED for ILIs, represented a 77.7% increase compared to the same time period in 2008 ($n = 633$). In either of the two time periods, an approximate of 29.0% patients required hospitalization for managing ILIs. Number of admissions increased from 320 in June and July in 2009 comparing to 186 in the same time period in 2008.

Comparison of epidemiological and clinical characteristics

Of patients admitted for ILIs through ED, clinics, and referral physicians, 111 patients were confirmed to have pandemic H1N1 influenza A infections. Characteristics of these patients with laboratory-confirmed influenza A infection were compared to 44 patients who were hospitalized between December 2008 and March 2009 for a laboratory confirmed seasonal influenza A infection.

We found patients in both cohorts were similar with regards of gender and race distribution. However, patients with pandemic H1N1 influenza were older than patients with seasonal influenza (median age: 4.7 years versus 1.6 years, $P = 0.04$). Nearly half of patients (46.8%) with pandemic H1N1 influenza were 5 years or older, in contrast to 29.6% in patients with seasonal influenza.

In each of the two cohorts, about 40% patients had no significant preceding medical history (pandemic cohort: 39.6% versus seasonal cohort: 47.7%, $P = 0.39$). Compared to patients with seasonal influenza, those with pandemic H1N1 influenza were more likely to have a history of asthma (pandemic cohort: 21.6% versus seasonal cohort: 9.0%, $P = 0.07$) or sickle cell diseases (pandemic cohort: 13.5% versus seasonal cohort: 6.8%, $P = 0.24$).

Fever was the most common symptom upon admission and was reported by 69.8% of patients in the two cohorts combined. In addition, 44.5% of patients reported gastrointestinal (GI) symptoms including vomiting and/or diarrhea. The proportion of patients with GI symptoms slightly declined to 40.5% in patients with pandemic H1N1 influenza comparing to 54.5% in those with seasonal influenza ($P = 0.11$).

Pneumonia occurred in 28.0% of patients with pandemic H1N1 influenza A, compared to 15.9% patients with seasonal influenza ($P = 0.12$). Moreover, neurological symptoms such as seizure occurred in 16.1% patients overall, but was more common in patients with seasonal influenza (25.0%) than in those with pandemic influenza (12.6%) ($P = 0.06$).

The pandemic influenza patients resulted in a total of 587 hospital days, comparing to 351 hospital days resulted from patients with seasonal influenza. The median hospital days of the two cohorts were comparable (pandemic cohort: 3 days versus seasonal cohort: 4 days, $P = 0.06$). In addition, 18 (16.2%) patients with pandemic influenza and 11 (25.0%) patients with seasonal influenza required intensive care ($P = 0.21$). Thirteen (72.2%) patients who were admitted to an intensive care unit (ICU) for pandemic influenza A infection had preexisting medical conditions including asthma ($n = 5$), sickle cell disease ($n = 2$), genetic disorders ($n = 3$), neurology or immunology disorders ($n = 2$), and ex-24 week premature birth ($n = 1$). In contrast, only 6 (54.5%) patients admitted to ICU for seasonal influenza A infections had pre-existing medical conditions.

One patient died of pandemic influenza infection. This 11-month old previously healthy boy developed viral respiratory infection resulted from sick contacts at home. Patient suffered an episode of epilepticus associated with fever followed by acute respiratory distress. Patient deceased despite extended treatment using extracorporeal membrane oxygenation. There was no death in patients with seasonal influenza A infection.

Discussion

After the identification and circulation of the pandemic H1N1 influenza nationwide and in local communities, the volume of ED visits for ILIs in our hospital was nearly doubled compared to a comparable time period prior to the pandemic era. Similarly, pandemic influenza caused significant strain on inpatient units mainly due to the surge of patients. Despite that these marked and sudden increase in patient volume, patients with pandemic H1N1 influenza virus and those with seasonal influenza virus were nearly indistinguishable.

Nearly half of the children in our study cohort presented gastrointestinal symptoms such as vomiting and diarrhea. This proportion was much higher than the population surveillance data provided by the Centers for Disease Control and Prevention,[1] but remained unchanged during the pandemic H1N1 outbreak period. Although neurological complications associated with pandemic influenza A (H1N1) virus infection had been observed in U.S. children,[8] our study demonstrated that neurological complications also

occurred in a higher percentage of hospitalized seasonal influenza patients. Pandemic H1N1 influenza infection alone was not associated with an increased risk for associated neurological complications as demonstrated in our study cohort.

Nonetheless, as it had been described in the Mexican pediatric population,[2] we observed a shift in age to children older than 5 years of age during pandemic H1N1 outbreak period. We also observed that less than half of the patients hospitalized during pandemic H1N1 outbreak had preexisting medical conditions. This ratio was lower than the reported 65% in the adult population.[9,10] However, among those with preexisting medical conditions, there was an increase of patients with asthma suggesting that this population represented a high priority population for vaccination and should be closely monitored in the presence of pandemic H1N1 influenza. Patients with sickle cell disease were previously considered at high risk for complications related to seasonal influenza.[10] Our study noted this population was at increased risk for hospitalization if infected with pandemic H1N1 influenza A virus.

In summary, we compared clinical and epidemiological characteristics of children infected with pandemic H1N1 influenza A versus those infected with seasonal influenza A. Although the majority of clinical and epidemiological features were shared by both cohorts, significant differences were also detected. Compared to those infected with seasonal influenza A, children infected with pandemic H1N1 influenza A tended to be older and more likely to have preexisting asthma. More importantly, we observed a vast impact of this pandemic on hospital resource utilization. Insights provided by this study could shed light on emergency preparedness for pandemic influenza in the future.

References

1 CDC. Novel H1N1 Flu: Facts and Figures. Available at: http://www.cdc.gov/h1n1flu/surveillanceqa.htm (accessed 17 December 2010). Centers for Disease Control and Prevention, 2009.

2 Chowell G, Bertozzi SM, Colchero MA *et al.* Severe respiratory disease concurrent with the circulation of H1N1 influenza. N Engl J Med 2009; 361:674–679.

3 CDC. Surveillance for pediatric deaths associated with 2009 pandemic influenza A (H1N1) virus infection – United States, 2009. MMWR Morb Mortal Wkly Rep 2009; 58:941–947.

4 Herberg JA, Jones KD, Paulus S *et al.* Comparison of pandemic and seasonal influenza reveals higher mortality and increased prevalence of shock in children with severe H1n1/09 infection. Pediatr Infect Dis J 30:438–440.

5 Kumar S *et al.* Clinical and epidemiologic characteristics of children hospitalized with 2009 pandemic H1N1 influenza A infection. Pediatr Infect Dis J 2010; 29:591–594.

6 O'Riordan S *et al.* Risk factors and outcomes among children admitted to hospital with pandemic H1N1 influenza. CMAJ 2009; 182:39–44.

7 Tamma PD, Turnbull AE, Milstone AM *et al.* Clinical outcomes of seasonal influenza and pandemic influenza A (H1N1) in pediatric inpatients. BMC Pediatr 2010; 10:72.

8 Neurologic complications associated with novel influenza A (H1N1) virus infection in children – Dallas, Texas, May 2009. MMWR Morb Mortal Wkly Rep 2009; 58:773–778.

9 Use of influenza A (H1N1) 2009 Monovalent Vaccine Recommendations of the Advisory Committee on Immunization Practices (ACIP), 2009. MMWR Morb Mortal Wkly Rep 2009; 58:1–8.

10 Fiore AE *et al.* Prevention and control of seasonal influenza with vaccines: recommendations of the Advisory Committee on Immunization Practices (ACIP), 2009. MMWR Recomm Rep 2009; 58:1–52.