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Clinical Presentation, Laboratory Findings, Complications, and Mortality of Influenza during the Epidemic of October 2019-February 2020 in Iran

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ABSTRACT

Background: Influenza remains a major cause of pediatric morbidity worldwide. We evaluated clinical characteristics, complications, and outcomes of influenza infection in children during Iran's 2019-2020 epidemic.
Methods: This cross-sectional study analyzed 357 hospitalized children (<15 yr) with PCR-confirmed influenza at a tertiary center in Qom, Iran (Oct 2019-Feb 2020), representing 375 total PCR-positive cases after excluding 18 with incomplete data.
Results: Among 357 patients (mean age 3.2±2.1 yr; 61.3% male), fever (89.6%) and cough (76.8%) were most common. Laboratory findings included lymphopenia (26.3%) and leukopenia (21.8%). Complications occurred in 70 patients (19.6%), including pneumonia (4.8%), otitis media (4.5%), myositis (4.5%), sinusitis (2.8%), and seizures (2.8%). No mortality was observed.
Conclusions: Nearly 20% of hospitalized children with influenza developed complications, primarily respiratory and musculoskeletal. While no deaths occurred, the substantial complication rate underscores the importance of early detection and management in high-risk pediatric populations.

Keywords: Influenza, Pediatrics, Complications, Clinical characteristics, Iran

Introduction

Epidemics have not only been the biggest crises in health systems but also one of the biggest problems in the world. The occurrence of the COVID-19 pandemic reminded everyone once again that the influenza virus causes the first, largest, and most serious epidemics known.

The influenza virus, as an RNA virus, belongs to the family Orthomyxoviridae, divided into 3 types: A, B, and C. Type B and C strains have slight antigenic changes that primarily cause upper respiratory tract involvement, whereas the type A strain has an unstable antigenic structure that enables multiple mutations and antigenic shifts. Antigenic shift, due to a lack of prior immunity, leads to rapid transmission, seasonal outbreaks, epidemics, and pandemics (1-3). Seasonal flu outbreaks occur annually, but pandemics, such as the 1918 H1N1 pandemic, which infected ~500 million people and killed 50–100 million (3%–5% of the global population at the time)remain a major threat (4). Despite advancements in awareness and research, influenza remains a significant public health challenge. An estimated 1 billion people are infected yearly, including 90

million children under five, with 1 million developing severe lower respiratory tract infections (5, 6). Annual deaths range between 290,000 and 600,000 worldwide (7). Transmission occurs via droplets, contaminated surfaces, and mucus contact (8, 9). The virus has a short incubation period (1–2 d), with peak viral shedding on the first day of infection, yet remains transmissible for 7–10 d. Children are particularly vulnerable due to close contact in gatherings, facilitating rapid spread. Common complications include acute respiratory diseases (ARDS, pneumonia) and neurological involvement (encephalitis, encephalopathy, seizures), which can be life-threatening (10, 11).

Geographical variations in symptom severity and organ involvement necessitate region-specific studies to guide treatment and reduce mortality (12, 13).

This retrospective cross-sectional study examined clinical presentations, complications, and disease course in children aged 6 months to 15 yr during an influenza outbreak in Iran

Methods

A retrospective cross-sectional study has conducted at Hazrat Masoumeh Children's Center in Qom, Iran, during the 2019–2020 influenza epidemic. Of 1,225 patients under 15 yr presenting with flu-like symptoms (fever, cough, myalgia, sore throat), 375 were confirmed via PCR. Only PCR-positive cases were included.

Data Collection

Symptoms were defined as follows: fever (axillary temperature ≥38 °C), cough/myalgia/sore throat (clinician-documented), vomiting/diarrhea (≥3 episodes/24h), lethargy (decreased responsiveness), and headache (persistent pain). Complications included pneumonia (clinical signs + chest X-ray findings), acute otitis media (otoscopic findings + symptoms), myositis (CK ≥500 IU/L + limb symptoms), sinusitis (clinical criteria ± imaging), and seizures (febrile: fever-associated in children 6m–5y; non-febrile: neurologist-confirmed). Laboratory cut-offs were leukopenia (WBC <4,000/μL), lymphopenia (<1,500/μL [ages 1–5] or <1,000/μL [older]), thrombocytopenia (<150,000/μL), and elevated CRP (≥10 mg/L). Underlying diseases were categorized as respiratory (asthma, BPD), neurological (epilepsy, CP), immunocompromised (cancer, HIV), and cardiac/metabolic (CHD, diabetes).

Sample Size

Calculated for 5% types I error, 6% precision, and 50% probability, requiring ≥270 patients.

Statistical Analysis

Performed using SAS ver. 9.4. Frequencies and percentages were reported for categorical variables. A *P*-value<0.05 was considered significant.

Patient Involvement

No active patient participation; data were extracted from medical records.

Ethics approval

The study was approved by the Qom University of Medical Sciences biomedical research ethics committee (IR.MUQ.REC) with study number IR.MUQ.REC.1399.161.

Results

Among 1,225 patients presenting with flu-like symptoms, 375 (30.61%) tested positive for influenza via PCR and were hospitalized due to complications. After excluding 18 cases (incomplete data), 357 patients were analyzed. The cohort comprised 219 males (61.3%) and 138 females (38.7%), with the most affected age group being 13 months–3 yr (36.41%) and the least affected 12–15 yr (0.84%) (Table 1).

Table 1: Age Groups of 357 Hospitalized Patients with Influenza

Age Group	*Number of Patients*	*Percentage*
<3 months	8	2.24
4–6 months	8	2.24
7–12 months	19	5.32
13 months–3 yr	130	36.41
4–5 yr	74	20.73
6–7 yr	82	22.97
8–12 yr	33	9.24
12–15 yr	3	0.84

Among 357 hospitalized influenza patients, 70 (19.6%) developed complications, with pneumonia being the most frequent (17 cases, 4.76%), followed equally by otitis and myositis (16 cases each, 4.48%).(Table 2).

Table 2: Complications in Hospitalized Influenza Patients

Complication	*Number of Patients*	*Percentage*
Pneumonia	17	4.76
Otitis	16	4.48
Myositis	16	4.48
Sinusitis	10	2.80
Seizure	10	2.80
Encephalitis	1	0.28

The most common presenting symptom was fever (320 patients, 89.6%), followed by cough (274 patients, 76.8%) (Table 3).

Table 3: Symptoms at Initial Visit

Symptom	*Prevalence*
Fever	89.6
Cough	76.8
Vomiting	25.5
Myalgia	23.8
Lethargy	17.0
Headache	8.5
Diarrhea	8.0

Among the 357 hospitalized influenza patients, lymphopenia was the most prevalent laboratory abnormality (94 patients, 26.3%) (Table 4).

Table 4: Laboratory Abnormalities

Finding	*Number of Patients*	*Percentage*
Lymphopenia	94	26.3
Leukopenia	78	21.8
Neutropenia	47	13.2

Among 357 hospitalized influenza patients, neurological disorders (38 patients, 10.6%) and respiratory diseases (36 patients, 10.1%) were the most common underlying conditions.

Discussion

Our study provides critical insights into the epidemiological and clinical characteristics of pediatric influenza hospitalizations in Qom, Iran, with findings that both align and contrast with regional and global data. The male predominance (61.3%) in hospitalizations mirrors trends observed in other Middle Eastern studies, such as a Saudi Arabian cohort (14), but contrasts with a Western report where sex distribution was balanced (15). This discrepancy may reflect regional

healthcare-seeking behaviors or biological factors, warranting further investigation. The peak hospitalization rate among children aged 13 months–3 yr (36.41%) aligns with global data highlighting increased severity in toddlers (16), likely due to immature immunity and high exposure rates in daycare settings. Notably, this contrasts with H1N1 pandemic patterns, where infants <6 months predominated (17), underscoring how strain-specific virulence impacts age distribution. Fever (89.6%) and cough (76.8%) as dominant symptoms are consistent with WHO influenza case definitions (WHO, 2022), but our higher rates of vomiting (25.5%) vs. Middle Eastern peers (15%–20%) suggest potential regional variations in viral presentations. The prevalence of lymphopenia (26.3%) and leukopenia (21.8%) exceeds rates reported in temperate climates (18), pneumonia has been identified as a significant complication in various studies conducted in Iran. For instance, a study on community-acquired pneumonia (CAP) in Mashhad found that Streptococcus pneumoniae was the most common etiological agent, accounting for 24.4% of cases, followed by Mycobacterium tuberculosis (17.5%) and Staphylococcus aureus (6.7%) (19). Influenza is associated with significant neurological (10.6%) and respiratory (10.1%) complications, particularly in children and high-risk individuals. Vaccination and close monitoring are crucial to reduce severe outcomes (20, 21).

This study has several limitations that should be considered. First, the single-center design may restrict the generalizability of the findings to broader populations. Second, the lack of viral subtyping or vaccination status data limits the ability to assess strain-specific effects or vaccine-related outcomes. Additionally, the underrepresentation of mortality analysis due to sample size constraints may affect the interpretation of severe disease outcomes. To address these limitations, future research should prioritize multicenter studies across Iran's diverse climates to enhance external validity. Furthermore, strain-specific severity analyses and cost-benefit assessments of expanded vaccination in high-risk age groups are recommended to inform public health strategies and improve clinical management.

Conclusion

Complications of influenza were not uncommon in children and affected a fifth of the patients. The influenza epidemic of Oct 2019-Feb 2020 imposed a heavy burden on our hospital and children aged 13 months to 3 yr were the most common group of admitted pediatric patients. Therefore, understanding the clinical presentations, laboratory findings, and consequences of influenza is vital for the diagnosis and management of influenza virus infection and its consequences.

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Ethics consideration

All the participants gave consent to participate in the study.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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