



# Retrospective analysis of clinical features in children with influenza associated encephalitis who present to the emergency department



Mei-Hua Hu, Shao-Hsuan Hsia, Kuang-Lin Lin

Division of Pediatric General Medicine, Division of Pediatric Critical Care Medicine, Division of Pediatric Neurology, Chang Gung University, Chang Gung Memorial Hospital at LinKou Branch

## INTRODUCTION

Influenza-associated encephalitis is a significant pediatric neurological emergency, often leading to various complications or mortality. Despite extensive research, the correlation between influenza antibodies and epidemic encephalitis remains unclear. This study aims to compare the clinical characteristics of influenza-associated encephalitis with survival and mortality.

## MATERIALS & METHODS

We conducted a retrospective review of patients presenting with influenza-associated encephalitis at the pediatric emergency department between 2010 and 2015. Encephalitis was defined according to the criteria established by the International Encephalitis Consortium (see Table 1). All statistical analyses were performed using SPSS software.

### Table 1. Definition of encephalitis

Major criterion
Altered mental status but no identifiable alternative cause.
Minor criteria include
(1) fever > 38°C(100.4°F) within 72 h before or after presentation;
(2) generalized or partial seizures;
(3) new onset of focal neurological findings;
(4) cerebrospinal fluid white blood cell levels > 5 µL or elevated cerebrospinal fluid protein levels > 45 mg/dL and/or neuroimaging findings of abnormalities in the brain parenchyma that are suggestive of encephalitis
(5) abnormal electroencephalography findings that are consistent with encephalitis and not attributable to other causes.
Possible encephalitis : major criterion with 2 minor criteria
Probable encephalitis: major criterion with 3 or more minor criteria.

## RESULTS

Out of 158 diagnosed cases of encephalitis, 18 patients exhibited acute infection with influenza A or B virus, while 81 patients had influenza-associated encephalitis. Of the 18 patients with acute influenza infection, the most common presentation occurred in January (see Figure 1), with a peak incidence observed among 10-year-olds (see Figure 2). The mean age of patients with influenza encephalitis was 7.6 ± 4.6 years, with a mortality rate of 22.2% (see Table 2). A comparison between survival groups revealed higher rates of intubation and a greater incidence of acute necrotizing encephalopathy of childhood (ANEC) among those in the mortality group (see Table 3). Notably, one patient with negative influenza antibodies experienced mortality.



Figure 1. Month distribution of Influenza encephalitis

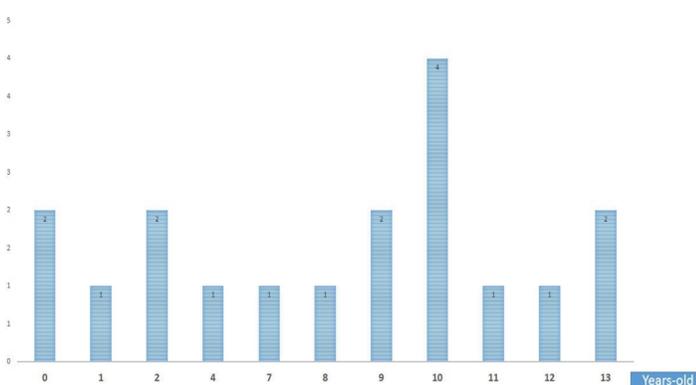


Figure 2. Age distribution of influenza encephalitis

Table 2. Demographic and clinical characteristic of Influenza patients

Variable	Number	
AGE (years)	7.6 ± 4.6	
Gender (male)	12	66.7%
Clinical presentation		
Fever	18	100%
Seizure	17	94.4%
Vomiting	9	50.0%
Acute necrotizing encephalopathy (ANEC)	3	16.7%
Intubation	9	50%
Expired	4	22.2%
AED at discharge	13	72.2%

Table 3. Clinical difference in survival and mortality subgroups in influenza encephalitis

	Survival group	Mortality group	P value
Age (year)	7.1 ± 4.3	9.4 ± 5.7	0.391
Gender (Male)	10 (71.4%)	2 (50%)	0.423
Coma scale (EVM)	11 ± 4	9 ± 6	0.326
Vomiting	7 (50.0%)	2 (50%)	1.00
Sugar	120 ± 31	167 ± 64	0.074
AST(Aspartate aminotransferase)	62 ± 102	79 ± 75	0.764
Influenza Antibody negative	0 (0%)	1 (100%)	0.118
Intubation	5 (35.7%)	4 (100%)	0.023
Acute necrotizing encephalopathy (ANEC)	1 (7.1%)	2 (50.0%)	0.043

## DISCUSSION

The higher rates of intubation and increased incidence of acute necrotizing encephalopathy observed in the mortality group of acute pediatric encephalitis patients. This could be due to a combination of factors such as brain edema, increased intracranial pressure, compromised airway protection, or impairment of respiratory drive resulting from extensive brain damage. The greater incidence of ANEC in the mortality group highlights the role of severe brain inflammation and injury in determining patient outcomes. The presence of ANEC suggests a dysregulated immune response, possibly triggered by viral infection, leading to excessive cytokine release, blood-brain barrier disruption, and neuronal damage.

## CONCLUSIONS

These findings highlight the importance of early recognition of clinical symptoms for prompt treatment. Additionally, further research is needed to elucidate the specific mechanisms underlying these findings and identify potential targets for therapeutic intervention.

## REFERENCES

- Clin Infect Dis. 2013;57:1114-1128.
- J Neurol Neurosurg Psychiatry.1995;58:555-561.
- Journal of Child Neurology.2020, 35:724-730
- J Child Neurol. 2014;29:182-186.