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Anaphylaxis: Ten-year retrospective study from a tertiary-care hospital in Northern Thailand

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Abstract

Background: The study of anaphylaxis in different geographic areas raises the awareness to improve prevention and medical care.

Objective: To investigate the incidence, causes, characteristics, and management of anaphylaxis in Chiang Mai, Thailand

Methods: We performed a retrospective review, based on ICD-10 electronic medical records of patients who attended the Out-Patient and Emergency Departments at Chiang Mai University Hospital from January 2007 to December 2016.

Results: A total of 441 episodes of anaphylaxis in 433 patients were analyzed. Three-hundred and sixty-two (84%) were adults and 71 (16%) were children. Anaphylaxis was common in the second and third decades of life. The incidence rate for all causes of anaphylaxis was 3.9 episodes per 100,000 out-patient and emergency visits per year. The rate in children was more frequent than in adults. Foods were the most common culprit (47%), followed by insect stings (23%) and drugs (18%). Severe anaphylaxis, defined as the loss of consciousness, hypotension, respiratory failure, or cyanosis were found in 163 events (37%). The time lapses between exposure with an allergen and the onset of symptom less than 30 minutes and triggered by insect stings were significantly associated with severe anaphylaxis. Biphasic reactions occurred in 6 patients (1.4%). Adrenaline injections were prescribed in most of patients (90%). There were no fatality cases in the past 10 years.

Conclusion: The incidence of anaphylaxis in our hospital appears more often in children than in adults. The frequency in adults trends to be increasing. Food and insect stings are the common causative agents.

Key words: Anaphylaxis; food allergy; allergen; epidemiology; Thailand

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Introduction

Anaphylaxis is an acute serious systemic hypersensitivity reaction which can be fatal. It requires immediate diagnosis and treatment.[1-3] Variable epidemiology data associated with differences in population, places of occurrence, and geographic areas have been reported.[4,5] Several studies showed the incidence and prevalence rising of anaphylaxis in many countries worldwide.[4] In 2006, The American College of Allergy, Asthma, and Immunology estimated the accumulative prevalence rate of anaphylaxis ranged from 0.05% to 2%.[6] A systematic review from European epidemiological studies estimated that 0.3% of the population experience anaphylaxis in their lives.[7] However, the pooled community-based prevalence of anaphylaxis in the general Asian population remains unknown. In Thailand, the incidence of anaphylaxis varied between 10 to 451 cases per 100,000 hospitalized patients[8-10] and 53 to 652 cases per 100,000 patients visiting the Emergency Department.[11-14] Food is the most common trigger in children, while insect stings and drugs have been found to be more common in adults.[4,5,15] Peanuts and tree nuts are the most common food allergen in Western countries, whereas wheat and shellfish are more frequently causative foods in Asia.[15-18] Many local foods have been reported as triggers, such as, bird nest in Singapore,[19] fried insect and ant eggs in Thailand.[12,20] Although there were several studies on the incidence of anaphylaxis in Thailand, all of them were from the

hospitals within Bangkok, the capital of Thailand.[8-14] The clinical features of anaphylaxis might show disparity due to variations in eating habits, living lifestyle and environment. Therefore, there is a need for data on the local epidemiology and clinical spectrums of anaphylaxis in our area.

To better understand the epidemiology and characteristics of anaphylaxis in Northern Thailand, we analyzed the incidence, etiology, clinical profiles, and treatment according to age groups and severity of anaphylaxis at Chiang Mai University Hospital during a 10-year period.

Materials and Methods

Patients and Methods

A retrospective study was conducted in the Emergency and Out-Patient departments at Chiang Mai University (CMU) Hospital, Chiang Mai, Thailand. CMU Hospital is the largest teaching hospital in the northern part of Thailand with 1,400 beds. It is the emergency care center for 230,000 people living in the Chiang Mai urban area and serves as the tertiary care -referral medical center for more than 11 million inhabitants in the northern region. Approximately 1.2 million patients visited the Emergency and Out-Patient Units each year. Although the access to medical service is sufficient in the Chiang Mai urban area, less severe emergency events may be treated at primary care units and private hospitals nearby.

Electronic medical records from the emergency and out -patient visits were reviewed using ICD-10 codes; T78.0 anaphylactic shock due to adverse food reaction, T78.2 anaphylactic shock unspecified, T80.5 anaphylactic shock due to serum, T88.6 anaphylactic shock due to drug adverse effect. Patients who fulfilled one of the three clinical diagnostic criteria of the 2006 National Institute of Allergy and Infectious Diseases/Food Allergy and Anaphylaxis Network (NIAID-FAAN) symposium[1] were diagnosed with anaphylaxis. All consecutive patients diagnosed as anaphylaxis and had been emergency treated at CMU hospital during January 2007 to December 2016 were recruited. Patients who were referred for investigation and treatment of anaphylaxis from other hospital were excluded.

The data were gathered using a record form that included demographic data, underlying diseases, atopic status, previous allergic reactions, the symptoms of anaphylaxis, time lapse between exposure to allergens and onset of symptom, treatment procedures, and outcomes.

The severity was stratified into 2 groups; mild to moderate, or severe anaphylaxis. Patients were classified as having severe anaphylaxis if they had potential life-threatening symptoms and signs. These included one or more of the following: loss of consciousness, hypotension, cardiovascular collapse, respiratory failure, or cyanosis. Patients aged < 15 years old were classified as children. Hypotension was defined as systolic blood pressure < 70 mmHg in patient ages 1 month to 1 year; < 70 + (2 * age) mmHg in ages > 1 to 10 years; < 90 mmHg in ages > 10 years. Pulse oximetry saturation (SpO2) < 95% was considered cyanosis. The triggers of anaphylaxis were identified and evaluated from history in medical records by allergist. Due to the limitation of medical facility, only small numbers of patients were further investigated by allergy skin test, serum specific IgE, or challenge test.

The study was approved by the Research Ethics Committee of the Faculty of Medicine, Chiang Mai University Hospital, Chiang Mai University.

Statistics

The Statistical Package for the Social Science (SPSS), version 23.0 for windows was used for all statistical analysis. A descriptive analysis was used for characterization of the study population. Continuous variables and categorical variables were expressed as the median, interquartile range (IQR) and percentage or ratio as appropriate. Comparison between the children and adult groups were performed using t-test, chi-squared test, or Fisher's exact test as appropriate. The odds ratio (OR) and 95% confidence interval (95% CI) were calculated to analyze the associated factor of 'severe anaphylaxis'. Covariates with p-value < 0.05 on univariate analysis were included in multivariate analysis. A p-value < 0.05 for a two-sided test was considered statistically significant.

Results

During the study period, there were 10,848,695 visits (9,902,416 were adults and 946,279 were children) at the Out-Patient and Emergency Departments. Four-hundred and eighty -one visits were encoded with any 1 of 4 inclusive ICD-10 diagnostic codes; T 780 anaphylactic shock due to adverse food reaction, T 782 anaphylactic shock unspecified, T 805 anaphylactic shock due to serum, T 886 anaphylactic shock due to adverse effect of drug. Forty visits (8.3%) were excluded due to unfulfilled the NIAID-FAAN anaphylaxis criteria or inadequate medical records. The total of 441 anaphylactic episodes out of 433 patients; 362 (84%) adults and 71 (16%) children, were recruited in the study. The characteristics of the patients are shown in **Table 1**. The median ages of patients were 9.5 and 28 years in children and adults, respectively. About one-third (32.5%) of patients had a history of allergic diseases. Twenty -two percent had a history of food allergy, with no significantly different rates between children and adults. Coexistence of asthma was more frequently observed in children (11.3% vs 5.3%), while underlying cardiovascular diseases were more frequently noted in adults (9.8% vs 23.0%). The frequency of anaphylaxis classified by age group and gender are shown in **Figure 1**. The frequency of anaphylaxis was highest among adolescents and young adults (11-20 and 21-30 year old groups). Anaphylaxis occurred more often in male ages > 3 to 20 years. Whereas, among children ages < 3 years and adults ages > 20 years, there was a female predominance. A history of recurrent anaphylaxis was found in 14 (3.2%) patients. Of these 14 recurrent anaphylaxis patients, 12 patients had 2 anaphylactic events due to insect stings, shellfish, and medicine. The causative allergen could not be identified in 2 of these 12 patients. Two patients had a history of 3 and 4 episodes of anaphylaxis caused by nonsteroidal anti-inflammatory drugs (NSAID) and shrimp, respectively.

The average incidence of anaphylaxis during 10-year period in CMU Hospital were 93.83 episodes per 100,000 emergency visits, with 119.5 and 91.6 episodes per 100,000 emergency visits in children and adults, respectively. Due to the context of CMU hospital, a large number of children (58%) and adult

Table 1. Characteristics of Subjects; Number of Patients (%)

	Total (n = 433)	Children (n = 71)	Adult (n = 362)	p-value
Sex: Male	202 (46.6)	47 (66.1)	155 (42.8)	<0.001
Median Age (interquartile range; year)	24.0 (19.0-43.0)	11.0 (5.8-13.0)	28.0 (21.0-48.0)	-
History of Allergic Diseases	141 (32.5)	28 (37.8)	113 (31.2)	0.181
• Food Allergy	99 (22.8)	17 (22.9)	82 (22.6)	0.782
• Allergic Rhinitis	22 (5.1)	5 (7.0)	17 (4.7)	0.414
• Asthma	28 (6.5)	8 (11.3)	19 (5.3)	0.015
• Chronic Urticaria	5 (1.1)	1 (1.3)	3 (0.8)	0.514
• Atopic Dermatitis	2 (0.5)	1 (1.4)	1 (0.3)	0.199
Underlying Cardiovascular Diseases	90 (20.8)	7 (9.8)	83 (23.0)	0.006
History of Recurrent Anaphylaxis	14 (3.2)	3 (4.2)	11 (3.0)	0.714

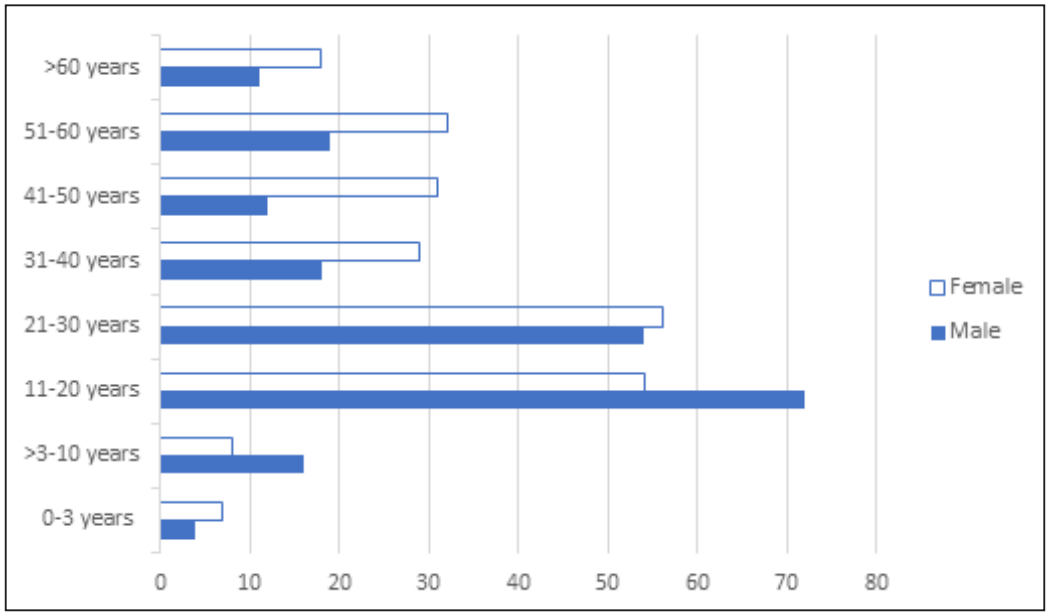

Figure 1. Frequency of Anaphylaxis Patients According to Age Groups and Genders (N = 433)

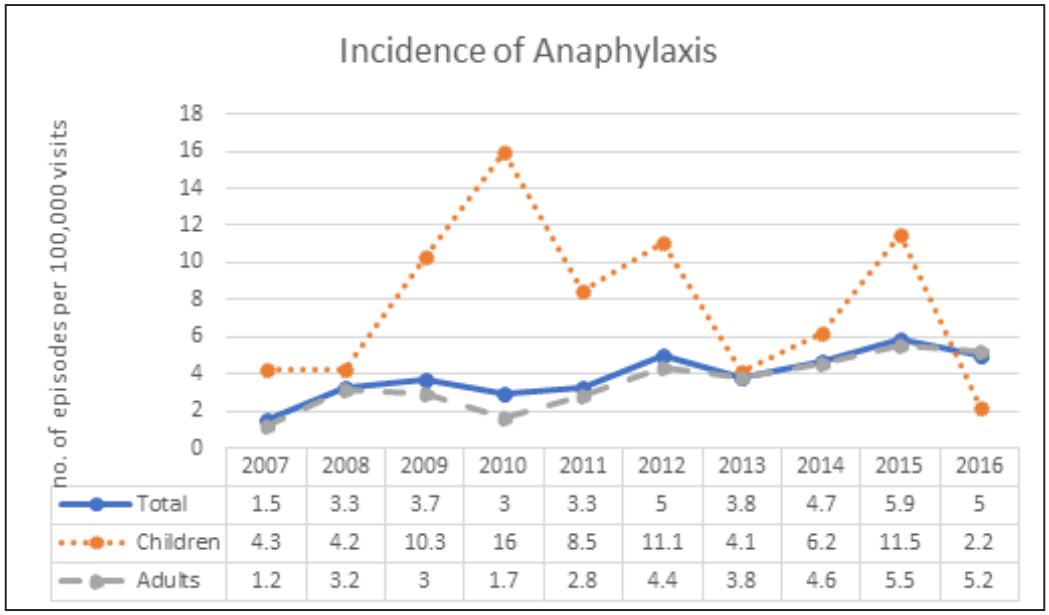

Figure 2. Incidence of Anaphylaxis Each Year from 2007-2016; Number of Episodes per 100,000 Out-Patient and Emergency Visits per Year

(24%) who had less severe anaphylactic symptoms were treated at the out-patient department. For more coverage, patients from either emergency or out-patient visit were included. The average incidence of anaphylaxis during the 10-year study period were 3.9 episodes per 100,000 out-patient and emergency visits, with 7.8 and 3.5 episodes per 100,000 visits in children and adults, respectively. When the study period was divided into 2007-2011 and 2012-2016 periods, the incidence of anaphylaxis in our hospital increased from 3.0 to 4.9 episodes per 100,000 visits between 2007-2011 and 2012-2016. Interestingly, we found the increase only in adults (2.4 to 4.7 vs 8.7 to 7.0 episodes per 100,000 visits in adults and children, respectively). The incidence of anaphylaxis in each year is demonstrated in **Figure 2**.

The most commonly reported causes of anaphylaxis were foods (47.4%), insect stings (23.1%), and drugs (17.9%) (**Table 2**). The order of these 3 leading causative agents were similar in both children and adults. The food implicated most frequently in both adults and children were shellfish (25.6%), especially shrimp. Some local foods such as ant eggs and fried insects, namely grasshopper, crickets, silk worms, and bamboo worms, were found in 23 of 209 patients (11%) with food-induced anaphylaxis. Twenty-seven patients (6.1%) came with food-induced anaphylaxis caused by a meal cooked with several unknown ingredients and the specific culprit allergen could not be identified, indicated as 'complex food' in **Table 2**.

Drugs were significantly more common causes of anaphylaxis in adults than in children (19.8% vs 8.1%, p=0.019). The mains culprit drugs were nonsteroidal anti-inflammatory drugs (NSAID) (7.4%), followed by antimicrobial agents (4.0%). The term 'idiopathic', referred to an unidentified trigger of anaphylaxis, found in 46 (11.4%) patients.

The clinical manifestations during anaphylaxis are reported in **Table 3**. Of 441 anaphylactic events, 94% were involved with the cutaneous and mucosal, 68% with respiratory, 54% with cardiovascular, 44% with gastrointestinal, and 7% with neurological systems. The ratios of clinical manifestations in both children and adults were comparable. The time lapse between exposure to an allergen and onset of symptoms in half of patients (48.8%) was < 30 minutes. Biphasic anaphylaxis was found in 6 patients (1.4%), the ratios of biphasic reactions were similar between children and adults. We did not find any significant difference

Table 2. Causes of Anaphylaxis; Number of Episodes (%)

	Total (n = 441)	Children (n = 74)	Adult (n = 367)	p-value
1. Foods	209 (47.4)	38 (51.3)	171 (46.5)	0.524
• Shellfish	113 (25.6)	22 (29.7)	91 (24.7)	
• Shrimp	58 (13.2)	10 (13.5)	48 (13.0)	
• Squid	10 (2.2)	2 (2.7)	8 (2.2)	
• Crab	18 (4.1)	4 (5.4)	14 (3.8)	
• Fish	17 (3.9)	4 (5.4)	13 (3.5)	
• Fried Insects	17 (3.9)	2 (2.7)	15 (4.1)	
• Wheat	1 (0.22)	1 (1.35)	0 (0)	
• Ant Eggs	6 (1.4)	2 (2.7)	4 (1.1)	
• Fruits/Vegetables	6 (1.4)	0 (0)	6 (1.6)	
• Alcohol Beverage	5 (1.1)	0 (0)	5 (1.4)	
• Others[1]	17 (3.9)	4 (5.0)	13 (3.5)	
• Complex Food[2]	27 (6.1)	3 (4.0)	24 (6.5)	
2. Insect stings	102 (23.1)	23 (31.1)	79 (21.5)	0.096
• Bee	26 (5.9)	6 (8.1)	20 (5.4)	
• Wasp	26 (5.9)	10 (13.5)	14 (3.8)	
• Ant	11 (2.5)	0 (0)	11 (3.0)	
• Unknown	41 (9.3)	7 (9.5)	34 (9.3)	
3. Drugs	79 (17.9)	6 (8.1)	73 (19.8)	0.019
• NSAIDs	33 (7.4)	3 (4.1)	30 (8.1)	
Ibuprofen	13 (2.9)	2 (2.7)	11 (3.0)	
Diclofenac	10 (2.3)	1 (1.4)	9 (2.5)	
Other NSIADs	10 (2.3)	0 (0)	10 (2.7)	
• Antimicrobial Agents	18 (4.0)	3 (4.1)	15 (4.0)	
Beta-Lactams	7 (1.6)	1 (1.4)	6 (1.6)	
Sulfonamides	3 (0.7)	2 (2.7)	1 (0.3)	
Quinolones	2 (0.5)	0 (0)	2 (0.5)	
Macrolides	4 (0.9)	0 (0)	4 (1)	
Other Antimicrobials	2 (0.5)	0 (0)	2 (0.5)	
• Radiocontrast Media	4 (0.9)	0 (0)	4 (1.1)	
• Others[3]	24 (5.4)	0 (0)	24 (6.5)	
4. Exercise-Related	5 (1.1)	2 (2.7)	3 (0.8)	0.198
5. Idiopathic[4]	46 (10.4)	5 (6.8)	41 (11.2)	0.899

[1] Other identified food e.g. frog meat, mushroom, food additives, honeycomb, etc.
[2] Considered if anaphylaxis caused by a meal cooked with several unknown ingredients and the specific culprit allergen could not be identified
[3] Other drugs e.g. anti-neoplastic agents, immunomodulating agents, biologic agents, opioids, paracetamol, vaccines, drug additives, cosmetics, etc.
[4] Considered if the trigger or causative allergen could not be identified

Table 3. Clinical Features, Treatment and Outcome of Anaphylaxis; Number of Episodes (%)

	Total (n = 441)	Children (n = 74)	Adult (n = 367)	p-value
1. Clinical Manifestations				
• Skin and Mucosa	416 (94.3)	71 (95.9)	345 (94.0)	0.782
Urticaria	371 (84.1)	66 (89.2)	301 (82.0)	
Angioedema	152 (34.5)	33 (44.6)	117 (31.9)	
Flushing	21 (1.8)	5 (6.8)	16 (4.4)	
Conjunctivitis	8 (1.8)	4 (5.4)	4 (1.1)	
• Respiratory	299 (67.8)	47 (63.5)	252 (68.7)	0.414
Cyanosis	106 (24.0)	22 (29.7)	84 (22.9)	
Dyspnea	137 (31.1)	27 (36.5)	108 (29.4)	
Chest Discomfort	257 (58.3)	38 (51.4)	217 (59.1)	
Wheezing	105 (23.8)	26 (35.1)	76 (20.7)	
Rhinitis	5 (1.1)	0 (0)	5 (1.4)	
Laryngeal Edema	13 (2.9)	2 (2.7)	11 (3.0)	
• Cardiovascular	239 (54.2)	45 (60.8)	194 (52.9)	0.250
Hypotension	80 (18.1)	8 (10.8)	70 (19.1)	
Tachycardia	199 (45.1)	42 (56.8)	157 (42.8)	
Palpitation	41 (9.3)	2 (2.7)	38 (10.4)	
• Gastrointestinal	194 (44.0)	39 (52.7)	155 (42.2)	0.159
Diarrhea	81 (18.4)	11 (14.9)	70 (19.1)	
Nausea/Vomiting	112 (25.4)	24 (32.4)	88 (24.0)	
Dysphagia	5 (1.1)	1 (1.4)	4 (1.1)	
Abdominal Pain	59 (13.4)	8 (10.8)	50 (13.6)	
Oral Pruritus	4 (0.9)	1 (1.4)	3 (0.8)	
• Neurological	31 (7.0)	4 (5.4)	27 (7.4)	0.803
Alteration of Consciousness	30 (6.8)	4 (5.4)	24 (6.4)	
Diaphoresis	3 (0.7)	0 (0)	3 (0.8)	
2. Severe Anaphylaxis[1]	163 (37.0)	25 (33.8)	138 (37.6)	0.598
3. Time Lapse Between Exposure to Allergen and Onset of Symptom				
• < 5 Minutes	35(7.9)	5 (6.8)	30 (8.2)	0.681
• 6-30 Minutes	180(40.8)	27 (46.5)	153 (41.7)	0.406
• 31-60 Minutes	110(24.9)	20 (27)	90 (24.5)	0.650
• > 60 Minutes	116(26.3)	22 (29.7)	94 (25.6)	0.463
4. Treatment				
• Adrenaline	396 (89.8)	67 (90.5)	329 (89.6)	0.817
Intramuscular	386 (87.5)	65 (87.8)	321 (87.5)	0.930
Intravenous	5 (1.1)	0 (0)	5 (1.4)	0.313
Subcutaneous	5 (1.1)	2 (2.7)	3 (0.8)	0.162
• H1 Antagonist	397 (90.0)	63 (85.1)	334 (91)	0.244
• H2 Antagonist	365 (82.8)	44 (59.4)	283(77.1)	0.003
• Systemic Corticosteroid	394 (89.3)	59 (79.7)	335 (91.3)	0.006
• Nebulized Beta-Agonist	89 (20.2)	22 (29.7)	67 (18.3)	0.038
• Oxygen Supplement	41 (9.3)	11 (14.9)	30 (8.2)	0.080
• Respiratory Failure with Intubation	2 (0.5)	0 (0)	2 (0.5)	0.524
• Intravenous Fluid Resuscitation	58 (13.2)	11 (14.9)	47 (12.8)	0.809
• Chest Compression	0 (0)	0 (0)	0 (0)	-
Outcome				
• Biphasic Reaction	6(1.4)	1 (1.4)	5 (1.4)	0.994
• Admission ≥ 24 hr	157 (35.6)	61 (82.4)	96 (26.2)	<0.001
• Death	0 (0)	0 (0)	0 (0)	-

[1] Considered if there were one or more of the following: loss of consciousness, hypotension, cardiovascular collapse, respiratory failure, or cyanosis

of clinical factors or treatment whether patients had a biphasic reaction or not (data not shown).

Information on the treatment of anaphylaxis is shown in **Table 3**. Epinephrine was administered in 396 (89.8%) anaphylactic events, most of them were injected intramuscularly. The total rates of usage H1 antihistamine and systemic corticosteroids were 90% as compared to epinephrine. Children were more frequently treated with nebulized beta-agonist but received less prescribed H2 antihistamine and systemic corticosteroids compared with adults. Two adults with respiratory failure needed intubation. No fatality was documented. The admission rate was significantly higher in children (82.4% vs 26.2%, $p < 0.001$).

The associated factors for 'severe anaphylaxis' are given in **Table 4**. Significant factors that were found on univariate logistic regression analysis were a history of atopy (OR = 0.55; 95%CI = 0.36-0.85), anaphylaxis caused by food (OR = 0.50; 95% CI = 0.34-0.75), anaphylaxis caused by insect stings (OR = 2.64; 95%CI = 1.68-4.15), and the time lapse between expose to allergen and onset of symptom < 30 minutes (OR = 1.91; 95%

Table 4. Factors Associated with Severe Anaphylaxis

	OR [95%CI][1]	Adjusted OR [95%CI][2]
History of Allergic Diseases[3]	0.55 [0.36-0.85]	0.73 [0.46-1.17]
History of Asthma	0.57 [0.26-1.22]	
Underlying Cardiovascular Diseases	1.19 [0.57-2.46]	
Age		
• Less than 3 Years	0.68 [0.13-3.53]	
• 3-10 Years	1.30 [0.60-2.82]	
• 11-20 Years	0.76 [0.49-1.18]	
• 21-60 Years	1.18 [0.80-1.75]	
• More than 60 Years	1.04 [0.48-2.27]	
Triggers		
• Foods	0.50 [0.34-0.75]	0.78 [0.48-1.27]
• Drugs	0.83 [0.49-1.39]	
• Insect Stings	2.64 [1.68-4.15]	1.94 [1.14-3.29]
Time Lapse[4] ≤ 30 Minutes	1.91 [1.29-2.83]	1.62 [1.08-2.44]

[1] Univariate logistic regression model
[2] Multivariate logistic regression model
[3] Allergic rhinitis, asthma, atopic dermatitis, chronic urticarial or food allergy
[4] Time lapses between exposure to allergen and the onset of symptom
CI, confidence interval; OR, odds ratio.

CI = 1.29-2.83). Both an anaphylaxis caused by insect stings and the time lapse between the exposure to an allergen and onset of symptom < 30 minutes were still statistically significant after being adjusted for in the multivariate logistic regression model.

Discussion

This study described the incidence, clinical characteristics and treatment modalities of anaphylaxis among adults and children who attended the Out-Patient and Emergency Departments in a university hospital, located in Northern Thailand. The overall incidence of anaphylaxis was 3.9 episodes per 100,000 out-patient and emergency visits from 2007-2016. To our knowledge, this is the largest study concerning anaphylaxis in Thailand and the first data from a provincial area, other than the Bangkok metropolis.

From previous studies the incidence of anaphylaxis from emergency departments worldwide ranged from 35 to 333 episodes per 100,000 visits.[4-7] In Thailand, the incidences from several hospitals in Bangkok varied from 52.5 in 2008 to 652 episodes per 100,000 emergency visits in 2015.[11-13] It seems that the incidence of anaphylaxis in this study were lower than those previous reports. In our hospital, the patients with severe anaphylaxis are treated at the Emergency Department, while the less severe one might visit and be treated at the Out-Patient Department. We calculated the incidence of anaphylaxis in our hospital by the sum of the patients who were visiting both the Out-Patient and Emergency Departments. Since this was a population from different clinical settings and locations, we were unable to compare the incidence of anaphylaxis with previous studies. In addition, our study showed that the incidence of anaphylaxis increased from 3.0 to 4.9 episodes per 100,000 visits between 2007-2011 and 2012-2016. Such a temporal trend might be the result of ongoing increases in allergic diseases in developing countries or due to an increased recognition of anaphylaxis by physicians.[21] Our population, however, demonstrated an increased incidence only in adult patients.

Several studies reported that the distribution of anaphylaxis varied according to the gender and age of participants.[4-6] The incidence of anaphylaxis in children ages 0-4 years was almost 3 times higher than that of other age groups.[4] Whereas in this study, the peaks of the anaphylactic frequency were adolescents and young adult (11-20 and 21-30 years old). This is in line with the report by Poachanukoon et al.[13] Moreover, our study showed that there were gender distinctions according to the age groups. The proportion of anaphylaxis in children was higher in boys than girls, while from 20 years onwards, females were in a higher proportion. These disparities of sex were in accordance with the literature and might be explained by the effect of hormones.[22]

Foods have been demonstrated to be the most common causes of anaphylaxis in both adults and children in this study. Shellfish, especially shrimp, was the leading cause, similar to other case series of anaphylaxis in Thailand.[10-14] In young children, despite cow's milk and hen eggs being the most common food allergens in almost all of the epidemiology categories worldwide, these food allergens causing anaphylaxis were not found in the present study. Several unique food allergens have been previously reported.[18-20] Due to good taste, high protein and nutrients, insects such as grasshoppers, crickets, silk worms, and bamboo worms, have become favourites in many parts of the world. Anaphylaxis to fried insects was observed in 17 (3.7%) patients. Moreover, anaphylaxis to ant eggs (*Oecophylla smaragdina*) have been found in 6 (1.2%) patients. Ant eggs are used as favorite ingredients in many varieties of dishes in Northern Thailand and it has been reported as a common cause of anaphylaxis in clinical practice in this area.[20]

Insect stings have been reported as the most common cause of anaphylaxis in Turkish and Central European adults,[23,24] which were observed as the second leading cause of anaphylaxis in the present study. The percentage of insect sting-induced anaphylaxis was higher than previous studies from Bangkok.[11-14] The possible explanation is the variation of exposure between geographic areas. In agreement with previous literature, drugs have been found to be more common in adults than children. NSAID and antimicrobial agents were the common culprits.[4,5]

The skin and mucosal systems were involved in more than 94% of anaphylactic episodes followed by the respiratory and cardiovascular system. Unlike the previous study,[15] where no statistically significant differences in clinical signs and symptoms of anaphylaxis were found between children and adults. The incidence of biphasic anaphylaxis varies between 3 to 20%.[11,25] In this present study, we observed only 6 (1.4%) patients, which was lower than that found in previous reports. This finding might be explained by low rate of admission in adult, therefore they would not be observed long enough. Moreover, we did not see any predictors associated with this condition. This might be due to the small numbers of biphasic cases.

Intramuscular epinephrine has been recommended as a first line treatment of anaphylaxis[2,3] which was administered in nearly 90% of our participants. The rate of adrenaline usage is comparable to previous study in a university hospital in Bangkok,[10-14] which is much higher than previous reports from other Asian countries.[15,16,26,27] Of the outcomes of anaphylaxis

in the present study, the children trend to have higher rates of hospitalization. These did not imply the severity of symptoms, children were, albeit, easier to admit to hospital because of differences in the decision-making threshold, parental concern and hospital policy. Although, 37% of participants had symptoms of severe anaphylaxis, there were no fatal anaphylaxis reports in our hospital during the study period. The high rate of adrenaline usage and no fatal cases might reflect the success of education on anaphylaxis recognition and treatment among our medical personnel.

Despite the fact that the rate of recurrent anaphylaxis in this study was very low (3.2%), epinephrine auto-injectors still needed to be prescribed for most of the patients with anaphylaxis.[28] Since such an instrument is not available in our hospital, epinephrine prefilled syringes have been prescribed with instructions in some of the patients with high risk. We had no data on the number of prefilled epinephrine prescriptions. From our clinical experience, epinephrine auto-injectors are relatively comfortable and easier to use compared to prefilled syringes. Epinephrine auto-injector are therefore needed to improve the management of anaphylaxis in our institute.

Epidemiologic studies have provided data on the risk of developing severe or fatal anaphylaxis, which include older ages, the presence of cardiovascular or cerebrovascular disease and coexistent asthma in food-induced anaphylaxis.[29,30] The present study indicated that anaphylaxis caused by insect stings and time lapses between exposure to allergens and onset of symptom < 30 minutes were the associated factors of severe anaphylaxis.

Due to the retrospective design of this study, there were some limitations due to incomplete data. The evaluation and investigation for causative allergen by referral to allergists was low due to resource limitations. Further prospective studies in more communities are required for more accurate epidemiologic data on anaphylaxis in our region.

In summary, anaphylaxis is not uncommon in Northern Thailand. There has been an increase in the incidence of anaphylaxis among adults. Shellfish is the most common cause of anaphylaxis in every age group. The unique local foods such as fried insects, ant eggs have been reported as common food allergens in our area. Knowledge regarding the epidemiology of anaphylaxis may contribute to improved anaphylaxis management.

The authors have no conflict of interest to disclose.

The study was approved by the Research Ethics Committee of the Faculty of Medicine, Chiang Mai University Hospital, Chiang Mai University.

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Contributors

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