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Original Articles

Identifying the Service Gaps in the Management of Severe Systemic Allergic Reaction/Anaphylaxis by Paediatrics Departments of the Hospital Authority

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Abstract

Background: Anaphylaxis and severe systemic allergic reaction are potentially life-threatening conditions. There is a paucity of data on the management of such condition amongst Hong Kong children. ***Objective:*** This review was designed to assist health professionals to evaluate the current process of care for children admitted with anaphylaxis or severe systemic allergic reaction, to identify service gaps so that patients are appropriately investigated, treated and taught how to recognise and manage severe allergic reactions. ***Methods:*** The anaphylaxis and severe allergic reaction/angioedema for children under age of 18 were identified using ICD-9 codes 995.0, 995.1, 995.6. We performed a retrospective chart review of one

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hundred children. We assessed the clinical practice among all Paediatric Departments within the Hospital Authority (HA) from January 2006 to December 2007. ***Results:*** The standardised admission rates of anaphylaxis aged below 18 years was 0.5 /100,000 (CI 0.6-0.7), which was probably 5-7 fold less compared with Western countries. This territory wide survey confirmed that food allergy was the leading cause in systemic allergic reactions amongst children admitted to HA service. Drug was the second commonest cause, accounting for 24% of the cases. The causes could not be determined in one out of six cases (17%). The attempt to identify the exact aetiologies was hampered by the lack of allergy assessment in most of the units. Adrenaline auto-injector was infrequently prescribed and used in our practice. ***Conclusion:*** This study provided background information for possible implementation of improvement measures that might be needed in the management of this possible life-threatening reaction.

Key words Anaphylaxis; Angioedema; Audit; EpiPen®; Hong Kong Children

Introduction

Anaphylaxis is an increasing emergency in Western countries, especially in children.[1,2] Anaphylaxis is a severe and sudden allergic reaction. It can occur when a susceptible person is exposed to an allergen (such as a food or insect sting). Although death is rare, an anaphylactic reaction always requires an emergency response. Prompt treatment with injected adrenaline is required to halt progression and can be life saving. Fortunately anaphylactic reactions are usually preventable by implementing strategies for avoiding allergens. Common allergens that can trigger anaphylaxis are: foods (e.g. peanuts and other nuts, shellfish and fish; and in pre-school age children, milk and egg), insect stings (e.g. bee, wasp, jack jumper ants) medications (e.g. antibiotics, aspirin) latex (e.g. rubber gloves, balloons, swimming caps).

In western countries, the commonest cause of anaphylaxis in children is related to food allergy.[1-3] Recent local community survey indicated that parent-reported adverse food reaction is a common atopic disorder in Hong Kong pre-school children and prevalence rates are comparable to the Caucasians.[4] This study identified that about 10% have severe reaction such as respiratory difficulties and shock. However, we have a relative paucity of clinical data on management of severe allergic reaction and anaphylaxis.

Discrepancies in the operational definitions and diagnostic criteria of anaphylaxis represent one of the most controversial issues in defining its epidemiology.[1] The lack of reliable markers of the disease hampers its diagnosis. Previous report of single centre experience indicated a lack of auto-injector of adrenaline in Hong Kong.[5] The under-use of adrenaline is another important issue, as available overseas data demonstrates physicians' preference for steroid and antihistamines despite the current lack of evidence of their effectiveness.[6]

This study on management of anaphylaxis and severe systemic allergic reaction was designed to assist health professionals to evaluate and optimise their care of patients diagnosed with anaphylaxis to ensure that patients are appropriately investigated, treated and taught how to recognise and manage severe allergic reactions. This study has assessed clinical practice among all hospital paediatric units of Hospital Authority. The specific aims of the study included the followings: 1) To evaluate prescription patterns and procedures for auto-injectable adrenaline in paediatric units of Hospital Authority; 2) To provide information for discussion and implementation of any changes in practice that might be needed.

Methods

Anaphylaxis Epidemiology Descriptive Data and Case Identification

We obtained admissions data from Hospital Authority central computer system CDARS January 1997 to December 2007. We identified admissions for anaphylaxis and angioedema (ICD-9 codes: 995.0, 995.1, 995.6) for children under age of 18. We retrospectively reviewed 100 medical charts from January 2006 to December 2007 out of total 104 patients with the above codings. All paediatric units providing acute emergency admissions had participated in this chart review.

Operational Definition of Anaphylaxis and Selection of Disease Coding

An international widely accepted definition of anaphylaxis was adopted.

Definition of Anaphylaxis:[7]

Anaphylaxis is highly likely when ANY one of the following three criteria is fulfilled:

1. Acute onset of an illness (minutes to several hours) with involvement of the skin, mucosal tissue, or both (e.g. Generalised hives, pruritis or flushing, swollen lips-tongue-uvula) and at least one of the following:
   a. Respiratory compromise (e.g. Dyspnoea, brochospasm, stridor, hypoxia)
   b. Cardiovascular compromise (e.g. Hypotension, collapse)
2. Two or more of the following that occur rapidly after exposure to a likely allergen for that patient (minutes or several hours)
   a. Involvement of the skin or mucosal tissue (e.g. Generalised hives, itch, flushing, swelling)
   b. Respiratory compromise (e.g. Dyspnoea, bronchospasm, stridor, hypoxia)
   c. Cardiovascular compromise (e.g. Hypotension, collapse)
   d. Persistent gastrointestinal symptoms (e.g. Abdominal pain and vomiting)
3. Hypotension after exposure to known allergen for that patient (minutes or several hours):
   a. *Hypotension for children is defined as systolic blood pressure <70 mmHg from 1 month to 1 year, <70 mmHg+ [2x age] from 1 to 10 years, and <90 mmHg from 11 to <18 years*

The Data Form (Appendix I)

A study form covered the general concern and areas of interest related to severe allergic reaction/anaphylaxis. To ensure consistent collection of data, the data collection form was set to be simple and unambiguous. For each of the standards defined for the data collection, there should be at least one question with clear options for the answer. A pilot was conducted using the tool on a few cases that were also subsequently included in the sample. The results of the pilot indicated that the data met the study aims.

Data Handling

The study form was completed by a designated coordinator (as listed) from each unit. The form was then stored at individual units and a copy was sent to the central data manager. The patient confidentiality was of prime concern. Only a study code was recorded with individual particulars. There was however a link kept separately for future verification as deemed necessary. The data was entered into a computer with password locked.

Data Presentation and Clarification Process

There were interactive sessions for the investigators to clarify some unclear data. The process helped to recognise bias and variance and ranked problems according to priority for resolution. We also defined actions to address these problems.

Documentation and Action

The recommended actions and proposed changes in policy or procedure were discussed and documented to Coordinating Committee (COC) in Paediatrics who originally granted the approval of this study. It further granted the right for publication in order to achieve with wide circulation.

Ethics

According to the Hospital Authority research ethics guidelines, (http://www.ha.org.hk/visitor/ha_visitor_index.asp?Parent_ID=110&Content_ID=369) "Ethics approval is usually not required in a straight forward clinical audit or analysis of existing/secondary data without identifiers traceable to the subjects". This study was considered as part of an internal audit and was approved by the COC Paediatric Chairman and its respective committee members from all hospitals. The right for publication was also granted by the Committee.

Statistic Analysis

Categorical data of subgroup analysis was compared by using the 2x2 test with the Yates correction. One way ANOVA (analysis of variance) was used to comparing the difference in age among groups. All statistical analysis was performed with SAS software, version 9.1 (SAS, Inc, Cary, NC).

Results

Anaphylaxis Epidemiology

The average calculated standardised anaphylaxis admission rate with age below 18 years due to food was 0.5/100,000 admissions (CI 0.6-0.7). The average calculated standardised admission rate with age below 18 years due to any causes was 1.5/100,000 admissions (CI 1-3) (Table 1a to 1c). The average calculated standardised angioedema admission rate with age below 18 years due to any causes was 5/100,000 admissions (CI 3-6). Generally, the rates were steady over the years.

Case Identification

There were ten admissions coded as anaphylaxis 995.0,

Table 1a Admission rate for anaphylaxis (995.0) in Hong Kong (1997-2007) (Principle diagnosis only)

	Population			HA admission			HK admission*			Rate / 100,000			
Year	**0-4**	**5 -14**	**15-<18**	**0-4**	**5 -14**	**15-<18**	**0-4**	**5 -14**	**15-<18**	**0-4**	**5 -14**	**15-<18**	**ALL**
1997	372200	817800	374400	0.0	2.0	2.0	0	3	3	0	0	1	0
1998	377600	817500	376200	2.0	8.0	9.0	3	11	12	1	1	3	2
1999	368500	818400	368100	3.0	15.0	6.0	4	21	8	1	3	2	2
2000	348700	814000	363000	6.0	18.0	13.0	8	25	18	2	3	5	3
2001	325900	828700	348400	2.0	24.0	7.0	3	33	10	1	4	3	3
2002	305300	832100	341100	1.0	7.0	9.0	1	10	12	0	1	4	2
2003	282500	832300	345400	0.0	3.0	10.0	0	4	14	0	0	4	1
2004	261800	821600	344700	0.0	6.0	2.0	0	8	3	0	1	1	1
2005	242000	809200	352200	1.0	4.0	6.0	1	6	8	1	1	2	1
2006	234200	789100	355000	0.0	1.0	3.0	0	1	4	0	0	1	0
2007	224900	759400	350700	2.0	4.0	3.0	3	6	4	1	1	1	1

*HA to Private admission is 26.4:10

Table 1b Admission rate for angioneurotic oedema (995.1) in Hong Kong (1997-2007) (Principle diagnosis only)

	Population			HA admission			HK admission*			Rate / 100,000			
Year	**0-4**	**5 -14**	**15-<18**	**0-4**	**5 -14**	**15-<18**	**0-4**	**5 -14**	**15-<18**	**0-4**	**5 -14**	**15-<18**	**ALL**
1997	372200	817800	374400	28.0	37.0	6.0	39	51	8	10	6	2	6
1998	377600	817500	376200	24.0	37.0	7.0	33	51	10	9	6	3	6
1999	368500	818400	368100	23.0	30.0	8.0	32	41	11	9	5	3	5
2000	348700	814000	363000	12.0	25.0	12.0	17	34	17	5	4	5	4
2001	325900	828700	348400	10.0	25.0	7.0	14	34	10	4	4	3	4
2002	305300	832100	341100	13.0	25.0	2.0	18	34	3	6	4	1	4
2003	282500	832300	345400	10.0	21.0	4.0	14	29	6	5	3	2	3
2004	261800	821600	344700	18.0	28.0	9.0	25	39	12	9	5	4	5
2005	242000	809200	352200	17.0	24.0	6.0	23	33	8	10	4	2	5
2006	234200	789100	355000	18.0	26.0	5.0	25	36	7	11	5	2	5
2007	224900	759400	350700	11.0	37.0	12.0	15	51	17	7	7	5	6

*HA to Private admission is 26.4:10

Table 1c Admission rate for anaphylactic shock due to food (995.6) in Hong Kong (1997-2007) (Principle diagnosis only)

	Population			HA admission			HK admission*			Rate / 100,000			
Year	**0-4**	**5 -14**	**15-<18**	**0-4**	**5 -14**	**15-<18**	**0-4**	**5 -14**	**15-<18**	**0-4**	**5 -14**	**15-<18**	**ALL**
1997	372200	817800	374400	0.0	7.0	2.0	0	10	3	0	1	1	0.793
1998	377600	817500	376200	2.0	6.0	3.0	3	8	4	1	1	1	0.965
1999	368500	818400	368100	1.0	3.0	3.0	1	4	4	0	1	1	0.621
2000	348700	814000	363000	2.0	2.0	1.0	3	3	1	1	0	0	0.452
2001	325900	828700	348400	0.0	4.0	1.0	0	6	1	0	1	0	0.459
2002	305300	832100	341100	2.0	2.0	2.0	3	3	3	1	0	1	0.560
2003	282500	832300	345400	3.0	2.0	1.0	4	3	1	1	0	0	0.567
2004	261800	821600	344700	1.0	2.0	1.0	1	3	1	1	0	0	0.386
2005	242000	809200	352200	1.0	3.0	1.0	1	4	1	1	1	0	0.491
2006	234200	789100	355000	2.0	1.0	1.0	3	1	1	1	0	0	0.400
2007	224900	759400	350700	0.0	2.0	0.0	0	3	0	0	0	0	0.207

*HA to Private admission is 26.4:10

eighty-nine coded as angioedema 995.1, and five coded as anaphylactic shock due to food 995.6. A total of 100 (96%) medical records were available for review. These included all anaphylaxis cases but 85/89 of angioedema cases. Four records coded as angioedema could not be found.

Disease Coding

We studied the coding precision by comparing the reported clinical features with a pre-defined definition of anaphylaxis. All coding for anaphylaxis were precise. Out of 15 coded as anaphylaxis, 10 had cardiovascular compromise and 5 had respiratory compromise. Whilst 85 cases coded as angioedema, none had cardiovascular compromise but (25/85, 29.4%) had symptomatic respiratory symptoms. These 25 cases should actually be coded as anaphylaxis. After revision of coding, the inter-group comparison was tabulated. Group A is after revision of coding "remained as angioedema", Group B is after revision "changed from angioedema to anaphylaxis", Group C is fulfilled the diagnosis of anaphylaxis, and was labeled as such at the outset (Table 2).

Demographic Characteristics

The male to female ratio was 55:45. The age ranged from 2 months to just under 18 years. The mean and median ages were 8.09 (SD 5.7) years and 8.21 years respectively. There was no age difference between female and male. There were 98 Chinese and 2 Non-Chinese. The incidents took place at: home 56%; restaurant 8%; school 5%; community not-specified other than medical premises 21%.

Clinical Severity

The symptoms and signs of different organs were tabulated in Table 3. Majority of them had cutaneous manifestations. A third had respiratory symptoms. Ten percent had cardiovascular compromised states. Gastrointestinal symptoms were less frequent which occurred in 8 cases. There was no single mortality after the index event. Recurrence was not evaluated. Co-factor that influenced the severity of an anaphylactic reaction (e.g. pre-existing of asthma) was not evaluated. The mean hospital stay was 2 days. Biphasic reaction, as defined by returning of symptoms after initial resolution of symptoms but without further exposure to inflicting agent,[7] occurred in 10% of individuals.

Table 2 Subgroup analysis after revision of coding

	Group A n=59	Group B n=26	Group C n=15	p-value
Demographic				
Age	6.9 (5.1)	9.7 (4.5)	10.4 (5.8)	**0.0157**
Sex Male (%)	33 (55.9%)	17 (65.4%)	8 (53.3%)	0.6638
Index reaction at home	45 (76.3%)	14 (53.9%)	7 (46.7%)	**0.0304**
Triggers				0.6374
Food	20 (33.9%)	12 (46.2%)	8 (53.3%)	
Drug	15 (25.4%)	6 (23.1%)	3 (20.0%)	
Others	24 (40.7%)	8 (30.8%)	4 (26.7%)	
Manifestation				
Skin	59 (100%)	26 (100%)	15 (100%)	–
GI	1 (1.7%)	1 (3.9%)	**7 (46.7%)**	**<0.0001**
Respiratory	0 (0%)	**25 (96.2%)**	**12 (80.0%)**	**<0.0001**
Cardiovascular	0 (0%)	0 (0%)	**10 (66.7%)**	**<0.0001**
Use of medication				
Adrenaline	1 (1.7%)	8 (30.8%)	5 (33.3%)	**0.0001**
Steroid	18 (30.6%)	17 (65.4%)	12 (80.0%)	**0.0003**
Antihistamine	58 (98.3%)	23 (88.5%)	15 (100%)	0.071
Allergy evaluation	18 (30.5%)	14 (53.9%)	8 53.3%)	0.0671

Group A is after revision of coding "remained as angioedema", Group B is after revision "changed from angioedema to anaphylaxis", Group C is fulfilled the diagnosis of anaphylaxis, and was labeled as such at the outset.

Table 3 Presenting symptoms and signs in 100 episodes of index allergic reactions (*one can have more than one symptoms*)

Cutanenous (100)	
	Angioedema and urticaria (58)
	Angioedema alone (33)
	Urticaria alone (9)
Respiratory (37)	
	Shortness of breath (27)
	Wheeze (11)
	Stridor (4)
	Cough (1)
Cardiovascular (10)	
	Tachycardia (9)
	Shock (4)
Gastrointestinal (9)	
	Vomiting (4)
	Abdominal pain (5)

Causes of Anaphylaxis and Severe Allergic Reactions

The presumed causes accounting for the 100 episodes were tabulated in Table 4a. Food related events as the leading cause constituted 40%, seconded by drug in 24% and third by insect bites in 7%. Causes in 6 cases (17%) could not be determined. Shellfish and seafood accounted for most of food related events. Peanut and tree nut accounted for 3 cases. The most severe reactions with significant cardiovascular compromise were found to be related to food in 3 cases (fish 2, shellfish 1), and to drug in 3 cases (2 over the counter medication and one herbal medicine). In 4 of these severe cases, causes could not be determined. For a subgroup analysis, the patients were grouped according to triggers as Food allergy vs. Drug Allergy vs. Others. The demographic and clinical parameters were tabulated (Table 4b) .

Table 4a Causes of severe allergic reactions occurring in the community of Hong Kong children (n=100)

Food 40	Shellfish 14, Fish 4, Seafood not specified 3, Cow milk and dairy 5, Egg 3, Peanut 3, Tree nut 1, Mis 7 (bird nest, fruits , legume, mushroom, food not specified, herbs)
Drug 24	Antibiotics 8 (Beta-lactam 5, cephalosporine 3), NSAID 7, TCM 5, OTC 2, Mis 2 (anticonvulsant 1, not-specified 1)
Insect sting 7	
Idiopathic 6	
Exercise 1	
Undefined 17	(4 viral infection, para-infectious)
Vaccine and blood product 0	

Abbreviations: NSAID = non-steroidal anti-inflammatory drug; TCM = traditional Chinese medicine; OTC = over the counter common cold medication; Mis = miscellaneous

Table 4b Inter-group comparisons defined by triggers

Triggers	**Food n=40**	**Drug n=24**	**Others n=36**	**p-value**
Demographic				
Age	8.6 (5.6)	8.1 (5.0)	7.9 (5.0)	0.832
Sex Male	26 (65.0%)	11 (45.8%)	21 (58.3%)	0.3223
Index reaction at home	24 (60.0%)	20 (83.3%)	22 (61.1%)	0.1201
Manifestation				
Skin	40 (100%)	24 (100%)	36 100%)	-
GI	4 (10.0%)	2 (8.3%)	3 (8.3%)	0.9601
Cardiovascular	4 (10.0%)	3 (12.5%)	3 (8.3%)	0.8703
Respiratory	20 (50.0%)	8 (33.3%)	9 (25.0%)	0.072
Medication				
Adrenaline	5 (12.5%)	4 (16.7%)	5 (13.9%)	0.8972
Steroid	24 (60.0%)	11 (45.8%)	12 (33.3%)	0.0663
Antihistamine	39 (97.5%)	23 (95.8%)	34 (94.4%)	0.7934
Allergy evaluation	21 (52.5%)	8 (33.3%)	11 (30.6%)	0.1115

Use of Emergency Medications

In the community, there was limited self-care management. Four cases received antihistamine, 2 had oral antihistamine and 2 received intramuscular antihistamine at general practitioners' clinic.

At the Accident and Emergency Department, 10% of patients received adrenaline (intramuscular route IM 4, subcutaneous SC 4 and intravenous IV 2). Antihistamine was given to 68% of cases (IV 37, oral 21, IM 10). Systemic steroid was given to 38% of cases (IV 30, oral 8). Inhalation bronchodilator was given to 13% of cases. Fluid resuscitation was given in 8 and oxygen supplementation was required in 3 cases.

After transferal to paediatric wards, further treatment consisted of adrenaline in 10 cases (IM 5, SC 4, IV 1); antihistamine in 97 cases (oral 65, IV 32), and systemic steroid in 30 cases (IV 22, oral 8). Further fluids were given in 9 cases. Bronchodilator was required in 6. Oxygen supplementation was continued in 3 cases.

In summary, a third of the cases were treated with intravenous systemic steroid as the preferred route. Adrenaline was given in 10 cases with significant cardiovascular compromise. Intramuscular and subcutaneous routes were used in similar proportion in this series.

Allergy Assessment

The aetiology was defined by clinical evaluation alone in 56 cases. Immuno-Cap RAST were offered in 20 cases. Skin prick test were offered to 7 cases. Provocation test was applied in 2 cases. Others tests (total IgE and C1-inhibitor) were applied in 16 cases. Some cases had more than one type of evaluations. All except one patient had known allergen prior to the presenting episode.

Long Term Care and Risk Reduction for Severe Systemic Allergic Reaction/Anaphylaxis

Majority (75%) of patients were given verbal instruction for risk reduction of future severe systemic allergic reaction/ anaphylaxis. The exact content of such verbal advice was not assessed. Written instruction or action plan was offered to 6 cases and all belonged to a single institution. Eleven patients were offered adrenaline auto injector but 2 parents declined the offer. Subsequent general clinic follow up was arranged for 28% of cases. Eleven cases were referred specifically for follow up by allergy specialists if this was available in the same hospital or to other hospitals where appropriate.

EpiPen® Availability at Hospital Pharmacy

There was a varied practice among different units. Seven out of 12 units were not providing this at their pharmacy but could prescribe for purchase at community pharmacy when indicated. Four have limited availability and provided it as patient purchased item at a cost of 600-900 dollars/ item. Only one unit has been providing it as a regular item. Two families declined the medical recommendation of carrying an EpiPen® from units where they have to purchase it at cost.

Discussion

This first ever territory-wide study audit on management of childhood severe allergic reactions provided some unique information on the current management status in public hospitals but at the same time raised several pertinent areas of concern and pressed for improvement in the management of this life threatening condition. Statistically, we had no single mortality over the two year period, but a significant proportion of patients had severe symptoms that merited prompt resuscitative measures. We had 5-7 folds less admissions for these severe allergic reactions as compared to UK. We had not observed an increasing trend of admissions as reported in Western nations (e.g. UK and Australia).[8-10] Nonetheless, under-reporting and miss-classification could not be completely excluded. We should remain vigilant as we are witnessing an increasing globalisation and westernisation. In general, Hong Kong is a city of high atopy prevalence[11] and local questionnaire survey[4] confirmed that we have a comparable rate of food allergy.

To Improve Risk Management

The impression was that we tended not to commit to a diagnosis of anaphylaxis unless overt cardiovascular symptoms were detected. Such preposition with significant implication in attitude and practice of anaphylaxis care should best be assessed by a prospective study.

Ideally, every case admitted with a diagnosis of anaphylaxis or significant angioedema should be thoroughly investigated for the possible allergen and assessed the risk of recurrence. Patient with respiratory and cardiovascular symptoms should best be equipped with auto-injector adrenaline together with a written instruction of action plan (Appendix II, this is an example format which one of participated hospital is currently using. It is not

endorsed by other hospitals or COC paediatrics at the writing of this paper).

To Improve Clinical Care

The current management seemed effective in the prevention of severe complications and mortality. We were unable to assess the efficiency (how quick) of our management in the reversion of the anaphylactic episodes. The current international consensus is that adrenaline is the medication of choice for anaphylactic episodes.[9-11] Intramuscular adrenaline route is preferred.[12-15] Prompt injection of adrenaline has been associated with better outcome.[13,14] Other medications such as antihistamines, inhaled asthma medications, or steroids that are commonly used by physicians in treating anaphylaxis should not be regarded as first-line medications.[9-11] Our study showed that adrenaline auto-injectors were infrequently prescribed and used in our practice.

There was a significant proportion of undetermined cause for this cohort and yet they did not receive full assessment by a paediatric allergist/immunologist. A more detailed assessment may enable better clarification of allergens and implement probable avoidance measures. It is also of prime importance to empower the patient with appropriate knowledge and skill in dealing with severe allergic reaction is important in reducing long term morbidity and even mortality.[15]

Affordability and Availability of EpiPen®

EpiPen® is not a registered pharmaceutical product in Hong Kong. It is currently prescribed under named-patient basis and import licenses have to be applied via registration with Pharmaceutical Service of Department of Health (http://www.psdh.gov.hk/eps/index). According to a solicited data from Department of Health (Table 5), there has been a 2 fold increase in such prescriptions over a 3-year period. This included adults and children from both public and private sectors. This study raises concerns about lack of availability and affordability of adrenaline auto-injectors in Hong Kong public health care sector. Adrenaline auto-injector is not a drug item enlisted under 'safety net' for the poor. Some of our patients encountered difficulties in insurance reimbursement for purchasing EpiPen®. At times, syringe and ampoule of adrenaline was provided instead of auto-injectors which may pose difficulties for untrained people to administer correctly in emergency situation.

Table 5 Number of EpiPen® dispensed in Hong Kong (Source of data: Department of Health)

Year	EpiPen® Jr 0.15 mg	EpiPen® 0.3 mg	Total
2006	147	154	311
2007	235	233	468
2008	335	389	724

Limitation

This was a multi-centre retrospective analysis and thus pertinent clinical information was not documented completely in records at times. It would also be difficult to retrieve accurate data for assessing the timing of biphasic reaction by retrospective chart review. It was arbitrarily defined as after initial stabilisation at emergency room, but required a second dose of adrenaline in ward. We acknowledge it is not the ideal way to define biphasic reaction. There were problems of misclassification, under-diagnosis and under-reporting of systemic allergic reactions with our existing practice. It is understandable as we are lacking local guidelines or bench mark standards to refer to on this condition. The understanding of exact etiology was hampered by the lack of comprehensive allergy evaluation. As the primary objective of this study is to review the practice of the Department of Paediatrics, but we do reckon emergency room's practice forms an integral part of anaphylaxis management. However, this review is limited by not including information from the emergency departments. More importantly, the search strategy that we adopted must have missed patients who attended Accident and Emergency Department of Hospital Authority hospitals but not subsequently hospitalised. In addition, the case definitions for anaphylaxis are much more variable than what was revealed by the limited codes enlisted in the current study. Our strategy might miss a fair number of patients with anaphylaxis with respiratory (upper or lower) involvement and urticaria but no cardiovascular compromise. We should try to include the ICD-9 codes for diagnoses such as 'asthma', 'food allergy', 'drug allergy' and 'urticaria' as additional search criteria in future study. To circumvent the above limitation, a proper prospective designed clinical audit in collaboration with COC in A&E will yield more accurate case identification and data retrieval.

Conclusions and Recommendations

This retrospective chart review identified a few potential shortcomings of current practice that warranted further prospective study. There were perhaps discrepancies of operational definitions and diagnostic criteria of anaphylaxis among different units. Paediatrician's preference for steroids and antihistamines, despite the current lack of evidence of their effectiveness might have resulted in possible under-use of adrenaline. There has been a lack of proper evaluation and after care of patients presenting with severe allergic reactions in current HA paediatric service.

It is highly advisable to have a local practice guideline or to endorse an international guideline with due consideration of local constraints and clinical practice. It should preferably include an operational definition of anaphylaxis for proper diagnosis and standard management pathway. It should also address the indication and prescription of auto-injectable adrenaline (e.g. EpiPen®), which is an important resuscitative medication for treating severe allergic reactions in the community. The after care and allergy assessment of first documented anaphylaxis should also be discussed. It is vital to implement measures of improving long term risk reduction in anaphylaxis such as providing comprehensive allergy evaluation, appropriate preventive medication and written instructions. Due consultation of Emergency Departments should be made in the drafting and implementation process. We recommend to improve the availability of out-of-hospital use of auto-injectable adrenaline e.g. EpiPen® in the Hospital Authority service. EpiPen® should best be available in all hospital pharmacies. A registry of prescription of EpiPen® should preferably be established. It can serve as a vital parameter for assessment of severe allergy disease burden and for subsequent audit on proper use of EpiPen®.

Acknowledgement

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Appendix I

Hospital Authority COC – Paediatrics
QA – Subcommittee: Audit Team

Audit on Anaphylaxis management

Hospital ……..…….……..…….

Subject# ……..…….……..…….

Principle diagnosis

ICD Code	Diagnosis
☐ 995.0	Anaphylaxis/ anaphylactic shock
☐ 995.1	Angioneurotic oedema/ angioedema
☐ 995.6	Anaphylactic shock due to food

Patient particular:

Age: …….year……..month

Sex: ☐ Male ☐ Female

Ethnic: ☐ Chinese
☐ Non-Chinese - Asian
- Non-Asian

Cause of Anaphylaxis:
☐ Food: _____
☐ Drug: _____
☐ Vaccine
☐ Blood product
☐ Insect sting
☐ Exercise
☐ Idiopathic
☐ Undefined

Setting of index reaction: Happened at:
☐ Community
☐ Home
☐ School
☐ Other, specify: _____

☐ Hospital
☐ Paediatrics ward
☐ Non-Paediatrics ward

Severity score:
☐ Cutaneous (☐ Angioedema, ☐ Urticaria, ☐ Both)
☐ GI (☐ Vomiting, ☐ Diarrhoea, ☐ Colic, ☐ Bleeding)
☐ Respiratory (☐ Cough, ☐ Stridor, ☐ Wheeze, ☐ SOB)
☐ Cardiovascular (☐ ↓BP, ☐ Tachycardia)

(continued on page 196)

Appendix I (cont'd)

Treatment given:

At Community	At A&E	At Paediatric Ward
☐ Nil	☐ Nil	☐ Nil
☐ Adrenaline	☐ Adrenaline	☐ Adrenaline
☐ IM	☐ IM	☐ IM
☐ IV	☐ IV	☐ IV
☐ SC	☐ SC	☐ SC
☐ Antihistamine	☐Antihistamine	☐Antihistamine
☐ Oral	☐ Oral	☐ Oral
☐ IV	☐ IV	☐ IV
☐ IM	☐ IM	☐ IM
☐ IV Fluid	☐ IV Fluid	☐ IV Fluid
☐ Corticosteroid	☐ Corticosteroid	☐ Corticosteroid
☐ Oral	☐ Oral	☐ Oral
☐ IV	☐ IV	☐ IV
☐ Bronchodilator	☐ Bronchodilator	☐ Bronchodilator
☐ Others:	☐ Others:	☐ Others:

Allergy evaluation:
- ☐ Clinical alone
- ☐ RAST
- ☐ Skin test
- ☐ Provocation test (Challenge test)
- ☐ Others specify: _____

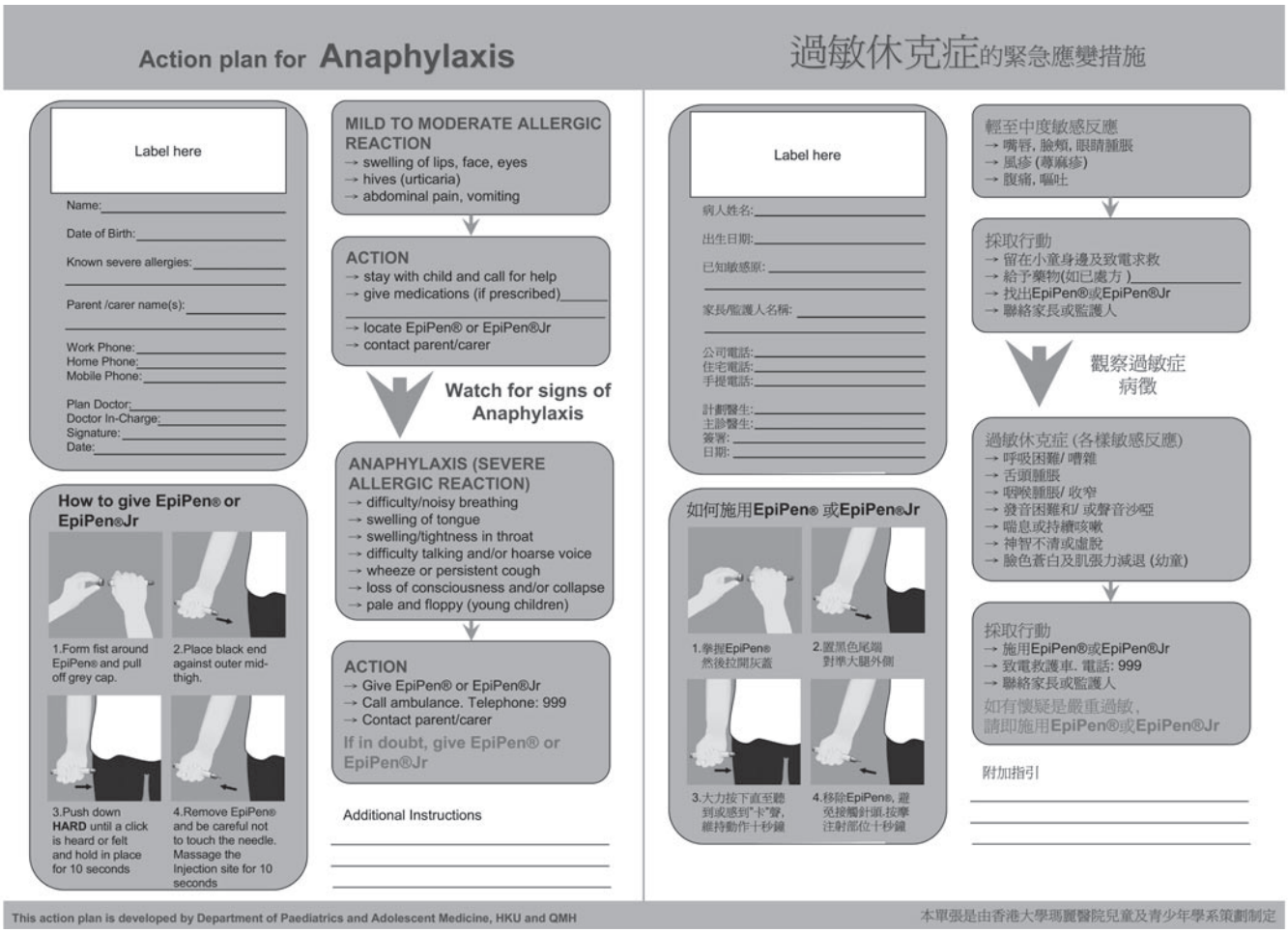
Follow up plan:
- ☐ Verbal instruction
- ☐ Written instruction given (e.g. action plan)
- ☐ Adrenaline provided
  - ☐ Epipen
  - ☐ Adrenaline (Syringe & ampoule)
  - ☐ Others specify: _____
- ☐ Follow up General Paed Clinic
- ☐ Referral to Specialist Care
- ☐ Others, specify: _____

Is Epipen available at your hospital's pharmacy?

- ☐ Yes
  - ☐ Patient-purchased item
  - ☐ Non-purchased regular item
- ☐ No

≺End≻

Appendix II


Action plan for Anaphylaxis
過敏休克症的緊急應變措施
Label here
Name:
Date of Birth:
Known severe allergies:
Parent /carer name(s):
Work Phone:
Home Phone:
Mobile Phone:
Plan Doctor:
Doctor In-Charge:
Signature:
Date:
How to give EpiPen® or EpiPen®Jr
1.Form fist around EpiPen® and pull off grey cap.
2.Place black end against outer mid-thigh.
3.Push down HARD until a click is heard or felt and hold in place for 10 seconds
4.Remove EpiPen® and be careful not to touch the needle. Massage the Injection site for 10 seconds
MILD TO MODERATE ALLERGIC REACTION
→ swelling of lips, face, eyes
→ hives (urticaria)
→ abdominal pain, vomiting
ACTION
→ stay with child and call for help
→ give medications (if prescribed)
→ locate EpiPen® or EpiPen®Jr
→ contact parent/carer
Watch for signs of Anaphylaxis
ANAPHYLAXIS (SEVERE ALLERGIC REACTION)
→ difficulty/noisy breathing
→ swelling of tongue
→ swelling/tightness in throat
→ difficulty talking and/or hoarse voice
→ wheeze or persistent cough
→ loss of consciousness and/or collapse
→ pale and floppy (young children)
ACTION
→ Give EpiPen® or EpiPen®Jr
→ Call ambulance. Telephone: 999
→ Contact parent/carer
If in doubt, give EpiPen® or EpiPen®Jr
Additional Instructions
Label here
病人姓名:
出生日期:
已知敏感原:
家長/監護人名稱:
公司電話:
住宅電話:
手提電話:
計劃醫生:
主診醫生:
簽署:
日期:
如何施用EpiPen® 或EpiPen®Jr
1.拳握EpiPen® 然後拉開灰蓋
2.置黑色尾端 對準大腿外側
3.大力按下直至聽到或感到"卡"聲, 維持動作十秒鐘
4.移除EpiPen®, 避免接觸針頭.按摩注射部位十秒鐘
輕至中度敏感反應
→ 嘴唇, 臉頰, 眼睛腫脹
→ 風疹 (蕁麻疹)
→ 腹痛, 嘔吐
採取行動
→ 留在小童身邊及致電求救
→ 給予藥物(如已處方)
→ 找出EpiPen®或EpiPen®Jr
→ 聯絡家長或監護人
觀察過敏症病徵
過敏休克症 (各樣敏感反應)
→ 呼吸困難/ 嘈雜
→ 舌頭腫脹
→ 咽喉腫脹/ 收窄
→ 發音困難和/ 或聲音沙啞
→ 喘息或持續咳嗽
→ 神智不清或虛脫
→ 臉色蒼白及肌張力減退 (幼童)
採取行動
→ 施用EpiPen®或EpiPen®Jr
→ 致電救護車. 電話: 999
→ 聯絡家長或監護人
如有懷疑是嚴重過敏, 請即施用EpiPen®或EpiPen®Jr
附加指引
This action plan is developed by Department of Paediatrics and Adolescent Medicine, HKU and QMH
本單張是由香港大學瑪麗醫院兒童及青少年學系策劃制定