Dengue Mortality in Patients under 18 Years Old: An Analysis from the Health Situation Analysis of Thai Population in 2010 Project

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Background: *Dengue is an important cause of morbidity and mortality in tropical and subtropical regions of the world. In Thailand, there has been no detailed research on mortality in children in terms of duration of admission and associated complications in the cases that died.*
Objective: *To assess the burden of dengue in Thailand in 2010 and to analyze the complications in patients aged under 18 years who died.*
Material and Method: *The authors described the mortality and complications of dengue fever and dengue hemorrhagic fever in patients under 18 years old using the information from the Health Situation Analysis of the Thai Population 2010 Project.*
Results: *In 2010, the overall mortality of dengue in all age groups and in patients aged under 18 years were 0.3 and 0.6/100,000, respectively. The mortality rate was highest among children aged 6-12 years (0.8/100,000). Among the 8 children with dengue fever that died, the 2 most common complications were fluid electrolyte and acid-base imbalance and disseminated intravascular coagulation (DIC). The common complications among the 91 cases with dengue hemorrhagic fever that died included fluid electrolyte and acid-base imbalance, hepatic failure, respiratory failure, bacterial infection, DIC and renal failure.*
Conclusion: *Early diagnosis, careful management of fluid therapy, awareness of hepatic and renal impairment and early treatment of co-infection should decrease mortality of dengue hemorrhagic fever.*

Keywords: *Dengue, Dengue hemorrhagic fever, Mortality, Pediatric*

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Dengue is an important cause of morbidity and mortality in tropical and subtropical regions of the world[1,2]. In 2010, the Bureau of Epidemiology, Department of Disease Control, Ministry of Public Health of Thailand, reported that the burden of dengue fever (DF), dengue hemorrhagic fever (DHF) and other arthropod-borne viral fevers [A90-A99] for the whole country was 184,544; that is, equal to 287.7/100,000. Mortality was highest in children under 15 years old; 0.5, 0.5 and 1/100,000 in children aged < 1, 1-4 and 5-14 years old, respectively[3]. Based on the national dengue surveillance programs, there was no data on the detail of mortality in children in terms of duration of admission and complications in the cases that died.

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The Health Situation Analysis of the Thai Population 2010 Project gathered information on illness of both in-patient and out-patient Medical Expense Forms for the fiscal year 2010 (October 1, 2009 and September 31, 2010) from the National Health Security Office (NHSO) and the Social Security Office, Thailand; and in-patient data from the Civil Servants Benefit System from the Comptroller General's Department. The data included 96% of the population. An analyst team checked data received for accuracy in: (a) overlapping information; (b) visiting dates; (c) missing items; (d) incorrect coding; and (e) correctly dating the fiscal year (Details are described earlier in this special issue). Our aim was to describe the mortality and complications of DF and DHF in patients under 18 years old using the information from this project.

Material and Method

Data on patients with a primary diagnosis of

DF and DHF [A90 and A91] were included in this analysis. The complications or other diagnoses from the second to the fifth category in patients under 18 years old who died were included in the mortality data. The hospitals were classified into 3 levels; primary: hospitals with less than 90 beds, secondary: hospitals with more than 90 beds including provincial hospitals and tertiary: regional hospitals and university hospitals.

Results

Burden of diseases

In 2010, the numbers of visit for out-patients and in-patients diagnosed as DF and DHF in each age group are presented in Table 1. The admission rates and mortality in each age group are presented in Table 2. The admission rate was highest (8.9/1,000) among patients aged 13-18 years (Table 2). The median duration of admission was 3 days with most of the cases (72 %) admitted for 2 to 4 days.

Mortality

The overall mortality of dengue in all age groups and in patients under 18 years old were 0.3 and 0.6/100,000, respectively. The mortality rate was highest among children aged 6-12 years (0.8/100,000) (Table 2). Eight of the cases of DF (median age, 9 years; range, 2-13 years) and 91 cases of DHF (median age, 9 years; range, 6 months-17 years) died. A respective 1, 27 and 60 cases of DHF died in a primary, secondary or tertiary hospitals and 3 died in a private hospital (Table 3). The median duration of hospital admission before death was 1 day (range, 1-25 days) or 72.5% (66/91) died within the first 2 days of admission.

Complications in fatal cases

Among the 8 children with DF that died, the 2 most common complications were fluid electrolyte and acid-base imbalance and disseminated intravascular coagulation (DIC). The common complications in the 91 cases with DHF that died included fluid electrolyte and acid-base imbalance, hepatic failure, respiratory failure, bacterial infection including 2 cases of melioidosis, DIC and renal failure (Table 4).

Discussion

According to the data from the Health Situation Analysis of the Thai Population Project, the overall mortality of dengue in 2010 was 0.3/100,000. The mortality among patients under 18 years old was 0.6/100,000. Most of the fatal cases died at tertiary hospital and 72.5% of DHF cases died within the first 2 days of admission; probably because of the severity of the condition by the time they were referred to a secondary and/or tertiary care center. It is well recognized that DHF patients with prolonged or uncorrected shock may progress to a more complicated course with metabolic acidosis and electrolyte imbalance, multi-organ failure and severe bleeding from various organs. Hepatic and renal failure also occur commonly in prolonged shock. Encephalopathy may occur in association with multi-organ failure, metabolic and electrolyte disturbances. Intracranial hemorrhage is rare and may be a late event. Patients with prolonged or uncorrected shock have a poor prognosis and high

Table 1. Burden of out-patient and in-patient regarding dengue fever and dengue hemorrhagic fever by age group

Age group	A90 Dengue fever (classical dengue)		A91 Dengue hemorrhagic fever	
	Out-patients	In-patients	Out-patients	In-patients
0-1 yr	929		644	
1-5 yr	10,113	689	4,116	1,159
6-12 yr	45,047	5,226	19,041	4,809
13-18 yr	41,207	22,376	22,959	24,782
19-24 Yr	22,279	20,128	14,199	31,439
25-39	23,627	9,763	13,920	18,689
40-59	10,435	10,132	6,023	17,339
60-69	1,227	4,831	767	7,314
70-79	557	692	348	953
80+	181	358	149	379
Missing	1,920	102	1,849	138
Total	157,522	74,297	84,015	107,001

Table 2. Admission rate and mortality of dengue fever and dengue hemorrhagic fever in each age group in 2010

Age group (years)	≤ 1	1-5	6-12	13-18	19-24	25-39	40-59	60-69	70-79	80+	Total
A90 Dengue fever	689	5,226	22,376	20,128	9,763	10,132	4,831	692	358	102	74,297
A91 Dengue hemorrhagic fever	1,159	4,809	24,782	31,439	18,689	17,339	7,314	953	379	138	107,001
Total admissions	1,848	10,035	47,158	51,567	28,452	27,471	12,145	1,645	737	240	191,016
Total mortality	4	12	49	34	18	17	13	3	3	3	156
Population 2010	638,795	3,849,802	5,828,237	5,803,260	6,243,113	15,462,466	17,162,126	3,941,907	2,387,937	1,011,415	62,514,239
Admission rate /1,000 population	2.9	2.6	8.1	8.9	4.6	1.8	0.7	0.4	0.3	0.2	3.1
Mortality rate/100,000	0.6	0.3	0.8	0.6	0.3	0.1	0.1	0.1	0.1	0.3	0.3

mortality[4,5].

The two most common complications in DHF cases that died were fluid electrolyte and acid-base imbalance and hepatic failure, which reflects both the severity and the common complications of DHF. A study of 55 cases of dengue shock syndrome presented at an emergency department at one children's hospital in Thailand between 2008 and 2009 revealed that 26 cases were referred cases and 5 of these cases died giving a case fatality of 8.5%. All fatal cases had prolonged shock, massive bleeding and liver failure at presentation. Other associated findings were encephalopathy, renal failure, respiratory failure and acidosis[6]. A prospective study of the etiology of acute hepatic failure in Thai children between 1-15 years of age revealed that among the 40 cases referred from 14 centers between 2000 and 2001, 12 (34.3%) had a dengue infection and 8 (8/12 = 66.7%) cases died[7]. The authors emphasized that dengue virus infection was the major cause of hepatic failure in Thai children.

Acute kidney injury caused by DHF has been reported to be associated with a high mortality rate of 64.0%[8]. The authors found that 14.3% of the fatal cases were associated with acute renal failure. Bacterial infections (*e.g.*, Staphylococcus septicemia and melioidosis) are reportedly associated with death among DHF patients[9-12]. In the current analysis, the authors found that 21.9% (20/91) of the patients had bacterial infections of which 2 were diagnosed as having melioidosis.

Hemorrhagic complications (*e.g.*, epistaxis, gingival bleeding, gastrointestinal bleeding, hematuria and hypermenorrhoea) are unusual in DF. Although rare, such severe bleeding (DF with unusual hemorrhage) are an important cause of death in DF[4,13]. From the authors analysis, DF cases that died were associated with fluid electrolyte imbalance and DIC, which are not commonly reported. It should be emphasized that the diagnosis of DF was based solely on the summary of patients' records by the responsible physicians and it is possible that these cases were actually cases of DHF.

Early diagnosis, careful management of fluid therapy to prevent shock and avoid prolonged shock, and awareness of hepatic and renal complications should decrease mortality of DHF. In DHF patients with unusual manifestations, co-infection with other micro-organisms should be investigated and treated as early as possible.

This current study has several limitations. Firstly, the data were collected from insurance and

Table 3. Number of deaths in cases with dengue fever and dengue hemorrhagic fever in patients 0-18 years old classified by hospital level

Primary diagnosis	Hospital level				Total
	Primary	Secondary	Tertiary	Private	
A90 Dengue fever [classical dengue]	0	3	5	0	8
A91 Dengue hemorrhagic fever	1	27	60	3	91
Total	1	30	65	3	99

Table 4. Complications in fatal cases of dengue fever and dengue hemorrhagic fever in patients 0-18 years old

Complications	DF (%) n = 8	DHF (%) n = 91	Total n = 99	(%)
Fluid electrolyte and acid-base imbalance	7 (87.5%)	51 (56.0)	58	58.6
Hepatic failure	2 (25.0%)	24 (26.4)	26	26.3
Respiratory failure	1 (12.5%)	22 (24.2)	23	23.2
Bacterial infection	0 (0%)	20 (21.9)	20	20.2
Disseminated intravascular coagulation	5 (62.5%)	15 (16.5)	20	20.2
Acute renal failure	2 (25%)	13 (14.3)	15	15.2

hospital data bases on the basis of reporting for reimbursement for services rendered as described earlier. A confirmed diagnosis of DF and DHF, therefore, had to rely upon the ability of physicians who performed the summary of the patient's records. This also applied to the complication information. Secondly, the authors included only the information of dengue fever [classical dengue, A90] and dengue hemorrhagic fever [A91], excluding A92 to 99, therefore the data are different from the information in the Annual Report of the Bureau of Epidemiology (BOE). The authors described the burden of dengue illness in Thailand in 2010 using the available information from the Health Situation Analysis of the Thai Population 2010 Project, which could not be compared to the BOE data. Thirdly, the authors included only the second to the fifth category of diagnosis from the medical record as the complications in the fatal cases, of which some other complications might be missing. However, most of the important diagnoses were assumed to be recorded as priority according to the reimbursement benefit. Nevertheless, the present study represents the first report on the detail of mortality of DF and DHF among children under 18 years old and also the complications associated with fatal cases of DF and DHF.

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Potential conflicts of interest

None.

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การเสียชีวิตของโรคเด็งกีในผู้ป่วยอายุน้อยกว่า 18 ปี: การวิเคราะห์ข้อมูลจากโครงการวิเคราะห์สุขภาพของคนไทยในปี พ.ศ. 2553

ผกากรอง ลุมพิกานนท์, ภพ โกศลารักษ์, แก้วใจ เทพสุธรรมรัตน์, สุมิตร สุตรา

ภูมิหลัง: *ไข้เด็งกี่และไข้เลือดออกเป็นสาเหตุสำคัญของการเจ็บป่วยและการเสียชีวิตในประชากรทั่วโลก ในประเทศไทยยังไม่มีข้อมูลการเสียชีวิตจากไข้เด็งกี่และไข้เลือดออกในผู้ป่วยอายุน้อยกว่า 18 ปี ในแง่ของระยะเวลาการอยู่รักษาในโรงพยาบาลและภาวะแทรกซ้อนที่พบร่วมด้วย*

วัตถุประสงค์: *เพื่อวิเคราะห์ขนาดของปัญหาของการติดเชื้อไข้เด็งกี่ และไข้เลือดออกในประเทศไทยในปี พ.ศ. 2553 และภาวะแทรกซ้อนในผู้ป่วยอายุน้อยกว่า 18 ปีที่เสียชีวิต*

วัสดุและวิธีการ: *การศึกษานี้ได้วิเคราะห์ข้อมูลผู้ป่วยอายุน้อยกว่า 18 ปีที่ได้รับการวินิฉัยไข้เด็งกี่และไข้เลือดออกและเสียชีวิต โดยใช้ข้อมูลจากการศึกษาสภาวะสุขภาพของประชากรไทยปี พ.ศ. 2553*

ผลการศึกษา: *การเสียชีวิตของไข้เด็งกี่และไข้เลือดออกในผู้ป่วยทุกอายุ และผู้ป่วยอายุต่ำกว่า 18 ปีเท่ากับ 0.3 และ 0.6 ต่อประชากร 100,000 คน ตามลำดับ อัตราการเสียชีวิตสูงสุดในเด็กอายุ 6-12 ปี เท่ากับ 0.8 ต่อประชากร 100,000 คน ในผู้ป่วยไข้เด็งกี่ 8 ราย ที่เสียชีวิต ภาวะแทรกซ้อนที่พบบ่อยคือความผิดปกติของสารน้ำและเกลือแร่ในร่างกาย และ DIC ส่วนผู้ป่วย 91 ราย ที่วินิจฉัยไข้เลือดออก พบความผิดปกติของสารน้ำและเกลือแร่ในร่างกาย ตับวาย ระบบหายใจล้มเหลว การติดเชื้อแบคทีเรีย DIC และไตวาย*

สรุป: *การวินิจฉัยโรคอย่างถูกต้อง การดูแลผู้ป่วยอย่างรอบคอบในเรื่องต่างๆ ที่กล่าวมาจะสามารถช่วยลดการเสียชีวิตจากโรคนี้ได้*