Dengue Shock Syndrome at the Emergency Room of Queen Sirikit National Institute of Child Health, Bangkok, Thailand

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Background: *Dengue virus infection is an important mosquito-borne disease with the reported 40,000-100,000 cases per year in Thailand. Shock is one of the common presentations at the emergency room (ER) and dengue shock syndrome (DSS) is among the common causes of shock. Proper and timely management of DSS determines the outcomes and prognosis of DSS patients.*

Objective: *To find the prevalence of DSS at the ER and evaluate the medical management and risk factors associated with the outcome of DSS patients.*

Material and Method: *A retrospective study on patients who presented with shock, including DSS patients at the ER of Queen Sirikit National Institute of Child Health (QSNICH), Bangkok, Thailand, from 1st January 2008 to 31st December 2009 was done. The prevalence of patients who presented with shock at the ER was retrieved from the Statistical and Information Technology Departments. Out-patient cards and In-patient charts of DSS patients were reviewed. Clinical and laboratory data were compared between recovered and death cases. Statistical analysis was done by using SPSS version 14.0.*

Results: *There were 109 shock patients seen at the ER during the present study period with 59 DSS (54.1%), 30 septic shock (27.5%), 13 hypovolemic shock (11.9%), 1 cardiogenic shock (0.9%) and 6 other non-specific shock (5.5%). DSS cases were found all year round with the peak prevalence from June to August which is the rainy season. Twenty-six of DSS (44.1%) were referred cases and 5 of them died, case fatality rate was 8.8%. All death cases had prolonged shock, massive bleeding and liver failure at presentation while these findings were found in 2 (4.4%), 16 (35.6%) and 10 (22.2%) cases of recovered cases. Encephalopathy, renal failure and respiratory failure were found in 80, 60 and 60% of the death cases while in recovered cases they were found in 11.1, 4.4 and 2.2%. Acidosis was found higher in the death group (60%) than in recovered group (8.9%). Other common presenting findings in death and recovered groups were bleeding (35.6 vs 100.0%), fluid over load (31.1 vs. 80%), hyponatremia (40 % for both groups) and hypocalcemia (83.3 vs. 80%). Among the 45 recovered cases; 3 cases were misdiagnosed and another 8 cases (17.8%) received no IV fluid at the ER. Cross matching was done in 32 cases (64%) and blood was transfused in 16 cases (50% of the cross matching).*

Conclusion*: DSS is the most common shock found at the ER especially during June to August. ER physicians should be alert for making the correct diagnosis of DSS with proper intravenous fluid resuscitation and correction of the common complications/laboratory abnormalities, i.e. acidosis, hyponatremia, hypocalcemia and cross matching for massive bleeding. A referred case with liver failure together with renal and respiratory failure was likely associated with mortality while fluid overload and significant bleeding do not if they are managed properly. Early signs of shock should be detected in walk in cases to prevent later shock after admission.*

Keywords*: Shock, Dengue shock syndrome, Emergency room*

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Dengue infection is transmitted by mosquito bites. Ninety percent of dengue infections (90%) are asymptomatic. Among the symptomatic cases (10%), clinical manifestations can be classified into non-specific viral syndrome (5%), dengue fever (4%) and dengue hemorrhagic fever (DHF) (1%) among which approximately 0.1-0.2% may develop Dengue shock syndrome (DSS)[1,2]. Although the chance of developing DSS is generally low, it is the major challenge in terms of management for emergency physicians. Delayed or misdiagnosis of DSS in the emergency room (ER) can result in inappropriate management with a high mortality rate. In addition, DSS is among the common causes of shock in Thailand. The present study of Dengue shock in the Emergency room will provide the useful informative data and challenges for continuous improvements.

Objective

To find the prevalence of DSS at the ER and evaluate the medical management and risk factors associated with the outcome of DSS patients.

Material and Method

A retrospective study on patients who presented with shock, including DSS patients at the ER of Queen Sirikit National Institute of Child Health (QSNICH), Bangkok, Thailand, from 1st January 2008 to 31st December 2009 was done. The prevalence of patients who presented with shock at the ER was retrieved from the Statistical and Information Technology Departments. Out-patient cards and In-patient charts of DSS patients who presented with shock at the ER were reviewed. Clinical and laboratory data were compared between recovered and death cases. Statistical analysis was done by using SPSS version 14.0.

DSS was classified using WHO criteria 1997. All cases were serological and/or virological confirmed dengue infections which were done at the Armed Forces Research Institute of medical Sciences.

DSS was managed according to the Thai National Guidelines for Dengue and Dengue Hemorrhagic Fever 2008 by the doctors and nurses team at the ER and under supervision of the first author.

All laboratory tests were done at QSNICH laboratories which had regular internal and external Quality Control and Quality Assurance.

Liver failure is defined as AST elevation > 200 U and INR > 1.3. Renal failure is defined as elevation of BUN > 20 mg% and serum creatinine > 1.0 mg%.

Results

There were 109 shock patients seen at the ER during the 2-year study period with 59 DSS (54.1%), 30 septic shock (27.5%), 13 hypovolemic shock (11.9%), 1 cardiogenic shock (0.9%) and 6 other non-specific shock (5.5%) Table 1. DSS cases were found all year round with the peak prevalence from June to August which is the rainy season. Fifty charts of DSS patients were available for analysis (Table 2). There were 5 deaths (8.5%) and all were referred cases while 46.7% of the recovered cases were referred. The ages of the 3 death cases were 10-14 years and another 2 were 3.5 and 5 years old. The mean age of the recovered and death cases were not different; 8.3 ± 4.4 and 8.5 ± 4 years old. The common age ranges were 10-14 years (38%) and 5-9 years (34%) (Table 3). The mean length of stay (LOS) were not different between the 2 groups; 6.7 ± 4.8 days for recovered and 5.2 ± 8.8 days for the death group. Three cases died within 24 hours, one died after 28 hours and one died of superimposed infections after 21 days in the hospital. The male to female ratio of the recovered and death groups were 1: 1.5 and 1.5: 1. Twenty-seven cases (60%) in the recovered group came to the ER out of the office hours (5 came in the morning

Table 1. Shock patients seen at the Emergency Room in the year 2008, 2009

Diagnosis of shock	2008		2009		Total	
	n	%	n	%	n	%
DSS	24	50.0	35	57.4	59	54.1
Septic	11	22.9	19	31.2	30	27.5
Cardiogenic	1	2.1	-	-	1	0.9
Hypovolemic	6	12.5	7	11.5	13	11.9
Non-specific	6	12.5	-	-	6	5.5
Total	48	100	61	100	109	100.0

Table 2. General Characteristic of DSS patients: Compare between Recovery and Death cases

	Complete recovered	Death	p-value
Number	45	5	
Male: Female	(18: 27) 1: 1.5	(3: 2) 1.5: 1	0.346
Mean age (year)	8.3 ± 4.4	8.5 ± 4.0	0.923
Refer (n/%)	21 (46.7)	5 (100)	0.029
Time at ER:			0.058
Morning shift (n/%)	23* (51.1)	2 (40.0)	
Afternoon shift (n/%)	15 (33.3)	1 (20.0)	
Night shift (n/%)	7 (15.5)	2 (20.0)	
Day of fever			0.0407
Day 3 (n/%)	4 (8.9)	0	
Day 4 (n/%)	7 (15.6)	0	
Day 5 (n/%)	15 (33.3)	1 (20.0)	
Day 6 (n/%)	9 (20.0)	2 (40.0)	
Day 7 (n/%)	7 (15.6)	2 (40.0)	
Day 8 (n/%)	2 (4.4)	0	
Day 9 (n/%)	1 (2.2)	0	
Re-visit (n/%)	11 (45.8)**	0	0.272
Mean length of stay (LOS)	6.7 ± 4.8	5.2 ± 8.8	0.542
***Range (day)	2-27	< 1- 21	

* 5 patients on weekends or holidays so 27 patients (60%) were seen out of office hours
** % of walk in patients, not include referred cases
*** 3 patients died within 24 hours, one patient died after 28 hours and one died of sepsis after 21 days

Table 3. Age range of DSS patients, compared between recovery and death cases

	Recover (n = 45) n/(%)	Death (n = 5) n/(%)	Total n/(%)	p-value
< 1 year	2 (4.4)	0	2 (4.0)	0.849
1-4 years	10 (22.2)	1	11 (22.0)	
5-9 years	16 (35.6)	1	17 (34.0)	
10-14 years	16 (35.6)	3	19 (38.0)	
> 15 years	1 (2.2)	0	1 (2.0)	
Total	45 (100.0)	5	50 (100.0)	

shift, from 8 AM to 16 PM of the weekends or holidays) while 3 (60%) of the death group came out of the office hours. Death cases occurred between days 5th-7th of fever while recovered cases came fro day 3rd through day 9th of fever. Eleven cases out of the 24 walk-in groups (45.8%) were defined as "revisit". These groups of patients came a few days earlier to OPD/ER and were misdiagnosed as influenza, pharyngitis, upper respiratory tract and diarrhea infections and then came again with shock.

All death cases presented with massive bleeding, prolonged shock and liver failure (Table 4) while in the recovered group these findings were presented in 35.6, 4.4 and 22.2%, respectively. In addition fluid overload was found in 80% of the death cases while it was present in 31.1% of the recovered group. Renal failure together with respiratory failure was found in 60% of the death group while only one (2.2%) in the recovered group had both renal and respiratory failure. This patient survived after 27 days in the hospital and peritoneal dialysis was performed.

The laboratory abnormalities that were significant lower in the death compared to the recovered group were mean albumin and mean cholesterol while significant higher were prolonged PTT, AST > 1,000 U, mean creatinine, creatinine > 1 mg% and acidosis

(Table 5). The mean WBC in both groups were not different and > 5,000 cells/mm^3. The mean rising Hct and platelet counts of both groups were not different and < 50,000 cells/mm^3. Common complications seen in both groups were not different, *i.e.* hyponatremia and hypocalcemia. The mean blood sugar was > 100 mg% in both groups. Most of blood sugar was drawn after initial fluid resuscitation.

In the recovered group, 28 cases (62.2%) were managed appropriately, according to the Thai National Dengue Guidelines for Early Diagnosis and Management[3]. The managing challenges of dengue in the ER in the recovered and death group are shown in Table 6. Three cases (6.7%) were missed diagnosed:

Table 4. Clinical presentations at ER: Compare between Recovery and Death cases

	Recover (n = 45) n/(%)	Death (n = 5) n/(%)	p-value
Significant bleeding	16 (35.6)	5 (100.0)	0.001
Prolonged shock	2 (4.4)	5 (100.0)	< 0.001
Fluid overload/acute pulmonary edema/ heart failure	14 (31.1)	4 (80.0)	0.05
Liver failure	10 (22.2)	5 (100.0)	0.001
Hepatic Encephalopathy	5 (11.1)	1 (20.0)	0.002
Renal failure	1 (2.2)	4 (80.0)	< 0.001
Respiratory failure	1 (2.2)	3 (60.0)	< 0.001

Table 5. Laboratory findings at ER: Compare between Recovery and Death cases ±

	Recover (n = 45) (n)	Death (n = 5) (%)	p-value
Mean wbc (cells/mm3)	7,247 ± 6,498	9,010 ± 4,538	0.600
Mean Hct (%)	46.2 ± 6.3*	**	0.688
Mean platelet (cells/mm3)	36,182 ± 25,075	32,600 ± 29,568	0.767
Mean albumin (gm%)	2.74 ± 0.7 (38)	1.68 ± 0.6	0.015*
Mean cholesterol (mg%)	86.6 ± 31.4 (31)	48.0 ± 23.3	0.002*
Mean Na (mEq/L)	131 ± 4 (40)	130 ± 4	0.856
Hyponatremia (%)	19/40 (47.5)	2 (40)	0.523
Mean iCa (mmol/L)	1.16 ± 0.08 (36)	1.13 ± 0.16	0.510
Hypocalcemia (%)	24/36 (66.7)	4 (80.0)	0.486
Prolonged PTT (%)	18/42 (42.9)	5 (100.0)	0.022*
Prolong INR (%)	11/42 (26.2)	3 (60.0)	0.148
Prolonged TT (%)	4/19 (21.1)	2/4 (50.0)	0.270
Mean AST (U)	969 ± 2,221 (44)	3,048 ± 2,174	0.053
AST > 1,000 U (%)	8/44 (18.2)	4 (80.0)	0.010*
Mean ALT (U)	311 ± 613 (44)	643 ± 630	0.259
ALT > 1,000 U (%)	3/44 (6.8)	2 (40.0)	0.075
Mean BUN (mg%)	13.6 ± 8.5 (31)	30.0 ± 12.0	0.001*
BUN > 20 (%)	6/30 (20.0)	3 (60.0)	0.095
Mean Creatinine (mg%)	0.56 ± 0.3 (31)	1.3 ± 0.5	<0.001*
Creatinine > 1.0 (%)	1/31 (3.3)	4 (80.0)	<0.001*
Acidosis (%)	4 (8.9)	3 (60.0)	0.006*
Mean Blood sugar	139 ± 84 (22)	158 ± 44 (3)	0.702
BS < 100 mg%	7 (31.8)	0	0.355

* calculate from 34 patients without significant bleeding
** Cannot calculate because all cases had significant bleeding

Table 6. Management at ER: Compare between Recovery and Death cases

	Recover (n = 45) (%)	Death (n = 5) (%)	p-value
Delayed IV fluid Resuscitation	8 (17.8)	0	0.401
Inappropriate rate of IV fluid resuscitation	8 (17.8)	1 (20.0)	0.401
Inappropriate type of IV fluid resuscitation	9 (20)	1 (20.0)	0.354
Cross matching	27 (40.7)	5 (100.0)	0.095
Mis-diagnosis	3 (6.7)	0	< 0.001

one as staphylococcal septic shock and 2 for hypovolemic shock from diarrhea. Intravenous fluid infusion was not started at the ER in 8 cases (17.8%) of the recovered group and they developed shock soon after admission. Inappropriate rate of intravenous fluid was found in 8 (17.8%); one was inadequate, another 7 were too much. Nine cases (20%) received inappropriate type of IV fluid; crystalloid instead of colloid solution for those patients who had signs and symptoms of fluid overload. Cross matching was done for 27 cases (40.7%) in the recovered group and for all death cases at the ER. One DSS case with a history of massive bleeding and needed blood transfusion but their cross matching was not done at the ER.

Discussion

DSS is the most common shock among children aged 5-14 years found in the ER of QSNICH, ranges from 50-57% of all cases who presented with shock. Initial correct diagnosis of DSS is the most important factor that helps in the proper amount of IV fluid resuscitation and management of the common complications associated with DSS[4-6]. These complications need to be corrected as soon as possible because without timely corrections, they may lead to death. In the present study one case was diagnosed as staphylococcal toxic shock syndrome that needed a larger amount of IV fluid resuscitation than DSS and that was the cause of fluid overload later. Another 2 cases were hypovolemic shock from diarrhea. After the blood pressure was restored, the IV fluid was changed to hypotonic solutions that are not appropriate to treat DSS and these also lead to fluid overload later. The clues for diagnosis of DSS are simple and can be obtained rapidly, *i.e.* high Hct and low platelet count, usually < 50,000 cells/mm^3 in cases with shock[3]. The difficulties for diagnosis is a DSS case with concealed bleeding that the Hct is not as high as expected and it is at normal value so inexperienced doctors do not think of DSS. In the present study, 11 patients (24.4%) of the walk in cases presented with normal or low Hct. All but one case had cross matching done at the ER. This patient had a baseline Hct of 40%, when she developed shock, usually with 30% hemo-concentration, her Hct should rise to more than 52%, but with concealed bleeding her Hct remained 40 and 42% at the time of shock. Her platelet count was 32,000 cell/mm^3. This case, if not receiving blood transfusion in time, will progress to have prolonged shock with more advance disseminated intravascular coagulation (DIC) and frank massive bleeding later that will end up with death. Platelet counts seem to be the most important clue for the diagnosis of DSS. Another important note is that 58% of all DSS patients had WBC > 5,000 cells/mm^3. This high WBC is the body response to the physiologic stress. Hence, leucopenia is not a good clue in helping the diagnosis of DSS.

The 7 common complications of DSS present at the ER in the present study are significant (frank or concealed) bleeding (42%), fluid overload (36%), liver failure (30%), prolonged shock (14%), hepatic encephalopathy (12%), renal failure (10%) and respiratory failure (8%). All these 7 complications are significantly found in those death cases so they may be considered as risk factors for DSS death. DSS patients who present with no or < 5 complications survived while patients who presented with > 5 complications died. Two patients with 5 complications died and another 2 survived; one with the longest LOS 27 days with peritoneal dialysis and one with 12 days in the ICU. Renal failure, especially oliguric renal failure is the late complication of DSS and seems to co-relate with high mortality rate. Those referred cases with signs of fluid overload and shock at the ER should receive colloidal solution (dextran) for initial fluid resuscitation instead of the routine crystalloid solution. Considering furosemide intravenously while loading with dextran may be life saving among these cases.

The ER physicians have to look for these common complications in DSS cases especially in the

referred cases. The following, besides complete blood count (CBC) are important investigations and management for DSS patients at the ER; cross matching, electrolyte including ionized calcium (iCa), blood gas (capillary or venous), liver function test, renal function test, Coagulogram (if available)[4-6]. Liver is noted to be the first organ injury (liver failure) found in DSS patients. Hypoglycemia was another common complication in DSS, but found only in 7 patients (14%). This high blood sugar among DSS patients may be due to the body response to stress or because most of the blood sugar was drawn after initial IV fluid resuscitation.

Another important point is that early detection of shock (pre-shock stage or compensated shock) or warning signs of shock should be thoroughly look for in patients with the diagnosis of DHF because in the present study 8 patients (33.3%) of the walk-in patients developed shock soon after admission without any IV fluid from the ER. These common signs are no clinical improvement when there is no fever, weakness, vomiting, abdominal pain, rapid pulse without fever, weak pulse[4,5].

For referred cases, correction of the existing complications or laboratory abnormalities until the patients' conditions are stabilized before transfer is mandatory for saving the patients' lives. Proper instruction of the personnel who accompany the patients about the management during transportation is very important because all the 5 death cases arriving the ER in shock conditions, 3 with additional respiratory failure and 1 with massive bleeding. Four of them had cardiac or respiratory arrested at the ER or soon after admission and 4 of them died within 28 hours. These 4 cases died rapidly because they were referred late. Early referring of the potential severe cases is recommended, especially those with high risk factors; obesity, infants, grade IV, encephalopathy, bleeding and cases with underlying diseases or conditions.

Conclusion

DSS is the most common shock among children age 5-14 years found in the ER of QSNICH, and ranges from 50-57% of all cases presenting with shock. Another 2 common causes of shock are septic shock (27.5%) and hypovolemic shock (11.9%) from diarrhea. ER physicians should be alert in making correct diagnosis of DSS with proper intravenous fluid resuscitation and correction of the common complications/laboratory abnormalities, *i.e.* acidosis, hyponatremia, hypocalcemia and cross-matching for cases with significant bleeding. Referred cases, especially those with liver failure together with renal and respiratory failure need special intensive care because they are likely to have poor prognosis and likely to die rapidly. Those referred cases should be stabilized before transfer with the proper instruction for the management during transfer. Cases with fluid overload and significant bleeding have a great chance of recovery with proper management. Early signs of shock should be detected in walk-in cases to prevent later shock after admission.

Potential conflicts of interest

None.

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ไข้เลือดออกช็อกในห้องฉุกเฉิน

ธัญญณัฐ บุนนาค, ศิริเพ็ญ กัลยาณรุจ

ภูมิหลัง: *ไข้เลือดออกเป็นโรคที่พบได้บ่อยในประเทศไทยประมาณปีละ 40,000-100,000 ราย ภาวะช็อกจากโรคไข้เลือดออกเป็นสาเหตุสำคัญและพบได้บ่อยในห้องฉุกเฉิน การวินิจฉัยไข้เลือดออกและภาวะช็อกได้อย่างแม่นยำและการดูแลรักษาภาวะช็อกในห้องฉุกเฉินอย่างเหมาะสมและรวดเร็วจะช่วยทำให้ผู้ป่วยกลุ่มนี้รอดชีวิตได้*

วัตถุประสงค์: *เพื่อหาอุบัติการณ์ของโรคไข้เลือดออกช็อกในห้องฉุกเฉิน และค้นหาปัจจัยทางคลินิกที่มีผลกระทบต่อผลการรักษาผู้ป่วย*

วัสดุและวิธีการ: *เป็นการศึกษาย้อนหลังในผู้ป่วยไข้เลือดออกช็อกในห้องฉุกเฉิน สถาบันสุขภาพเด็กแห่งชาติมหาราชินี กรุงเทพฯ ในช่วงเวลา 2 ปี ตั้งแต่ 1 มกราคม พ.ศ. 2551 ถึง 31 ธันวาคม พ.ศ. 2552 โดยศึกษาจากข้อมูลในเวชระเบียนผู้ป่วยในห้องฉุกเฉินและผู้ป่วยใน เปรียบเทียบอาการทางคลินิก, ผลตรวจทางห้องปฏิบัติการระหว่างกลุ่มผู้ป่วยที่รอดชีวิตและกลุ่มผู้ป่วยที่เสียชีวิต ทำการวิเคราะห์ข้อมูลทางสถิติโดยใช้ SPSS version 14.0*

ผลการศึกษา: *ในระยะเวลา 2 ปี มีผู้ป่วยช็อกในห้องฉุกเฉินจำนวน 109 ราย แบ่งเป็นไข้เลือดออกช็อก 59 ราย (54.1%), septic shock 30 ราย (27.5%) hypovolumic shock 13 ราย (11.9%), cardiogenic shock 1 ราย (0.9%) และช็อกจากสาเหตุอื่น 6 ราย (5.5%), โรคไข้เลือดออกช็อกพบได้ตลอดทั้งปี แต่พบมากที่สุดช่วงฤดูฝน ในเดือนมิถุนายน ถึง สิงหาคม ในจำนวนนี้ เป็นผู้ป่วยส่งต่อ ร้อยละ 44 และเสียชีวิต 5 ราย คิดเป็นร้อยละ 8.8 ผู้ป่วยที่เสียชีวิตมีภาวะ prolong shock, massive bleeding และ liver failure ทุกราย เมื่อเข้ามาในห้องฉุกเฉินเปรียบเทียบกับกลุ่มที่รอดชีวิตพบเพียงร้อยละ 4.4, 35.6 และ 22.2 ตามลำดับ พบภาวะ encephalopathy, renal failure และ respiratory failure, acidosis สูงกว่าในกลุ่มผู้ป่วยเสียชีวิต*

สรุป: *โรคไข้เลือดออกช็อกเป็นภาวะช็อกที่พบได้บ่อยที่สุดในห้องฉุกเฉิน โดยเฉพาะอย่างยิ่งช่วงฤดูฝน แพทย์ห้องฉุกเฉินต้องตระหนักในการวินิจฉัย ให้แม่นยำตั้งแต่ระยะแรก และให้สารน้ำที่เหมาะสมอย่างทันท่วงทีในห้องฉุกเฉิน รีบแก้ไขภาวะแทรกซ้อน เช่น acidosis, hyponatermia, hypocalcemia และรีบจองเลือดทันทีในห้องฉุกเฉินในกรณีผู้ป่วยมีเลือดออกชัดเจน กลุ่มผู้ป่วยส่งต่อที่มีภาวะตับวาย, ไตวาย และการหายใจล้มเหลวมักจะเสียชีวิต กลุ่มผู้ป่วยส่งต่อ ที่แม้จะได้รับสารน้ำเกินขนาดมาก่อนหรือมีภาวะเลือดออกชัดเจนก็อาจรอดชีวิตได้ถ้าได้รับการดูแลรักษาที่เหมาะสม ควรรีบวินิจฉัยภาวะช็อกให้ได้ตั้งแต่แรกในห้องฉุกเฉินโดยไม่ปล่อยให้ผู้ป่วยขึ้นไปเกิดภาวะช็อกในหอผู้ป่วย*