Pediatric Injuries in Emergency Room, Ramathibodi Hospital

ADISAK PLITPONKARNPIM, M.D., MPH.*,
SUWANNA RUANGKANCHANASETR, M.D., M.Sc.*,
SUDAPAN THANJIRA, B.Sc., MS.**

Abstract

The purposes of this study were to analyze the epidemiological data of child injuries from the computerized data system of the emergency room at Ramathibodi Hospital from June 1995 to May 1996 and assess the accuracy of triage system for child injury cases. Among 14,427 pediatric patients, 1,023 patients (7%) were injured. Most were under 5 years of age (48%), and most were male. Twenty-five per cent of cases were triaged as true emergency cases. Twelve per cent were disposed on an admission or referral by physicians. The negative predictive value of triage system to classify as a non-urgent was 91 per cent. Common causes of injury included falls (38%), inanimate force (19%), transportation (14%), and animal bite (12%). Older age group had significantly more severe injuries than younger ($p = 0.002$). However, only the transportation injuries were significantly more severe than other types ($p = 0.003$). The present ER-based injury surveillance system is useful to describe the basic epidemiology of pediatric injuries and to evaluate the triage system. However, for injury prevention purposes, the injury surveillance system should include more data of injury circumstances, associated environment and products.

Key word : Pediatric Injuries, Ramathibodi Hospital

Injuries are the leading cause of child deaths and permanent disabilities. During the period of 1985-1993, the percentage of total deaths due to injuries in Thai children under the age of 5 years increased from 12.7 per cent to 27.3 per cent among boys, and 10.9 per cent to 27.9 per cent among girls[1]. In 5-14 year-old children, the injury mortality rate increased by 37 per cent among boys and 44 per cent among girls[1]. In 1993, 1,295 of children under 5 and 2,508 of those 5-14 years of age died from injuries. Under this tip of an iceberg, it might be estimated that 200,000 hospitalizations

* Department of Pediatrics,
** Department of Nursing, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok 10400, Thailand.

and more than 3,000,000 emergency room (ER) visits are due to injuries annually[2,3].

Establishing the injury surveillance system, which will lead to understanding of an injury epidemiology is the priority for improving childhood safety[4]. Such a system should identify injuries in terms of incidence, mechanisms, product associated, risky environment, and risky behavior in order to establish injury-control interventions. Ribbeck's study[5] indicated that 78 per cent and William et al[6] found that 87 per cent of all medically attended injuries were treated in ER. Therefore, an injury surveillance system must be focused on ER patients. The computerized data system of the emergency room at Ramathibodi Hospital has been developed since 1994. It might be used as an injury surveillance system. The purpose of this study was to analyze the epidemiological data of child injuries from such data system and assess the accuracy of triage system for child injury cases.

MATERIAL AND METHOD

The ER patients of Ramathibodi Hospital who were younger than 15-year- old, during June 1995 to May 1996, were studied. Variables included demographics, age group, chief complaint, time of arrival, severity level, type of injuries, diagnosis, disposition and time of discharge.

Ten types of injuries were classified: transport, falls, foreign body, sport, burn, animal bite, near-drowning, poison, inanimate force (injuries caused by objects such as cutting, piercing), and animate force (injuries caused by human force such as striking).

Triage categories were defined as follows:

Level 1 (Crisis condition) : Children who had life-threatening conditions and must be seen immediately by a physician. Examples of these are shock, unconscious, dyspnea, etc.

Level 2 (Urgent condition) : Children who had major trauma but normal vital signs and needed care within 30 minutes in ER. Examples of these are fracture, multiple trauma, burn, bites, active bleeding wound, wound with severe pain, etc.

Level 3 (Acute condition but not emergency) : Children who could be provided care not only in ER but also in any out-patient clinic, but in that day. Admission is unlikely. Examples of these include acute minor trauma, anxious parents, non-active bleeding wound, foreign body in ear or nose without pain, etc.

Level 4 (Not acute condition) : Children who could be scheduled later date in any special clinics. Example of these are post traumatic deformity of finger, wound scar, etc.

The classification as true emergency cases by triage nurses (level 1-2) was compared with the severe cases categorized by the disposition done by physicians (admission or referral). Another assessment of triage accuracy was done by physician's evaluation of chart reviews compared with nurses' triage in five common chief complaints. The accuracy of nurses' triage was shown by sensitivity, specificity, positive and negative predictive value.

Chi-square testing was performed to assess the differences in severity of injuries between age groups.

RESULTS

Among 14,427 records of children in the emergency room of Ramathibodi Hospital during the one-year period of this study, 1,023 cases (7%) were due to injuries. The majority of them (58.7%) visited ER in the evening shift and 34.6 per cent in the morning shift. Only 6.6 per cent were seen during the night shift. Only 30 cases (2.9%) were transferred to ER by ambulances or some kind of community emergency services.

Regarding age groups, under-5-year (48%) had higher proportion of injury compared to the older age groups, while infants accounted for only 5.5 per cent. Males had higher incidence than females in any kinds of injury except near-drowning and poison which only a few cases were recorded in this study.

Among this group of childhood injuries, 0.9 per cent, 24.1 per cent, 73.9 per cent and 1.1 per cent were triaged as level 1 to 4, respectively. Only 12.3 per cent were admitted and 0.3 per cent were referred. The evaluative indices of triage were analyzed and demonstrated in Table 1. Sensitivity, specificity, positive and negative predictive values were 46 per cent, 78 per cent, 24 per cent and 91 per cent respectively. The second assessment had more accuracy with sensitivity of 85.6 per cent and specificity of 88.7 per cent (Table 2). There was no significant difference of triage among nurses with different seniority nor different shift, which reflects different workload ($\chi^2 = 0.64$, $p > 0.05$, and $\chi^2 = 9.3$, $p > 0.05$ respectively).

The four most common causes of injuries were falls, inanimate force, transportation, and ani-

Table 1. Evaluative indices of triage in prediction of admission.

		Physician's decision		
		Admission or referral	Discharge	
Triage level by nurses	Emergent (level 1-2)	60	195	255
	Non emergent (level 3-4)	69	698	767
Total		129	893	1022

sensitivity = 46%
specificity = 78%
positive predictive value = 24%
negative predictive value = 91%

Table 2. Relationship among nurses' triage and physicians' evaluation of 5 common symptoms.

Symptoms	Nurses' triage compared to physicians' evaluation			Total
	Milder (%)	Equivalent (%)	More severe (%)	
Abdominal pain	36 (10.6)	251 (73.8)	53 (15.6)	340
Headache	30 (18.4)	122 (74.8)	11 (6.7)	163
Fever	27 (18.2)	115 (77.7)	6 (4.1)	148
Chest pain	14 (24.6)	32 (56.1)	11 (19.8)	57
Dyspnea	19 (11.3)	131 (78.0)	18 (10.7)	168
Total	126 (14.4)	651 (74.3)	99 (11.3)	876

Accuracy = 74.3%
Milder : false negative = 14.4%; sensitivity = 85.6%
More severe : false positive = 11.3%; specificity = 88.7%

Table 3. Total number, sex ratio, triage and disposition of each type of injuries.

Type	% (N = 1023)	M : F (F = 1)	Emergency triage (%)	Admission or referral (%)
1. Transport	14.2	1.7	34.5	22.8
2. Falls	37.7	1.6	24.3	12.5
3. Foreign body	7.2	1.8	24.3	5.4
4. Sport	1.6	3.0	6.3	25.0
5. Burn	3.1	1.5	40.6	25.0
6. Animal bite	1.7	1.3	12.5	3.3
7. Near-drowning	0.3	0.5	100.0	100.0
8. Poison	0.9	0.8	33.3	66.7
9. Inanimate force	9.3	2.1	27.6	8.1
10. Animate force	4.0	2.9	9.8	7.3

mal bite (Table 3). The severe injuries classified by disposition outcome were near-drowning, poison, burn, sport and transportation. The incidences of transportation, sport, and animate injury were more common in older age groups while those of burn, falls, and foreign body were more common in younger age group. Animal bite was common in the group of 5-9 years (Fig. 1). Comparing the severity of injuries between age groups by disposition outcome, older age group was significantly more

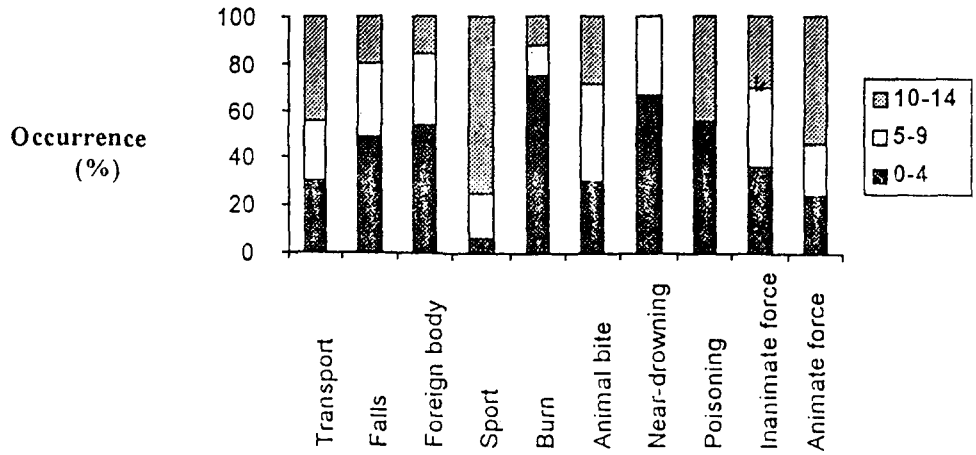

Fig. 1. Percentage of occurrence in diferent age groups in each type of injuries.

severe than youngers (χ^2 = 12.78, p = 0.002). However, only transportation injuries had significantly different higher rate than the others (χ^2 = 11.41, p = 0.0003).

DISCUSSION

This computerized data system of the emergency room function as a simple injury surveillance system and may be useful in basic epidemiology, mechanism of injuries and emergency management. However, the system is still required further validation.

This study shows that 7 per cent of emergency pediatric patients were injuried. Twenty-five per cent of them needed emergency care and 12 per cent needed admission. Only 1 per cent was on the life-threatening condition and needed the immediate resuscitation. In previous studies, Ruangkanchanasetr et al[7] reported 21.7 per cent of injury cases needed hospitalization in 1987, while Junnanond et al in 1989[2] found that 10 per cent of emergency pediatric patients were injured and 10 per cent of them needed admission. Tommukayakul found that 80 per cent of all cases were mild, 15 per cent were moderate, 3 per cent were severe and less than 1 per cent were fatal[8]. The mortality rate in the recent injury surveillance systems of 7 hospitals in Ministry of Public Health was 2.2 per cent [9].

Because of a high proportion of mild injury cases presented in ER, an effective triage for patients who enter the emergency room must be developed to screen patients who need emergency care in order that they will receive care in optimal time. However, a concern in triage system is the false negative classification which classifies urgent patients as non-urgent. In this study, a negative predictive value was 91 per cent. However, such comparison is not the direct validate assessment of triage, because some elective non-emergent cases were appointed to be seen for admission at ER. So the direct assessment by physicians' blind reviewing the medical records and comparing with nurses' triage was studied. It revealed higher sensitivity and specificity. This means that the triage in this ER is in acceptable range.

The peak time of injuries tends to be the evening when the children are in their homes. Nearly half of children under 5 years (48%) had higher incidence of home injury than the other age groups especially in burns, near-drowning, poison, falls and foreign body. Compared to Ruangkanchanasetr's study[7], traffic (27%) and falls (18%) were the first two common causes of injuries. Awareness in furniture design, construction, environment around the home and home products in the context of the stages of children's psychological and motor development could prevent these injuries. However, we cannot identify such risk factors from the available database. Whereas, Ruangkanchanasetr's case control study[7] reported the demographic risk factors and odds ratio in the parentheses as followed: boy (1.8), age older than 6 years (2.4), large family size (1.7-3.3), more care-providers at a time (6.2), parental education lower than primary school

level (female 2.1, male 1.8), and low family income (2.4).

In developed countries, ER-based injury surveillance systems were progressively developed as a basic tool for injury prevention programs including NOMESCO system of Nordic countries[10], European Home and Leisure Accident and Surveillance System (EHLASS) of European countries[11], and NEISS system in the United States[12]. By the effective continuous injury surveillance, the problems and risk factors were identified and the optimal prevention programs were implemented. Our present ER-based injury surveillance system is useful to describe the basic epidemiology of pediatric injuries and to evaluate the accuracy of triage system. However, for injury prevention purposes such system should include more data of the injury circumstances, associated environment and products.

While injuries have emerged as the common problem of children, public awareness has slowly grown. To improve child health status, injury care and prevention play a major role. An injury surveillance system and its feasibility in routine practice must be developed for pediatricians and emergency physicians to identify injury risks, in order to provide parents or guardians and children with information necessary to prevent injuries and serve as a community resource for information concerning child injuries.

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REFERENCES

1. Plitponkarnpim A. Childhood injuries in the advanced stage of epidemiologic transition: Thailand as a case study [thesis]. Stockholm: Karolinska Institute, 1998.
2. Junnanond C, Ruangkanchanasetr S, Chunharas A. Childhood trauma, country report (Thailand). J Med Assoc Thai 1993; 76:209-13.
3. Gallagher SS, Finison K, Guyer B, Goodenough S. The incidence of injuries among 87,000 Massachusetts children and adolescents: results of the 1980-81 Statewide Childhood Injury Prevention Program Surveillance System. Am J Pub Hlth 1984; 74:1340-7.
4. Berger LR, Mohan D. Injury control: a global review. Delhi: Oxford University Press, 1996.
5. Ribbeck BM, Runge JW, Thompson MH. Injury surveillance: a method for recording E-codes for injured emergency department patients. Ann Emerg Med 1992; 21:37-40.
6. Williams JM, Furbee PM, Presscott JE, Paulson DJ. The emergency department log as a simple injury-surveillance tool. Ann Emerg Med 1995; 25:686-91.
7. Ruangkanchanasetr S, Sriwatanakul K, Luptawan S, Prapat-tong S. Epidemiology and risk factors of injury in Thai children. Southeast Asian J Trop Med Pub Hlth 1991; 22:127-32.
8. Tonmukayakul A. Accidents in primary school age children. Siriraj Hosp Gaz 1984; 36:67-75.
9. Injury surveillance report, Thailand 1996. Epidemiology Division, Ministry of Public Health, January 1996. (Personal contact)
10. Nordic Medico Statistical Committee. Classification for accident monitoring. 2nd revised ed. Copenhagen: Nordic Medico Statistical Committee, 1990.
11. National Board of Health and Welfare. European Home and Leisure Accident Surveillance System, Annual Report-Sweden 1995. Stockholm: National Board of Health and Welfare, 1996.
12. United States Consumer Product Safety Commission. Annual Report to Congress U.S.A. 1996.

การบาดเจ็บในเด็กในห้องฉุกเฉินโรงพยาบาลรามาธิบดี

อดิศักดิ์ ผลิตผลการพิมพ์, พ.บ., M.P.H.,*
สุวรรณา เรืองกาญจนเศรษฐ์, พ.บ., M.Sc., สุดาพรรณ ธัญจิรา, วท.บ., M.S.***

ผู้วิจัยได้ทำการศึกษาระบาดวิทยาของการบาดเจ็บในเด็ก และประเมินความแม่นยำของระบบการคัดกรองในห้องฉุกเฉินจากระบบข้อมูลของห้องฉุกเฉินในโรงพยาบาลรามาธิบดี ซึ่งจัดเก็บโดยการบันทึกในคอมพิวเตอร์แทนการใช้สมุดบันทึกตามแบบนิยมเดิม ผลการศึกษาพบว่าในระหว่างช่วงเวลา 1 ปีของการศึกษา (เดือนมิถุนายน 2538 – พฤษภาคม 2539) มีผู้ป่วยเด็กในฐานข้อมูลของห้องฉุกเฉิน 14,427 ราย ในจำนวนนี้ 1,023 ราย (ร้อยละ 7) มาด้วยกลุ่มอาการการบาดเจ็บ ผู้ป่วยที่ได้รับบาดเจ็บส่วนใหญ่เป็นเด็กอายุน้อยกว่า 5 ปี (ร้อยละ 48) พบเพศชายมากกว่าเพศหญิง ร้อยละ 25 ได้รับการคัดกรองให้เป็นกลุ่มผู้ป่วยฉุกเฉินจริงโดยพยาบาล ร้อยละ 12 ที่แพทย์ต้องรับเป็นผู้ป่วยในหรือส่งต่อ ค่า negative predictive value ของการคัดกรองเท่ากับร้อยละ 91 สาเหตุของการบาดเจ็บที่พบบ่อยคือการพลัดตกหกล้ม (ร้อยละ 38) การบาดเจ็บในกลุ่มเด็กโตมีความรุนแรงมากกว่ากลุ่มเด็กเล็กอย่างมีนัยสำคัญ ($p = 0.002$) เมื่อแยกวิเคราะห์ตามชนิดของการบาดเจ็บ พบการบาดเจ็บจากอุบัติเหตุจากยานพาหนะบนถนนมีความรุนแรงมากกว่าชนิดอื่น ($p = 0.003$) ระบบฐานข้อมูลของห้องฉุกเฉินนี้สามารถใช้เป็นระบบข้อมูลของการเฝ้าระวังการบาดเจ็บในเด็ก มีประโยชน์ในการอธิบายระบาดวิทยาของการบาดเจ็บในเด็กและประเมินระบบการคัดกรองผู้ป่วย แต่ยังไม่เพียงพอต่อการนำมาใช้เพื่อประโยชน์ในการป้องกันการบาดเจ็บ ตัวแปรที่สำคัญที่ควรบันทึกเพิ่มเติม ได้แก่ ภาวะแวดล้อมในการเกิดอุบัติเหตุ และผลิตภัณฑ์ที่เกี่ยวข้อง

คำสำคัญ : การบาดเจ็บในเด็ก, โรงพยาบาลรามาธิบดี

* ภาควิชากุมารเวชศาสตร์,
** ภาควิชาพยาบาลศาสตร์, คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี, มหาวิทยาลัยมหิดล, กรุงเทพฯ 10400