Trauma Care Audit Using Srinagarind Hospital's Audit Filter

Polpun Boonmak MD*,
Chaiyut Thanapaisal MD**, Panor Techa-atik BSc (Nursing), MSN ***,
Kanya Wangsri BSc (Nursing), MA (library and information science)****,
Suntaraporn Wunsupong BSc (Nursing)***

** Department of Anesthesiology, Faculty of Medicine, Khon Kaen University, Khon Kaen*
*** Department of Surgery, Faculty of Medicine, Khon Kaen University, Khon Kaen*
**** Accident and Emergency Out-patient Ward, Srinagarind Hospital, Faculty of Medicine, Khon Kaen University, Khon Kaen*
***** Emergency Medical Service, Srinagarind Hospital, Faculty of Medicine, Khon Kaen University, Khon Kaen*

Background: *To audit trauma care (including the mortality rate and obstacles faced by the authors) at Srinagarind (University) Hospital using the trauma audit filter.*
Material and Method: *Conduct a prospective, descriptive, study of trauma patients who received trauma medical care at Srinagarind Hospital, Khon Kaen University, Thailand, between January and May 2006. Srinagarind Hospital's trauma audit filter was used to audit trauma care. The audit filter comprised 14 criteria (i.e., 1) emergency medical service; 2) accident and emergency out-patient service; 3) in-patient service). Any filter that generated a "Yes" response was investigated to find the reason(s). The obstacles and mortality were also recorded.*
Results: *The authors enrolled 3209 patients. The mortality rate was 0.5% (95% CI 0.3-0.8). Emergency medical service, accident and emergency out- and in-patient service were rated satisfactorily. The reported obstacles were lack of hospital beds, inappropriate locale for trauma care, financial process, admission process, and lack of equipment.*
Conclusions: *Srinagarind Hospital's audit filter had the capability to audit trauma care. Overall trauma care at Srinagarind Hospital was satisfactory albeit improvements are needed.*

Keywords: *Injuries, Trauma centers, Medical audit, Trauma audit filter*

J Med Assoc Thai 2008; 91 (11): 1714-8
Full text. e-Journal: *http://www.medassocthai.org/journal*

Trauma is the most important cause of death in Thailand. There are many strategies to reduce the death rate from this cause and prevention is invaluable (*i.e.*, by encouraging use of crash helmets by motorcyclists[1], mass media campaigns to reduce drinking and driving[2], and traffic law enforcement[3]); notwithstanding, appropriate medical service for trauma patients is also necessary.

Many hospitals have established a trauma center with a trauma care team, medical equipment, and a transfer & referral system to improve the trauma care system[4,5]. A key part of the trauma system is the trauma registry, which assesses quality assurance and performance improvement in each institution. The authors also created a trauma registry; however, it presents final outcomes. Moreover, errors in the trauma registry database can indicate invalid frequencies, rates, time estimates, and statistical measures[6].

The trauma audit filter is also a tool to evaluate the effectiveness of trauma care for each management process[7] and each hospital usually has its own trauma audit filter to monitor and attend to problems. The filters used will change according to the hospital administration's need to evaluate the various elements of the trauma program; that is, system problems and

Correspondence to: Boonmak P, Department of Anesthesiology, Faculty of Medicine, Khon Kaen University, Khon Kaen 40002, Thailand. Phone & Fax: 043-348-390

weaknesses are explored to identify the occurrence of significant events. In this vein, the authors wanted to evaluate Srinagarind Hospital's Trauma Audit Filter to evaluate trauma care (including the obstacles and the mortality rate) in our university hospital.

Material and Method

After receiving approval from our institution's research ethics board, the authors conducted a prospective, descriptive study (between January and May 2006) of Srinagarind Hospital's Trauma Audit Filter. The authors' aim was to assess trauma care provided through the in- and out-patient services and emergency medical service (EMS).

Srinagarind Hospital's Trauma Audit Filter was constructed by the Hospital's Trauma Committee using reviewed literature and committee consensus. The committee comprised general surgeons, neurosurgeons, orthopedic surgeons, anesthesiologists, forensic physicians, EMS staff, Accident and Emergency Out-patient Ward nurses, critical care nurses, and trauma ward nurses.

The audit filter has 14 items (Table 1) and each item aims to evaluate the efficacy of each part of trauma care given at the Hospital (i.e., 1) EMS; 2) accident and emergency out-patient service; and, 3) in-patient service). Each item might: (1) be missed by the trauma registry; (2) result in a major complication; or, (3) be appropriate to our hospital situation. For any items that generated a "Yes" response, the data were explored for an explanation. Data sources assessed included: 1) EMS records; 2) out-patient records; 3) in-patient records; 4) investigation notes, and 5) operation notes. The authors recorded patient characteristics (sex, age), time of service, transferal process, Abbreviated Injury Scale (AIS), and obstacles experienced by the trauma team.

Data analysis was performed using STATA for Windows version 8.0 (Stata Corporation, TX, USA). The mortality rate and each item occurrence were reported as percentage and 95% CI. The mean and SD, median and interquartile range were used as appropriate. The sample size required was based on: 1) a mortality rate of 0.02 [7]; 2) a Type I error of 0.05; 3) an absolute precision of 0.005; and, 4) an 80% power.

Results

The authors enrolled 3209 patients. The percentage occurrence of each item is presented in Table 1. Patient-characteristics are presented in Table 2.

1. The overall 'mortality rate' was 0.5% (95% CI 0.3-0.8, 15/3209); however, the 'death on arrival rate' was 0.4% (95% CI 0.2-0.7, 12/3209).

2. EMS service without complete records was 5.3% because of: 1) incomplete vital sign information, coma score or type of wound; or, 2) inappropriate airway management.

3. The arrival of the ambulance at the scene taking over 20 minutes was 3.8% (mean (SD) 9.9 (5.3)

Table 1. Trauma audit filter

Trauma audit filter (number of patients who enrolled to used filter)		% (95% CI)
1	Mortality rate (3209)	0.5 (95% CI 0.3-0.8)
2	EMS service without complete EMS records (152)	5.3 (95% CI 2.3-10.1)
3	Time for ambulance to arrive at the scene took > 20 min (79)	3.8 (95% CI 0.8-10.7)
4	Time to get a CT brain for in-patients with a GCS < 13 over 1 hr (25)	12.0 (95% CI 2.5- 31.2)
5	Time to receive endotracheal intubation or surgical airway for in-patients with a GCS < 8 over 5 min (39)	2.6 (95% CI 0.1-13.5)
6	Vital signs and patient data records inappropriate (3209)	0.9 (95% CI 0.6-1.2)
7	Duration in the resuscitation room or out-patient services > 3 h (3209)	6.0 (95% CI 5.2-6.9)
8	Time to operation for in-patients with sub- or epidural hematoma > 2 hrs (32)	6.3 (95% CI 0.8-20.8)
9	Time to operation for in-patients with abdominal injury > 2 hrs (18)	33.3 (95% CI 4.2-77.7)
10	Time to operation for in-patients with abdominal, thoracic, vascular, brain trauma > 24 hrs after arrival (54)	0.0 (95% CI 0-46.0)
11	Time before receiving treatment for an in-patient with an open fracture of the tibia (except low velocity GSW) > 8 hrs (8)	20.0 (95% CI 0.5-71.6)
12	Diaphyseal of femur fracture not receiving fixation (2)	0.0 (95% CI 0-84.2)
13	Unplanned re-surgery within 48 hrs of previous operation (78)	0.0 (95% CI 0-1.7)
14	Re-intubation within 48 hrs of extubation (62)	6.4 (95% CI 1.8-15.7)

Table 2. Patient characteristics

Patient characteristics	Total (n = 3209)
Out-patients/in-patients (n (%))	2745 (80.5)/464 (19.5)
Male/Female (n (%))	1972 (61.5)/1237 (38.5)
Age (yr) (mean ± SD)	28.8 ± 17.5
Time of service (out-patients/in-patients) (n (%))	
08.31-16.30	1025 (31.9)/137 (4.3)
16.31-00.30	1346 (41.9)/251 (7.8)
00.31-08.30	374 (11.7)/76 (2.4)
Transferal process (n (%))	
Themselves	2837 (88.4)
Emergency medical service	272 (8.5)
Hospital referrer	100 (3.1)
Abbreviated injury scale (AIS) score (median, range)	
Out-patients/in-patients (median, range)	1 (1-6)/2 (1-6)
AIS > 3	156 (4.9%, 95% CI 4.1-5.7)

minutes) and the causes were: 1) distant parking; 2) difficulty removing accident from vehicles; and, 3) delayed decision to go to hospital.

4. Time to get a brain computerized tomography (CT) for in-patients with a Glasgow Coma Score (GCS) < 13 taking over one hour was 12.0% (median (interquartile) 47 (30-59) minutes) because of: 1) instability of vital signs; 2) communication and transfer problems; or, 3) the need for a repeated CT scan.

5. Time to receive endotracheal intubation or surgical airway for an in-patient with a GCS < 8 taking over five minutes was 2.6% because: 1) the patient with a coma score d"8 at CT brain room needed to return to the Resuscitation Room.

6. Inappropriate records of vital signs and patient data occurred at 0.9% because of: 1) neglecting to follow protocol; 2) it was during a transfer period; or, 3) could not measure in a child.

7. Time in the Resuscitation Room or out-patient services was more than three hours occurred 6.0% because of: 1) the duration of the consultation; 2) too many patients; 3) admission process; or, 4) financial process. Notwithstanding, the duration time for half of the patients was within one hour. The duration time was less than 1, 1 to 2, and 2 to 3 hrs was 53.3, 30.0, and 10.8%, respectively.

8. Time to operation for in-patients with a subdural or epidural hematoma taking more than 2 hrs was 6.3% because of: 1) unavailable operating room; 2) delayed patient preparation process (i.e., investigations underway cross match).

9. Time to operation for in-patients with an abdominal injury taking more than two hours was 33.3% because of: 1) delayed investigative process; or, 2) unavailable operation room.

10. Time to receive treatment for in-patients with an open fracture of the tibia (except low velocity gunshot wound) taking over eight hours was 20% because of: 1) long distance transfer; or, 2) unavailable operating room.

11. Time to operation for in-patients with abdominal, thoracic, vascular, brain trauma taking more than 24 hrs after arrival was 0%.

12. Diaphyseal of femur fracture not receiving fixation was 0%.

13. Unplanned re-operation within 48 hrs of previous operation was 0%.

14. Re-intubation occurring within 48 hrs of extubation was 6.4% because of a worsening patient condition from pneumonia.

Process obstacles included: 1) insufficient hospital beds; 2) personnel (inexperience, delayed consultation, long waiting time, unavailable personnel, utility management, no practice guidelines, or miscommunication); 3) investigation (communication problem, long wait for service, long wait for investigative results, unavailable service, or unavailable equipment); 4) infrastructure (narrow space, no trauma resuscitation room, or long distance to CT room); 5) financial and admission process (delayed admission, delayed financial process, financial problems, or incomplete or lost data); and, 6) equipment (insufficient equipment, no monitoring during transfer, or communication equipment failure).

Discussion

The Srinagarind Hospital Trauma Audit Filter was designed as a quick and easy to use tool to evaluate trauma service in our tertiary care facility. The authors planned to use the audit filter to evaluate each aspect of trauma care including EMS, out- and in-patient services. Two items were used to audit EMS service, five for advanced traumatic life support and out-patient service, and six for in-patient services. The mortality rate was used as an overall evaluation of service.

Trauma care was explored and the authors found a problem with some aspect of the trauma care process. The presented data indicated a satisfactory EMS service. "Scoop and run" was always a first consideration among personnel and had an acceptable time to scene. Most of the unacceptable wait times were unavoidable. The minor errors were due to inappropriate management and record keeping.

Similarly, the primary trauma care was at an acceptable standard, and errors can be corrected by better communication and administration. By comparison, in a previous study[8,9], lack of airway control or failure to secure the airway, mismanagement or missed injuries, and delayed operative control of hemorrhage were the most important problems. These types of mistakes did not occur at the authors' hospital.

In Srinagarind Hospital, several Advanced Trauma Life Support (ATLS®) trained doctors and nurses managed trauma cases. ATLS providers in the trauma team might be one of the reasons for the authors' satisfactory outcome. A previous study[10] showed that the ATLS program improved trauma patient outcomes in the first hour after admission. An increased presence of consultants in accident and emergency wards has reduced mortality of seriously injured patients[11,12].

In-patient service includes primary and secondary trauma care and this was satisfactory. The one delayed case of endotracheal intubation was due to a GCS drop in the CT scan room.Therefore, available airway management in the CT scan room should be established. The occurrence of "time to CT brain for in-patients with a GCS < 13 over an hour" was too high and the authors have recommended improvements to the transferal and CT brain scan decision system. Times to operation (intracranial hematoma, abdomen, thoracic, vascular) were satisfactory; however, strategies to reduce the time, apart from more rooms and staff, would be faster investigations and blood component matching. Re-intubation was the indicator of good postoperative care and that was within the accepted range. The authors' mortality rate was comparable with other reviews[9].

The lack of hospital beds was the cause of delayed treatment in some patients necessitating transfer to other hospitals. The authors found several areas where trauma care could be improved: 1) provide inservice training for inexperienced personnel to upgrade their trauma care knowledge; 2) fast-tracking of urgent investigations would improve the overall trauma care process; and, 3) a larger area with separate zones for trauma care would improve trauma care focus and patient satisfaction.

Conclusion

Srinagarind Hospital's audit filter has sufficient sensitivity to audit cum evaluate trauma care at the hospital, which was found to be satisfactory with opportunities for improvement.

Acknowledgments

The authors wish to thank Dr. Vajvrabhongha Bhudhisawasdi and Srinagarind Hospital's Trauma Team for consultative assistance and Mr. Bryan Roderick Hamman for assistance with the English-language presentation of the manuscript.

References

1. Liu B, Ivers R, Norton R, Blows S, Lo SK. Helmets for preventing injury in motorcycle riders. Cochrane Database Syst Rev 2004; 2: CD004333.
2. Elder RW, Shults RA, Sleet DA, Nichols JL, Thompson RS, Rajab W. Effectiveness of mass media campaigns for reducing drinking and driving and alcohol-involved crashes: a systematic review. Am J Prev Med 2004; 27: 57-65.
3. Davis JW, Bennink LD, Pepper DR, Parks SN, Lemaster DM, Townsend RN. Aggressive traffic enforcement: a simple and effective injury prevention program. J Trauma 2006; 60: 972-6.
4. Celso B, Tepas J, Langland-Orban B, Pracht E, Papa L, Lottenberg L, et al. A systematic review and meta-analysis comparing outcome of severely injured patients treated in trauma centers following the establishment of trauma systems. J Trauma 2006; 60: 371-8.
5. Durham R, Pracht E, Orban B, Lottenburg L, Tepas J, Flint L. Evaluation of a mature trauma system. Ann Surg 2006; 243: 775-83.
6. Hlaing T, Hollister L, Aaland M. Trauma registry data validation: Essential for quality trauma care. J

Trauma 2006; 61: 1400-7.
7. Chadbunchachai W, Sriwiwat S, Kulleab S, Saranrittichai S, Chumsri J, Jaikwang P. The comparative study for quality of trauma treatment before and after the revision of trauma audit filter, Khon Kaen hospital 1998. J Med Assoc Thai 2001; 84: 782-90.
8. Chiara O, Scott JD, Cimbanassi S, Marini A, Zoia R, Rodriguez A, et al. Trauma deaths in an Italian urban area: an audit of pre-hospital and in-hospital trauma care. Injury 2002; 33: 553-62.
9. Gruen RL, Jurkovich GJ, McIntyre LK, Foy HM, Maier RV. Patterns of errors contributing to trauma mortality: lessons learned from 2,594 deaths. Ann Surg 2006; 244: 371-80.
10. van Olden GD, Meeuwis JD, Bolhuis HW, Boxma H, Goris RJ. Clinical impact of advanced trauma life support. Am J Emerg Med 2004; 22: 522-5.
11. Shakiba H, Dinesh S, Anne MK. Advanced trauma life support training for hospital staff. Cochrane Database Syst Rev 2004; 3: CD004173.
12. Beard D, Henry JM, Grant PT. National audit of the management of injured patients in 20 Scottish hospitals. Health Bull (Edinb) 2000; 58: 118-26.

การใช้ Srinagarind Hospital's audit filter ในการตรวจสอบระบบการดูแลผู้ป่วยที่บาดเจ็บ

พลพันธ์ บุญมาก, ไชยยุทธ ธนไพศาล, พนอ เตชะอธิก, กัญญา วังศรี, สุนทราพร วันสุพงศ์

วัตถุประสงค์: *ศึกษาการตรวจสอบระบบการดูแลผู้ป่วยที่บาดเจ็บ ปัญหาอุปสรรค รวมทั้งอัตราการเสียชีวิตโดยใช้ Srinagarind Hospital's audit filter*

วัสดุและวิธีการ: *ศึกษาผู้ป่วยที่บาดเจ็บซึ่งมารักษาที่โรงพยาบาลศรีนครินทร์ คณะแพทยศาสตร์ มหาวิทยาลัยขอนแก่น แบบไปข้างหน้า ในช่วงเดือนมกราคม ถึง พฤษภาคม พ.ศ. 2549 โดยใช้ Srinagarind Hospital's audit filter ในการตรวจสอบการดูแลผู้ป่วย ทั้งในส่วนของหน่วยบริการการแพทย์ฉุกเฉิน ผู้ป่วยนอกและผู้ป่วยใน รวมทั้งบันทึกปัญหาอุปสรรคที่เกิดขึ้น และอัตราการเสียชีวิตของผู้ป่วย*

ผลการศึกษา: *ศึกษาผู้ป่วย 3,209 ราย พบว่าการบริการของหน่วยบริการการแพทย์ฉุกเฉิน ผู้ป่วยนอกและผู้ป่วยในเป็นที่น่าพอใจ โดยมีอัตราเสียชีวิตร้อยละ 0.5 (95% CI 0.3-0.8) และอุปสรรคที่พบคือ เตียงของโรงพยาบาลไม่เพียงพอ สถานที่ดูแลผู้ป่วยไม่พร้อม สิทธิการรักษา ระบบการรับรักษา รวมทั้งการขาดแคลนอุปกรณ์*

สรุป: *Srinagarind Hospital's audit filter สามารถใช้ในการตรวจสอบระบบดูแลผู้ป่วยที่บาดเจ็บได้ดี ซึ่งผลโดยรวมของการดูแลผู้ป่วยที่บาดเจ็บของโรงพยาบาลศรีนครินทร์เป็นที่น่าพอใจ แต่อย่างไรก็ต้องมีการพัฒนาต่อไป*