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Peer Review Audit of Trauma Deaths in a Developing Country

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OBJECTIVES: Peer review of trauma deaths can be used to evaluate the efficacy of trauma systems. The objective of this study was to estimate the proportion of preventable trauma deaths and the factors contributing to poor outcome using peer review in a tertiary care hospital in a developing country.

METHODS: All trauma deaths during a 2-year period (1 January 1998 to 30 December 1999) were identified and registered in a computerized trauma registry, and the probability of survival was calculated for all patients. Summary data, including registry information and details of prehospital, emergency room, and definitive care, were provided to all members of the peer review committee 1 week before the committee meeting. The committee then reviewed all cases and classified each death as preventable, potentially preventable, or non-preventable.

RESULTS AND CONCLUSIONS: A total of 279 patients were registered in the trauma registry during the study period, including 18 trauma deaths. Peer review judged that six were preventable, seven were potentially preventable, and four were non-preventable. One patient was excluded because the record was not available for review. The proportion of preventable and potentially preventable deaths was significantly higher in our study than from developed countries. Of the multiple contributing factors identified, the most important were inadequate prehospital care, inappropriate interhospital transfer, limited hospital resources, and an absence of integrated and organized trauma care. This study summarizes the challenges faced in trauma care in a developing country. [*Asian J Surg* 2004;27(1):58–64]

Introduction

Trauma is a leading cause of morbidity and mortality in the under 45s, and the third highest cause of death in the developed world where there are established trauma care systems.[1] The situation in developing countries is alarming due to lack of resources, organization and integration in trauma care. In India, for example, approximately 3.2 million people are injured in road traffic accidents every year. Of these, about 48,000 die.[2] According to the World Health Organization, by the year 2020, trauma will be the leading cause of years of life lost in both developed and developing countries.[3]

The concept of preventable deaths is well recognized in trauma management. The estimated incidence of preventable deaths is of the order of 2% to 9% in developed countries where there are well-organized prehospital and hospital phases of trauma care.[4] The purpose of auditing trauma care is to further reduce preventable morbidity and mortality associated with trauma.[4] The audit of death following injury is an objective measure to evaluate the efficacy of trauma systems.[5] Trauma audit can identify deficiencies in care, and facilitates improvement of the trauma care system.[6]

Traditionally, two methods of audit, Trauma and Injury Severity Scoring (TRISS)[5] and peer review of trauma deaths,

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have been used to evaluate outcomes. TRISS has been extensively studied and validated in the Western world, but its applicability in developing countries has been questioned.[5,7] A recent study from our department also suggested that injury severity instruments using major trauma outcome study coefficients do not accurately correlate with the observed survival rates in developing countries.[8]

Peer review studies have an established history in trauma and surgical audit and have been used extensively to evaluate outcomes of trauma care and performance of trauma systems.[9] The peer review process identifies deficiencies in patient care; if these deficiencies are corrected, future deaths can be avoided. Peer review studies are also used to monitor quality of trauma care (percentage of preventable deaths in a system).

The Aga Khan University Hospital (AKUH) is a private tertiary care university hospital with 630 beds in Karachi, Pakistan. Two to three major traumas (patients with life-threatening injuries and multiple site injuries) and eight to ten minor traumas (patients with isolated extremity trauma or non-life-threatening injuries) are seen in the emergency room in a typical week at AKUH.[10]

The objectives of this study were to estimate the proportion of preventable trauma deaths at AKUH, and to identify the factors inside and outside the hospital that contribute to poor outcome.

Patients and methods

The trauma peer review committee at AKUH is multidisciplinary in composition, with two general surgeons (AJR, HZ), a neurosurgeon (SB), an orthopaedic surgeon (RHL), an anaesthetist (QH), and an emergency physician (RR), assisted by a surgical research officer (AAJ) acting as committee secretary.

All trauma deaths during the 2 years from 1 January 1998 to 30 December 1999 were reviewed. All patients above the age of 15 who presented alive to the emergency room were registered in a computerized trauma registry. Patients were assigned scores according to the abbreviated injury scale (AIS-90),[11,12] which is an anatomical score of injury severity in an organ. The three highest AIS scores from different body regions were used to calculate the Injury Severity Score (ISS).[13,14] The Revised Trauma Score (RTS; physiological score)[15,16] at admission to the trauma resuscitation area was determined from the trauma nursing flow chart. ISS, patient age, RTS, and nature of the trauma (blunt or penetrating) were used by the trauma registry software to calculate the probability of survival (Ps).[17]

Each patient's narrative summary was prepared in a standard format that included three components. First, prehospital data including the time of injury, mechanism of injury, mode of transport, and primary hospital resuscitation, in case of trauma transfers. Second, emergency room data including haemodynamic parameters, information on resuscitation, and diagnostic workup in the emergency room; time to definite treatment was calculated in all patients as the sum of the time from injury to presentation at the emergency room of AKUH and emergency room stay. And finally, definitive treatment data including details of surgical intervention, diagnostic procedures, and intensive care unit stay until death. A "timeline" for this phase of care was also developed.

This standard narrative summary was circulated to the members of the peer review committee 1 week prior to the meeting. Committee members were also given guidelines for the classification of deaths (Table 1). Each member was requested to review all the cases and classify each case into one of three categories (preventable, potentially preventable, non-preventable), based on his clinical experience and objective data. At the peer review committee meeting, each member of the committee gave a preliminary judgement regarding the classification of the death. This was then followed by a discussion evaluating the process of care and each member's point of view on the case. Following the discussion, a final consensus regarding the classification of death was reached and potential deficiencies in care were determined.

Deficiencies in trauma care were classified as due to system-related or provider-related factors. The term "system" in our study involves the whole series of events starting from the site of the incident until the point of definitive care. In Pakistan, prehospital care is in its infancy. An injured patient is transported to the nearest hospital in public or personal transport, without consideration of the available facilities and equipment. No ground or air transportation system is available. After initial care, which is mostly inadequate and inappropriate, the patient is transferred to a major hospital without any prior notification or documentation, and again without consideration of the available resources.[10] This results in prolonged delays in definitive patient management. The term "provider" relates to the trauma team providing definitive care. The concept and the role of the trauma team is also not well defined in developing countries.

Results

A total of 279 patients presenting between 1 January 1998 and 30 December 1999 were registered in the trauma registry. There were 18 trauma deaths during this period. Seventeen

Table 1. Guidelines for peer review committee[5]

Category	Guidelines
Non-preventable	- Injuries and sequelae non-survivable with optimal management - Evaluation and management appropriate according to ATLS guidelines - Suspect care does not affect classification of death but is treated as morbidity
Potentially preventable	- Injuries or sequelae severe but survivable - Evaluation and management generally appropriate - Error(s) in care directly or indirectly implicated in patient's death
Preventable	- Injuries or sequelae considered survivable - Evaluation and management suspect - Error(s) directly or indirectly caused patient's death

ATLS = Advanced Trauma Life Support.

cases were included in the review process. One patient was excluded because the record was not available for review.

The median ISS of dead patients was 25 (range, 9–75), compared to a median ISS of 9 (range, 1–41) for patients who were discharged alive from the hospital. The mean age of patients was 40 years. There were three females and 14 males.

Twelve patients (70.6%) presented with blunt and five (29.4%) with penetrating injuries. The cause of injury was road traffic accident in nine patients (52.9%), falls in three (17.6%), and gunshot wound in five (29.4%).

The head or neck was the principal injury site in 13 cases (76.5%), the abdomen or pelvis in three (17.6%), and the chest in one (5.9%). The probable cause of death and Ps for each patient are shown in Table 2. The AIS, ISS, RTS, and Glasgow Coma Score of each principal body region are shown in Table 3.

Time to definitive care could be calculated for 16 patients. The mean ± standard deviation (SD) was 414 ± 405 minutes (range, 145–1,740 minutes). The time from injury to arrival in the emergency room at AKUH was calculated for 16 patients (mean ± SD, 270 ± 360 minutes; range, 10–1,440 minutes). It was not calculable for one patient because the time of injury was not documented. Emergency room stay was calculated in 17 patients (mean ± SD, 175 ± 105 minutes; range, 40–360 minutes).

Table 2. Probable causes of death and probability of survival (Ps) (*n* = 17)

Patient	Cause of death	Ps
1	Penetrating abdominal trauma/exsanguination	0.90
2	Blunt polytrauma/exsanguination	0.88
3	Severe head injury (bilateral contusions and subarachnoid haemorrhage)	0.96
4	Head injury (depressed skull fracture) and disseminated intravascular coagulation	0.97
5	Severe head injury	0.30
6	Severe head injury	0.68
7	Severe head injury	0.94
8	Severe head injury	0.98
9	Severe head injury with extradural haemorrhage	0.79
10	Severe head injury with subdural haemorrhage	0.64
11	Penetrating abdominal trauma/exsanguination	0.06
12	Severe head injury/haemothorax	0.79
13	Penetrating thoracoabdominal trauma	0.96
14	Penetrating abdominal and head trauma	0.63
15	Severe head injury	0.10
16	Severe head injury	0.20
17	Severe head injury	0.85

Table 3. Anatomical and physiological parameters (*n* = 17)

Body region	*n*	AIS		Median ISS (range)	Mean RTS (± SD)	Mean GCS (± SD)
		< 3	≥ 3			
Head or neck	13	1 (7.7%)	12 (92.8%)	25 (9–75)	3.5 (± 2.4)	5 (± 2.7)
Chest	1	0	1 (100%)	21	7.5	15
Abdomen or pelvis	3	0	3 (100%)	26 (17–36)	6.9 (± 0.88)	15

AIS = Abbreviated Injury Scale; ISS = Injury Severity Score; RTS = Revised Trauma Score; GCS = Glasgow Coma Score.

After peer review, six deaths were judged to have been preventable, seven to have been potentially preventable, and four to have been non-preventable. Multiple factors contributing to death were identified and were categorized based on prehospital and hospital care (Table 4). These are discussed in relation to deficiencies in system-related or provider-related care.

Table 4. Major contributors to trauma death in preventable and potentially preventable categories (*n* = 13)

Contributor	Patients *n* (%)
Compromised prehospital care	5 (38.5)
Compromised hospital care	3 (23.0)
Compromised prehospital and hospital care	5 (38.5)

Preventable death

System-related factors: five of six patients were inappropriately transferred; all were unstable and should have been treated at the receiving hospitals. In addition, the transfers were done without notification and consultation. One patient had four interhospital transfers before definitive care. Five patients had inappropriately long emergency-room stays. Two of the cases should have undergone emergency surgery. One patient had delayed neurosurgical intervention for paraplegia, and another patient had brain injury that went unrecognized by the resident staff, leading to poor outcome.

Provider-related factors: two patients were considered to have inappropriate resuscitation. One patient had inappropriate general surgical evaluation and another had delayed neurosurgical intervention for cord decompression; his mortality was attributed to pulmonary embolism. Two patients were judged to meet the criteria for damage-control surgery.

Potentially preventable death

System-related factors: there were seven patients in this category. All patients received inappropriate prehospital care. In addition, two were inappropriately managed before transfer. Three patients had inappropriately long emergency-room stays because intensive care unit (ICU) beds were not available, and in one case, additional delay was attributed to CT scan malfunction.

Provider-related factors: initial resuscitation of patients with haemorrhagic shock and the use of mannitol in head injury management were significant contributing factors in four patients. The committee felt that this was not consistent with Advanced Trauma Life Support (ATLS) guidelines. One patient was declared "no code" and treatment was withdrawn in the emergency room. The committee felt this to be an inappropriate decision by the care provider. Surgical technique and decision were considered inappropriate in two cases.

Non-preventable death

System-related factors: in three of four patients, inappropriate transfer was a major determinant. None of these patients should have been transferred by the primary hospitals. Transport time was long and the vehicles were inappropriate. Two patients had inappropriately long emergency-room stays due to lack of ICU beds, and one patient was considered to have inappropriate admission to the neurosurgical service. All four patients were considered to have died as a consequence of the severity of their injuries.

Discussion

Peer review studies have been widely used to evaluate the effectiveness of trauma care and the performance of trauma systems.[9] Criticism of the peer review process stems from its subjective nature, especially in cases of preventable deaths. Application of differing standards results in poor reliability of preventable death judgements and, consequently, in difficulties in comparing various studies.[18,19] However, it has been

reported that by using standard methods, including provision of comprehensive information for review and standardization of reviewers and criteria for judgement of preventable death, a high level of committee agreement on categorization of death can be achieved.[20] In this study, we attempted to overcome these deficiencies by providing comprehensive information in a standard format ahead of review. Committee members were also provided with uniform criteria for the classification of death (Table 1).

In our study, the percentages of preventable and potentially preventable deaths are unacceptably high compared to those in developed countries.[5] In addition, the mean ISS in our patients was low.[1,5] The committee felt that the most significant contributor to poor outcome was inadequate and inappropriate prehospital care. It is an established fact that the time from injury to definitive care affects ultimate survival; 60% of deaths from trauma are reported to occur within 4 hours of injury, and the prognosis for intracranial haemorrhage is markedly improved when treated within 4 hours.[6,21] In our study, the mean time from injury to arrival in hospital of patients dying with injuries was 6.9 hours (maximum, 29 hours). This had a significant adverse effect on outcome when 13 (76.5%) of our deaths were the result of severe head injuries. Patients also spent a mean of 2.9 hours (maximum, 6 hours) in the emergency room. This delay reflects the limited resources in developing countries. These delays in definitive treatment had considerable negative impact on the outcomes in our setting. The "golden hour" concept of major trauma care was not fulfilled in most cases.

The influence of prehospital treatment and interhospital transfer on ultimate patient outcome has been extensively analyzed in a number of studies.[21,22] Moylan et al compared the impact of prehospital care and air versus ground interhospital transport on the survival of patients with multisystem injury.[23] A total of 136 patients were transported by air and 194 by ground vehicles. Air-transported patients with trauma scores between 5 and 10 had a significant survival advantage (83% vs 54%). The authors concluded that the better survival in the air-transported group was the result of earlier therapeutic intervention, including higher frequencies of endotracheal intubation, blood transfusions, larger volumes of electrolyte fluid infused, and the application of military antishock trouser suits.

Another study also concluded that major trauma patients transported by helicopter Emergency Medical Services (EMS) had a better outcome than those transported by ground EMS.[24] The arrival time of patients at the trauma centre averaged 51 minutes less among air-transported patients. In the helicopter EMS group, 46 deaths were predicted but only 33 occurred, whereas in the ground EMS group, 15 deaths were predicted and 15 occurred.

The reason behind the alarming situation in our study is the absence of an integrated and organized structure of trauma care in developing countries in general and in ours in particular. All transportation is by personal and private ground vehicles, or ambulances without trained paramedics, and there is virtually no air-based evacuation and transportation system. Critically injured patients are almost always transported to the nearest available hospital without consideration of the availability of facilities for advanced life support. Even after initial resuscitation, severely injured patients are either not transported to more suitable hospitals or, if transported, the process is improper without any notification to the receiving hospital. The situation is quite contradictory to that in developed countries. In San Francisco, the records of all 437 patients who died of major trauma in 1977 were examined.[1] In only 10 cases (2%) was death from trauma considered to be due to delayed transport or to errors in diagnosis and treatment, and therefore deemed preventable.

Even in tertiary care hospitals like ours, there were a number of important contributing factors. These included the non-availability of portable ventilators in the emergency room, non-availability of beds in the ICU, delayed availability, and in some cases non-availability, of diagnostic radiology, absence of pre-arrival notification, indecision on the part of admitting teams, and at times delayed availability of a senior admitting physician, and non-existence of a trauma team and the absence of a senior anaesthetist resident in the trauma team. These deficiencies in the trauma care system reflect the overall inadequate infrastructure development in developing countries.

The lack of adherence to ATLS principles in resuscitation is another major contributor to the ultimate poor outcome in any trauma audit. A prospective audit of rural interhospital transfer of 98 polytrauma patients to a referral trauma centre was reported in 1990.[25] The authors identified that the most frequent departures from the ATLS guidelines that contributed to poor outcome involved failure to insert a nasogastric tube, failure to document the neurological status, inadequate cervical spine immobilization, inadequate intravenous access, and inadequate oxygen delivery. The authors concluded that there was a need for further education of physicians about priorities in trauma management as it affects the final outcome.

In our study, provider-related weaknesses in education were apparent in the areas of resuscitation and head injury management. These weaknesses were exposed because most patients required resuscitation or suffered from head injuries. Apart from a reflection of overall weakness in our undergraduate and postgraduate education, these deficiencies indicate a need for further education of physicians involved in trauma care in our system. This should be rectified by requiring additional teaching of the principles of management of trauma patients in our medical schools and hospitals. More specifically, the principles of resuscitation should be disseminated and taught, and adherence to these should be evaluated periodically. All residents expected to be involved in trauma care should receive formal training based on ATLS principles.

Based on these observations, the committee concluded that there was a need to redefine the organizational structure of trauma care in our country. Delay in definitive treatment was a very significant contributor to poor outcome and is probably peculiar to a developing nation. These delays have caused deaths in patients with extradural haematoma in our environment that would have been entirely avoidable in any developed country. These delays will remain a fact of life for the foreseeable future in our emergency room. We need to reorganize trauma care in such a fashion that the patient receives definitive care in the emergency room. This will ensure a good outcome and improve quality of care even if the patient is shifted to another facility. Thus, a patient with a severe head injury would be intubated and ventilated during his stay in the emergency room until he is transferred to the ICU or to another facility outside AKUH. This requires a conceptual shift in how we think about definitive care and where it should be provided. The trauma team needs to be reorganized so that it becomes multidisciplinary and takes responsibility for definitive treatment in the emergency room. This is an extension beyond the usual initial assessment and stabilization performed by the team and is different from the usual role in a developed country where admission to a definitive care area is not an issue.[26]

Interhospital communication between major referring hospitals does not exist and an effective communication system between referring hospitals is needed. This can result in early notification and trauma team activation, better resource utilization, and, in case of non-availability of required resources, early referral to another facility. At present, it is beyond our scope to develop an effective communication system. Nevertheless, we can develop awareness by interacting with major referral hospitals to communicate with AKUH prior to patient transfer and vice versa. Later, an interhospital transfer protocol between major referring hospitals should be developed. Paramedics should also be trained for interhospital transfer of patients.

Management of head injuries is the Achilles' heal of trauma management. In principle, head injury management should be based on international guidelines and these should be disseminated and followed in patients with head injury.[27,28]

The challenge faced by trauma care in a developing country like Pakistan is overwhelming. Resources are scarce, primary care takes precedence over critical care, and the infrastructure required by the Western model of trauma care, such as sophisticated communication and transportation, does not exist. This peer review of trauma deaths highlights just the tip of the iceberg. These recommendations provide guidelines to establish a definitive trauma care system at our hospital that best suits our requirements, resulting in improvement in overall outcome. Adherence to established principles and guidelines for trauma management and the availability of adequate resources is the ultimate solution to the overwhelmingly poor situation of trauma care in our country.

References

1. Baker CC, Oppenheimer L, Stephens B. Epidemiology of trauma deaths. *Am J Surg* 1980;140:144–50.
2. Agarwal ND. National policy on accidents. *Indian J Orthop* 1985;19: 107–8.
3. Soderlund N, Zwi AB. Traffic-related mortality in industrialized and less developed countries. *Bull World Health Organ* 1995;73:175–82.
4. David JW, Hoyt DB, McArdle MS, et al. An analysis of errors causing morbidity and mortality in a trauma system: a guide for quality improvement. *J Trauma* 1992;32:660–6.
5. Fallon WF, Barnoski AL, Mancuso CL, et al. Benchmarking the quality-monitoring process: a comparison of outcome analysis by trauma and injury severity score (TRISS) methodology with peer-review process. *J Trauma* 1997;5:810–6.
6. McDermott FT. Trauma audit and quality improvement. *Aust NZ J Surg* 1994;64:147–54.
7. Talwar S, Porwal R, Laddha BL, et al. Trauma scoring in a developing country. *Singapore Med J* 1999;40:386–8.
8. Zafar H, Rehmani R, Raja AJ, et al. Registry based trauma outcome: perspective of a developing country. *Emerg Med J* 2002;19:391–4.
9. MacKenzie EJ. Review of evidence regarding trauma system effectiveness resulting from panel studies. *J Trauma* 1999;47: S34–41.
10. Raftery KA. Emergency medicine in Southern Pakistan. *Ann Emerg Med* 1996;27:79–83.
11. American Association for the Advancement of Automotive Medicine. *The Abbreviated Injury Scale.* Morton Grove, Ill: American Association for the Advancement of Automotive Medicine, 1990.
12. Walder AD, Yeoman PM, Turnbull A. The abbreviated injury severity scale as a predictor of outcome of severe head injury. *Intensive Care*

Med 1995;21:606–9.
13. Baker SP, O'Neill B, Haddan W Jr, Long WB. The injury severity score: a method for describing patients with multiple injuries and evaluation of emergency care. *J Trauma* 1974;14:187–96.
14. Szell K, Salamon A, Sudar I, Sandor I. Classification of polytraumatized patients, experience with the ISS system. *Magy Traumatol Orthop Helyreallito Seb* 1990;33:191–6. [In Hungarian]
15. Champion HR, Sacco WJ, Copes WS, et al. A revision of the Trauma Score. *J Trauma* 1989;29:623–9.
16. Gilpin DA, Nelson PG. Revised trauma score: a triage tool in the accident and emergency department. *Injury* 1991;22:35–7.
17. Boyd CR, Tolson MA, Copes WS. Evaluating trauma care: the TRISS method. *J Trauma* 1987;27:370–8.
18. MacKenzie EJ, Steinhach DM, Bone LR, et al. Inter-rater reliability of preventable death judgment. The Preventable Death Study Group. *J Trauma* 1992;33:292–302.
19. Wilson DS, McElligott J, Fielding LP. Identification of preventable trauma deaths: confounded inquiries? *J Trauma* 1992;32:45–51.
20. McDermott FT, Cordner SM, Tremayne AB. Reproducibility of preventable death judgments and problem identification in 60 consecutive road trauma fatalities in Victoria, Australia. Consultative Committee on Road Traffic Fatalities in Victoria. *J Trauma* 1997;43: 831–9.
21. Bazzoli GJ, Madura KJ, Cooper GF, et al. Progress in the development of trauma systems in the United States. Results of a national survey. *JAMA* 1995;273:395–401.
22. Cales RH, Trunkey DD. Preventable trauma deaths. A review of trauma care systems development. *JAMA* 1985;254:1059–63.
23. Moylan JA, Fitzpatrick KT, Beyer AJ 3rd, Georgiade GS. Factors improving survival in multisystem trauma patients. *Ann Surg* 1988; 207:679–85.
24. Boyd CR, Corse KM, Campbell RC. Emergency interhospital transport of the major trauma patient: air versus ground. *J Trauma* 1989;29:789–94.
25. Martin GD, Cogbill TH, Landercasper J, Strutt PJ. Prospective analysis of rural interhospital transfer of injured patients to a referral trauma center. *J Trauma* 1990;30:1014–20.
26. Driscoll PA, Vincent CA. Organizing an efficient trauma team. *Injury* 1992;23:107–10.
27. Gentleman D, Dearden M, Midgley S, Maclean D. Guidelines for resuscitation and transfer of patients with serious head injury. *BMJ* 1993;307:547–52.
28. Narayan RK. Development of guidelines for the management of severe head injury. *J Neurotrauma* 1995;12:907–12.

Appendix

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