Improving Emergency Department trauma care in Fiji- Implementing and Assessing the Trauma Call System

Abstract

Objective: The trauma team process was recently implemented at the Colonial War Memorial (CWM) Hospital. This study audits the trauma call procedure at the hospital over a period of 12 months.

Method: Retrospective descriptive study of trauma calls from August 2015 to July 2016 at CWM Hospital, Suva. Data relating to patient demographics, time of presentation, time to team assembly and time to CT scan were extracted from the emergency department trauma call database. Disposition from the emergency department and status at hospital discharge was extracted from the hospital patient information system.

Results: There were 38 trauma calls for 46 patients. 72% were male. 82% occurred when the CT radiographer was off site (4pm-8am) including 47% which occurred between midnight and 8am. 52% patients were intubated, 43% went to ICU, 26% went directly to the operating theatre, 37% died. Benchmarks for time to trauma team assembly and time to CT scan were met in 50% of cases.

Conclusion: This was a severely injured cohort of patients with a high mortality rate. The rate of missed calls was not assessed in this study. Time to CT scan could be improved with an onsite radiographer.

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Time to team assembly could be improved with trauma team training and early notification from pre-hospital providers. There is a need to continue to monitor and refine the trauma call process and to extend data capture to measure injury severity and outcomes.

Key Words: audit, key performance indicators, trauma call, trauma team

Introduction

Trauma is a neglected epidemic in developing countries [1] accounting for 10% of the global burden of disease and killing one person every 6 seconds. Death rates from trauma are highest in the low and middle income countries (LMIC) like Fiji, where health systems are less developed and fragmented and prevention strategies are limited. [2, 3]

The Traffic Related Injury in the Pacific (TRIP) study found an annual injury related death and hospitalization rate of 333 per 100,000, with 29% of trauma related deaths happening after admission to hospital in Fiji. [4]

Despite the jaw dropping numbers, trauma is often overlooked as a major public health concern in LMIC's [5], and while preventative strategies are important, there is also an urgent need to strengthen the treatment of the injured.

It has been suggested that efforts to improve trauma care in LMIC's should focus on pre-hospital and Emergency Department (ED) care. [6] Improved ED care is critical to improving outcomes, [7] especially in Fiji where pre-hospital care is limited by the lack of an organized pre-hospital system and a scarcity of ambulances.

The establishment of hospital trauma teams is a key feature of trauma systems worldwide. Trauma teams have been shown to reduce resuscitation time, time to Computed Tomography (CT) scan, time to reach the operating theatre and time to ED discharge. [8] This has been reflected in improved survival rates, even in hospitals not formally recognized as trauma centers. [9]

Method

Setting

The Colonial War Memorial (CWM) Hospital is the major hospital in Fiji's Central Division and the main referral center for the Central-Eastern division. The trauma team concept was introduced and led by senior ED clinicians at the hospital in 2014. It was designed to drive a team approach to managing severely injured patients and enhance delivery of timely care to improve patient outcomes. It was crucial to monitor the success of the trauma calls. Time to team mobilization and time to CT scan (if needed) were set as key performance indicators for this new process. Review of the trauma call data was to be used to refine the trauma call process as part of a quality improvement loop (plan-do-study-act cycle). [10]

Multidisciplinary consultation (including ED, surgical, anaesthetic, radiology, pathology, and intensive care representatives) enabled two key benchmarks to be set: an expected response time for the trauma team members of five minutes or less, and time to commencement of CT scan (if requested) of one hour or less from the time the call is made. This was based on the limitations of our current environment, given the lack of formal pre-hospital notification of trauma cases. There are no universally agreed international benchmarks for these times; however this study documents local practice with a view to establishing acceptable, achievable standards.

The current trauma call activation criteria (see Figure 1) and call procedure was agreed upon by the hospital Trauma Committee after reviewing criteria from other centers, reviewing the literature and considering the risk of over and under triage and are adapted to the CWM Hospital requirements and resource availability.

Trauma Team Activation Criteria

Airway: Compromise (or compromise expected e.g. burns)/Injury

Breathing: RR<10, >28 breaths/minute SpO2 on arrival <93%

Circulation: HR>120 beats/minute, Systolic BP<90 mmHg

Disability: GCS<13/ Spinal Cord Injury

Penetrating Injury to the neck/chest/abdomen

Amputation of a limb

Burns>20% Body Surface Area (BSA)

Multiple casualties (>1 Severely injured)

ED overwhelmed with acuity or volume

Figure 1. The CWM Hospital Trauma Call Activation Criteria

The hospital telephone operators were identified as key to the success of the procedure and given specific, targeted training on how to activate the trauma calls. The time critical nature and importance of the procedure was emphasized.

This study aims to establish baseline data on trauma call patients, such as demographics, disposition and outcomes. It describes the distribution of demand according to time of day and day of the week and documents team response times and time to CT scan. Measuring key

performance indicators and establishing a trauma database helps track system performance and drive quality improvement. [11]

Mechanistic and clinical information relating to each patient will provide a contemporary picture of the most severely injured patients in the central region of Fiji.

Trauma call Process

When a trauma patient meeting the trauma call activation criteria presents to the ED, the attending emergency doctor activates the trauma team via the trauma call activation process. This is done via a single call to the hospital operator, who then announces the activation on the overhead public address system followed by calls to the individual trauma team members on the day. The trauma team is mobilized and undertakes appropriate assessment and management of the patient.

Assessment of the Trauma Call

The scribe nurse records the time of activation and the times as each member of the team arrive into the ED. Following the appropriate disposition of the patient from the ED, the attending ED doctor records the details of the trauma call on a data sheet. This data sheet is filed into a folder called the Trauma Call File that is kept in the ED under the care of ED registrar with the trauma portfolio.

For the purpose of this retrospective audit, de-identified data was collected from the trauma call file using a predesigned data collection form for a period of 12 months, from 1st August 2015 to

31st July 2016. The data collected for the study included demographic details of patients (age and sex), day and time of trauma call activation, pre-hospital notification, injury type, (burn, blunt or penetrating injury) and emergency procedures performed. Times collected included the response times (from trauma call activation to arrival in the ED) for the surgical and anaesthetic registrar, and the time from activation until commencement of CT scan. Outcome data collected included patient disposition from the ED.

This data was supplemented with data from the computer-based hospital patient information system (PATIS), computer based CT scan register and paper based intensive care unit (ICU) register. PATIS was searched for outcomes at hospital discharge to determine the mortality rate.

Data was gathered for a consecutive sample of all trauma calls recorded at CWM Hospital over a period of 12 months. All the data was entered into a Microsoft Excel spreadsheet and analyzed to present results as frequencies, proportions and percentages on tables and graphs.

Approval was given by the Medical Superintendent of the CWM Hospital to access data for audit purpose. Ethical approval was given by the Fiji National University Research Committee and the Ministry of Health.

Results

Between August 2015 and July 2016 a total of 38 trauma calls occurred in the ED of the CWM Hospital for a total of 46 patients. Thirty-three calls were made for single patients and 5 calls for

incidents involving multiple patients. Seventy-two percent of trauma call patients were male and 50% were between the ages of 20 and 39 years of age.

Variable		<i>n</i>	%		
				Mean Age (years)	SD
Gender	Male	33	72	33.6	15.2
	Female	13	28	31.9	14.9
Mechanism of Injury	Blunt	36	78.3		
	Penetrating	4	8.7		
	Burn	6	13		
				Pre-hospital Notification	
				<i>n</i>	%
Mode of Arrival to ED	Ambulance	23	50	17	36.8
	Police Vehicle	5	10.9	0	0
	Other Vehicle	18	39.1	0	0
Time of Presentation to ED	8am-4pm	9	19.6		
	4pm-12am	14	30.4		
	12am-8am	23	50		

Procedures done in ED	Endotracheal intubation	24	52
	Chest drain	2	4
	Joint/fracture reduction	2	4
	Cricothyrotomy	1	2
Patient disposition from ED	Operating Theatre	12	26
	ICU	20	43.5
	Ward	10	21.7
	Discharged from ED	1	2.2
	Died in ED	3	6.6
Patient Outcome	Died	17	37
	Survived to Discharge	29	63

Table 1 Distribution of Gender, mechanism of injury, mode of arrival to hospital, time of presentation, patient disposition and patient outcome from trauma calls at CWMH over 12 months.

The commonest cause of death was head injury, which accounted for 10 (59%) deaths. Three (17%) patients died from burn injuries, 3(17%) from poly-trauma and 1(6%) from facial fractures.

Data collected on the key performance indicator of time to Trauma team assembly showed that the surgeons arrived to the trauma call within the set benchmark time of 5 minutes or less in 50% of the calls while the anesthetists attended trauma calls within the set benchmark time in 47% of the calls. There was 1 call that the surgeon and 3 calls which the anesthetists did not attend.

CT scans were performed in 25 (66%) of the trauma calls for a total of 27 patients.

The benchmark time of 1 hour or less to CT scan from time of trauma call was achieved 56% percent of the time. A total of 4 patients had CT scan done during normal business hours compared to 21 during out of hours.

KPI	Mean (minutes)	Standard Deviation (minutes)	Interquartile Range (minutes)		
			Q1	Median	Q3
Time to arrival Surgeon	7.7	6.1	4.5	5	10
Time to arrival Anesthetist	8.9	9.8	4	5	10
Time to CT scan	87	81	32.5	54	115

Table 2 Time distributions (median, mean, standard deviation and interquartile range) for the KPI's: Time to arrival of Surgeon, Time to arrival of Anaesthetist, Time to CT scan

Discussion

A trauma call system was successfully implemented at CWM hospital, with 46 severely injured patients assessed. A high proportion of patients were managed in accordance with pre-defined KPIs. The results of this study show that major trauma disproportionately affects young males presenting to the CWM Hospital ED which is very similar to the findings of the TRIP study [4] finding and of those around the world. [12, 13]

A large proportion of blunt trauma is also comparable to rates in other places around the world. [14, 15]. Knowledge of the mechanism of injury is important as certain mechanisms can be related to specific injuries that may need particular interventions or resources. Penetrating injuries have a higher chance of requiring operative management and urgent transfer to operating theatre [16] At the CWM Hospital where theatre space time is valuable, this will mean delaying or cancelling another elective case to keep the theatre ready and on standby for the trauma case. Three (50%) of the 6 patients admitted with burn injuries died, showing a high mortality for major burns at the largest hospital in the country and also justifying major burn as a criteria to trauma team activation.

Fifty percent of the trauma call patients are being brought to hospital by private or police vehicles highlighting a deficiency in pre-hospital care for the seriously injured in the Central Division of Fiji. This is generally true for LMIC's where drivers, volunteers and other bystanders provide a large proportion of pre-hospital transport and occasionally provide first aid as well [17]. The lack of central dispatch and bystanders bringing patients to ED are some of the factors that contribute to the 63% non-notification rate of severe trauma patients arriving into the ED. The presence of a pre-hospital notification system would allow trauma calls to be activated prior to arrival of patients to the hospital and give advance preparation time both to the trauma team and the usually bed blocked, busy ED. A scarcity of well-equipped ambulances and inadequate training for personnel in the emergency response services have been identified as areas for improvement.

While the KPIs were met only 50% of the time and there is scope for improvement, the median time of surgical / anaesthetic attendances were short. The possible reasons for not achieving the set benchmark team assembly time of 5 minutes or less include the lack of a formal paging system for notification of trauma calls, as well as being dependent on mobile phones, which are limited by battery and signal reception to contact trauma team members. Introduction of new registrars to the departments who are not familiar with the process could also play a role. These rates were similar whether there was pre-hospital notification or not. Getting the trauma team assembled in a timely manner has been a challenge from the very beginning and a few strategies were employed to improve the attendance and the response time. These include telephone operators announcing the activation of the trauma call on the overhead announcing system prior to calling trauma team members individually. The notification of the surgical consultant on call ensured the surgical registrars turned up for the calls, as they need to keep their consultants updated on the patients. Regular multi-disciplinary audits to discuss cases are a regular event to help drive this process. Mock trauma calls are also carried out to continue reinforcing the process and to promote teamwork and team building among the different disciplines.

There was a failure to achieve the benchmark time to CT scans within 1 hour in 44% of the cases. The likely reason for this investigation to be delayed is the need for the CT radiographer to be called in to do scan after normal hours and on weekends. This important investigation in trauma patients needs to be timely. CT scans help guide early operative intervention, which is significantly associated with favorable outcomes, in particular for severe head injury. [18]. Delay

in CT scan can delay interventions such as surgery in head injury patients and worsen outcomes. It also leads to delays in decision-making, delays in ruling out spinal injury and hence prolonged immobilization and avoidable complications. Patient disposition may depend upon CT scan results and delays to CT scan contribute to Emergency Department overcrowding. A recommendation of having a CT radiographer in hospital overnight and in weekends has been made which will reduce the time to CT for trauma patients.

The majority of the trauma calls (84%) occurred after normal working hours, which presents many challenges. These include: fewer senior clinicians in the hospital, lack of support staff and services, as well as more limited access to the operating theatre and radiology. Presentation during weekends presents similar challenges to those faced after normal working hours.

The 37% mortality rate and the large proportion of patients ending up in ICU and the operating theatre suggest that there may be a significant missed trauma call rate or that the activation criteria are resulting in under triage of the injured. It is important to determine the missed call rate as this will mean a need for the revision of the trauma call activation criteria.

The trauma call, like any other new process had its teething phase and some important issues were identified. These included: trauma team members turning up late or not turning up at all to the trauma calls. Team leadership and teamwork was often fragmented as team members were not used to working within a multidisciplinary team. ED clinicians led efforts to improve

attendance and team function by running regular mock trauma calls and multi-disciplinary trauma audits.

Continued education to enforce the importance of the process and having a surgical and anaesthetic registrar champion for the trauma portfolio would help monitor both missed calls as well as driving the auditing and compliance to the established KPI's.

Limitations

Studying a process in real time introduces certain limitations, both known and unknown, with inter-clinician variability in activating trauma calls despite the existence of objective criteria.

Missed trauma calls are one of the limitations of this study. Going through the trauma call file, it was noted that certain ED registrars activated more calls than others. Over a period of one year, it seemed unlikely that this was due to chance alone. The possible reasons for this were explored with informal interviews. The reasons given included not requiring the team as they felt they could manage the patients on their own. This was more likely to happen if ED was less busy, there was adequate staffing on the floor and the patients did not appear severely injured. The exact number of missed calls is not known but we expect that the absence of information on the missed group most likely skewed the data towards more severely injured patients.

Data collection and completeness is also an issue identified. The trauma call process has only been recently implemented at the CWM hospital and is still in its development phase. The data on each of the calls is not electronically recorded but written down in a file kept in the ED.

Collecting data that has been recorded in a retrospective fashion introduces the potential for bias in the study.

Conclusion

Trauma calls in the ED at CWM are activated for the most severely injured patients. This study illustrates that there is room for improvement in all of the time based key performance indicators: time to team assembly and time to CT scan. There is also a need to continue to monitor and refine the trauma call process and to extend data capture to measure injury severity and outcomes.

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