

Outcome of major trauma at Mulago Hospital in Uganda. Assessment using the TRISS methodology.

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A prospective study of 150 patients presenting with major trauma (ISS >15) at Mulago Hospital, Kampala over a period of 11 months starting from 1st February 1998 was undertaken with the main objective of determining the trauma outcome using the TRISS methodology. Injury severity scores (ISS), Revised Trauma scores (RTS), age, sex, cause of trauma, investigations performed and treatment given were recorded. Using the TRISS methodology, and basing on the major trauma outcome study (MTOS) norms of North America, PRE-charts were constructed to determine the outcome. Patients' follow up was limited to two weeks. Autopsies were done for patients who died during the study period.

The study population included 132 males and 18 females. Seventy-four percent of the patients were aged less than 40 years. The majority (86.7%) of the cases sustained blunt injuries. Road traffic injuries accounted for 75% of the cases and these were followed by assaults in 21% of the cases. The mean ISS for the survivors was 20 and 29 for non-survivors. There were 39 deaths (26% mortality rate), 25 (64.1%) of which were unexpected using the TRISS methodology. Of these 24 were deemed preventable by peer review.

The following statistics were obtained: $Z=6.838$, $W=14$ and $M=0.719$, indicating that the performance of Mulago Hospital in trauma care was worse than expected basing our assessment on the North American standards. The leading causes of death were intracranial haematoma (46%) and haemorrhagic shock (41%). Twenty-three (59%) of the death occurred on the first day of injury. Missed injuries contributed 13 (54%) of the preventable deaths.

In conclusion, major trauma outcome in Mulago Hospital is far below expectations using the MTOS trauma outcome norms. Most preventable deaths were due to missed injuries.

Introduction:

Trauma is reported to be the leading cause of death among the young in the developed world^{1,2,3,4,5}. A similar trend is reported to be taking place in the developing world^{6,7}. In Mulago Hospital, trauma is the single commonest indication for admission reported in the surgical wards^{8,9,10}. To evaluate performance of the trauma health care facility, Body et al¹¹ developed an objective way using the TRISS methodology. This takes into consideration the Injury Severity Score (ISS) calculated by the method described by Baker et al¹², the Revised Trauma Score (RTS), the age and type of injury, whether blunt or penetrating, to calculate the possibility of survival of a given trauma patient. Using these parameters, scattered diagrams (PRE-charts) are constructed, from which a given patient's survival probability can be predicted whether it is less or more than 50%. Patients who fall to the right of the P-50 Isobar are expected to die while those who fall to the left of this Isobar are expected to survive. Deaths of patients who fall to the left of this line and survival of patients whom fall to the right of this line are unexpected outcomes. These are then subjected to peer review in the evaluation of trauma care.

The TRISS methodology is useful in comparing performance of the trauma health care institutions¹¹. Using specific outcome norms as standard, statistics are calculated so as to compare major trauma outcome in the institution under study to that used as the standard.

- The Z- statistic quantifies the difference in the actual number of deaths (or survivors) in the test subset and the predicted number of deaths (or survivors) based on the baseline. An absolute value of Z, which exceeds 1.96, means there is a significant difference in the outcomes of the institutions compared.

- The M- statistic is an injury severity match of the populations under comparison. M-values less than 0.88 indicate a disparity in injury severity match between the two-study populations under comparison. However, M does not tell the injury severity of the population under study.
- The W- statistic indicates the increase or decrease in the number of deaths per 100 patients treated in the institution under study compared to the baseline institution.

Hence, using the Z, M and W statistics, it is possible to have the objective comparison of trauma outcome of different trauma care institutions.

Major trauma outcome norms have been established for North America¹⁶ and the United Kingdom⁵. However, in case of East and Central Africa, no study so far has established major trauma outcome norms hence lack of standard against which to evaluate performance of health institutions in trauma care. Trauma deaths have been reported to occur in three peaks^{1,2,13,14,15} of which the second peak is due to major blood loss and intra cranial space- occupying lesions. It is this second peak of death that is usually the focus of the trauma care evaluation. Most trauma deaths are likely to occur in the first 24 hours after injury^{3,13}.

Patients and Methods

A prospective cross-sectional study involving 150 patients aged 15 years and above, admitted to Mulago Hospital in Kampala, Uganda with major trauma (ISS>15) within the first 24 hours after injury was undertaken between 1stFebruary and 31st December 1998.

A standard questionnaire was filled for each patient.

The ISS was calculated using the abbreviated injury scale (AIS) dictionary- 1990 Revision and the Revised Trauma Score (RTS) calculated using coded values of the unassisted respiratory rate, systolic blood pressure and Glasgow coma score on admission. Examination findings and results of investigations done were recorded.

Four PRE-charts were constructed to predict survival probabilities of these patients. Major Trauma Outcome Norms of North America were used.

Patients were followed up for a maximum of 2 weeks. The follow up period was shorter if deaths or discharge occurred before the 2 weeks elapsed. Statistical comparison between this study outcome and the MTOS of the North America was made.

Autopsies were performed when deaths occurred so as to establish the actual causes of deaths. Unexpected deaths (as predicted on the PRE-charts) were subjected to peer review to document the errors in trauma care that could have caused deaths.

Results

A total of 132 (88%) were males. Most of the patients (74%) were under the age of 40 years (Figure 1). The commonest cause of trauma was road traffic crash that accounted for 112 (75%) of the cases and this was followed by assault in 31 (21%). Seven (4%) were a result of other causes, which included industrial accidents, falls from heights and attempted suicide.

There were 130 (86.7%) of cases of blunt trauma, while the rest (13.3%) had penetrating injuries. Figure 2 shows the pre-chart predicting the outcome of trauma. There were 39 deaths of which 25 were unexpected. There were no expected survivors.

Z, W, M STATISTICS

The values calculated were:

- Z=6.383. This meant statistically significant differences between the actual and predicted number of deaths (Z value greater than 1.96%).
- W=16.7 (approximately 17). There was an increase of 17 deaths per 100 patients treated compared with the norm expectations of North America as reported by Champion et al¹⁶.
- M=0.791. This value was less than 0.88, which showed an injury severity mismatch between the study population and that used in the North America study.

Table 1. Causes and Time of Death after Injury.

Time of death after Injury (Days)	Causes of Death	Frequency	Total
1	Haemorrhagic shock	13	23
	Intra -cranial haematomata	9	
	Cervical spine fracture	1	
2	Intra -cranial haematomata	3	6
	Haemorrhagic shock	1	
	*Cardio-respiratory arrest	1	
	Pulmonary embolism	1	
3	Haemorrhagic shock	1	4
	Intra-cranial haematomata	3	
4	Intra cranial haematomata	1	1
	Intra-cranial haematomata	1	
6	Septicaemia	1	3
	Haemothorax	1	
8	Intra-cranial haematomata	1	1
	Septicaemia	1	
10	Septicaemia	1	1
	TOTAL	39	39

**This was an incidental cause of death in a patient who sustained injuries in a Road traffic accident and while on the road he developed a strangulated inguinal hernia. At surgery for the hernia, he had a cardio-respiratory arrest.*

Twenty-three (59%) of the deaths occurred on the first day of injury (Table 1). Haemorrhagic shock caused more deaths on the first day (12) than intra-cranial haematomata (9). Septicaemia was accounted for 2 (5%) deaths. The commonest causes of death were intra cranial haematomata 18 (46%) followed by haemorrhagic shock 16 (41%). Most preventable deaths (52%) were caused by missed injuries (Table 2).

TABLE 2. ERROR CATEGORY OF PREVENTABLE DEATHS.

Error Categories	Frequency	(%)
Missed diagnosis	13	52
Inadequate intravenous fluid therapy.	5	20
Delayed surgery.	4	16
Inadequate surgery.	2	8
Poor airway control.	1	4
Total	25	100

Discussion

In this study, the outcome after major trauma was far below expectations as predicted using the TRISS methodology and basing it on the outcome norms of the major trauma outcome study of North America by Champion et al¹⁶.

It may not be fair to compare trauma care and outcome in a Ugandan setting, with that one of North America. However, This comparison was done because there is no trauma outcome norms established for Uganda and the East and Central African region in general, hence the adoption of the North America outcome norms as a standard.

Uganda is a developing third world country with very limited facilities while North America is a developed country with better-organized ambulance services, well-developed Advanced Trauma Life Support System and better means of communication. These factors result into shorter extrication times and better care for trauma patients in North America compared to Uganda. North America has specialized trauma centres with excellent resuscitation, investigative, monitoring and treatment facilities. Uganda on the other hand, lacks many of these facilities.

Generally, major trauma outcome is worse in the developing world compared to the developed world. This has been documented before, among others, by Bonne¹⁶ in Lusaka – Zambia and Mock et al^{4,7} in Ghana. Occasionally, such outcomes have been reported in the developed world as well¹⁸.

In this study, 59% of deaths occurred on the first day

of injury (Table 2). The number of deaths progressively decreased with time after injury. The two leading causes were intra-cranial haematomata (46%) followed by haemorrhagic shock (41%).

These results showed that the majority of deaths due to major trauma in the first two weeks of injury in Mulago Hospital in Kampala, Uganda occurred within the first 48 hours after injury and were predominately caused by intra cranial haematomata and exsanguinations. Similar findings have been reported in other studies^{3,13,17,18}

Septicaemia as a cause of deaths in the first two weeks was rare (5%). This was most likely because follow up was only for 2 weeks. Time is needed for infection to get established and progress to multiple organ dysfunction syndrome.

Like in other studies, it was mainly the second peak of deaths that was encountered in this review^{1,13,14,15}. This is because the first peak of deaths that would have occurred in the field while the third peak becomes more common after the first two weeks.

There were 25 unexpected deaths using the TRISS methodology and Major trauma Outcome Study norms of North America. When these deaths were subjected to peer reviews, errors in management noted were missed diagnoses, inadequate intravenous therapy, delayed surgery and poor airway control. Of the 25 preventable deaths in our series, 52% were due to missed injuries.

The factors responsible for the high incidence of missed injuries were: -

- Inadequate clinical evaluation.
- Inadequate investigation.
- Poor interpretation of radiological signs.
- Altered sensorium of patients.

Hirshberg et al¹⁹ reported similar findings in their study population.

Diagnostic peritoneal lavage was not used for patients with abdominal injuries, some of which were missed. This diagnostic procedure has been used elsewhere and documented to be very sensitive for abdominal injuries^{20,21,22}

In conclusion, outcome after major trauma in Mulago Hospital, Kampala– Uganda is far below the expectations using the TRISS methodology and Major Trauma Outcome Study norms of North America. The leading causes of deaths in trauma patients were intra cranial haematomata and exsanguinations. It is mainly the second peak of death encountered in the

first two weeks of injury among admitted patients. Most preventable deaths are due to missed injuries.

Recommendation

It is recommended that a Major Trauma Outcome Study be carried out in this region of the world (East and Central Africa) to establish the major trauma outcome norms against which to base evaluation of health institutions that care for trauma patients.

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