Trauma registries as a tool for improved clinical assessment of trauma patients in an urban African hospital

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This combined retrospective and prospective study describes trauma patients in an urban African Hospital and assesses whether use of trauma registries leads to improved clinical assesment. The Kampala Trauma Score (KTS) is assessed as an injury severity filter. The level of clinical assessment was defined by Model Rural Trauma Project (MRTP) trauma triage criteria.

Trauma registries were filled out systematically for every alternate patient on arrival in the casualty department, and the patient status was recorded two weeks after admission. This retrospective study showed that 52% of the trauma patients were inadequately assessed. Amongst the deaths, 72.7% had been inadequately assessed (p value = 0.0193).

Prospective data showed that injuries were most common amongst young males (72.7%), in and around the city following road traffic injuries (50.7%). The mean time between injury and arrival at the hospital was 0.363 hours (SD 0.331) and the mean hospital response time was 0.36 hours SD 0.245)

The rate of inadequate assessment decreased significantly after the introduction of the registry (p value = 0.000). The case fatalities before and after the introduction of the registry was, however, not statistically significant.

The KTS was found to be a reliable severity filter for injured patients, with a KTS score of less than 14 increasing the likelihood of death by at least three times. The results showed a cut off value of 12 by the ROC curve (0.8755; 95% CI = 0.8455 - 0.9055).

Introduction

Injuries account for 10% of global mortality and the death toll from Road Traffic Injuries (RTIs) alone by 1990 was 1.0 million people[1]. In Africa injury is the third commonest cause of mortality.

The survival of trauma patients has been associated with the severity of injury, the time from injury to definitive care, and the quality of care[2]. It has been shown that the main treatment failures for trauma patients tend to be errors and delays during the first phases of hospital assessment and care.

Trauma registries, apart from improving patient assessment, provide a database for further research in the field, and create an audit system[4]. Internationally, audit processes in trauma are recommended for the evaluation of trauma management[5].

OBJECTIVES:

The main objectives of the study were to describe trauma patients in an urban African hospital and to

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assess whether use of trauma registries leads to an improved clinical assessment of trauma patients. The KTS (Kampala Trauma Score) was assessed as an injury severity filter. Improvement of the clinical assessment of the trauma patients using the registries was measured. Assessment of whether improved clinical assessment leads to an improved clinical outcome was carried out. Data from the registry will be used to audit patients at the hospital and to develop a database of trauma patients.

Patients and methods

The study was undertaken at Nsambya hospital, a 360 bed mission hospital in Kampala city. All patients are first seen by a nurse at the registration desk and the trauma patients are sent to a trauma room in the casualty department. All the patients are seen and attended to by a doctor. Kampala has no established pre-hospital care service and most of the patients are brought in by bystanders, the police, or friends and relatives.

Patient enrolment criteria

A retrospective review of the patient clinical charts from October 1996 to November 1997 was carried out to find the adequacy of clinical assessment of all trauma patients during that period. Inadequate clinical assessment was defined as a recording of fewer than four of the following parameters: blood pressure, pulse, respiratory rate, neurological status, mechanism of injury, and the anatomical description of injury site. The criteria were based on the Model Rural Trauma Project MRTP Trauma triage criteria[8].

Using the same MRTP criteria, a prospective study was curried out over a seven month period from December 1997 to July 1998. The effect of the introduction of a trauma audit on the assessment of trauma patients was examined. Admitted patients of all ages and both sexes were included. Trauma registries were filled out systematically by nurses in the casualty department for every other patient. The forms were left in the charts until discharge or two weeks after admission. The doctors and records clerk filled out the status of the patients at the end of two weeks.

Training casualty staff, and piloting

Nurses and doctors in the casualty department were taught how to fill in the trauma registry forms (see Appendix). Serial workshops on the use of the registries were carried out three times during the study period. A detailed audit of one of the patients was carried out during the study period. Each workshop lasted 1 hour and was aimed at ensuring competence in the use of trauma registries, KTS scoring and the proper completion of forms, item by item. Training was carried out in the casualty department and in a doctors' seminar room. The registry was piloted for two weeks prior to the study.

Design of registry

Injury was defined by the external cause such as road traffic accident, poisoning, fall, gunshot etc. Both intentional and unintentional injuries were included. This system was based on the International Classification of Diseases Edition 9 (ICD 9 E800-E9990) and the International Classification for External Causes of Injuries (ICECI) with modifications in the interest of brevity[9,10,11]. The registry was based on the minimal epidemiological data set and Kampala Trauma Score designed at Mulago Hospital in Kampala[12]. It included a one page 24-item form with demographic data, injury event data, severity data, and hospital care data (see appendix). Hospital care data was added in order to assess the emergency care given at the hospital. The severity of injury was based on the Abbreviated Injury Score with a score of 3 or less being considered as severe, and this was used in the Kampala Trauma Score.

Analysis of data

Epi Info version 6 (Centres for Disease Control, Atlanta, Georgia) was used for analysis by the principal investigators and a qualified biostatistician. Frequencies 'means' standard deviations were done and analyses were carried out using chi square and paired t-tests.

Results

The results are based on a retrospective review of 873 trauma patients admitted between October 1996

and September 1977 and a 7 month prospective study of 432 trauma patients beginning in December 1997.

Retrospective data

A review of hospital records from October 1996-September 1997 showed that trauma constituted the main cause of death amongst surgical patients. The total number of patients admitted was 20,887 and the percentage of whom 4.2% had trauma. Trauma constituted 1632 or (51.5%) of the surgical patients. There were 1,089 deaths, of which the surgical deaths were 57. Of the surgical deaths 33 (57.8%) were due to trauma.

Of the surgical patients who died 22 (72.7%) were inadequately assessed. The deaths occurred in significantly more patients with inadequate assessment (p value= 0.0193).

Prospective data

During the prospective study period there was a total of 5,456 hospital admissions. There were 890 surgical admissions and of these, 432 (48.5%) were due to trauma. There were 617 deaths of which 39 were of surgical patients, 14 (35.9%) of them being due to trauma. There were 168 (71.8%) males and 66 (28.2%) females enrolled in the registry. The unregistered group had 146 males (73.7%) and 52 females. The mean age for the registered group was 22.563 (SD= 12.27,95% C.I = 20.98 - 24.15) whilst that for the non- registered group was 23.22 (SD = 12.77). The majority of the patients were between 21 and 30 years of age (figure 1)

Of the 234 registered patients, 204 (87.2%) had an adequate clinical assessment. Of the 198 patients not enrolled into the registry, 155 (78%) were adequately assessed. Forty three patients were not enrolled, and they had an inadequate assessment. In the registered group 91 (54.5%) of the patients arrived at the hospital within 30 minutes of injury, 27.5% arrived between 30 minutes and 1 hour, 12.0% between 1 and 2 hours and 6.0% over 2 hours later. In the non registered group 105 or 60.7% of the patients arrived within 30 minutes, 24.9% between 30 minutes and 1 hour, 9.8% between 1 and 2 hours and 4.6% over 2 hours later. The mean arrival time was 21.8 minutes or 0.363 hours (SD = 0.331). The time interval between injury and arrival at the hospital was not significantly correlated with the status at two weeks. On arrival at the hospital the average response time was 0.36 hours (SD = 0.245). The majority (80.7%) of the patients were seen within 30 minutes, 19.3% were seen between 30 minutes and 2 hours. No patients were seen later than 2 hours. The time interval between arrival at the hospital and attention by the doctor was not significantly correlated with the status at two weeks (p value = 0.147). No data were available from the non registered group. In both the registered and unregistered groups, over 80% of the patients came from Kampala (88.0% and 86.4% respectively). The remaining patients came from the nearby districts.

The registered and unregistered groups were not different with respect to occupation, causes and severity of injuries, and so these results are reported without distinction.

The majority of the patients were students (22.9%). Civil servants and private employees accounted for 16.4% while pre-school children comprised 15.5% of the cases. Of note were the many drivers and turn boys, who accounted for 6.95% of patients. The majority of the patients (56.6%) were injured on the road. Home was the next most common place of injury, accounting for 28.9% of the cases. Traffic injuries constituted 50.7% of the causes. Most of the traffic injuries occurred among pedestrians (59.9%), followed by vehicle occupants (23.3%), then cyclists (17.0%). Falls accounted for 13.8%, and burns for 12.0% of cases.

With regard to intent, 82.4% of the injuries were unintentional, while 17.3% were intentional. Of those which were intentional 28 (65.1%) were due to assault and 15 (34.9%) were self inflicted. Three out of four deaths were a result of intentional injuries. There was a significant correlation between the intent and the outcome of the injuries with intentional ones being more likely to result in death (P value = 0.052). Females were more likely to have an intentional injury (OR = 0.36 Cornfield 95% CI = 0.17<OR<0.77, Maximum Likelihood ratio = 0.37 and relative risk ratio of female = 0.5) (Confidence interval 0.34<RR<0.78).

The head and extremities were involved in 43.0% and 41.9% of the cases respectively. The abdomen and pelvis accounted for 10.0%. One half of the dead patients had a head injury, either alone, or in combination with another injury. The case fatality rate for head injuries was the highest of all injuries (4.6 percent) while for the bony pelvis and extremities it was 2.3% (Figure 1)

The registered and unregistered groups were different in terms of number of serious injuries (p value 0.0000); 78.6% in the registered group and 51% of patients in the non registered group had one serious injury. More than two injuries occurred in 1.3% of the registered group and 1.01% in the non registered group. The death patients had an average of 1.14 injuries. The number of injuries was correlated with outcome (p value = 0.0002).

Four percent of the patients were referred immediately, and 0.45% died while being resuscitated in the casualty department. The rest of the patients were admitted. The correlation of the patient's KTS with the patient disposition was found to be statistically significant (p value = 0.0043).

The groups were also different regarding the patient outcome (p value 0.0001). At the end of two weeks 90.7% of the registered group and 76.3% of the non registered group were discharged. Two percent of the registered group and 5.05% in the non registered group had died and 4.9% in the registered group and 15.2% in the non registered group were still in hospital. Two percent of the registered group and 3.54% in the non registered group were transferred to a higher level facility.

Out of 234 patients in the registered group 104 (44.4%) had pain management, 60 (25.6%) had volume replacement and 49 (20.9%) had stabilization of fractures. Ten percent of the patients were referred for physiotherapy.

Fifty six (14%) of the patients had operations (11.3% registered 16.7% non registered) while 86.03% (345) did not.

Comparison of retrospective and prospective data: The case fatality before introduction of the registry was 0.0378. The case fatality amongst all patients after the introduction of the registry was 0.032 (p value = 0.623).

In the registered group the case fatality was 0.0171 and that in the non registered group was 0.051 (p value = 0.05). The difference between the retrospective group and the registered prospective group was not statistically significant (p value = 0.118).

Tables 1 and 2 show the Kampala Trauma Score and outcome in the registered and unregistered groups.

D. KTS of Patients:

The mean KTS for the registered group was 14.47 (SD = 1.114). The mean KTS of the deaths was 12 (SD = 0.5)

TABLE 1 Registered group

KTS	Proportion of deaths	Proportion of non deaths	Likelihood ratio
	n=4	n=204	
=>14	0	0.716	0
<14	1	0.284	3.521

TABLE 2: Non registered group

KTS	Freq deaths	Prop deaths	Freq non deaths	Prop non death	Likelihood ratio
=>14	0	0	104	0.703	0
<14	7	1	44	0.297	3.37

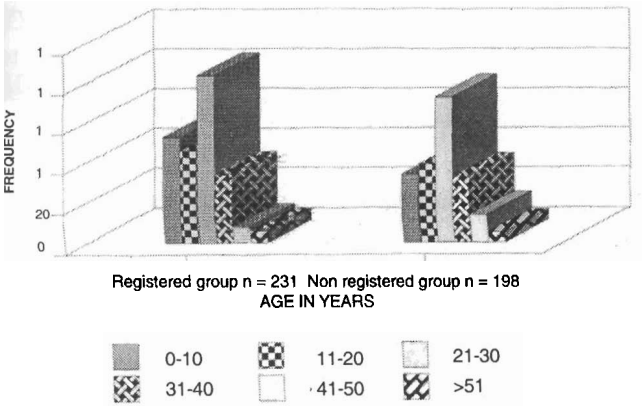
TABLE 3

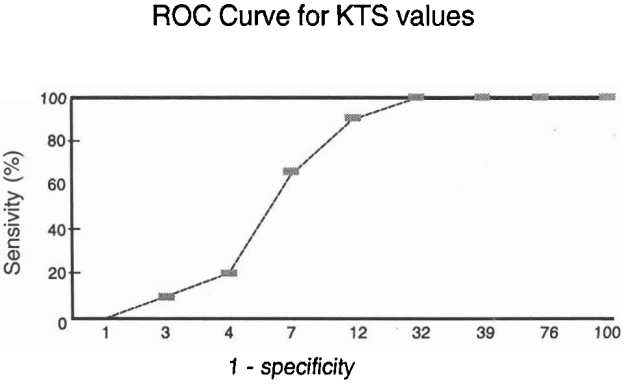
KTS	Death n=11	Survival n = 352	Sensitivity	Specificity	False positive rate
8	0	3	0.00	0.99	0.01
9	1	6	0.09	0.97	0.03
10	1	6	0.18	0.96	0.04
11	5	9	0.64	0.93	0.07
12	3	18	0.90	0.88	0.12
13	1	69	1.00	0.68	0.32
14	0	25	1.00	0.61	0.39
15	0	132	1.00	0.24	0.76
16	0	84	1.00	0.00	1.00

The mean KTS for the non registered group was 13.47 (SD = 8.09). The mean KTS of the deaths was 10.71 (SD = 0.95). When the registered and non registered groups were compared, the p value was not found to be significant (p value = 0.079)

When the KTS of both groups was tested with the outcome the results were generally found to be statistically significant (p value = 0.0041 (Table 3). The results showed a cut off value off value of 12 by the ROC curve (Figure 3). The area under the curve was 0.8755; 95% CI = 0.8455 - 0.9055

Figure 2: Age Groups In Trauma Patients





The introduction of trauma forms as a tool for improved clinical assessment and a means of an audit system led to a reduction in the prevalence of poor clinical assessment and this was found to be highly statistically significant. The prevalence of poor assessment with the registry was 11.1%. The prevalence of poor records from the review of the records before the study was began was 52.0% (P value 0.000).

When the clinical records and the registries were compared, it was found that 204 patients were well assessed both by the registry forms and the clinical records. Those with a poor assessment by use of the records were 30. Those who were poorly assessed by both the records and the registry were 26.

Clinical records

The probability of poor assessment with the registry was 0.111, of good assessment with the registry was

0.889, and the likelihood ration of a good clinical assessment with the registry was 7.52.

Discussion

Nsambya Hospital has a system of disease coding based on the Internation Classification of Diseases coding (ICD 9). However, as in many Sub-Saharan African hospitals, coding excludes the external cause of injury[14]. Trauma registries have been shown to improve data collection and management[6].

In this study we demonstrate the amount of information that can be generated using a one page form as well as the use of injury severity coding with the KTS which has already been validated[10]. Patients can therefore be classified and quickly assessed[15]. During the prospective study period we found a prevalence of trauma patients of 48.53% of all surgical admissions. Most injuries occurred in young urban males and usually due to road traffic injuries as reported from numerous studies[16,17,22]. Pedestrians were the most frequently injured (60.1%) in both the registered and non registered groups which is comparable to Mulago Hospital, the referral and main trauma hospital in Kampala (43.5%)[22]. Muhimbili Medical Centre in Tanzania showed passengers to be the most frequently injured[16].

Pupils and students were injured most often (22.92%) but this be due to the fact that they constitute a large percentage of the population in and around Kampala. The next most commonly injured people were civil servants, casual labourers and children less than five years of age. Drivers and turnboys accounted for a total of 4.4%. In comparison, studies at Muhimbili found 15.0% of the injured to be pupils but the majority of injured were small business owners and the unemployed and drivers only accounted for 2.0%. Other studies in Africa show the commonest age group to be the 20-29 year olds[16,18,22]. The second commonest place of injury was in homes mainly due to burns and accidental falls.

Head injuries were the commonest anatomically and caused most deaths, and most patients had only one serious injury. The registered group had significantly more patients with a serious injury but there were no significant differences in outcome between the two groups. The mean KTS for the two groups were not statistically significant demonstrating the fact that each item in the KTS on its own is not a good predictor of outcome but as a total score there is better predictability of outcome.

The mean interval between injury and arrival at the hospital was found to be 21.78 minutes which is much better than Mulago Hospital (mean time 155 minutes) 22 and remote counties in the United States (mean time 48 minutes)[19] but much slower than the 12.7 minutes in countries with an established Emergency Medical Service (EMS) System[23]. This difference in presentation time could be because most patients brought to Nsambya Hospital are of a higher socioeconomic status than those taken to Mulago Hospital and can afford quicker transportation. The response times of less than 30 minutes correlated with studies in neighbouring Kenya[18].

The time between injury and arrival at the hospital, which was usually within 30 minutes of the accident, seemed not to affect the outcome. This could be because of the short follow up period of only two weeks and the use of only extreme outcome measures like death. There may be unmeasured outcomes like physical disabilities, although the number of referrals to the physiotherapy department (10.0%) can give a crude estimate of the numbers of physical disabilities.

Most of the injuries were unintentional (81.6%). Of those which were intentional 65.1% were due to assault and 34.9% were self inflicted. The prevalence of intentional injuries varies in different settings and the value of 18.0% contrasts sharply with Nevada (98.4% for assault and 5.2% for self inflicted injuries)[17] but were comparaable to Tanzania (18%)[16] and less than Nigeria's 30%[20]. Most of the intentional injuries occurred in males (53.5%) but females were relatively more likely to have an intentional injury. The main activities in the casualty department were pain control, administration of intravenous fluids and fracture stabilization. This information is of use in

the planning of equipment for the casualty department.

The KTS was found to be a reliable severity filter for injured patients. A KTS score of 14 or less was found to increase the patient's likelihood of death by at least 3 times and was found to correlate with the patient's status at two weeks. The results showed a cut off value of 12 by the ROC curve. The area under the curve was 0.8755; 95% CI = 0.8455-0.9055) Studies with other trauma registries using the ICD-9 codes have a value of ROC 0.872; (95% CI = 0.837 - 0.908)24. It can thus also be used as an audit filter. The KTS has also been verified through studies based at Mulago and Kawolo hospitals in Uganda and was found to be highly reliable and valid with a better performance than the Revised Trauma Score (RTS)[21]. This finding correlates with studies which have found similar results with hospital based trauma registries[12].

The registry had a high probability of good assessment compared to the clinical records. The case fatality rates before and after the introduction of the registry were not statistically significant. This could be due to the short period of time available for significant changes in outcome. A change in the clinical assessment however, is a significant step in the process of reduction of morbidity and mortality. The registry has since been introduced into the other major hospitals in Kampala in a shorter form. The hospitals are finding it a useful instrument and this has created a city-wide trauma surveillance system which is another positive step towards the standardization of care.

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