Direct (presenting primarily to trauma center) versus indirect (referred or transferred) admission of patients to the Trauma Centre of King George Medical University: One-year prospective pilot study

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ABSTRACT

Background: India does not have a trauma registry. There is lack of base line demographic data of trauma victims that present directly to the trauma center and those that are transferred to the trauma center.

Aim: To compare the clinical and demographic profile of directly admitted (presenting primarily to the trauma center) and referred (transferred to trauma center) patients at the trauma centre of King George Medical University.

Materials and Methods: The demographic and clinical profiles of patients admitted on thirty-three consecutive Mondays were collected and compared. In addition, the demographic data of patients admitted on Mondays and eight randomly selected Wednesdays and Saturdays were analyzed to ascertain the representativeness of the studied sample.

Results: Of the 572 patients in the study, 327 were referred and 245 were directly admitted. There was 27% mortality in the referred group and 22% mortality in the directly admitted group, the difference been statistically insignificant (P value 0.20). Patients referred from peripheral hospitals were more severely injured with a lower GCS and a higher TRISS, and had a higher proportion of multi system major trauma and severe head injury.

Conclusion: Referred admitted (transferred) patients at the KGMU trauma center are more seriously injured than the patients presenting directly. Yet there is no statistically significant difference in the overall mortality. A future study focusing on certain sub-categories of patients such as those demonstrating subdural hematoma, GCS less than 9 or ISS more than 15 may yield interesting data.

Key Words: Admission, direct, transferred, trauma centre

INTRODUCTION

The trauma centre of King George Medical University (KGMU) is the only designated trauma center in Uttar Pradesh. It provides round the clock trauma service to the injured of about 30 administrative districts and has an annual turnover of about 25000 admitted patients. Based on the admission pattern its catchment population is about seven million. However the trauma centre lacks a devoted trauma team as the “trauma and emergency medicine specialty” is non-existent in India. The area served by the KGMU trauma center does not have a formal round the clock system of pre-hospital and hospital care. The first response retrieval, transport and initial care are provided in, what can only be described as a random service by passers-by, relatives, or friend and family. The patient is generally taken to the nearest hospital,
which could in some cases be the trauma center itself. Peripheral hospitals are focused on providing maternal and child health care, providing vaccination for vaccine preventable diseases, preventing outbreaks and spread of epidemic. They have no facilities for resuscitating a trauma victim and at best provide primary care and refer a trauma victim. No formal inter-facility protocols exist. Very often patients are transferred using non-ambulance vehicle. The objective of this prospective observational study was to compare the demography and clinical profile of referred (transferred) and directly admitted patients (presenting primarily to the trauma center) to the trauma center. The results of this pilot study would provide baseline data which may be used in designing and planning of trauma care in India.

**MATERIALS AND METHODS**

Patients presenting directly to the emergency room of the trauma centre, *i.e.* picked up and transported were considered as “direct admissions,” regardless of the mode of transfer. Patients admitted at peripheral hospitals and subsequently transferred to trauma centre were considered “referred patients.” Once the patient arrived at the emergency room of the trauma centre, same treatment algorithms were followed in both the groups.

Ethical approval for the study was obtained from the Institutional Review Board. The inclusion criteria for the study were all patients admitted on consecutive Mondays subject to written informed consent. For critically ill patients, consent was obtained from next of kin. To statistically ascertain the representativeness of the studied sample over a week, the demographic data of patients admitted on Mondays and eight randomly selected Wednesdays and Saturdays of the week was analyzed. Data were consistently and contemporaneously collected by one of the authors. All injuries were recorded using Abbreviated Injury Scale (AIS), which was then used to calculate the Injury Severity Score.

Data was collected on demographic and clinical details of the patient. These included age, sex, chronic comorbidities (*i.e.* Coronary artery disease, Chronic obstructive pulmonary disease, Hypertension, Renal disease, Diabetes mellitus), Glasgow Coma Score (GCS), blood pressure at admission to trauma centre, respiratory rate at admission, Injury Severity Score (ISS), Trauma Injury Severity Score (TRISS), number of surgeries performed on the patient, time elapsed since injury to admission to trauma centre.

Patients were classified into one of the following categories: Head injury, head injury with any other injury, single segment of an extremity (for *e.g.*, Thigh, arm, leg, foot), >1 segment of an extremity (for *e.g.*, Arm and forearm, thigh and leg, leg and foot), or > 1 extremity (*e.g.*, Thigh of left extremity and leg of right extremity, arm of left extremity and leg and thigh of right extremity), abdominal injury, chest injury, face injury, cervical spine injury, thoracic spine injury, lumbar spine injury and other poly-trauma (all other combinations of injuries with more than one region involvement).

**Statistical methods**

Descriptive statistics were described as mean ± SD/median and freq/percentage. Level of significance between the difference was estimated by using Pearson’s *χ²* test and making adjustment for low cell frequencies (expected frequency <5) or Fisher’s Exact test as applicable. The quantitative variables were compared by using two-sample *t*-test for normally distributed data or otherwise Mann–Whitney U-test.

**RESULTS**

Five hundred ninety-two patients met the inclusion criteria for the study. However twenty patients did not consent to the study and were hence excluded (*n* = 572). These included three hundred seventy-eight patients admitted on 33 Mondays, ninety nine patients admitted on 8 Wednesdays and ninety five patients admitted on 8 Saturdays (for purposes randomization/validation of representativeness of the sample). Since the day of the week did not make any difference to the clinical and demographic profile of the patients, data collected on Wednesdays and Saturdays was included in analysis. Out of total 572 patients, 327 (57%) patients were referred (transferred from another health facility) patients and 245 (43%) were directly admitted patients, presenting primarily. Patients admitted on different days of the week found to be clinically and demographically similar (*P* value > 0.5 for all the parameters).

Patients referred (transferred) from peripheral hospitals were more severely injured with lower GCS (*P* value 0.0296) and a higher TRISS (*P* value 0.0101) from multi system major trauma and severe head injury. However, the ISS was not significantly different (*P* value 0.0536). Median time to admission to trauma centre was 14.92 h in the referred admitted group and 5 h in the directly admitted group. The time to admission (*P* value < 0.0001) to trauma center and duration of hospital stay (*P* value 0.013) were higher in the referred group.

With reference to the financial capabilities of the patients [Table 1], in the referred group 22.32% (73/327) patients had an official below poverty line card. The

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corresponding figure in the directly admitted group was 14.69% (36/245), the difference being statistically significant (P value 0.0215). It is noted that the insurance or state funded care in India is inconsistent – in many cases the victims or their family pay for health care from their own funds.

Patients referred from peripheral hospitals had a trend towards higher operative rates directly related to trauma (0.544 operations per patient vs. 0.461 operations per patient), lower blood pressure at admission, greater proportions of head injury and female patients. The differences, however, were statistically not significant (P = 0.05). Ten patients in the referred group presented to the hospital with neurogenic shock. In the referred group, 18.65% (61/327) patients had hypotension (systolic BP < 109 mm Hg) at presentation to the trauma centre. The corresponding figure in the directly admitted group was 13.88% (34/245), the difference being statistically not significant. Operative intervention was required in 45.25% (148/327) of the referred patients and 41.63% of the directly admitted patients.

Patients referred from a peripheral hospital had a higher percentage of major trauma (P value 0.015) and severe head injury patients (P value 0.006). One-year mortality since the time of injury was 27% in the referred group and 22% in the directly admitted group, the difference being statistically insignificant (P value 0.20). Compared to the directly admitted group, major trauma patients and severe head injury patient had higher mortality in the referred group but the differences were not significant statistically [Table 1].

An important finding of our study was that severe head injury (GCS < 9) within 100 Km of the trauma center was significantly associated with direct admission to the trauma center (P value 0.0003) shown in Table 2. However the same was not true for major trauma (P value > 0.05).

Table 1: Comparison of referred and directly admitted patients

| Quantitative variable | Referred (transferred) admitted | Direct (presenting primarily) admitted | P value |
|-----------------------|---------------------------------|----------------------------------------|---------|
| Age                   | 327                             | 245                                    | 0.5994  |
| ISS                   | 327                             | 245                                    | 0.0536  |
| RR                    | 327                             | 245                                    | 0.1248  |
| GCS                   | 311                             | 226                                    | 0.0296  |
| TRISS                 | 311                             | 225                                    | 0.0101  |
| Median time to admission to referral centre (hours) | 327                             | 4                                      |         |
| Median time to admission to trauma centre (hours) | 327                             | 14.92                                  | <0.0001 |
| Hospital stay (days)  | 327                             | 10.89 ± 12.3/7                        | 0.013   |
| Qualitative variables | N (Number of patients) % Age     | N (Number of patients) % Age            | P value |
| Female/male           | 327                             | 18.96/81.04                            | 0.0596  |
| Comorbidities         | N (Number of patients)          | N (Number of patients)                 |         |
| CAD                   | 327                             | 2.45                                   | 3.67    |
| COPD                  | 327                             | 4.49                                   | 4.49    |
| Hypertension          | 327                             | 4.89                                   | 4.08    |
| Renal disease         | 327                             | 0.61                                   | 0.82    |
| Diabetes mellitus     | 327                             | 4.28                                   | 0.41    |
| Tracheostomy at CSMMU | 327                             | 6.73                                   | 2.04    |
| Holder of official below poverty line card | 327                             | 22.32                                  | 14.69   |
| Systolic blood pressure < 109 | 327                             | 19.24                                  | 13.46   |
| ISS > 15              | 327                             | 42.50                                  | 32.24   |
| GCS < 9               | 311                             | 28.94                                  | 18.58   |
| Mortality in extra dural hematoma | 19                             | 42.11                                  | 33.33   |
| Mortality in sub dural hematoma | 10                             | 70.00                                  | 33.33   |
| Mortality in major trauma ISS > 15 | 139                           | 55.39                                  | 50.63   |
| Mortality in severe head injury patients (GCS < 9) | 90                             | 68.88                                  | 64.42   |
| Trauma pattern         | N (Number of patients)          | N (Number of patients)                 |         |
| Head injury           | 327                             | 35.17                                  | 27.76   |
| Head injury combined with any other injury | 327                             | 10.09                                  | 11.84   |
| Single segment of an extremity | 327                             | 29.05                                  | 33.06   |
| > 1 segment of an extremity or > 1 extremity | 327                             | 6.42                                   | 8.98    |
| Other poly trauma     | 327                             | 7.34                                   | 6.53    |
| Cervical spine        | 327                             | 4.28                                   | 5.31    |
| Thoracic spine        | 327                             | 1.53                                   | 1.22    |
| Lumbar spine          | 327                             | 0.92                                   | 1.22    |
| Chest                 | 327                             | 2.75                                   | 2.86    |
| Abdominal trauma      | 327                             | 2.14                                   | 0.82    |
| Face                  | 327                             | 0.31                                   | 0.41    |

ISS: Injury severity score, RR: Respiratory rate, GCS: Glasgow coma score, TRISS: Trauma injury severity score
DISCUSSION

Our finding that admission and subsequent transfer from a peripheral hospital is associated with significant delay in admission to trauma centre and subsequent definitive specialist care is consistent with the finding of other studies.[1,2] Treating a life-threatening effect of injury before arrival at trauma centre either pre-hospital or at the first hospital, depending on important variables, are reported to be more relevant to decreasing mortality than simply shortening the time to trauma center. [3] However in this study it seems that treatment at peripheral hospitals prior to admission to trauma centre did not provide any survival advantage to the referred admitted group when compared with the directly admitted group. The reasons for this may be multifactorial and may represent amongst other things, the lack of formal training in the initial care of trauma such as ATLS or the higher levels of skills, resources and speed of intervention.[3] Anyway, data on mortality and morbidity in peripheral hospitals are required to examine the effect of admission to the nearest hospital. Our findings confirm the results of other studies that report a higher injury severity[4] in the referred group, in the referred patient group.

An important finding was the presence of hypotension at admission in 19.24% referred (transferred) cases. A systolic blood pressure of ≤109 mm Hg at presentation is known to be associated with mortality in trauma patients.[5] Though the matter is contentious, the question arises whether hypotension, in the context of this study, raises the possibility of under resuscitation of transferred patients.

Our finding of a higher proportion of head injury patients confirms the findings of other studies that have also reported a higher proportion of head injury patients in the referred group.[4] A higher proportion of head injury patients in the referral group may be due to the need for mechanical ventilation in those with low GCS score (a facility which is lacking in many peripheral hospitals)

A significantly higher percentage of multisystem major trauma patients and severe head injury patients comprised the referred group. Although the directly admitted group had lower mortality of severe head injury and major trauma patients, the difference was not statistically significant. Direct admission to a trauma centre in cases of head injury[7] and extradural haematoma[8] has been reported to associated with lower mortality than indirect transport to a trauma centre. Sampalis et al,[9] have reported that direct transport to a tertiary care center lowers mortality among major trauma victims after introducing a system of effective pre-hospital care, an organized system of triage, referral and transport. Our data emphasize the need to for a comprehensive regional trauma system. A future study focusing on categories of patients such as those demonstrating subdural hematoma, GCS less than 9 or ISS more than 15 may yield data to support the designing of local inter-hospital transport protocols in developing health care environments.

From an economic perspective, referral from a peripheral hospital was associated with below poverty line status of the patient. This could be because of a poorer population going to the nearby hospital instead of rushing to the trauma center, or such a patient being encouraged to transfer to the trauma centre due to the inability to pay the cost of care in some local hospitals. This behavior could be due to lack of knowledge about the right hospital or lack of money to hire a vehicle. Another reason could be that people in peripheral areas are poorer. On the basis of present study we cannot comment on the exact cause for this association.

Whilst this study aimed to identify baseline demography, it is clear that continuous data collection is essential. Establishment of a trauma registry is desirable in the developing countries, as it gives an insight into the nature and extent of trauma,[10,11] plays an important role in monitoring the management of the injured patients[12] and helps in the regulation. A trauma registry will provide a large and longitudinal database for analysis,[13] and reliable information necessary for health policy and care delivery including pre-hospital care.[14] Trauma registries even in austere environments are likely to be valuable tools for developing the health care system, identifying priority areas for quality improvement, policy implementation gaps and relevant interventions.[13]

An important determinant of patient’s choice of hospital seemed to be the distance of injury site from the trauma center in cases of severe head injury as direct admission is seen to be significantly associated with a distance of less than 100 Km from the injury site. This could be due to lack of formal consistently available EMS system. However, the time of injury (day versus night) was not found to be a factor in determining the patients’ choice of hospital. There are likely to be multiple considerations influencing the patient’s choice of hospital such as perceived severity of injury, social influences and the cost and availability of transport.

| Table 2: Effect of distance on choice of hospital if GCS < 9 |
|------------------------------------------------------------|
| Direct | Referred | Total |
|--------|----------|--------|
| Within 100 Km | 25 | 28 | 53 |
| Beyond 100 Km | 6 | 40 | 46 |
| Total | 31 | 68 | 99 |

Odd’s ratio 5.9524 (95% CI; 16.4001-2.1604), P value 0.0003. GCS: Glasgow coma score.
LIMITATIONS OF THE STUDY

This analysis is based on data from a single trauma centre. A limitation of our study (though a deliberate one) is that it applies only to the patients attending the KGMU trauma centre. Our results are not generalizable to other hospitals accepting trauma patients.

CONCLUSION

Referred admitted (transferred) patients at the KGMU Trauma centre are more seriously injured (higher TRISS) than the patients presenting directly to the trauma centre. However the mortality is not different between the two groups. Establishing a trauma registry can shed light on factors affecting referrals such as below poverty line status and severe head injury.

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