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Research Article

Pattern of trauma in a rural hospital and factors affecting mortality in trauma patients

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ABSTRACT

Background: Trauma is associated with human civilization since ancient times. With the modern urbanization and increase in motor vehicles incidence and pattern of trauma changed. Hence the present study was conducted to study the pattern of trauma in a rural population admitted to a Kasturba Hospital Sewagram (Rural Hospital) and to detect factors affecting the mortality of trauma patients.
Methods: A prospective randomized controlled trial was conducted in Department of general surgery, Kasturba Hospital, Mahatma Gandhi Institute of Medical Sciences, Sewagram. A total number of 1525 trauma patients were studied over a period of 2 yrs. The detail examination was done and findings were recorded. All the factors affecting mortality of trauma patients were studied.
Results: Trauma affects younger population more with a male predominance. Incidences of vehicular accidents are more than the non-vehicular accidents and other modes of trauma. Head injury was most common type of injury as observed in the present study. Advancing age and polytrauma were the main factors for high mortality. The mortality increased as the Revised Trauma Score decreased. While mortality increased with increasing Injury Severity Score and vice versa.
Conclusions: Age, sex, mechanism and type of injury affect the mortality in Trauma Patients. The mortality increased as the Revised Trauma Score decreased while mortality increased with increasing Injury Severity Score.

Keywords: Factors affecting trauma outcome, Mortality, Revised trauma score (RTS), Injury severity score (ISS)

INTRODUCTION

Trauma is perhaps the oldest of man's afflictions and the history of trauma is as old as medicine itself.[1] The process of rapid and unexplained urbanization has resulted in an unprecedented revolution in growth of motor vehicle worldwide. Though trauma is health care problem of vast population yet a minimum research has been done on this health problem. Hence present study was conducted at Kasturba Hospital, Sewagram with the aim:

1. To study the pattern of trauma in a rural population admitted to a Kasturba Hospital Sewagram (Rural Hospital).
2. To detect factors affecting the morbidity and mortality of trauma patients.

METHODS

A prospective randomized controlled trial was carried out in Department of general surgery, Kasturba Hospital of Mahatma Gandhi Institute Of Medical Sciences,

Sewagram between 2006 to 2008 over a period of 2 years. A prospective study of 1525 trauma victims who were admitted to Kasturba Hospital was included in present study.

Every patient was interrogated for general information like age and sex of patients. The details of injury were noted like type (blunt, penetrating, crushing) and mechanism of injury (vehicular or non-vehicular). Details regarding any pre- hospital treatment taken were noted with details of type of pre- hospital treatment. Their vitals were recorded and all the bodily injuries were identified i.e which body system is injured (head, chest, abdomen, polytrauma, superficial injury). All the information was recorded in the standard proforma.

Information of injuries was recorded by single investigator, thus reducing the error subjectively to minimum.

Revised trauma score

The respiratory rate of the patient was counted for one minute and the points were given accordingly. The blood pressure was measured while patient in supine position and only systolic blood pressure was noted. The central nervous system status was assessed with Glasgow Coma Scale using the response of patient to stimuli. The stimuli used were verbal commands, eye opening and standard pain stimuli in the form of sustained knuckle pressure over sternum for 30 seconds or until the patient responds.

The best response out of eye opening, verbal or motor response was picked up and points for each were recorded. All these three parameters were given due points and then multiplied by weight suggested by the authors.[2-4]

Table 1: Revised trauma score.

Glasgow coma scale	Systolic BP (mm Hg)	Respiratory rate (per min)	Coded values
13-15	>89	10-29	4
9-12	76-89	>29	3
6-8	50-75	6-9	2
4-5	1-50	1-5	1
3	0(absent carotid)	-	-

Weight for Revised Trauma Score**:**

1. Glasgow coma scale : 0.9368
2. Systolic BP : 0.7326
3. Respiratory rate/min : 0.2908

All these values computed together are equivalent to revised trauma score which varies between 0-7.8408 or broadly between 0-8.

Injury severity score

This scoring was done according to the codes given for various injuries in the Abbreviated Injury Scale1990 revision by dividing the body into six regions as follows:

- Head & neck
- Face
- Thorax
- Abdomen and pelvic contents
- Extremities and pelvic girdle
- External, including skin and subcutaneous tissue.

All the injuries in the patient were identified and each individual injury was recorded under various body regions. Only apparent anatomical injuries were noted without taking into consideration the pure clinical diagnosis as specified by the AIS. Also included were the injuries confirmed by radiological investigations including x-rays, ultrasonography and CT scan and operative findings.[5,6]

The injuries in the region of head and neck were described on the basis of either anatomical disruption or the level of consciousness. In the Thoracic injuries besides anatomical injuries, the presence or absence of haemothorax, pneumothorax or both was an important factor.

After giving numerical codes to various injuries, the highest score in each body region was taken. Out of these only three highest scoring injuries in three different body regions were picked up and were squared.

Thus the ISS was calculated according to definition i.e. "the sum of the squares of the highest AIS grades in each of the three most severely injured cases."[7]

The outcome of patients was recorded as discharged alive or dead and also the date of discharge or date of death was noted to calculate the total hospital stay for alive and dead patients. The patients were studied for distribution of various injuries according to age, sex, body region, and type of injury, mode of injury and presence or absence of any prehospital treatment.[8]

For assessment of predicting mortality both scoring systems were subjected to ROC analysis to obtain cut off and they are as follows:

RTS => 3.9 ~ 4
ISS => 24.5 ~ 25

Sensitivity and specificity were calculated for the above mentioned cut offs.

$$\text{Sensitivity} = \frac{\text{True Positive}}{\text{True Positive + False Negative}}$$

$$\text{Specificity} = \frac{\text{True Negative}}{\text{False Positive + True Negative}}$$

The patients were treated as per their requirement and were discharged once recovery was complete.

RESULTS

The total number of patients of trauma was 1980, but as 455 patients were referred to Superspeciality Hospital, their further follow-up regarding outcome was not available hence they were excluded from the study. A total number of 1525 patients were included in the study. The detail examination was done and findings were recorded on standard proforma.

Age

Age of the patient ranged between 1yr to >60 years. It was observed that majority of patients were in the age group of 16-30 yrs followed by patients between 31-45 yrs of age (Table 2).

Table 2: Age.

Age (years)	Number of patients	Percentage
1-15	190	12.5%
16-30	552	362%
31-45	456	29.9%
46-60	188	12.3%
> 60	139	9.1%
Total	1525	100.0%

In present study it was seen that mortality was maximum in elderly age group i.e. > 60 years of age (Table 3).

Table 3: Age and mortality.

Age in years	Alive patients	Dead patients	% Mortality
1 – 15	186	4	2.1
16 – 30	525	24	4.3
31 – 45	424	32	7.0
46 – 60	171	17	9
> 60	123	16	11.5

Table 4: Sex distribution .

Sex	Number of patients	Percentage
Male	1201	78.8%
Female	324	21.2%
Total	1525	100.0%

Sex

Males outnumbered females as was observed in this study (Table 4).

When sex of patient was plotted against mortality, males showed predominance (6.3%) as compared to females (5.2%).

Body part

It was observed that maximum number of patients' sustained injury to head (55%) followed by superficial injuries (16%), chest (11%), abdomen (9%) and 8% patients sustained polytrauma.

It was observed that maximum mortality occurred in patients sustaining polytrauma i.e. injury to more than one body parts (22.8%) (Table 5).

Table 5: Parts and mortality.

Body part injured	Alive patients	Dead patients	% Mortality
Chest	154	5	3
Abdomen	141	10	6.6
Head injury	788	43	5.2
Polytrauma	98	24	22.8
Superficial injury	246	6	2.4

While mortality in remaining group was almost equal with abdominal injury 6% then head injury (5%), chest injury (3%) and last was superficial injury (2.4%).

Mechanism and type of injury

It was observed that 75% of patients sustained injuries due to vehicular accidents, 15% were non-vehicular (including accidental fall from height, etc.) and 10% were due to physical assault.

It was observed that Blunt trauma was the leading cause of injury (84%) followed by penetrating injury (15%) and crushes injury (1%).

Pre- hospital Treatment: It was observed that 79% of patients received no pre-hospital treatment at all, 20% of patients received preliminary treatment in form of IV fluids, dressing of injured parts, splintage of injured part and antibiotic shots while 0.7% patients received definite treatment i.e. who were referred from higher center for nursing care after definitive treatment.

It was observed that there was no mortality in the patients who received definite treatment while it was almost similar remaining patients who either received preliminary treatment or did not receive any treatment (Table 6).

Table 6: Pre-treatment and mortality.

Pre t/t	Status at discharge		Total	% mortality
	Alive	Dead		
Preliminary t/t	280 (94.0%)	18 (6.0%)	298	6.0
No t/t	1146 (93.9%)	75 (6.1%)	1221	6.1
Definite t/t	6	-	6	0
Total	1432	93	1525	

Revised trauma score

Revised trauma scoring was done in all the patients. It was observed that maximum patients had RTS values > 5 (Table 7).

When all scores were compared it was observed that maximum mortality was seen from RTS values 0 -2. According to ROC curve analysis the cut off score of 3.9 showed change in mortality rates. Score of > 4 onwards showed gradual decrease in mortality. Patients with score of 6-8 had mortality of only 1.6% whiles those patients with score <1 had mortality of 60%. With this it was inferred that there is an increase in mortality with decreasing RTS values and vice-versa. (Table 7) RTS was found to be 89% sensitive and 64% specific to detect death in trauma patients.

Table 7: RTS score and mortality.

RTS values	Status at discharge		Total patients (%)
	Alive patients (%)	Dead patients (%)	
< 1	8 (40)	12 (60)	20 (1.3)
1 - 2	26 (39.4)	40 (60.6)	66 (4.3)
3 - 5	242 (91.7)	22 (8.3)	264 (17.3)
6 - 8	1156 (98.40)	19 (1.6)	1175 (77)
Total	1432	93	1525

Table 8: ISS and mortality.

ISS values	Status at discharge		Total patient (%)
	Alive patients (%)	Dead patients (%)	
< 30	1006 (98.1)	20 (1.9)	1026(67.3)
31- 45	349 (91.8)	31 (8.2)	380(24.9)
46 - 60	55 (71.4)	22 (28.6)	77(5.0)
61 - 75	19 (54.3)	16 (45.7)	35(2.3)
> 75	3 (42.9)	4 (57.1)	7(0.5)
Total	1432	93	1525

Injury Severity Score: The relationship between % mortality and Injury Severity Score is shown in Table 8. As expected the % mortality rises with increasing severity score. In present study the injury severity score was divided in groups of 15 each. The number of patients was categorized in various groups with maximum patients having score < 30 (67.3). Later number of patients in each group with number of deaths was computed against each group. Mortality shows a steep increase from ISS > 45 onwards and was > 28.6%. Mortality increased to 46% in group 61-75 and 57% when score is >75. In present study lowest score was 3 while highest score was 86 (Table 8). ISS was 68% sensitive and 96% specific in detecting death in trauma patients.

DISCUSSION

During period of present study total Hospital admissions were 78,799 patients, Surgical admissions were 10,502 patients (14% of total admissions) and number of trauma patients were 1980 (3% of total admissions and 18% of surgery admissions) but as 455 patients were referred to Superspeciality Hospital, a total number of 1525 patients were included in the study.

Age and sex

Injuries due to accidents are larger killers in people in age group of 1- 34 yrs.[9] Study of data on host factors influencing mortality in trauma patients and found that age and gender influence mortality in trauma patients [10]. Study on geriatric population of United States observed that persons aged 65 yrs and older account for 27.9% of deaths due to accidental causes and have higher population based accident mortality rates than any other group.[11]

Increasing age puts a trauma patient into a high risk category and elderly patients sustaining major trauma are known to have high complication and mortality rate than their younger counterparts [12] Similarly in the present study the mortality was maximum in patients over 60 years of age (11.5%) followed by 9%in the patients between 46 yrs to 60 yrs of age.

Studies showed more male predominance with the most affected age group between 15 - 45 years.[13-16]

In the present study majority of patients were in young age group (16 – 45 yrs) and males were the most affected. About 2/3rd of patients belonged to age group 16 - 45 yrs and 3/4th of the patients were males.

Table 9: Age and sex.

	Zafar et al	Kuhls et al	Rabbani et al	Present study
Age (yrs)	15 - 55	20 - 55	15 - 55	16 - 45
Mean age	33 yrs	36.8 yrs	28 yrs	32.4 yrs
Males (%)	84.2	70	62	78.8
Females (%)	15.8	30	38	21.2

Mechanism of injury

Studies showed that amongst all injuries vehicular injuries were maximum.[13-15]

Most of the patients admitted with history of trauma were due to vehicular accidents (76%) followed by non-vehicular accidents i.e. fall (15.8%) and rest were due to assault (9.8%) as was seen in present study (Table 10).

Table 10: Mechanism of injury.

	Zafar et al	Kuhls et al	Rabbani et al	Present study
Vehicular injury	64.5%	79.7%	46%	74.5%
Nonvehicular injury	35%	20%	54%	25%

Type of injury

On studying patients according to the type of injury present study showed that majority of patients sustained blunt injury (84.8%) and 15% patients sustained penetrating injuries. Similar were the findings among other comparative studies showing more incidence of blunt injuries.[13-15] (Table 11).

Table 11: Type of injury.

	Zafar et al	Kuhls et al	Rabbani et al	Present study
Blunt injury	73%	86%	87%	84.8%
Penetrating injury	27%	14%	13%	15%

Site of injury

In the present study it was observed that out of the total admitted patients majority had injury to head (55%), followed by superficial injuries (16%), chest (11%), abdomen (10%) and 8% of patients sustained polytrauma. Number of patients with head injury was highest (55%) This could be because of the unpredictable nature of head injuries and referral of large number of patients by rural and general hospitals of nearby areas. Comparative study of 33,000 patients showed that maximum patients had external injury (30.8%) head injury was in 19% patients.[17] (Table 12).

Table 12: Site of injury.

	Head	Thorax	Abdomen	Extremity
Copes et al	19%	12.5%	7.7%	30.8%
Present study	54.5%	10.8%	9.9%	16.5%

Head injury patients in present study were 52% but mortality was only 5.2% while polytrauma patients were 8% of total patients but mortality was 22.8%. Study analyzed data of major trauma outcome studies of 47,000 trauma patients and concluded that maximum mortality was in patients who had head and neck injuries.[16]

Thus patients with injuries to more sites over the body have higher mortality than the patients who have one or two sites of injury (Table 13).

Table 13: Body part injured and mortality.

Body part injured	% mortality	
	Copes et al	Present study
Head and neck	17.2	5.2
Thorax	6.1	3
Abdomen	10.5	6.6

Pre- hospital treatment

In present study 304 patients received pre-hospital treatment before admission to Kasturba Hospital, Sewagram, out of which 6 patients received definite treatment and remaining 1221 (80%) received no treatment before admission to the hospital. It was observed that there was no mortality in the patients who receive definite treatment and it was almost similar in remaining patients who either received preliminary treatment or who did not receive any treatment at all (6% each).Preliminary treatment was in form of first aid measures like Intra-venous fluids, splintage of injured parts and simple occlusion dressing.

Study on the effect of pre- hospital fluids on 6855 patients observed an overall mortality rate of 37.3% in those who received pre- hospital fluids and concluded that this type of treatment does not affect the outcome. They suggested that this treatment should not be given at the expense of rapid transportation of patient to hospital for definitive treatment. Hence it can be said that there is no change in mortality statistics whether the patient receives pre-hospital treatment or does not receive it.[18] (Table 14).

Table 14: Pre-hospital treatment.

	Kawaski et al	Present study
% Mortality in pre-treatment	37.3	6.0
% Mortality in no-treatment	38	6.1

Revised trauma score

The mortality of patient rises sharply with decreasing trauma scores (61%) i.e. the group where score was between 1- 2, while at higher values of RTS the mortality

rates decreased regularly. Score of 4 onwards showed gradual decrease in mortality.

On evaluating RTS as pre ROC curve analysis in the present study with optimum cut off of 4 sensitivity of the scoring system was 89% & specificity was 64%. Positive likelihood ratio was 2.47. This indicated that RTS is 2.47 times better in performance to assess the outcome i.e. mortality as per present study. Similar were the observations of other studies showed sensitivity 59% and 42% and specificity 82% and 96% respectively.[14,19] (Table 15).

Table 15: Revised trauma score.

	Kuhls et al	Fedakar et al	Present study
Sensitivity	59%	42%	89%
Specificity	82%	96%	64%

Injury severity score

This relationship was first studied by Baker et al who proposed this index of severity.[9] Later it was supported by other authors. In present study it was observed that the mortality rate steadily increased with increasing value of ISS. Maximum mortality was seen with ISS values > 75.

In present study it was found to be 24.5 (app. 25). Patients with ISS score > 25 showed gradual increase in mortality while below this score mortality was very less. Other study of 627 trauma patients observed that the sensitivity of ISS was 79.6% while specificity was 93.6% and positive likelihood ratio was 8.22.[19,20] (Table 16).

Table 16: Injury severity score.

	Fedakar et al	Present study
Sensitivity	79.6%	68%
Specificity	93.6%	96%

Thus to summarize:

- Out of the total number of patients majority of patients were in age group of 16 – 30 yrs followed by patients between 31 – 45 yrs of age. Only 12.5% of patients were less than 15 yrs of age and 9.5% of patients were more than 60 yrs of age. Mortality increases with advancing age (11.5% in age > 60 yrs, as compared to 2.1% in 1 – 15 yrs of age group).
- Maximum number of patients (71.8%) were males rest of patients were female (21.2%) with males showing predominance (6.3%) in mortality as compared to females (5.2%).
- It was observed that 75% of patients sustained trauma due to vehicular accidents while other sustaining injury due to non-vehicular accidents and physical assault (15 and 10% respectively).
- In the present study it was seen that maximum number of patients had blunt trauma (84.8%) followed by penetrating trauma (14.5%) and rest had crush injury.
- It was observed that maximum number of patients had head injuries (54.5%) followed by patients who had superficial injury (16.5%), chest injury (10.8%), abdominal injury (9.9%) while only 8% patients sustained polytrauma. Mortality was maximum in polytrauma patients (22.8%) followed by patients with abdominal trauma (6.6%) and lowest in patients with superficial injury (2.4%).
- Out of the total number of patients (1525) include in the study 80.1% patients does not receive any pre-hospital treatment. While patients who received definitive treatment was < 1%. Only 19.5% patients received preliminary treatment. It was observed that no mortality in the patients who receive definite treatment and it was almost similar in remaining patients who either received preliminary treatment or who did not receive any treatment at all (6% each).
- Overall mortality in the present study group was 6.09%.
- Maximum number of patients in study group had Revised Trauma Score of >6 (77%) and mortality in these patients was 1.6%. The mortality increased as the Revised Trauma Score decreased (score of 3 – 5 was 83%, score of 1 – 2 was 60 % and score of < 1 was 60%).
- When Injury Severity Score was applied maximum number of patients had Injury Severity Score of < 30 (67.3%) and mortality increased with increasing Injury Severity Score and vice versa (1.9% for score of <30 an 57.1% for score of >75).

CONCLUSIONS

Thus from the present study it can be concluded that:

- Trauma affects younger population more with a male predominance.
- Incidences of vehicular accidents are more than the non-vehicular accidents and other modes of trauma.
- Head injury was most common type of injury as observed in the present study.
- Advancing age and polytrauma were the main factors for high mortality.
- The mortality increased as the Revised Trauma Score decreased. While mortality increased with increasing Injury Severity Score and vice versa.

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