Cross-sectional Study

ANNALS OF MEDICINE & SURGERY

OPEN

Pattern of admission, outcome and predictors of trauma patients visiting the surgical emergency department in comprehensive specialized hospital: a retrospective follow-up study

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Background: Traumatic injuries represent a huge burden in the developing world, and a significant proportion has found in low-income and middle-income countries. However, the pattern, outcome and factors of injury varies from setup to setup and is less studied in public health problems.

Objective: To assess pattern of admission, outcome and its predictors among trauma patients visiting the surgical emergency department in a comprehensive specialized hospital.

Methods: A retrospective follow-up study was conducted, and data were taken from the medical records of patients from 2019 to 2021. A simple random sampling technique was used to get a sample size of 386 from injured patient charts. Data were entered into Epi-Data version 4.6 software and exported to STATA version 14.1 for analysis. The dependent variable was injured patient's outcome , which could be died or not died. The independent variables with *P* value less than 0.25 in the bi-variable regression analysis were considered for the multivariable regression. Adjusted odds ratio (AOR) with the 95% CI were used to declare statistical significance.

Result: About 13.99% of injured patients with (95% CI: 10, 17) had died during the study period. The leading cause of injury was assault (62.44%) followed by road traffic accidents (26.17%). Severe Glasgow Coma Scale (AOR 6.6; 95% CI: 2.6–16.4), length of hospital stay more than or equal to 7 days (AOR = 2.8; 95% CI: 1.2–6.2), time of arrival in between 1 and 24 h (AOR = 0.15; 95% CI: 0.06–0.37), and upper trunk injury (AOR = 6.3; 95% CI: 1.3–28.5) were significantly associated with mortality.

Conclusion and recommendation: Mortality after traumatic injury was considerably high. Severe Glasgow Coma Scale, Length of hospital stay more than or equal to 7 days, time of arrival in between 1 and 24 h, and upper trunk injury were the associated factors for mortality. Priority should be given for injured patients with decreased levels of consciousness and upper trunk injury. The establishment of organized pre-hospital emergency services and provision of timely arrival is recommended. The authors recommend prospective follow-up study.

Keywords: damage, emergency, injury, mortality, trauma

Introduction

The WHO defines injury as the damage caused by physical, thermal, chemical and radiant that exceeds the physiological threshold of the body. Injury may be associated with transport, work, violence, recreation, sports and the home situation[1].

HIGHLIGHTS

- The mortality of patients after traumatic injury was considerably high.
- Length of hospitalization, time of arrival at hospital, and types of injury were the factors.
- Patients with decreased consciousness levels and upper trunk injury should be prioritized.
- Establishment of pre-hospital services is recommended.

Traumatic injury is among the leading causes of mortality and morbidity worldwide[2–4].

The global burden of all types of injuries has been increasing, with 9% of deaths attributable to it, resulting in substantial consequences and disability. About 16 000 people die due to injuries every day all over the world. But, the proportion of injury is higher in low-income and middle-income counties[5]. Especially in sub-Saharan Africa, injury-related mortality and morbidity are very high and from which road traffic injury is the leading cause[6–8].

Children aged 1–9 years are more vulnerable to fire-related deaths than older children and adults[9]. On the other hand,

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Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

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Annals of Medicine & Surgery (2024) 86:3281–3287

Received 6 February 2024; Accepted 14 April 2024

Published online 1 May 2024

http://dx.doi.org/10.1097/MS9.0000000000002109

regardless of the age, fall-related injuries accounted for more than half[10]. A study had also revealed that males and young adults aged below 40 years were the most vulnerable groups to sustain varied categories of injuries[11].

The main reason for this high burden of injuries can be a lack of organized efforts for applying prevention and emergency treatment strategies in resource-limited settings[12]. Surgery and anaesthesia for trauma victims are common, and should be equipped with emergency care services[13]. The majority of Emergency Department (ED) visits are unplanned, and patients visiting the ED may encounter several challenges, including overcrowding, inadequate communication, lack of empathy, poor pain control, uncomfortable environment, and insufficient manpower, especially in low-income and middle-income countries[14,15].

The English National Health Service reported a high magnitude of emergency department admissions and the cost of delivering emergency service is also becoming higher. Even though the economic burden of emergency care for injured patients is expected to be substantial, there is no organized data available in Ethiopia[16]. For the improvements of ED service delivery, the presence of efficient organizations, availability of appropriately trained healthcare staff, presence of facilities or resilience capacity, and continuous quality improvement mechanisms are imperative[15,17,18]. The aim of this study was to assess pattern, outcome and its associated factors of injury among trauma patients visiting the emergency department, which may help to improve the emergency department service delivery.

Methods

Study area

This study was conducted in the surgical emergency department of comprehensive specialized hospital. The hospital provides healthcare to around 6 million people coming from Regional State and partly from neighbouring regions. It has nearly 1500 beds in different wards. About 500 patients daily visit the hospital, of whom around 10 visit due to injury per day.

Study design and period

A retrospective follow-up study was conducted on patients who sustained traumatic injuries and visited the surgical emergency department from 9 January 2019 to 8 January 2021. The ethical approval was obtained from the institutional ethical review board with reference number of 689/6/21. The article has been registered with the UIN of the research registry, and it has been reported in line with the STROCSS 2021criteria[19].

Source and study population

Source population

All trauma patients who visited the surgical emergency department of Comprehensive Specialized Hospital.

Study population

All trauma patients who visited the surgical emergency department of Comprehensive Specialized Hospital during the study period.

Eligibility

Inclusion criteria

All trauma patients' charts with complete dependent and independent variables information (Fig. 1).

Exclusion criteria

Patients who were referred to other centres after admission, patients who discontinued the hospital service, and patients' charts with missed variables (Fig. 1).

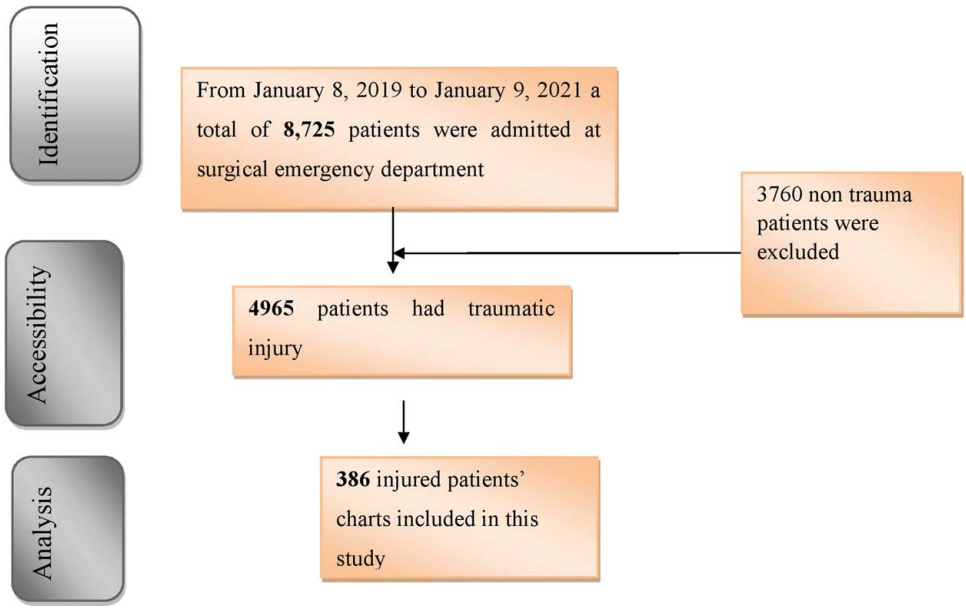

Figure 1. Inclusion/exclusion algorithm and make up of study sample of patients visited surgical Emergency Department ($N = 386$).

Variables of the studies

Dependent variable

The patient outcome that could be died or not died.

Independent variables

Socio-demographic variables: age, sex, and place of residency.

Other variables: mechanism of injury, types of injury, Glasgow Coma Scale, time to arrive at the institution, mode of transportation, surgery done, and length of hospital stay.

Operational definitions

Pattern: A characteristics of an object causing injury on the body, or by contact of the body with a surface or individualization of a particular injury to a particular body part[20,21].

Injury: is the physical damage that results when a human body is suddenly or briefly subjected to intolerable levels of energy[22].

Outcome after injury: the intent of the injury that results on the victim either not died or died[23–25].

Trauma: is an injury to a person caused by an extrinsic agent, a disordered behavioural state, physical injury and an emotional upset[26].

Glasgow comma scale (GCS): is a technique of measuring the level of consciousness that is GCS of 13–15 (mild), GCS of 9–12 (moderate), and GCS of less than or equal to 8 (sever).

Sample size determination and sampling technique

Sample size determination

The required sample size was calculated using a single proportion formula to obtain the sample size needed to estimate the prevalence of injury. It was taken from a previous study[2].

$P = 0.494$, CI = 95% and margin of error (d) = 5%. Hence, the sample size for the study was calculated as:

$$n = \frac{(z\propto/2)2pq}{d^2}$$

Where:

n = is the desired sample size; z = is standard normal distribution usually set as 1.96 (corresponds to 95% confidence level); P = proportion of injury among emergency patients (49.4%, 0.494), q which is 1 – 0.494 = 0.506 and d = degree of accuracy desired [margin of error is 5% (0.05)].

Based on the above assumptions a total of 386 injured patients that visited the surgical emergency department was required.

Sampling technique

The required sample size was obtained by using a simple random sampling technique. Records of all injured patients within the specified 2 years period were identified from the trauma database or logbook according to their entry time, and each record for our study using computer random number generated till the required sample size was obtained.

Data collection procedure

A structured questionnaire adapted from WHO injury surveillance and validated for low and middle-income countries was used to collect the information.

The questionnaire consists of socio-demographic data (age, sex, and place of residence), injury mechanism, interval time from injury to admission, systolic blood pressure (SBP), diastolic blood pressure (DBP), pulse rate (PR), respiratory rate (RR), type, mechanism of injury, Glasgow Coma Scale (GCS), length of stay (LOS), and patient status on discharge.

Data quality management

A pretested and structured checklist was used to retrieve the data from hospital records. Data were collected from the patients' charts about injury and possible factors. Data on basic socio-demographics and types of injury were collected from each individual's chart. Data collectors were given training on the content of the checklist. The data extraction checklist was pretested on 20 patients' charts, and modifications were made accordingly. The supervisor rechecked the checklist daily and submitted to the principal investigator to maintain data quality.

Data processing and analysis

After checking the data for completeness and consistency, it was coded to its short form and entered using epi-data version 4.6, and transferred to STATA version 14.1 statistical software for analysis. Normality tests were checked by using the Shapiro-Wilk test with P value of greater than 0.05. Multi-collinearity was also checked using the variance inflation factor (VIF) that was less than 10%. The data were presented with frequency and percentage. A cross-tabulation with independent variables were performed. To identify associated factors, binary logistic regression model was used, and model fitness was assessed using Hosmer–Lemeshow test. Variables with P value less than 0.25 in the bivariable binary logistic regression analysis were considered for the multivariable logistic regression analysis. In the multivariable logistic regression analysis, the Adjusted odds ratio (AOR) with 95% CI were used to show the strength of association between the dependent and independent variables. Finally, P value less than 0.05 at 95% CI has been considered as statistically significant.

Results

A total of 8725 patients visited the surgical emergency department of the hospital during the study period, of whom 4965 patients were trauma cases. Three hundred and eighty-six cases were included. The rest have been referred to other centres after admission, discontinued the hospital service and patients' charts with missed variables.

Socio-demographic characteristics

The median age of study participants was 28 years [interquartile range (IQR) 20–39). About 81.09% (313) of trauma victims were male, and male to female ratio was 4:1. The majority of the cases experiencing trauma were rural dwellers 61.66% (238) compared to urban residents who were 38.34% (148) (Table 1).

Mechanism of injury

In this study, the overall prevalence of trauma was 56.9%. The assault was the most common mechanism of injury, accounting for 62.44% (241 cases), followed by road traffic accidents at

Table 1

Socio-demographic and outcome of participants visiting surgical emergency department from 9 January 2019 to 8 January 2021 (*N* = 386).

Variable	Category	Frequency (percentage), *N* (%)	Patient outcome	
			Not died	Died
Age in years	< 20	74 (19.17)	59	15
	20–40	216 (55.96)	188	28
	> 40	96 (24.87)	85	11
Sex	Male	313 (81.09)	266	47
	Female	73 (18.91)	66	7
Residence	Rural	238 (61.66)	204	34
	Urban	148 (38.34)	128	20

26.17% (101), whereas burn injury was the lowest mechanism of injury, 2.07% (9) (Fig. 2).

The most frequent type of injury was head injury which is about 32.38% (125), followed by multiple-trauma 24.61% (95), and lower extremity trauma 18.39% (71) (Fig. 3).

Outcomes of injury

In this study, there were 13.99% (95% CI: 10, 17) deaths among the included samples visiting the Surgical Emergency Department. Mortality was more prevalent in the 20–40 age group 51.8% (28), and among males 87% (47). There were more deaths among rural dwellers 14.28% (34) compared to the one who lived in urban areas 13.5% (20) (Table 1).

Assault was the commonest cause of death 15.35% (37), followed by road traffic accident 13.86% (14), and no death was found in burn patients. Head and face injury was responsible for the majority of deaths, 15.7% (20), followed by Multiple-trauma, 10.5% (10). The mortality of the cases with lower GCS score at admission was very high. The mortality of cases that arrived in health institutions after 1 h was very high (Table 2).

Overall outcome of injury

Of 386 injured patients, about 13.99% with (95% CI: 10–17) had died (Fig. 4).

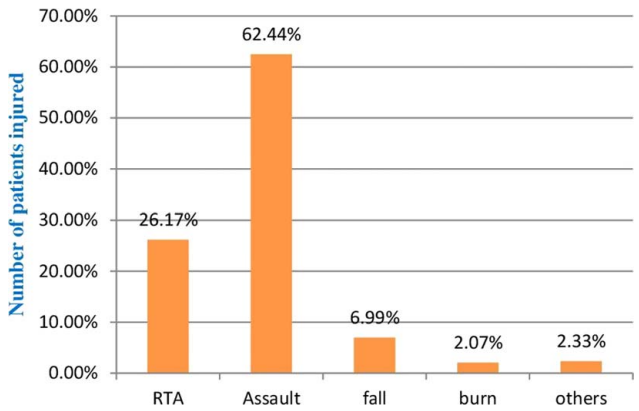

Figure 2. Mechanism of injury of patients visiting surgical Emergency Department from 8 January 2019 to 9 January 2021, Northwest Ethiopia (*N* = 386).

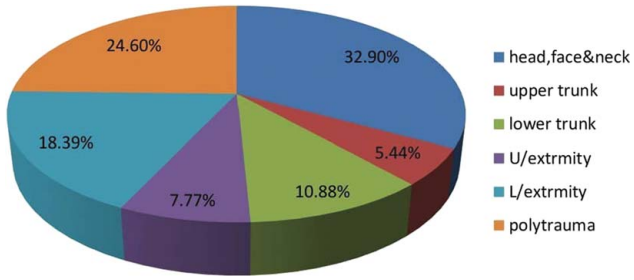

Figure 3. Percentage of types of injury of patients visiting surgical Emergency Department from 8 January 2019 to 9 January 2021, Northwest Ethiopia (*N* = 386).

Associated factors for outcome of injury

Glasgow Coma Scale, length of hospitalization, time of arrival at hospital, and types of injury were found to be significantly associated variables of patient death in multivariable logistic regression analysis with *P* value less than 0.05.

The odds of mortality among patients with severe GCS levels were 6.6 times [AOR = 6.6, 95% CI; (2.6, 16.4)] higher compared to those with GCS levels of mild and moderate. Being admitted for

Table 2

Cause and outcomes of trauma patients visiting surgical emergency department from 8 January 2019 to 9 January 2021 (*N* = 386).

Variable	Category	Outcome		Number (%)
		Not died	Died	
Mechanism of injury	Assault	204	37	241 (62.45)
	RTA	87	14	101 (26.16)
	Fall	25	2	27 (6.99)
	Burn	8	0	8 (2.07)
	Others	8	1	9 (2.33)
Types of injury	Head	107	20	127 (32.9)
	Upper trunk	16	5	21 (5.44)
	Lower trunk and pelvis	35	7	42 (10.88)
	Upper extremity	25	5	30 (7.77)
	Lower extremity	64	7	71 (18.4)
	Multiple-trauma	85	10	95 (24.61)
Glasgow Coma Scale	GCS (13–15)	289	28	317 (82.12)
	GCS (9–12)	17	8	25 (6.47)
	GCS (≤ 8)	26	18	44 (11.4)
Pulse rate	Bradycardia(< 60 bpm)	5	1	6 (1.55)
	Normal (60–100 bpm)	264	20	284 (73.57)
	Tachycardia (> 100 bpm)	93	3	96 (24.87)
Time to arrive institution	Immediate (< 1 h)	45	13	58 (15.02)
	Within hours (1–24 h)	260	19	279 (72.27)
	Within days (> 24 h)	27	22	49 (12.7)
Mode of transportation	Ambulance	128	9	137 (35.49)
	Bajaj	103	8	111 (28.75)
	Taxi	87	5	92 (23.83)
	Others	13	2	15 (3.9)
Operated	Yes	216	30	246 (63.73)
	No	116	24	140 (36.26)
Hospitalization	< 7 days	205	21	226 (58.54)
	≥ 7 days	126	33	159 (41.19)

GCS, Glasgow Coma Scale; RTA, Road traffic accident.

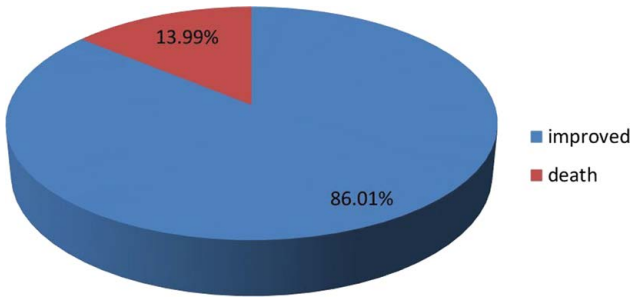

Figure 4. Outcome of injury among trauma patients who visited surgical Emergency Department from 8 January 2019 to 9 January 2021, Northwest Ethiopia (*N* = 386).

more than or equal to 7 days in hospital was 2.8 times [AOR = 2.8, 95% CI; (1.2, 6.2)] more likely to predict mortality compared to those admitted for 1-6 days. Patients who arrived at the hospital within 24 hours after injury were 85% [AOR = 0.15, 95% CI; (0.06–0.37)] less likely to predict mortality compared to those arrived after 24 h of injury. In addition, the region of the body which is affected by trauma was a significant predictor for injury outcome. Patients who sustained upper trunk injury had 6.3 times higher odds of mortality compared to those experienced other site injury [AOR = 6.3, 95% CI; (1.3–28.5)] (Table 3).

Discussion

Traumatic injury is a major problem in hospitals in Ethiopia with severe and wide-ranging consequences for the entire society. Therefore, the aim of this study was to assess pattern, outcome and its predictors among trauma patients visiting the surgical emergency department.

We found ~56.9% injury, which is comparable with a study conducted in Rwanda (57.2%). On the other hand, the finding was higher than a study conducted in Yirgalem (49%), Dilla (46.6%) and Tikur Anbesa hospitals (32%), respectively[2,23,27,28]. This discrepancy might be due to the war in the northern part of the country and the increasing poor conflict resolution methods in our study area. However, the prevalence of injury in the Western Cape Province of South Africa was threefold lower than our study(17.1%) and this could possibly be due to better political stability and good governance system of the country[29].

This study revealed that male gender, young age group, and 20–40 age groups were the most commonly injured ones and this can be justified by the fact that most of economic activities are done by young male dwellers when compared to their female counterparts. This finding is consistent with findings of WHO injury and violence surveillance facts and other studies conducted in sub-Saharan countries[7,8,23,29].

In this study, patients from rural areas are more affected by injury as compared to urban area residents and this finding is comparable with a study done in Dilla and Yirgalem. This is explaining that more hazardous types of occupations and other economic activities are done to sustain life in rural areas[2,23].

Interpersonal violence was the commonest mechanism of injury (62.44%), followed by road traffic accidents (26.17%), which is comparable with findings of sub-Saharan African countries and WHO reports[4,7,8]. In this study, head, face and neck injuries were the most common type of injury like other studies conducted in Africa[30–32].

Table 3

Bi-variable and multivariable logistic regression for predictors with outcomes of injury from 8 January 2019 to 9 January 2021 (*N* = 386).

		Outcome					
Variable	**Category**	**Not died**	**Dead**	**COR (95% CI)**	***P***	**AOR (95% CI)**	***P***
Age in year	< 20	59	15	1.96 (0.8–4.5)	0.11	2.3 (0.7–6.7)	0.12
	20–40	188	28	1.15 (0.5–2.4)	0.7	1.1 (0.4–2.9)	0.77
	> 40	85	11	1.00		1.00	
Sex	Male	266	47	1.6 (0.7–3.8)	0.2	1.2 (0.4–3.5)	0.6
	Female	66	7	1.00		1.00	
Time of arrival in hour	< 1	45	13	0.35 (0.15–0.8)	0.01	0.79 (0.26–2.37)	0.68
	1–24	260	19	0.08 (0.04–.18)	0.000	0.15 (0.06–0.37)	0.000
	> 24	27	22	1.00		1.00	
Length of hospitalization in day	< 7 days	205	21	1.00		1.00	
	≥ 7 days	126	33	2.5 (1.4–4.6)	0.002	2.8 (1.2–6.2)	0.009
Operated on	Yes	216	30	1.4 (0.8–2.6)	0.18	1.8 (0.8–4)	0.1
	No	116	24	1.00			
Types of injury	Head	107	20	1.7 (0.6–4.2)	0.25	1.2 (0.4–3.9)	0.6
	U/trunk	16	5	2.8 (0.8–10)	0.1	6.3 (1.3–28.5)	0.01
	L/trunk	35	7	1.8 (0.5–5.6)	0.29	3.1 (0.8–11.6)	0.08
	U/extremity	25	5	1.8 (0.5–6.3)	0.33	2.1 (0.5–9.4)	0.29
	L/extremity	64	7	1.00		1.00	
	Multiple-trauma	85	10	1 (0.39–2.9)	0.88	0.8 (0.2–2.9)	0.8
SBP	Hypotensive	40	10	1.6 (0.7–3.5)	0.19	0.7 (0.2–1.9)	0.53
	Normotensive	292	44	1.00		1.00	
GCS	Mild	289	28	1.00		1.00	
	Moderate	17	8	4.8 (1.9–12.5)	0.001	3.7 (1.1–12.1)	0.02
	Severe	26	18	7.14 (3.4–14.6)	0.000	6.6 (2.6–16.4)	0.000

1.00: reference; AOR, adjusted odds ratio; COR, crud odds ratio; GCS, Glasgow Coma Scale; SBP, systolic blood pressure.

The study showed that the incidence of death was high (13.99%) compared to a similar study conducted in Dilla (Southern Ethiopia) (6%), Rwanda(5.5%), China(2.53%), Nigeria (9.2%), and Lagos (10.1%)[24,27,32–34]. This difference might be explained by the difference in the type and severity of injury and a large number of patients admitted in our study area, which can compromise the quality of care delivered to severely injured emergency patients.

This study also showed that patients who arrived within 24 h 'after injury were less likely to die compared to patients who arrived after 24 h. This finding is consistent with studies conducted in Tanzania, which showed that those who arrived after 24 h had an increased risk of death[25]. This can be due to a lack of access to healthcare facilities and organized ambulance services in remote areas since most of our study participants were rural area inhabitants.

Our study revealed that the duration of hospitalization greater than 7 days were 2.8 times more likely to predict mortality. This finding is in line with a study in Tanzania, Iran and Dilla, Ethiopia, in which patients who had hospitalization of greater than 7 days were more likely to die[23,25,34]. A study conducted in China has also found that prolonged hospital stay is independently associated with an increased risk of hospital mortality[35]. This can give a very important implication that patients who stay longer in the hospital are vulnerable to hospital-acquired infection, insufficient diet, complications related to immobilization, which can significantly increase the burden of mortality in trauma patients. However, patients with prolonged at the emergency department had better outcomes[36]. This discrepancy may be due to the difference in the study population that patients were seriously injured and required definitive emergency care in the previous study.

Our study showed that patients having severe GCS level has 6.6 times more likely to cause mortality. This finding is comparable with the other study[23].

Patients with upper trunk injury were six times more likely to die when compared to lower extremity injury. This might be due to the upper trunk consists of vital organs of the body like heart and lung, and if these organs are involved patients will die of severe bleeding, pain and hypoxia, which lead to irreversible complications and death.

Strength and limitations

We believe that our study adds significant contribution as a source of information and reliable data for the outcome and its predictors for trauma patients. However, we have used the retrospective data having lack of organized and easily available trauma registry and incomplete patient chart variables.

Conclusion

The mortality of patients after traumatic injury was considerably high in the surgical emergency department. Severe GCS, length of hospital stay more than or equal to 7days, time of arrival in between 1 and 24 h, and upper trunk injury were the associated factors for mortality.

Recommendations

During emergency service deliver, priority should be given to injured patients with decreased level of consciousness and upper trunk injury. The establishment of organized pre-hospital emergency services and provision of a sustainable timely arrival through ambulance service with trained staff is recommended. We recommend prospective long-term follow-up study to determine the outcome of injury and its associated factors among trauma patients.

Ethical approval

Ethical approval for this study has been received from the institutional review board of School of medicine, College of medicine and health science, University of Gondar with reference number of 689/6/21. The ethics committee approved this study to not need consent from the study participants because of the retrospective nature of data and a support letter has been obtained from the medical director office of the hospital for retrieving retrospective data from the database and records. All the information was kept confidential, and no individual identifiers were collected. We certify that the study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Consent

Consent for publication: Written informed consent was obtained from the patient for publication and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Source of funding

Dilla University.

Author contribution

R.M. has done conceptualization, data curation, formal analysis, investigation, methodology. Y.A.N., D.Y.F., N.R.A. and B.A.T. have participated in approval of the title, analysis, result interpretation, supervision, edition and manuscript preparation.

Conflicts of interest disclosure

There was no conflict of interest.

Research registration unique identifying number (UIN)

Research registry
Unique Identifying number or registration ID: 9944
Hyperlink to your specific registration (must be publicly accessible and will be checked):: https://www.researchregistry.com/browse-the-registry#home/

Guarantor

Biresaw Ayen Tegegne.

Data availability statement

Data for this study are available on request.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Acknowledgements

The authors thank both University of Gondar and Dilla University for funding and providing necessary resources.

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