Research Article

Incidence of Morbidity and Mortality in Traumatized Adult Patients in Intensive Care Unit in Minia University Hospital

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Abstract

Background: Traumatic injury is a leading cause of morbidity and mortality worldwide, Admission to the ICU after traumatic injury is common and many of these patients will develop hospital course complications which are associated with significantly higher hospital mortality for ICU patients This study aim to evaluate feasibility, merits and demerits of laparoscopic splenectomy in cases of benign hematological disorders and benign non traumatic disorders of spleen in relatively straightforward cases in children. **Methods:** The study included 20 cases with different benign hematological and splenic disorders as candidates for splenectomy. **Results**: After obtaining approval from our hospital – El-Minia university hospital – ethics committee and obtaining written consent from the patient or responsible relative, in a period of six months, from 1st February, 2017 to 31st July, 2017 all trauma patients will be approached and enrolled in the study. **Conclusion**; the occurrence of morbidity and mortality in the adult patients admitted as a case of trauma and managed in intensive care unit, including an assessment of the risk factors for hospital complications and hospital mortality in this population

Key Words: Traumatic injury, morbidity, mortality and ICU

Introduction

Traumatic injury is a leading cause of morbidity and mortality worldwide, Admission to the ICU after traumatic injury is common and many of these patients will develop hospital course complications which are associated with significantly higher hospital mortality for ICU patients (Meghan Prin and Guohua, 2016)

Trauma includes intentional and unintentional injury from motor vehicle crashes, penetrating or blunt violence, falls, firearms, poisoning, and burns (Meghan Prin and Guohua, 2016)

Prolonged intensive care unit (ICU) stays for critical illness can result in acceptable mortality rates and quality of life despite significant costs (Adrian W Ong et al., 2009)

Advances in resuscitative management has increased the survival rate of patients with multiple injuries but has rendered them vulnerable to nosocomial infections and other complications during the course of their treatment in the hospital (Dr. Parul Mullick, Dr. Vandana Talwar, Dr. M. Pawar, 2014)

Evaluation of trauma care is an integral part of any system designed for care of seriously injured patients (Dr. Parul Mullick, Dr. Vandana Talwar, Dr. M. Pawar, 2014)

The timing and appropriateness of therapy administered to the trauma patient in the initial hours are likely to influence outcome both in the short- and long-term perspectives (Livingston DH, et al., 2012)

Improved prehospital and initial management in the trauma unit have contributed to a reduction in mortality for severely injured patients over the last decades, For patients surviving the initial period, much of the morbidity and complications occur in the intensive care unit (ICU) during the next phase of treatment (Vassar, et al., 2009)

Increasing knowledge and improved opportunities for monitoring ICU patients may have lowered the incidence of

morbidity and mortality after severe trauma, despite this; early and late complications as well as death are common among severely injured patients also at a later stage (O. BRATTSTROM, et al., 2010)
The development of these ICU related complications may be dependent on several mechanisms, In addition to severity of injury, factors involving pre-hospital and early intra-hospital management as well as patient characteristics may be important for the post-traumatic course (O. BRATTSTROM, et al., 2010)
Although trauma patients requiring prolonged ICU stays utilize many resources, the ultimate outcome may be fairly good (Goins WA, et al., 2011)

Subjects and Methods

After obtaining approval from our hospital – El-Minia university hospital – ethics committee and obtaining written consent from the patient or responsible relative, in a period of six months, from 1st February, 2017 to 31st July, 2017 all trauma patients will be approached and enrolled in the study

The minia university hospital is a tertiary hospital located in minia city present in north of Egypt with an ICU capacity of 16 beds and level I trauma center
The ICU admits patients from various specialties including medicine, surgery and obstetrics and gynecology, it is managed by consultant anesthetists, residents and doctors in the various specialties and manned by trained ICU nurses.
Data will be obtained from the ICU records and patient case files and from continuous follow up of the patients clinical course, these were prospectively reviewed.
Information obtained included the patients' demographics, diagnosis, etiology and mechanisms of trauma, trauma severity scores (Injury Severity Score (ISS), injury class (e.g., blunt versus penetrating), intention (assault, self-harm, unintentional, other), Emergency Room vital signs (e.g., blood pressure, Glasgow Coma Scale Score (GCS), preexisting clinical diagnoses, in-hospital diagnosis codes, and discharge status (mortality, discharge destination), any complications, interventions, outcomes and length of stay in the ICU, All patients were followed until discharge from ICU
Cases in whom there were missing data or without adequate records or close follow up were not included in the study

Preexisting comorbidities included coronary artery disease, congestive heart failure, hypertension, diabetes mellitus, cerebrovascular accident, peripheral vascular disease, pulmonary disease, chronic kidney disease, alcoholism, and a current smoking history
The frequency and types of complications were reported for all patients admitted to the ICU, complications were also reported by injury mechanism, Patients may have had more than one complication during the hospitalization, Glasgow Outcome Scale score was calculated on discharge and also clinical conditions on discharge were recorded
All patients were assigned an ISS and an APACHE II score at the time of admission
Inclusion criteria
Age: ≥ 18 to ≤ 65 years
Sex: male and female
Trauma cases including burn patients
Exclusion criteria
Patints less than 18 years or more than 65 years
Patients who were unable to complete the assessment tools
Patients with no relatives to sign the consent
Patients admitted to intensive care unit not due to trauma
Patients not expected to live more than 24 hours
Patients discharged from or died in the Emergency Room
Parameters to be assessed:
The admission characteristics, pre-existing conditions and acquired complications in the intensive care unit will be recorded
Patients will be assessed initially by the acute physiology and chronic health evaluation II score (APACHE II), the trauma score-injury severity score (TRISS) and the sequential organ failure assessment score (SOFA) and also any other score involved in a specific disease state
Patients will be followed up for the development of:

Morbidity as classified by body systems into:
Pulmonary
In the form of:
Hospital acquired pneumonia: Diagnosis is based on time of onset (>48 hours after admission to a healthcare facility), CXR changes (new or progressive infiltrates) and either clinical features and simple laboratory investigations or the results of quantitative microbiology. Using a clinical approach, pneumonia is diagnosed by the finding of a new infiltrate or a change in an infiltrate on chest radiograph and growth of pathogenic organisms from sputum plus one of the following: white-blood-cell (WBC) count greater than 12× l05/L, core temperature ≥38.3°C, sputum Gram stain with scores of more than two on a scale of four of poly-morpho-nuclear leucocytes and bacteria.

Ventilator associated pneumonia (VAP): VAP is typically suspected when a patient has new or progressive radiographic infiltrates and clinical findings suggesting infection, such as the new onset of fever, purulent sputum, leukocytosis, increased minute ventilation, and/or a decline in arterial oxygenation, Because interpretation of chest radiographs is difficult, particularly in patients with prior abnormalities, such as ARDS, it is also mandatory to consider the diagnosis of VAP in ventilated patients who clinically deteriorate, and/or in whom vasopressors should be increased to maintain blood pressure, even in the absence of a clear-cut progression of the radiographic abnormalities.
The need for mechanical ventilation
Acute respiratory distress syndrome: ARDS still refers to acut hypoxemic respiratory failure due to bilateral and diffuse alveolar damage, and is now classified as mild, moderate and severe based on the PaO2/FiO2 ratio, a minimum positive end-expiratory pressure (PEEP) of 5 cmH2O is specified and chest radiograph criteria and exclusion of hydrostatic edema clarified
Bronchospasm,
Lung collapse,
Pulmonary edema,
Pneumothorax,
Hydrothorax,
Tracheal Stenosis
cardio-vascular
In the form of:
Development of shock, diagnosed clinically by hypotension
Need for vasopressors or inotropes,
Occurrence of arrhythmias,
Ischemia,
Heart failure,
Pulmonary embolism,
Cardiac arrest,
Hypertension
Renal
In the form of:
Development of acute kidney injury (AKI): AKI describes a syndrome characterised by a rapid (hours to days) decrease in the kidney's ability to eliminate waste products such as urea and creatinine, Other typical clinical manifestations include decreased urine output, metabolic acidosis and hyperkalaemia.
Need for renal replacement therapy,
Polyuria: urine output more than 1 ml/kg/hr, a urine loss of >3 litres per day in an adult of normal mass or >2 L/m2 in children
Urinary tract infections,
Life threatening electrolytes imbalance
central nervous system
In the form of:
Development of encephalopathy and/or disturbed conscious level,
Coma: (from the Greek komas, or deep sleep) is a state of unresponsiveness in which the patient is incapable of arousing to external or internal stimuli (lack of alertness).
Delirium: The American Psychological Association's (APA) Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV describes delirium as a disturbance in consciousness and cognition that develops over a short period of time (eg, hours to days) and tends to fluctuate during the course of the day, Specifically, there are four criteria required to diagnose delirium: First; Disturbance of consciousness, with reduced awareness of the environment and impaired ability to focus, sustain or shift attention, Second; Altered cognition (eg, memory impairment, disorientation, or language disturbance) or the development of a perceptual disturbance (eg, delusion, hallucination, or illusion) that is not better accounted for by preexisting or

evolving dementia, Third; Disturbance develops over a short period of time (usually hours to days) and tends to fluctuate during the course of the day, Fourth; Evidence of an etiological cause, which the DSM-IV uses to classify delirium as Delirium Due to a General Medical Condition, Substance-Induced Delirium, Delirium Due to Multiple Etiologies, or Delirium Not Otherwise Specified.

Seizures,

Cerebero-vascular accidents including; cerebral ischemia and infarction, intracerebral hemorrhage, and subarachnoid hemorrhage

Central nervous system infections,

Diabetes insipidus: refers to a syndrome characterized by pathological polyuria, excessive thirst and polydipsia, The urine produced in DI is inappropriately dilute having both low specific gravity and low osmolality in the face of a high or normal plasma osmolality.

Any motor or sensory deficit

sepsis and septic shock, Sepsis is defined as an infection associated with a systemically activated inflammation response syndrome (SIRS), severe sepsis is defined as sepsis with multi-organ dysfunction and septic shock is defined as severe sepsis with hemodynamic instability despite fluids and vasoactive drugs

Abdominal in the form of: ileus, intestinal obstruction, intra-abdominal infections or hemorrhage, diarrhea, abdominal compartment syndrome which is defined by the World Congress on Abdominal Compartment Syndrome as sustained intra-abdominal hypertension (above 20 mm Hg; IAH) with attendant organ dysfunction.

Musculoskeletal in the form of: limb ischemia or gangrene, deep venous thrombosis, infections, decubitus ulcer

hematological in the form of: anemia, bleeding or thrombo-embolism

Hepatic in the form of: hepatitis, hepatic failure or decompensation, jaundice, ascites

Metabolic and Endocrine in the form of weight loss, malnutrition, hypo- or hyper-glycemia, hypo- or hyper-thyroidism, hypo-adrenalism

Miscellaneous in the form of: Exposure keratitis, Local wound infection, psychosis, spine fractures

Mortality

Each case of morbidity or mortality will be marked as iatrogenic or non-iatrogenic

All investigations, radiological scanning or procedures needed for evaluation, diagnosis and follow up of the patient will be done according to clinical status and the course of the patient illness and will be mentioned during the study

Statistical analysis

The collected data were coded, tabulated, and statistically analyzed using SPSS program (Statistical Package for Social Sciences) software version 19. Descriptive statistics were done for numerical data by mean, standard deviation and minimum& maximum of the range, while they were done for categorical data by number and percentage.

Results

There were 130 adult trauma patients admissions in the ICU during the six months period of study starting from first of February, 2017 to the last of July, 2017 and all these patients have been adequately recorded and analyzed.

The rate of adult trauma admissions was 42.34% of the total ICU admissions which was 307 cases

There were 106 (81.53 %) males and 24 (18.46 %) females with a male to female ratio of 4.41:1. The male to female ratio for the total ICU admissions during the same period was 2.23:1.

The age range was from 18 years to 65 years, ages more than 65 years and less than 18 years were excluded from the study

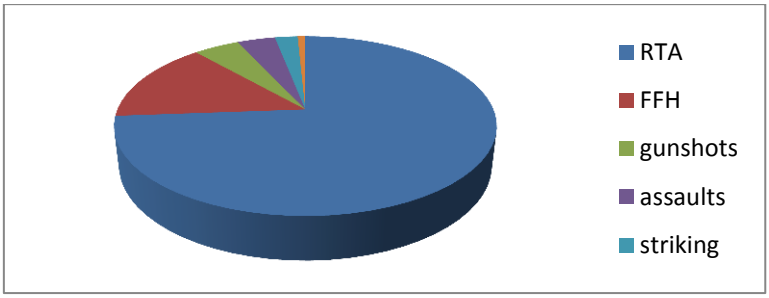
Of the total admissions 203 (66.12%) were from accident and emergency while 96 (31.27 %) were from the theatre and 8(2.60%) from the ward

The majority (86.5 %) of patients was admitted to the ICU after blunt trauma, and the majority of injuries were unintentional (95.6 %).

Demographic data	
Total ICU admissions	307
Males	212
Females	95
Total adult ICU admissions	209
Trauma admissions	203
Males	158
Females	45
Adult trauma admissions	130
Males	106
Females	24
Admissions from ER	203
Admissions from ward	8
Admissions from the theatre	96
Adult trauma admissions / Total ICU admissions	42.34%
Males / Adult trauma admissions	81.53%
Females / Adult trauma admissions	18.46%

The most common cause of injury in adults was road traffic accident (RTA) 96 cases (73.84%) followed by fall from height 19 cases (14.61%) then gunshots 6 cases (4.61%) then assaults from others 5 cases (3.84%) then striking by heavy objects 3 cases (2.30 %) and the least common cause of injury was burn 1case (0.76 %), no cases were admitted for drowning or near drowning or due to toxic causes (table)

Causes of trauma	Number of cases	Percentage of adult trauma
RTA	96	73.84
FFH	19	14.61
Gunshots	6	4.61
Assaults from others	5	3.84
Striking by heavy objects	3	2.30
Burn	1	0.76



The length of stay (LOS) was from 1 day to 23 days with a medium LOS of 8 days. Twelve patients (9.23%) had a LOS of less than two days, sixty seven (51.53%) of patients had a LOS of 3 to 7 days and fifty one (39.23%) of patients had a LOS of more than 7 days (Table).

Length of stay (in days)	Number of cases	Percentage of adult trauma
Less than 2 days	12	9.23
2 – 7 days	67	51.53
More than 7 days	51	39.23

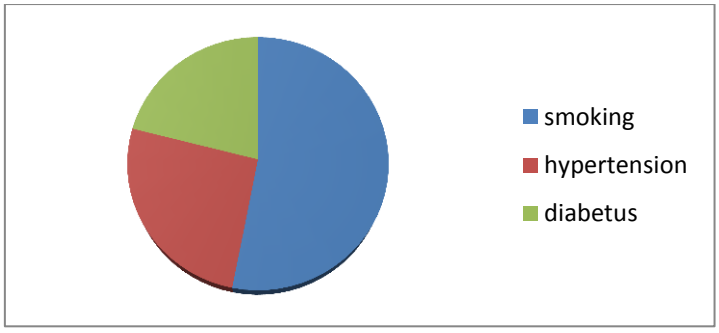
Of the 130 patients admitted, 58 died giving a mortality rate of 44.61% while 72 (55.38%) were transferred out of the ICU alive; Mortality rate in the ICU during the same period was 36.48%.

Outcomes	
Total mortality in ICU	112
Mortality / admissions	36.48%
Total trauma mortality	94
Trauma mortality / trauma admissions	46.30%
Total adult trauma mortality/ Adult trauma admissions	44.61%
Transferred a live (Adult trauma)	55.38%

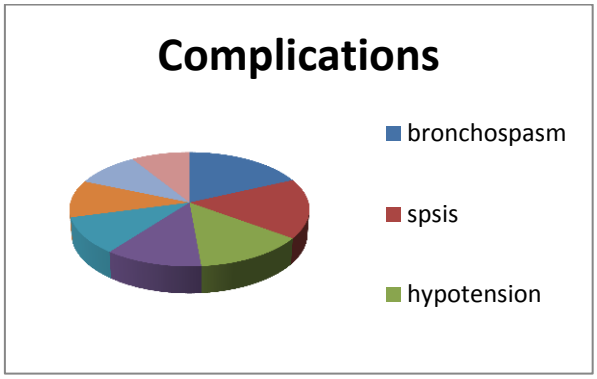
Of the deaths, 44.33% occurred in males but was not significantly different from the mortality in the female population

Mortality distribution	
Total cases of adult trauma males	106
Mortality in adult trauma males	47
Mortality in adult trauma males / Total cases of adult trauma males	44.33%
Total cases of adult trauma females	24
Mortality in adult trauma females	11
Mortality in adult trauma females / Total cases of adult trauma females	45.83%

The most common cause of deaths was head injury which contributed to 79.31% of total deaths in adult trauma, this is expected as the most common cause of admissions was road traffic accident and The most commonly injured body regions were the head (49.3 %) followed by extremities (45.0%), also, Severe traumatic brain injury (TBI) was present in 40 (41.66%) adult trauma patients due to road traffic accident The most common pre-existing comorbidities were a current smoking status (37.3%), hypertension (18.2%) and diabetes mellitus (14.8 %)



The most common hospital complications amongst adult trauma patients admitted in the ICU were bronchospasm (60%), sepsis (55.9%), hypotension (44.61%), pneumonia (38.9%), anemia (34.61%), thrombophlebitis (34.61%), electrolytes imbalance (32.4%), hyperglycemia (29.23%), and urinary tract infection (24.7%)



Factors which conferred the highest incidence for hospital complications in patients admitted to the ICU were mechanical ventilation, preexisting pulmonary disease and Injury Severity Score ≥ 16

Factors which increased the incidence of hospital mortality in patients admitted to the ICU included age over 60 years, mechanical ventilation, Injury Severity Score ≥21, Glasgow Coma Scale Score between 3 and 8, and hospital complications including in-hospital cardiac arrest.

Patients with increased LOS were significantly older, more severely injured, and had lower Glasgow Coma Scores (GCS) on admission and also had significantly higher incidences of pre-existing cardiac, renal, pulmonary conditions and diabetes mellitus

A modest positive correlation existed between injury severity score (ISS) and ICU LOS.

Male gender, ISS, or the presence of cardiopulmonary arrest, pneumonia, acute respiratory distress syndrome (ARDS), respiratory failure requiring intubation or re-intubation, urinary tract infection, deep vein thrombosis, arrhythmias, sepsis, or gastrointestinal bleed were found to be independent predictors of increased LOS

Of all adult trauma admissions, 63.32% of patients required ventilatory support, The average time spent on mechanical ventilators was 9 days, Infectious complications occurred in 92% and organ dysfunction was seen in 68 % of patients.

The incidence of cardiovascular complications was significantly more than respiratory complications in patients who stayed for less than 2 days in the ICU. However, no significant difference was found between the incidence of respiratory and cardiovascular complications in patients stayed more than 2 days.

The incidence of most common complications and its percentage to the number of adult trauma admissions is shown in the following table

Complications		Cases	Percentage
Respiratory	Pneumonia	50	38.9
	Bronchospasm	78	60
	Lung collapse	2	1.53
	Pulmonary edema	3	2.30
	Pneumothorax	6	4.61
	Hydrothorax	2	1.53
	Tracheal stenosis	1	0.76
	ARDS	3	2.30
	Reintubation	17	13.07
Cardiovascular	Anemia	45	34.61
	Hypotension	58	44.61
	Hypertension	16	12.30
	Arrhythmias	28	21.53
	Myocardial ischemia	2	1.53
	Heart failure	2	1.53
Renal	Urinary tract infection	32	24.7
	Renal failure	7	5.38
Gastrointestinal	Diarrhea	16	12.30
	Constipation	4	3.07
	Hematemesis	1	0.76
	Shock liver	13	10
Metabolic	Electrolyte imbalance	42	32.4
Endocrine	Hypoglycemia	22	16.92
	Hyperglycemia	38	29.23
	Hypoadrenalism	2	1.53
	Diabetes insipidus	7	5.38
	SIADH	4	3.07
Infectious	Thrombophlebitis	45	34.61
	Sepsis	43	55.9
Miscellaneous	Bed sores	11	8.46

The most common techniques and practices which lead to iatrogenic complications found were inadequate sedation and analgesia which leads to anxiety and distress, early weaning from mechanical ventilation which leads to high possibility of reintubation, poor fluid management which leads to edema, dehydration and electrolyte imbalance unjustified orders of investigations which leads to multiple punctures of the patients and increased costs and finally the unnecessary prescription of blood products

Iatrogenic technique	Complication
inadequate sedation and analgesia	Anxiety, distress
early weaning from mechanical ventilation	high possibility of reintubation
poor fluid management	edema, dehydration, electrolyte imbalance
unjustified orders of investigations	multiple punctures of the patients, increased costs, exhaustion of resources
unnecessary prescription of blood products	Increased costs, Complications of transfusions,exhaustion of resources

Conflict of interest: All authors declare that they have no conflict of interest.

Discussion

Advances in resuscitative management of trauma has resulted in an increased survival rate in patients, The use of invasive diagnostic and therapeutic procedures has however increased their susceptibility to infection through creation of multiple portals of entry for bacteria .1

In addition, trauma leads to a state of relative immunosuppression with decreased humoral and cell mediated immunity.[4,5,6]

Prolonged ICU stay further exposes the seriously injured to a multitude of problems like anaemia, inadequate nutrition and multiple transfusions.

This study describes the characteristics and outcomes for adult patients admitted to the ICU at Level 1 trauma hospitals after traumatic injury in minia university hospital minia city, Egypt

Patients were admitted to our ICU with varying severity of trauma, to objectively analyze the extent of trauma, we assigned an ISS to all the patients and correlated this with their duration of ICU stay and with the various complications that had occurred

We discovered trauma admission rate of 66.12% among ICU patients with an admission rate of adult traumatized patients among all ICU patients of 42.34%.

The most common cause of injuries was road traffic accident and the median length of stay was 7 days, Road traffic accidents are still an important public health problem in our environment

Trauma admission rates in general ICUs from previous studies vary considerably with reports ranging from 20% to 69% .

It is known that location of health facilities as regards proximity to major motor ways and the availability of other ICU capable of dealing with trauma patients usually influence the rate of trauma admissions in these facilities.

This may among other factors account for the sharp differences in the rates of trauma admissions in different ICUs.

The essential elements of a pre-hospital trauma care system for victims of accidental injury include, prompt communication and activation of the system, timely response of the system, correct assessment and efficient treatment, and prompt transport of injured people to a formal health-care facility when necessary[9]. When victims of trauma are cared for in this organized manner, mortality is reduced[10] , One of the key principles in trauma patient management is that of the 'golden hour' or 'golden period', This period is defined as the immediate time after injury when resuscitation and stabilization will be most beneficial to the patient[11] , As time passes following critical trauma, tissue hypoxia increases and the chance of survival or good post-survival prognosis decreases[12.13]

In our environment, considerable delay occurs due to inadequate ambulance services and also, as in some other parts of the developing world, injured people are usually cared for and transported to the hospital by relatives, untrained lay people or drivers of commercial vehicles[15.16.17] , Training specific target groups, such as drivers of commercial vehicles, soldiers, policemen, high school students and volunteers can improve pre-hospital trauma care

The male preponderance in our study like in most other studies is probably due to the fact that males are most likely to engage in high risk activities.

Our trauma patients were also young. They were generally younger than patients in the study by Olajumoke et al.,[7], and Adenekan & Faponle[8] in Nigeria but comparable to the patients in the studies by Chalya et al.,[9] in Tanzania

like other studies within the same period which had most of their trauma admissions in the ICU being due to road traffic accident[6]-[8], majority of our trauma ICU admissions were due to road traffic accident.

The majority of victims of road traffic accidents were drivers all of them were not wearing the protective seat belt and little were pediasters.

Like in findings from other ICUs in the country[6]-[8], and in other parts of Africa and the world road traffic accidents (RTAs) was a major cause of injury among our patients[9] [13].

Also like in previous studies from other centres[11] [12] and from another study from

Tanzania [9] and in parts of Asia[14], a high proportion of the RTAs were due to motorcycle crashes.

Following the outlawing of motorcycles as a means of public transport in some parts of the state some years ago this pattern may have changed but RTAs still constitute a major reason for trauma admissions into our ICU.

Head injury was the most common reason for admission resulting from RTA. This was similar to findings from within and outside our region[7]-[9] [13].

The failure of authorities concerned to enforce the use of crash helmets by motorcycle riders is probably a factor in the high number of head injuries seen in our series and those from other developing nations.

It must be said that this pattern of trauma admission in the ICU does not necessarily represent the general population of trauma patients in the hospital since only the severely injured were admitted into the ICU.

Indeed previous studies involving trauma patients in our centre and from other hospitals in our region have found lacerations and fractures of the limbs as the most common forms of injuries presenting at the emergency departments[11] [15]-[18].

Mortality in our study was slightly higher than that found in some ICUs within Africa and other parts of the world [9] [19] [20].

The higher level of mortality in our study could be attributed to the low level of facilities and assistant tools in our ICU.

This inadequacy was also true for many other facilities both diagnostic and therapeutic in the ICU.

Mortality among trauma patients was higher than the overall mortality among ICU patients during the period.

It is still debatable whether trauma patients do better in trauma ICUs compared to general ICUs. The study by Duane et al.,[20] suggests that severely injured patients do better when managed in trauma ICUs. The study also stressed the importance of qualified, experienced personnel above location in the less severely injured patients.

Most of our patients had a length of stay (LOS) of 7 days and below and in agreement with other studies, survivors had a longer LOS[7]-[9].

A possible reason why some of patients died early was due to lack of pre-hospital care and ambulance services. Often victims were transported to hospitals under suboptimal conditions and resuscitation and care only started when they arrived alive in the hospital thereby losing precious time.

Our study found a bimodal pattern of deaths with regards to age. The high mortality within the age range 18 -28 years may be attributed to the severity of injury among this group while the high mortality that occurred after 55 years may be due to the high level of co-morbidity in this age group.

Diminished physiologic reserve and deficiencies in management contribute to higher rates of morbidity and mortality in the elderly patient with trauma as compared to the younger patient with equivalent trauma as quoted by Lonner and Koval.[12]

The outcome from critical illness in the elderly population has been observed to be poor by Ridley et al., who noted long term survival to be related to both the severity of illness and age of the patients in the ICU.[13]

Copes et al., in their study on 23,000 patients found that in patients more than 55 years of age there was a significantly increased mortality as compared to younger patients for comparable levels of physiological derangement and anatomic injury severity.[14]

Hospital mortality amongst patients with hospital course complications was significantly high and similar to that of ICU populations nationwide (Lilly et al., 2011).

Hospital complications developed in almost ninety percentage of adult patients admitted to the ICU due to trauma and were associated with a higher severity of injury (median ISS 26)

This high rate of hospital complication amongst patients admitted to the ICU leads to increasing scrutiny on quality of care and recent linking of complication rates to reimbursement (Sipkoff 2008), healthcare systems nationwide are searching for ways to reduce in-hospital complications.

An important target of future research should include clarifying the time course of hospital complications in hospitalized trauma patients, so as to better identify modifiable risk factors.
One recent multicenter study described the case mix, complications, and outcomes of 11,064 patients admitted to ICUs after trauma, and found that hospital complications were associated with age, gender, and traumatic CNS injury (Mondello et al., 2014).
Although ICU admission for traumatic injury, at least for some period of observation, is common practice in many centers (Kaufman et al., 2016), regional triage criteria and the actual utilization of ICU-level care (e.g., mechanical ventilation) are unclear.

ICU admission for observation-only may theoretically result in unnecessarily high healthcare costs (Wunsch et al., 2008), exposure of patients to ICU-related complications (e.g., nosocomial infections (Grundmann et al., 2005) and medical errors during transfers of care (Bell et al., 2011) and denial of ICU beds to other patients.
Similarly, ICU admission for patients with extremely high expected mortality may be considered futile, and may also result in high healthcare costs and delayed ICU admission for other patients (Huynh et al., 2014).
Admission decisions are often subjective, and for these reasons it is important to clarify the optimal use of ICU resources.

This study may serve as a first step to informing ICU triage decisions for trauma patients. For example, these data demonstrate a higher severity of injury amongst patients with hospital course complications who were admitted to the ICU (median ISS 26, IQR 17–34).
Hospital course complications may be one clinical factor utilized to determine whether some proportion of patients may be safely treated in other hospital areas, such as intermediate care units, without adversely affecting outcomes.
Additionally, these data demonstrate that 63.32% of trauma patients admitted to the ICU receive mechanical ventilation, With the exception of patients intubated for airway protection (i.e., central nervous system trauma, airway hemorrhage, penetrating chest trauma), alternatives to mechanical ventilation may be explored for some patients to reduce the prevalence of associated complications and mortality.
For example, non-invasive pressure support ventilation has demonstrated a mortality benefit in adult trauma patients (Roberts et al., 2014; Chiumello et al., 2013).
Stillwell and Caplan observed that it is uncommon for infection to arise in hospitalized trauma patients within the first 2 or 3 days after injury.[4]

In contrast, we found a predominance of respiratory complications in trauma patients, bronchospasm occurred at least once in 65.92% and lung collapse in 15.5% of cases, two patients (1.53%) developed complications secondary to a malpositioned central venous pressure (CVP) line like hydrothorax, four patients (3.07%) developed tracheal stenosis as a result of prolonged intubation and tracheostomy, Chest infection occurred in 68% of patients, This significantly increases with chest trauma and longer duration of mechanical ventilation.
Langer and colleagues noted that the incidence of nosocomial pneumonias increased with the duration of mechanical ventilation, being less than 5% in patients treated for less than a day on a ventilator and close to 70% if mechanical ventilation extended for over 30 days.9
Gastrointestinal complications were not seen in patients who stayed for less than 2 days in the ICU apart from one patient who had hematemesis on admission which was attributed to stress ulceration; however, in patients with a longer duration of stay, a significantly increased incidence of diarrhea was noted.
Enteral nutrition, impaired digestion and absorption following trauma, drug therapy, gut atrophy or gut infection are some of the commoner causes of diarrhea seen in the ICU.10
Incidence of miscellaneous problems was higher in patients with prolonged length of stay; Prolonged immobilization increased the incidence of bed sores which occurred

in 34.62% of patients with higher incidence in patients who stayed more than 7 days
To summarize, the predominant complications seen in trauma admissions to the ICU were bronchospasm (60%), sepsis (55.9%), hypotension (44.61%), pneumonia (38.9%), anemia (34.61%), thrombo-phlebitis (34.61%), electrolytes imbalance (32.4%), hyperglycemia (29.23%), and urinary tract infection (24.7%)

The main factors influencing morbidity were duration of stay and age of the patients.
Anaemia, electrolyte imbalances, hyperglycemia and hypotension were the predominant complications seen in patients who stayed for less than 3 days in the ICU, Subsequently we should aim at decreasing the incidence of these complications in patients who stay for a longer period of time, This will not only shorten their ICU stay but also decrease the subsequent morbidity and mortality of patients
The incidence of chest infections, gastrointestinal complications and bedsores increased as the duration of stay of the patients increased.
Management of cardiovascular parameters is of prime importance in the initial 3 days of ICU stay, since trauma patients are hemodynamically unstable at that time.
Semmlow and Cone found the days of hospitalization and the percentage of patients with major surgical procedures to increase linearly with ISS.3
Moylan and others who used the ISS in an evaluation of the quality of care of hospital patients with major trauma, recommend that patients with severity scores above 30 should receive special attention from panels reviewing trauma care.[15]
We found the percentage mortality to be more in patients with a higher ISS, being 14.8% at an ISS of less than 10, in contrast to 100% at an ISS of more than [41].
An ISS of 16 is predictive of 10% mortality and defines major trauma based on anatomic injury.[16]

The closest agreement between ISS and survival has been found for scores of 40 or less.[3]
The Baltimore and Birmingham studies clearly demonstrated the rise in percent mortality with an increasing ISS, being almost 20% at an ISS of 25.2
Preexisting comorbidities were also common in the ICU cohort, especially smoking, hypertension and diabetes, despite a generally young population.
Notably, these three common comorbidities were not strong predictors of hospital complications and were not associated with an increased risk of hospital mortality.

Although the mechanism underlying this association is beyond the scope of this study, these findings are consistent with the results of a single-center study evaluating smoking and trauma outcomes (Ferro et al., 2010).
The comorbidities most strongly associated with hospital complications and mortality are pulmonary disease, cardiovascular diseases, and chronic kidney disease were not common in the cohort, This type of information may help guide triage decisions and future study design.
Older trauma patients have been recognized as having a higher risk of dying when chronic medical conditions exist compared with those without chronic conditions, and this relation between mortality and pre-existing medical conditions is more apparent when these patients sustain less severe injuries

An important limitation of these data is the lack of temporal association between ICU admission and the development of hospital complications, we do not suggest that hospital complications lead to ICU admission, or vice versa, this important data would greatly enhance the ability to draw clinical conclusions from this study.

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