Trauma and Emergency Care

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Testing the trauma pathway of an emergency department of a tertiary care center in Saudi Arabia, not designated to receive trauma

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Abstract

Background: Trauma remains a global health threat, leading to significant morbidity and mortality. Globally, it is estimated that 1.2 million people die each year from road traffic accidents and many others live with long-term adverse health consequences.

Direct transfer of trauma patients to specialised trauma centers significantly reduces mortality. Rapid assessment and early intervention in these specialised centers contributes to the survival benefit.

King Faisal specialist hospital & research center (KFSH&RC), Riyadh is highly equipped facility with all subspecialties on site, however it is not a designated trauma center. Nevertheless, emergency department (ED) receives both ambulance transported and self-presented major trauma cases intermittently.

Objectives: To check whether the ED on a non-designated center is following the international Advanced Trauma Life Support (ATLS) standards, whilst managing trauma patients using the hospital trauma pathway.

Design: Retrospective observational study carried out in a tertiary care institution in Riyadh, Saudi Arabia.

Methods: We included all trauma patients from April to November 2022 who presented to our ED, and for whom a 'trauma code' (trauma team) was activated. Data was collected form the electronic medical records.

Outcome: Readmission and in hospital mortality rate.

Sample size: 19 patients, mean age 34 years, males 68%.

Results: Ten patients (53%) had musculoskeletal injury while six patients (32%) had head injury, remaining had a combination of injuries. Blunt injury was the most frequent (79%) type of injury. Road traffic accidents (RTAs) and falls were the most common mechanisms of injury (42% in each category). Median arrival times (in minutes) for trauma team members were within the set target. Six patients (32%) were intubated three (16%) patients received emergency blood transfusion, massive transfusion protocol was activated for 6 (16%) patients. Eighteen (95%) patients had pan computed tomography (CT) done in ED. Two patients went to operating room (OR) directly from ED. Eleven patients (58%) were admitted to a standard inpatient bed and 8 (42%) patients (including 2 from OR) were admitted to intensive care unit (ICU). Two (10.5%) patients had to be admitted to ICU from a standard inpatient bed. Eighteen patients were discharged alive from the hospital. None of the discharged patient returned for readmission.

Conclusions: Our ED which is not designated to receive trauma, but achieved compliance with the ATLS guidelines. Our ED activation & implementation of the trauma pathway complies with the principles of trauma management as recommended by the ATLS.

Introduction

Trauma remains a global health threat, leading to significant mortality and morbidity. Globally, 1.2 million people die each year from road traffic accidents and many others live with long-term adverse health consequences [1,2].

In Saudi Arabia (SA), trauma caused by road traffic accidents (RTAs) is a major health problem with estimated fatalities at 27.4 per 100,000 population [2,3,4]. The SA government has implemented preventive programs of road traffic injuries, which has led to decreasing rates of accidents and improved injury severity index (ISS) with a better outcome [4,5]. However, in-hospital mortality rate remains high in severely injured patients admitted to trauma centers, compared to large US trauma centers [6,7,8].

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Table 1. Demographic and clinical characteristics of the study group (n=19)

Gender	
Male	13 (68.0)
Female	6 (32.0)
Age	
<14	3 (16.0)
15-20	3 (16.0)
21-30	4 (21.0)
31-40	3 (16.0)
41-50	2 (11.0)
51-60	1 (5.0)
Nationality	
Saudi Arabia	14 (74.0)
Philippines	1 (5.0)
Pakistan	2 (11.0)
Egypt	1 (5.0)
Syria	1 (5.0)
Data are number (%)	

Direct transfer of trauma patients to specialised trauma centers significantly reduces mortality [9,10]. Rapid assessment and early intervention in these specialised centers contributes to the survival benefit [11,12].

Unfortunately SA has very few designated level I trauma units, which are only concentrated in the big cities. Therefore a lot of major trauma is managed in lesser equipped units throughout the country [13,14].

KFSH&RC is highly equipped facility with all subspecialties on site; however, it is not a designated trauma center. Nevertheless, ED receives both ambulance transported and self-presented major trauma cases regularly. Hence KFSH&RC has developed a trauma pathway and a local trauma registry.

The aim of this study is to review the implementation of hospital trauma pathway within our ED and compare the management with international standards of Advanced Trauma & Life Support (ATLS) set by the American college of surgeons (ACS). The analysis includes appropriate activation of trauma pathway, type of cases received, management, disposition and 30-day mortality.

Methods

The data of all the trauma patients, presenting to our institution is collected in a local trauma register, which is maintained by a designated trauma coordinator. All the trauma cases which have trauma code activation, based on preset triggers are recorded in our register.

We retrieved an 8 months retrospective data of 19 patients between April to November 2022 from the trauma register. The cases were analyzed individually to elicit all the relevant details.

The analysis focused on patient demographics, time of trauma code activation, number of specialty responders (included in the trauma team), mechanism of injury, initial lifesaving interventions (including massive transfusion protocol), investigations including radiological interventions (pan CT) and patient disposition.

Each case from the trauma register were checked individually to assess the journey from the pre-hospital to disposition.

Results

Our patient cohort consisted of 19 patients with a mean age 34 years [Table 1-4]. Male patients dominated the group with a total number of 13 (68%). The patients were divided into various groups due to different susceptibility and vulnerability at different ages [1].

Musculoskeletal injury counted to be 10 (53%) was the most prevalent injury, followed by head injury patients which were 6 (32%).

Blunt injury 15 (79%) was most common type of injury.

RTAs) and falls were the most common mechanisms of injury each having a patient contribution of 8 (42%).

Median arrival times for the trauma team physicians were within the set target.

Six patients were intubated (32%), three (16%) received emergency blood transfusion, massive transfusion protocol was activated for six patients (32%). Eighteen (95%) patients had pan CT.

Two patients went to operating room (OR) directly from ED.

Eleven patients (58%) were admitted to a regular unit and 8 (42%) were admitted to ICU. Two patients went to OR directly from ED before going to ICU.

Two (10.5%) patients had to be admitted to ICU from a standard inpatient bed. Eighteen (95%) patients were discharged alive from the hospital.

Discussion

Major trauma is a significant contributor to patients' mortality worldwide and Saudi Arabia (SA) is no exception [1,2]. RTAs add to a sizeable number of patients injuries and deaths in SA. Saudi red crescent

Table 2. Trauma Characteristics of the study group (n=19)

Working Days	**13 (68.0)**
During working hours	5 (26.0)
0701-1200 HR	*4 (80.0)*
1201-1700 HR	*1 (20.0)*
After working hours	8 (42.0)
1701-0000 HR	*7 (88.0)*
0001-0700 HR	*1 (12.0)*
Weekends	**6 (32.0)**
0701-1200 HR	*2 (33.0)*
1201-1700 HR	*3 (50.0)*
1701-0000 HR	*1 (17.0)*
0001-0700 HR	*0 (0.0)*
Mode of Arrival	
Ambulance	17 (89.0)
Self	2 (11.0)
Mechanism of Injury	
Motor vehicle collisions (MVC)	8 (42.0)
Fall	8 (42.0)
Others	3 (16.0)
DEM Initial Assessment	
Number of patients with initial DEM Arrival SBP < 90	2 (11.0)
Number of patients with initial DEM GCS Motor Score <6	4 (21.0)
Injury Type	
Blunt Injury	15 (79.0)
Penetrating	4 (21.0)
Trauma Location	
Musculoskeletal	10 (53.0)
Head/Brain	6 (31.0)
Chest/ Thoracic	3 (16.0)
Data are number (%), One patient CT was not done (death in DEM)	

Table 3. Characteristics of the Trauma Code Team

Median time in minutes from Patient Arrival to 'Trauma Code Activation'	14.5 minutes
Activation Criteria	
Gun shot	1 (5.0)
Suicide attempt	1 (5.0)
MVA	5 (26.0)
RTA Pedestrian	2 (11.0)
Fall riding a horse	3 (16.0)
Fall	5 (26.0)
Motorcycle crash > 32 kilometers per hour.	1 (5.0)
DEM Consultant judgment.	1 (5.0)
X-ray Technologist	7 minutes
Anesthesiologist	8 minutes
Anesthesia Technologist	7.5 minutes
General Surgery Consultant	17.5 minutes
Neuro Surgery Resident	10 minutes
Nursing Supervisor	9 minutes
Security Supervisor	2 minutes
Pan CT	18 (95.0)
PIV	19 (100.0)
CVC	1 (5.0)
Intubation	6 (32.0)
Chest tube	1 (5.0)
Emergency Blood Transfusion	3 (16.0)
MTP	3 (16.0)
OR	2 (11.0)
Pan CT Turn Around Time (TAT0 in minutes (n=18)	39 minutes

Procedures/ Interventions (n=19)	
PIV	19
Pan CT	18
Intubation	6
Emergency Blood Transfusion	3
MTP	3
OR	2
CVC	1
Chest tube	1

ambulance (SRCA), the main ambulance service transported 68414 patients with RTA to different hospitals in SA in 2018. The economic impact of RTAs is approximately >22,000 million Saudi Riyals (SAR) per year [6, 7].

The programs launched to prevent RTAs by Ministry of health (MOH), SA has helped reduce the incidence of RTAs and related deaths. RTAs have decreased from 1,645 /100,000 in year 2016 to 1,102 /100,000 in year 2019. The mortality from 28.8 /100,000 in year 2016 has also fallen down to 16.8 /100,000 in year 2019 [3].

SA has few designated trauma centers in major cities [4,5]. According to Trauma system maturity index (TSMI) by WHO, which gives awareness about the trauma systems, SA designated trauma centers ranking fall between the levels I-III (out of the four TSMI levels), level IV being the highest standard; KFSH&RC despite being a non-designated trauma center falls in the same TSMI index range as the designated trauma centers in SA. It also has the capability of sub-specialised interventions, which is the requirement of a level I trauma center.

Management of major trauma is best catered for in the designated trauma centers, as the mortality can be significantly lowered [9,10,11]. A Swedish study by Stephen et al. [13] showed 41% reduction in mortality in the designated trauma centers, when compared with the non-trauma centers for severely injured patients [15-17]. The level I trauma centers in SA have higher trauma patient mortality compared to USA and Europe centres, as per the studies done by Alghanam et al & Alharbi et al. [18,19,20]

Trauma patients tend to regularly spill over in the non-designated trauma centers due to multiplicity of reasons [5,7,8]. Distance to the nearest trauma center has a strong influence on transport decisions. The chance of a trauma patient carried to the designated trauma center decrease by 5% for every kilometre [14]. Prehospital under-triage of patients of patients with high injury severity score (ISS) may also cause him to be transported to a non-designated trauma center. The reasons for under-triage include lack of training, non-adherence to protocols and clinical judgement [15]. A systematic review done in SA revealed no field triage done on trauma patients by SRCA [17].

A large number of patients transported to non-designated trauma centers can lead to approximately 20-40% of preventable deaths [16].

ISS was not recorded on trauma patients brought to KFSH&RC. The life saving procedures carried out on these patients (endotracheal intubations, massive haemorrhage protocol activation) indirectly informs us of these patients, high ISS. Eight of our patients went to ICU and two further transfers from the standard ward to ICU are also indicators of injury severity. The single trauma death in our patient cohort was also due to the high severity of presenting injuries.

"Resources for Optimal Care of the Injured Patient (6th edition) was published by the American college of surgeons" (ACS) in 2014, to help the world understand trauma system. Trauma prevention (raising public awareness about injury prevention), prehospital care (field triage and integration), intra-hospital care, post trauma rehabilitation, education and training, maintaining a national trauma registry, rigorous audit and research are the areas mandatorily required for a robust trauma system [18].

Advanced trauma and life support (ATLS) principles laid by the American college of surgeons have been practiced worldwide for management of major trauma, which has significantly reduced morbidity & mortality in major trauma patients. Immediate identification and management of life threatening causes during the primary survey followed by detailed secondary survey is the hallmark of ATLS. These principles when applied within an appropriate framework will achieve the desired outcomes of major trauma management.

Although our tertiary care institution is not designated for trauma, nevertheless, it has the readiness and preparation for dealing with this major catastrophe. Our center is resource backed and has the expertise available, when required to deal with this challenge.

Table 4. Trauma Code Patients' Disposition and Outcome

Disposition	
Unit/ Regular Floor	11 (58.0)
ICU	8 (42.0)
ICU Patients	
Median ICU LOS (Days)	17.5
Median ICU Ventilator Days	15
Unplanned Readmission to ICU	1 (12.5)
Hospital LOS	
Median Hospital LOS in days	7
Discharge Status	
Alive	18 (95.0)
Death	1 (5.0)
Hospital Readmission within 30 days of discharge	0 (0.0)

KFSH&RC despite a major organ transplant and oncology institution has a dedicated trauma team, whose composition is similar to a team in a designated trauma center. The only difference is lack of regular exposure with trauma cases due to smaller presenting numbers. This problem is overcome by doing regular trauma simulation practice.

The management of KFSH&RC trauma patient cohort fell completely aligned with the ATLS principles. Our patient case mix comprised mainly blunt trauma with a high ISS, which is in accordance with the international statistics. The trauma code activation criteria was appropriately utilised and the trauma team response was within the target time. Patients were admitted to clinical areas proportionate to their needs and moved to a step up zone, when the clinical condition warranted it. Unfortunately our patients were discharged back in the community instead of rehabilitation centers. Although none of our patients returned back to our hospital for more clinical needs, we know this is a very important component of trauma resuscitation, which the non-designated trauma centers may not be able to provide.

Further research in utilisation of a resourceful non-designated hospital like KFSH&RC should be carried out, with a view to link them with the local designated level I trauma centers.

Establishment of a national trauma registry can become the backbone of research in SA and lead the way to a concerted effort in establishing a nationwide trauma system.

Conclusions

The trauma system in SA needs to be established on the lines of ACS recommendations with a national trauma registry.

Level 1 trauma centers should be set up in each region of SA with protocols set by the MOH. The prehospital trauma management, rehabilitation post trauma and a robust education and training program should form important components of trauma care delivery.

The non-designated trauma centres with resources like KFSH&RC can stay geared up for unexpected trauma. KFSH&RC can share the lessons learnt from its trauma cases management to other similar facilities across the country.

Limitations

Small number of patients

Single center study

No injury severity score or similar scale used to measure the severity of the injured patients brought to our institution.

No objective comparison was done with the trauma patients managed in the designated trauma center.

Our study was done in a single center with a small patient cohort. The results from our tertiary care institution which is a large transplant and oncology center cannot be extrapolated to other non-designated trauma centers.

Conflict of interest

None.

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