

# Clinical and epidemiological characteristics of road traffic accidents patients received at 2 intensive care units in Saudi Arabia—A cross-sectional study

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## ABSTRACT

**Background:** Road traffic accidents (RTAs) lead to major trauma, which is the greatest cause of morbidity and mortality worldwide. The purpose of the study was to determine the clinical epidemiological profiles of the patients received in intensive care units (ICU) with road traffic injuries (RTIs). **Methods:** The study, which included 300 patients, was conducted at emergency departments and two reference ICUs in Saudi Arabia. The patients were of varying ages and genders from different demographic backgrounds with different modes of injuries, varying degrees of shock, and multiple types of injury. Study variables included demographics, clinical presentations, and the types of fractures and lacerations. **Results:** Most of our study population was male ( $n = 273$ ; 91%). Car accidents were found to be the prevalent cause of injury ( $n = 267$ ; 89.0% cases). Only 21.7% of the study population ( $n = 65$ ) needed ICU admission compared to non-ICU patients ( $n = 235$ ; 78.3%). Injuries to the chest ( $P = 0.0001$ ), abdomen ( $P = 0.0001$ ), upper limbs ( $P = 0.022$ ), and spine ( $P = 0.001$ ) significantly contributed to ICU admissions. **Conclusion:** The burden on ICUs due to RTIs can be reduced in Saudi Arabia by adopting strict preventive measures against RTAs.

**Keywords:** Injury, road traffic accidents, Saudi Arabia

## Introduction

Road traffic accidents (RTAs) can lead to major trauma and are the greatest cause of morbidity and mortality worldwide.<sup>[1]</sup> Major trauma following RTAs results in serious and multiple injuries of which a high number of patients require admission to the intensive care unit (ICU). Literature shows that major trauma contributes to 37.1% of all ICU admissions and increased mortality.<sup>[2]</sup> Admission to the ICU poses significant

stress, unexpected loss of health, and a considerable economic burden.<sup>[3]</sup> Globally, more than 3,000 people die of RTAs daily and tens of millions suffer from road traffic injuries (RTIs) annually, increasing the number of patients requiring admission to the ICU.<sup>[2]</sup> RTAs are a growing problem in Saudi Arabia due to rapid urbanization and motorization, contributing to a higher mortality rate compared to other developed countries.<sup>[4]</sup>

RTIs lead to various fatal and nonfatal injuries including bruises, abrasions, lacerations, and fractures.<sup>[1]</sup> Lacerations, abrasions, bruises, crush and cutting injuries, penetrating wounds, and fractures are also common in RTAs. Speeding is among the

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chief contributors to RTAs and the severity of RTIs.<sup>[5]</sup> Collisions may happen between two or more vehicles as well as between vehicles and pedestrians or foreign objects.<sup>[5]</sup> In Saudi Arabia, RTIs account for 80% of admissions in a traumatic setting. They burden the healthcare system and warrant the need for ICUs in the country.<sup>[6]</sup>

The severity of RTIs depends on several factors including the speed of the vehicle, human characteristics, type of the vehicle, road layout, weather condition, alcohol consumption, and driver's fatigue.<sup>[7]</sup> Fatal and severe RTIs require intensive care and admission to the ICU, which increases the cost of treatment. Literature shows that motor vehicle accidents (MVAs) are the most common reason for admission to the ICU.<sup>[8]</sup> Although a high number of RTIs are not fatal, a significant number of injuries are reported to be serious, requiring admission to the ICU.<sup>[9]</sup> The most common RTIs requiring admission to the ICU include soft tissue injuries, fractures, craniocerebral injuries, visceral injuries, and burns.<sup>[2]</sup>

RTIs are on the rise in Saudi Arabia and this is severely impacting the society and families. Although several studies on RTIs have been conducted in different regions of Saudi Arabia, literature on ICU admission and associated factors is lacking. Thus, the current study aimed to determine the clinical epidemiological profiles of the patients received in ICU with RTIs.

## Methodology

### Setting and participants

Patients were recruited at the emergency department and followed through their admission at the ICU departments of the King Khalid hospital and Prince Sultan Centre for Health Services in the city of Al-Kharj, Saudi Arabia. Data were collected between December 2018 and December 2019. Al-Kharj lies southeast of Riyadh (the capital of Saudi Arabia) and has a population of 376,325 people. King Khalid hospital and Prince Sultan Centre for Health Services are some of the busiest hospitals in the region supporting trauma patients and have ICUs with 20 beds.

### Selection criteria

The study included individuals who arrived at the emergency department with trauma due to RTAs. Patients of varying ages, genders, from different demographic backgrounds and with different modes of injuries, varying degrees of shock, and multiple types of injuries were all included in the study.

All participants were resuscitated according to the Advanced Trauma Life Support (ATLS) guidelines. Measurements such as heart rate, blood pressure, and the output of urine were used to assess the degree of shock. Only patients who were able to provide valid consent for themselves or patients whose legal guardians provided consent were included as participants in the study. Individuals from whom we were unable to get valid

consent or who arrived at the hospital following a police chase RTA or an RTA of a criminal nature (such as a hit and run) were not included in the study. Patients who arrived at the hospital deceased or who succumbed during their hospital admission were excluded from the study.

### Data collection

All patients meeting the study criteria were followed from admission to the emergency department. Data regarding demographic characteristics (age, gender, and nationality), clinical presentations (cause of injury and degree of shock), ICU admission, the types of fractures, lacerations, and injuries were documented. Patients of RTAs were contacted in emergency department and followed in the ICU if required. The shock was classified into four categories according to the American College of Surgeons ATLS hemorrhagic shock classification (first degree, second degree, third degree, and fourth degree shock) based on approximate blood loss, heart rate, blood pressure, pulse pressure, respiratory rate, urine output, and mental status.<sup>[10]</sup>

### Statistical analysis

Data were entered into MS Excel and analyzed with SPSS version 22.0. Descriptive statistics of demographic characteristics, clinical presentations, clinical outcomes, types of fractures, lacerations, and injuries were presented. Association of study variables including demographics, clinical presentations, types of fractures, lacerations, and injuries with ICU admission was assessed by applying logistic regression. The significance level was set as 0.25 or less in the first step of the univariate analysis. Only the significant factors found in the univariate analysis were included in the second step of the multivariate analysis. *P* values of <0.05 were considered statistically significant. The results were shown as tables and bar charts.

### Ethical considerations

The study was approved by the ethical board of Deanship of Scientific Research Ethics Committee in Health and Science Disciplines of Prince Sattam Bin Abdul Aziz University (REC-HSD-54-2021). All patients gave a written informed consent prior to recruitment into the study. For unconscious patients, a written informed consent was taken from their legal guardians. The confidentiality of participants was maintained during the study. Names and personal information were de-identified.

## Results

### Sociodemographic characteristics

Most of our study population were male ( $n = 273$ ; 91%) vs. female ( $n = 27$ ; 9%). That is a ratio of 9.1:0.9. Most of our participants were 20–30 years old ( $n = 114$ ; 38.0%). They were followed by 30–40 years old patients ( $n = 70$ ; 23.3%), 10–20 ( $n = 47$ ; 15.7%), 50–60 ( $n = 29$ ; 9.7%), 40–50 ( $n = 21$ ; 7%), 0–10 ( $n = 15$ , 5%), and over 60 ( $n = 4$ ; 1.3%). The patient demographics are given in Table 1.

**Causes/etiologies**

Car accidents were found to be the prevalent cause of injury ( $n = 267$ ; 89.0% cases) followed by pedestrians getting hit by a car ( $n = 21$ ; 7%), motorbike accidents ( $n = 10$ , 3.3%), and bicycle accidents ( $n = 2$ ; 0.7%). [Table 1]

**Clinical characteristics**

Most patients (61.7%) included in our data did not suffer from any shock as determined by their blood pressure measurements, heart rate, and urine output. Only 26.7% of patients had a first-degree shock, followed by second-, fourth-, and third-degree shock in 9%, 2%, and 0.7% of cases, respectively. Only 21.7% of the study population ( $n = 65$ ) needed ICU admission compared to non-ICU patients ( $n = 235$ ; 78.3%) [Table 1].

When assessing the correlation between different factors dictating ICU admission, age and gender did not reach statistical significance. However, strong statistical significance was noted between ICU admission and the cause of the accident and the degree of shock ( $P = 0.017$  and  $P = 0.001$ ). People who were involved in a car-related MVA and who had a higher degree of shock were statistically more likely to be admitted to the ICU than other groups. [Table 2]

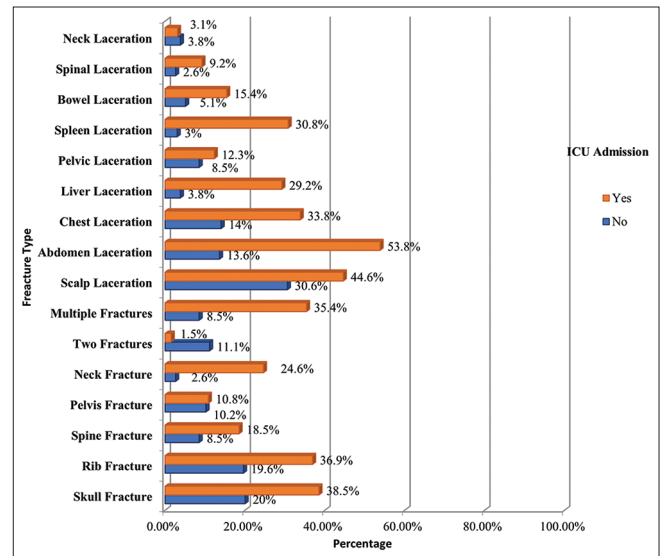
There was also strong statistical significance between the types of fractures and lacerations and the need for admission to the ICU [Table 3]. For instance, 25/65 (38.5%/100.0%) of patients admitted to the ICU had fractures of the skull ( $P = 0.002$ ). Of the 65 patients, 24 (36.9%/100.0%) had fractures of the ribs ( $P = 0.003$ ). Fractures of the spine ( $P = 0.021$ ), neck ( $P = 0.0001$ ), two fractures ( $P = 0.018$ ), multiple fractures ( $P = 0.000$ ), lacerations on the scalp ( $P = 0.035$ ), abdominal lacerations ( $P = 0.0001$ , chest lacerations ( $P = 0.0001$ ), liver lacerations ( $P = 0.0001$ ), spleen lacerations ( $P = 0.0001$ ), bowel lacerations ( $P = 0.005$ ), and spinal lacerations ( $P = 0.015$ ) had strong association with ICU admission [Table 3 and Figure 1].

Statistical significance was also noted between the types of injury and the need for admission to the ICU. For instance, 38/65 of ICU admissions (58.5%/100.0% cases) had a chest injury ( $P = 0.001$ ). Similar statistical significance was noted for abdominal injuries ( $P = 0.0001$ ), injuries of the upper limbs ( $P = 0.022$ ), lung contusions ( $P = 0.0001$ ), spine injuries ( $P = 0.001$ ), pneumothorax ( $P = 0.0001$ ), pleural effusion ( $P = 0.02$ ), and hemithorax ( $P = 0.0001$ ) [Table 4 and Figure 2].

Finally, an increased amount of blood transfusions was associated with a higher likelihood of admission to the ICU. More than 90% of individuals requiring five or more units of blood transfusions needed admission to the ICU. This is in comparison to only 11.3% of ICU admissions of individuals requiring no transfusion [Figure 3].

**Table 1: Demographics, clinical characteristics and outcomes of the trauma patients**

Patient's characteristics	Frequency	Percentage	
Age groups (in years)	0-10	15	5%
	10-20	47	15.7%
	20-30	114	38%
	30-40	70	23.3%
	40-50	21	7%
	50-60	29	9.7%
	above 60	4	1.3%
Gender	Female	27	9%
	Male	273	91%
Nationality	Saudi	170	56.7%
	Non-Saudi	130	43.3%
Cause of injury	Bicycle	2	0.7%
	Car	267	89%
	Hit by car	21	7%
	Motor bike	10	3.3%
Shock degree	First degree	80	26.7%
	Second degree	27	9%
	Third degree	2	0.7%
	Fourth degree	6	2%
	No shock	185	61.7%
ICU admission	Yes	65	21.7%
	No	235	78.3%



**Figure 1: Type of fracture and laceration according to ICU admission**

**Discussion**

This cross-sectional study demonstrates that there is a significant correlation between the degree of shock, type of fracture, and type of injury with admission to the ICU. RTAs contribute to 57% of all injury-related admissions and are the principal cause of admission to the ICU, posing a significant burden on healthcare.<sup>[3,11]</sup> Alfalahi et al.<sup>[12]</sup> conducted a hospital-based study including 156 casualties from 128 road traffic crashes to determine the pattern of RTIs and the associated factors in Yemen. They reported that 17% of casualties required

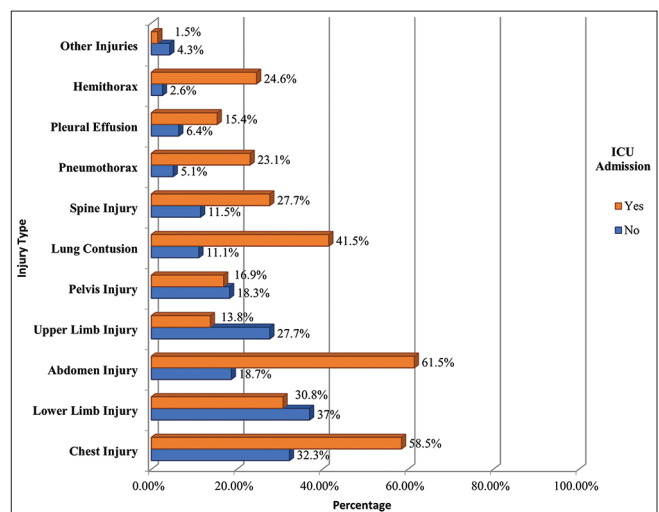
**Table 2: Association of ICU admission with study variables**

Study variables		ICU admission		P
		No	Yes	
Age category	0-10	10	5	0.057
		66.7%	33.3%	
	10-20	44	3	
		93.6%	6.4%	
	20-30	89	25	
		78.1%	21.9%	
	30-40	49	21	
		70.0%	30.0%	
40-50		15	6	
		71.4%	28.6%	
50-60		25	4	
		86.2%	13.8%	
Above 60		3	1	
		75.0%	25.0%	
*Gender	Female	22	5	0.667
		81.5%	18.5%	
	Male	213	60	
		78.0%	22.0%	
Cause	Bicycle	2	0	0.017*
		100.0%	0.0%	
	Car	202	65	
		75.7%	24.3%	
	Hit by car	21	0	
	100.0%	0.0%		
	Motor bike	10	0	
		100.0%	0.0%	
Shock degree	First degree	44	36	0.0001*
		55.0%	45.0%	
	Second degree	13	14	
		48.1%	51.9%	
	Third degree	2	0	
	100.0%	0.0%		
	Fourth degree	0	6	
		0.0%	100.0%	
	No shock	176	9	
		95.1%	4.9%	

admission to the ICU. Similarly, Grivna *et al.*<sup>[13]</sup> conducted a cross-sectional study at the Al Ain Hospital and Tawam hospital (United Arab Emirates) including 333 patients who survived RTAs. They reported that 20% of RTA patients required ICU admission. They also reported car accidents as the most common cause of crashes. These two studies reported well-matched frequencies of ICU admissions of patients of RTAs. A higher frequency of ICU admissions in this study may indicate the severity of injuries or unjustified admissions to the ICU which need to be evaluated carefully as admission to the ICU poses an extra burden of stress and cost.<sup>[3]</sup> In the present study, RTIs caused by car accidents most often led to ICU admission. Therefore, the clinicians must look for the cause of RTIs as different mechanisms of injuries lead to different outcomes. For instance, trauma and its associated forces directly or indirectly impact the human body, resulting

**Table 3: Association of ICU admission and fractures and laceration**

Types of fracture and laceration	ICU admission		P
	No	Yes	
Skull fracture	47	25	0.002*
	20.0%	38.5%	
Rib fracture	46	24	0.003*
	19.6%	36.9%	
Spine fracture	20	12	0.021*
	8.5%	18.5%	
Pelvis fracture	24	7	0.896
	10.2%	10.8%	
Neck fracture	6	16	0.0001*
	2.6%	24.6%	
Two fractures	26	1	0.018*
	11.1%	1.5%	
Multiple fractures	20	23	0.000*
	8.5%	35.4%	
Scalp laceration	72	29	0.035*
	30.6%	44.6%	
Abdomen laceration	32	35	0.0001*
	13.6%	53.8%	
Chest laceration	33	22	0.0001*
	14.0%	33.8%	
Liver laceration	9	19	0.0001*
	3.8%	29.2%	
Pelvic laceration	20	8	0.352
	8.5%	12.3%	
Spleen laceration	7	20	0.0001*
	3.0%	30.8%	
Bowel laceration	12	10	0.005*
	5.1%	15.4%	
Spinal laceration	6	6	0.015*
	2.6%	9.2%	
Neck laceration	9	2	0.775
	3.8%	3.1%	

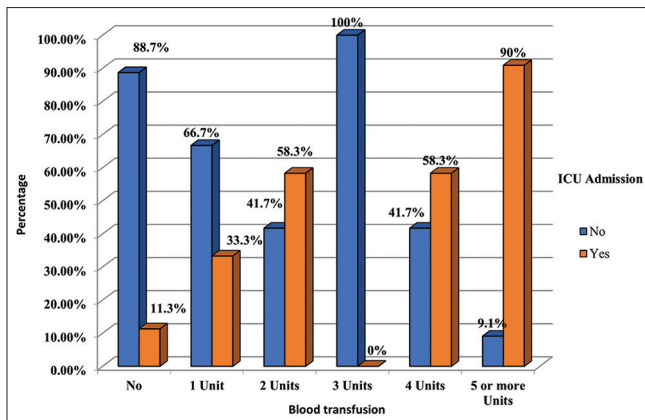


**Figure 2: Types of injury according to ICU admission**

in multiple organ damage. Therefore, the major RTIs caused by car accidents most often require ICU admission.

**Table 4: Association of ICU admission and types of injury**

Types of injury	ICU admission		P
	No	Yes	
Chest injury	76 32.3%	38 58.5%	0.0001*
Lower limb injury	87 37.0%	20 30.8%	0.352
Abdomen injury	44 18.7%	40 61.5%	0.0001*
Upper limb injury	65 27.7%	9 13.8%	0.022*
Pelvis injury	43 18.3%	11 16.9%	0.798
Lung contusion	26 11.1%	27 41.5%	0.0001*
Spine injury	27 11.5%	18 27.7%	0.001*
Pneumothorax	12 5.1%	15 23.1%	0.0001*
Pleural effusion	15 6.4%	10 15.4%	0.02*
Hemithorax	6 2.6%	16 24.6%	0.0001*
Other injuries	10 4.3%	1 1.5%	0.302

**Figure 3: Blood transfusion according to ICU admission**

Traumatic brain injury following RTAs is a prevalent cause of ICU admission associated with longer hospital stays, high morbidity, and mortality.<sup>[14]</sup> Rivera-Barrios *et al.*<sup>[15]</sup> conducted a multicenter retrospective study including 156 patients to determine the frequency and distribution of craniofacial fractures following terrain vehicle crashes, reporting that nearly 40% of patients required ICU admission. In Qatar, Helmi *et al.*<sup>[16]</sup> conducted a retrospective analysis of 3,744 patients of RTAs to determine the incidence and severity of abdominal trauma, reporting that 17.8% of patients required ICU admission. They also reported that abdominal trauma (injuries of the abdominal viscera, mesentery, diaphragm, urethra and perineum, retroperitoneal hematoma) constituted 0.45% of the patients of which 12.6% required admission to the

ICU. Similarly, in Saudi Arabia, Haddad *et al.*<sup>[17]</sup> conducted a retrospective analysis of 11,374 traumatic patients to study the patient profiles and outcomes and model the predictors of mortality among patients with abdomino-pelvic injuries. They reported 18.6% patients with abdomino-pelvic trauma of which 33.1% required admission to the ICU. In their study, the most prevalent cause of abdomino-pelvic trauma was RTA (70.4%).

The strength of the study is that it has evaluated ICU admissions following RTAs and their association with the type of injury, cause of injury, and shock. Limitations of the study include single focus with a limited sample size and time period.

## Conclusion

Implementation of strong preventive measures against RTAs may reduce RTIs and subsequent burden on ICUs of hospitals in Saudi Arabia. Moreover, injuries to chest, abdomen, upper limbs, and spine may be considered for early admission to the ICU.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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