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Case Series

Pattern of orthopedic injuries among Victims of Road Traffic Accidents in Aseer region, Saudi Arabia

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ABSTRACT

Background: Road Traffic Accidents (RTA) are one of the most common causes of morbidity and mortality in Saudi Arabia despite preventive measures and programs. The major factors for the increase in the incidence of mortality and morbidity are due to human factors, such as over speeding, not obeying traffic laws, fatigue, and driving before the legal age. In this study, we aim to report the pattern of orthopedic injuries (OIs) from RTA in the south-western region of Saudi Arabia and to explore the healthcare outcomes of OIs.

Method: This is a retrospective, record-based, case series study including RTA patients who were admitted to the Emergency Department (ED) at a tertiary hospital in the south-western region of Saudi Arabia. The data was collected for 531 admitted RTA patients with OIs over for five years from May 2011 to May 2016. Patients who were 15 years of age or above were included in this study. The data were analyzed using the statistical package for social science (SPSS) version 21.

Results: A total of 531 patients were included with an age range between 15 and 90 years with an average age of 29 ± 2 years. Most of the population was male constituting 91.3% of the sample while 91.9% of the sample were Saudis. About 75% of the OIs had simple fractures and complex fractures were recorded among 10.2% of the cases. About half of the cases (52%) had lower limb fractures and 32% had upper limb fractures.

Conclusions: RTA and the resultant OIs, death, and permanent disabilities cause a tremendous burden on economic resources and should be of concern for local authorities. More attention and regularities should be paid to avoid life-threatening driving behaviors.

1. Introduction

Road traffic injures (RTIs) contribute to a considerable portion of deaths and injuries and are responsible for more lost years of life than most human diseases [1,2]. Although the numbers of lives lost in road crashes in high-income countries indicate a downward trend in recent decades, for most of the world's population, the burden of RTIs in terms of societal and economic costs is rising substantially [3]. The distribution of road traffic deaths by road user groups varies dramatically across epidemiological World Health organization (WHO) sub-regions and also varies across low-income, middle-income, and high-income countries. For example, 45% of road traffic fatalities in low-income countries involve pedestrians, compared to 29% in middle-income and 18% in high-income countries [3,4]. Orthopedic fractures were the most common injuries among inpatients due to road traffic accidents (RTA) in Taiwan from 2002 to 2011. They were frequently associated with other injuries especially head injuries. A significant relation to the male gender, older age, low income, and admission to high-level

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hospitalization for the observed fracture patterns was observed [5].

In Saudi Arabia, RTA is one of the most common causes of morbidity and mortality despite preventive measures and programs [6]. RTAs cause more than 19 deaths every day and approximately four injuries every hour in Saudi Arabia [7]. The major factors for the increase in death rates are human factors, such as over speeding, not following traffic laws, fatigue, and driving before the legal age [8,9]. Meanwhile, other factors include the increase in the number of motor vehicles as the population grows [10]. Most orthopedic injuries (OIs) are associated with high speed, higher hospital admissions. Meanwhile, the most frequently affected body parts are the head and neck followed by the upper and lower extremities [6]. However, other studies report the opposite [10–12]. Our current study was done to describe the pattern of OIs among RTA victims in the Aseer Region, Saudi Arabia.

2. Methodology

This a retrospective case series study that was based on the medical records of 531 patients who were admitted to Aseer Central Hospital (ACH) to the Emergency department with RTA with any type of OIs during the period from May 2011 to May 2016. Involving persons aged 15 years or more. Ethical approval was obtained from the institutional review board (IRB) of ACH with approval number 2016-06-11. The study also carries registration number researchregistry6789 in the research registry. ACH is the main and largest hospital in Abha city which is the capital of the Aseer region. We included patients of ≥15 years old and patients with complete data and medical records. The data collection form collected information on patients' demographic characteristics, description of fracture, associated injuries, admission data, and the period of hospitalization, intensive care unit (ICU) admission, complications, and outcome. The article has been reported in line with the PROCESS guidelines of reporting [13].

2.1. Data analysis

After the data was extracted, it was revised and filtered of errors. Then the data was entered into the statistical package for social science (SPSS) version 21. All statistical methods that were used with a P value less than or equal to 0.05 were considered statistically significant. Descriptive statistics were used by computing frequencies with their percentages for all categorical variables. Any associations between different injury data and sample attributes were tested using chi-square or exact tests based on assumptions fulfilled.

3. Results

A total sample of 531 persons was included with ages ranging from 15 to 90 years with an average age of 29 ± 2 years. Males constituted 91.3% of the sample and 91.9% were Saudis. Regarding co-morbidity, 89.8% of the injured individuals were medically free while Diabetes Mellitus (DM) was recorded among 4.9% and hypertension among 2.1% of individuals.

Considering the recorded OIs according to the affected part (Fig. 1), the most frequent recorded injury was fractures of the lower limbs (49%) followed by fractures of the upper limbs (28%), pelvic fractures (11%), and spinal fractures (10%). Head and neck fractures were the lowest recorded injuries (3% each).

Concerning the nature of the recorded OIs among the included cases, about three quarters (75.3%) of the recorded fractures were simple fracture followed by complex fractures which were recorded among 10.2% of the cases, open fractures were 5.3%, and dislocations without fracture were recorded among 3.8% of the studied patients (Fig. 2). As for the number of fractures per case, the majority of the included cases (83.8%) had only one fracture while multiple fractures (3 or more) were recorded among 2.1% of the cases. Finally, regarding the fate of the studied cases, 97.2% of the cases improved while 1.1% of cases had a permanent disability (Fig. 3).

The paper illustrates the distribution of the recorded fractures by the anatomical site and type. Half of the simple fractures 50% were of the lower limbs while 33% were of the upper limbs. Considering complex fractures, half of the 50% were of the lower limbs and 29.6% were of the upper limbs. Open fractures were dominant also in the lower limbs (64.3%) followed by the upper limbs in 32.1% of the cases. Dislocations were recorded in the lower limbs in half of the cases and 35% of the upper limbs. Combined injuries (many sites) were recorded mainly in the lower limbs (65.5%) and pelvis (37.9%) (Table 1).

On studying the relation between each case characteristics and the number of fractures the patient had (Table 2), it was clear that 12.5% of cases who were 60 years or more with multiple fractures compared to 1% of those who reached 18 years and none of those who were below 18 years had recorded statistical significance. As for gender, multiple fractures were recorded almost equally among each (2.1% and 2.2%, respectively). Considering nationality, 2.3% of the Saudi cases had multiple fractures compared to none of the non-Saudis. Comorbidity was not an important item regarding the number of fractures but 2.3% of the healthy cases had multiple fractures.

As for injury consequences for the studied cases (Table 3), half of the cases were the result of accidents during the afternoon period (rush hours), 30.8% during the morning, and 18.5% during the night. About 22% of the cases recorded other injuries besides their OIs. As for complications of the OIs, 74% of the cases had no complications, 22.8% had bleeding, 1.5% had pulmonary emboli with other complications including infection (0.9%), recurrent fracture at the same time, and amputation (1 case for each).

For relating injury type to the timing of RTA (Table 4), it was found that simple fractures were mainly found in cases with RTA during the afternoon period at 56.4%, followed by, complex fractures, which were recorded among 54.2% of cases of RTA during the morning period

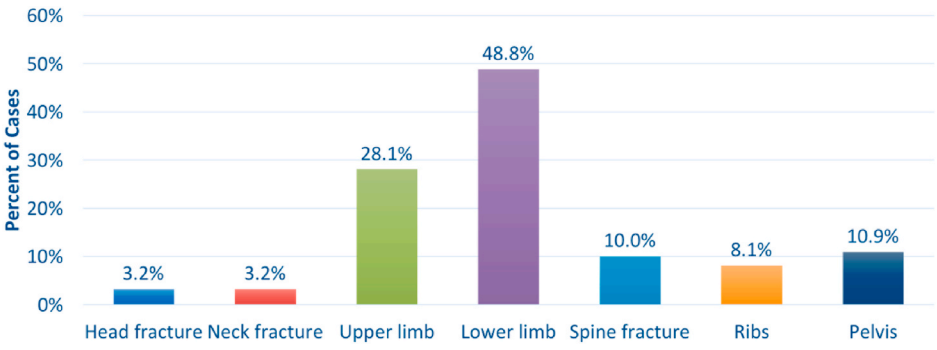

Fig. 1. Distribution of the orthopedic injuries according to body part among Victims of Road Traffic Accidents in Aseer region, Saudi Arabia during the period from 2011 to 2016.

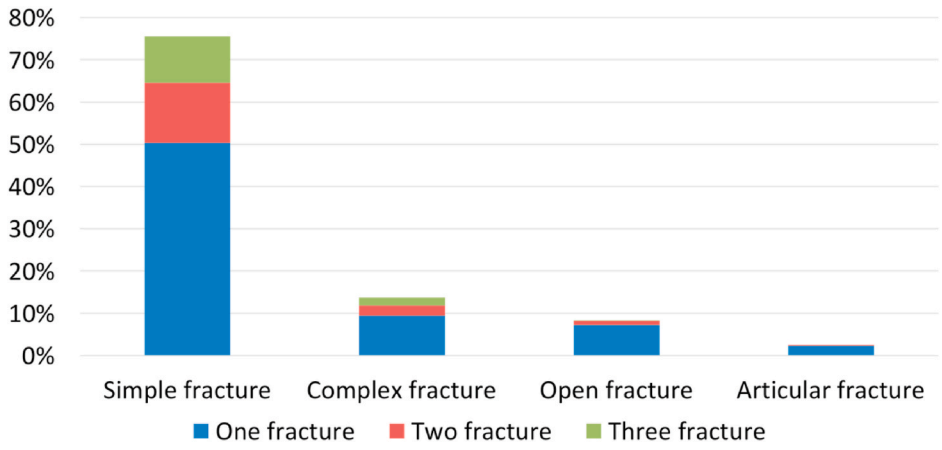

Fig. 2. Distribution of the orthopedic injuries according to their nature among Victims of Road Traffic Accidents in Aseer region, Saudi Arabia during the period from 2011 to 2016.

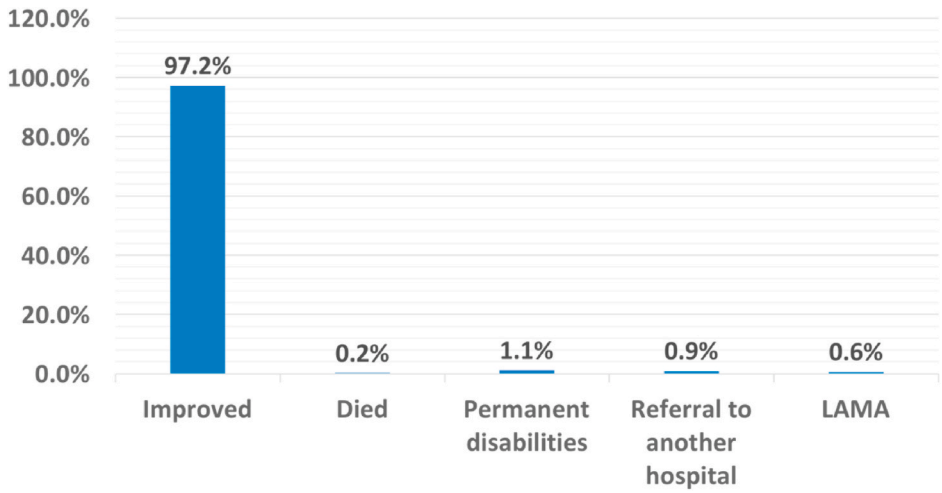

Fig. 3. Fate of Victims of Road Traffic Accidents in Aseer region, Saudi Arabia during the period from 2011 to 2016.

Table 1
Distribution of the orthopedic injuries according to their site and fracture type among Victims of Road Traffic Accidents in Aseer region, Saudi Arabia during the period from 2011 to 2016.

Fracture type	Fracture													
	Head fracture		Neck fracture		Upper limb		Lower limb		Spine fracture		Ribs		Pelvis	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Simple	12	3.0%	12	3.0%	132	33.0%	200	50.0%	44	11.0%	34	8.5%	41	10.3%
Complex	3	5.6%	3	5.6%	16	29.6%	27	50.0%	4	7.4%	7	13.0%	2	3.7%
Open	0	0.0%	0	0.0%	9	32.1%	18	64.3%	0	0.0%	0	0.0%	1	3.6%
Dislocation	1	5.0%	1	5.0%	7	35.0%	10	50.0%	4	20.0%	0	0.0%	3	15.0%
Combined	1	3.4%	1	3.4%	6	20.7%	19	65.5%	1	3.4%	2	6.9%	11	37.9%

followed by night accidents at 27.1%. About 46% of open fractures were recorded among cases with RTA during the afternoon period. Meanwhile, dislocations were recorded equally during the morning and afternoon at 42.1% for each. Combined fractures were mainly among RTA during the afternoon period at 42.9% and during the morning at 35.7%.

4. Discussion

RTIs-related morbidity and mortality is a major public health problem worldwide and more so in less developed countries, including the Arabian Gulf countries and particularly Saudi Arabia [14–20]. The goal of this study is to quantify a clear, coherent image of the negative impact RTA has from two different perspectives, i.e., the economic and the healthcare burden. Analysis of admitted patients to ACH's ED revealed a hierarchical characteristic of reported fractures based on localization and type. Localization of reported injuries is highest for the lower limb, followed by the upper limb, pelvis, spine, and finally the head and neck region. The type of injury reported is highest for simple fractures followed by complex fractures, and lastly open fractures. Furthermore, older patients, i.e., those aged 60 or older, reported multiple injuries compared to their younger cohorts. Finally, the majority of patients recovered from their injuries, while a few had permanent disabilities.

The pattern shows several overlaps with other similar studies conducted on RTA's. According to Aloudah et al. [19] and Sonbol et al. [20],

Table 2
Relation between patient's characteristics and number of fractures per case among Victims of Road Traffic Accidents in Aseer region, Saudi Arabia during the period from 2011 to 2016.

Patient characteristics		Total	No of fractures/case						P
			One		Two		Three/more		
			No	%	No	%	No	%	
Age (years)	<18 years	48	39	81.3%	9	18.8%	0	0.0%	0.020[a]
	18–24	201	174	86.6%	25	12.4%	2	1.0%	
	25–34	165	134	81.2%	26	15.8%	5	3.0%	
	35–59	93	80	86.0%	12	12.9%	1	1.1%	
	60+	24	18	75.0%	3	12.5%	3	12.5%	
Gender	Male	485	407	83.9%	68	14.0%	10	2.1%	0.937
	Female	46	38	82.6%	7	15.2%	1	2.2%	
Nationality	Saudi	488	406	83.2%	71	14.5%	11	2.3%	0.367
	Non-Saudi	43	39	90.7%	4	9.3%	0	0.0%	
Co-Morbidity	Free	477	399	83.6%	67	14.0%	11	2.3%	0.693
	DM	26	22	84.6%	4	15.4%	0	0.0%	
	HTN	11	10	90.9%	1	9.1%	0	0.0%	
	Asthma	9	6	66.7%	3	33.3%	0	0.0%	
	Others	8	8	100.0%	0	0.0%	0	0.0%	

[a] $P < 0.05$ (significant).

Table 3
Injuries consequences among Victims of Road Traffic Accidents in Aseer region, Saudi Arabia during the period from 2011 to 2016.

Injury consequences		No	%
Time of ER presentation	Morning	148	30.8%
	Afternoon	244	50.7%
	Night	89	18.5%
Associated injuries	No	416	78.3%
	Yes	115	21.7%
complications (during admission)	None	393	74.0%
	Bleeding	121	22.8%
	Pulmonary Embolism	8	1.5%
	Infection	5	.9%
	Recurrent fracture the same site	1	.2%
	Post trauma	1	.2%
	Spinal shock	1	.2%
	Amputation	1	.2%
ICU admission	No	493	92.8%
	Yes	38	7.2%

Table 4
Distribution of the injury type according to time of ER presentation among Victims of Road Traffic Accidents in Aseer region, Saudi Arabia during the period from 2011 to 2016.

Fracture type	Time of ER presentation						P
	Morning		Afternoon		Night		
	No	%	No	%	No	%	
Simple	93	26.0%	202	56.4%	63	17.6%	
Complex	26	54.2%	9	18.8%	13	27.1%	
Open	11	39.3%	13	46.4%	4	14.3%	0.001*
Dislocation	8	42.1%	8	42.1%	3	15.8%	
Combined	10	35.7%	12	42.9%	6	21.4%	

age, gender, and the number of fractures are three of the most significant overlaps with the pattern of results mentioned above. Our study reports a significant level of RTA-related injury among age groups between 18 and 34 years, which is similar to the reported number of cases in 21–30 years [19], 16–30 years [20], 20–29 years [21]. Moreover, our study reports that males are generally more predisposed to RTA compared to females, i.e., about 91%. This is also highlighted by both Aloudah et al. (2020) [19], where the number reported was 82.4% and Sonbol et al. (2020) [20] where it was reported to be 78%.

Young males are reported to be most commonly affected in a plethora of studies during the recent decades [22]. Finally, with regards to the number of fractures, our study shows a higher percentage of single fractures compared to multiple ones. However, both Aloudah et al. (2020) [19] and Sonbol et al. (2020) [20] report a higher number of bilateral and multiple site fractures, mostly occurring within the head and neck regions. Other reported similarities across different countries also showed similar patterns of RTA-related osteopathic injuries [23] as ours and those within the Saudi Arabian regions, and this significantly merits further investigation into advocating for change into RTA-related injuries.

With regards to the time of day of the occurrence of the accident, the highest percentage of RTAs were reported in the afternoon, followed by accidents in the morning, and finally, those reported at night. This is similar to a previous study conducted in the Aseer region where the highest incidence of RTAs occurred during daytime (59.9%) [24]. On the contrary another study concerning timing showed that 58% of the RTAs happened during the evening (6:00 p.m.-9:00 p.m.) and 20% happened in the morning [25].

The results of this study highlight the impact RTA injuries have on the socio-economic stability of both the individual and the community. A link to the importance can be drawn from our results specifically related to age group and productivity. The reported results, including ours, illustrates that the majority of RTA injuries are reported by patients in the 16–34 years age group. A survey of the literature shows a significant impact of productivity loss due to high levels of RTA-associated injury within this particular age group across several different countries [26,27]. The economic burden within the main workforce, i.e., the young population, is dire given the high number of injuries related to road accidents. The rapid expansion of Saudi Arabia's workforce and the number of deaths per annum related to RTAs increased during a 6-year study, of which the main age group is those aged 20–39 years [28]. As a result, this economically active age group is at risk of high mortality due to RTAs unless several road regulations are implemented. Therefore, further investigation into minimizing RTA from an economic standpoint serves to give merit to the country and more importantly to the lives of the young cohort. Further research exploring more variables and factors affecting the injury type such as high-velocity impacts. Furthermore, regional similar research is needed to compare and raise awareness according to the results that appear.

5. Conclusions and recommendations

The current study revealed that many serious OIs were recorded among RTA cases especially injuries of the extremities which were complex in one out of 10 persons irrespective that most of the cases had

just one injury. Also, most RTA-associated OIs were admitted during rush hours (afternoon). Road traffic accidents and the resultant OIs, death, and permanent disabilities caused a tremendous burden on economic resources and should be of concern to local authorities. Raising awareness about the seriousness of RTAs and implementing strict and effective road safety regulations may help in reducing this major public health problem.

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Author Contributions

All authors contributed evenly to the conceptualization, drafting, data analysis, writing and proofreading of the research.

Declaration of competing interest

The authors declare no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amsu.2021.102509.

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