European Review for Medical and Pharmacological Sciences 2021; 25: 7878-7886

Association between orthopedic fractures and traumatic spinal injury due to road traffic accidents

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Abstract. – **OBJECTIVE:** Traumatic spinal injury (TSI) is a serious trauma-related injury with a significant risk for mortality and morbidity. Road traffic accident (RTA) is the leading cause for the spinal and orthopedic injuries globally. Detailed information on the association of orthopedic fractures with TSI and its influence on outcomes is lacking. In this study, RTA-related TSI with orthopedic associated fractures in terms of demographics, prevalence, patterns, and outcomes were studied.

PATIENTS AND METHODS: This was a single-center retrospective study conducted over ten years in the largest tertiary hospital in Southern Saudi Arabia. A total of 184 patients suffered TSI associated with orthopedic fractures out of the 810 RTA-related TSIs (22.71%) were recruited. The majority was males (86%), and 55% of the cohort was between 21-40 years.

RESULTS: The commonest spinal injury level was lumbar (25%) followed by the sacral spine (24.5%), while multiple regions orthopedic fractures and fracture pelvis were the commonest orthopedic fractures, 27.2% and 25%, respectively. The mortality rate was 4.3% and significantly correlated with the spinal injury level (p=.018). The region of orthopedic fracture has significant associations with the gender and hospital length of stay (p=.020 and p=.005, respectively). We also found a significant association between the spinal injury level and orthopedic fracture location (p<0001).

CONCLUSIONS: Traumatic spinal injuries due to traffic accidents are commonly associated with orthopedic fractures. This association has distinct patterns and influences the patient's outcomes.

Key Words:

Orthopedic fracture, Traumatic spinal injury, Traffic accident.

Introduction

Road Traffic Accidents (RTAs) are major causes of morbidity, mortality, and constitute a huge financial burden worldwide[1,2]. Road injuries are estimated to cost the global economy an annual tax of 0.12% on the global gross domestic product (GDP)[3].

In Saudi Arabia, RTA caused 16.5% of the mortalities in 2019[4] comprising a mortality rate of about 36 per 100,000[5]. Saudi youth in the age group (15-34 years) represent the largest population group[6]. Unfortunately, RTA claims the lives of one-third of this group[4]. Furthermore, the economic burden of RTA in Saudi is estimated to be 0.2% of total GDP in 2015-2030[3].

Traumatic spinal injury (TSI) is a serious injury with a mortality rate ranging from 3.8% to 15.4%, principally caused by RTA[7-9]. In Saudi Arabia, RTA causes about 80% of TSI, and the country has one of the highest world rates of spinal cord injuries, with 62 people injured per 1 million[10,11]. Accordingly, detailed studies on RTA-related TSI come as a priority.

The associations between traumatic injuries, such as clavicle fracture and lung injuries, are well established; nonetheless, few studies investigated the association between TSI and orthopedic injuries and the related clinical outcomes[9]. The traffic accident is a high-energy mechanism with a high potential for multiple organs injuries[8,9,12]. Hence, a detailed analysis of RTA-related TSIs, including their non-spinal associated injuries, is essential for better disease understanding, management, and prevention. Correlating the demographics and orthopedic fracture locations with the spinal injury level can help guide the clinical and radiological workups and improve the care of patients with such injuries.

In this context, this research aims to fill the knowledge gap around these injuries and provide information on RTA-related spinal injuries with orthopedic associated fractures. We intend to identify the distribution of the spinal injury level and the orthopedic associated fracture region. Also, we aimed to determine the association between the spinal injury level and the orthopedic associated fracture location. Moreover, we also studied the association between the spinal injury level or ortho-

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pedic associated fracture region from one side and patients' demographics or clinical outcomes from the other side. Knowledge of the abovementioned information is helpful in the daily practice of health practitioners providing care for such injuries as it helps them identify TSI patients at increased risk of associated orthopedic fractures and address their needs based on the anticipated outcomes.

Patients and Methods

Study Population and Study Design

This is a retrospective, record-based study conducted in Aseer province, Southwest Saudi Arabia. Being the only tertiary hospital in the Southern Province, Aseer Central Hospital (ACH) receives most RTA cases. We included 184 cases of RTA-related TSI associated with orthopedic fractures admitted to ACH between January 1st, 2010, and December 31st, 2019. We collected the sociodemographic characteristics, hospital admission details, and in-hospital outcomes. Eight hundred and ten patients diagnosed with RTA-related TSI were screened for this study. Patients included were those suffering orthopedic fractures in addition to TSI. Patients were excluded if no associated orthopedic fracture was found. There were no missing variables.

Table I. The demographic characteristics of the road traffic accident-related traumatic spinal injuries associated with orthopaedic fractures.

Characteristics	No. (%)
Gender	
Male	159 (86.4)
Female	25 (13.6)
Age category	
0-20 years	44 (23.9)
21-40 years	101 (54.9)
41-60 years	27 (14.7)
61-80 years	12 (6.5)
Weekend admission	
No	129 (70.1)
Yes	55 (29.9)
Critical care unit admission	
No	178 (96.7)
Yes	6 (3.3)
Discharge condition	
Not Improved	11 (6.0)
Improved	173 (94.0)
Mortality	
Alive	176 (95.7)
Dead	8 (4.3)
Hospital length of stay	
Short (0-5 days)	17 (9.2)
Medium (5-10 days)	29 (15.8)
Long (11 or more days)	138 (75.0)
Traumatic spinal cord injury	
No	178 (96.7)
Yes	6 (3.3)
Associated non-orthopedic injury	
No	123 (66.8)
Yes	61 (33.2)

Statistical Analysis

Patient demographics and endpoints are described by percentages. The association between patient demographics and outcomes with injury location and between orthopedic fractures region and spinal injury level is analyzed using the Chi-square test. Post-hoc analysis for the significant chi-square values is carried out by calculating the adjusted residuals to identify the cells with the largest deviation from the null hypothesis. *p*-value correction for multiplicity was performed with the Benjamini-Hochberg procedure. The hospital length of stay (LOS) of 0-5 days was considered "short", 6-10 days was considered "medium", and 11 days or more was considered "long". *p*-value less than or equal to 0.05 was considered statistically significant. Analysis was conducted using the SPSS statistical package (SPSS Inc., Version 25, IBM, Armonk, NY, USA).

Results

Out of the 810 patients with RTA-related TSI, 184 (22.71%) suffered concomitant orthopedic fractures, representing the commonest non-spinal associated injury. The majority (54.9%) was in the age group between 21-40 years, and males represented 86.4% of the entire cohort (Table I). Most (70.1%) admissions occurred during working days, and the vast majority (96.7%) did not require Intensive Care Unit (ICU) admission during their hospital stay. The hospital length of stay was long (≥ 11 days) for 75% of the patients. Concomitant traumatic spinal cord injury occurred in 3.3% of victims, while associated non-orthopedic injuries were present in 33.2%. The majority (94%) of patients improved and was discharged home, while the in-hospital mortality was 4.3%. Lumbar followed by sacral spine were the most affected levels, 25% and 24.5%, respectively (Table II). For the associated orthopedic fractures, multiple regions fractures and pelvic fractures were the most frequent, 27.2% and 25.5%, respectively (Table III).

Table II. Distribution of the level of spine injury.

Spinal injury level	No. (%)
Cervical spine	40 (21.7)
Dorsal spine	36 (19.6)
Lumbar spine	46 (25.0)
Sacral spine	45 (24.5)
Multiple levels	17 (9.2)

Table III. Distribution of the region of orthopaedic fracture.

Orthopedic fracture region	No. (%)
Multiple regions	50 (27.2)
Clavicle/shoulder	22 (12.0)
Upper limbs	27 (14.7)
Lower limbs	38 (20.7)
Pelvis	47 (25.5)

Table IV. Association between the orthopedic fracture region and the spinal injury level.

Orthopedic fracture region		Spinal injury level					Chi² *p*-value
	Total No. (%)	Cervical No. (%)	Dorsal No. (%)	Lumbar No. (%)	Sacral No. (%)	Multiple levels No. (%)	
Multiple regions	50 (27.2)	9 (4.9)	3 (1.6)	16 (8.7)	19 (10.3)	3 (1.6)	<.0001
Adjusted SR		-0.7511	-2.8334	1.3395	2.6108	-0.9268	
p-value		.453	.005	.180	.009	.354	
Adjusted *p*-value		.514	.016*	.266	.022*	.443	
Clavicle/shoulder	22 (12.0)	13 (7.1)	6 (3.3)	1 (0.5)	0 (0.0)	2 (1.1)	
Adjusted SR		4.5267	0.9712	-2.3613	-2.8442	-0.0256	
p-value		<.0001	.331	.018	.005	.980	
Adjusted *p*-value		<.0001*	.436	.041*	.016*	.980	
Upper limbs	27 (14.7)	8 (4.3)	12 (6.5)	3 (1.6)	1 (0.5)	3 (1.6)	
Adjusted SR		1.0761	3.5279	-1.8043	-2.7160	0.3636	
p-value		.281	<.001	.071	.007	.716	
Adjusted *p*-value		.392	.003*	.137	.021*	.778	
Lower Limbs	38 (20.7)	5 (2.7)	14 (7.6)	10 (5.4)	3 (1.6)	6 (3.3)	
Adjusted SR		-1.4397	3.0139	0.2103	-2.6665	1.5654	
p-value		.150	.003	.833	.008	.118	
Adjusted *p*-value		.234	.013*	.868	.021*	.196	
Pelvis	47 (25.5)	5 (2.7)	1 (0.5)	16 (8.7)	22 (12)	3 (1.6)	
Adjusted SR		-2.1383	-3.4924	1.6592	4.1316	-0.7836	
p-value		.032	.001	.097	<.0001	.433	
Adjusted *p*-value		.068	.003*	.173	<.0001*	.514	

*Significant *p*-value in Pearson residual analysis with Benjamini-Hochberg method for multiple testing. SR: Standard residual.

We investigated the relationship between the spinal injury level and the orthopedic fracture region and found a significant association (p<.0001) (Table IV, Figure 1). The post-hoc analysis showed a significant positive association between cervical spine injury and fractures involving the region of clavicle and shoulder (p<0001). For dorsal spine injury, there were significant positive associations with both upper and lower limb fractures (p=.003*,* p=.013, respectively), while significant negative associations with multiple regions fractures (p=.016) and fracture pelvis (p=.003). Regarding the lumbar spine injury, there was a significant negative association with fracture clavicle (p=.041). Finally, the sacral spine injury was significantly negatively associated with fracture clavicle (p=.016), fracture upper limbs (p=.021), and fracture lower limbs (p=.021); while, significantly positively associated with multiple regions fractures (p=.022), and fracture pelvis (p<.0001).

Regarding the association between the level of spine injury and demographics or outcomes, there was a statistically significant association between the spinal injury level and the mortality rate (p=.018) (Table V). Spinal injury at the cervical or dorsal levels correlated with increased mortality compared to other levels (p=.048*,* p=.027, respectively), though this association was attenuated after multiplicity correction (p=.534 for each). There was no significant association between spinal injury level and other demographics or outcomes.

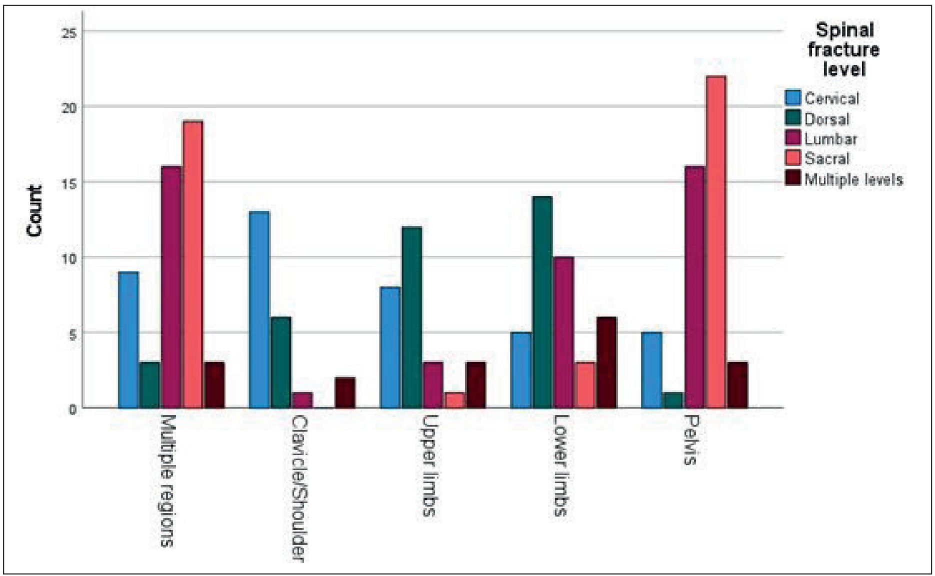

Figure 1. Orthopedic fracture regions.

Regarding the association between the region of orthopedic fracture and demographics or outcomes, there is a statistically significant association between gender and orthopedic fracture location (p=.02) (Table VI). Male gender was significantly negatively associated with fracture pelvis (p=.039). Furthermore, there was a statistically significant association between the LOS and orthopedic fracture region (p=.005). Clavicle/shoulder region fracture had a statistically significant negative association with prolonged LOS (p=.039). Also, it was positively associated with short and medium LOS (p=.020*,* p=.028, respectively), but these associations did not reach statistical significance once multiplicity correction was applied (p=.199*,* p=.242, respectively). Multiple-region orthopedic fractures were positively associated with prolonged LOS (p=.013) and negatively associated with short LOS (p=.008); however, these associations did not reach statistical significance upon applying multiplicity correction (Table VI). Upper limb fracture was negatively associated with prolonged LOS (p=.04), but it did not reach statistical significance when multiplicity correction was applied.

Discussion

Spinal injury is present in 13% of trauma victims and accounts for 10-15% of trauma-related admissions[13-15]. Polytraumatized patients with TSI have higher mortality and more unsatisfactory outcome compared to patients with no spinal injury[13,16,17].

Few studies discussed TSI-associated injuries[15]. Concurrent non-spinal injuries, however, have been reported to affect 30-60% of TSI patients[11,16,18]. Furthermore, even a minor spinal injury could act as a proxy of the location and direction of traumatic forces and serves as an indicator for the presence of other coexisting orthopedic injuries. In one study, the odd for pelvic fracture increases by four folds in the presence of isolated lumbar transverse process fracture[19].

High-velocity trauma, such as RTA, is associated with multiple and noncontiguous spinal injuries than low-velocity trauma[14]. Furthermore, the prevalence of associated other organ injuries is significantly higher in TSI due to RTA than lower energy mechanism, such as fall[16,18]. A study[20] has indicated RTA as the injury mechanism in 73% of lumbar spine fractures with intra-abdominal associated injuries. Among non-spinal associated injuries, orthopedic fractures are common. In one report, the rate of TSI-concomitant orthopedic fractures was 13.52% for upper extremities, 13.52% for pelvis, and 27.04% for lower extremities, representing the second most frequent non-spinal associated injury[16]. In RTA-related trauma, orthopedic fractures may rise to be the commonest non-spinal associated injury. One study[21] that looked at RTA-related TSI identified injury to lower extremities alone as the commonest associated injury.

Within this context, the main objectives of our study are to define the demographics of patients with RTA-related TSI with orthopedic associated

Table V. Association of the demographic characteristics and outcomes with the spinal injury level.

Characteristic		Spinal injury level					Chi² *p*-value
	Total No. (%)	Cervical No. (%)	Dorsal No. (%)	Lumbar No. (%)	Sacral No. (%)	Multiple levels No. (%)	
Gender							.149
Male	159 (86.4)	37 (20.1)	31 (16.8)	42 (22.8)	34 (18.5)	15 (8.2)	
Age category							.832
0-20 Years	44 (23.9)	12 (6.5)	10 (5.4)	7 (3.8)	9 (4.9)	6 (3.3)	
21-40 Years	101 (54.9)	22 (12.0)	19 (10.3)	26 (14.1)	26 (14.1)	8 (4.3)	
41-60 Years	27 (14.7)	3 (1.6)	6 (3.3)	9 (4.9)	7 (3.8)	2 (1.1)	
61-80 Years	12 (6.5)	3 (1.6)	1 (0.5)	4 (2.2)	3 (1.6)	1 (0.5)	
Weekend admission							.446
Yes	55 (29.9)	9 (4.9)	12 (6.5)	13 (7.1)	13 (7.1)	8 (4.3)	
Critical care unit admission							.065
Yes	6 (3.3)	3 (1.6)	3 (1.6)	0 (0.0)	0 (0.0)	0 (0.0)	
Discharge condition							.063
Improved	173 (94.0)	35 (19.0)	32 (17.4)	46 (25.0)	45 (24.5)	17 (9.2)	
Mortality							.018
Dead	8 (4.3)	4 (2.2)	4 (2.2.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Adjusted SR		2.0	2.2	-1.7	-1.6	-0.9	
p-value		.048	.027	.095	.1	.356	
Adjusted *p*-value		.534	.534	.534	.534	.668	
Hospital length of stay							.288
Short	17 (9.2)	5 (2.7)	5 (2.7)	2 (1.1)	2 (1.1)	3 (1.6)	
Medium	29 (15.8)	9 (4.9)	5 (2.7)	6 (3.3)	5 (2.7)	4 (2.2)	
Long	138 (75.0)	26 (14.1)	26 (14.1)	38 (20.7)	38 (20.7)	10 (5.4)	
Traumatic spinal cord injury							.175
Yes	6 (3.3)	0 (0.0)	3 (1.6)	2 (1.1)	0 (0.0)	1 (0.5)	
Associated non-orthopedic Injury							.467
Yes	61 (33.2)	17 (9.2)	12 (6.5)	11 (6.0)	16 (8.7)	5 (2.7)	

SR: Standard residual

fractures, characterize the pattern of spinal injuries and associated orthopedic fractures, analyze their pattern of association, and describe their clinical outcomes.

We found that almost every fourth RTA-related TSI has associated orthopedic fracture(s). Associated orthopedic fractures represented the most common non-spinal associated injury in this subset of trauma patients. The 23% association ratio found here is close to the 20.7% and 26% reported by others[15,22]. This supports the observation that orthopedic fracture is the commonest TSI-associated non-spinal injury in RTA-related trauma[21].

Most patients in our study were males, in agreement with many published studies[7,11,22]. Male preponderance is even more marked across studies looking at RTA-related TSI, mainly because road accident injury is skewed towards the male population[8,11,13].

The mortality reported in our study is 4.3%, which is within the TSI mortality reported range of 3.8%-15.4%[7]. Direct comparison, however, is difficult because no previous study has investigated a similar cohort of RTA-related TSI with orthopedic fractures. This study population is relatively young compared to most other studies, with 78.8% of patients aging ≤ 40 years. This may have contributed to the low mortality observed here, given that advancing age is a known predictor of increased comorbidities and mortality. Furthermore, only 3.3% of patients required critical care unit admission, indicating overall low injury severity. Injury severity has been found to be the most crucial determinant of TSI mortality[9].

The percentage of patients who suffered concurrent traumatic spinal cord injury (TSCI) is low (3.3%). This is close to the 3% reported by another study[8] and within the reported range of 1.6-

Table VI. Association of the demographic characteristics and outcome with the orthopedic fracture region.

Orthopedic fracture region		Orthopedic fracture region					Chi² *p*-value
	Total No. (%)	Multiple No. (%)	Clavicle/ shoulder No. (%)	Upper limbs No. (%)	Lower limbs No. (%)	Pelvis No. (%)	
Gender							.020
Male	159(86.4)	46 (25.0)	19 (10.3)	24 (13.0)	36 (19.6)	15 (8.2)	
Adjusted SR		1.4	0.0	0.4	1.7	-3.3	
p-value		.177	.994	.684	.093	.001	
Adjusted *p*-value		.651	.994	.939	.464	.039*	
Age category							.366
0-20 Years	44 (23.9)	10 (5.4)	4 (2.2)	4 (2.2)	15 (8.2)	11 (6.0)	
21-40 Years	101 (54.9)	28 (15.2)	12 (6.5)	16 (8.7)	18 (9.8)	27 (14.7)	
41-60 Years	27 (14.7)	7 (3.8)	6 (3.3)	4 (2.2)	4 (2.2)	6 (3.3)	
61-80 Years	12 (6.5)	5 (2.7)	0 (0.0)	3 (1.6)	1 (0.5)	3 (1.6)	
Weekend admission					.255		
Yes	129 (70.1)	36 (19.6)	19 (10.3)	17 (9.2)	28 (15.2)	29 (15.8)	
Critical care unit admission				.260			
Yes	6 (3.3)	2 (1.1)	1 (0.5)	0 (0.0)	3 (1.6)	0 (0.0)	
Discharge condition							.516
Improved	173 (94.0)	45 (24.5)	21 (11.4)	26 (14.1)	35 (19.0)	46 (25.0)	
Mortality							.782
Dead	8 (4.3)	2 (1.1)	1 (0.5)	1 (0.5)	3 (1.6)	1 (0.5)	
Hospital length of stay							.005
Short	17 (9.2)	0 (0.0)	5 (2.7)	5 (2.7)	3 (1.6)	4 (2.2)	
Adjusted SR		-2.6	2.3	1.8	-0.3	-0.2	
p-value		.008	.020	.072	.748	.842	
Adjusted *p*-value		.151	.199	.409	.939	.971	
Medium	29 (15.8)	6 (3.3)	7 (3.8)	6 (3.3)	5 (2.7)	5 (2.7)	
Adjusted SR		-0.9	2.2	1.0	-0.5	-1.1	
p-value		.392	.028	.319	.621	.264	
Adjusted *p*-value		.808	.242	.720	.940	.704	
Long	138 (75.0)	44 (23.9)	10 (5.4)	16 (8.7)	30 (16.3)	38 (20.7)	
Adjusted SR		2.5	-3.4	-2.0	0.6	1.1	
p-value		.013	.001	.040	.528	.283	
Adjusted *p*-value		.151	.039*	.318	.938	.704	
Traumatic spinal cord injury				.120			
Yes	6 (3.3)	0 (0.0)	1 (0.5)	3 (1.6)	1 (0.5)	1 (0.5)	
Associated non-orthopedic Injury						.946	
Yes	61 (33.2)	17 (9.2)	8 (4.3)	8 (4.3)	14 (7.6)	14 (7.6)	

*Significant *p*-value in Pearson residual analysis with Benjamini-Hochberg method for multiple testing. SR: Standard residual.

13%, irrelevant of the injury mechanism. Since the 3.3% reported her is half of the 6.6% reported by a study[12] that looked at RTA-related TSI, the presence of orthopedic fractures may indicate a pattern of directional forces that dissipate traumatizing energy away from the spine resulting in less TSCI. In support of this, a study[15] has found limb fractures to be associated with decreased odd for TSCI.

One-third (33.2%) of TSI patients here also suffered non-orthopedic associated other organs injuries. This highlights the importance of keeping a high index of suspicion and doing systematic workup of these patients to limit the risk of missed injuries.

For the spinal injury level, the lumbar then sacral levels were the most involved. This is similar to the finding from a study with RTA as the trauma mechanism[12]. However, most TSI studies have reported the cervical spine as the commonest injury level[7,11,23]. It is possible that orthopedic fractures, especially in the upper extremity, act as shock absorbers redirecting traumatic forces away from the cervical spine. This is supported by a study that found limb fractures to be associated with low odd for spinal injuries[15].

For the associated orthopedic fractures, multiple regions fractures followed by fracture pelvis were the most frequent in our study. The most frequently reported location of orthopedic associated fractures regardless of TSI injury mechanism is extremity[15,16,22]. Some found clavicular fractures to be the commonest[23]. However, pelvic fractures are the most frequent TSI-associated fractures when taking RTA as the sole trauma mechanism[12,21]. This indicates different distributions of traumatic forces between the spine and the rest of the orthopedic skeleton based on the trauma mechanism.

One of probably the most important findings of this study is elucidating the pattern of association between spinal and orthopedic injuries. The association between spinal injury level and orthopedic fracture location, specifically in RTA-related injuries was not adequately studied before.

In this study, cervical spinal injuries were significantly positively associated with clavicle/shoulder region fractures. This can be attributed to the regional proximity, which is supported by the preponderance of other injuries in the area of the principal injury[9]. One report found a significant correlation between cervical spine injury and upper limb fractures[22]. Whether or not the shoulder region was included as part of the upper limb is unclear from that study. Another study[9] that included clavicle and shoulder fractures as part of the upper limb fractures found 20% association with the cervical spine injury and found the clavicle/shoulder to be the most involved region of the upper limb.

Dorsal spinal injuries, here, were significantly positively associated with upper and lower limb fractures but significantly negatively associated with fractures in multiple regions and pelvis. A previous study[9] found upper and lower extremity fractures in 27% and 14% of dorsal TSI, respectively. The study, however, did not comment if this association was significant.

The upper limb association can be explained by regional proximity, while the lower limb association could be related to the crash mechanism. One study identified lower limb fractures as TSI commonest associated injury in frontal crashes[21].

Lumbar spinal injuries were significantly negatively associated with clavicle/shoulder region fractures, possibly due to distant injury locations. Unlike dorsal spine injury, we did not find a positive association with lower extremity fractures. This is also different from a previous report that found such an association[22].

The sacral spine injury had significant positive associations with orthopedic fractures in multiple regions and pelvic fractures but had significant negative associations with fractures of the clavicle/shoulder, upper limbs, and lower limbs. The positive association between sacral spinal injuries and pelvic fractures is expected due to contiguous location. This is consistent with another study[22]. The negative association of sacral spine injury with the clavicle/shoulder and upper limb regions is explained by distant locations. The negative association with the lower extremity fractures seen here is interesting. One study did not find an association between sacral spine injury and lower extremity fractures[22]. Our study demonstrates a remarkable pattern of association between the spinal injury level and lower extremity fractures. The pattern reflects a decreasing association as the injury moves down the spine, from a positive association in the dorsal level, to non-significant in the lumbar, to a negative association in the sacral spine. It is possible that the directional forces that predispose to lower extremity fractures during traffic accidents decrease as these forces move down the spine. It is plausible that these forces culminate in the pelvis, indicated by a positive association between sacral and pelvic injuries, thus shielding traumatic forces from the lower limbs.

We also investigated the association of the patients' demographics and outcomes with the spinal injury level. Only mortality is significantly associated with the level of spinal injury. The results indicated increased mortality for the cervical and dorsal spinal injuries; however, the associations did not reach statistical significance upon multiplicity correction. This could be related to the small number of patients in these two groups. Nonetheless, the positive correlation observed here is supported by other studies that found increased mortality of cervical and dorsal TSIs compared to different levels[13,22].

Regarding the association of the patients' demographics and outcomes with the region of orthopedic fracture, a significant association between gender and the orthopedic fracture region exists. Namely, the male gender is significantly negatively associated with pelvis fractures. Though there is no obvious explanation for this negative association and no similar previous studies for comparison, anatomical and pathophysiological reasons such as the prevalence of osteoporosis in females may be behind this difference. In this study, the hospital length of stay was extended for three-quarters of patients, indicating that orthopedic fracture with RTA-related spinal injury is a predictor of increased hospital LOS. Further, there is a significant correlation between LOS and the orthopedic fracture region. Clavicle/shoulder region fractures were significantly likely to be discharged within ten days. This can be attributed to the usual mild nature of these injuries that allow their outpatient follow-up. The same can be said about upper limb fractures, which were negatively associated with prolonged LOS, though the significance of association was not as robust. On the contrary, fractures in multiple orthopedic areas were associated with prolonged LOS. The presence of fractures in multiple orthopedic regions is a sign of increased injury severity, accounting for the extended LOS.

The strengths of this study come from the fact that it is the first to give a detailed analysis on the association between orthopedic fractures and TSI caused by the most prevalent spinal injury mechanism, RTA. It sheds light on many clinically relevant and common aspects faced in daily practice. It encompasses patients' data over ten years with an adequate sample size that allowed post hoc analysis of relevant variables.

The study, however, was limited by its retrospective and single-center nature. It lacked details of the traffic collision and information on the injury severity as measured by a validated scale. Despite these limitations, the study provides results that have direct implications on the clinical practice and care given to TSIs and warrant larger multi-center projects to explore this further.

Conclusions

Traumatic spinal injuries due to traffic accidents are commonly associated with orthopedic fractures. This association has distinct patterns and influences the patient's outcomes. Knowledge of these patterns and related outcomes is indispensable for efficient workup that minimizes the risk of overlooked injuries at the rush of the emergency service and for better care of these patients by the bedside clinicians in view of the results demonstrated in this study.

Statement of Ethics

This study was conducted according to the guidelines of Helsinki's declaration, and it was approved by the Institutional Ethical Review Board (IERB) of King Khalid University Abha, KSA. The reference number is 2021-4001, dated 10-03-2021.

Conflict of Interest

The author declares that he has no conflict of interest.

Funding Sources

The author did not receive any funding.

Acknowledgment

The author would like to thank the authority of KKU for the provision of research environment.

Data Availability

Data will be available on request/demand.

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