

ORIGINAL ARTICLE

Traumatic spinal cord injury in Saudi Arabia: an epidemiological estimate from Riyadh

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Study design: Retrospective study.

Objectives: To review traumatic spinal cord injury (TSCI) rates and epidemiology at the Riyadh Military Hospital (RMH) in Saudi Arabia and to hypothesise strategies for a more integrated approach to injury prevention in Saudi Arabia.

Setting: RMH, Rehabilitation Division.

Methods: A review was conducted of all patients with TSCI aged ≥ 14 years admitted to RMH from January 2003 to December 2008. Descriptive analysis was performed for age, gender, cause of TSCI, completeness and neurological level of the injury.

Results: In all, 307 TSCI patients were admitted during this period: 88% were male, and their mean age was 29.5 years old (median 27, range 14–70). Of all TSCI patients, 52% had tetraplegia and 51% had a complete TSCI. Road traffic accidents (RTAs) were the main cause of TSCI (85%).

Conclusions: TSCI in Saudi Arabia affects mainly the male population. The rate of RTAs caused by four-wheeled vehicles is the highest globally reported RTA statistic. Primary prevention strategies specific to the region should be developed to decrease the number of car accidents. The higher-than-expected rate of complete injuries may reflect practices in acute management and transport, and suggests that a review of the acute and integrated management of TSCI may also be necessary.

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INTRODUCTION

Traumatic spinal cord injury (TSCI) is catastrophic to individuals and the society. The total cost of spinal cord injury (SCI) in Australia was roughly estimated to be around \$2.0 billion (AUD). According to a statistical report, across Australia the lifetime cost per incident case of SCI of paraplegia and quadriplegia was estimated to be \$5.0 and \$9.5 million (AUD), respectively.¹ In the United States, every year there are nearly 10 000 incidents of TSCI, resulting in a substantial economical burden of almost 8 billion US dollars annually.²

There is limited information available to estimate the incidence of TSCI within Saudi Arabia. Information from Qatar,³ which is culturally similar to Saudi Arabia, however, provides comparable TSCI data (incidence rate: 12.5 TSCIs per million per year with road traffic accidents (RTAs), 72% of total). An estimated incidence rate for the Middle East, Jordanian, Qatari and Turkish incidence data^{4,5} is about 15 TSCIs per million per year and is likely an underestimate.

A recent global epidemiological review highlighted that TSCI incidence in North America is 40 per million, Australia 15 per million and Western Europe 16 per million. The major cause of TSCI in these regions was RTAs, primarily caused by four-wheeled motor vehicles.⁵

The motor vehicle is the main means of transportation in Saudi Arabia. Regional RTA mortality for Saudi Arabia is high.^{6,7} During 2007, with a population of 27.6 million, about 7006 people died on the roads in Saudi Arabia due to RTAs, accounting for > 10% of the total number of deaths during that year (65 461).⁸ This equates to 254

RTA deaths per million in Saudi Arabia (2007 data re-calculated by the authors) compared to 152 in the United States and 95 in Australia (2000).⁹ Ansari reported that during the period 1971–1997, there were 564 762 deaths or injuries from RTAs over a 26-year period (3.5% of the Saudi Arabian population) and that over 65% of RTAs included the components of excessive speed and/or disregarding traffic regulations. This paper also reported that 79.2% of TSCI admitted to Riyadh Military Hospital (RMH) were caused by RTAs.⁷

The Ministry of Health is the major health-care provider in Saudi Arabia (60% of health services) with 244 hospitals. Other government services (including armed forces, security forces, national guard services) provide health care to their respective employees (and their families) as well as all residents during emergencies. These services include 39 hospitals and provide 19.3% of health services. The private sector includes an additional 125 hospitals and provides 21.2% of health services.⁶ This paper reports on the epidemiology of a cohort, specifically patients admitted to the RMH.

The geographical catchment of the RMH¹⁰ is difficult to estimate. It is the main provider of medical services for military personnel (and their dependants) in the capital of Saudi Arabia (Riyadh) and is the biggest military hospital there. It is one of the two military hospitals in Saudi Arabia that has rehabilitation facilities and where TSCI patients are admitted. There are more than one million registered patients in the RMH as of 2006 (including peripheral clinics) and it has 1192 beds, including 26 rehabilitation beds.

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Table 1 Epidemiological characteristics of traumatic spinal cord injury patients admitted to Riyadh Military Hospital, Saudi Arabia, 2003–2008 (counts and table percentages)

	Male		Female		Group total	
	Count	Per cent	Count	Per cent	Count	Per cent
<i>Age at TSCI (years)</i>						
14–15	6	2	2	1	8	3
16–30	172	56	24	8	196	64
31–45	64	21	8	3	72	23
46–60	21	7	2	1	23	7
61–75	8	3	0	0	8	3
76+	0	0	0	0	0	0
All ages	271	88	36	12	307	100
<i>Cause of TSCI</i>						
RTA	227	74	35	11	262	85
Falls	27	9	1	0	28	9
Gunshot	14	5	0	0	14	5
Diving	3	1	0	0	3	1
All causes	271	88	36	12	307	100
<i>Neurological category</i>						
Complete tetraplegia	61	20	5	2	66	21
Incomplete tetraplegia	85	28	10	3	95	31
Complete paraplegia	80	26	10	3	90	29
Incomplete paraplegia	45	15	11	4	56	18
All neurological levels	271	88	36	12	307	100

The aim of this paper is to see if TSCI rates and epidemiology at the RMH institution have changed since Ansari's 1971–1997 review and to examine the causes of TSCI to hypothesise strategies for a more integrated approach to injury prevention.

MATERIALS AND METHODS

A retrospective chart review of all TSCI patients admitted to the RMH from January 2003 to December 2008 was carried out.

Inclusion criteria

All TSCI adult patients who were admitted to the RMH in the above period were included. These patients were predominantly military personnel and their dependants; however, some patients from the Ministry of Health were also included during the study period (although the exact numbers of non-military personnel are not available) and were categorised according to age, gender and cause of TSCI. Patients were grouped by using the American Spinal Injury Association Impairment Scale (AIS)¹¹ to determine neurological status as the following: tetraplegia complete, tetraplegia incomplete, paraplegia complete and paraplegia incomplete. Descriptive statistics were used to analyse the data. Data were insufficient to provide an incidence statistic, owing to the uncertainties regarding the underlying population catchment.

RESULTS

Three hundred and seven TSCI patients aged 14–70 years were admitted to the RMH between January 2003 and December 2008. Of these, 271 patients (88%) were male and 36 (12%) were female (Table 1). The mean age was 29.5 years (median 27, range 14–70). The majority of patients (64%) were between 16–30 years old. RTAs accounted for 85% of all the patients, followed by fall from height (9%), gunshots (5%) and sport injuries (about 1%). In all, 53% of the patients presented with tetraplegia and 47% with paraplegia. About

Table 2 Age at traumatic spinal cord injury by neurological category of patients admitted to Riyadh Military Hospital, Saudi Arabia, 2003–2008 (counts)

	Neurological category				Group total
	Complete tetraplegia	Incomplete tetraplegia	Complete paraplegia	Incomplete paraplegia	
<i>Age at TSCI (years)</i>					
14–15	1	4	2	1	8
16–30	43	68	47	38	196
31–45	17	17	28	10	72
46–60	5	6	7	5	23
61–75	0	0	6	2	8
76+	0	0	0	0	0
All ages	66	95	90	56	307

Abbreviation: TSCI, traumatic spinal cord injury.

Table 3 : Cause of traumatic spinal cord injury by neurological category of patients admitted to Riyadh Military Hospital, Saudi Arabia, 2003–2008 (counts)

	Neurological category				Group total
	Complete tetraplegia	Incomplete tetraplegia	Complete paraplegia	Incomplete paraplegia	
<i>Cause of injury</i>					
RTA	58	84	72	48	262
Falls	4	6	12	6	28
Gunshot	4	2	6	2	14
Diving	0	3	0	0	3
All causes	66	95	90	56	307

half (51%) of the patients had a complete SCI (22% were tetraplegic and 29% paraplegic). Also, 31% had an incomplete tetraplegia and 18% incomplete paraplegia (Table 1). For the 16–30-year age group, 57% ($n = 111$) sustained high-level SCIs, with 39% ($n = 43$) of these patients having complete tetraplegia (Table 2).

Fifty-four percent ($n = 142$) of RTAs resulted in tetraplegia, with 69% ($n = 58$) of these patients having complete tetraplegia. Over a third of fall-related TSCIs resulted in tetraplegia and 57% ($n = 12$) of all cases had complete injury (Table 3). All diving TSCIs resulted in incomplete tetraplegia and 71% ($n = 10$) of TSCIs from gunshots caused complete lesion of the spinal cord.

DISCUSSION

The rate of TSCI caused by RTAs is the highest of all globally reported TSCI statistics at 85%. This is slightly higher than the proportion that Ansari reported from the same spinal unit more than a decade previously,⁷ which showed no improvement in an extremely high rate of injury. Data from Qatar³ suggest that this may be part of a wider regional problem and is an obvious target for a coordinated injury prevention strategy. In our study we found that the male:female ratio is high (9:1) (similar to Ansari's report⁷) compared to the 3:1 male:female ratio found in Australia.¹² This male:female ratio is similar to that found in culturally similar Qatar (8.3:1).³ In Saudi

Arabia, the male:female ratio is likely amplified by the fact that women are not allowed to drive by law, as a result making them less exposed to the risk of TSCI from RTAs. Given the skew that is possibly caused by inclusion in the military hospital, the age, sex and aetiology data should be interpreted with caution.

Prevalence of TSCIs cannot be reliably estimated because of the stratified health system in Saudi Arabia (military vs civilian) and uncertain underlying population catchments.

The major causes of TSCI in Saudi Arabia in comparison to other regions reveals the following: TSCI due to violence/self-harm was 4.6% in Saudi Arabia. The rates were higher in North America (15%) and Western Europe (6%) but lower in Australia (2%). Sub-Saharan Africa has the highest reported rate of violence-related TSCI in the world (38%). Rates are also high in North Africa/Middle East (24%) and Latin America (22%).⁴

TSCI due to falls was as low as 9% in Saudi Arabia compared to North America and Australia (29% and 20%, respectively).⁴ This may be related to Saudi Arabia's young population, with only 2.8% of people being ≥ 65 years old.⁸

Sport injury was very low in Saudi Arabia (1%) compared to North America (11%) and Australia (9%),⁴ which may be due to lack of high-contact sports, like American football and rugby, plus a lack of interest in water sports such as surfing and diving.

We found that the majority of TSCI patients had tetraplegia, which could possibly be explained by a lack of seat-belt use.⁷ Although seat-belt use in Saudi Arabia is mandatory, in practice compliance is very low. The higher-than-expected rate of complete injuries may reflect practices in acute management and transport, and suggests that a review of the acute and integrated management of TSCI may also be necessary. Societal issues, such as transporting the TSCI patients from accident location without waiting for the arrival of trained emergency services staff, also contribute to the severity of the TSCI.

This study outlines the urgent need for a prospective study in order to get a clear idea about the exact incidence and prevalence of SCI in an area with a defined catchment. Within Saudi Arabia this would require an integrative approach across the health delivery sector. A national trauma or SCI registry (using international data standards for trauma and SCI) and, ideally, together with the International Classification of External Causes of Injury (ICECI) (an international data standard for injury), would also provide this information and is recommended.^{13–15} Reliable data of this type also assist in providing information to allow extrapolative methods to better estimate regional incidence rates⁵ relevant to other socially similar societies such as Qatar. Saudi Arabia has implemented recent measures to reduce the number of road fatalities, which might help in reaching the target of a reduction of RTA fatalities of 30% between 2000 and 2015.⁹ These measures include compulsory use of safety seat belts in vehicles, speed cameras, safety cameras at traffic lights, random check points and regular education through various media. Alcohol use by drivers and the associated increased risk of road crashes are difficult to measure in Saudi Arabia. Alcohol use is illegal in Saudi Arabia and it is likely that this leads to reporting bias. An integrated system for collecting data relevant to injury prevention across the different sectors of the health system and a method for linking and interpreting data would assist in determining and quantifying the effectiveness of injury prevention initiatives and need to be part of an urgent multidisciplinary and societal response to what is a national crisis.¹³

This report contributes to the available data in the region and extends the body of evidence that identifies this region as having

disproportionately high levels of RTA caused by four-wheeled motor vehicles as a cause of TSCI. This has significant societal implications, as those affected are primarily young males with high life-time costs of care, and has long-term implications as citizens are being injured when they are in their most productive age. Rehabilitation services have the challenge of reintegrating into society a population of young TSCI persons, to help them reach their full potential as active participants in the Saudi Arabian society. To be truly effective, rehabilitation services need to be part of an integrated national approach to trauma prevention and management.

CONCLUSION

This study demonstrates that there has been little change in the high percentage of RTA-associated TSCI since 1997, which was already at globally very high levels. Systems to reliably measure TSCI incidence and prevalence, however, need to be enhanced in an integrated fashion across the entire health delivery sector as representative statistics for Saudi Arabia cannot be derived for TSCI from the available data. The World Health Organisation global region of North Africa/Middle East as a whole lacks the advantages of a prospective TSCI registry based on an internationally acceptable data standard for the purposes of service planning and injury prevention.

CONFLICT OF INTEREST

The authors declare no conflict of interest

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