Patterns of cervical spine injuries in adults at a major trauma center in Saudi Arabia

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ABSTRACT

Objectives: To describe the patterns of cervical spine injuries in an adult population in a major trauma center in Riyadh, Saudi Arabia.

Methods: A retrospective cohort study including all adults with cervical spine injuries from 2014 to 2018 was conducted. All patient data with radiological evidence of injury involving the cervical spine were collected.

Results: The final sample size realized as 257 patients. Majority of the sample (85.6%) were male and the age ranged from 14-90 years (mean of 36.6 years±18.5 SD). Motor vehicle accidents were the most frequent mechanism of injury (92.6%, n=238). Single level of injury of the cervical spine was encountered in 52.9% (n=136) and 2 or more levels of injury were encountered in 47.1% (n=122) of patients. In total, 442 cervical spine injury levels were identified. At these levels, 559 fractures were observable radiologically. Associated head injury was present in 125 patients (48.6%). Only a small proportion (22.2%, n=57) had neurological sequelae.

Conclusion: It reflects the impact of this injury on younger male patient population.

Keywords: cervical spine, C spine, trauma, injury, fracture, head injury, neurological deficit, neurological sequelae, tetraplegia

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Trauma is one of the most frequent causes of mortality and morbidity in young adults.[1] Cervical spine injuries are among the most common etiologies of such outcome.[2,3] The incidence of spinal fractures is estimated as 10% in all polytrauma patients, one fourth of which are located in the cervical spine, and almost 50% may result in a form of spinal cord injuries.[4] Cervical spine injuries are common in our developing country. Limited literature is available about our local experience regarding the patterns of cervical spine injuries.

The study aimed to describe the patterns of cervical spine injuries in an adult population in a major trauma center, King Abdulaziz Medical City (KAMC), Riyadh, Saudi Arabia.

Methods. A retrospective cohort study including all patients who presented to the emergency department with a trauma code from 2014 to 2018 (inclusive) was conducted. Patients' data were extracted from the trauma registry database that includes all trauma cases presenting to the emergency department in the hospital. The database includes patients' demographics (age, gender, and so forth) and trauma details (list of all injuries, mechanism of injury, transportation methods) that are recorded and followed from admission date until date of discharge, transfer, or death. The quality of the data collected in the database is evaluated annually with the medical records. Using OpenEpi, version 3, open source calculator, the recommended sample size with margin of error (MOE) of 10% and confidence interval (CI) of 90% was 271. In total, 1206 trauma code patients were identified in the trauma database in the specified period. Patients' files, electronic charts, and radiological studies were reviewed using the hospital's electronic system. We excluded i) pediatric patients (less than 14 years), ii) patients who did not require CT scans of the cervical spine as part of trauma evaluation, and iii) patients who had normal CT scans of the cervical spine. The final sample size realized as 257 adult patients (≥14 years) with abnormal trauma CT scans of the cervical spine which were included in the current study. Patients' demographics, mechanism of injury, Glasgow coma scale upon arrival to the ER, head and spine trauma CT findings, and last follow up neurological examination findings were collected. The neurological deficits were classified according to the association with head injury, cervical spine injury, or other neurological injuries such as thoracic/lumbar spine, cranial nerves, or peripheral nerves. Severity of spinal cord injuries of the cervical spine was assessed using the American Spinal Injury Association (ASIA) impairment scale. All descriptive results are presented as frequency and percentage using IBM SPSS Statistics, version 23, (IBM corporation, Armonk, New York, United States).

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The proposal was approved by the Institutional Review Board of King Abdullah International Medical Research Center (KAIMRC), with protocol number RC19/142/R.

Results. *Demographic information.* Majority of the sample (n=257) were male (85.6%) and the age ranged from 14-90 years (mean of 36.6 years ±18.5 SD). Half of the sample age (49.8%, n=128) fell between 21-40 years with a small proportion (1.2%, n=3) above the age of 80 years (Table 1).

Mechanism of injury. The vast majority of injuries (92.6%, n=238) were secondary to motor vehicle accidents (MVA). The driver or the passengers were the mostly affected persons (93.7%, n=223), followed by pedestrians (4.2%, n=10) (Table 1).

Cervical spine injury characteristics. Radiological evidence of cervical spine injuries on a single level was observed in 52.7% (n=136) and on 2 or more levels in 47.1% (n=121). A total of 442 cervical spine injury levels were observed. The frequencies are as follows: occipital condyle, C1, C2, C3, C4, C5, C6, C7, and T1. At these levels, 559 fractures were identified radiologically (more than one fracture can be seen at the same level). The most frequent anatomical location of fracture was at the transverse process (27.9%), followed by the lamina (17.7%) and the facets (17.2%) (Table 2).

Associated head injury. As evidenced on a brain CT, head injury was present in almost half of the patients (49%, n=125). Of the subgroup with head injury, 45% (n=56) had mild (GCS 14-15), 16% (n=20) had moderate (GCS 9-13), and 39% (n=49) had severe head injury (GCS ≤8). Death was encountered in 13% (n=16) of the subgroup as a result of severe head injury.

Neurological status assessment. As displayed in Table 3, 65% of the sample (n=167) was found neurologically intact on physical examination, and 22.1% (n=57) had neurological sequelae. Approximately 8.6% (n=22) died on presentation and 4.3% (n=11) continued their evaluation and follow-up in another institution. Of the

Table 1 - Demographic information of the sample and mechanism of injury of the cervical spine.

Variables	n	(%)
Gender		
Male	220	(85.6)
Female	37	(14.4)
Age (years)		
14-20	47	(18.3)
21-40	128	(49.8)
41-60	45	(17.5)
61-80	34	(13.2)
>80	3	(1.2)
Mechanism of injury		
Motor vehicle accidents:	238	(92.6)
Car drivers/passengers	223	(86.8)
Motor cyclers	5	(1.9)
Pedestrians	10	(3.9)
Falls	11	(4.3)
Other	8	(3.1)

Table 2 - Levels of injury and anatomical locations of cervical spinal fractures.

Variable	n	(%)
Number of injury levels		
Single level	136	(52.9)
≥2 levels	121	(47.1)
Levels of injury		
Occipital condyle	6	(1.4)
C1	24	(5.4)
C2	46	(10.4)
C3	27	(6.1)
C4	37	(8.4)
C5	62	(14.0)
C6	98	(22.2)
C7	120	(27.1)
T1	22	(5.0)
Total	**442**	**(100)**
Location of fracture		
Transverse process	156	(27.9)
Lamina	99	(17.7)
Facet and articular process	96	(17.2)
Vertebral body	87	(15.6)
Spinous process	65	(11.6)
Pedicle	45	(8.1)
Pars interarticularis	11	(2.0)
Total	**559**	**(100)**

Table 3 - Neurological assessment after trauma.

Neurological assessment	n	(%)
Normal	167	(65.0)
Abnormal	57	(22.1)
Head injury related deficit	7	(2.7)
Hemiplegia	4	(1.5)
dysphagia	1	(0.4)
Vegetative state	2	(0.8)
Cervical spine injury related deficit	35	(13.6)
Tetraplegia/tetraparesis	26	(10.1)
Upper limb weakness	7	(2.7)
Upper limb sensory deficit	2	(0.8)
Other associated neurological injuries	15	(5.8)
Thoracic/lumbar spine injury related deficit	12	(4.6)
Peripheral nerve deficit	3	(1.2)
Deceased	22	(8.6)
Lost to follow-up	11	(4.3)

subgroup with neurological sequelae, 12.3% (n=7) were related to head injury, 61.4% (n=35) were related to cervical spine injury, and 26.3% (n=15) were related to other neurological injuries like cranial nerves, peripheral nerves, thoracic or lumbar spine injuries. In patients with neurological deficits related to the cervical spine injury (n=35 patients), 14 cases (40%) had associated head injury. Of which, 8 cases had mild, 2 cases had moderate, and 4 cases had severe head injury. Spinal cord injuries were found in 26 patients (10% of the total cohort group). American Spinal Injury Association Impairment scale was used to assess the severity of the spinal cord injuries for conscious patients in the emergency department (n=20) and upon follow-up (n=26). A scores were found in 13 (65%), B in 2 (10%), and C in 5 patients (25%). Upon follow up, 6 (23%) had scores of A, 4 (15%) had B, 9 (35%) had C, and 7 patients (27%) had D. Improvement in ASIA score from initial presentation to the last follow up visit was encountered in almost 70% of patients (n=18). No worsening of ASIA score was encountered.

Discussion. The current study reported the pattern of cervical spine injury, a major health issue in Saudi Arabia. Cervical spine injuries result in significant mortality and serious morbidity, primarily in the young population. Worldwide, spinal injuries comprised 10% of polytrauma patients, approximately 25% of which were cervical spine injuries.[4] Approximately 2% of blunt trauma injury patients had associated cervical spine injuries.[5] In the current study, cervical spinal injuries occurred in 20% of all trauma code patients, reflecting a higher incidence of cervical spine injury. This may be explained by our cohort group selection of patients who had trauma code high MVA speed, identifying more significant injuries.

The prevalence of a cervical spine injury is influenced by multiple factors, such as age. It is reported that cervical spine injuries are more common in younger individuals in Saudi Arabia. Al-Habib et al[3] reported a mean age of 32 years, and Alshahri et al[6] reported a mean age of 29.5 years. AlEissa et al[2] reported that more than 80% of their sample with neurological deficits were younger than 45 years. Similarly, Aldosari et al[7] reported that most patients were below the age of 40. In the current study, almost 70% of the sample were below the age of 40 years (68.1%, n=175), and only 14% (n=37) were above the age of 60 years.

Motor vehicle accidents were the most frequent mechanisms of injury (92.6%) which is higher than international reports (25-50%).[8-10] This is in keeping with previous studies published from our country and nearby developing countries.[2,3,11,12]

Associated head injury was present in almost 50% of the cases (n=125) which falls within the range of reported incidence internationally (24-55%).[13-15]

Study limitations. Although the study provides valuable information regarding injuries of the cervical spine in our community, it has some limitations. The study was hospital-based and not national based data that is needed for further improvement in patient care. It was a retrospective cohort study which may be prone to information bias though using the electronic patient records may have negated some of the bias.

The study provides evidence of a significant problem that requires urgent attention. A nationwide registry is required to provide more comprehensive data to facilitate the development of such preventive and therapeutic strategies to improve the provided medical care.

In conclusion, this study demonstrates the local experience with cervical spine injuries in a major trauma center. It reflects the different mechanisms of injury, demographic characteristics, levels and anatomical locations of injury, the association of head injuries, and neurological sequelae. The study provides evidence of a significant problem that requires urgent attention. A nationwide registry is required to provide more comprehensive data to facilitate the development of such preventive and therapeutic strategies to improve the provided medical care.

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