

Profile of Traumatic Cervical Spine Injuries in Assiut University Hospital

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ABSTRACT

Background Data: Cervical spine fractures and dislocations are potentially devastating injuries that must be quickly identified and properly managed to optimize patients' outcomes; however, the incidence of cervical spine injuries (CSI) in Egypt is largely unknown.

Purpose: To evaluate the demographics, mechanisms of injury, neurological status, and management of CSI in the Trauma Unit of Assiut University Hospital.

Study Design: A retrospective descriptive analytic cross-sectional study.

Patient and Methods: During the period from January 2015 to December 2016, data of all CSI patients who presented to and managed in the Assiut University Hospital Trauma Unit were retrospectively recorded. Initial management was made according to ATLS guidelines. Classification of CSI and neurological examination were conducted according to the AO classification and Frankel classification, respectively. The study was approved by our Institutional Ethical Committee.

Results: During the study period, 267 patients presented with CSI and managed in Assiut University Hospital Trauma Unit. CSI occurred in approximately 1% of all admitted patients (28548 patients) during the same period, 1.3% of admitted orthopedic patients (20556 patients), and 15.5% of patients with all spinal injuries (1717 patients). Most of the patients were males (85.8%), and the most common age group was from 20 to < 40 years (39.0%). The most common causes of CSI were road traffic accidents (62.2%), falling injuries (32.6%), and heavy object trauma (5.2%). Out of 267 patients with CSI, 159 (59.5%) had neurological insults and 77 (28.8%) complete quadriplegia. Traumatic cervical disc prolapse occurred in 63 patients (23.6%), upper CSI in 23 patients (16.1%), and subaxial cervical fracture type A in 24 patients (15.7%), type B in 32 patients (12%), and type C in 87 patients (32.6%). The preoperative in-hospital mortality rate was 14.6% (39 patients).

Conclusion: In our locality, the most common cause of CSI was road traffic accidents, which mainly involved young people in the most productive age group, leading to a high rate of disability and mortality. Preventive measures in roads and proper use of protective equipment in vehicles must be practiced avoiding such major consequences for individuals, families, societies, and economic resources. (2020ESJ210)

Keywords: Cervical spine, Trauma, Fracture, Odontoid, Epidemiology.

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INTRODUCTION

Cervical spine fractures and dislocations are potentially devastating injuries that must be quickly identified and properly managed to optimize patient outcomes. The principles of the Advanced Trauma Life Support (ATLS) course from the American College of Surgeons (ACS) advocate assuming a cervical spine injury (CSI) until proven otherwise in all trauma patients who present after blunt trauma.¹⁶ Emergency medical technicians should apply cervical collars should early in the prehospital care course.¹²

Injury to the cervical spine occurs frequently in trauma. More than 13 million patients are assessed each year in emergency departments across the United States; of these, 30,000 (0.2%) will have CSI and of this group, only 10,000 (0.08% overall) will have spinal cord injuries.⁷ A similar national registry in Egypt is unfortunately currently not available.

Most patients with CSI are males and young people aged 15–45 years.¹¹ Most studies report motor vehicle accidents to be the most common mechanism of injury leading to CSI.¹⁷ Spinal cord injury (SCI) is reported to occur in 10–50% of cases with CSI.¹⁷ Surgery is indicated in cases of spinal instability or cord compression.²

In the absence of a national data registry on cervical spine injury, this study aims to establish the demographics and characteristics of patients with CSI presenting to the Trauma Unit of Assiut University Hospital, one of the biggest tertiary care centers in Egypt.

PATIENTS AND METHODS

This is a descriptive record-based study in the Trauma Unit of Assiut University Hospital during the period from January 2015 to December 2016. It includes all patients presenting with traumatic CSI regardless of their age, level of injury, or neurological status and excludes patients

presenting with nontraumatic acute cervical conditions. This study was approved by our institutional ethical committee.

Using a dedicated sheet, the following data were retrospectively retrieved from our patients' records: (A) patients' demographic data and full medical history; (B) examination findings, including careful documentation of the neurological status classified by Frankel classification⁵ and associated injuries; (C) imaging findings, including plain X-rays, MSCT, and MRI; (D) classification of the upper cervical fracture according to the type and level of injury and subaxial fracture according to the AO classification;¹⁸ (E) management and mortality rate.

Statistical Analysis

Descriptive statistical analysis included the following variables: gender, age, mechanism of trauma, associated injuries, classification of injury, and management. Categorical variables were expressed as numbers and percentages (N, %), whereas continuous variables were expressed as mean and standard deviation (Mean, SD). All analyses were conducted using IBM SPSS 24.0 software.

RESULTS

According to hospital records, 28548 patients were admitted and treated in the Trauma Unit of Assiut University Hospital during the period from January 2015 to December 2016. Of these patients, 20556 (72%) patients were treated by orthopedic surgeons due to isolated or combined spinal injuries with musculoskeletal and/or other injuries; of these patients, 1717 (8.4%) had at least one level of spinal fractures. During this period, 267 patients were documented to have upper and/or lower traumatic CSI, representing 0.94% of all admitted patients, 1.3% of patients with musculoskeletal injury, and 15.5% of patients with all spine injuries. Table 1 summarizes the demographic data of our patients.

Of the 267 CSI patients, 229 (85.8%) were males. The mean age of our patients was 37.96 ± 18.37 (range, 1–78 years) and the most common age group affected was from 20 to < 40 years (104 patients, 39%), followed by the age group from 40 to < 60 years (78 patients, 29.2%). Children with CSI were the least affected (28 children, 10.5%).

In this study, the most common causes of CSI were road traffic accidents (166 patients, 62.2%), falling injuries (87 patients, 32.6%), and heavy object trauma (14 patients, 5.2%). Most patients had isolated cervical fractures (166, 62.2%). The most common associated injuries were skeletal injuries (60 patients, 22.4%) and head trauma (25 patients, 9.4%) (Table 1).

At the time of hospital admission, 108 patients (40.5%) were neurologically free, 159 (59.6%) presented with some degree of neurological deficit, and 77 (28.8%) were suffering from complete quadriplegia (Table 1).

The most common types of injury were subaxial cervical spine fractures and dislocations (161 patients, 60.3%), traumatic cervical disc prolapse (63, 23.6%) (Tables 2 and 3), and upper cervical injuries (43, 16.1%).

Thirty-eight patients (14.3%) were transferred upon their request after stabilizing their general condition to other hospitals to pursue their treatment. Thirty-nine patients (14.6%) with complete quadriplegia died preoperatively due to respiratory failure and intractable pneumonia. Ninety-three patients (34.8%) underwent surgical treatment, whereas 97 patients (36.3%) were treated conservatively. The surgeries conducted were as follows: anterior cervical discectomy and fusion (64 patients, 68.8%), anterior corpectomy and plating (24, 25.8%), laminectomy and fixations (3, 3.2%), and odontoid screw (2, 2.2%). Two patients with complete quadriplegia died within 1 week postoperatively in the ICU from respiratory failure.

We looked carefully into the pediatric group in our cohort (Table 4). Male children (22 patients, 78.6%) were more affected than females (6 patients, 21.4%). The most common mechanism

of injury was falling (18 patients, 64.3%), followed by road traffic accidents (7 patients, 5%), and the least common cause was heavy object trauma (3 patients, 10.7%). None of the children presented with complete quadriplegia.

Table 1. Demographic and clinical data of patients (N = 267).

Characteristic		No.	%		
Gender	Male	229	85.8		
	Female	38	14.2		
Age	< 20 years	52	19.5		
	20 years	104	39.0		
	40 years	78	29.2		
	60 years	33	12.3		
Mechanism of injury	Road traffic accidents	166	62.2		
	Falling injuries	87	32.6		
	Heavy object trauma	14	5.2		
Isolated cervical spine fractures		166	62.2		
Associated injuries	All		101	37.8	
	Skeletal		60	22.4	
	Subtypes	Long bones	32	12	
		Spine	12	4.5	
		Pelvis and acetabulum	6	2.2	
		Others	10	3.7	
	Head and facial injuries		25	9.4	
	Chest injuries		8	3	
	Abdominal injuries		8	3	
Neurological status	Neurologically free		108	40.5	
	Complete quadriplegia		77	28.8	
	Incomplete quadriplegia		79	29.6	
	Subtypes	Central cord syndrome		38	14.2
		Brown-Sequard syndrome		4	1.5
		Incomplete quadriplegia (Frankel B) ⁵		12	4.5
		Incomplete quadriplegia (Frankel C)		21	7.9
		Incomplete quadriplegia (Frankel D)		4	1.5
	Complete paraplegia*		3	1.1	

*From associated thoracolumbar burst fracture.

Table 2. Classification of cervical injuries.

Classification of injury		Number	%
Traumatic CDP		63	23.6
Upper cervical injuries		43	16.1
Subtypes	Odontoid fracture	16	5.99
	Type 1	2	
	Type 2	6	
	Type 3	8	
	Hangman fracture	10	3.74
	Type1	6	
	Type 2	2	
	Type 3	2	
	RAAF	8	2.99
	Grade 1	4	
	Grade 2	2	
	Grade 3	2	
Other injuries		9	3.37
Subaxial fracture		161	60.3
Subtypes	Type A	42	15.7
	Type B	32	12
	Type C	87	32.6

Table 3. Traumatic cervical disc prolapse (N = 63).

Parameters		No.	%
Gender	Male	54	85.7
	Female	9	14.3
Age	<16 years	1	1.6
	16–40 years	18	28.6
	40–60 years	24	38.1
	> 60 years	20	31.7
Mechanism of injury	Road traffic accidents	34	54
	Falling injuries	25	39.7
	Heavy object trauma	4	6.3
Neurological status	Neurologically free	15	23.8
	Complete quadriplegia	18	28.6
	Incomplete quadriplegia		
	Central cord syndrome	10	15.9
	Incomplete quadriplegia (Frankel B)	7	11.1
	Incomplete quadriplegia (Frankel C)	10	15.9
	Incomplete quadriplegia (Frankel D)	3	4.7
Type of treatment	Conservative	22	34.9
	Surgical ACDF	41	65.1
Mortality rate		6	9.5

Table 4. Demographic and clinical data in the pediatric group (N = 28).

Parameters		No.	%
Gender	Male	22	78.6
	Female	6	21.4
Age	<6 years	9	32.1
	<10 years	5	17.9
	≤16 years	14	50
Mechanism of trauma	Falling	18	64.3
	Road traffic accidents	7	25
	Heavy object trauma	3	10.7
Classification of injury	Traumatic disc prolapse	1	3.6
	Odontoid fracture type II	1	3.6
	Odontoid fracture type III	2	7.1
	RAAF	7	25
	Subaxial type A	10	35.7
	Subaxial type C	7	25
Neurological status	Central cord syndrome	4	14.3
	Incomplete quadriplegia (Frankel C)	2	7.1
	Neurologically free	22	78.6
Associated injury	Head	6	21.4
	Skeletal	2	7.1
	Internal hemorrhage	2	7.1
	No	18	64.4
Operation	C5 corpectomy with cage and plate	1	3.6
	ACDF	3	10.7
	No	24	85.7

DISCUSSION

The incidence of traumatic CSI in the general population in Egypt is largely unknown. Several reports describe the incidence of CSI in different subpopulations, such as trauma center patients, specific age groups, head injury patients, military populations, and osteoporotic patients.²⁰ To the best of our knowledge, this is the first study in Egypt that tries to characterize patients with CSI in a major tertiary care hospital.

The Trauma Unit of Assiut University Hospital is the oldest, biggest, and busiest trauma center in Upper Egypt serving more than 25 million people and is one of the biggest in the whole country. In 2015 and 2016, CSI occurred in approximately 1% of all admitted trauma patients and 1.3% of all admitted orthopedic patients, and 15.5% of patients with spinal injuries. In this study, the overall incidence of CSI was 1.3%, less than that in most published reports which ranges from 2% to 12%.⁷ The authors believe that this could be attributed to the high mortality rate of CSI for patients with complete quadriplegia before reaching the hospital.

A clear understanding of age distribution and mechanisms of these injuries would not only serve to increase awareness of clinicians of individuals who are at high risk of cervical fractures but also allow for rapid initiation of appropriate treatment strategies.¹¹ In the present study, males constituted 86% of CSIs, which is in line with the results of Lowery et al.'s study.¹¹

All age groups can suffer from CSI. In this study, the youngest patient was 1 year old and the oldest was 78 years old, and the most common age group affected was from 20 to < 40 years (39%), followed by the age group from 40 to < 60 years (29.2%). Elderly males are the most common group of population to suffer CSI posttrauma.¹¹ The most common mechanism of injury in this study was road traffic accidents (62.2%) and then falling injuries (32.6%) and this applies to all age groups except for the pediatric groups, in which the most common cause was falling injuries. Most authors found that motor vehicle accidents to be the leading cause of injury, then falls, gunshot wounds, violence, and sports.⁴ For this reason, safety measures for prevention of road traffic accidents must be practiced including the following: (A) passive safety: softened seat back, active and smart head restraint, energy-absorbing seat base, seat belt, airbags, and other devices developed for head and neck protection of vehicle occupants; (B) active safety: advanced driver-assistant system (ADAS) including braking

systems, such as brake assist, traction control system, and electronic stability control systems; (C) road base repair; (D) prevention of speeding.¹⁰ The present study revealed that more than one-third of patients with CSI have associated injuries (37.8%), and the most common associated injuries were skeletal injuries (22.4%), trauma (9.4%), and chest injuries (3%). Comparable results were also observed in the study of Santos et al.¹⁵ who reported that the chest and head are at greater risk of associated injury with cervical trauma. The association between cervical and thoracolumbar fractures deserves special attention. In this study, 12 patients (4.5%) presented with both cervical and thoracolumbar fractures. Similar studies¹⁹ reported that around 13% of the patients with a cervical spine fracture also had a thoracic or lumbar fracture, whereas among patients without cervical spine fracture only, 6.9% had a thoracolumbar fracture. It is therefore highly recommended to perform a whole spine CT imaging in case of suspected or documented spinal fracture to avoid missing another fracture at a distant level.

Although 40% of the patients in this study were neurologically free, most patients with CSI (60%) suffered from some degree of neurological deficits. Complete quadriplegia and incomplete quadriplegia were found in 28.8% and 29.6%, respectively. In this study, the incidence of CSI in patients with neurological affection was significantly higher than that reported in most studies in the literature.⁸ Assiut University Hospital is a tertiary center; therefore, most cases with mild CSI are usually referred to other centers. In the study of Fredø et al.,⁶ neurological status was normal in 79%, 5% had radiculopathy, 8% had an incomplete SCI, 2% had a complete SCI, and neurological function could not be determined in 6%.

In the current study, subaxial CSI were the most common type of injury (161 patients, 60.3%), followed by traumatic cervical disc prolapse (63 patients, 23.6%); and the least common type of injury was upper cervical injuries (43 patients, 16.1%). These results indicate that the

estimated incidence for surgically treated CSI in our population was 3.1/100,000/year. The data showed that 17/133 (12.8%) patients with C0–C2 fractures and 68/203 (33.5%) with subaxial fractures underwent surgery.⁶

One-third of the patients in this study (34.8%) were surgically treated in our hospital. The aim of surgical treatment is decompression of the neural element and stabilization of the injured cervical levels to allow for early mobilization and rehabilitation of the patient.⁹ As a rule, the approach (anterior, posterior, and combined) is chosen based on the needs of cervical decompression, reconstruction, and stabilization.³ The most common surgeries conducted in this study were as follows: anterior cervical discectomy and fusion (68.8%) and anterior corpectomy (25.8%). Awad et al.² reported that surgical fusion was done in 16 patients (80%) including anterior approach in 14 patients and combined anterior and posterior approach in 2 patients. Posterior C1-C2 fusion was performed by Abou-Madawi et al.¹ for rotatory atlantoaxial instability. Samy et al. reported temporary fixation without fusion for recent type 2 odontoid fractures.¹⁴ Our study revealed that 25 patients were treated surgically due to instability without neurological affection and 68 patients due to neurological affection.

Despite the recent advances in surgery, nonoperative treatment still has an important role in the management of CSI. The most available options are spinal orthoses, and stable fractures can now be immobilized with more confidence and patient satisfaction. Good results of conservative treatment depend on understanding the fracture morphology, stability, and patient comorbidities.¹³ In this study, a little more than one-third of the patients (36.3%) were treated conservatively using Philadelphia collar or Minerva cast.

In the present study, the mortality rate was 15.3% for all patients with CSI. Most patients died preoperatively and only 2 patients died after surgical treatment (0.75%). This agrees with Santos et al.¹⁵ who reported 15.2% in-hospital

mortality (range 11%–22%) in a study of 217 patients with CSI during a ten-year study period.

An important limitation is the retrospective nature of this study as the preexisting database may have not included all data of all patients and there was missing information such as radiographs, phone numbers, and surgery details. Therefore, we recommend devoting more effort to enhancing our database recording system to obtain more accurate study results.

CONCLUSION

The most common cause of CSI in our locality was road traffic accidents, which involve mainly young people in the most productive age group and lead to a high rate of disability and mortality. Preventive measures in roads and proper use of protective equipment in vehicles must be practiced to avoid such major consequences for individuals, families, societies, and economic resources.

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الملخص العربي

نبذة عن اصابات العمود الفقري العنقي في مستشفى جامعة أسيوط

البيانات الخلفية: قد تكون كسور العمود الفقري العنقي اصابات مدمرة لذلك يجب تشخيصها وعلاجها بسرعة وبشكل صحيح من اجل تحسين نتائج تأثيرها على المرضى على الرغم من ذلك فأن حدوثها غير معروف لحد كبير. **الغرض:** لتقييم التركيبة السكانية واليات الأصابة والحالة العصبية وعلاج اصابات العمود الفقري العنقي في مستشفى جامعة أسيوط .

تصميم الدراسة: دراسة لحالات اكلينيكية على 267 مريض التي تم حجزها في قسم الاصابات جامعة اسيوط في الفترة من يناير 2015 إلى ديسمبر 2016 تم إجراء تقييم تحليلي بأثر رجعي للنتائج السريرية والاشعاعية والجراحية لعدد 267 مريض عانوا من كسور الفقرات العنقية.

المرضى والطرق: خلال الفترة من يناير 2015 إلى ديسمبر 2016 ، تم تسجيل بيانات جميع مرضى CSI الذين قدموا إلى وحدة الطوارئ بمستشفى جامعة أسيوط وتم التعامل معهم بأثر رجعي. تم إجراء التقييم الأولي وفقاً لإرشادات ATLS. تم تصنيف CSI والفحص العصبي وفقاً لتصنيف AO وتصنيف Frankel على التوالي. تمت الموافقة على الدراسة من قبل الجنه الأخلاقية المؤسسية.

النتائج: شكلت إصابة للعمود الفقري العنقي حوالي 1% من جميع المرضى الذين تم حجزهم و 1.3% من حالات اصابات العظام و15.5% من جميع إصابات العمود الفقري. كان معظم المرضى من الذكور وكانت الفئة العمرية الأكثر شيوعاً من 20 إلى 40 عاماً وكانت حوادث المرور على الطرق هي السبب الأكثر شيوعاً 62.2% يليها اصابات السقوط 32.6% وأخيراً صدمات الاجسام الثقيلة 5.2%. أصيب 59.5% من المرضى بأصابات بالحبل الشوكي منهم 28.8% أصيبوا بشلل رباعي كامل. شكلت انزلاقات الفقرات العنقية بسبب الاصابات 23.6% وكسور الفقرات تحت المحورية من النوع A 15.7% والنوع B 12% والنوع C 32.6% وبلغ معدل الوفيات قبل الجراحة في المستشفى 14.6%.

الخلاصة: على الرغم من أن اصابات العمود الفقري العنقي لا تمثل سوى 1% من جميع الاصابات إلا أن العواقب وخيمة ومعدلات الوفيات عالية والعجز العصبي الغير قابل للعلاج والذي يمثل كاهل اقتصادي هائل على المجتمع لذلك يجب بذل كل جهد لمنع حوادث الطرق خاصة وطرق الاصابة عامة وسرعة علاج المرضى بشكل صحيح لاستئناف وظائفهم.