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Cervical Spine Fractures in Multiple Injured Patients in Kurdistan Region, Iraq

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Abstract

Objective The aim of study to describe the main types of cervical spine fractures presented to the emergency department and to illustrate the main aspects of management and outcome.

Methods This is a prospective study of 72 patients with cervical injury out of 932 male patients with history of multiple injuries. All patients with cervical spine injury were admitted within 1 week of injury and follow up thereafter by regular outpatient visit. Cervical spine injuries were diagnosed by full radiological assessment according to NEXUS criteria (plain x-ray with lateral, anteroposterior, odontoid views in addition to cervical spine C.T for indicated patients) and evaluated neurologically.

Results Mean age of patients at time of accident was 25 years ranging from 7–73years, 50% of them were in the third decade of life. Road traffic accidents constitute 58.3% of causes of cervical injury followed by fall from height (19.5%). Results has shown that mid and lower cervical spine injuries constitute 87.5% of all types of vertebra involved while upper cervical spine injuries constitute only 12.5% of them. Associated injuries were found in 42 patients (58.3%) and the most common associated injury was cerebral concussion. 50% of patients had no history of neural deficit at time of admission, while the others had neurological abnormalities (27.7%) of them with complete deficit at time of admission. The most common type of skeletal injury was wedge fracture (28 patients, 38.8%), followed by spinous process fracture and burst fracture (18 patients, 25% and 12 patients, 16.6%) respectively. Respiratory complications were the most common in our series (12 patients of 72, 16.6%) followed by an equal share of urinary tract infection and neck pain (7 patients, 9.7%).

Conclusion Traffic accident constitutes the main reason for cervical spine fractures followed by falls. Cervical spine fractures affect the younger age group with mean age of 25 year. A collar is sufficient treatment for more un displaced fractures. Seat belt is one of the restrains that shares in reduction of fatality and severity of cervical spine injuries.

Keywords Cervical spine, fractures, multiple injured patients, Iraq

Introduction

Cervical spine injuries are still a major cause of disability although their diagnosis and treatment have become more advanced and standardized over the past 3 decades. Of primary importance in injuries to cervical spine are spinal cord and nerve roots; however, it is essential to focus knowledge about location, type of injury and associations. The etiology of traumatic spinal cord injury is estimated to be 42% due to motor vehicle collisions, 27% due to falls, 15% due to acts of violence (primarily gunshot wounds), 8% from sports, and 8% from other mechanisms.[1] The assessment of spinal stability is an important factor in the evaluation of the injured spine. Spinal stability is defined as the ability of the spine to limit patterns of displacement under physiologic loads so as not to damage or irritate the spinal cord or nerve roots. Although simple in principle, determining spinal stability after an acute injury is particularly difficult. One of the most common methods are used the Denis three-column principle to classify injuries as stable or not.[2] Loss of integrity of the posterior wall of a vertebral body is a marker for instability in the middle column and is visualized by detecting sagittal plane fracture lines through the posterior vertebral body cortex or loss of >25% of posterior vertebral body height.[3] Prehospital care for spinal injuries involves immobilization of the entire spine at the scene, with immobilization maintained during transport. The cervical spine can be immobilized with a rigid cervical collar supplemented with external rigid objects placed bilaterally (e.g., sandbags or solid foam blocks) and with tape or self-adhesive straps applied across the forehead to hold the head to the backboard.[4] The higher the level of spinal injury, the more compelling the indication for early airway intervention. The roots of the phrenic nerve, which supply the diaphragm, emerge at the third, fourth, and fifth cervical vertebral levels. Thus, any patient with an injury at C5 or above should have his or her airway secured via endotracheal intubation. It may be prudent to intubate patients with cervical cord lesions even below this level.[5,6] More than 90% of hypotensive patients with penetrating spinal cord injury have blood loss to at least partly explain their hypotension.[4–6] The National Emergency X-Radiography Utilization Study (NEXUS) group determined that cervical spine imaging would be unnecessary in patients who demonstrate five clinical criteria. In the original Study, the NEXUS criteria were 99.6% sensitive for detecting clinically significant cervical spine injuries, but only 12.9% specific.[7-12] High-speed, high-resolution multidetector CT scan has greatly enhanced the ability to image the cervical spine. CT is more sensitive and specific than plain radiography for evaluating the cervical spine in trauma patients, and can be performed in a more expeditious fashion.[13–18] CT can be used to visualize the entire cervical spine and is particularly useful at the craniocervical and cervicothoracic regions, where plain films are often limited. Injury mechanism parameters that are highly indicated for C.T: high speed more than 80 km/hr., death at scene of R.T.A. and fall from height more than 3 meters.[19] The aim of study is to describe the main types of cervical spine fractures presented to the emergency department and to illustrate the main aspects of management and outcome.

Method

This is a prospective study of 72 patients with cervical injury out of 932 male patients with history of multiple injuries, received and treated at surgical emergency department of Baghdad teaching hospital and Al-Hussein teaching hospital in Karbala governorate between March 2015 and October 2017 after admission or referral. Primary survey had been accomplished for all patients regarding maintaining airway, breathing and circulation with full neurological assessment and exposure, hard collar, I.V. lines, O2, monitoring, analgesia. Regular outpatient visit admitted all patients with cervical spine injury within 1 week of injury and follow up thereafter. Cervical spine injuries were diagnosed by full radiological assessment (plain x-ray with lateral, anteroposterior, odontoid views in addition to cervical spine C.T for indicated patients,[19,20] according to availability) and evaluated neurologically by method of Frankel et al.,[21,22] which five grades of function described:

A. Complete motor paralysis and sensory loss below the level of lesion.
B. Sensory sparing without motor function.
C. Non-useful motor function.
D. Useful motor function.
E. Motor, sensory and autonomic normality.

One clinical decision rule has been defined, to avoid unnecessary radiography; this rule is intended for alert, stable adult trauma patients who have no neurological deficits. Conservative treatment is adopted on the assumption that no neural compression requiring operative relief is present, however cervical collar, skull traction, bed rest and analgesia were been initiated. Laminectomy has been done for patients with signs and symptoms of neural compression documented by CT or magnetic resonance image, meanwhile methylprednisolone I.V. infusion has started before operations were planned. Post operatively intravenous injection of ceftriaxone and ampicillin were given for 10 days with external support of cervical collar for patients with laminectomy.

Results

The mean age of patients with cervical injury at time of accident was 25 year (range 7–73) as in Table 1.

Road traffic accident was the most common cause of cervical injury (58.3%) followed by falls (19.5%) as in Table 2.

Table 1. **Ages of the patients at time of accident**

Age groups	No. of patients with cervical injury	Percentage
0–10	2	2.7%
11–20	18	25%
21–30	36	50%
31–40	8	11.1%
41–50	4	5.5%
51–60	2	2.7%
61–70	1	1.3%
71–80	1	1.3%
Total	72	100%

The fifth cervical vertebra was the most type of vertebra injured (20 patients, 27.7%), followed by C6 injury (19 patients, 26.3%). Upper cervical spine injury (C1, C2) was seen in 9 cases (12.5%) while, mid and lower cervical spine injury was seen in 63 cases (87.5%). Associated injuries were seen in 42 patients (58.3%) and the most common associated injury was cerebral concussion (16 patients 22.2%) followed by wound laceration (12 patients, 16.6%) as in Table 3.

36 patients (50%) had no neural deficit at time of admission while 20 patients were quadriplegic and 16 patients had incomplete neural deficit at time of admission (Table 4). Each patient was classified accordingly on admission and on follow up. Of the 20 patients with complete lesions only one patient had improved significantly while, 14 of 16 patients with incomplete lesions improved. All patients who had full neural function on admission remained so (50%). Of the 20 patients who were quadriplegic at time of admission 3 of them showed slight improvement (from A to B group by criteria of Frankel et al.). Of the total 16 patients with incomplete neural loss, 14 patients improved (87.5%), half of them showed complete recovery and the other half showed mild to moderate recovery. Wedge fracture was the most common type of skeletal injuries

Table 2. **Causes of injury and their percentages**

Cause of injury	No. of patients	Percentage
Road traffic accident	42	58.3%
Fall from height	14	19.5%
Diving	4	5.5%
Struck by heavy object	8	11.1%
Bullet injury	4	5.5%

Table 3. **Associated injuries**

Associated injury	No. of patients
Cerebral concussion	16
Rib fracture	2
Long bone fracture	4
Short bone fracture	6
Wound laceration	12
Nasal bone fracture	2
Total	**42 (58.3% of total no.)**

Table 4. **Severity of motor paralysis and sensory loss on admission**

Degree of neural deficit	No. of patients with cervical injury	Percentage
No deficit	36	50%
Complete motor paralysis and sensory loss	20	27.7%
Complete motor paralysis and in complete sensory loss	4	5.5%
Incomplete motor paralysis and incomplete sensory loss	12	16.7
Total	72	100%

(28 patients, 38.8%), followed by spinous process fracture (18 patients, 25%) as in Table 5.

According to table six, 34 patients developed complications (47%). Four patients developed gastrointestinal bleeding 1 of them died within 5 days in spite of I.V fluid, blood replacement and drugs (omeprazole I.V.). One patient with burst fracture of fifth cervical vertebra developed deep venous thrombosis who has been put on thrombolytic therapy. Urinary tract infection confirmed in 7 patients who responded to antibiotic therapy according to culture and sensitivity of urine. Respiratory complications were the most common in our series (12 patients of 72, 16.6%) followed by an equal share of urinary tract infection and neck pain (7 patients, 9.7%) as shown in Table 6.

Respiratory complications categorized according to type, site of injury and neurological status based on Frankel et al. Classification as shown in Table 7.

Table 5. **Type of skeletal injury with neurological status in 72 patients**

Type of skeletal injury	No. of patients	%	With neural deficit	Without neural deficit
Wedge fracture	28	38.3%	14	14
Burst fracture	12	16.6%	12	0
Fracture dislocation	6	8.3%	4	2
Gunshot injury	4	5.5%	4	0
Hangman fracture	2	2.7%	1	1
Odontoid fracture	2	2.7%	1	1
Fracture spinous process	18	25%	36	18

Table 6. **Complications**

Complications	No. of patients	Percentage
Respiratory complications	12	16.6%
Neck pain	7	9.7%
Bed sore	3	4.1%
Urinary tract infection	7	9.7%
Gastrointestinal bleeding	4	5.5%
Deep venous thrombosis	1	1.3%
Total	34	47.2%

Table 7. **Respiratory complications**

Type of respiratory complication	Number of patients	%	Site of injury	Neurological status
Acute respiratory distress syndrome	5	41.6%	3C5/2C4	B & C
Aspiration pneumonitis	4	33.3%	1C2/1C3	A,B & C
Respiratory failure	3	25%	2C2/1C3	A & B

Table 8 shows the correlation between seat belt and site of patients in the vehicle in presence or absence of cervical injury. Five of 42 patients with cervical injury used seat belt (11.9%), while 240 of 560 patients out of cervical injury used their seat belts (42.8%). No one in patients with cervical injury who was in the front or rear seat put on his seat belt while, 3 patients who had no cervical injury in the front seat put on their seat belts. 18.5% of drivers who sustained cervical injury used their seat belts while, 66.7% of drivers with multiple injuries other than cervical injury used their seat belts. The highest no. of patients who put on their seat belts with no cervical injury was the age group (41–50 year, 76%), on the other hand, the age group with the highest no. of patients used their seat belts whom had cervical injury was (21–30 year, 20%, followed by 10% for 11–20 year age group.

Table 9 shows different types of neurological deficits according to Frankel et al. classification comparing with age, site in vehicle, and level of spinal injury. Ten of 20 patients who sustained class (A) criterion according to Frankel classification were due to R.T.A and, 29 of 36 patients were with class (E) criterion Table 4. Sixteen of 20 patients with C5 fracture were due to R.T.A (80%) while all patients with C4 fracture were due to R.T.A. The lowest incidence regarding level of injury due to R.T.A was the share of C2 vertebra (2 of 9 fractures, 22.2%) others were implicated by other mechanism of injury.

Discussion

Cervical spine injuries are among the major causes of severe disability and death following trauma. It is most frequently a problem of the young adult males,[1] occurring most commonly in the 11 years extending from age 16–26 years.[23] In this series 25% of patients were in the second decade and 50% in the third decade so, constitute 75% of the total No. of patients who are under the age of 30 years with mean age 25 years (7–73 years). Cervical spine injury has been reported in 2–4.6% of patients presenting with trauma arriving emergency departments.[24] In correlation with our series, 7.7% had cervical spine injuries (72 of 932 patients with multiple injuries). This no. has grown now a day due to terrorism, traffic accidents, and increase reconstruction projects with absence of compliance with safety systems. In our study, the majority of S.C. injuries occur because of road traffic accidents (58.3%) and this result was correlated with the results of National spinal cord injury statistical center (2009), (42%), and also correlated with Bohlman results (1997), (50%),[43] 19.5% fell from height and 11.1% struck by heavy object and an equal share for both diving accidents and bullet injury (5.5%).[1,25] Falls remain a significant cause of morbidity and mortality. In our study 101 patients suffered from falls accidents, 14 patients had cervical spine injury (13.8%), while 78 patients had head injury with variant levels of consciousness (77.2%), 8 of them had both above mentioned problems. Most of our patients had occupational causes of falls, as 10 patients were workers using scaffolds or working at high altitudes, their ages range from 11–40 years. The brain, spinal cord, and extremities are the most commonly injured systems. Falls from more than 5 meters have historically been triaged to trauma centers, but even low-level falls can cause serious head injuries.[26,27] Cervical injuries from diving in to a shallow

Table 8. **The correlation between seat belt and site of patients in the vehicle in presence or absence of cervical injury**

Age groups	Cervical injury In R.T.A patients	Site in vehicle with seat belt						Percentage	R.T.A patients with no cervical injury	Site in vehicle with seat belt						Percentage
		D	S	F	S	R	S			D	S	F	S	R	S	
0–10	2	0	0	2	0	0	0	0%	21	0	0	14	0	7	0	0%
11–20	10	7	1	2	0	1	0	10%	92	32	19	37	1	23	0	21.7%
21–30	20	17	4	3	0	0	0	20%	216	188	101	16	1	12	0	47.2%
31–40	5	2	0	2	0	1	0	0%	87	52	40	12	0	23	0	45.9%
41–50	2	0	0	1	0	1	0	0%	75	61	57	12	0	2	0	76%
51–60	1	1	0	0	0	0	0	0%	37	17	15	15	0	5	0	40.5%
61–70	1	0	0	1	0	0	0	0%	18	4	4	12	1	2	0	27.7%
71–80	1	0	0	0	0	1	0	0%	14	1	1	8	0	5	0	7.1%
Total	42	27	5	11	0	4	0	11.9%	560	355	237	126	3	79	0	42.8%

D, driver; S, seat belt; F, front seat, R, rear seat

Table 9.

Age groups	Cervical injury	Site in vehicle with seat belt						level of spinal injury							Neurological deficit according to Frankel et al. classification				
		D	S	F	S	R	S	C1	C2	C3	C4	C5	C6	C7	A	B	C	D	E
0–10	2	0	0	2	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1
11–20	10	7	1	2	0	1	0	0	1	1	1	4	2	1	2	0	0	1	7
21–30	2	17	4	3	0	0	0	0	0	3	1	8	4	4	5	0	1	0	14
31–40	5	2	0	2	0	1	0	0	1	1	0	2	0	1	2	0	0	0	3
41–50	2	0	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	2
51–60	1	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
61–70	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
71–80	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1
Total	42	27	5	11	0	4	0	0	2	6	4	16	8	6	10	0	1	2	29

D, driver; S, seat belt; F, front seat; R, rear seat; C, cervical vertebra. A, B, C, D, E, neurological assessment level according to Frankel et al. classification.

water of all sorts consistently involved predominantly young healthy men (5.5%) with ages range between 18–34 years.[28,29] Usually the most common types of vertebrae involved are C5, C6 because mechanism of injury is mostly due to hyper flexion force with loading over vertebral bodies of C4-C7.[23] In regard of our series mid and lower cervical vertebral injuries constituted the highest incidence (63 of 72 patients, 87.5%) however, upper cervical vertebral injuries constituted the remaining 9 patients (12.5%). The fifth cervical vertebra represented the most cervical vertebra involved in this series (20 patients, 27.7%) followed by C6 involvement (19 patients, 26.3%). Laminectomy initially advocated to decompress a swollen cord has been found not to benefit many patients and may cause harm.[25,30] However, it may be indicated in much selected cord damaged patients especially if there is posterior cord compression. However, in this series only 2 patients benefit from this operation, both had compression wedge fracture at C3 and laminectomy revealed extradural decompression. Penetrating neck trauma represents approximately 5–10% of all trauma cases that present to the emergency department. About 30% of these cases are accompanied by injury outside of the neck zones as well 39; the incidence of gunshot injury in this series was 5.5%.[31] Data shows that during motor vehicle crashes, misuse or lack of using restraints increased the likelihood of death and injury. Seat belts alone have been effective in reducing fatalities and injury severity by 40% to 50% and 45% to 60%, respectively.[32] In our study out of 42 patients who had cervical spine fracture, only 5 patients used their seat belt (11.9%), while out of 560 patients who had multiple injuries other than cervical injury, 240 patients wear seat belt (42.8%). The overall patients who had R.T.A were 602 patients, 245 used seat belts (40.6%), 42 patients developed cervical injury (6.9%). Out of 27 drivers with cervical injury due R.T.A; 5 patients used their seat belts (18.5%), while 237 of 355 drivers with no cervical injury used seat belt (66.7%), so that seat belt has played an important role in reducing incidence and severity of cervical injuries. Out of 5 patients who had cervical injury although, seat belts were been used, 3 patients had completely normal neurological function at time of admission (60%), means criterion (E) according to Frankel classification, the other 2 patients had criteria (C&D) at time of admission. Respiratory complications continue to be a major cause of morbidity and mortality after cervical spinal cord injury with a reported incidence from 36 to 83% according to Lemons results.[33] In regard of our series respiratory

complications were the most common (12 of 72 patients, 16.6%) followed by an equal share of urinary tract infection and neck pain (7 patients, 9.7%). In correlation to Lemons data, there is reduction in incidence of respiratory complications might be due lack of optimal follow up, discharge before definitive treatment is achieved, shortage in no. of respiratory care unit beds leading to loss keeping in touch with patients.[33]

Conclusion

Traffic accident constitutes the main reason for cervical spine fractures followed by falls. Cervical spine fractures affect the younger age group with mean age of 25 year. A collar is sufficient treatment for more un displaced fractures. Seat belt is one of the restrains that shares in reduction of fatality and severity of cervical spine injuries.

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