AIM OF THE WORK

The aim of the work is to determine the incidence and risk factors of cervical spine fractures in severe blunt head trauma patients and the pattern of spinal injuries and to illustrate an associated injury or neurological deficit.

PATIENTS

A prospective study will be conducted on patients subjected to severe blunt trauma presenting to the emergency department at Alexandria main university hospital within 24 h after trauma within a period of 6 months from March 2014 to August 2014.

Inclusion criteria:

1. Patients more than 18 years old.
2. Patients whose injury occurs within 24 hr.
3. Patients with severe blunt head trauma.

Exclusion criteria:

1. Patients less than 18 years old.
2. Pregnant patients.
3. Patients whose injury occurs more than 24 hr previously.
4. Patients with penetrating trauma from stabbing or gunshot wound.
5. Patients who return for reassessment of the same injury.

METHODS

This study is a prospective study conducted on one hundred and sixty one patients with severe blunt head trauma who presented at the emergency department at Alexandria University Hospital following severe blunt trauma, regardless of the nature of the trauma were included in the study.The study was conducted after the approval of the hospital's ethics committee. It was conducted under waiver of consent, since it involved only collection of data.

All patients were subjected to the following:

1- History:

Full history taking with special emphasis on Patient data as age and sex, mechanism of blunt trauma (RTA, FFH, and AA) and complain of neck pain with full range of active and passive motion of neck.

2- Physical examination:

Primary survey:

- **Airway:** The airway must be assessed immediately for patency, clear from secretions, protective reflexes, foreign body and injury.
- **Breathing:** Breathing was assessed by looking for chest expansion, determining the patient's respiratory rate and by subjectively quantifying the depth and effort of inspiration. Good auscultation of the chest is to exclude evidence of pneumothorax or hem thorax
- **Circulation:** The circulation assessment begins with an evaluation of the patient's mental status, skin color, pulse, blood pressure and skin temperature. Large-bore peripheral intravenous catheters in the upper extremities are the resuscitation lines of choice.
- **Disability:** A rapid and brief evaluation for neurologic deficits was conducted. The Glasgow Coma Score (GCS) and the gross motor and sensory status of all 4 extremities were determined and recorded. A GCS score of 8 or less at the time of admission to hospital is now widely accepted as indicating a severe head injury. A moderate head injury was defined as an initial coma score between 9and 12; mild head injury was defined as an initial equated to score between 13and 15.
- **Exposure/Environment:** Complete exposure and head-to-toe examination must be performed.

Glasgow Coma Scale is a neurological scale that aims to give a reliable, objective way of recording the conscious state of a person for initial as well as subsequent assessment. Three types of response are measured, and added together to give an overall score. The lower the score the lower the patient's conscious state. The GCS is used to help predict the progression of a person's condition.

The scale comprises three tests: eye, verbal and motor responses. The three values separately as well as their sum are considered. The lowest possible GCS (the sum) is 3 (deep coma or death), while the highest is 15 (fully awake person).

The three responses measured are:

- Best motor response - maximum score of 6
- Best verbal response - maximum score of 5
- Eye opening - maximum score of 4

Eye Opening

4 = Spontaneous eye opening.
3 = Eye opening in response to speech.
2 = Eye opening in response to pain.
1 = No eye opening.

Verbal Response

5 = Oriented.
4 = Confused.
3 = Inappropriate speech.
2 = Incomprehensible speech.
1= No verbal response.

Motor Response

6 = Obeying commands.
5 = Localizing response to pain.
4 = Withdrawal to pain.
3 = Flexion to pain.
2 = Extension to pain.
1 = No motor response.

Resuscitation and primary care:

After doing the primary survey the following will be done:

- According to Glasgow coma score resuscitation was done .keeping Patent airway up to endotracheal intubation with the application of manual inline cervical stabilization protocol. Keeping adequate breathing (as evidenced by atrial blood gases (ABG) through supplemental oxygen up to ventilatory assistance if required.
- Cannulation of the patients by means of peripheral or central venous lines under a septic technique to give fluids and medications .keeping adequate circulation and prevention of hypovolemia by means of intravenous fluids (crystalloid, whole bloodtransfusion) to adequate cerebral perfusion pressure.
- Oro gastric tubes were inserted to all patients and enteral route feeding was established once feeding tested succeeded.
- Urinary catheters were inserted in all patients under a septic technique to allow estimation of urine output (UOP) and to collect samples if needed.

Secondary survey

This assessment is a complete examination of the patient from top to toe, both front and back.

Monitor Vital Signs:

1. Pulse (Regular or Irregular)
2. Respiratory Rate
3. O2 Saturations
4. Blood Pressure
5. Temperature

- Head& Neck: must be examined for scalp wounds, ears (blood or CSF), eyes for pupil size and reaction or wounds, color of the lips, jaw for displacement, mouth for loose or missing teeth or bitten tongue, skin color, texture and temperature (Flushed, Dry and Hot).The neck for any injuries (fracture cervical vertebra and wounds). Inspect the neck anteriorly for evidence of airway or great vessel injury.

- Chest & Heart: check Palpate the chest wall for tenderness, instability, or crepitation, followed by auscultation of the lungs and heart looking for abnormal sounds, new murmurs and muffled heart sounds. Also checking the clavicles, Sternum for bruising and possible fractures. Ribs for fractures, flail segments, bruising and abnormal breathing.

- Abdomen & pelvis: examined for rigidity and guarding, wounds, pulsating masses, bruising, pelvis fractures or abnormal movement, rectal, urethral and vaginal bleeding.

- Extremity examination: Inspection and palpation of all extremities for deformity, fractures, swelling, and skin injuries. Checking all peripheral pulses. Testing motor function, skin sensation and reflexes.

- Back: logging roll the patient with an inline stabilization of the head and neck. Then inspection of the entire spine from the occiput to the sacrum for bony abnormalities, deformities, and tenderness. At the same time, perform a detailed survey of the back to identify penetrating injuries, ecchymosis, or other injuries.

3- Radiological investigation:

- CT brain was done to all patients in this study to detect associated brain injury.
- Plain X –ray of cervical spine:
  - Cross-table lateral view (CTLV).
  - Anteroposterior view (AP LV).).

- CT and / or MRI cervical spine when needed.
- CT brain was done to all patients in this study to detect associated brain injury.
- Full radiological and imaging study to exclude other injuries include chest X-ray to detect possible pneumothorax or fractured rib.
- Ultrasonography on the abdomen and pelvis for possible collection and if needed CT abdomen was done, skeletal survey forpossible skeletal fractures.

4- Lab studies

- Valuable blood studies in the initial evaluation of a patient should include hemoglobin level and hematocrit. The presence of massive hemorrhage is usually obvious from hemodynamic parameters, and the hematocrit value merely confirms the diagnosis.

Severely injured patients should have a complete blood count, blood glucose level electrolytes, blood gas, clotting studies and type &cross match.

- Arterial blood gas analysis
- Renal function test.
- All patients should have their tetanus immunization history reviewed. If it is not current, prophylaxis should be given.

RESULTS

This study was conducted on one hundred and sixty one patients subjected to severe blunt trauma who were admitted to the Emergency Department at Alexandria Main University Hospital within 24 hours after trauma within a period of 6 months from March 2014 to August 2014 in whom 10 patients were diagnosed to have traumatic cervical spinal fractures.

Distribution of studied cases according to demographic data:

I. Distribution of studied cases according to gender: (Table 1)

The analysis of sex of patients in this study revealed that 7 patients were males representing 70%, while 3 patients were females representing 30% of total number of cases. The overall male to female ratio was approximately 3:1.

II. Distribution of studied cases according to age: (Table 1)

The age of the patients ranged from 18 to 77 years the most common age group at which cervical spine injury occurred was at 41—60 years representing 40% of patients.

Table (1): Distribution of the studied cases according to demographic data

	No.	%
Gender		
Male	7	70
Female	3	30
Age		
≤20	2	20
21 – 40	2	20
41 – 60	4	40
≥61	2	20

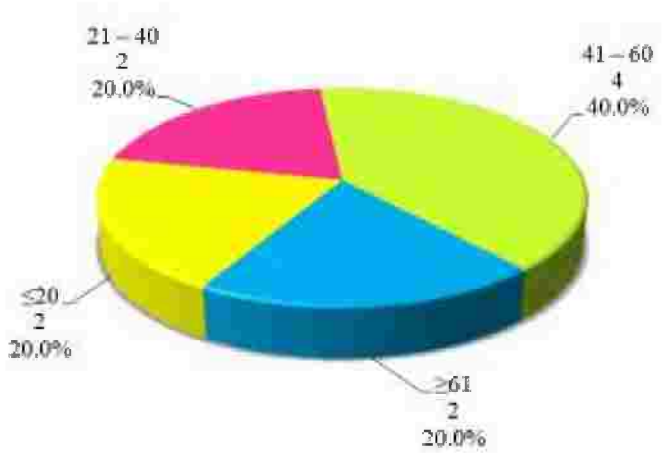

Figure (2): Distribution of the studied cases according to age

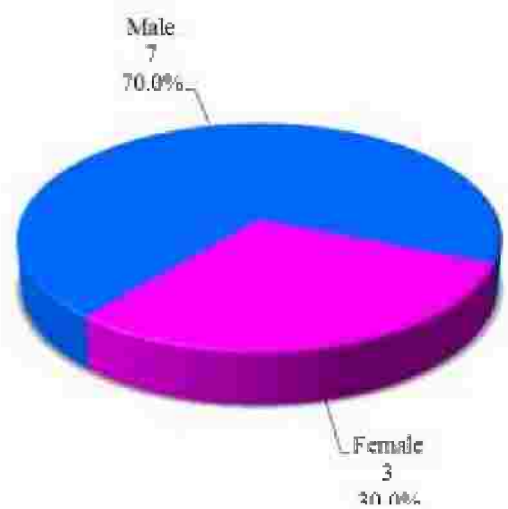

Figure (3): Distribution of the studied cases according to sex

Distribution of the studied cases according to the mechanism of trauma :(Table 2)

The analysis of the mechanism of trauma in this study revealed that Road traffic accidents were the cause of cervical vertebral fractures in 7 patients representing 70%, fall in 2 patients representing 20%, and Assault (violence) in 1 patients representing 10% of patients in this study.

Table (2): Distribution of the studied cases according to mechanism of trauma

	No.	%
Mechanism of trauma		
RTA	7	70
Fall	2	20
Assault (violence)	1	10

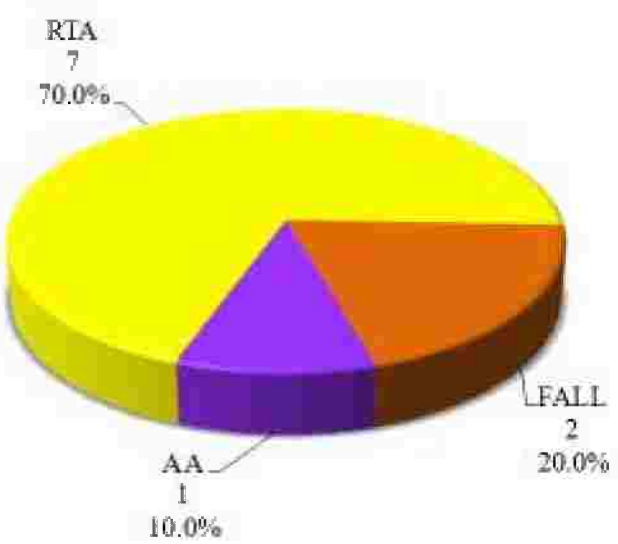

Figure (4): Distribution of the studied cases according to mechanism of trauma

Distribution of the studied cases according to the level of cervical spine fractures :(Table 3)

The analysis of level of cervical spine fractures in patients included in this study revealed that 5 patients (50%) had C2 fractures, 2 patients (20%) had C6 fractures and 3 patients (30%) had multi-level cervical spine fractures.

Table (3): Distribution of the studied cases according to the level of cervical spine fractures

	No.	%
level of vertebral fractures		
C2	5	50.0
C6	2	20.0
Multi-level	3	30.0

Distribution of the studied cases according to CT brain finding (table 4)

The analysis of CT brain finding in this study revealed that 7 patients (70%) had brain edema, 3 patients (30%) had SAH, 4 patients (40%) had SDH, 7 patients (70%) had IVH&4 patients (40%) had hemorrhagic contusion.

Table (4): Distribution of the studied cases according to CT brain finding

CT brain finding	NO	%
Brain edema	7	70.0
SAH	3	30.0
SDH	4	40.0
IVH	7	70.0
hemorrhagic contusion	4	40.0

- One patient may have more than one CT brain finding

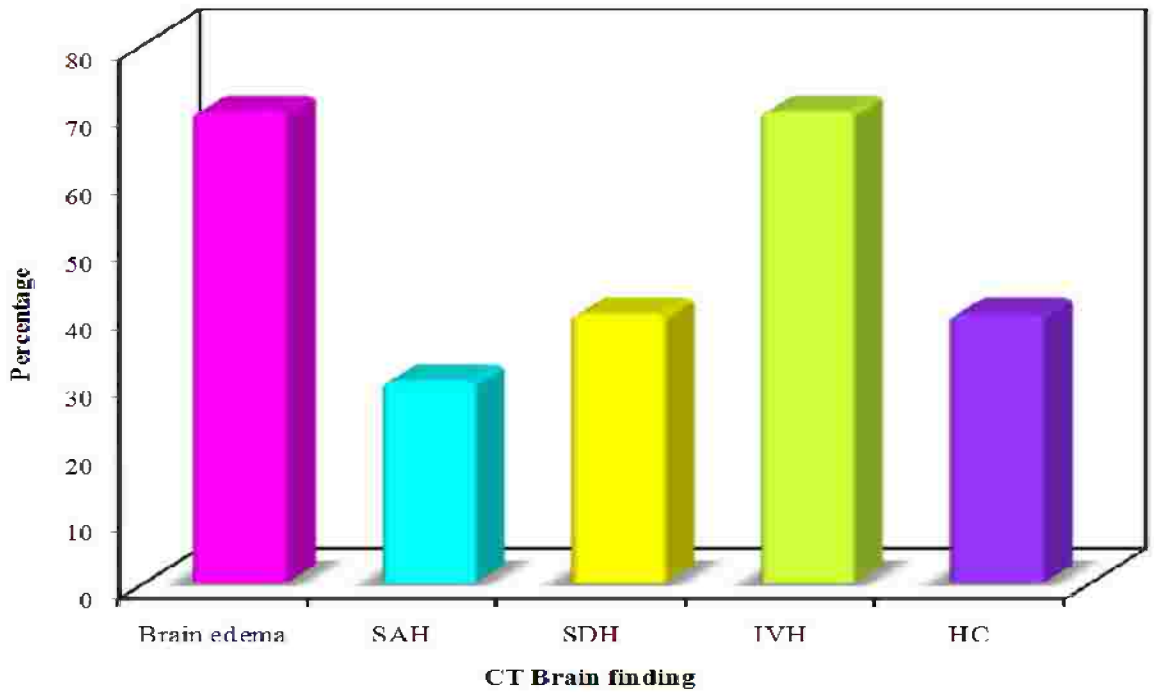

Figure (5): Distribution of the studied cases according to CT Brain finding

Distribution of the studied cases according to Glasgow coma Scale: (table 5)

According to conscious level of patients with cervical spine fractures included in the study by assessment via GCS, 3 patients (30%) had GCS 8, one patient (10%) had GCS 7, and 2 patients (20%) had GCS 6, one patient (10%) had GCS 5, one patient (10%).

Table (5): Distribution of the studied cases according to GCS

GCS	NO	%
8	3	30
7	1	10
6	2	20
5	1	10
4	1	10
3	2	20

Distribution of patients according to the blood pressure :(Table 6)

Distribution of patients according to blood pressure either stable or not, hypotension is defined as systolic blood pressure of less than 90 mm Hg. 7 patients representing 70% were unstable and only 3 patients representing 30% were stable.

Table (6): Distribution of the studied cases according to blood pressure

	No.	%
Vital signs		
Unstable	7	70.0
Stable	3	30.0

Figure (6): Distribution of the studied cases according to blood pressure

Distribution of the studied cases according to respiratory: (table 7)

In this study, 5 patients representing 50% of cases were distressed had either increased or decreased respiratory rate and 5 patients representing 50% of cases were not distressed. Respiratory distress is defined as respiratory rate more than 35RR/ minute.

Table (7): Distribution of the studied cases according to respiratory rate

	No.	%
Respiratory rate		
Distressed	5	50.0
Not distressed	5	50.0

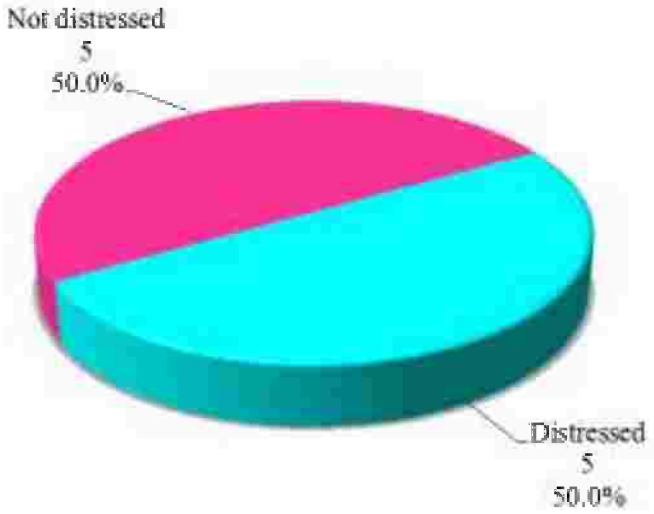

Figure (7): Distribution of the studied cases according to Respiratory rate

Distribution of the studied cases according to associated injuries: (Table 8)

In this study only one patient had isolated traumatic cervical spine fracture and there were no associated injuries. 9 patients representing 90% of cases had associated injuries discovered in assessment of chest and abdomen by CT or U/S or in skeletal survey. Among these patients, 6 patients had abdominal injuries representing 60% taking the largest share among associated injuries, 4 patients had associated thoracic injuries representing 40%, 5 patients had associated pelvic in juries representing 50%, 4 patients had associated orthopedic injuries representing 40%, and 3 patients(30%) had associated dorsolumber spine injuries.

Table (8): Distribution of the studied cases according to associated injuries

Associated injuries*	NO	%
No associated injuries	1	10.0
Abdominal injuries	6	60.0
Thoracic injuries	4	40.0
Orthopedic fractures	4	40.0
Pelvic injuries	5	50.0
Dorso lumber spine injuries	3	30.0
one patient may have many associated injuries		

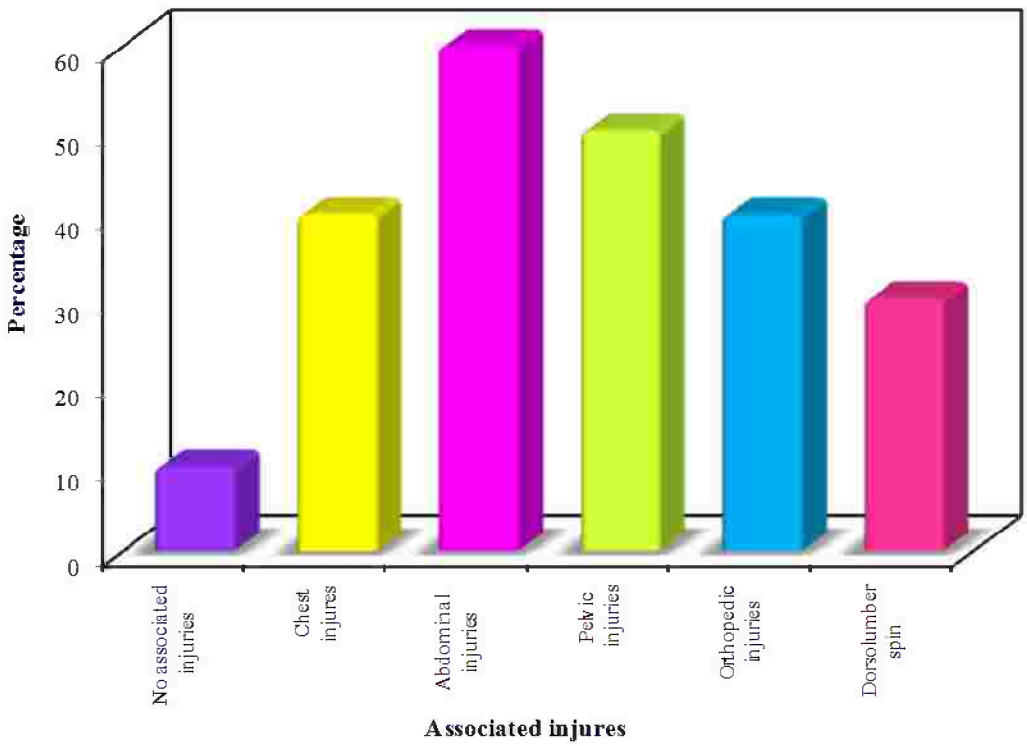

Figure (8): Distribution of the studied cases according to associated injures

Relation between gender and age (table 9)

This table shows that the common age group for both males and females was between 41- 60 year-old.

Table (9): Relation between gender and age

	Gender				χ^2	^{MC}p
	Male (n = 7)		Female (n = 3)			
	No.	%	No.	%		
Age						
≤20	1	14.3	1	33.3		
21 – 40	1	14.3	1	33.3	2.035	1.000
41 – 60	3	42.9	1	33.3		
≥61	2	28.6	0	0.0		

χ^2: Value for Chi square MC: Monte Carlo test
MC: Monte Carlo test

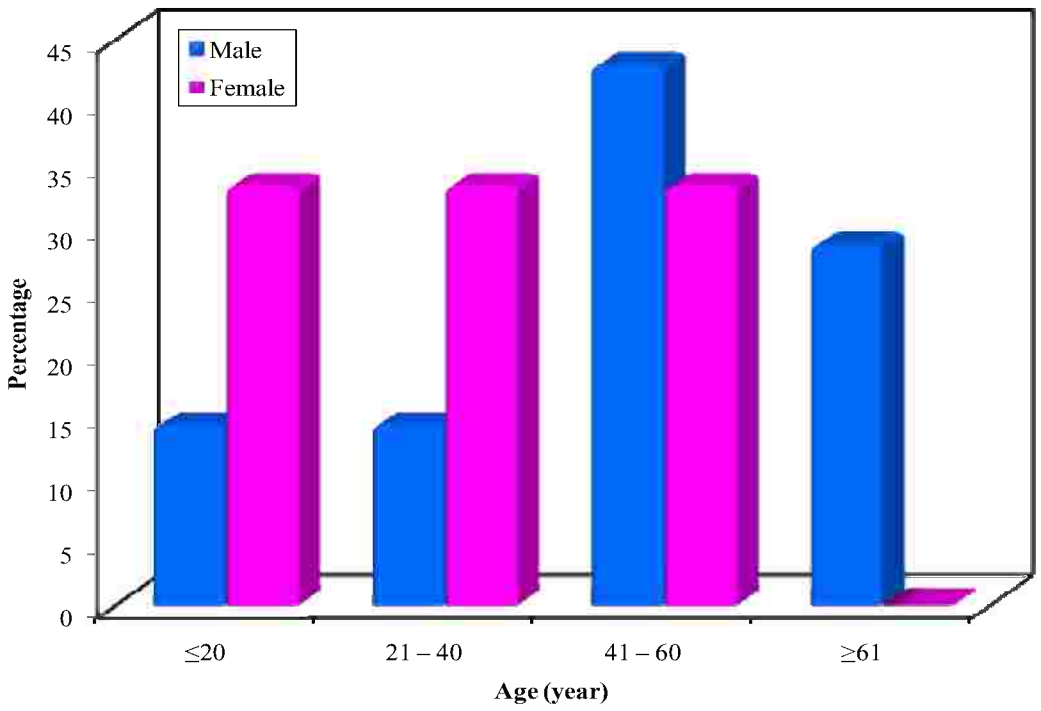

Figure (9): Relation between gender and age

Relation between gender and mechanism of trauma (table 10)

In this study, 5male patients representing 71.4% of all male patients were more affected and injured due to RTA, while 2 females representing 66.7%of all females patients were injured due to RTA.

Table (10): Relation between gender and mechanism of trauma

	Sex				χ^2	^{MC}p
	Male (n = 7)		Female (n = 3)			
	No.	%	No.	%		
Mechanism of trauma						
RTA	5	71.4	2	66.7		
FALL	1	14.3	1	33.3	1.209	1.000
AA	1	14.3	0	0.0		

χ^2: Value for Chi square
MC: Monte Carlo test

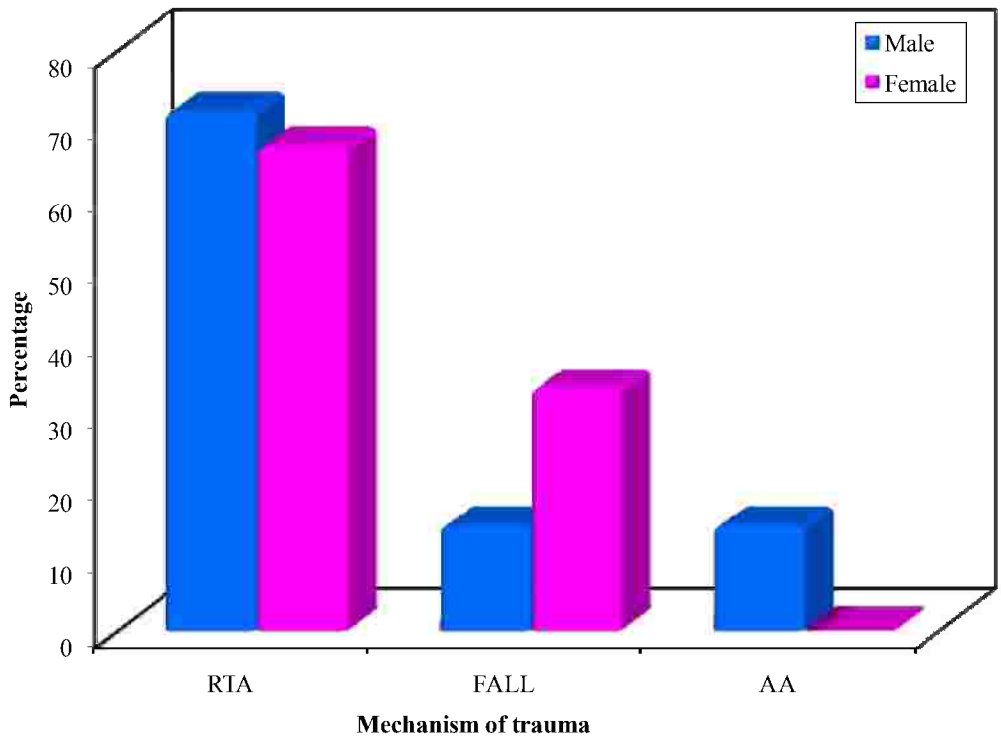

Figure (10): Relation between gender and mechanism of trauma

Relation between age and mechanism of trauma :(table 11)

The age of patients with road traffic accident ranged between 21and 77 years old with peak between 41 and 60 years .while falls and accident were at younger age group.

Table (11): Relation between age and mechanism of trauma

	Mechanism of trauma						χ^2	^{MC}p
	RTA (n = 7)		FALL (n = 2)		AA (n = 1)			
	No.	%	No.	%	No.	%		
Age								
≤20	0	0.0	1	50.0	1	100.0	8.452	0.138
21 – 40	1	14.3	1	50.0	0	0.0		
41 – 60	4	57.1	0	0.0	0	0.0		
≥61	2	28.6	0	0.0	0	0.0		

χ^2: Value for Chi square
MC: Monte Carlo test

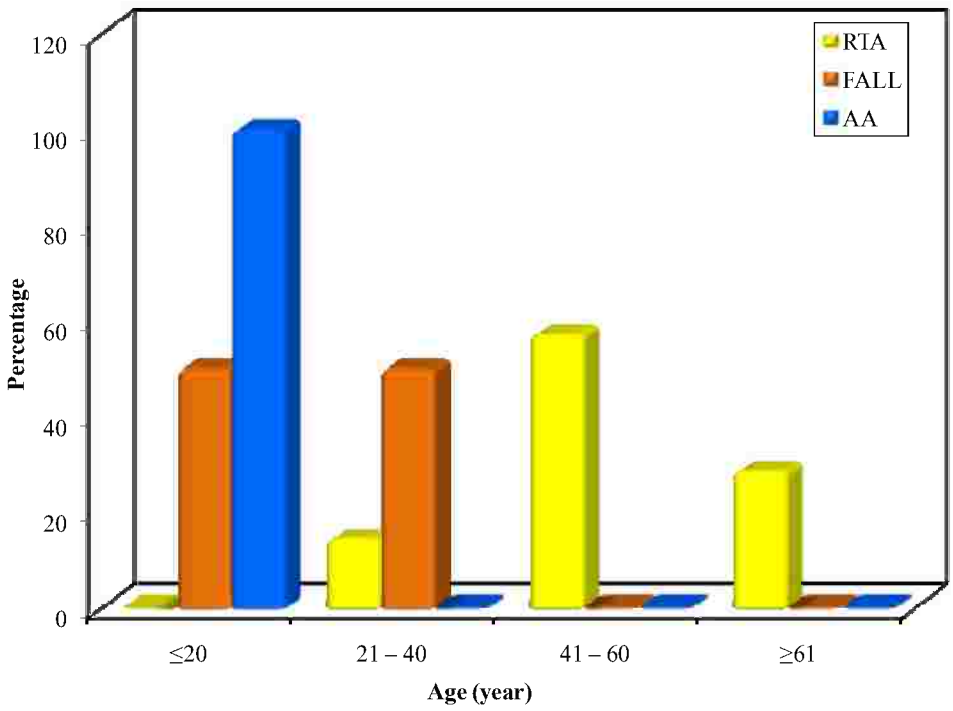

Figure (11): Relation between age and mechanism of trauma

Relation between level of cervical spine injury and mechanism of trauma: (table 12)

In our study 5 patients representing 50% of all the studied cases with cervical spine fractures were younger than 61 years old. The most common cause of trauma at this age group was RTA.With the C2 vertebra as most frequently injured, followed byC6.

Table (12): Relation between level of cervical spine injuries and mechanism of trauma

	Mechanism of trauma						χ^2	^{MC}p
	RTA (n = 7)		FALL (n = 2)		AA (n = 1)			
	No.	%	No.	%	No.	%		
Region of cervical spine injuries								
C2	4	57.1	0	0.0	1	100.0		
C6	1	14.3	1	50.0	0	0.0	3.958	0.726
Multiple Cx injures	2	28.6	1	50.0	0	0.0		

χ^2: Value for Chi square
MC: Monte Carlo test

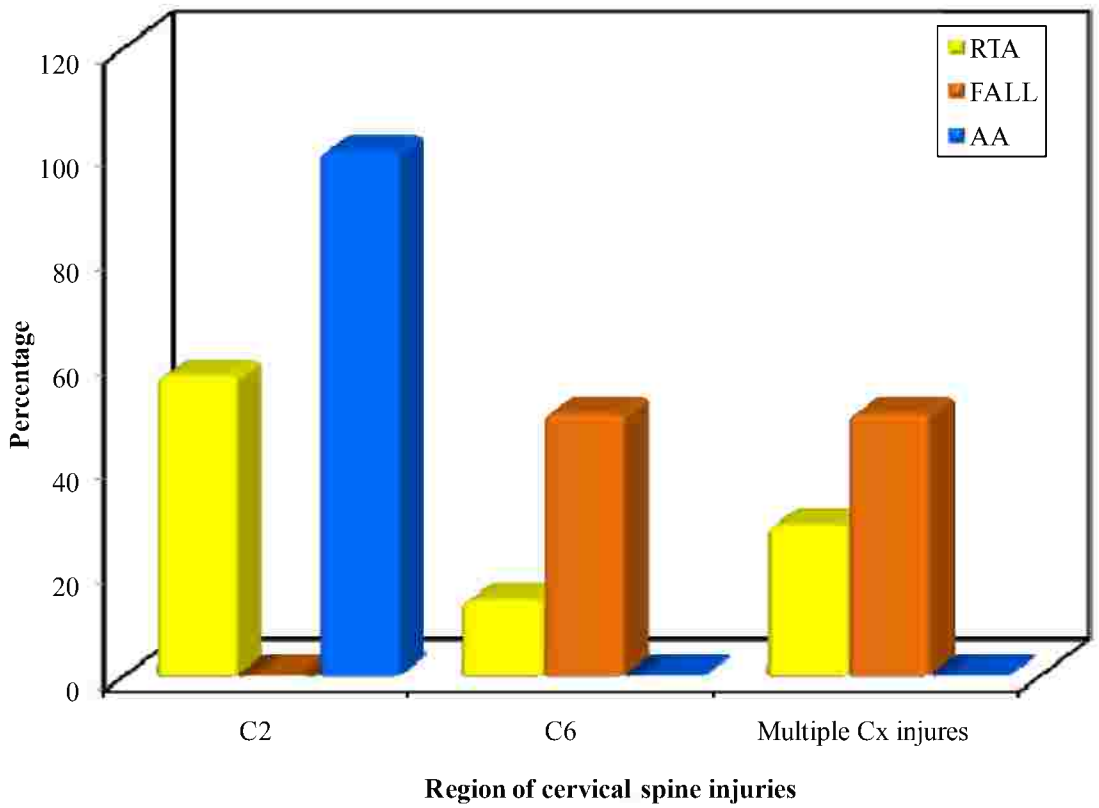

Figure (12): Relation between level of cervical spine injuries and mechanism of trauma

Relation between mechanism of trauma and associated injuries (table 13)

Only one patient representing 10% of all patients had no associated injuries. Nine patients representing 90% of all patients had associated injuries.3 patient (4%) had chest trauma,6 patient(60%) suffered abdominal injuries ,5 patients (50%) had pelvic injuries ,4 patients (40%)had orthopedic injuries and 3patient (30%) sustained dorsolumber spine fracture.

Table (13): Relation between mechanism of trauma and associated injuries

	Mechanism of trauma						χ^2	^{MC}p
	RTA (n = 7)		FALL (n = 2)		AA (n = 1)			
	No.	%	No.	%	No.	%		
Associated injuries								
No associated injuries	0	0.0	0	0.0	1	100.0	5.409	0.100
Chest injures	3	42.9	1	50.0	0	0.0	1.039	1.000
Abdominal injuries	6	85.7	0	0.0	0	0.0	5.644*	0.035*
Pelvic injuries	4	57.1	1	50.0	0	0.0	1.322	1.000
Orthopedic injuries	3	42.9	1	50.0	0	0.0	1.039	1.000
Dorsolumber spin	2	28.6	1	50.0	0	0.0	1.209	1.000

χ^2: Value for Chi square
MC: Monte Carlo test
*: Statistically significant at $p \leq 0.05$

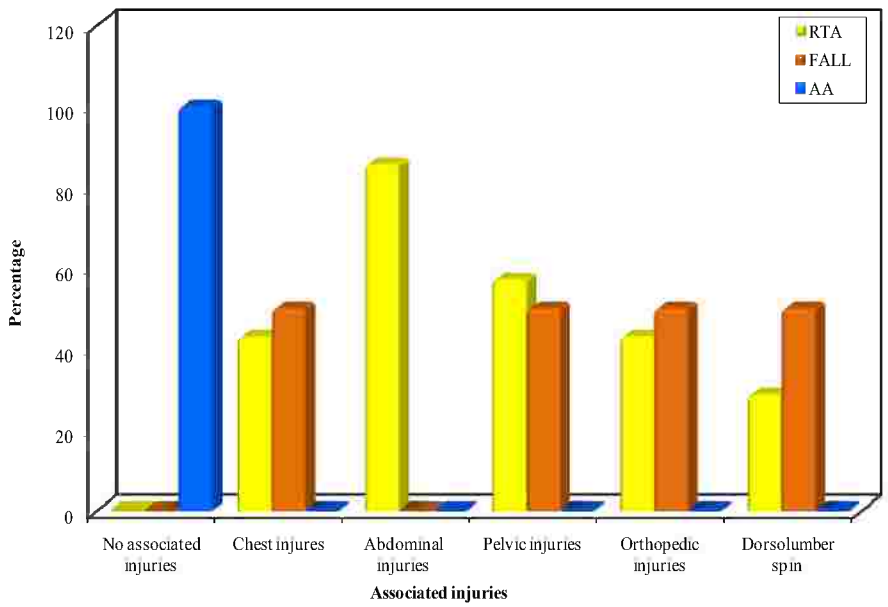

Figure (13): Relation between mechanism of trauma and associated injuries

Relation between cervical spine injuries and associated injuries: (table14)

In this study abdominal injuries are the most common associated injuries representing60%of all patients followed by pelvic injuries representing 50%wlile injury of other spines other than cervical spines represents 30%.

Table (14): Relation between cervical spine injuries and associated injuries

	Cervical injuries						χ^2	^{MC}p
	C2 (n = 5)		C6 (n = 2)		Multiple Cx injures (n = 3)			
	No.	%	No.	%	No.	%		
Associated injuries								
No associated injuries	1	20.0	0	0.0	0	0.0	1.428	1.000
Chest injures	1	20.0	0	0.0	3	100.0	5.555	0.073
Abdominal injuries	4	80.0	1	50.0	1	33.3	1.972	0.710
Pelvic injuries	2	40.0	1	50.0	2	66.7	0.868	1.000
Orthopedic injuries	2	40.0	2	100.0	0	0.0	4.169	0.118
Dorsolumber spin	2	40.0	0	0.0	1	33.3	1.120	1.000

χ^2: Value for Chi square
MC: Monte Carlo test

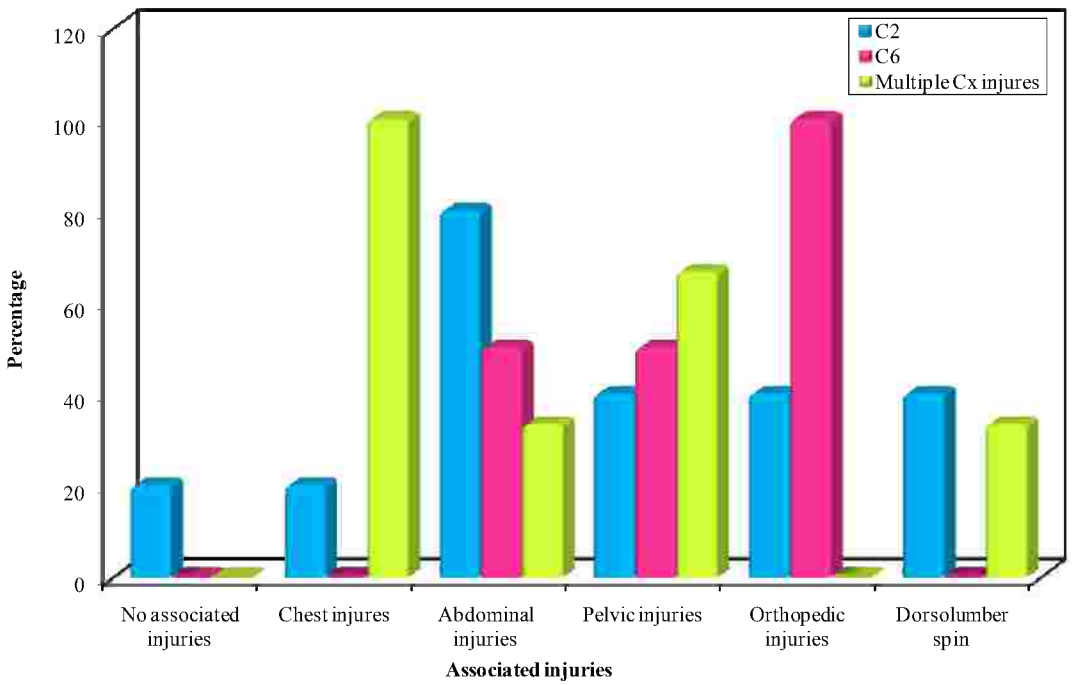

Figure (14): Relation between cervical spine injuries and associated injuries

Relation between cervical spine injuries and blood pressure: (table 15)

In this study 7 patient s representing 70 % of all patients show signs of UN stability as regard blood pressure and 3 patients representing 30% had normal blood pressure.

Table (15): Relation between Cervical spine injuries and blood pressure

	Blood pressure				χ^2	^{MC}p
	Stable (n = 3)		Unstable (n = 7)			
	No.	%	No.	%		
Cervical injuries						
C2	2	66.7	3	42.9		
C6	1	33.3	1	14.3	1.930	0.496
Multiple Cx injures	0	0.0	3	42.9		

χ^2: Value for Chi square
MC: Monte Carlo test

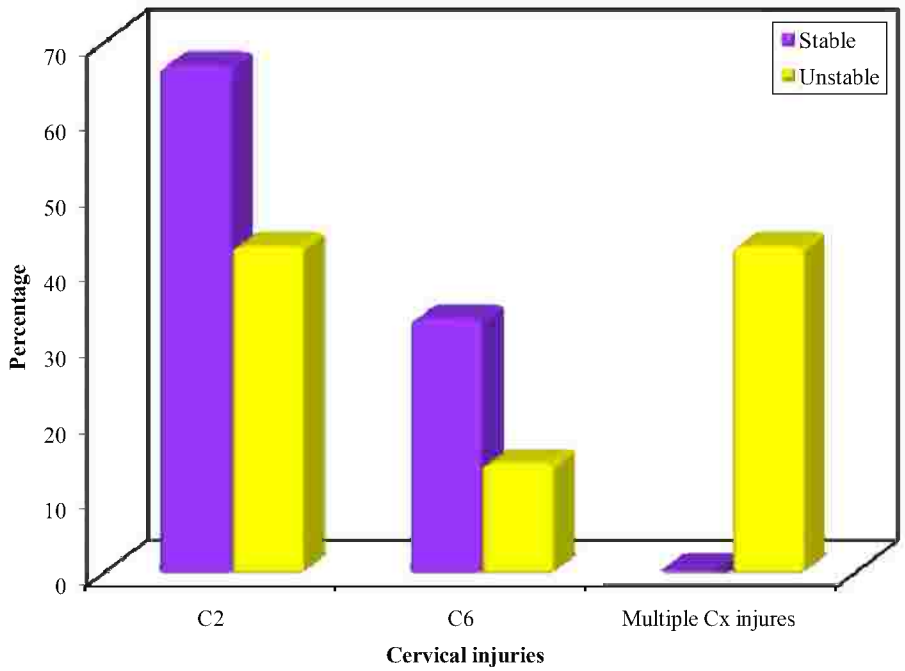

Figure (15): Relation between Cervical injuries and blood pressure

Relation between cervical spine injuries and respiratory rate: (Table 16)

In this study 5 patients representing 50%of all patients were distressed.

Table (16): Relation between Cervical injuries and Respiratory rate

	Respiratory rate				χ^2	^{MC}p
	Distressed (n = 5)		Not distressed (n = 5)			
	No.	%	No.	%		
Cervical injuries						
C2	2	40.0	3	60.0		
C6	0	0.0	2	40.0	4.452	0.168
Multiple Cx injures	3	60.0	0	0.0		

χ^2: Value for Chi square
MC: Monte Carlo test

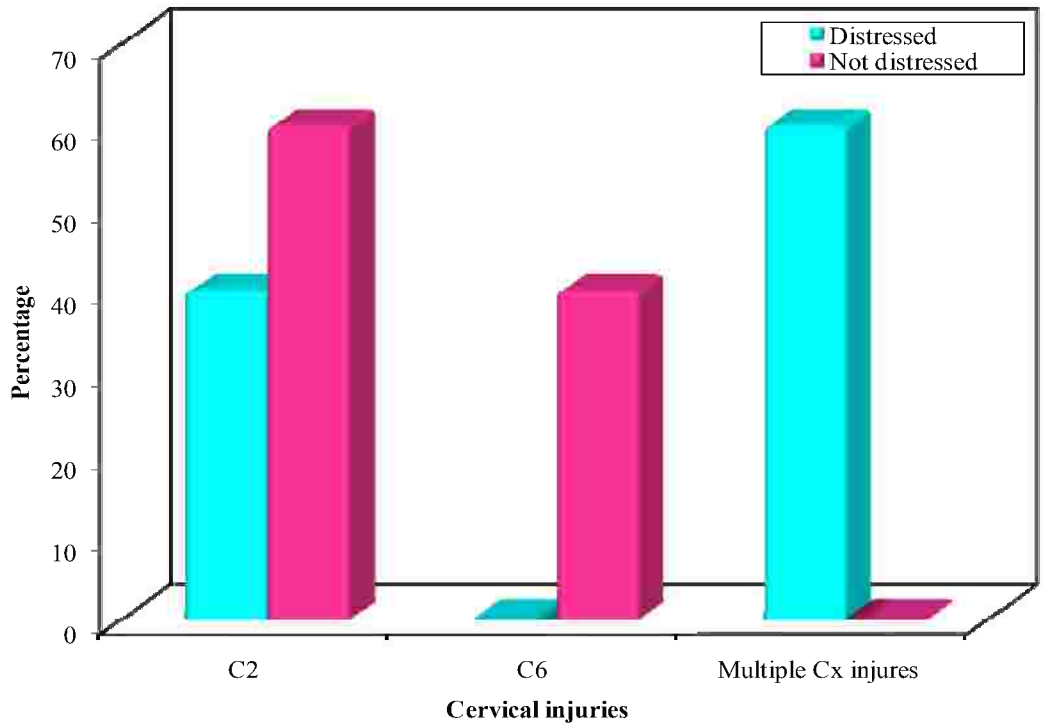

Figure (16): Relation between Cervical injuries and Respiratory rate