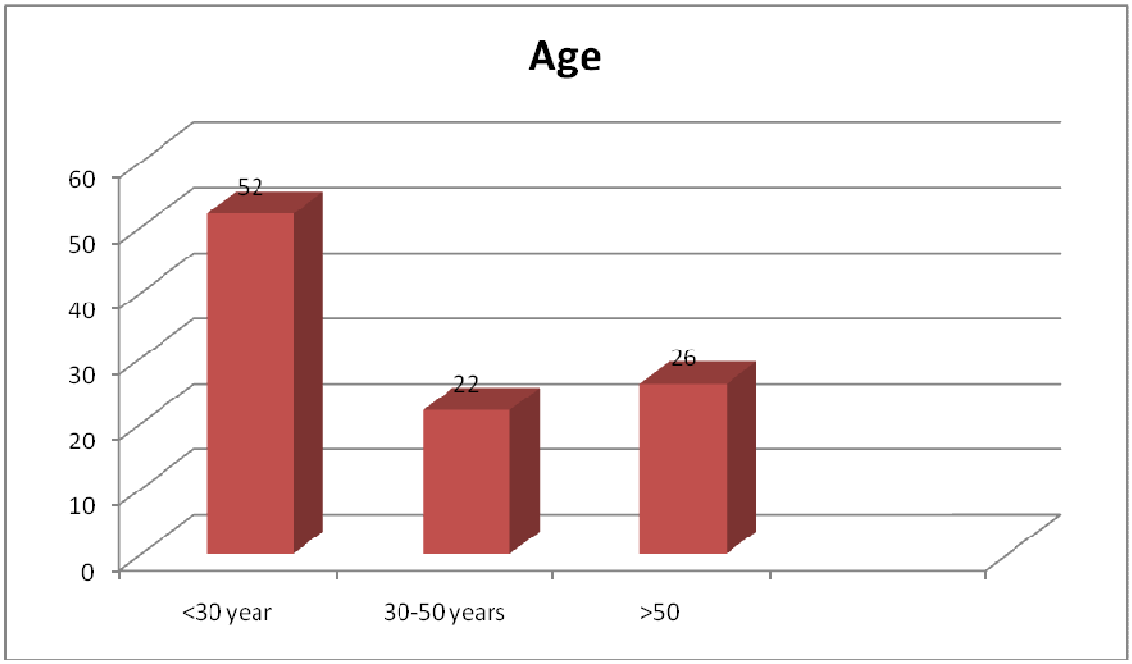
RESULTS

A total of 50 cases were studied 39 males and 11females.Their age ranged between 16 years and 84 years (mean 42years). T1 and T2WI were acquired for all cases in sagittal and axial views. Plain X –rays were available in 7 cases and CT was available only in 11cases.

Table (1): Age distribution:

Age	Mean=S.D		Range
	42=17.32		16 years -84 years
	Number	%	
<30 years	26	52	
30-50 years	11	22	
>50 years	13	26	

In this study (Diag. 1), age of the patients ranged from 16 and 84years.

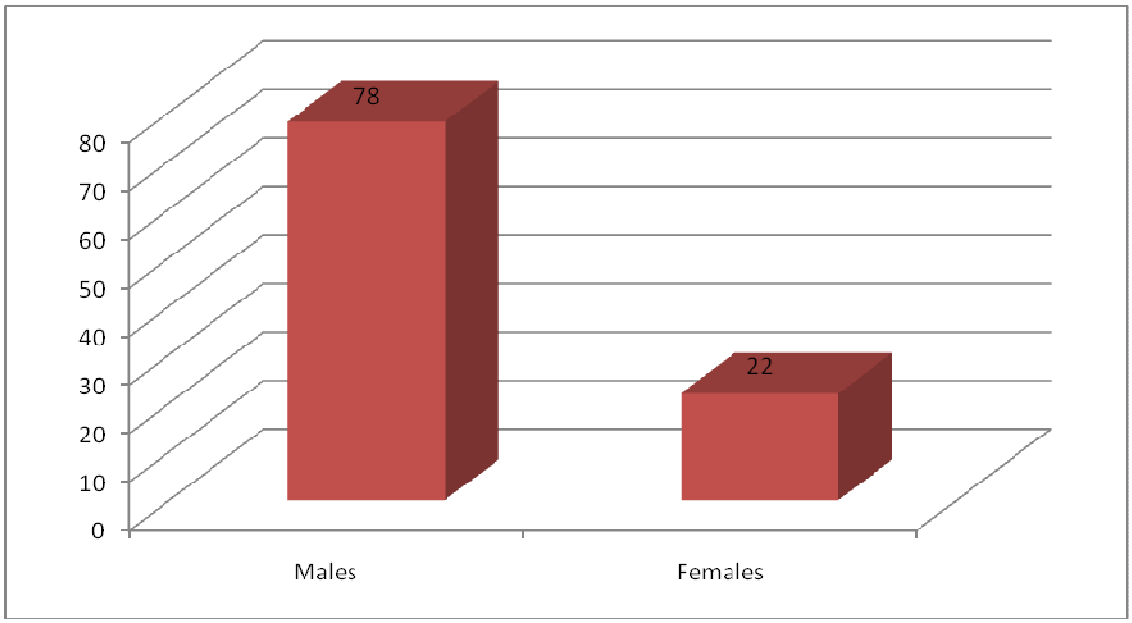


Diag. (1): Age distribution in percentage.

Table (2): Gender distribution:

Gender	Number	(%)
Males	39	78
Females	11	22

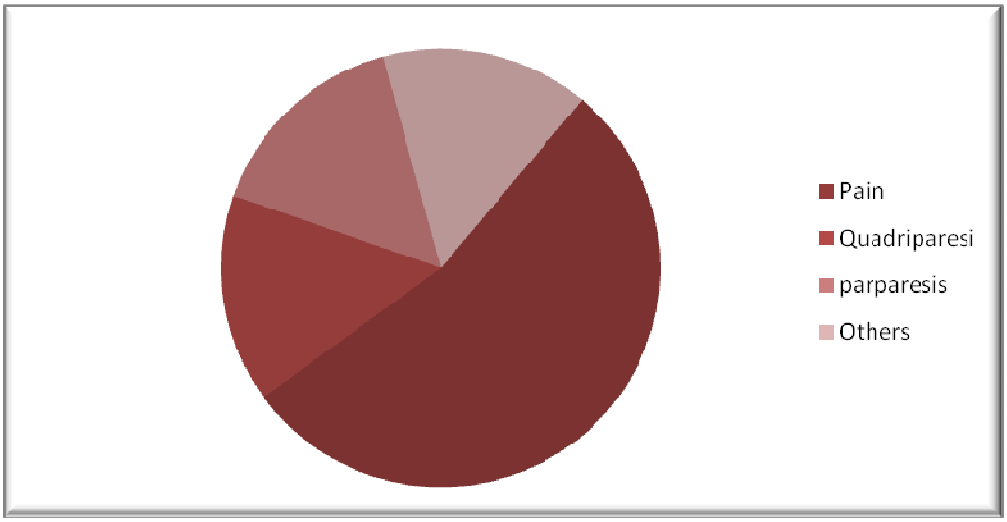
In this study (Diag. 2) 78 % of the patients were males and 22% were females.



Dig. (2): Gender distribution in percentage.

Table 3: Clinical manifestation of the studied patient

Sign and symptoms	No of cases
Pain	28
Paraplegia	4
Quadriplegia	8
Incontinence	3
Loss of consciousness	3
Others	4



Diag. (3): Patients complaints in percentage.

N.B: More than one symptom may be present for the same patient

Most of the patients, in this study, (28 out of 50 cases) complained of pain related to upper limbs .The next most common complaint was back pain due to lesion in thoracic spine followed by lumbar spine.

Two groups of patients identified during MR imaging, the 1st group presented with acute spinal injury 45 patients, and the 2nd group with chronic spinal injury (old trauma) 5 patients.

Three major groups of accident types where identified: traffic accident, falling from height, and other accidents including sports. In traffic accidents, 28 patients (22 males and –6 females) sustained ==mainly wedge compression fractures (WCFs) and== burst fractures (BFs). In the falling accidents (range 1-12m, average ? m), 18 patients (14male and4 females) sustained 8 WCF and 6 burst fractures.

The neurological deficit correlated positively with falling from height. Falling from height accidents had the highest incidence of fracture of

the thoracic vertebra (n=9/50%) then lumbar spine (n=6/33, 33%).and cervical spine 16, 6 % (n=3).

Traffic accidents account for 56% (n=28) of the spine related injury. In traffic accidents, the neurological deficit was the highest of spinal trauma and the number of females was the lowest.

There were 6 females (12%) involved in traffic accidents, 4(8%) and 1(2%) females in falling accidents and other accidents, respectively (Table 5).

The average age in males (49 years) and females (35 years) was not similar. Of 39 male patients, 11 (22%) had burst fractures, and 2 of them at non contiguous levels, and of 13 females, 2 (4%) had burst fractures.

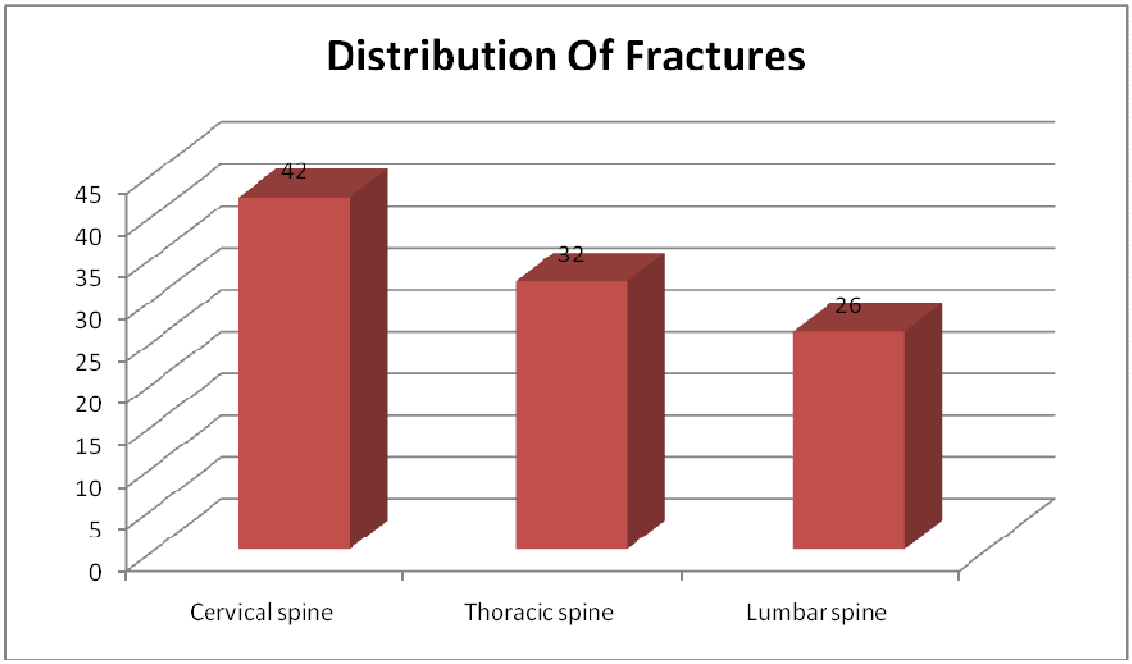
Difference in the distribution of spine fractures over the spine between genders was not significant.

With both genders, the incidence of the commonest fracture WCF peaked at the thoracic spine between T 4 and T12 and thoracolumbar junction (TLJ).

In males the predominant cause of injury was traffic accidents (44%) followed by fall (14%) and in females; it was also traffic accidents or fall followed by other accidents.

Table 4: Gender distributions, mean age, and fracture location by accident mechanism

	Cases (m/f)	Mean age	CS	TS	LS
	50	16-84 (42)	21	16	13
			42%	32%	26%



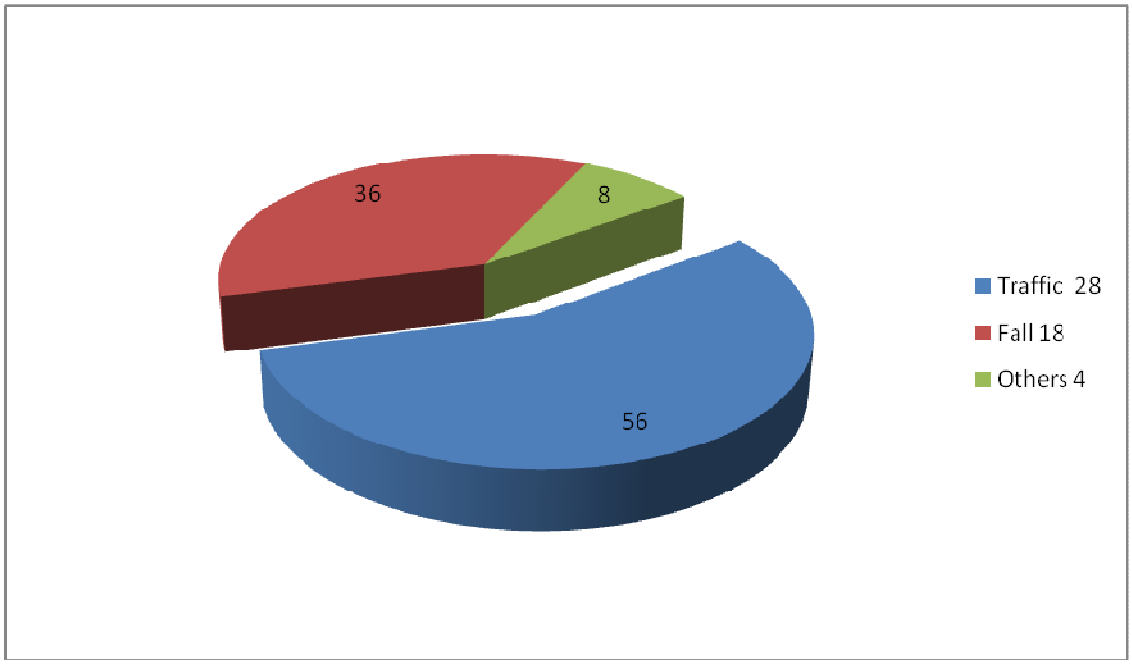
Diag. (4): Distribution of fracture over the spine in percentage.

The majority of injuries occurred in the cervical spine, followed by thoracic spine and then lumbar spine.

Table 5: Mean age and amount of spine fracture in the male and female subgroups by fracture location.

	No-				Modality		
		CS	TS	LS	Falls	Traffic	Others
Male	39(78%)	19(38%)	12(24%)	8(16%)	14(28%)	22(44%	3(6%)
Female	11(22%)	2(4%)	4(8%)	5(10%)	4 (8%)	6(12%)	1(2%)
Total	50(100%)	21(42%)	16(32%)	13(26%)	**18**(36%)	**28**(56 %)	**4**(8%)

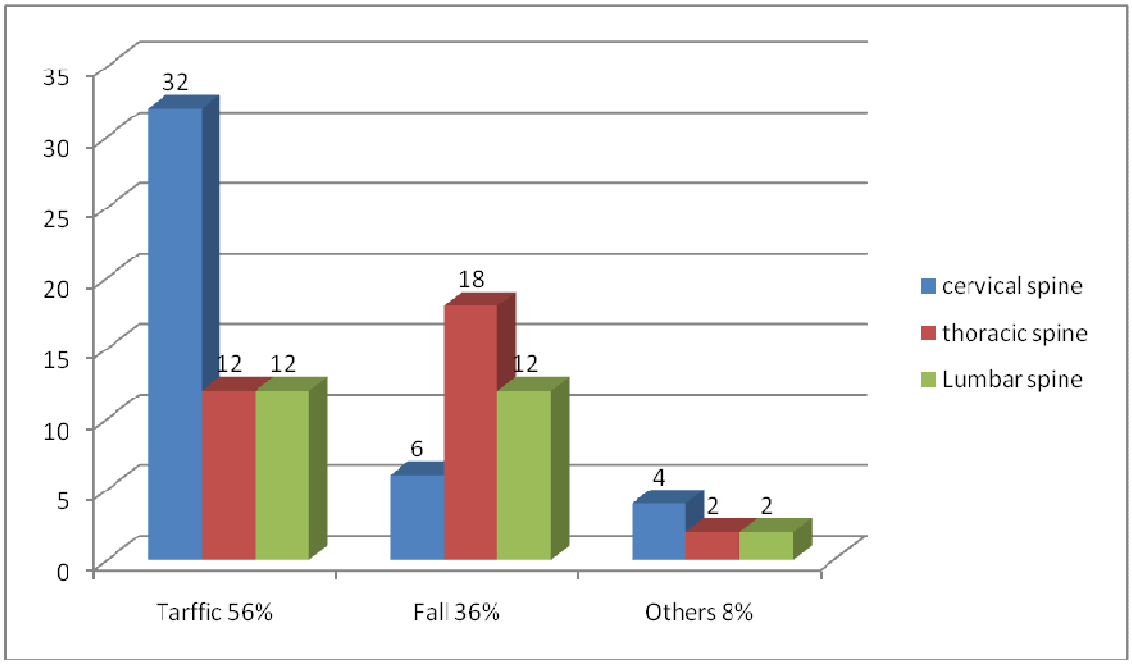
The mechanisms of injury consisted of 28 motor vehicle collisions, 18 falls, 4 others.
Most blunt spine injuries in this study occurred after traffic accidents (56%) then falling from height (36%).



Diag. (5): Mechanism of accident (percentage distribution) in traumatized patients with spine injuries.

Table 6: Mechanism of injury and distribution through spine

	Cases (m/f)	CS	TS	LS
Traffic	28(56%)	16(32%)	6(12)	6(12%)
Falls	18(36%)	3 (6%)	9(18)	6(12%)
Other	4(8%)	2 (4%)	1(2%)	1(2%)



Diag. (6): Distribution of spinal injuries by mechanism over the spine in percentage.

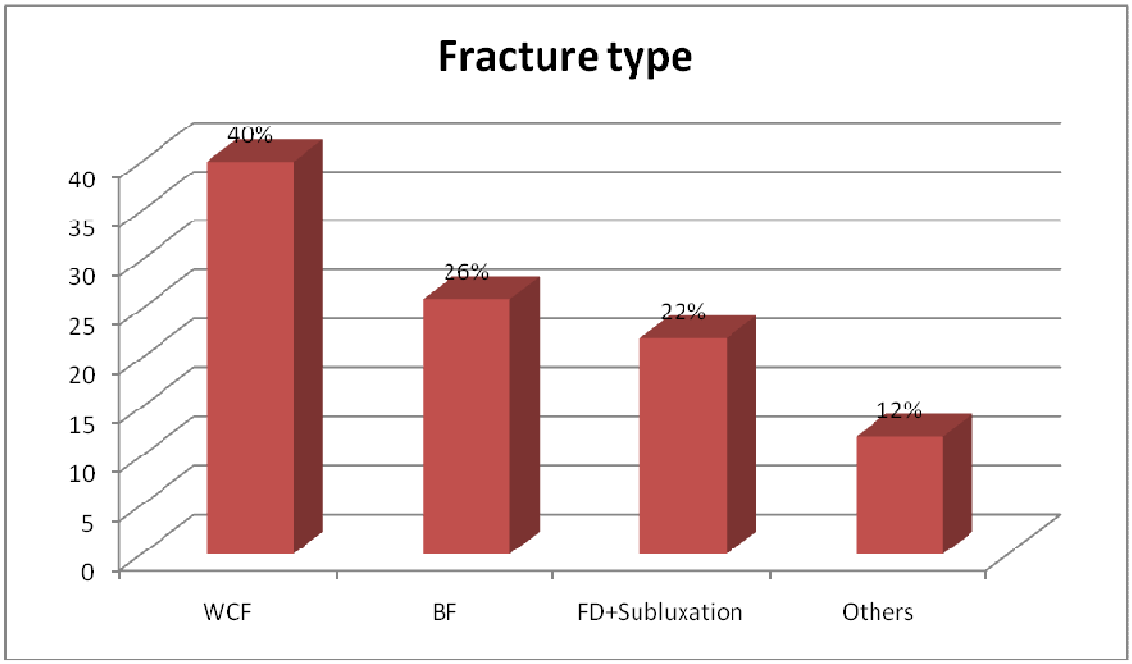
The most common site of injury in traffic accident was the cervical spine, followed by the thoracic and lumbar spines.

The most common site of injury in falling from height accidents was the thoracic spine, followed by lumbar spine and then cervical spine.

Table 7: Type of fractures and distribution over the spine:

Type of fracture	Cervical	Thoracic	Lumbar	Total
WCF	4	10	6	**20**
BF	4	4	5	**13**
Facet f/dislocation	4	2	1	**7**
Subluxation	4	-	-	**4**
BB SCIWRA	1	-	-	**1**
C1/C2 fracture.	4			**4**
Avulsion fracture	-	-	1	**1**
Chance fracture	-	1*	-	
Total no. of cases	21	16	13	**50**
% of cases	42%	32%	26%	**100%**

*N.B Chance fracture included in Fracture dislocation subtypes.



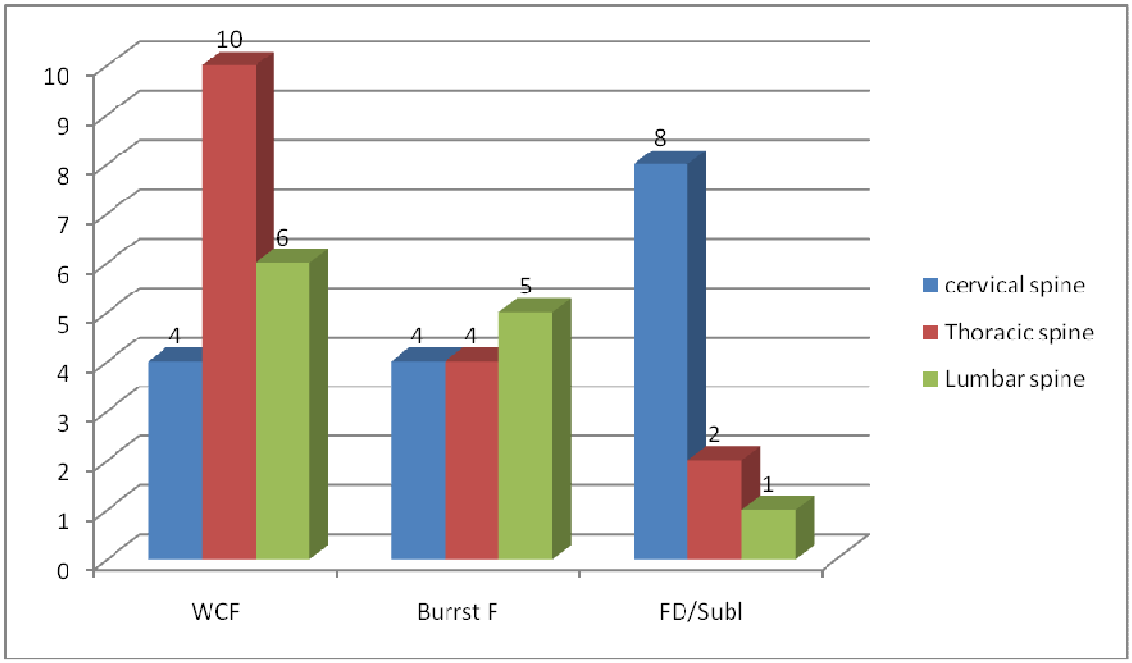
Diag. (7): Classification and distribution of primary vertebral injury in percentage.

The commonest injury was wedging compression fractures (WCF), accounting for 40 %(n=20) of all injuries, followed by burst injury26% (n=13).

The majority of WCF injuries occurred in the thoracic spine, followed by lumbar spine and then cervical spine.

Compression fracture was most commonly seen in the thoracic spine (n=10, 50%), then lumbar spine (n=6, 30%) and less common in the cervical spine (n=4, 20%).

Burst fracture (n=13, 26%) was the second most common fracture type and was most frequently seen in the thoraco-lumbar junction (N=9, 69, 2%) and (N=4, 30, 76 %) of burst fracture were seen in the cervical spine.



Diag. (8): Distribution of primary vertebral fracture over the spine.

Table 8: Classification of fracture and mechanism of injury

		WCF	BF	FD	SL	Avulsion	C1/C2	SCIWORA
Traffic	**28**	**10(35,71%)**	**7(25%)**	**5(17,85%)**	**2(7,14%)**	**-**	**4(14,28%)**	**-**
Fall	**18**	**8 (44,44%)**	**6(33,33%)**	**2(11,11%)**	**-**	**1(5,55%**	**-**	**1**
Others	**4**	**2**	**-**	**-**	**2**	**-**	**-**	**-**
Total	**50**	**20**	**13**	**7**	**4**	**1**	**4**	**1**

Compression fractures were more common in traffic accidents then in falls and other type of injury.

Burst fractures were more common in traffic accidents as well as in falls, Table 8.

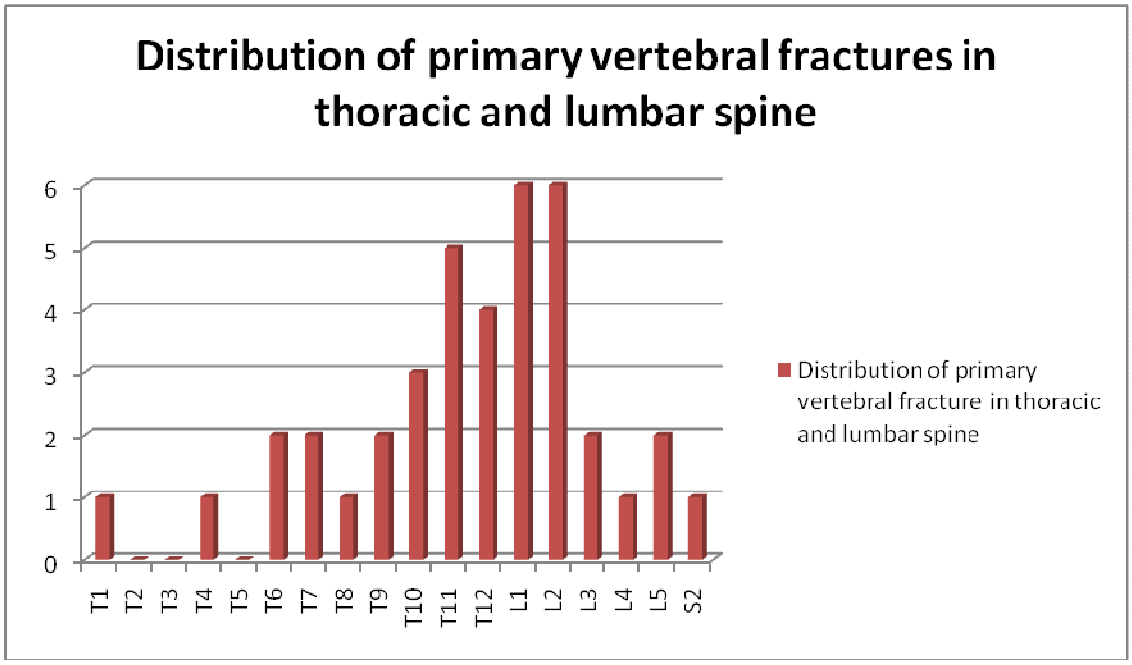
The characteristic of secondary injuries are seen as wedging compression fractures, bone bruises and to less extent burst fractures. A secondary injury was identified in approximately 88% of all cases. Bone bruise was the commonest type of secondary injury.

Most patients had a combination of multiple levels and multiple types of secondary injury, which could be contiguous or non contiguous, the majority having a combination that included bone bruise.

Multi-level spine fractures were seen, the fractures were seen at non contiguous level and contiguous level.

Other fractures: Eleven patients with fracture dislocation and subluxation were most commonly seen in the cervical spine.

Four patients with C1 and C2 fractures(Type I and type II Odontoid fracture, one patient with Avulsion (Ships) fracture in lumbar spine and one patient with spinal cord injury without radiographic abnormality (SCIWORA).



N.B Multiple WCF in thoracic and lumbar vertebrae seen as 1ry vertebral injury.

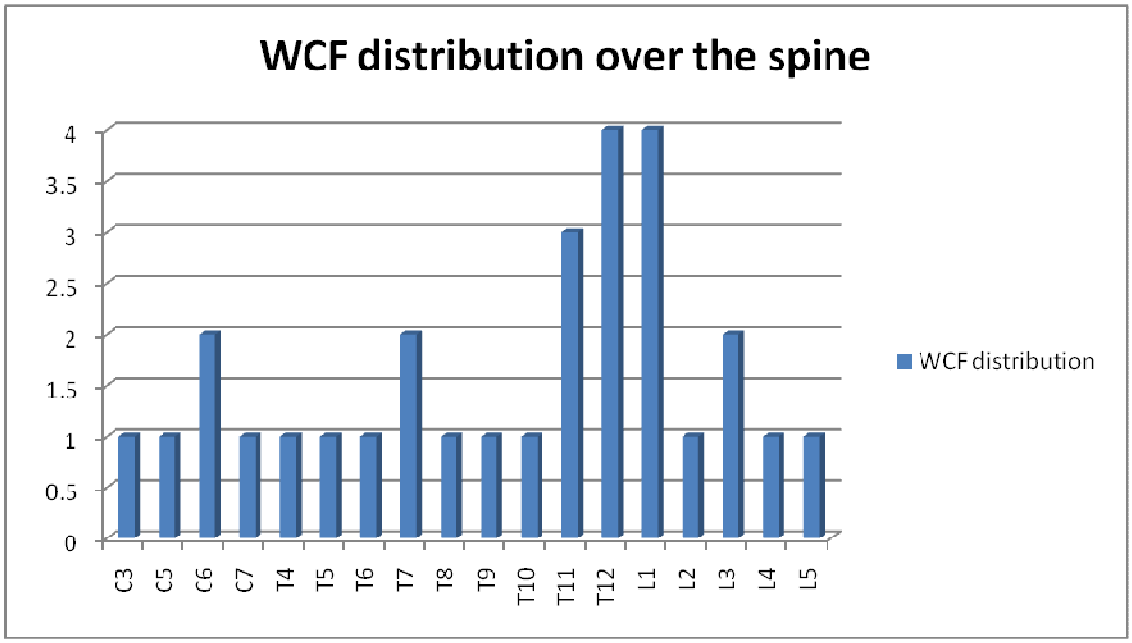
Diag. (9): Distribution of primary vertebral fractures in thoracic and lumbar spines (level of injury).

N.B More than one primary injury may be encountered in the spine. Most injuries were seen in lower thoracic and upper lumbar .i.e. at thoracolumbar junction.

Table 9: Relationship between primary fracture site and incidence of secondary injury:

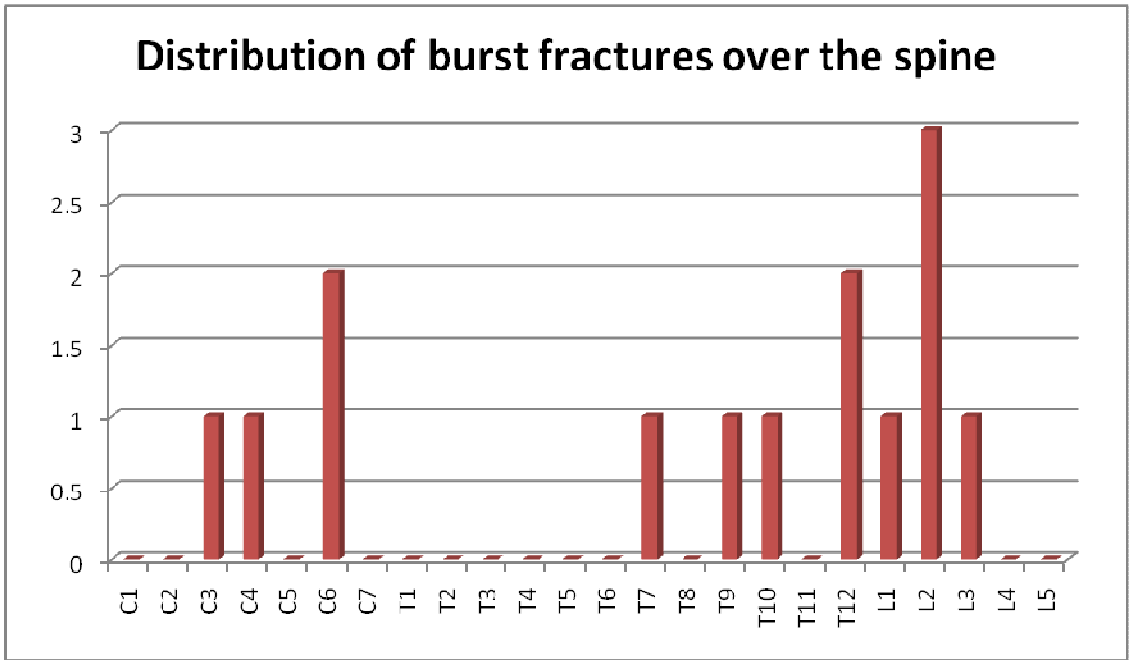
Primary injury level	No of cases with WCF	BF	FD/FS
Cervical	4	4	8
Thoracic	10	4	2
Lumbar	6	5	1
Total	20	13	11

N.B Multiple bone bruises (BB) in thoracic and lumbar vertebrae seen as 2ry injury.



Diag. (10): Distribution of wedge compression fractures over the spine.

The incidence of wedge compression fractures peaked at the thoracolumbar junction. N.B this diagram (10) involve more than one WCFs (both 1ry and 2ry fractures).



Diag. (11): Distribution of burst fractures over the spine.

The incidence of burst fractures peaked at the thoracolumbar junction.

Soft tissue spinal injuries:

45 patients (out of 50) with acute spinal injury had acute traumatic findings on MRI which were subdivided: 17 of 45 patients (37,77%) had acute ligamentous injury, 23 of 45(51,11%) patients had acute disc injuries, 6 of 45 patients (13,33%) had a spinal epidural or subdural hematoma, 21 of 45 patients (46,6%) patients had spinal cord edema or contusion, 5 of 45 patients (11.3%) had a prevertebral hematoma. (Table 10).

Spinal Cord Injury (SCI)

Among 21 patients who had acute spinal cord injury (cord edema VS contusion), 3 had hemorrhage within the cord, 1 of them with cauda equina damage was seen. Eleven cases of cord damage (SCI) located at the cervical region (52, 3%) and 6 in the thoracic region (28, 5%) and 4 (19, 04%) in the lumbar region.

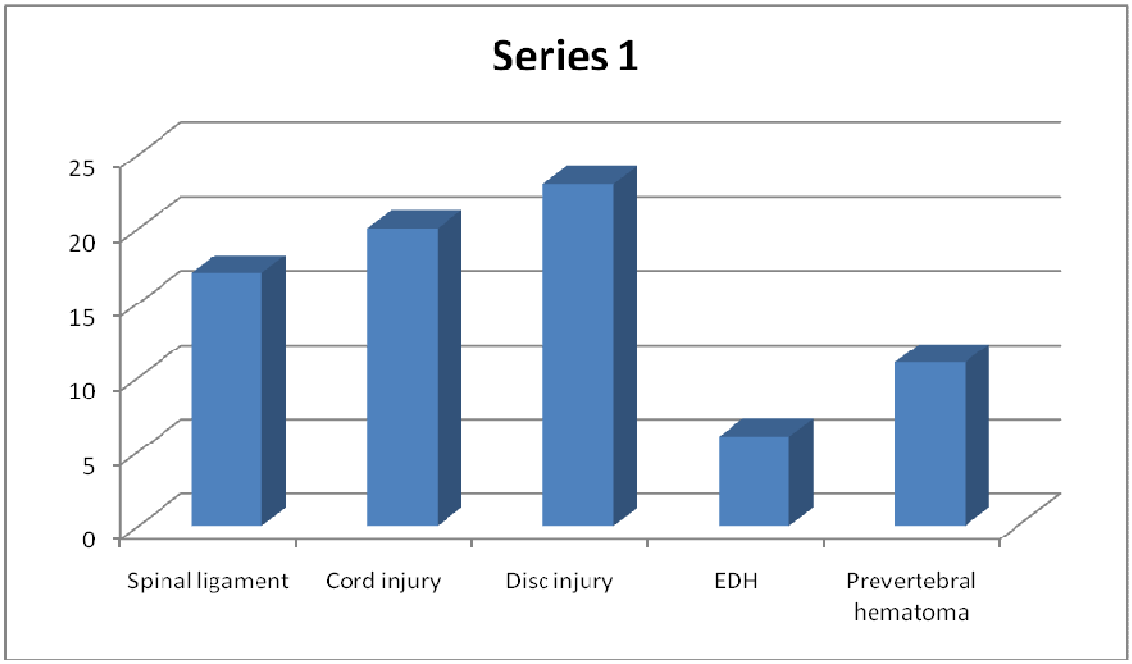
The injured segment of cord was localized to the level of vertebral or disc injury.

Altered signal intensity in the cord extended over one to two segments proximal and distal to the level of vertebral injury.

Table 10: MR Imaging Findings in Spinal Trauma Patients:

Total	Ligament injury	Disc herniation or injuries	TSEH	Prevertebral hematoma	Myelomalacia	Cord contusion edema
	17 (37,77%)	**23** (51,11%)	6 (13,33%)	11 (24,4%)	3	21 (46,6%)

N.B Percentage in acute spinal soft tissue injuries over 45 cases.



Diag. (12): Acute spinal soft tissue injuries in percentage.

Soft Tissue Injury	Percentage of Patients	No. of Patients
cervical	(52,3%)	11
Thoracic	(28,5%)	6
Lumbar	(19,04%)	4
Total	100%	21

Table 11: Distribution of Soft Tissue Injuries (cord) in Association with Spinal Trauma

Anatomic structure	MRI findings
Vertebral body	Abnormal marrow signal (bone contusion) Deformity of shape/contour (fracture)
Anterior longitudinal ligament	High T2 signal Displacement/elevation Disruption
Posterior longitudinal ligament	High T2 signal Displacement/elevation Disruption
Intervertebral disc	High T2 signal Widening
Epidural hematoma	High T2 signal
Ligamentum flavum	High T2 signal Disruption
Neural arches	Deformity of shape/contour (fracture
Facet capsules	High T2 signal Widening Dislocation

Table 12: MRI findings of injury to osseous and soft tissue /ligamentous structures.

Spinal ligaments

The anterior longitudinal ligament was intact in most of cases and could be seen to buckle rather than tear (abnormal high signal intensity in 16 patients) however complete ALL tear occurred in 8 of these patients all of whom sustained bilateral fracture , and disc and cord injury was documented in 2 of these patients.

Posterior longitudinal ligaments tear occurred in 12 patients. ISL tear seen in (9) patients.

No isolated ligamentous injuries noted.

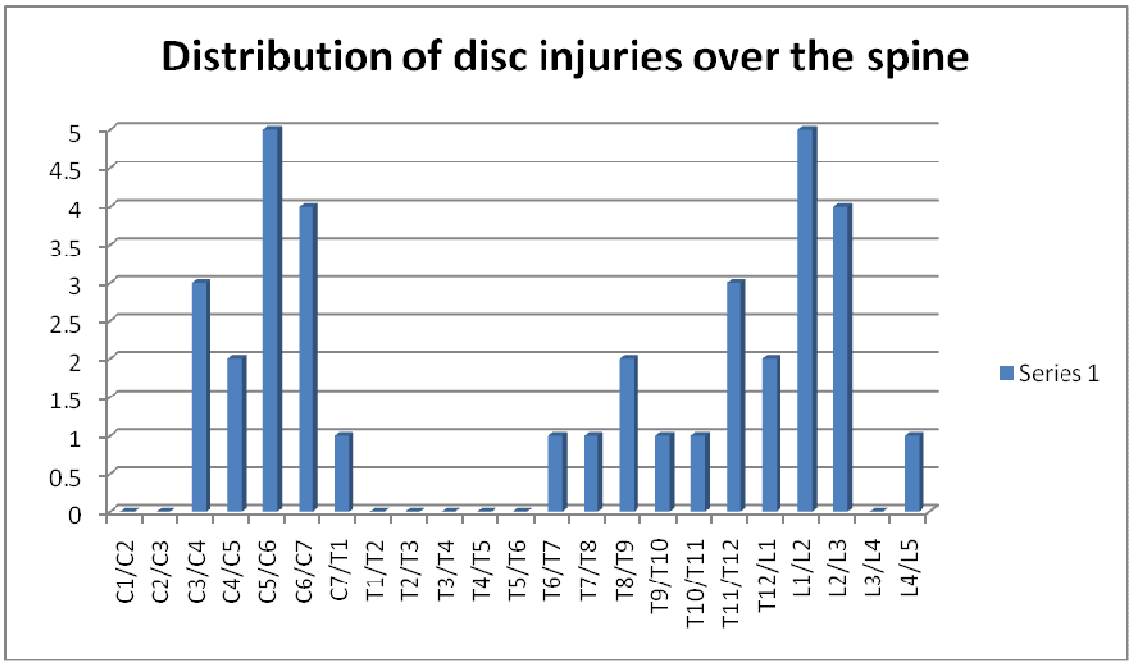
Intervertebral discs

11 patients had posttraumatic disc degeneration and 8 had posttraumatic disc herniation. Five patients had disc widening. The injured disc was localized to the level of vertebral injury. Acute disc degeneration presented by increased signal intensity within disc material.

Table 13: Types of disc injuries in acute spinal trauma

Disc injury	Degeneration	Widening	Herniation
Cervical	4	2	3
Thoracic	3	1	2
lumbar	4	2	3
Total	11	5	8

N.B More than one spinal disc injury occur in primary spinal trauma



Diag. (13): Distribution of disc injuries over the spine.

Most disc injuries in spinal trauma occurred in the lower cervical spine (15 cases) and thoracolumbar junction (20cases).

Epidural hematoma

Epidural hematoma was rare or infrequent and occurs anteriorly and posteriorly, or in both components of the epidural space.

Areas of hematomas, with a characteristic elongated appearance, were presents in 6 of the 45 patients (13%); all were associated with vertebral fractures. The TSEHs were located in the cervical spine in 3/6 (50%) of the patients, and in the thoracic spine in 3/6 (50%). Hematomas resulted in compression of the spinal cord or cauda equina at a spinal level with fracture in 3 cases.

Other TSEHs caused deformity (change in shape) of the thecal sac without compression of the spinal cord or cauda equina .The longest TSEH extended over 4 contiguous vertebral levels; however, most TSEHs extended over only 2 to 3 vertebral levels. The hematoma sizes (lengths) are summarized in Table 15.The most commonly observed signal characteristics of a TSEH were isointense on T1-weighted images and hyperintense on T2-weighted images. These specific signal characteristics were observed in 3/6 (50%) of the TSEHs. The second most common imaging appearance consisted of isointense signal on both the T1- and T2-weighted images, occurring in 2/6 (33,3%) of the hematomas. The signal characteristics of all identified TSEHs are summarized in Table 14. All 6 patients with a TSEH had an associated spinal fracture or dislocation. In the 6 patients with a TSEH, there were 2 burst fractures the subaxial cervical spine , 1 burst fracture in the thoracic

spine, 1fracture dislocation in the subaxial cervical spine, 2 bilateral facet fracture dislocation in the thoracic spine.

Table 14: Epidural hematoma signal characteristics

T1-weighteda	T2-weightedb	Number of hematomas
Isointense	Hyperintense	3
Isointense	Isointense	2
Hypointense	Hyperintense	-
Hypointense	Isointense	-
Hyperintense	Hyperintense	1

Table 15: Hematoma size (length)

Number of contiguous vertebral levels involved	Number of patients
1	1
2	**3**
3	**1**
4	**1**