SURGICAL TREATMENT OF THORACAL AND LUMBAR SPINE FRACTURES

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35 cases of thoracal and lumbar spine fractures were surgically treated in Çukurova University Hospital. Of these cases, 23 were males and 12 were females. Mean age was 30.2 years (range 16-55). The etiologic factors were blunt trauma in 1(3%), traffic accident in 19(54%), and fall from height in 15(43%) cases. Fracture types according to Denis' classification were as follows: compression fractures in 1(2.8%), burst fractures in 21(60%), and fracture-dislocations in 13(37.2%) cases. We used Luque rods, Harrington rods (alone or segmentally fixed), Hartshill rectangles, and Isola system with preference of Harrington distraction system in axial loading injuries.

The number of cases that were followed more than 6 months were 23 and the mean follow-up for these cases was 16.2 months (range 6-35). Although we obtained meanly 52.7% correction of kyphosis in early post-operative period, and the overall loss of correction in kyphosis angle was 2.8° in the last follow-up.

Internal fixation of the unstable vertebral fractures is the treatment of choice since many advantages has been proved.

In this report, the treatment choice concept of thirty five cases and the six months or over follow up outcome of twenty three cases; whom treated by internal fixation implants for thoracal and lumbar vertebral fractures in the Çukurova University Faculty of Medicine between January 1989- June 1992 are presented.

MATERIAL and METHOD

Between January 1989 and June 1992 we performed surgical treatment by various implants for twenty three male (65.8%), twelve female (34.2%) totally thirty five cases of unstable vertebral fractures in the Çukurova University Faculty of Medicine.

The mean age was 30.2 with a range of 16 to 55.

The etiologic factors of 35 cases were nineteen traffic accidents (54%) fifteen fall from height (43%) and one blunt trauma (3%).

Seventeen thoracal (48.5%), eighteen lumbar fractures (51.5%) were evaluated.

The neurologic level of the cases were evaluted according to Frankel classification (8):

A- Complete loss of both motor and sensory function below a given level.

B- Some preservation of sensation; complete motor paralysis.

C- Motor useless; some motor function preserved but insufficient to be useful.

D- Motor useful; weak but useful motor function.

E- Neurologically intact.

The cases were operated as soon as their general conditions permitted. The mean interval between the operation and the trauma was 7.2 days (range 0-31 days).

The fixation instruments that we have used were as follows.

1. Harrington Distraction System (HD).
2. Harrington Distraction System + Segmental Spinal Instrumentation (sublaminar wiring or transpedicular fixation by Hartshill pedicle screw bridge) (HD+SSI).
3. Luque Rods or Hartshill Rectangle.
4. Isola System.

In Harrington or Luque system sublaminar wiring, posterior fusion and rod stabilization were performed for at least two above and two below vertebras while in Isola system only one below and one above vertebral level was stabilized.

After the operation the cases were mobilized by molded plastic thoraco lumbar or lumbosacral braces as early as possible.

The duration of hospitilazation was 23.8 days (range 15-50 days). Post operative follow up was performed in the 1.5, 3, 4.5, 6, 9, 12 months.

All the cases were clinically and radiologically evaluated in the preoperative period, the post operative period and the last follow up. In the radiologic examination proper antero-posterior and lateral x-rays were taken as well as the computerized tomographic imaging.

In lateral x-ray examination five different measurement were done (2, 3, 5, 5, 9, 12):

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1. Local Kyphosis Angle (LKA). The angle between the superior and inferior end plates of the segments above and below and below the fractured vertebra respectively.

2. Anterior Vertebral Hehigt (AVH): The anterior vertebral and disc space height (Ht) at the injured level (B) is divided by average height of adjacent vertebral disc segments (A and C).

$$\% Ht = B / \frac{A + C}{2}$$

3. Posterior Vertebral Hehigt (PVH): The posterior vertebral and disc space height at the injured level is divided by average posterior height of adjacent vertebral disc segment.

4. Translation: Translation is determined by measuring the perpendicular distance between a line constructed at the posterior cortex of the injured segment to a line parallel with the posterior cortex of the adjacent proximal vertebra.

5. Displacement percentage: Displacement percentage is the distance that the displaced vertebra has moved forward relative to the posterior surface of the fractured vertebra, divided by the width of the normal vertebra immediately below the fractured one.

Hereby the percentage of canal compromise was calculated by CT scanning. The formula is shown below (7):

$$\frac{((A+C)/2) - B}{(A+C)/2} \times 100$$

The canal compromise percentage:
A: Above segment
B: Fractured segment
C: Below segment

RESULTS

The fracture regions and types (Denis classification (4)) of thirty five cases are shown in the Table I.

Table I: Fracture types and regions.

Compression	Burst		Fracture dislocation	
Th5 1 case	Th5	1 case	Th4-5	1 case
	Th5-6	1 case	Th6-7	1 case
	Th6	1 case	Th8-9	1 case
	Th8	1 case	Th10-11	3 case
	Th8-9	1 case	Th12-L1	1 case
	Th-12	3 case	L1-2	3 case
	L1	10 case	L2-3	1 case
	L 3	3 case	L3-4	1 case
1 case		21 cases		13 cases

The neurologic levels of the thirty five cases are shown in the Table II.

Table II: Neurologic level.

Frankel	A	15 cases	(42.8 %)
Frankel	B	2 cases	(5.7 %)
Frankel	C	5 cases	(14.3 %)
Frankel	D	7 cases	(20.0 %)
Frankel	E	6 cases	(17.2 %)
		35 cases	(100 %)

Eleven out of thirty five cases were having only vertebra fractures. Twenty four cases were having multiple system injuries. The most common associated injuries are shown in the Table III.

Table III. Associated injuries (in 24 cases)

1-	Lower limb injuries	10 cases
2-	Upper limb injuries	9 cases
3-	Blunt thorax trauma	6 cases
4-	Other injuries	6 cases

The fixation methods according to fracture types are shown in the Table IV:

Table IV. Fixation methods.

	Compression	Burst	Frac.-disloc.	Total
HD	-	4	2	6
HD + SSE	-	12	4	16
Luque or Hartshill	1	4	7	12
Isola	-	1	-	1
Total	1	21	13	35

Results of radiological evaluation parameters according to fracture types and fixation methods are shown in Table V, VI, VII.

Table V. Overall results.

	BURST		FRAC-	FRACTURE-DISLOC.		COMPRESSION	
	Preop	Postop	Preop	Postop		Preop	Postop
LKA	22.2°	10.7° (53%)	22.6°	10.5°(53.5%)		22°	18°(18%)
AVH	50.6	81.2	-	-		40	64.5
PVH	82.4	90.9	-	-		80	80
Translation	-	-	13.2 mm	3.1 mm		-	-
Dis. percent	-	-	34.9 %	8.4 %		-	-
Canal	52.1 %	25 %	48 %	27.3 %		-	-

Table VI. Results according to fixation methods in burst fractures (percentage of improvement).

BURST FRACTURES (Twenty one cases)				
	HD+SSI	HD	Luque or Hartshill	Isola
LKA	63	42.7	23.5	69.7
AV	79	8.5	29	57.5
PVH	13.7	2.6	12.4	Normal

Table VII. Results according to fixation methods in fracture dislocations (percentage of improvement)

FRACTURE DISLOCATIONS (Thirteen cases)			
	HD+SSI	HD	Luque or Hartshill
LKA	55.9	48	41.9
Translation	83.3	77.2	71.4

Twenty three out of thirty five cases who had been followed up six months or over were evaluated.

The mean age was 27.8 years (range 15-52 years) and the mean follow up was 16.2 months (range 6-35 months).

Fourteen (61%) lumbar, 9(39%) thoracal fractures were evaluated. Of these fractures sixteen were burst fractures (69.5%); seven were fracture dislocations (30.5%).

Preoperative and postoperative neurologic follow up of these twenty three cases according the Frankel scale (8) are shown in the Table VIII.

Table VIII. Neurologic outcome.

Preoperative	Improvement	Last follow up
7 Frankel A	4 cases (2 B, 1 C, 1 D)	3 Frankel A
1 Frankel B	1 case (1 D)	2 Frankel B
4 Frankel C	4 cases (4 D)	1 Frankel C
5 Frankel D	4 cases (4 E)	7 Frankel D
6 Frankel E		10 Frankel E

Average loss of corrections are shown in Table IX.

Table IX. Loss of correction at the last follow up.

LOSS OF CORRECTION		
	BURST	FRACTURE DISLOCATION
LKA	3°	2.5°
AVH	4.3%	-
PVH	2.4%	-
Translation	-	57.7%

In the last follow up we observed one reduction loss and three hook displacement in four cases. The one of four cases was treated by Luque Rods while the latter three cases were treated by Harrington Distraction or HD+SSI.

Two of these three cases have been internally fixed only by HD system and we reoperated them to remove the instruments since the proximal hooks were loosened.

In the third case the distal hooks bilaterally loosened and this was a case of HD+SSI.

DISCUSSION

The aims of spinal surgery in vertebral fractures are restoring the anatomy, relieving the pain, an obtaining the stability without impairing the neurological functions. For this reason, internal fixation and fusion of unstable vertebral fractures, neither with nor without neurological deficit, are widely accepted (1-3, 4-6, 9-12).

The most common fracture localization of our 35 cases was thoracolumbar region with 17 cases (48.5%). The given percentages of this localization were 47% by Akbarnia et al (1), 63% by Cotler et al (3), 70% by Alp (2) in their series.

We used HD, HD+SSI, Luque Rods, Hartshill Rectangles and Isola System as the internal fixation materials.

We measured mean preoperative and postoperative LKA values of 23 cases whom we followed up for more than 6 months as 22°and 10.7° respectively. The mean reduction loss measured as 2.8°. In the series of Yosipovitch et al (12) 16 cases have shown 5° of reduction loss with a mean preoperative 20.5° and postoperative 11° of measurement. In 44 cases of Cotler et al (3) mean preoperative and postoperative LKA were measured 19.2° and 6.8° respectively with a reduction loss of 3.3°. Gertzbein et al (9) were observed 5° of reduction loss in their series of 36 cases with 26° preoperative and 11° postoperative average LKA measurement.

The translation value of the fracture dislocation cases that we followed up for 6 months or more was 10.3 mm preoperatively and 2.3 mm posteperatively. We measured 4.7 mm of reduction loss during the follow up. The pre and postoperative displacement percentage was measured 27.7° and 11.7°.

In the research of Alp (2) pre and postoperative translation values have been measured 22 mm and 3.3 mm. In the series of Dickson et al (5) immediately op-

erated cases have shown 35% and 2% pre and postoperative displacement percentages while 51%, mean preoperative and 137% mean postoperative displacement percentages were measured for cases operated on between 8 and 35th days.

The loss of total reduction was occurred in one case who had fracture dislocation. In this case, the causes were usage of thin Luque rods and poor cooperation of the patient.

In three cases dislodgments of hooks were occurred. Two of these cases we treated by HD and the other by HD+SSI. No pseudoarthrosis observed.

Flesh et al (6) in a series of 40 cases, have given 4 pseudoarthrosis, 2 rod fractures and 2 hook dislodgments. Cotler et al (3), in a series of 44 cases, have given 4 hook dislodgments and 1 pseudoarthrosis, Gertzbein et al (9), in a series of 36 cases, have given 10 lower hook dislodgments, 4 upper hook lateral dislocations. Korkusuz et al (11), in series of 48 cases, have given 1 hook dislodgment and 1 rod fracture.

Since the number of cases in our series is not sufficient we could not statistically anayzed the results neither from the view of used systems nor complication rates but we obtained better results in cases whom we performed HD+SSI system.

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