

SURGICAL TREATMENT of THORACOLUMBAR BURST FRACTURES with NEUROLOGIC DEFICIT

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ABSTRACT:

Between 1992 and 1995, eleven patients with neurologic deficits secondary to a thoracolumbar burst fracture were treated surgically. There were 9 men and 2 women. The mean age was 35 years (range, 16-68 years). Mean follow-up was 18.4 months (range, 6-31 months). In 6 patients (54.5%), fractures occurred at thoracolumbar (T12-L1) region, in 2 thoracic and 3 lumbar. Fractures were classified according to Denis classification. The average local kyphosis angle was 21° preoperatively and 11.3° at the end of follow-up period. The average canal compromise was 38% at the time of injury and 12.6% after decompression. Indirect decompression by posterior reduction was performed for four patients, anterior decompression for four, posterolateral decompression for two, and posterior decompression two. Alico spinal instrumentation were applied for three patients, CD instrumentation for four, AO fixateur interne for three, and Z plate for one.

Ten patients improved postoperatively at least one Frankel level. One patient with complete paraplegia remained unchanged. This small series demonstrated that, the surgery improved the neurological outcome, after sufficient decompression of the spinal cord and nerve roots. The improvement rate was much better in patients with incomplete lesions than among those with complete lesions.

Key Words: Burst fractures, neurologic deficit, thoracolumbar.

The management of fractures of the thoracolumbar spine is often difficult and controversial. Many authors believe that failure of the middle column, particularly with retropulsion of bony fragments into the spinal canal produces spinal instability with impending neurologic compromise (3, 8, 10, 12, 16, 20). In the past, most of the reports have been concentrated on the nonoperative treatment of these patients (6, 11). With the advent of effective spinal instrumentation systems, surgical treatment of these fractures has been popularized (2, 10, 21, 22).

The goal of the decompression is to provide an optimum environment for neurologic recovery. The choice of surgical approach and instrumentation depends on fracture type, injury level, and degree of neural injury.

In this study, results of decompression and stabilization in burst fractures of thoracolumbar spine with neurologic deficit are evaluated.

MATERIALS and METHODS

From 1992 to 1995, 21 patients with major fractures and fracture-dislocations of the thoracic and lumbar spine were treated surgically at Trakya University, Medical Faculty, Department of Orthopaedics and Traumatology. Of 11 patients having thoracic and

lumbar burst fractures with neurologic deficits were included. Patients with fracture-dislocations and patients without neurologic deficit were excluded. Average age was 35 years (range, 16-68 years) and mean follow-up was 18.4 months (range, 6-31 months). There were two thoracic, six thoracolumbar, three lumbar fractures. Using the Denis (7) classification, the authors noted six type lumbar fractures. Using the Denis (7) classification, the authors noted six type B burst fractures, three type A, and two type E. Fractures were evaluated according to type, kyphosis angle and the compromise of the neural canal. The average kyphosis angle, determined by use of the superior end plate of the vertebra above and inferior end plate of the vertebra below, measured 21° preoperatively and 11.3° at the end of follow-up. All patients had a preoperative computerized tomography (CT) for evaluation of the compromise of the canal. Determination of canal stenosis by CT was performed by direct measure of midsagittal anteroposterior canal dimension at the fracture level. This figure was compared to an average of similar dimensions at the levels above and below the injury level. The result of this comparison was reported as a percent of anteroposterior canal compromise at the injury level in Table 1. The average integrity of the canal was 38%. CT was also used for evaluation of the residual canal compromise after the decompression. The average residual spinal canal stenosis was 12.6%.

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Table 1.

Name	Age	Sex	Level of inj.	Type *	Kypho Angle (degree)		Canal Com-promise %		Class. of paraly sis. (Frankel)		Surgery	Time from inj. to surgery	Follow-up (month)
					Pre-op	Post-op	Pre-op	Post-op	Pre-op	Post-op			
A.G.	16	M	L5	B	27	17	36.8	28.2	B A	E C	Post. decomp. Post. inst.+fusion	12 hours	30
Ö.T.	23	M	L3	E	26	0	55.5	0	A	C	Ant. decomp. Post. inst.+fusion	5 hours	6
H.Ş.	38	M	L1	A	18	8	57.8	22.2	B	D	Posterolat.decomp Post. inst.+fusion	12 hours	25
A.A.	68	M	T9	B	17	13	50	16.6	B	D	Ant. decomp. Post. inst.+fusion	12 hours	20
M.G.	16	M	L4	B	19	14	23.8	0	C	D	Ant.decomp. Post. inst.+fusion	20 days	7
Ş.D.	33	M	TS	B	18	12	33.3	18.4	A	A	Indirect decomp. Post. inst.+fusion	10 days	28
K.G.	38	M	L1	B	25	15	42.8	0	B	D	Posterolat.decomp Post. inst.+fusion	3 days	20
N.K.	38	F	L1	E	18	12	30	0	D	E	Ant. decomp. Ant. inst.+fusion	90 days	10
K.C.	32	M	L1	B	28	13	33.3	25.2	A	B	Indirect decomp. Post. inst.+fusion	11 days	31
Z.T.	32	F	T12	A	17	11	33.3	15.9	A	B	Indirect decomp. Post. inst.+fusion	3 days	12
K.Ö.	52	M	T12	A	18	10	22.2	12.5	D	E	Indirect decomp. Post. inst.+fusion	48 hours	14

* According to Denis classification.

Lower extremity sensation and functional motor status was quantified using the Frankel (11) grading system and found that four patients as Frankel A, four patients Frankel B, one patient Frankel C, and two patients Frankel D.

The patients were operated within five hours to three months. Indirect decompression was performed in four patients by reduction with posterior instrumentation, posterolateral decompression in two patients, anterior decompression in four patients, posterior decompression in one patient. Two patients underwent the second stage-anterior decompression after posterior spinal stabilization procedure with instrumentation, because of persistent partial neurologic deficits associated with canal compromise. AICI spinal instrumentation were used in three patients, CD in four, AO fix-

ateur intern in three, and Z plate in one. Postoperative external supports were used selectively.

RESULTS

There was a correlation between the integrity of spinal canal and significant neurologic deficits. Among 11 patients, eight patients had the canal compromise over 30%. They were graded as Frankel A (4 patients) and Frankel B (4 patients).

After the surgery ten patients (90.9%) improved by at least one class according to Frankel (11) grading system. One patient who graded Frankel A remained unchanged. No further deterioration of the neurologic condition after surgery was observed. In five patients, early decompression (in 48 hours) was performed. These patients showed improvement by average 2

Frankel grade after the surgery. Six patients had delayed decompression at the mean of 22.8 days after injury with improving average 1 Frankel grade. Spinal fusion anteriorly, posteriorly or both was achieved in all patients.

Neurologic recovery with an average 1 Frankel grade was observed in patient with complete neurologic deficits and average 1.7 Frankel grade in patients with partial neurologic deficits.

One patient developed lung atelectasia necessitating tracheostomy after surgery. Two patients complained of chronic thoracolumbar back pain. There was one superficial wound infection that was successfully treated with antibiotic therapy. No instrumentation related complication occurred.

DISCUSSION

Some authors noted that most of the patients with partial or complete neurologic deficits resulting from thoracolumbar fractures improved at least one Frankel grade with conservative treatment (6, 11). More recently, many reports in the literature have demonstrated good results achieved after operative decompression and instrumentation of burst fractures with neurologic deficits (4, 9, 13, 19). Jacobs et al. (15) have a comparative study between recumbent treatment and posterior instrumentation with incomplete thoracolumbar cord lesions. They documented the incidence of improvement as 44% in the non-operative treatment group compared with a 53% improvement in the operative group. The primary goal in managing thoracolumbar burst fractures with neurologic deficits is to provide optimal environment for neurologic recovery.

The relationship between initial spinal canal encroachment and neurologic deficit has been discussed in many reports (14, 18, 23). There is no consensus about this correlation. In this series, there was a significant correlation between neurologic deficit and the percentage of spinal canal stenosis. Eight patients graded Frankel A and B had canal compromise over 30% with an average 42.8% (range, 33.3-57.8).

The relationship between the timing of surgery and neurological result remains controversial. Early decompression and stabilization of the spine can be difficult in polytraumatized patients especially with intraabdominal pathologies. In case of progressive neurologic deterioration in a patient with thoracolumbar fracture, emergent surgery is indicated. Aebi et al. (1) reported that neurologic improvement occurred more frequently after early than after delayed surgery.

Marshall et al. (17) presented 283 patients with spinal cord injuries. Of 14 deteriorated neurologically during acute hospital management. The advantages of early decompression include reversing vascular compression and the ability to achieve better canal clearance from indirect reduction using posterior instrumentation (5, 19). In our series, the average improvement in Frankel score was 2 grades after early decompression and stabilization and 1 grade after delayed surgery. We haven't had experience excessive bleeding, systemic complications and neurologic deterioration because of the acute management.

Decompression of the spinal canal can be accomplished indirectly, by posterior spinal stabilization or directly, by removing the bone fragments and disc materials from the canal. Posterior decompression by laminectomy is indicated when laminary fracture occurred and dura entrapped between the fractures. We performed the posterior decompression in one patient who had burst fracture of fifth lumbar fracture and dural laceration. In this rare case, dura was repaired and posterior instrumentation applied. We found that the residual canal stenosis was lower in the patients who had been treated direct decompression. There was no significant difference between anterior and posterolateral decompression. We gained an average 36.9% of clearance in canal compromise by direct decompression and average 12.3% by indirect decompression.

Finally, this study demonstrated that 1) the degree of canal encroachment correlates with neurologic deficit, 2) direct decompression methods are more effective than indirect method 3) earlier the decompression, greater the neurologic recovery. 4) neurologic recovery occurs more frequently in patients with partial neurologic deficits than in those with complete paraplegia.

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