NEUROLOGICAL DEFICIT IN RELATION TO THE CANAL ENCROACHMENT, LEVEL AND TYPE OF THE THORACOLUMBAR FRACTURES*

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ABSTRACT :

Recently with the advent of computer assisted tomography and critical classification of the neurological injuries associated with thoracolumbar fractures, more emphasis has been rightly placed on neural compression by fragments of bone and disc and their relationship to ultimate neurological recovery.

The aim of this study is the assessment of the relationship between the neurological deficit, level and type of the fracture and canal encroachment.

Between 1990 and 1996. 110 patients surgically treated in Dokuz Eylül University Medical Faculty Department of Orthopaedics and Traumatology were included into this study. The patients' ages ranged from ten to sixty-eighth, mean 36 years. Male-female ratio was 1.5. The level of the injury, type of the fracture, canal encroachment and the neurological status were determined for each patient. A personal computer (PC) was used to analyse the data gathered from the patients' charts, Pearson correlation had been applied.

The most frequently fractured level was L1. Neurological compromise occured more frequently at the upper levels and there is a significant correlation between the canal eneroachment and neurological compromise. There is no significant correlation between the type and the level of the fracture.

As a result, there was a significant correlation between neurological compromise, fracture type and amount of canal encroachment.

Key words: *Spinal fracture, spinal canal narrowing, neurologic deficit, computerized tomography.*

INTRODUCTION

The spinal column is a unique osteoligamentous structure of integral components tha allow it to function as a supportive member of skeleton, and it consists of mobile segments whose structure varies according to anatomic level. With excessive motion and force, a host of injuries can occur, depending of mechanism and anatomic level involved. The main forces include compression, distraction, shear and torsion, which can be applied in flexion, extension, and rotation. The association of neurological injury with vertebral fractures has been well established (2, 4, 7, 9, 12, 15, 16, 17). Nearly 25% of these will result with paraplegia and many others will result in more limited neurological injuries.

In the upper part of the thoracic spine, fractures are quite stable due to the contiguous rib cage, but the narrower spinal canal in this region makes it almost inevitable that patients with these injuries also sustain a severe neurological injury (5). Approximately five-sixths of fractures of the upper part of the thoracic spine with cord injury result in complete paraplegia, and one-sixths may present with an incomplete cord injury syndrome.

Most fractures of the thoracic and lumbar spine occur at the fulcrum of motion, where the thoracic and lumbar portions of the spine meet. Various authors have classified thoracolumbar spinal fractures in relationship to their mechanism of injury and their resulting stability or instability (1, 3, 4).

The five types of fractures according to Denis, that commonly occur at this level include axial loading and flexion injury resulting in a wedge compression fracture, axial loading resulting in a burst fracture, flexion injury with ligament rupture and a resultant dislocation, flexion and rotation causing a fracture dislocation, and hyperextension injury with posterior dislocation of an upper vertebra on the lower one. Less commonly other types of fractures have been

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described, such as so-called seat-belt injury, which is a purely osseous fracture through both the anterior and posterior elements of a lumbar vertebra.

MATERIALS and METHODS

Between 1990 and 1996, surgically treated 110 patients in Dokuz Eylül University Medical Faculty Hospital Department of Orthopaedics and Traumatology were included into this study. The patients' ages ranged from ten to sixty-eight, mean 36 years. Male female ratio was 1.5. The level of the injury, type of the fracture, canal encroachment and the neurological status were retrospectively determined for each patient. CT was used to determine canal enchroachment. Neurological assesment was done and graded as described by Frankel (6). A personal computer was used to analyse the data gathered from patients charts, and Pearson's correlation had been applied.

RESULTS

Of the 110 patients, 67 (61%) had a burst fracture, 27 (24.5%) had a compression fracture, 15 (13.6%) had a chance fracture and 1 (0.9%) had a flexion - extension type of fracture, 57 patients had no neurological compromise where 53 patients had neurological deficit ranging from Frankel A to D. The incidence of neurological deficit was 80% (12/15) in chance fractures, 51% (34/33) in burst fractures, 22% (6/27) in compression fractures and lout of 1 in flexion-extension type of fractures.

Of the 67 burst fractures the neurological status was Frankel E in 33 patients, D in 10 patients, C in three patients, B in 1 patient, A in 20 patients.

The neurological outcome of the 27 compression fractures were Frankel E in 21 patients. D in 5 patients and C in 1 patient. Of the 15 chance fractures 10 patients were Frankel A, 2 patients were C, and 3 patients were E.

The frequently of involvement was 35.5% at L1, 20% at L2 and 17.2% at T12.

Statistically, at the upper levels neurological compromise occurred more frequently (Coefficent: 0.2549, P: 0.007) and there were a significant correlation between the canal encroachment and neurological compromise (Coefficent: 0.4761, P: 0.000).

There is no significant correlation between canal encroachment, type and level of fracture. We found a significant correlation between neurological compromise and both fracture type and amount of canal encroachment.

DISCUSSION

The pathophysology of spinal cord trauma has been reviewed by various authors. The recovery from such injury depends on the amount of initial damage or contusion of the cord as well as on mechanical factors such as compression of the neurological structures by fragments of bone and disc. There is still controversy whether spinal canal enchroachment causes neurologic deficit or not (10, 11, 13, 14). In Trafton's (14) series burst fractures at T12 or L1 with decrease of 50% or more of the mid sagittal neural canal diameter had significant risk of neurologic involvement. On the other hand, Gertzbein et al. (7) found no statistical difference between the extent of encroachment and Frankel grade in 60 patients with burst fractures from various types of spinal injuries. SRS Multicenter Spine Fracture Study revealed that at the cord level there was no statistically significant correlation between the amount of spinal canal compromise and the neurologic deficit. At the conus medullaris level there was a significant correlation of both the midsagittal diameter and cross sectional area with the neurologic status (8).

In the upper part of thoracic spine, a considerable violence is necessary to produce a fracture or dislocation. The narrower spinal canal in this region makes it almost inevitable that patients with these injuries also sustain a severe neurological injury. In our series neurological compromise occurred more frequently at the upper levels with 0.2549 coefficient and P: 0.007.

A great majority of vertebral fractures occur at thoracolumbar junction. In the review of the literature, burst fractures present acutely with neurological deficit and these make up 50-60% all burst fractures. In our series neurological deficit rate was 51%. Although our results are somehow in accord with literature (4, 11, 12), canal encroachment and spinal cord injury relation should be evaluated in regard to posterior ligamentous complex damage, fracture mechanism and canal encroachment severity and level of fractures Further studies with large series are needed.

Table 1. Level of the fracture

T5	T6	T7	T8	T9	T10	T11	T12	L1	L2	L3	L4	L5
4	0	3	6	1	2	6	19	39	22	2	2	4
(3.6%)		(2.7%)	(5.5%)	(0.9%)	(1.8%)	(5.5%)	(17.2%)	(35.5%)	(20%)	(1.8%)	(1.8%)	(3.6%)

Table 2. Classification of neurological deficit (Frankel)

Frankel A	Frankel B	Frankel C	Frankel D	Frankel E
31 (28%)	1 (0.9%)	6 (5.5%)	15 (13.6%)	57 (51.8%)

Table 3. Type of the fracture

Burst	Compression	Chance	Flexion-distraction
67 (61%)	27 (24.5%)	15 (13.6%)	1 (0.9%)

Table 4. Statistical Data Output (Person's correlation)

	CANAL COMPROMISE	TYPE OF FRACTURE	NEUROLOGIC DEFICIT
	C= 0.1909	C= 0.1444	C= 0.2549
LEVEL	P= 0.171	P= 0.132	P= 0.007
CANAL COMPROMISE		C= 0.2883 P= 0.36	C= 0.0681 P= 0.000
TYPE OF FRACTURE			C= 0.4761 P= 0.000

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