POSTEROLATERAL DECOMPRESSION FOR TREATMENT OF VERTEBRAL BURST FRACTURES

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Primary aim for treatment of vertebral burst fractures is to decompress, stabilise and fuse involved segments. Direct decompression may be accomplished either by anterior or posterior approaches. Posterolateral decompression, firstly described by Erickson in 1977, is a method which allows both decompression and stabilisation in a single cession. Twenty-two patients (16 men. 6 women mean age 23 years) were treated in SSK İstanbul Hospital IInd Orthopaedics and Traumatology Clinic from October 1991 to May 1994 by using posterolateral decompression, stabilisation, and fusion operations. Except of one patient all the fractures were in thoracolumbar region, predominantly at first lumbar vertebrae (58 I percent). Narrowing of canal diameter 30 percent or more and or presence of neurologic deficit were the indications for decision of operation. Neurologic deficit was detected in eight patients (6 at Frankel C level and 2 at Frankel D level). Mean percentage of canal occlusion measured by use of computerised axial tomography (CAT) was 43.4 percent. All the patients were evaluated both clinically and radiologically in May 1994. Mean follow-up period was 24.3 months (5 to 30 months). For clinical assessment of patients. Denis Pain and Work scale and for radiological evaluation percent of canal compromise local kyphosis angle, anterior body compression were used as parameters. All the patients with neurologic deficit showed one or two Frankel level improvement at the latest follow-up. Mean percentage of canal compromise improvement was 28 percent. Complications were postoperative exitus for one patient, and deep wound infection for another patient. As a result we concluded that in vertebral fractures with neurological deficit posterolateral decompression is an alternative to anterior route. For neurologically intact patients effects of direct and indirect decompression methods should be kept in mind in the light of recently published articles about remodelation process.

Key Words: *Burst Fractures, posterolateral decompression.*

Burst fracture of vertebrae was first described by Holdsworth in 1970. Nevertheless, his description differs for today's by his claim about intact ligaments. Later on Kelly and Whiteside published an article about two column model and claimed that retropulsed fragment should be decompressed anteriorly. Today's burst fracture concept was first declared by Denis in 1983 by using 3 column model. He also described treatment principles of burst fracture and stated that attention should be paid on middle column since any fracture at this causes instability of spinal column during flexion (2, 30).

Thirty to sixty percent of burst fractures comes out along with neurologic deficit. Retropulsed fragment is the cause of this injury and should be decompressed (1, 2, 6, 10, 11, 15, 17, 21, 23, 24, 28, 30). If the ligaments are intact, decompression can be done by indirect methods. However, in case of injured ligaments decompression should be done either by anterior or posterior, or posterolateral route. Posterolateral decompression is first published by Erickson in 1977 (21).

MATERIALS AND METHOD

Posterolateral decompression was applied to 22 patients (16 men, 6 women, mean age 23.8) out of 162 operated vertebral fracture patient in SSK İstanbul Hospital, IInd Orthopaedics and Traumatology Clinics from January 1991 to May 1994.

Aetiology of trauma was fall from height for 15 patients, traffic accident for 6 patients, heavy material hit for 1 patient. Fifty-nine percent of fractures was at L1 level (Table 1). Preoperatively radiological evaluation of patients was by plain radiography. CAT and or MI. Mean kyphosis angle was 31 degrees, 9 degrees to 31 degrees). By CAT measurements, mean canal compromise was 4.2 mm. and mean percentage of canal compromise was 43.4 percent. Anterior body compression of fractured vertebrae in relation to upper and lower vertebra was average 58 percent. Eight patients showed neurologic deficit of which 6 was at Frankel C level and 2 at Frankel D level (Table 2).

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Table 1. Distribance Of Fracture Levels.

T5	1
T11	1
T12	3
L1	13
L1+3	1
L2	2
L3	1

Table 2. Preoperative Radiologic and Clinical Evaluation

Canal Compromise	3-5mm	(4.2 mm)
% Canal Compromise	%28-63	(%43.4)
Local Kyphosis Angle	9°-41°	(31°)
Anterior Body Compression	%30-80	(%58)
Neurologic Deficit	8 Case	
	(6 Case Frankel-C)	
	(2 Case Frankel-D)	

By using standard posterior approach, posterolateral decompression, posterior segmental instrumentation and posterior and posterolateral fusion procedures were applied to all patients.

Twenty-one patients were included in the study and average follow-up period was 24.3 months (5 to 30 months). Mean canal compromise was 28 percent at latest follow up in May 1994. Average anterior body compression was measured as 8 percent. i.e. vertebral height was restored 92 percent. One or 2 Frankel level improvement was detected for 8 patients with neurologic deficit.

Four of six patients at Frankel C level preoperatively became Frankel D, 2 patients became Frankel E. and 2 patients at Frankel D level preoperatively became Frankel E (Table 3). Evaluation of patients according to Denis Pain and Work Scale is shown on Table 4.

One patient died of pulmonary emboli on second postoperative day. Deen wound infection developed in one patient of whom instrumentation materials removed in 13th month postoperatively. During removal of instrumentation, posterior fusion of involved segments was detected. At the latest follow-up of that patient deep wound infection was resolved, but 6 percent correction loss was measured. This was evaluated as P3-W3 according to Denis Pain and Work Scale.

Table 3. Evaluations of Patients With Neurologc Deficit

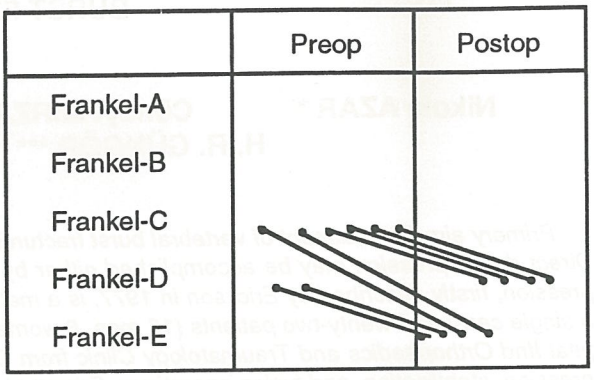

Table 4. Postoperative Results According To Denis Pain And Work Scale

Pain	Work
P1 : 8	W1 : 6
P2 : 6	W2 : 11
P3 : 3	W3 : 3
P4 : 3	W4 : 1
P5 : 1	W5 : -

DISCUSSION

The most important indication for surgical treatment of vertebral burst fracture is the presence of incomplete neurologic deficit. According to Kaneda and Boyd, canal compromise and neurologic deficit are related to each other. For this reason, their opinion is that immediate decompression is necessary for patients with neurologic deficit (30). However, Mc Afee, Keenk, and Gertbein propose that there is no relation in between (30). Staufer (1984), Edwards (1986), Fidler (1988) stated that resorption of retropulsed fragment takes places in canal after a time and this process is sufficient for improvement of neurologic deficit. Nevertheless, most of the authors opposes this opinion (Denis 1984, Dewald 1984, Kostnik 1988) and say that resorption does not take place necessary enough to resolve compression, and decompression is needed for maximum improvement of neurologic deficit.

Our opinion for this subject is that since canal compromise and neurologic deficit are closelv related to each other, decompressive surgery should be performed for vertebral burst fractures with incomplete

neurologic deficit. Improvement of patients with neurologic deficit in our series support this thought (table 3).

The historical decompression method for vertebral burst fractures was decompressive laminectomy. But today, since this procedure compromises biomechanics and pathoanatomy of spinal column, decompressive laminectomy for vertebral burst fracture is no longer performed. Nowadays, popular methods for decompression of burst fractures are transthorasic and thoracoabdominal decompression through anterior route and posterolateral decompression by posterior route.

Posterior decompression is first described by Donal Erickson and used by some authors later on (Gartin 1985, Gelderman 1985, Lesoin 1986, Napakawa 1986, Davis 1987, Mc Kinley 1987, Bridwell 1988, Shaw 1989, Caniklioğlu 1991-1993, Wiberg 1993).

For patients with vertebral burst fracture, surgical treatment along with decompression should be carried out if patient's clinical examination shows incomplete neurologic deficit findings, or if there is findings of progressive neurologic deficit. In case of neurologically intact patient, decompression is indicated if vertebral body is fragmented and angle between its end plates is greater than 15 degrees together with 4 mm. canal compromise (According to Argenson canal compromise greater than 30 percent), and if local kyphosis angle is greater than 20 degrees (Gantallier 1988, Argenson 1993) (3, 30).

Most of the authors (Kaneda, Boyd, Mc Afee, Shaw, Hu, Gelderman) prefer anterior approach for decompression. However, anterior instrumentation materials applied through anterior approach are insufficient againts torsional and axial loading forces upon vertebral column and for this reason, a second operation either in the same cession or in another becomes necessary for posterior instrumentation and fusion. Through posterior route, following posterolateral decompression, posterior instrumentation and posterior fusion may easily be performed providing sufficient stability. Ease of appliance in one cession makes posterior route more advantageous and it is also without risk of retroperitoneal or retropleural bleedings and adhesions since it does not involve retroperitoneal or retropleural spaces (2, 21, 30). In addition to this, by posterior route through posterolateral aspect anterior interbody fusion may be applied by inserting graft.

Since exposure of spinal column, spinal cord and nerve roots are excellent. Latrogenic injury risk during posterolateral decompression is low. Posterior segmentary stabilisation necessitates shorter fusion levels and withoud external bracing early rehabilitation programme may be carried out.

In our series, we applied instrumentation and fusion to either one upper and one lower vertebrae or 2 upper and 2 lower vertebrae of fracture level according to localisation of fracture. Pedicular screws are supported by sublaminar wiring in patients for whom only 3 segment fusion is done.

In literature, the most common causes for vertebral burst fractures are traffic accidents due to high energy trauma, and fall from heigh comes the second (2, 6, 10, 26, 28, 30). In our series this ranking is reverse due to regional peculiarities.

The most common levels for vertebral burst fractures are at between T10 and L2 (30). In our series, all the fractures except two were at these levels (59 percent at L1 level). One of the fractures was at adjacent L3 vertebrae, and the other was at T5 vertebrae. For the later case, the mechanism of injury was heavy material hit that is thought to be the reason for upper segmental involvement.

Preoperative mean canal compromise was measured as 43.4 percent and postoperatively at the latest follow-up as 28 percent. We couldn't find any data about this subject in literature. However, we think that decrease in canal compromise in our series below to Argenson's decompression indication limit (30 percent) along with neurologic improvement in all patients with neurologic deficit supports adequacy of posterolateral decompression for burst fractures.

Ninety-two percent of anterior body height restored in our series. This is 83 to 98 percent in literature (10, 30).

Complications were one exitus due to pulmonary emboli and one deep wound infection. Iatrogenic neurologic deficit postoperatively was not detected in any patient. In the light of literature, these data support safety of our technique for posterolateral decompression.

SUMMARY

If anterior stabilisation is not indicated for vertebral burst fractures, posterolateral decompression is an adequate method for decompression.

Posterolateral decompression is an easier method conscumes less time may be performed along with posterior stabilisation and fusion and does not need a second operation and is without risk of retroperitoneal

breedings and adhesions latrogenic injury risk in experienced hands is also low.

Post operative is easier since posterior segmentary stabilisation may be performed following decompression which removes the need for external bracing.

REFERENCES:

1. Akbarnia B.A., Moskowitz A., Merenda J., Carl A. Surgical Treatment of spine fractures using (I) instrumentation. 5th proceeding of the international congress on C.D.I., p. 87-92, 1988.
2. Algün D. Torokolomber fraktür ve fraktür - dislokasyonlarda CD enstrumantasyon ve Alıcı Spinal Sistem uygulamaları. Uzmanlık Tezi. İstanbul, 1992.
3. Argenson C., Lovet J., De Peretti F., Perraud M., et al. CD instrumentation for the fixation of thorosic and lumbar vertebral fractures (110 cases). Acta Orthop. Turcica. 27 (4). p. 248-56. 1993.
4. Bridwell K.H., Jenny A.B., Saul T., Rich K.M., Grubb R.L., Posterior segmental spinal instrumentation with posterolateral decompression and debulking for metastatic thoracic and lumbar disease limitations of the technique. Spine. 13: 12. p. 1383-94, 1988.
5. Davis C., Partial posterior vertebrectomy for nanterior thorasic compression. Br. J. Neurosurg 1 (2), p. 569-72, 1993.
6. Fajgenbaum M.C., Tylkowski C.M. Treatment of unstable fractures of thorasic and lumbar spine with C.D.I. 4th proceeding of the international congress on C.D.I. p. 139-41. Sauramp Medical., 1987.
7. Farey J.P., Weidenbaum M. Pitfalls in fracture fixation with C.D.I. 5th proceeding of the international congress on C.D.I., p. 103-9, 1988.
8. Ficcioli F., Lima J., Bricolo A., One stage decompression and stabilisation in the treatment of spinal tumors. J. Neurosurg Sci. 29 (3), p. 199-205, 1985.
9. Finn C., Staufer E.S., Burst fracture of 5th lumbar vertebrae. JBJS. 74-A (3), p. 398-403. 1992.
10. Freeman B.L., Fractures, Dislocations and fracture-dislocations of spine. Campbell's Operative Orthopaedics, Vol. 4, Chapter 69, p. 3109-42, Mosby Company, 1987.
11. Garfin S.R. Mowery C.A., Gverra J., Marshall L.F., Confirmation of the posterolateral technique to decompress and fuse thorocolumber spine burst fractures. Spine. 10: 3. p. 218-23, 1985.
12. Gelderman P.W. The operative stabilisation and grafting of thorosic and lumbar spinal fractures. Surg Neurol., 23 (2), p. 101-20, 1985.
13. Hu S.S., Capen D.A., Rimoldi R., Zigler J.E., The effect of surgical decompression on neurologic outcome after lumbar fractures, Clin. Orthop. 288, p. 166-73, 1993.
14. Kaelin A.J. C.D.I. in surgical treatment of vertebral fractures. 5th proceeding of the international congress on C.D.I., p. 83-85, 1988.
15. Lemons V.R., Wagner F.C.Montesano P.X., Management of thorocolumbar fractures with accompanying neurological injury. Neurosurg. 30 (5), p. 667-71, 1992.
16. Lesoin F., Rousseaux M., Lozes G., Villette L., et al. Posterolateral approach to tumors of dorsolumbar spine. Acta Neurochir., 81 (1-2), p. 40-4, 1986.
17. Lesoin F., Rousseaux M., M. Autricque A., et al. Bilateral posterolateral approach to the thorocolumbar spine through transversoarthropediculectomy with corpectomy, Surg. Neuroc. 26 (1), p. 17-23, 1986.
18. Lobosky J.M., Hitchon P.W., Mc Donnel D.E. Transthorasic anterolateral decompression for therasic spinal lesions. Neurosurg. 14 (1), p. 26-30, 1984.
19. Mc Bride G. CD rods in spinal fractures. 4th proceeding of the international congress on C.D.I. p. 139-41. Sauramp Medical. 1987.
20. Mc Evay R.D. Bradford D.S. The management of burst fractures of thorasic and lumbar spine experience in 53 patients. Spine. 10 (7). p. 631-7, 1985.
21. Mc Kinley L.M., Obenchain T.G. Posterior perpendicular spinal canal decompression. 4th proceeding of the international congress on C.D.I., p. 142-7, Sauramp Medical, 1987.
22. Nagakawa H. Transthorasic approach and costa transversectomy in thorasic discogenic disease. No Shinkei Geka (Japan), 14 (11), p. 1291-6, 1986.
23. Pfeifer B.A., Deinbach P.D., Freidberg S.D., Stabilisation of fractured spine: combined orthopaedic and neurosurgical approach. 5th proceeding of the international congress on C.D.I. p. 111-22, 1988.
24. Richaud J., Bosquet P., Ealet G., Clemens J., et al. Recalibration via a posterolateral approach in rescent traumatic stenosis of dorsal and lumbar spine. Neurochirurgie (France). 36 (1). p. 27-38, 1990.
25. Shaw B., Mansfield F.L., Borges L. One stage posterolateral decompression and stablisation for primary and metastatic tumors in the thorosic and lumber spine. J. Neurosurgery, 70 (3), p. 405-10, 1989.
26. Suk S.I., Shin B.J., Lee C.S. CD pedicle screws in the treatment of unstable lumbar fractures. 5th proceeding of the international congress on C.D.I., p. 93-102, 1988.
27. Viale G.L., Silvestro C., Francaviglia N., Carta F., Bragazzi R., et al. Transpedicular decmopression and stabilisation of burst fractures the lumbar spine, Surg. Neurol. 40 (2), p. 104-11, 1993.
28. Vigliani F., Fabris D., Surgical management of thorocolumbar fractures: prospects of CD instrumentation, 4th proceeding of the international congress on C.D.I., p. 116-8, Sauramp Medical. 1987.
29. Vlach O., Messner P., Bayer M., Nydile M. Surgical treatment of sequelae injuries of the thorocolumbar spine. Acta Clin. Orthop. Travmatol Cech., 58 (3), p. 168-73, 1991.
30. Weidenbaum M., Farcy J.P.C. Surgical management of thorasic and lumbar burst fractures. Text Book of Spinal Surgery. Vol. 2. Chapter 37. p. 911-57. J.B. Lippincot Company. 1991.
31. Wiberg J., Hennig R. Thoracolumbar injuries, surgical treatment of patients with neurological damage Tidsskr. Nor. Laegeforen (Norway), 113 (5), p. 569-72, 1993.