SHORT SEGMENT TRANSPEDICULAR SCREW APPLICATIONS IN THE TREATMENT OF LUMBAR SPINE FRACTURES*

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ABSTRACT:

In unstable spine fractures, short segment instrumentation with transpedicular screws via posterior approach is one of the choices.

In this paper, 16 patients, whose L_{1-3} burst fractures stabilised by Alıcı Spinal System, were evaluated. Mean follow-up and age of patients were 40 months (not less than 30 months) and 31.6, respectively.

In our patients, anterior vertebral height (AVH) loss was 44% preoperatively, 17% postoperatively and 21% in the follow-up. Vertebral body angle (VBA) was 23.2°, 8.5° and 11.1°, preoperatively, postoperatively and in the follow-up, respectively. Cobb angle was 7.6° preoperatively, -1,4° postoperatively and 1.2° in the follow-up. Spinal canal encroachment in CT Scan was 46.3% preoperatively, and was 21.2% postoperatively. According to Frankel's classification only one case with incomplete neurodeficit recovered partially.

Wound infections in 2 cases (1 superficial and 1 deep) and sterile sinus syndrome in 1 case were the medical complications in the postoperative period. Complications due to instruments in the postoperative period were loosening of transpedicular screws (in 2 cases, 3 screws), bending of transpedicular screws (in 1 case, 2 screws) and breakage of transpedicular screws (in 1 case, 1 screw).

As a result, although short segment transpedicular screw instrumentation had the advantage of short segment immobilisation and sufficient anatomic reduction we also observed screw complications especially in cases without sufficient correction.

Key words: *Lumbar spine fracture, short segment, transpedicular screw.*

INTRODUCTION

Modern age in the treatment of spine fractures, has begun in 1958 with Harrington's instrumentation (6, 11). While preliminary results were satisfactory, after years some authors reported complications (17, 21, 34). Harrington rod distraction system was immobilising a long segment of spine. In the course of time, attempts in order to shorten the immobilised spine segment gave rise to develop transpedicular screws systems (9). In the present time, there are many types of transpedicular screws. The most popular ones are; Roy-Camille plates (27), AO Fixator Interne (10, 14), AO DCP Plates (28), Steffe plates (30) Zielke System (29), Cotrel-Dubousset System (4, 7) and Alıcı Spinal System (1, 2).

In this study, we evaluated the results of 16 short segment Alıcı transpedicular screw applications in the treatment of lumbar spine fractures.

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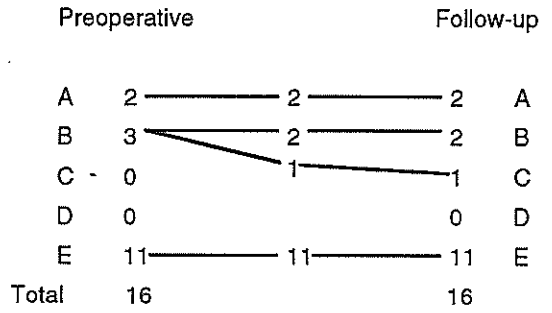
MATERIALS and METHODS

In this study, 16 patients with lumbar spine fractures who were treated with transpedicular screw rod system (Alıcı Spinal System) at the 1st Department of Orthopaedics and Traumatology of İzmir State Hospital were included. Mean follow-up was 40 months (range 30 to 54 months). Their mean age was 31.6 (range 17 to 62). 12 of them were male and 4 of were female. Injury causes were fall from height (10 cases), traffic accident (4 cases) and crush under heavy material (2 cases). In 5 cases, there were additional injuries (1 tibia fracture, 1 calcaneus fracture, 1 mandibula fracture, 1 clavicle fracture, 1 malleol+talus fracture).

In all cases, preoperative conventional radiograms (AP and Lateral) and CT Scans were obtained. Classification was based on Denis' 3-column theory (8). According to Denis, all fractures were burst-type (Type-A: 4 cases, Type-B: 11 cases, Type-C: 0 case, Type-D: 0 case and Type-E: 1 case).

Neurological status was based on Frankel's system (Table 1) (15). According to Frankel's classification 5 of the cases had neurodeficits (Table 1).

Table 1. Distribution of Cases with Lumbar Fractures According to Frankel's Classification in the Preoperative and Follow-up Period



In the preoperative period Loss of Anterior Vertebral Height (AVH) (%) Vertebral Body Angle (VBA) and Cobb's Angle were calculated on conventional radiograms. Also, spinal canal encroachment was determined by CT Scan (Table 2).

Table 2. Radiologic Measurements of Patients in the Preoperative, Postoperative and Follow-up Period

	Preoperative	Postoperative	Follow-up
% Loss of Anterior Vertebral Height (AVH)	44%	17%	21%
Vertebral Body Angle (VBA)	23,2°	8,5°	11,1°
Cobb's Angle	7,6°	-1,4°	1,2°
Medullary encroachment (%)	46,3%	21,2%	–

Mean time from injury to operation was 4.8 days (range 12 hours to 13 days). In all cases stabilisation was achieved via posterior approach by Alıcı Spinal System. Short segment transpedicular screw stabilisation was achieved by inserting screws upper and lower intact segments next to the injured segment. Rods were bent similar to lumbar lordosis and distraction was performed under control, because of technical impossibilities for floroscopic control during the application of transpedicular screws. Direct decompression wasn't performed in any cases. Directly posterior fusion with iliac grafts was performed in only 3 cases. Mean operation time was 2.3 hours (range 1 to 3 hours).

In the postoperative period, patients without neurodeficit were mobilised (with corset support) meanly at 2.5 days (range 1 to 7 days). Mean time of hospitalisation in the postoperative period was 9.7 days (range 4 to 20 days).

RESULTS

In the postoperative period and final follow-up loss of Anterior Vertebral Height (AVH) (%), Vertebral Body Angle (VBA), Cobb's angle and spinal canal encroachment in CT were calculated (Table 2).

Neurologic examination in the postoperative period and final follow-up was based on Frankel's classification (15). According to this, partial recovery was observed in one case with incomplete lesion (Frankel B to C) (Table 1). In any cases neurologic signs weren't worsened. In one case with L_3 fracture, deep wound infection developed. It didn't respond to medical treatment and pathogen bacteria was Staphylococcus aureus. Following union in the 9th postoperative month infection was eradicated with extraction of instrument. In one case with L_1 fracture, there was superficial wound infection. Pathogen bacteria was E. coli and infection was treated succesfully with antibiotics. In an another case with L_3 fracture, there was sterile discharge in 20th month. In 28 th month, instruments were extracted and biopsy material didn't confirm infection. It was qualified as sterile sinus syndrome. Complication related to instruments were, off the pedicle of 1 transpedicular screw (confirmed with CT), insufficient tightening of 1 telescopical nut in one case, loosening of 3 transpedicular screws in 2 cases, bending of 2 transpedicular screws in 1 case, and breakage of 1 transpedicular screw. In the follow-up 1 telescopical nut was loosened.

In 9 patients, spinal instrument was extracted.

DISCUSSION

Because of anatomic and biomechanical differences of lumbar spine when compared with thoracal spine, new approaches become to occur (3,

Table 3. Complications in Short Segment Transpedicular Screw Applications

Period	Relation with instrumentation	Complication	Number	Patient	%
INTRAOPERATIVE	Related to instrumentation (Poor technique)	Progressive neurodeficit	0	0	0
		Pedicular fracture	0	0	0
		Mallocation of transpedicular screw	1/64a	1	0.6
		Insufficient tightening of telescoppical nut	1/128b	1	1.5
		Haemorrhage of vertebral vein	1	1	6,2
		Death	0	0	0
POSTOPERATIVE	Unrelated to instrumentation	Wound infection (deep)	1	1	6,2
		Wound infection (superficial)	1	1	6,2
		Sterile sinus syndrome	1	1	6,2
		Urinary tract infection	2	2	1.5
		Deep vein thrombosis	0	0	0
		Heterotopic ossification	0	0	0
	Related to instrumentation	Nonunion	0	0	0
		Loosening of transpedicular screw	3/64a	2	4.6
		Bending of transpedicular screw	2/64a	1	3.1
		Breakage of transpedicular screw	1/64a	1	1.5
		Loosening of telescoppical nut.	1/128b	1	0.7

a : (Total transpedicular screws)
b : (Total telescopical nuts)

28). Although, many authors report successful results with the application of long segment instrumentations (11, 17, 23, 24), some authors such as An et al (3) and Sarso et al (28) avoid long segment instrumentation. An et al (3) reported painful patients, due to immobilisation and loss of lordosis because of long segment instrumentation and fusion. Cartilage destruction in immobilised segments will also increase the pain (20).

Some authors found short segment transpedicular screw technique effective and reliable with its short segment immobilisation, but also in the aspect of biomechanical and clinical effectivity (4, 6, 9, 10, 18). However, some authors called attention to, loss of reduction and screw problems in this technique (5, 12, 13, 22, 24, 25, 26). The most common problems in short segment applications are related with screws (5, 16, 19, 22, 25, 26). In order to prevent the problems

due to transpedicular screws, it is necessary to evaluate the pedicular anatomy, and structure, bone quality and bone density, preoperatively (31, 32, 33). However, wrong localisation rate of transpedicular screws is up to 1,9% (4, 5, 32, 33). In our series, number of mistaken localised transpedicular screw is only 1 (1,5%).

In the postoperative follow-up period screw bending, screw breakage and/or screw loosening is a consequential problem. Although they had applied different types of instruments, many authors had pointed out screw problems such as: Mc Kinley et al (24) didn't mention numbers, McCain et al (25) breakage of screws in 10 of 19 cases, McAfee et al (22) 16 screws breakages and 6 screws bending in 526 screws applications (120 cases), Ebelke et al (12) breakage of screws in 5 of 21 cases, Carl et al (6) 2 screws breakages and 7 screws bendings in 40 cases and Esenkaya et al (13) 2 screws bendings in 3 cases and 1 screw breakage in 2 cases. In the postoperative follow-up we detected 4.6% screws loosening 3.1% screws bending and 1.5% screws breakage in 16 cases. It became necessary to extract instruments following union in 7 cases, because of instrument stability problem. During the extraction operations, we observed that arthrodesis were completed in facets that belong to short segment in instrumentation although fusion hasn't performed (fusion was performed in only 3 cases). Although, stabilisation of system was seemed to be a problem in the postoperative and follow-up radiograms, loss of correction amount leading spinal instability was not excessive and these amounts were correlated with the literature (1, 2, 4, 6, 12, 13, 14, 18, 22, 24, 25). Preoperative and postoperative radiograms of cases with screw problems were cerefully reviewed. In one case, it was detected that bone quality was being insufficient. In the other cases, we concluded that limits of posterior stabilisation has been forced and anterior stabilisation would have been better. Despite everything if anterior stabilisation is impossible, short segment instrumentation combined with extinction hooks will be better although it has a disadvantage of long segment immobilisation.

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