

THE TREATMENT OF SPONDYLOLISTHESIS WITH POSTEROLATERAL AND LATERAL MASS FUSIONS

A. Biçimoğlu *, Y. Tümer **

Eleven patients with spondylolisthesis were operated between the years 1978-1989. Lateral fusion was applied to five of the patients and posterolateral fusion to six of them. No neurological complication was diagnosed. In four of them lateral mass fusion was carried out through the bilateral paravertebral incisions and symptoms relieved earlier than other methods. In the patients where two incisions were used, full plaster or iron jacket were applied for three months after surgery.

One of the causes of low back pain is spondylolisthesis. The surgical treatment is required for those patients with persistent pain that do not respond to conservative therapy progressive radiographic slip and for those with persistent nerve root compression symptoms (11, 19, 26). Many authors have recommended posterior and posterolateral fusion for this purpose (4,15,17,19,20,29,32,33,34,36). Moreover, there are some authors also proposing vertebral interbody fusion (7,14,31) and intertransversal lumbar fusion (9,13,22). Recently, it was published that spondylolisthesis, having more than 50 percent slip or slip angle more than 55 degrees, should be reduced. But nevertheless in the series of these reports the occurrence of neurological complications is also stated (2,6,10,12, 21,2335). There are also some authors who propose combined anterior and posterior fusion with or without reduction (3,27,30). Since posterolateral fusion allows the visualisation of vertebral defects, nerve roots and intervertebral discs, it is usually preferable and safer than other methods (11).

MATERIAL AND METHODS :

During the years between 1978 and 1989, 11 patients with spondylolisthesis were operated in Egirdir Bone Disease Hospital and in one of private hospitals. 8 of the patients were females and 3 were males. Mean age was 35.7 (Range 17-51 years). 3 of the patients had L4-L5 and 8 had L5-S1 spondylolisthesis. In 3 cases there were grade I, in 4 grade II and 4, grade III slip. (Table I).

* Vise President ANKARA memorial Hospital Orthopaedics and Traumatology Department Ankara-TURKEY

** Professor of Orthopaedics and Traumatology.

All of the patients were suffering from back pain, radiating pain to the legs and one of them had left S1 nerve root compression symptoms. This was demonstrated by EMG also. All the patients were treated conservatively for 3 to 12 months without any respond. In one patient, slip progression was observed. Grade distribution of the cases are shown in table 2.

Two sided lateral mass fusion were performed in four cases by two paravertebral longitudinal incisions. Fusion was performed only between the transverse processes and articular facets of the two vertebrae affected. In one case, lateral mass fusion performed through the midline incision. In the procedures that were carried out by two incisions, supraspinous and interspinous ligaments and paravertebral muscles are spared. In the other 6 cases using midline incision, spinous processes, laminae, articular facets and transverse processes were exposed, and posterolateral fusion was proceeded. In all of the cases, chip grafts obtained from the posterior iliac crest were used. (Table I). Only in one case where left S1 nerve root compression was present, the nerve root was released by foraminotomy. In the patients where two incisions were used, full plaster or iron jacket were applied for three months and in the others for six months.

RESULTS :

The patients were followed in an average time of 2 years 9 months (Range 5 months-11 years 9 months). All the patients except one relieved of pain and returned to normal activity. In one exceptional case, there was back pain only after physical activity. Neurological deficits of the patient who had S1 nerve root compression relieved after the operation. Superficial infection was observed in one case in the third day postoperatively. After using appropriate antibiotic therapy and wound dressing changes, it was healed. We have detected solid fusion during the follow up assess-

CASE NO	AGE	SEX	LEVEL OF THE LESION	OPERATION	TYPE OF INCISION	COMPLICATIONS
1	17	F	L5-S1	Intertransversal fusion	Bilateral paravertebral	-
2	32	F	L5-S1	Intertransversal fusion	Bilateral paravertebral	-
3	43	F	L4-L5	Intertransversal fusion	Bilateral paravertebral	-
4	36	F	L4-L5	Intertransversal fusion	Bilateral paravertebral	-
5	23	M	L5-S1	Intertransversal fusion	Midline	-
6	51	F	L5-S1	Posterolateral fusion	Midline	-
7	25	F	L5-S1	Posterolateral fusion	Midline	-
8	18	M	L5-S1	Posterolateral fusion	Midline	-
9	53	F	L5-S1	Posterolateral fusion	Midline	Superficial infection
10	50	M	L4-L5	Posterolateral fusion	Midline	-
11	45	F	L5-S1	Posterolateral fusion	Midline	-

Table I : Documentation of the patients.

ment of all patients by radiographic examinations. Moreover, we haven't observed slip progression.

DISCUSSION :

Wiltze et al. classified spondylolisthesis into five types as, dyplastic, istmic, degenerative, traumatic and pathological (37). The degenerative type is most frequently seen and these patients are generally over 50 years old. In lover ages, dysplastic and islmic types are more common. Slip progression is more frequent in children and adolescents than adults, and dyplastic types than istmic types (8, 16, 24, 25). Therefore, in the adults, who suffered from istmic types of spondylolisthesis, the conservative therapy consisting of analgesic use, back and abdominal muscle excersizes and physical therapy, must firstly be exerted.

Surgery is indicated for patients, who do not respond to medical therapy, have slip progression and neurological deficits, children and adolescents showing more than 50 percents slip (1,4,11,25,36).

The primary surgical treatment of spondylolisthesis is the fusion of the lesion area. This is done as

Spondylolisthesis	L4-L5	L5-S1
Grade I	2 cases	1 case
Grade II	1 case	3 cases
Grade III	-	4 cases

Table 2 : Grade distribution of the cases.

posterior insitu fusion, posterolateral fusion, intertransversal lateral mass fusion, anterior interbody fusion, circumferential fusion, and the latter is the combination of these former procedures. Posterolateral fusion is mostly prefered due to the fact that it is more secure and helps to relieve patients syptoms (4,15,17,18,19,29,32,33,34,36). Hoover suggested that posterolateral mass fusion will be the most appropriate surgical method for spondylolisthesis and he indicated 80 percent success rate with this procedure (17). Dandy and Shannon stated that insitu posterior fusion is a reliable and safer method in 46 children with severe spondylolisthesis (8). Boxal at al. have reached excellent results in 8 of 9 patients with posterolateral fusion only (4). Velicas and Blackburne, in 36 children and adolescents, obtained 83 percent solid

fusion and 75 percent of patients symptoms relieved (36). Dawson et al. had 92 percent satisfactory fusion rate (9). Johnson and Kirvan treated 17 patients with insitu posterior fusion, followed their cases for 16 years and observed it being a good method (18). Kiviluoto et al. followed 80 cases 1 to 4 years, only two patients posterior fusion failed (19). Stanton et al. applied posterolateral fusion in 20 patients.

In their results formation of solid fusion rate was 90 percent, and all of their patients were symptom free (32). Freeman and Donati have shown that posterior insitu fusion is an effective, safer and reliable method in 12 patients with grade III and IV spondylolisthesis. As a result, they obtained solid fusion in all of them (13). In our series all of the 6 patients whose posterolateral fusion was proceeded solid fusion was obtained. 5 of the 6 patients were free of their clinical complaints, but, however only one case suffered from slight pain after physical activity.

Some authors indicated that the slip progressed even after insitu fusion in children and adolescents (5,7,20). Bradford observed 40 percent slip progression in spite of solid fusion in patients with a slip angle higher than 55 degrees. Laurent and Osterman stated that postoperative slip progression continued in 14 of their 91 cases. But these authors treated most of their patients by midline posterior arthrodesis, using tibial grafts. In order to prevent postoperative slip progression, the fusion must be carried out through only the ends of transverse processes (25, 33). For this reason, lateral mass fusion may also be proceeded through only the lateral structures of the spine (9, 22). Lateral mass fusion may be done by one midline or bilateral paravertebral incisions. The advantages of bilateral paravertebral incisions are, due to the sparing of interspinous and supraspinous ligaments, postoperative healing time is reduced, and even external fixation is avoided.

We have accomplished lateral mass fusion to 4 of our cases by double incisions and, to one case with a single incision. All of these solid fusions were successful and all of the symptoms of patients were relieved. We didn't observe slip progression in none of our patients. It is probable that these results are reached because slip percentage in all of our cases, except 4 were lower than 50 percent and in grade III patients in whom there were more than 50 percent slip, had slip angle less than 55 degrees. Nowadays there are assessments and report about the reduction of severe spondylolisthesis (2,6,10,12,21,23,28). But, nevertheless, in these reports the occurrence of a lot of neu-

rological complications have been written. The most common complications were paresis of L5 nerve root (2,5,6,21,23,18), paresis of L4 (10), lesion in SI and S2 nerve roots (10, 23) and cauda equina syndrome (10, 21). The spinal cord monitoring may be insufficient during the operation. For this reason, specific monitoring of the proximal roots is mandatory (35).

Freeman and Donati, Velicas and Blackburn and Stuffer and Coventry stated that as far as posterolateral fusion being a safe procedure, fusion may be carried out without the need for reduction (13,33,36).

As a conclusion, in surgical treatment of spondylolisthesis, posterolateral or lateral mass fusions are selected due to the fact that it is more reliable, safer, successful and relieves the symptoms. Also it is easy to apply laminectomy or foraminotomy for releasing of nerve root compressions, showing neurological complications.

REFERENCES :

- 1 . Apol D.M., Lorenz M.A., Zindrick M.R. : Symptomatic Spondylolisthesis in Adults : Four Decades Later. *Spine* 14: 345-348, 1989.
- 2 . Balderston R.A., Bradford D.S. : Technique for Achievement and Maintenance of Reduction of Severe Spondylolisthesis Using Spinous Process Traction Using Wiring and External Fixation of Pelvis. *Spine* 10:376-382, 1985.
- 3 . Bohlman H.H., Cook S.S. : One-Stage Decompression and Postero lateral and Interbody Fusion for Lumbosacral Spondylolisthesis Through a Posterior Approach. *J. Bone Joint Surg.* 64-A 415 - 448, 1982.
- 4 . Boxal D., Bradford D.S., Winter R.B., Moe J.H. : Management of Severe Spondylolisthesis in Children and Adolescents. *J. Bone Joint Surg.* 61-A 479-495, 1979.
- 5 . Bradford D.S. : Treatment of Severe Spondylolisthesis A Combined Approach for Reduction and Stabilisation. *Spine* 4 : 423-429, 1979.
- 6 . Bradford D.S. : Closed Reduction of Spondylolisthesis. An Experience 22 Patients. *Spine* 5: 580-587, 1988.
- 7 . Cloward R.B. : Spondylolisthesis; Treatment by Laminectomy and Posterior Interbody Fusion. *Clin. Orthop.* 154, 74-82, 1981.
- 8 . Dandy D.J., Shannon M.J. : Lumbosacral Subluxation (Group I Spondylolisthesis) *J. Bone Joint Surg.* 53-B 578 1971.
- 9 . Dawson E.G., Lotysch M., Urist M.R. : Intertransverse Process Lumbar Arthrodesis with Autogenous Bone Graft. *Clin. Orthop.* 154, 90-96 1981.

10. Dewald R.L., Faut M., Faddonio R.F., Neuwirth M.G. : Severe Lumbosacral Spondylolisthesis in Adolescents and Children : Reduction and Stage Circumferential Fusion. *J.Bone Joint Surg.* 63-A 619-626 1981.
11. Edmonson A.S. : Kyphosis and Spondylolisthesis. *Campbell's Operative Orthopaedics*, C.V. Mosby Co., St. Louis. Seventh Ed. 3237-3253 1987.
12. Esses S.I. : The AO Spinal Internal Fixator. *Spine* 14 : 373-378 1989.
13. Freeman B.L., Donati N.L. : Spinal Arthrodesis for Severe Spondylolisthesis in Children and Adolescent. A Long-Term Follow-Up Study. *J. Bone and Joint Surg.* 71-A 594-598 1989.
14. Flynn J.C., Hoque A. : Anterior Fusion of the Lumbar Spine : End-Results Study with Long-Term Follow-Up. *J.Bone and Joint Surg.* 61-A 1143-1150 1979.
15. Harris I.E., Weinstein S.L. : Long-Term Follow-Up of Patients with Grade III and IV Spondylolisthesis. *J. Bone and Joint Surg.* 69-A 960-969 1987.
16. Hensinger R.N., Lang J.R., McEven G.D. : Surgical Management of the Spondylolisthesis in Children and Adolescents. *Spine* : 1 207 1976.
17. Hoover N.W. : Methods of Lumbar Fusion. *J.Bone Joint Surg.* 50-A 194-210 1968.
18. Johnson J.R., Kirvan E.O'G : The Long-Term Results of Fusion in situ for Severe Spondylolisthesis. *J. Bone and Joint Surg.* 65-B 43-46 1983.
19. Kiviluoto O. Santavirta S., Salenius P., Morri P., Pylkkanen P. : Posterolateral Spine Fusion. *Acta Orthop. Scand.* 56. 152-154 1985.
20. Laurent L.E., Osterman K. : Operatif Treatment of Spondylolisthesis in Young Patients. *Clin. Orthop.* 117, 85-91 1976.
21. Luis R. : Fusion of Lumbar and Sacral Spine by Internal Fixation with Screw Plates. *Clin. Orthop.* 203 : 18-33 1986.
22. Macnab J., Dall D. : The Blood Supply of the Lumbar Spine and Its Application to the Technique of Intertransverse Lumbar Fusion. *J. Bone Joint Surg.* 53-B 628-637 1971.
23. Matthias H.H., Heine J. : The Surgical Reduction of Spondylolisthesis. *Clin. Orthop.* 203 : 34-44 1986.
24. Me Phee I.B. : Slip Progression in Lumbosacral Spondylolisthesis. *J. Bone Joint Surg.* 71-B 881 1989.
25. Moe J.H., Winter R.B., Bradford D.S., Lonsteins J.E. : Spondylosis and Spondylolisthesis. *Scoliosis and Other Spinal Deformities*. W.B. Saunders Company Philadelphia 403-434 1987.
26. Newman P.H. : Surgical for Spondylolisthesis in the Adults. *Clin. Orthop. Rel. res.* 117, 106-11 1976.
27. O'Brien J.P., Me Phee I.B., Dowling F.E., Webb J.K.:Severe Spondylolisthesis:Gradual Reduction with Combined Anterior and Posterior Arthrodesis. *J. Bone Joint Surg.* 62-B 530, 1980.
28. O'Brien J.P., Mehdian H., Jaffray D. : Reduction of Severe Spondylolisthesis: A Report of 22 Cases with a Four to 12 Years Follow-Up. *J.Bone Joint Surg.* 71-B 154, 1989.
29. Riley P.M., Gillespie R., Koreska J. : Severe Spondylolisthesis and Spondyloptosis : Results of Posterolateral Fusion in Children and Adolescents. *J. Bone Joint Surg.* 68-B 856 1986.
30. Ronald L.D., Faut M.M., Taddonio R.F., Neuwirth M.G. : Severe Lumbosacral Spondylolisthesis in Adolescents and Children. Reduction and Circumferential Fusion. *J. Bone Joint Surg.* 63-A 619-626 1981.
31. Scvastikoglou J.A., Spangfort E., Aaro S. : Operative Treatment of Spondylolisthesis in Children and Adolescents with Tight Hamstring Syndrom. *Clin. Orthop.* 147, 192-199, 1980.
32. Stanton R.P., Meehan P., Lovell W.W. : Surgical Fusion in Childhood Spondylolisthesis. *J. Pediatric Orthop.* Vol:5 P:411-415 1985.
33. Stauffcr R.N., Coventry M.B. : Posterolateral Lumbar Spine Fusion. Analisis of Mayo Clinic Series. *J.Bone Joint Surg.* 54-A 1195-1204 1972
34. Thompson W.A., Gristina A.G., Healy E.A. : Lumbosacral Spine Fusion. *J.Bone Joint Surg.* 56-A 1643-1647 1974.
35. Transfeldt E.E., Dendrinis G.K.,Bradford D.S.: Paresis of Proximal Lumbar Roots After Reduction of L5-S1 Spondylolisthesis. *Spine* 14, 884-887 1989.
36. Velicas E.P., Blackburne J.S. : Surgical Treatment of Spondylolisthesis in Children and Adolescents. *J.Bone Joint Surg.* 63-B 67-70 1981.
37. Wiltse L.L., Newman P.H., Macnab II. : Classification of Spondylolysis and Spondylolisthesis. *Clin. Orthop.* 117 23-29 1976.