The Results of Decompression and Instrumented Fusion with Pedicular Screw Plate System in Degenerative Lumbar Scoliosis Patients with Spinal Stenosis: A Prospective Observational Study

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Objective: *To study pain relief, curve correction, and functional outcomes after decompression and instrumented arthrodesis in degenerative lumbar scoliosis patients with spinal stenosis.*
Material and Method: *Thirty-one degenerative scoliosis patients with symptom of spinal stenosis who underwent decompression and fusion with pedicular screw plate instrumentation and completed at least 2-year follow-up were included in this study. Functional outcomes were obtained using Oswestry Disability Index (ODI) and Roland Morris score. The VAS pain relief, walking ability, and curve correction were collected as a result of the surgery.*
Results: *Average age of the patients at the time of surgery was 64.87 years (range, 50-87 years) and mean follow-up was 32 months (range, 24-60 months). There was significant improvement in all outcome parameters including pain scales, walking ability, ODI, and Roland Morris score ($p < 0.05$) Five patients had major complications with two cases requiring re-operation.*
Conclusion: *Degenerative scoliosis with spinal stenosis is a complex spinal disease that requires decompression and stabilization procedures. Wide decompressive laminectomy and instrumented arthrodesis with pedicular screw plate system provided satisfied outcome included pain relief and functional restoration.*

Keywords: *Degenerative scoliosis, Spinal stenosis, Surgery, Arthrodesis, Instrumentation, Outcome*

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Degenerative (de novo) scoliosis is defined as any frontal plane curvature of the spine more than 10 degrees that developed without a previous history of scoliosis in a childhood period[1]. It should be distinguished from adult idiopathic scoliosis that is the consequence of a process beginning before skeletal maturity, even though it may not always be possible to exactly discriminate degenerative from adult idiopathic scoliosis[2].

Degenerative lumbar scoliosis developed on asymmetric degenerative change of the disc with the consecutive frontal plane deviation and a concomitant curve rotation. Patients with degenerative lumbar scoliosis usually present with disabling low back pain and/or lower extremities pain and/or spinal imbalance[3]. Surgical treatment in degenerative lumbar scoliosis is much more complicated than lumbar spinal stenosis due to senility, osteoporosis, more medical co-morbidities, and more aggressive procedures in these patients[4]. Thus, the surgery is reserved when comprehensive aggressive conservative treatment failed.

Although many literatures reported the favorite outcome after surgery in lumbar spinal stenosis, the degenerative scoliosis patients were usually in the subgroup analysis of those studies[5-9]. The other published series reported the results of surgery in

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adult scoliosis patients without definite symptoms of spinal stenosis[2,10]. Only a few studies presented the outcome after operation in a specific group of degenerative scoliosis with spinal stenosis patients[4,11]. The aim of the present study was to assess the surgical outcomes including visual analog scale (VAS) pain relief, functional scores, magnitude of curve correction, and complications after decompressive laminectomy and pedicular screw plate fusion in degenerative lumbar scoliosis patients with spinal stenosis.

Material and Method

All patients who enrolled in the present study had clinical and radiographic evidence of degenerative lumbar scoliosis according to the criteria above. All patients had low back, buttock and/or leg pain. The diagnosis was confirmed by imaging studies (myelography or magnetic resonance imaging) showing central or foraminal canal compromise. The prospective observational data was collected from the degenerative lumbar scoliosis patients who underwent decompression and instrumented arthrodesis at Ramathibodi Hospital between January 1998 and December 2004. The procedure started with wide laminectomy. The pedicular screw plate systems (Ramathibodi Spinal System: RSS) were then applied to stabilize and to correct the sagittal and coronal alignment of the lumbar spine. All surgical cases were completed with posterolateral fusion (Fig. 1). The authors excluded the patients who had previous spinal surgery and who could not complete the questionnaires.

The questionnaires were completed by an interviewer who was not involved in the patient's care. The demographic and clinical features were collected. The primary outcome measured in the present study was functional score. The authors used Oswestry Disability Index (ODI) and Roland Morris score. The authors also collected the pain scale (VAS) and walking ability of the patients. The data was collected at the preoperative period and the time of follow-up at 3, 12, and 24 months. Any event of complications and the need of re-operation were reviewed.

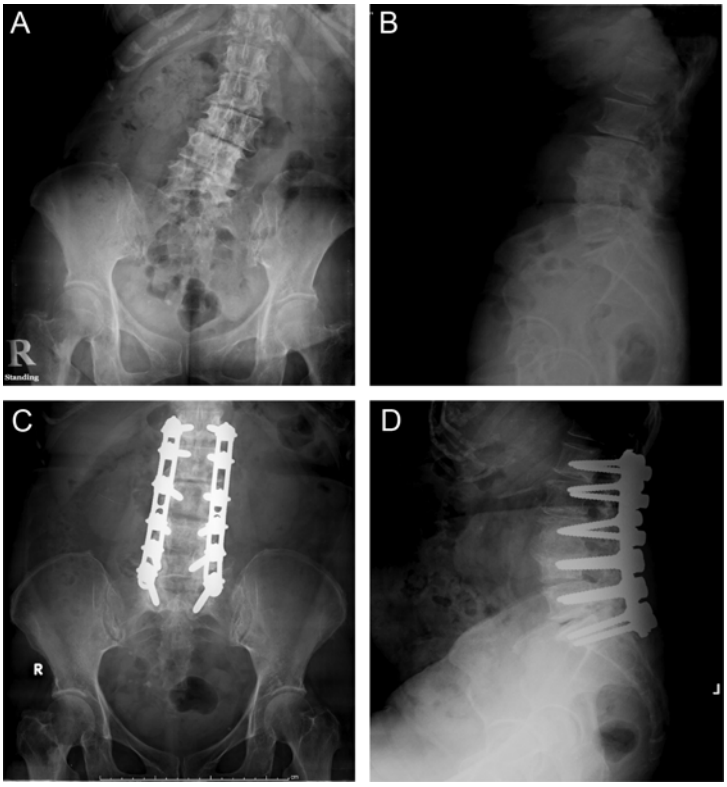

Fig. 1 (A) and (B) Preoperative radiographs of degenerative scoliosis patient and (C) and (D) postoperative radiographs after decompression, reduction and correction using pedicular screw plate instrumentation

Statistical analysis was performed with SPSS 11.5. The authors used *t* tests for continuous data and Pearson chi-square test for discrete data. The significance was defined as p-value < 0.05.

Results

Thirty-one patients were eligible and completed at least the two-year follow-up during the period of the present study. The demographic characteristics of the patients are presented in Table 1. The average age of the patients at the time of surgery was 64.87 years (range 50-87 years). Forty-five percent had co-morbidities and the two most frequently reported co-morbidities were cardiac diseases and hypertension. Eighty-seven percent of the patients were women. The mean duration of pre-operative symptoms was 50.68 months (SD 12.77). The mean duration for follow-up time was 32 months (range 24-60 months). The mean preoperative Cobb angle was 14.38 degrees. The levels of fusion were T10-L5 in one patient, T11-L5 in one patient, T12-L5 in 10 patients, L1-L5 in five patients, L1-L4 in one patient, L2-L5 in eight patients, L3-L5 in three patients, and L4-L5 in two patients. The mean estimated blood loss was 667.39 ml.

Table1. Demographic characteristics of the patients (n = 31)

Parameters	Results
Age	Mean 64.87 years: SD 8.87
Sex	Male 12.5% Female 87.5%
Duration of symptom	Mean 50.68 months: SD 12.77
Co-morbidities	Yes 43% No 57%
Preoperative Cobb angle	Mean 14.38 degrees: SD 2.59
Estimated blood loss	Mean 667.39 ml: SD 330.62

SD = standard deviation

The postoperative outcomes at the latest follow-up were compared to preoperative data as shown in Table 2. The mean deformity correction using Cobb angle was 7.85 degrees. The Oswestry Disability Index and Roland Morris scores were both improved from 54.40 to 34.23 and 14 to 10, respectively. The mean visual analog pain scale decreased from 8.32 to 2.26 and the mean walking range increased from 146.20 to 561.67 meters. All functional outcome parameters showed statistically significant improvement ($p < 0.05$).

Five patients had complications after surgery and two needed re-operation. One case had dural tear intraoperatively, which was repaired with nonabsorbable suture without any further complication. One case had L4 root paresis immediately after surgery and underwent foraminotomy at the compression site. This patient had fair recovery of the motor power. Two incidents of CVA occurred 2 days and 3 months after surgery. Three patients developed junctional degeneration at the proximal adjacent level. Two cases had no clinical symptom and one case was re-operated on with extended decompression and arthrodesis with instrumentation.

Discussion

Surgical management of degenerative (de novo) lumbar scoliosis is challenging. Several surgical options are available depending on the severity and the extent of stenosis and deformity. The variety of the procedures is extended from laminotomy or laminectomy alone to an anterior release with posterior decompression and fusion with instrumentation. The surgical risks and complications are higher than in adolescent scoliosis and lumbar stenosis patients because of advanced age, medical co-morbidities, lower bone density, and more spinal stiffness. The objective of the proper surgical selection is to achieve the greatest benefit with the least complex intervention.

Table 2. Postoperative outcomes after decompression and instrumented fusion (n = 31)

	Preoperative mean (SD)	Follow-up mean (SD)	Mean difference	p-value
Cobb angle (degree)	14.38 (2.59)	6.53 (1.85)	7.85	0.019
ODI	54.40 (18.89)	34.23 (17.22)	20.17	<0.001
Roland-Morris score	14 (5.5)	10 (5.1)	4	0.002
VAS	8.32 (2.23)	2.26 (1.93)	6.06	<0.001
Walking range (meters)	146.2 (258.0)	561.6 (412.7)	415.4	<0.001

ODI = oswestry disability index
VAS = visual analog pain scale

The goals of surgery are to decompress the neural compromise and to stabilize and balance the spine. Wide laminectomy alone is not recommended because it can lead to further instability and progression of the curve. To relieve the neural compromise, stabilize, and correct the scoliotic spine, the authors performed decompression and instrumented fusion using pedicular screw plate system (Ramathibodi spinal system) and evaluated the outcome in these patients.

There are few studies assessing the results of surgical treatment in adult patients with degenerative lumbar scoliosis and stenosis. Simmons ED Jr et al[11] reported 40 cases of lumbar scoliosis associated with spinal stenosis treated with posterior decompression and pedicular screw fixation. Average length of follow-up was 44 months (range, 24-61). Eighty-three percent of the patients reported severe pain before surgery, and 93% reported mild or no pain post-operatively. Scoliosis was reduced from 37° to 18° at the latest follow-up. This study did not assess any functional scores to determine the outcomes. In a case series of 16 patients with adult idiopathic scoliosis, low back pain and spinal stenosis who underwent combined anterior and posterior surgical reconstruction with a minimum follow-up period of 2 years, Shapiro GS et al[4] found significant improvement in all outcome domains including Modified Scoliosis Research Society outcome and Oswestry Disability questionnaires. The curve correction averaged 50.4% with improvement of coronal and sagittal balance in all the patients.

The present study showed significant improvement in pain relief and functional outcomes including Oswestry disability questionnaires and Roland Morris score. The walking capacity was also improved significantly after surgery. The published complications in degenerative scoliosis were high in most series, ranging from 20-40%. The present results revealed five complications related to the surgery (16.1% of the present study group). The authors think that this complication rate was acceptable compared to the previous reports.

There are several limitations in the current study. The duration of the follow-up was relatively short. The adjacent degenerative change in the three presented patients may cause clinical deterioration in the future. The long-term results of this kind of surgery are needed. The second issue is the lack of comprehensive radiographic evaluation. The authors could not report the improvement in overall balance of the spine due to the absence of long-cassette standing film. Furthermore, the authors could not exactly conclude that no pseudarthrosis had occurred since there was lack of routine motion radiographs (flexion and extension film) or CT scans in the presented patients. Nevertheless, no broken instrument was found in the present series. It might reveal that good stability of the spine was achieved and the authors believed that the functional outcomes of the surgery did not correlate with the radiographic pseudarthrosis.

Conclusion

Surgery in degenerative lumbar scoliosis is challenging. Decompression and correction with an instrumented fusion using pedicular screw plate system (Ramathibodi Spinal System: RSS) is a procedure that can meet the goals of the surgery including relief of the neural compromise, and stabilization and balancing the spine. Significant pain relief and recovery of functional outcome can be achieved with these procedures with acceptable risks of surgery.

References

1. Aebi M. The adult scoliosis. Eur Spine J 2005; 14: 925-48.
2. Bradford DS, Tay BK, Hu SS. Adult scoliosis: surgical indications, operative management, complications, and outcomes. Spine 1999; 24: 2617-29.
3. Ploumis A, Transfledt EE, Denis F. Degenerative lumbar scoliosis associated with spinal stenosis. Spine J 2007; 7: 428-36.
4. Shapiro GS, Taira G, Boachie-Adjei O. Results of surgical treatment of adult idiopathic scoliosis with low back pain and spinal stenosis: a study of long-term clinical radiographic outcomes. Spine 2003; 28: 358-63.
5. Katz JN, Lipson SJ, Chang LC, Levine SA, Fossel AH, Liang MH. Seven- to 10-year outcome of decompressive surgery for degenerative lumbar spinal stenosis. Spine 1996; 21: 92-8.
6. Husni ME, Lipson SJ, Brick GW, Grobler LJ, Fossel AH, Katz JN. Five year outcomes of surgery for lumbar spinal stenosis. Arthritis Rheum 2001; 44: 2949.
7. Airaksinen O, Herno A, Turunen V, Saari T, Suomlainen O. Surgical outcome of 438 patients treated surgically for lumbar spinal stenosis. Spine 1997; 22: 2278-82.
8. Hansraj KK, O'Leary PF, Cammisa FP Jr, Hall JC, Fras CI, Cohen MS, et al. Decompression, fusion, and instrumentation surgery for complex lumbar spinal stenosis. Clin Orthop Relat Res 2001; 18-25.

9. Atlas SJ, Keller RB, Wu YA, Deyo RA, Singer DE. Long-term outcomes of surgical and nonsurgical management of lumbar spinal stenosis: 8 to 10 year results from the maine lumbar spine study. Spine 2005; 30: 936-43.
10. Grubb SA, Lipscomb HJ, Suh PB. Results of surgical treatment of painful adult scoliosis. Spine 1994; 19: 1619-27.
11. Simmons ED Jr, Simmons EH. Spinal stenosis with scoliosis. Spine 1992; 17(6 Suppl): S117-20.

ผลการรักษาด้วยวิธีผ่าตัดขยายช่องไขสันหลัง และเชื่อมกระดูกสันหลังด้วยโลหะชนิดแผ่นดาม ในผู้ป่วยกระดูกสันหลังตีบจากภาวะกระดูกสันหลังเสื่อมคด: การศึกษาสังเกตไปข้างหน้า

กันต์ แก้วโรจน์, ตุลยพฤกษ์ ถาวรสวัสดิ์รักษ์, วิเชียร เลาหเจริญสมบัติ, วิวัฒน์ วจนะวิศิษฐ,สุภนีวรรณ เชาว์วิศิษฐ

วัตถุประสงค์*: เพื่อศึกษาผลการรักษาด้าน การลดอาการปวด, ความสามารถในการแก้ไขมุมคด และการกลับไปใช้ชีวิต (functional outcome) หลังผ่าตัดขยายช่องไขสันหลัง และเชื่อมกระดูกสันหลังโดยใช้โลหะชนิดแผ่นดาม ในผู้ป่วยกระดูกสันหลังตีบจากภาวะกระดูกสันหลังเสื่อมคด*

วัสดุและวิธีการ*: ผู้ป่วยกระดูกสันหลังตีบจากภาวะกระดูกสันหลังเสื่อมคด 31 ราย ที่ได้รับการผ่าตัดขยายช่องไขสันหลัง และเชื่อมกระดูกสันหลังด้วยโลหะชนิดแผ่นดาม โดยได้รับการติดตามการรักษาอย่างน้อย 2 ปี ผลการรักษาในเรื่องการกลับไปใช้ชีวิต ใช้แบบสอบถาม Oswestry Disability Index (ODI) และ Roland Morris score รวมทั้งศึกษาความปวดที่ลดลง ความสามารถในการเดิน และในการแก้ไขมุมคด จากการผ่าตัดวิธีนี้*

ผลการศึกษา*: อายุเฉลี่ยของผู้ป่วยขณะได้รับการผ่าตัด 64.87 ปี ได้รับการติดตามการรักษาเฉลี่ย 32 เดือน พบผลการรักษาดีขึ้นในทุกค่าที่วัด ได้แก่ ความปวด, ความสามารถในการเดิน แบบสอบถาม Oswestry Disability Index (ODI) และ Roland Morris score ($p < 0.05$) พบภาวะแทรกซ้อนในผู้ป่วย 5 ราย โดยมี 2 ราย ที่ได้รับการผ่าตัดซ้ำ*

สรุป*: ภาวะกระดูกสันหลังตีบจากกระดูกสันหลังเสื่อมคด เป็นโรคที่มีความซับซ้อนในการรักษา โดยการผ่าตัดต้องอาศัยการขยายช่องไขสันหลัง และการทำกระดูกสันหลังให้มั่นคง การผ่าตัดขยายช่องไขสันหลัง และเชื่อมกระดูกสันหลังด้วยโลหะชนิดแผ่นดาม ให้ผลการรักษาที่น่าพอใจทั้งในแง่การลดปวด และการกลับไปใช้ชีวิต*