Posterolateral Fusion with Autogenous Laminospinous Process Bone Graft

PINIT HIRUNYACHOTE, M.D., FRCST., FRCOST.*,
WALLOP ADULKASEM, M.D., FRCST., FRCOST.*

Abstract

The results of posterolateral spinal fusion by using autogenous iliac bone graft is gold standard. However, there are some undesirable effects at the donor site. This study reports the outcome of posterolateral spinal fusion by using an autogenous bone graft from the lamina and spinous process.

From June 1993 to May 2001, Decompressive laminectomy, pedicle screw fixation system and posterolateral fusion were performed on 92 patients using autogenous bone from the decompressive laminectomy procedure. The follow-up periods were 2-8 years. 97.56 per cent of the patients had a solid fusion mass at 6 months after operation. There were no undesirable effects at the iliac region. The JOA score for low back pain improved in all patients.

The result of posterolateral spinal fusion by using autogenous bone from the lamina and spinous process is comparable to the autogenous iliac bone graft. The advantages of using the laminospinous process bone graft are short operating time, less blood loss than taking a bone graft from the iliac crest, no complication or undesirable effects at the iliac region.

Key word : Posterolateral Fusion, Laminospinous Process Bone Graft

HIRUNYACHOTE P & ADULKASEM W
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Posterolateral spinal fusion along with the pedicular screw fixation system for lumbar instability is now widely accepted[1-10], but the results in some reports are not so good[11,12]. Most articles reported a good outcome of fusion using the autogenous iliac bone graft[1-10]. However, undesirable effects may

* Orthopedic Department, Nakhon Pathom Hospital, Nakhon Pathom 73000, Thailand.

Table 1. Show age groups of patients.

Age (year)	Female 74	Male 18
47-55	10	1
56-65	18	6
66-75	35	9
76-85	11	2

Table 2. Show type of instability.

Type	Number of patients
Grade 1 listhesis	61
Grade 2 listhesis	22
L-instability	9

Table 3. Show number of patients in each group of fusion level.

Fusion level	JOA score average	No. of patients
1 level	20	18
2 levels	18	23
3 levels	17	32
4 levels	16	19

Table 4. Show the fusion rate and number of patients of each groups.

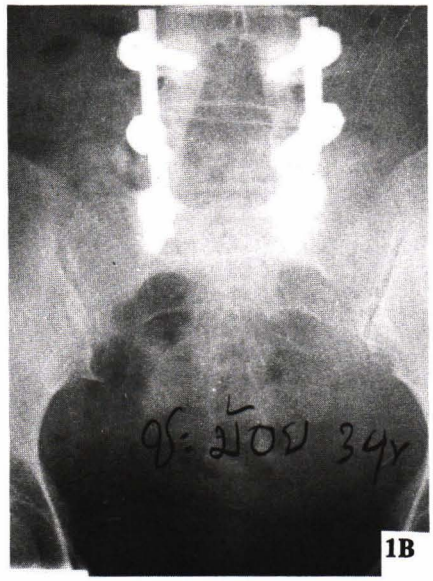
Fusion level	% of fusion	Number of patients
1 level (16)	100	16
2 level (19)	100	19
3 level (29)	96.55	28
4 level (18)	94.44	17

occur at the donor site: such as pain, soreness of the gluteal muscle, hematoma, infection, paresthesia and numbness or even pelvic fracture[13-15]. Allograft has also been introduced as a substitute for autogenous iliac bone graft. Due to slow incorporation of the graft, low fusion rate[16,17], infection and fear of HIV disease[18-21], new substances for bone substitution have been studied as an artificial bone substitutes[22-24]. So far, these substances are very expensive and not available in Thailand. This article shows the results of posterolateral spinal fusion and pedicle screw fixation with a bone graft from the lamina and spinous process which was taken from the decompressive laminectomy procedure.

MATERIAL AND METHOD

From June 1993 to May 2001, on 92 cases with lumbar-instability and lumbar-stenosis, decompressive laminectomy, posterolateral fusion and pedicular screw system fixation were performed. 61 cases had grade 1-2 degenerative spondylolisthesis, 22 cases had grade1-2 isthmic spondylolisthesis with canal stenosis, the rest had lumbar stenosis with lumbar-instability according to White- Panjabi criterion. The age range was from 47-85 years, average 67 years. There were 74 females and 18 males. The JOA score for low back pain was 15-20 points, average 18 points. One case had foot drop on the left side and another case already had loss of right big toe dorsiflexion before the operation. 18 cases underwent one level fusion, 23 cases had 2 levels fusion, 32 cases had 3 levels fusion and 19 cases had 4 levels fusion. (Table 1-3) The types of pediclular screw fixation were 56 cases of Diapason, 31 cases of Universal spinal system and 5 cases of Xia.

Fig. 1 (A). The 3rd year follow-up X-ray pictures of 76 years old woman, who was performed decompressive laminectomy and PL fusion with laminospinous process bone graft.



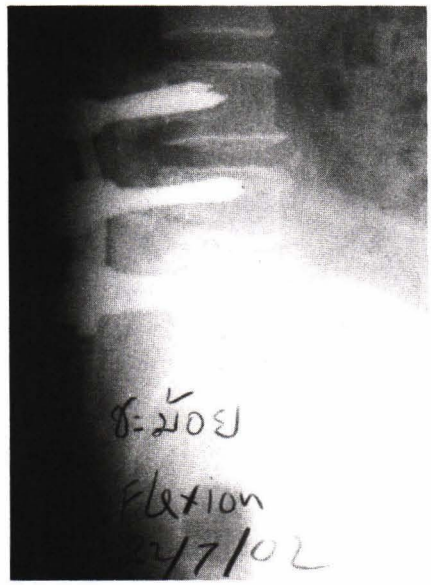


Fig. 1 (B-E). The 3rd year follow-up X-ray pictures of 76 years old woman, who was performed decompressive laminectomy and PL fusion with laminospinous process bone graft.

Operative technique

The patient was placed in the prone position. Posterior midline incision from the skin through the lamina was performed. Paraspinal muscles were detached from the bone to expose the lamina and transverse process. Decompressive laminectomy was performed centrally, lateral recess and lateral canal. Pedicular screws were placed nearly parallel and bi-cortically by the Nakhonpathom technique[25]. The recipient base was prepared by decortication at facets, the remaining lamina and transverse processes[26, 27]. Bone from the lamina and spinous process was mosarized to 2-3 mm in size and used as the bone graft. Rods were contoured and connected constrainly

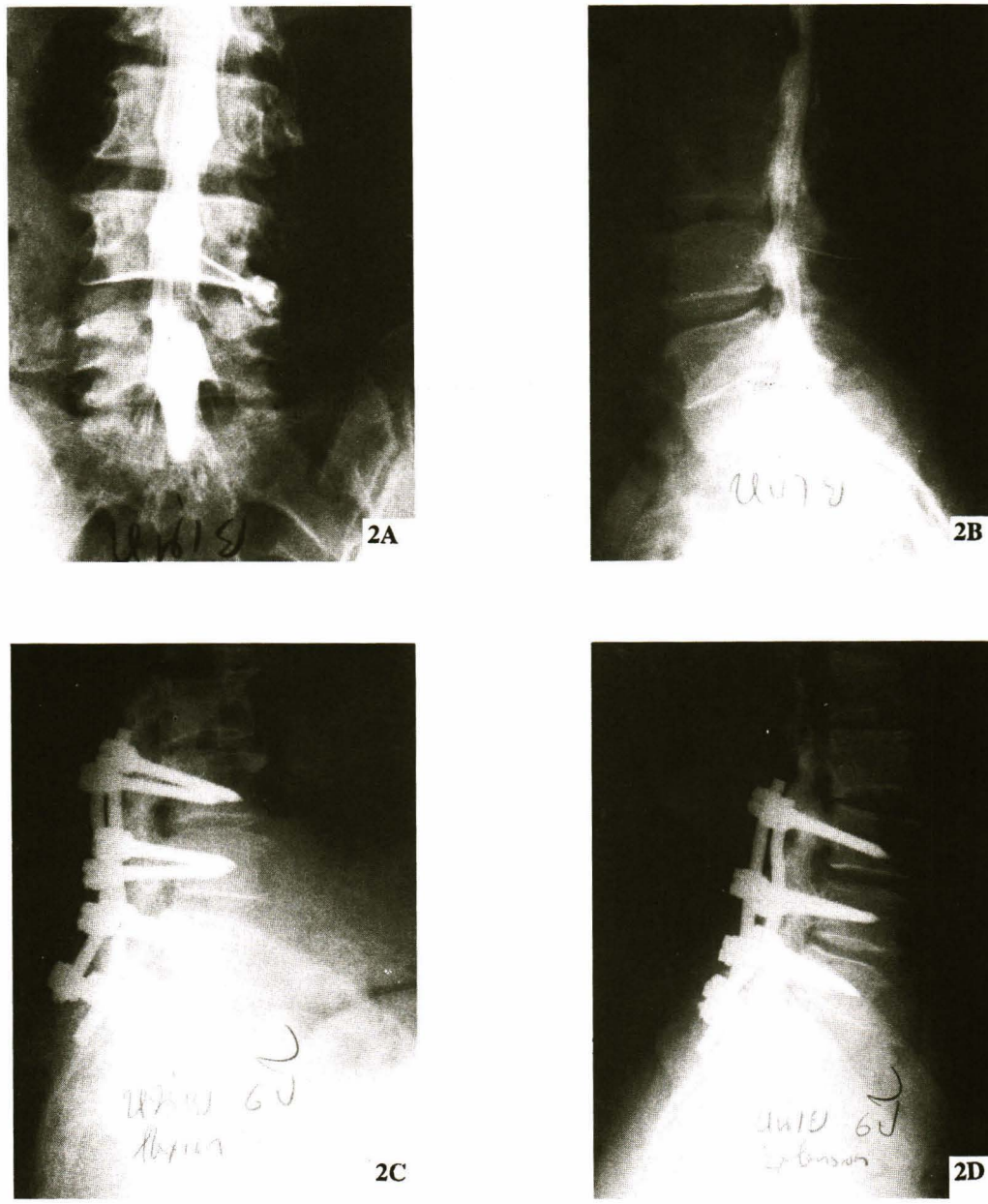


Fig. 2 (A-D). The 6th year follow-up X-ray pictures of 72 years old woman, who was performed decompressive laminectomy and PL fusion with laminospinous process bone graft.

to the pedicular screws. Suction drainage was placed. Soft tissues were sutured layer by layer. The patient was permitted to be in the upright position in bed one day after the operation. Suction drainage was removed 2-3 days after the operation depending on the amount of drainage. Then the patient was permitted to ambulate with lumbosacral support without bending forward for at least 3 months or until the X-ray showed the signs of bone union. The patient was interviewed and the X-rays were taken at 6 weeks. 3, 6 months and annually to evaluate the clinical results and fusion mass[28].

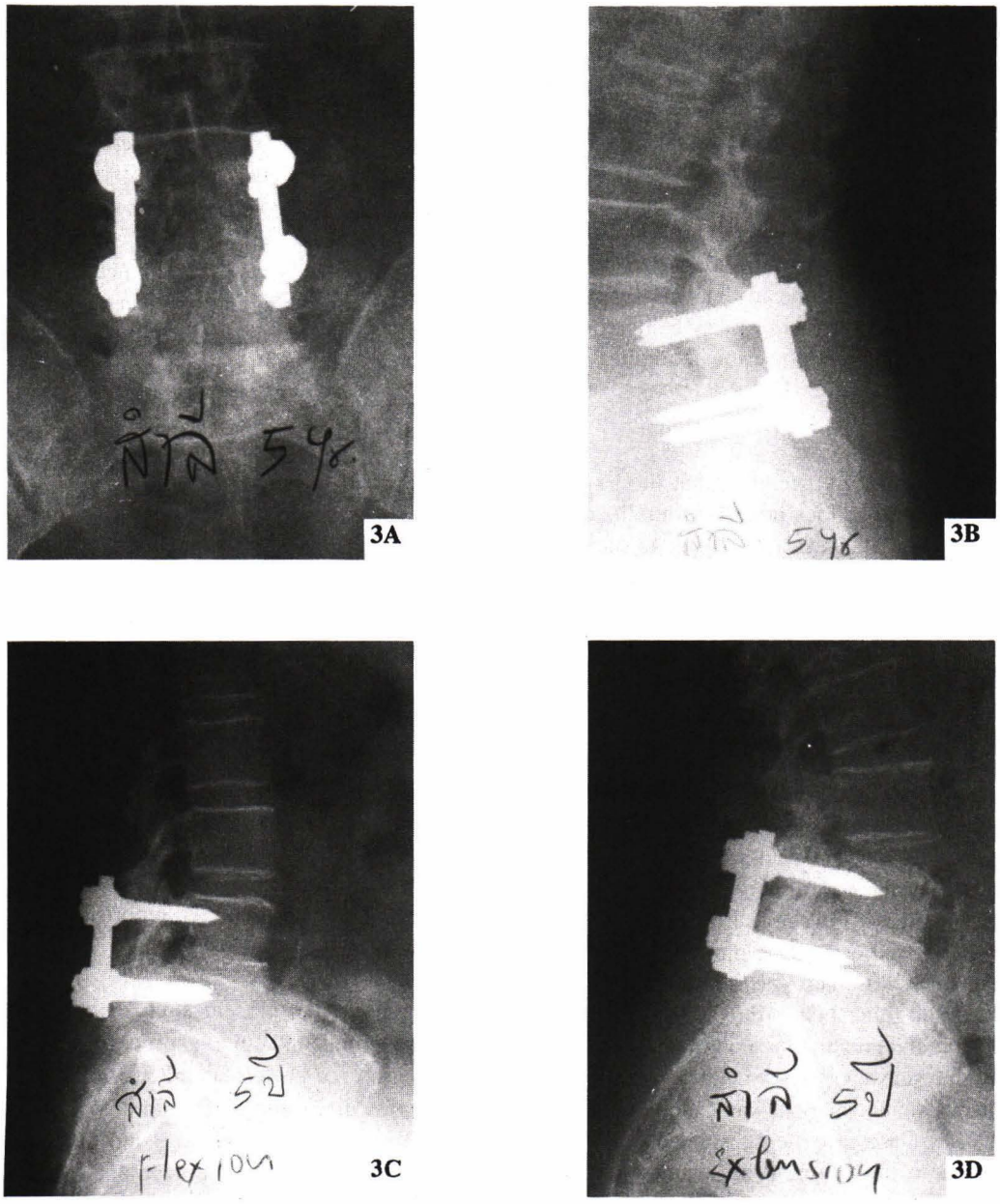


Fig. 3 (A-D). **The 5th year follow-up X-ray pictures of 52 years old woman, who was performed decompressive laminectomy and PL fusion with laminospinous process bone graft.**

RESULTS

The operating time ranged from 90-210 minutes and estimated blood loss was 150-600 ml. There was superficial wound infection in 3 cases which resolved after partial stitch removal and oral antibiotics. There were subcutaneous haematoma in 4 cases, which subsided in 3 weeks without any intervention. The follow-up time was 2-8 years. average 4.2 years. 10 cases were lost to follow-up. All patients were relieved of the heaviness and tightness in both legs immediately after the operation. The JOA scores for low back pain were improved to average 26 points at one year follow-up. The numbness recovered in time varying from the early post-operatively period

to 2 years. There was no recovery of muscle function in the foot drop case but the patient recovered from loss of dorsiflexion of the big toe after 2 years. There was 97.56 per cent fusion rates in this series, 100 per cent in 1 level fusion (16 patients), 100 per cent in 2 levels fusion (19 patients), 96.55 per cent fusion in 3 levels fusion (29 patients) and 94.44 per cent in 4 levels fusion (18 patients). (Table 4) There were 2 cases of non union at the L5-S1 level. One in 3 levels fusion and one in 4 levels fusion. The X-ray showed a solid fusion mass 6 months post-operatively. There were no serious complications in the present series. (Fig. 1-3)

DISCUSSION

It is generally accepted that the best bone for grafting is autogenous bone from the iliac crest. However, it needs an extra operation to harvesting the graft. This may cause some undesirable complications to the patient such as pain, numbness, paresthesia, clunial nerve injury, hematoma, infection or even major complications such as sciatic nerve injury, hernia and pelvic fracture[13-15]. To prevent these problems, many substances or methods have been studied to replace the autogenous iliac bone graft. Allograft is the optimum solution for this problem, but due to religious reasons, slow incorporation, low fusion rate[16,17], bacterial contamination and fear of HIV transmission[18-21] other substances have been studied to replace it. Bone morphorgenetic protein (BMP) and osteogenic protein-1 (OP-1) have now been studied in many forms in order to promote fusion and substitute bone graft[22-24]. Because of difficulties in the preparation along with the unstable form of the substance, this method is still being researched. Calcium sulphate and Calcium phosphate cement (CPC) are also being studied.

There are a report of using autogenous bone from the decompressive laminectomy procedure which is another way to solve the problem[29]. To achieve fusion of the spine, the following factors need to be considered. Spinal instrumentation is necessary to stabilize the spine to increase the fusion rate[2,30]. So far, the pedicular screw system is the most modest and stable spinal instrument. However, to get good results, two factors need to be achieved. First, a good bone grip on the screw thread. Second, constraint of the screw rod connection. The constraint of the connection can be created easily *in vitro* but not *in vivo* due to the multi-directional angulation of the screws and the rod is difficult to bend to fit all the screws. To overcome this problem, a ball ring and polyaxial screw head have been developed by many companies. The fusion technique really different from bone grafting. The later only places the bone in one place but the former also concerns the recipient bed preparation, vascularity of the bed, type and size of bone graft, and the stability of the unit. Even though the quality of bone from the lamina and spinous process can't be compared with bone from the iliac crest, the operative techniques are strictly done as mentioned above. The results from the present series are still comparable to other reports in terms of fusion rate, time of fusion, complications, and daily activity of the patients. This present study revealed a short operating time, little blood loss and no undesirable complications at the iliac crest region which are better than other reports.

SUMMARY

From the present study, autogenous bone from the lamina and spinous process can be used as a bone graft for posterolateral fusion instead of the autogenous iliac bone graft with comparable results of the fusion rate, fusion time and clinical results, but with a better operating time, blood loss and fewer complications at the iliac region.

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การผ่าตัดเชื่อมกระดูกสันหลังชนิด posterolateral โดยใช้กระดูกจาก lamina และ spinous process

พินิจ หิรัญโชติ, พ.บ. FRCST., FRCOST.,*
*วัลลภ อดุลย์เกษม, พ.บ. FRCST., FRCOST.**

การผ่าตัดเชื่อมกระดูกสันหลังชนิด posterolateral โดยการใช้กระดูกจากเชิงกรานของผู้ป่วยเอง เป็นที่ยอมรับโดยทั่วไปและถือเป็นมาตรฐาน การผ่าตัดนำกระดูกเชิงกรานเพื่อการเชื่อมกระดูกนั้นอาจเกิดอาการไม่พึงประสงค์ได้ เพื่อหลีกเลี่ยงอาการดังกล่าว รายงานนี้ได้แสดงผลการผ่าตัดเชื่อมกระดูกสันหลังชนิด posterolateral โดยใช้กระดูกจาก lamina และ spinous process ที่ได้จากขั้นตอนการทำ decompressive laminectomy

ผู้ป่วยจำนวน 92 คน ได้รับการผ่าตัด decompressive laminectomy และเชื่อมกระดูกสันหลังชนิด posterolateral โดยใช้กระดูกจาก lamina และ spinous process และใช้ pedicular screw system ยึดตรึง ในระหว่างช่วงเดือนมิถุนายน พ.ศ. 2536 ถึง เดือนพฤษภาคม พ.ศ. 2544 ติดตามผลการผ่าตัดเป็นระยะเวลา 2-8 ปี ผู้ป่วยจำนวน 80 จาก 82 ราย คิดเป็น 97.56 เปอร์เซ็นต์ มีการเชื่อมติดของกระดูกสันหลังอย่างแข็งแรง ในระยะเวลาประมาณ 6 เดือนหลังการผ่าตัดและอาการของพยาธิสภาพทางระบบประสาท และกล้ามเนื้อทุเลาลง

ผลการเชื่อมของกระดูกสันหลังโดยการใช้กระดูกจาก lamina และ spinous process สามารถเทียบเคียงได้กับการใช้กระดูกจากเชิงกราน แต่มีข้อดีกว่าในแง่ของระยะเวลาที่ใช้ในการผ่าตัด จำนวนเลือดที่สูญเสียไประหว่างผ่าตัดและอาการไม่พึงประสงค์ที่เกิดขึ้นที่บริเวณเชิงกราน

คำสำคัญ : การเชื่อมกระดูกสันหลังชนิด posterolateral, กระดูกส่วน laminospinous process

พินิจ หิรัญโชติ, วัลลภ อดุลย์เกษม
จดหมายเหตุทางแพทย์ ฯ 2545; 85: 1105-1112

กลุ่มงานศัลยกรรมออร์โธปิดิกส์, โรงพยาบาลนครปฐม, นครปฐม 73000