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Abstract

Lumbar X-ray findings and clinical manifestations were investigated in 10 patients who underwent posterior fusion with or without Harrington instrumentation for idiopathic scoliosis between 1965 and 1975. The subjects were 4 men and 6 women, who ranged from 10 to 17 years of age at the time of surgery (mean, 12 years and 9 months). The postoperative follow-up period ranged from 20 to 30 years (mean, 24 years and 7 months). All patients were followed-up at our institution. Three patients received posterior fusion without instrumentation, and Harrington instrumentation was used in 7 from 1967 onwards. The distal end of the fusion was L2 in 4, L3 in 4, and L4 in 2 patients. Pain, evaluated by Moskowitz's criteria, was stage I in 5 and stage II in 5 patients (none of them had stage III or IV). In X-ray evaluation, graded according to Lawrence's classification, grade III changes were noted in 2 patients; one with thoracolumbar fusion with Harrington instrumentation to the L4 vertebra and the other patient was assessed at 30 years post-surgery. According to White-Panjabi's criteria, instability was noted in 1 patient with Harrington fixation including the L4 vertebra. Clinical manifestations and X-ray abnormalities were less severe than anticipated at 20 years post-surgery, although a tendency for deterioration was observed in patients with fusion including the L4 or patients followed up for more than 30 years post-surgery.

KEYWORDS: scoliosis, long-term follow-up, lumbar spinal changes, thoracolumbar fusion

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Lumbar Spinal Changes Over 20 Years after Posterior Fusion for Idiopathic Scoliosis

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Lumbar X-ray findings and clinical manifestations were investigated in 10 patients who underwent posterior fusion with or without Harrington instrumentation for idiopathic scoliosis between 1965 and 1975. The subjects were 4 men and 6 women, who ranged from 10 to 17 years of age at the time of surgery (mean, 12 years and 9 months). The postoperative follow-up period ranged from 20 to 30 years (mean, 24 years and 7 months). All patients were followed-up at our institution. Three patients received posterior fusion without instrumentation, and Harrington instrumentation was used in 7 from 1967 onwards. The distal end of the fusion was L2 in 4, L3 in 4, and L4 in 2 patients. Pain, evaluated by Moskowitz's criteria, was stage I in 5 and stage II in 5 patients (none of them had stage III or IV). In X-ray evaluation, graded according to Lawrence's classification, grade III changes were noted in 2 patients; one with thoracolumbar fusion with Harrington instrumentation to the L4 vertebra and the other patient was assessed at 30 years post-surgery. According to White-Panjabi's criteria, instability was noted in 1 patient with Harrington fixation including the L4 vertebra. Clinical manifestations and X-ray abnormalities were less severe than anticipated at 20 years plus post-surgery, although a tendency for deterioration was observed in patients with fusion including the L4 or patients followed up for more than 30 years post-surgery.

Key words: scoliosis, long-term follow-up, lumbar spinal changes, thoracolumbar fusion

After posterior fusion, mobility of the spine is mainly dependent on the remaining lumbar verte-

brae. If the normally mobile lumbar vertebrae are rendered almost immobile for a long period as a result of surgery, degenerative changes and symptoms such as low back pain may develop. Investigation of lumbar spinal changes after fusion may also be important to determine the proper extent of fusion for scoliosis. Thus, we assessed clinical manifestations and lumbar X-ray findings in patients followed up for over 20 years after posterior fusion for idiopathic scoliosis.

Materials and Methods

Ten patients were studied who had undergone posterior fusion for idiopathic scoliosis at least 20 years prior. Twenty patients had undergone such surgery at our department between 1965 and 1975 and ten of them were available for direct investigation. The subjects were 4 men and 6 women, who ranged from 10 to 17 years old at the time of surgery (mean, 12 years and 9 months). The period since surgery was between 20 and 30 years (mean, 24 years and 7 months).

Harrington instrumentation (1) was used for posterior fusion in 7 patients who were operated on after 1967 and no instrumentation was used in 3 patients. The distal end of the fusion was the L2 in 4, L3 in 4, and L4 in 2 patients.

The severity of lower back pain was evaluated according to Moskowitz's criteria (2) (stage I, none; stage II, dull pain or heaviness; stage III, occupational pain and restriction, rarely needing medication; and stage IV, constant pain requiring treatment or hospitalization), in which stage I or II pain is mild. On lumbar vertebral X-ray exposures, secondary changes due to disc degeneration were evaluated according to Lawrence's classification (3) (grade I, slight anterior fraying and osteophyte

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formation; grade II, obvious anterior fraying and osteophyte formation; grade III, osteophyte formation and disc narrowing; grade IV, large osteophyte and marked disc narrowing with sclerosis and posterior subluxation of the vertebral end plate). Lumbar instability was assessed according to the White-Panjabi's criteria (4). Instability was defined as a 25% displacement of the vertebra relative to the adjacent lower vertebral body.

Results

Pain evaluated by Moskowitz's criteria was stage I in 5 patients and stage II in 5 patients, and none of them had stage III or IV pain. There were no patients with restriction of their daily activities or a need for medication.

Grade I and II changes according to Lawrence's classification were noted in 5 and 3 patients, respectively, meaning that mild changes were noted in 8 of the 10 patients. Grade III changes were only noted in 2 patients; one was assessed at 30 years post-surgery and the other had fusion down to the L4 vertebra and was assessed at 22 years post-surgery.

According to White-Panjabi's criteria, there was no instability in 9 patients, but instability was noted in one patient who had undergone fusion with Harrington instrumentation including the L4 vertebra.

Although none of them had severe pain, Lawrence's grade III changes were noted on X-ray exposures in 2 patients. Abnormal instability was also found in one patient evaluated according to White-Panjabi's criteria. Thus satisfactory results were obtained in 8 of the 10

patients.

Case reports. A 47-year-old man has been followed up for 30 years since posterior thoracolumbar fusion down to the L4 vertebra without Harrington instrumentation at the age of 17. He is currently a teacher and has Moskowitz's stage II pain and Lawrence's grade II changes between the L4 and L5 vertebra. Hypermobility is noted between the L4 and L5 as well as between the L5 and S1 on extension of the lumbar spine. His finger-floor distance (FFD) is 13 cm. He complains of a slightly dull feeling during prolonged walking and carrying of a child (Fig. 1). Lumbar MRI has revealed degeneration of the L4-L5 intervertebral disc (Fig. 2).

A 42-year-old woman has been followed up for 30 years since posterior fusion without Harrington instrumentation at the age of 12. She currently has Moskowitz's stage II pain (occasional dullness in the back for over the last 4 years). Her FFD is 0 cm and Lawrence's grade III changes are present. She has worked as a kindergarten teacher for 20 years and has two children. She has marked vertebral degeneration between the L3 and L4 (Fig. 3).

A 38-year-old woman has been followed up for 26 years since posterior fusion with Harrington instrumentation at the age of 12. She currently has stage I pain according Moskowitz's criteria and grade I radiological changes according to Lawrence's classification. She had been an office worker for two years, but is now a housewife with 2 children. She has no symptoms, even while playing tennis (Fig. 4).

A 32-year-old woman has been followed up for 22

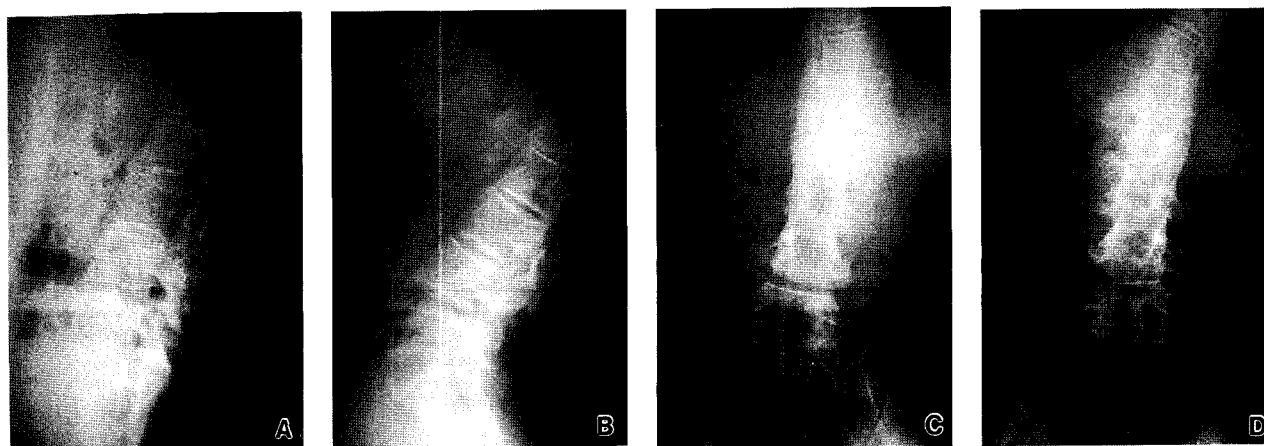


Fig. 1 X-ray findings in case 1. Lumbar vertebral X-ray exposures of a 47-year-old man who has been followed up for 30 years since posterior thoracolumbar fusion down to the L4 vertebra. A: Flexion; B: Extension; C: Left-bending; and D: Right-bending in standing position.

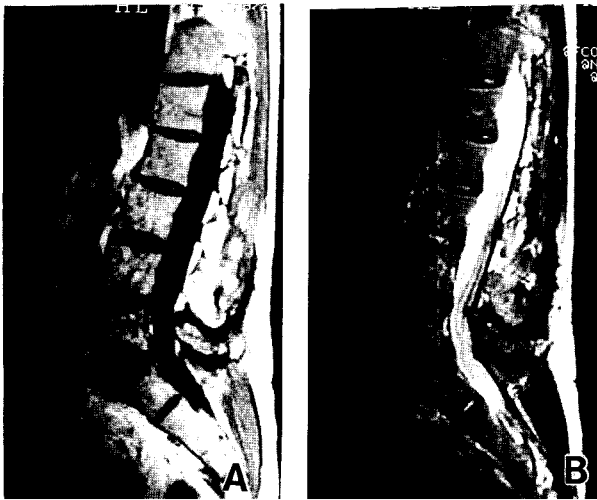


Fig. 2

Fig. 2 MRI findings of the lumbar vertebrae in case 1. A: T1-weighted sagittal image; B: T2-weighted sagittal image.

Fig. 3 X-ray findings in case 2. Lumbar vertebral X-ray exposures of a 42-year-old woman who has been followed up for 30 years since posterior thoracolumbar fusion down to the L2 vertebra. A: Flexion; B: Extension; C: Left-bending; and D: Right-bending in standing position.

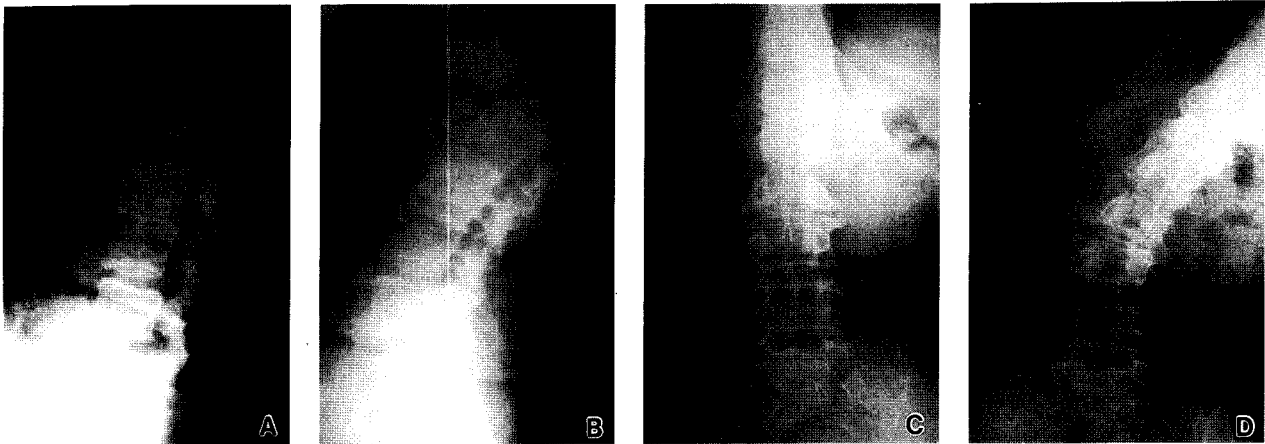


Fig. 3

Fig. 4 X-ray findings in case 3. Lumbar vertebral X-ray exposures of a 38-year-old woman who has been followed up for 26 years since posterior thoracolumbar fusion using Harrington instrumentation down to the L3 vertebra. A: Flexion; B: Extension; C: Left-bending; and D: Right-bending in standing position.

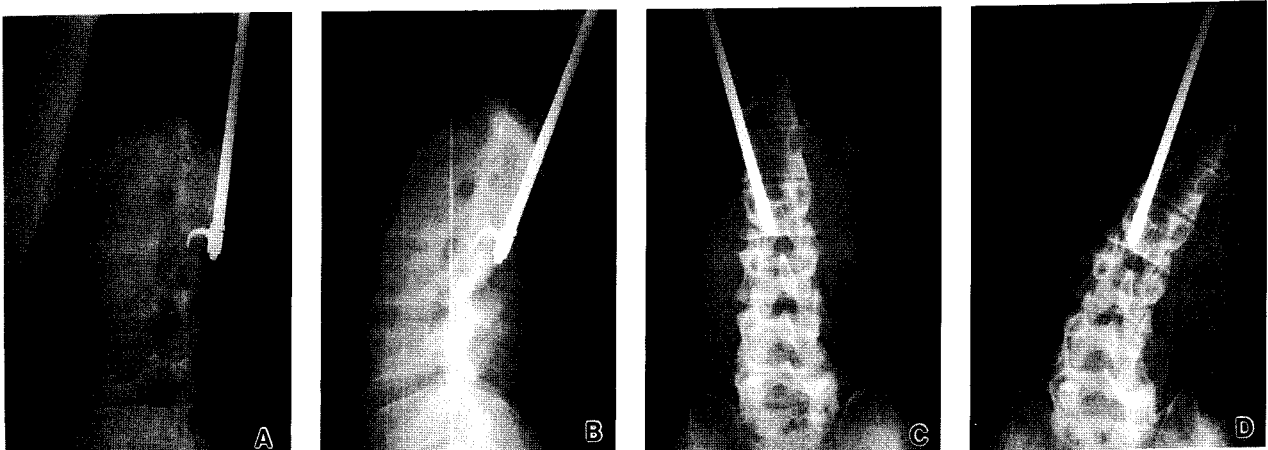


Fig. 4

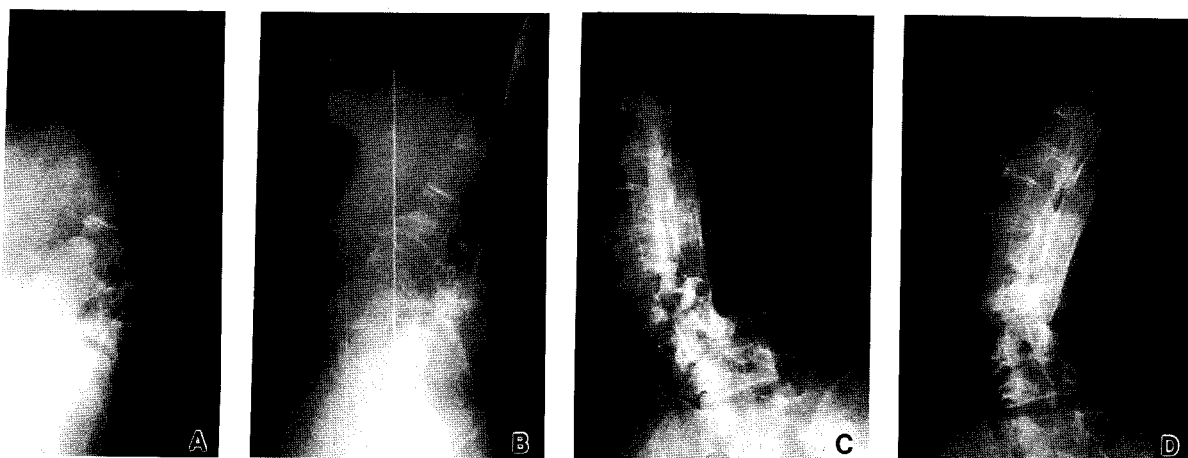


Fig. 5 X-ray findings in case 4. Lumbar vertebral X-ray films of a 32-year-old woman who has been followed-up for 22 years since posterior thoracolumbar fusion down to the L4 vertebra using Harrington instrumentation. **A:** Flexion; **B:** Extension; **C:** Left-bending; and **D:** Right-bending in standing position.

years since posterior thoracolumbar fusion using Harrington instrumentation at the age of 10. She currently has Moskowitz's stage II pain and Lawrence's grade III changes. Instability is noted between the L4 and L5 according to White-Panjabi's criteria. She has worked as a nurse for 10 years and her lower back pain has gradually increased intensity for the last three years (Fig. 5).

Discussion

According to Edgar (5), who investigated 91 patients who had undergone thoracolumbar fusion for idiopathic scoliosis at least 10 years prior, the incidence of lower back pain increased as the distal end of the fusion was extended. Kitahara *et al.* (6) investigated 311 patients at over 5 years post-surgery and found that 81% of them were in stage I or II of Moskowitz's criteria and 85% were satisfied with the surgical outcome. According to Kohler (7), who used Dwyer's method, no pain was noted in 67% of 21 patients at over 10 years post-surgery, and abnormal lumbar vertebral X-ray findings were noted in 50%. Willer (8) investigated 33 patients with a mean post-surgery follow-up period of 10.8 years. He did not support the common view of an increased incidence of lower back pain after posterior fusion down to the L4 or L5.

We investigated patients who underwent posterior fusion during their adolescent growth period and were followed-up for over 20 years. None of patients had stage

III or IV pain, and there were no patients with a restriction of daily activities or need for medication. Their lumbar vertebral and disc degeneration changes were less severe than anticipated, although more spinal deformity tended to be present in patients with fusion including the L4 or patients who had undergone surgery over 30 years prior. It goes without saying that the extent of posterior thoracolumbar fusion should be as small as possible. As described by Cochran (9), lower back pain was found statistically significantly more often in patients in whom fusion was carried down to the L4 or L5. Ginsburg (10) also reported that, if only one or two disc levels were preserved below the spinal fusion area, back pain occurred frequently. The results of this study indicate that lower back pain may develop earlier in patients who undergo posterior thoracolumbar fusion including the L4. It is important to retain L4 mobility to prevent lower back pain after thoracolumbar fusion for scoliosis. In patients for whom posterior thoracolumbar fusion down to the L4 vertebra is indicated because of their thoracolumbar deformity, for example King's type I, we try to perform thoracolumbar fusion down to the L3 vertebra but not the L4 vertebra in combination with anterior thoracolumbar fusion with Zielke instrumentation. We think that retaining L4 mobility is very important for preventing lower back pain after posterior fusion for scoliosis.

Lumbar vertebral changes were investigated in patients who had undergone posterior thoracolumbar fusion in adolescence and had been followed up for over 20

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years. Symptoms were less severe than anticipated, and radiographic changes were also minor. On the other hand, a tendency for deterioration was noted at over 30 years post-surgery or in patients with fusion including the lower lumbar vertebrae.

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