

THE SURGICAL TREATMENT FOR DEFORMITIES OF THE SPINE IN THE SAGITTAL PLANE

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In this study, we evaluated the results of 25 kyphosis cases, surgically treated at our clinic between 1989 and 1993 and we reviewed the principles of surgical treatment of the deformity.

9 cases had Scheuermann's kyphosis, 8 had posttraumatic kyphosis and 8 had postinfectious kyphosis. The average age was 22.3 (13-42) and the average follow-up was 2.1 years (1-3.2 years).

Preoperatively, 20 patients complained of pain and 8 cases had neurologic deficit. In all cases, except 3 with Scheuermann's kyphosis, we performed anterior and posterior combined procedures and we used CD instrumentation for posterior correction and stabilization.

Average kyphosis angle was 83° (76°-95°) preoperatively, and 38z (30°-62°) postoperatively for the Scheuermann's kyphosis group, and 76° and 42° in the postinfectious and traumatic groups, respectively. All cases with neurologic deficit were able to walk without any external support at the last follow-up. Postoperatively there was no pain in 18 patients, mild pain 4 cases, severe pain in 2 cases and radicular pain in 1 case.

Our cases illustrate that, in posttraumatic and postinfectious kyphosis progressive neurologic deficit predominates the clinical picture and combined procedures are required, however, in Scheuermann's kyphosis pain predominates the picture and, posterior surgery is required in cases with a flexible curve and less than 80 degrees of deformity, and anterior plus posterior surgery are required in cases with a more severe and rigid deformity.

Key Words: Spine, sagittal plane deformity, surgical treatment.

Two deformities can develop in the sagittal plane of the spine. These are kyphosis and lordosis. Although kyphosis is often seen due to several causes, isolated thoracic lordosis is rarely seen and is usually of congenital origin.

A kyphotic deformity is defined as an abnormal dorsal curvature of the spine in the sagittal plane. In the thoracic spine, the curvature can be considered pathologic if it is greater than the upper range of normal, 40° to 45°. In the normally lordotic lumbar spine, any degree of dorsal curvature represents a kyphotic deformity. A configuration with less than normal lordosis (30°-60°), but with maintenance of some ventral angulation, is called hypolordosis.

The anterior elements of the spinal column, vertebral body, intervertebral disc, and associated ligaments resist compressive forces. The posterior osseoligamentous structures resist tensile forces. Deficiencies can be caused by growth disturbances, trauma, tumor, infection, degenerative disease, or iatrogenic processes.

In 1975, Bradford, presented the first large series of patients treated with Harrington compression rods (1). Taylor et al. in 1979 reported a group of patients who underwent Harrington compression instrumentation (17). After these studies reporting high rate of pseudar-

throsis and implant failure, anterior approach has become more important in the surgical treatment of kyphosis. Bradford (2), Herndon (7) reported their results of combined fusion with less complications of this kind, in 1980 and 1981 respectively. In the following years, Luque instrumentation was found inadequate in the surgical treatment of kyphosis (12). The most important development in this subject took place with the use of Cotrel Dubousset instrumentation in 1980s. In 1988 Shufflebarger (15), in 1989 Morin (14) and Lowe (11) reported more successful results with CDI. Denis has made important contributions with the classification and combined procedures he suggested in the treatment of posttraumatic kyphosis (4).

In this study, we evaluated the results of 25 kyphosis cases, surgically treated at our clinic between 1989 and 1993 and we reviewed the principles of surgical treatment of the deformity.

PATIENTS AND METHOD

9 cases had Scheuermann's kyphosis, 8 had posttraumatic kyphosis and 8 had postinfectious kyphosis. The average age was 22.3 (13-42) and the average follow-up was 2.1 years (1-3.2 years).

Preoperatively, 20 patients (80%) complained of pain and 8 cases (32%) had neurologic deficit. In all cases, except 3 with Scheuermann's kyphosis, we performed anterior and posterior combined procedures and

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we used CD instrumentation for posterior correction and stabilization (Table 1).

Table 1. Clinical data of our cases.

| | Scheuermann | | Post-traum.-inf. | |
|---------------------------|-------------|--------|------------------|---------|
| | Preop | Postop | Preop | Postop. |
| Kyphosis angle | 83° | 38° | 76° | 42° |
| Pain | | | | |
| No pain | 2 | 7 | 3 | 11 |
| Mild | 3 | 2 | 7 | 2 |
| Severe | 4 | - | 4 | 2 |
| Radicular | - | - | 2 | 1 |
| Neurologic deficit | | | | |
| Minor | - | - | 4 | 4 |
| Paraparesia | - | - | 2 | - |
| Paraplegia | - | - | 2 | - |

RESULTS

Average kyphosis angle was 83° (76°-95°) preoperatively, and 38° (30°-62°) postoperatively for the Scheuermann's kyphosis group, and 76° and 42° in the postinfectious and traumatic groups, respectively. All cases with neurologic deficit were able to walk without any external support at the last follow-up. Postoperatively there was no pain in 18 patients, mild pain 4 cases, severe pain in 2 cases and radicular pain in 1 case.

There was no neurologic deficit or implant loosening postoperatively. There was one deep infection which required removal of implants. This led to loss of correction but the infection healed.

DISCUSSION

Kyphotic deformities can generally be studied in two groups. The first is regular kyphoses which involve several segments of the spine. These curves can either be rigid or flexible. The second is deformities which can be named as localized or angular. These deformities are usually of traumatic or infectious origin and they are often rigid. Patients with this kind of deformity have a high risk of developing neurologic deficit.

Scheuermann kyphosis is the prototype for discussion of the surgical treatment of regular deformity. Progressive kyphosis despite bracing, intractable back pain, neurologic compromise, or significant deformity

are indications for surgery. Generally, surgical treatment is recommended for curves over 70°. Surgical treatment is rarely indicated in the adolescent. The deformity usually can not be controlled with bracing. Neurologic deficit is rarely seen. Speck and Chopin (16), and Morin (14) reported that full correction can be achieved with only posterior approach by shortening the posterior column without anterior release in patients who are Risser 4 or less. Hyperextension film has great importance here. If kyphosis angle is seen in normal range in this film, posterior approach will be

sufficient. We achieved adequate correction in 3 cases who had posterior fusion and instrumentation according to these criteria. There was no complications such as pseudoarthrosis or loss of correction. None of our cases had neurologic deficit preoperatively.

Surgical treatment indications are pain and severe deformity in adults. In these patients the successful surgical treatment of kyphosis frequently depends on the reconstruction of the anterior column. Without sufficient support in the anterior column, the posterior instrumentation and fusion remain under tension and will fail. Furthermore, adequate correction can only be achieved with anterior release. We also preferred combined procedures in cases who are skeletally mature. There was no pseudoarthrosis in any of our cases. However, there were pain in 80% of cases preoperatively whereas only 22% of cases had pain postoperatively.

Unlike in idiopathic scoliosis, there are no absolute rules in the selection of the fusion levels in Scheuermann's kyphosis. Morin draws our attention to the importance of hyperextension film in the selection of distal fusion level. He stated that it is sufficient to end the fusion at the segment above the disc space with a vertical position in the hyperextension film (14). Hammerberg emphasized that this disk space should also be mobile (6). Some authors suggest that the beginning of lumbar lordosis should be the end level of the fusion (11, 16). We achieved a well-balanced spine

in the sagittal plane by performing both techniques recommended by Morin and Hammerberg. We observed that the sagittal vertical axis was within normal range postoperatively.

Posttraumatic kyphosis is an angular deformity with an increased local kyphosis angle. It is usually the result of a failed treatment of a fracture. The most severe form develops after laminectomy unduly done in an unstable fracture of the spine. There is usually spinal cord compression in this kind of deformities and it is generally accompanied by progressive neurologic deficit (6, 10). Other problems are pain, progressive deformity and instability. Several studies have shown that regional kyphosis of 50° or more is often symptomatic and requires surgical intervention (4, 5, 6, 13). There are four major sources of pain; Persistent instability or nonunion, spinal muscle fatigue, facet overload, anterior cord or root impingement. Apical pain can be resolved by achieving a solid arthrodesis. The symptoms of low back pain resulting from compensatory hyperlordosis and extensor muscle overuse can only be relieved by reduction of the regional kyphosis and restoration of the normal sagittal contours of the spine. Improvement in neurological function is best accomplished by an anterior spinal canal decompression and correction of the local deformity.

Anterior column, which is inadequate in the surgical treatment of this deformity, should be supported. Denis does not recommend anterior fusion alone (4). Correction of local kyphosis with anterior strut grafting alone has also limited success. Anterior decompression and fusion with instrumentation has been shown to increase fusion rates. Kaneda (8), Kostuik (9) reported successful results with their own instruments. Another point of consensus is that anterior procedure only is indicated if posterior elements are intact (3, 4, 5, 6, 13). We can say that posterior instrumentation and fusion after anterior procedure is the standard method of treatment if there is posterior instability. In our series, we performed two stage procedures in cases with posttraumatic kyphosis.

There is a limited indication of posterior approach in the treatment of this deformity. Denis reported that posterior procedure would be adequate in flexible curves and in cases without a significant loss of the anterior column supporting elements (4). In our series there was no case with these specifications.

The treatment of angular kyphoses as a sequel to Pott's disease is generally not different from posttraumatic kyphoses. The most important problems in

these cases are progression of the curvature and development of neurologic deficit.

Harrington and Luque instrumentations have been used extensively for kyphosis and significant disadvantages for each system detract greatly from their usage. Inability to balance sagittal curves, frequent implant failure, high rate of pseudoarthrosis and need for postoperative immobilization are disadvantages of Harrington instrumentation. Neurologic complications, junctional kyphosis adjacent to instrumented segments are disadvantages of Luque instrumentation. Versatility of Cotrel-Dubousset instrumentation in hook placement, rod contour, and application of corrective forces represents a significant improvement over these systems. Posterior stabilization with CDI makes postoperative rehabilitation much easier. Walking and return to daily activities are more rapid. But the high cost of the implant is a disadvantage of this instrumentation.

CONCLUSION

Our cases illustrate that, in posttraumatic and postinfectious kyphosis progressive neurologic deficit predominates the clinical picture and combined procedures are required. The deformity is stabilized with minimal correction in conjunction with anterior spinal cord decompression. However, in Scheuermann's kyphosis pain predominates the picture. Posterior surgery is required in cases with flexible curve and with less than 80 degrees of deformity. Anterior and posterior surgery are required in cases with a more severe deformity. In our experience CDI provides an excellent correction and fixation in these cases.

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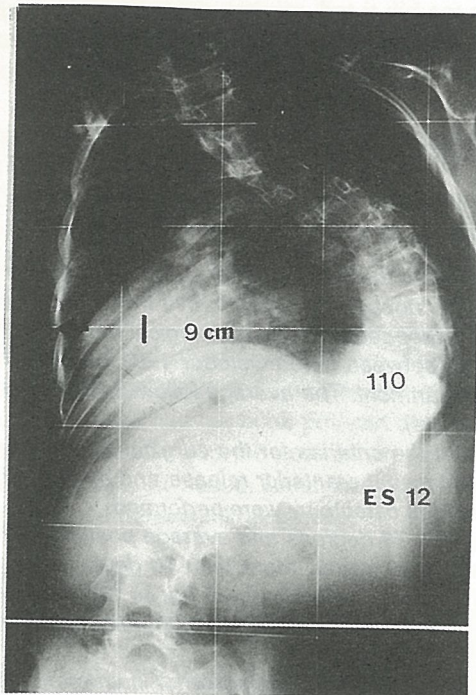


Figure 1.A.

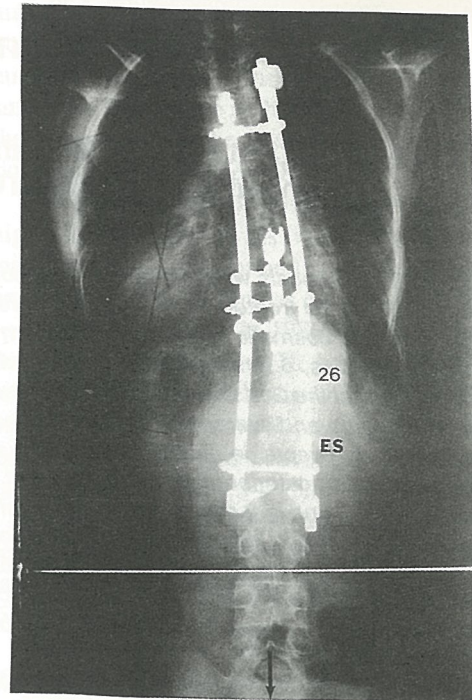


Figure 1.B.

Figure 1: A case with Scheuermann's kyphosis treated with combined surgery.

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