

FOLLOW-UP RESULTS OF PATIENTS WITH SCOLIOSIS TREATED BY HARRINGTON SYSTEM

An Analysis Of The Clinical Value of Progression

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From 1980 to 1989, 110 scoliotic patients treated by Harrington system at Hacettepe University were selected for this study. But, only 52 patients had satisfactory documents for study follow-up evaluations and were thus included in this search. Twenty-four were males and twenty-eight were females, whose at operation ranged from 6 to 18 years, with an average 12.4 years. 15 of our patients were treated with posterior fusion alone, 28 with a single Harrington distraction rod, 4 with double Harrington rods, 2 with subcutaneous Harrington technique, one with a Harrington rod and sublaminar wiring, one with a Harrington rod and sublaminar wiring, one with anterior and posterior fusion without instrumentation, and one with Dwyer instrument. We found that the Harrington system produces predictable correction of spinal deformity. When compared with other newer systems, it is less difficult, requires less operating time and blood loss to insert, and costs substantially less.

Before 1960, the surgical treatment of patients who had scoliosis, consisted of posterior fusion followed by application of a Risser localizer cast, from 1960 to 1980, posterior spinal fusion with the Harrington instrumentation was the surgical procedure of choice. The Harrington system was the first effective instrumentation for treatment of scoliosis. Still widely used, it is the standart with which newer systems must be compared.

Numerous systems of instrumentation have been used over the years, including the Harrington distraction rod, distraction and compression rods, sometimes with a transvers loading device, and the Harrington distraction rod with sublaminar wires.

In Department of Orthopaedic Surgery, Hacettepe University, Harrington instrumentation with posterior fusion were done since 1978. The long-term results on surgically treated scoliotic patients have also been documented in the literature. It is thus important to investigate the effects of that made of treatment regarding the change of degrees of deformity, the rigidity of fixation, safety, ability for maximum preservation of spinal mobility, technical complexity and the case of postoperative care.

We report on the out-comes of fifty four patients who had scoliosis that was treated by Harrington systems, between 1980 and 1989.

MATERIALS AND METHODS

The hospital charts of 90 patients treated with Harrington systems and posterior fusion or posterior fusion alone, during a ten year period were reviewed.

Only 52 patients had satisfactory documents for study follow-up evaluations and were thus included in this search.

The technique of arthrodesis remained essentially unchanged during this ten years. All patients had a one staged posterior approach. After careful subperiosteal exposure preparation of the sides of placement of the hooks, the facets were excised. Decortication was performed, usually after the placement of the rods and the hooks for diminishing blood loss. Fusion levels extended from one level above the measured curve to two levels below the curve if the end vertebra was in the stable zone, as Harrington himself, stated. Autologous iliac bone used graft in the vicinity of the patients, but sometimes we used allograft (bone bank) for long fusions.

The radiographs and summaries of the charts were reviewed for all the patients. The AP and LAT. radiographs are measured by the method of Cobb. The charts provided information about the patients age at admission, as well as the Risser sign and RVAD, surgical procedure, operation time, type and duration of

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post-operative immobilization and complications.

There were 24 males (46,1 %) and 28 females (53,9 %). The mean admitting age was 11.08 years, ranging from 2 months to 18 years.

Their diagnosis were as follows : 12 congenital scoliosis (23 %), 8 neuromuscular scoliosis (15.4 %), 4 neurofibromatosis (7.8 %), 4 infantile idiopathic scoliosis (7.8 %), 12 juvenile idiopathic scoliosis (23 %), 12 adolescent idiopathic scoliosis (23 %).

The average age at the time of surgical intervention was 12.4 years.

RESULTS

Classification of curve patterns were done according to Bradford. The more structural and deforming curve is called as a major curve and the less structural and deforming as a minor curve. Two of the patients were grouped to have a single major high thoracic curve, 37 had single major thoracic curve, 12 with single major thoracolumbar curve, and 1 with a single major lumbar curve.

15 of our patients were treated with posterior fusion alone, 28 with a single Harrington Distraction rod, 4 with double Harrington rods, 2 with subcutaneous Harrington technique, one with a Harrington rod and sublaminar wiring, one with anterior and posterior fusions without instrumentation, and one with Dwyer instrument. All the patients undergone spinal instrumentation were also had spinal fusions except subcutaneous technique.

An average of 3 units of blood were transfused during surgical interventions and the mean operation time was V^d hours.

Patients were immobilized with a Risser cast on an average of 8 months, subsequently 8 months more with braces.

The mean follow-up time was 3.41 years.

For the entire group of 52 patients, the average scoliosis was 58 degrees prior to surgical intervention. It is reduced to a mean 41 degrees postoperatively, and measured on an average of 55 degrees at the latest control. Thus, average correction was 17° (29 %), and the average loss of correction was 14° (34 %).

The average scoliosis angle, correction and loss of correction were listed in Table 1 according the scoliosis type and curve patterns.

Among the 14 idiopathic scoliosis patients with whom RVAD measured compared less than 20° , the mean progression of scoliosis angle was 10° . When compared to 15 patients with a RVAD measured more

than 20° who had 15° of progression since spinal surgery, this indicates the significance of RVAD for prognosis.

We also looked for the prognostic value of the Risser sign at the time of admission. The average progression of scoliotic curves were shown according to the Risser sign in Table 2. This was found less significant.

At the follow-up period 6 patients were seen with breakage of the Harrington rods and pseudoarthrosis, 4 patients with hook dislodgement, 5 patients with prominence of the rods, and 3 with cast wounds and noted as complications. We did not see any deep wound infections, pneumothorax or permanent neurologic involvement.

DISCUSSION

The surgical management of scoliosis has undergone remarkable changes in the past 10 to 15 years. Indications have become more precisely defined, techniques have been greatly advanced, and as consequence results have been vastly improved. With recent advances in the surgical management of scoliosis, the ideal result should consist of the following :

1. Complete or near complete correction of the curvature,
2. Correction of the vertebral rotation and the rib hump,
3. Preservation and restoration of the physiologic sagittal curves,
4. Avoidance of a long fusion and,
5. low incidence of pseudoarthrosis.

Numerous of systems have been developed since Harrington's original system, yet there are few data that directly compare their effectiveness in the treatment of scoliosis. Each instrumentation system needs to be evaluated from different aspects listed above. Also the technical complexity and overall cost of the instrumentation systems are important.

Satisfactory results using the Cobb angle have been obtained using standard Harrington instrumentation alone. Correction at surgery of 44 % to 70 % were reported. In this study, we have 29 % of correction rate. Although low, we think it is because of a somewhat high mean scoliotic curve (58°) prior to surgery and because of the congenital scoliotic cases which correction has not attempted. Meanwhile, it is became apparent that Harrington instrumentation does not correct the thoracic hypokyphosis or lordosis and in many cases, worsens the sagittal alignment. Normal lumbar lordosis is desirable for energy consumption in ambulation, cosmesis and possible pain prevention. We advise rod contouring besides Moe's

Scoliosis Type	No.	Admit Age	Conserv. Follow-up	Operation age	Pre-op Angle	Post-op Angle	Risser Sign	Follow-up Angle	Correction Angle	Loss of correction
Congenital Scoliosis	12	10	0.8	10.8	55	54	2	68	1	25.9 %
Neuromuscular Scoliosis	8	11.3	1.8	13.1	73	47	2	62	26	31.9 %
Nurofibromatosis	4	8.5	0.7	9.2	53	44	0	67	9	52.2 %
Infantil Idiopathic Scoliosis	4	5.5	4.7	10.2	58	41	1	56	17	36.5 %
Juvenil Idiopathic Scoliosis	12	12.3	1.2	13.5	64	34	2	46	30	35.5 %
Adolescent Idiopathic Scoliosis	12	15.2	0.4	15.6	47	28	3	40	19	42.8 %

Table 2.

Risser Sign	No.	Average Progression of Scoliotic Curves
0	23	17°
1	1	12°
2	0	-
3	6	6°
4	14	14°
5	8	15°

modification of the Harrington system, using square end rods and hooks for decreasing this morbidity.

The quality of fixation is determined by the maintenance of correction obtained at surgery and ability to reduce the post-operative immobilization. A single Harrington distraction rod is dependent on two hooks where all the stress is applied. Bone grafting is necessary to accomplish a solid spinal arthrodesis, without which the Harrington system will ultimately fail. In the literature the loss of correction reached up to 11 % at two years follow-up. Although our follow-up time was much longer we have a considerable higher loss of correction (34 %). It is shown that, curve progression occurs in the face of thick fusion masses as well as rigid instrumentation. Since a vertebra grows from three centers, two of them being at the base of each

pedicle, posterior fusion alone would not arrest all remaining spinal growth. As growth occurs in the presence of a posterior fusion, the spine turns around the axis of the fusion mass with gradual progression of the deformity. This indicates anterior fusion combined with a posterior one more frequently as we do since the last two years in our department.

We believe that, concerning the neurologic problems, the Harrington instrumentation is much safer than the newer techniques, if the spine is not overdistractioned. We didn't see any permanent neurologic sequela by this technique.

We use the compression system to enhance fixation of the thoracic spine, to aid in the reduction of thoracic hyperkyphosis. But, because the fusion rate in the thoracic spine is so satisfactory when using a single distraction rod, performing a careful facet fusion, and using post-operative external fixation we don't recommend its usage routinely. Meanwhile, it is obviously contraindicated in patients with thoracic hypokyphosis.

Double distraction rods were used in severe thoracic curves to increase the stability and as a safety factor against hook dislodgement. Post-operative cast immobilization varies from 4 to 8 months in the literature. We routinely use it for 8 months and limit vigorous physical activities for at least 14 to 16 months by

bracing to ensure a consolidated mature spinal arthrodesis.

CONCLUSION

With the experience of more than ten years we found that the Harrington system provides predictable correction of spinal deformity. Its implantation requires minimal invasion of the spinal canal and is associated with a low incidence of neurologic complications. When compared with other newer systems, it is less difficult, requires less operating time and blood loss to insert, implants a smaller mass of metal, and costs substantially less.

Conversely, it has some disadvantages. It has limited ability to provide sagittal plane control. Loss of correction is higher and it is necessary to use post-op external support for a longer period. And it does not derotate the spine.

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