

SUBCUTANEOUS ROD INSTRUMENTATION WITHOUT FUSION FOR TREATMENT OF SCOLIOSIS

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ABSTRACT:

One of the major problems in treatment of scoliosis is the difficult curves of children that require immediate attention. Subcutaneous rod instrumentation (SCR) has been suggested for such curves that could not be controlled with conservative methods.

Sixteen patients (7 girls and 9 boys) treated with SCR instrumentation were evaluated retrospectively. The average age at time of surgery was 7 years. Ten patients had idiopathic scoliosis, two had neuromuscular and the rest were patients that had complex syndromes associated with scoliosis. The curves had an average Cobb angle of 55 degrees. The patients were instrumented with subcutaneously placed rods without fusion as described by Moe. The surgical procedure was performed in 7 patients after a trial of conservative treatment and in 9 patients after the first evaluation because of their significant deformity. The instruments that were used included 11 Harrington rods, 7 Isola rods and 1 TSRH rod. Four patients had a posterior fusion as a definitive surgery after an average of 55 months follow-up. The total number of operations per patient was 4. At last follow up (average 70 months) the average Cobb angle was 50 degrees. Fourteen complications occurred in 8 patients (3 rod breakages, 2 rod dislocations, 3 infections, 4 hook dislocations, 2 pressure sores due to the rods).

Conclusion: In small children with scoliosis that have a significant growth potential and risk for progression, SCR instrumentation without fusion is an effective alternative in management.

Key Words: Subcutaneous rod, Scoliosis, Surgical treatment

INTRODUCTION

There has been a significant progress in the treatment of adolescent scoliosis, but severe curve of children with a significant growth potential remains as an unsolved problem. Conservative treatment of a severe curve with braces is not always successful and early fusion causes short trunk height and other complications (4, 6, 14).

Internal fixation without arthrodesis has been proposed for severe spinal deformities of young children. The concept was developed by Paul Harrington (5) and was used by other authors with some modifications (4, 9, 12, 16). In 1979 Luque and Cardoso (7) reported a new instrumentation system using segmental spinal instrumentation without arthrodesis. Experiences with this system so called "Luque-Trolley" was later presented by other authors (3, 8, 10, 11, 15, 17).

Previous reports do not provide enough scientific evidence in favor of any of these treatment modalities. In this study we evaluate our patients treated with subcutaneous rod instrumentation to provide additional information.

MATERIALS AND METHODS

Sixteen scoliotic patients with an average age of 7 (range 3.5 to 11) years were subjected to subcutaneous rod instrumentation without arthrodesis between 1986 and 1994. There were 7 female and 9 male patients. All patients had a significant growth potential determined by their biologic age and secondary sexual development. None of them had secondary sexual development, and the Risser sign was 0 in all. Ten patients had juvenile idiopathic scoliosis, 2 had neuromuscular scoliosis, two had arthrogryposis multiplex congenita, one had Golden-Haar syndrome and one had Pierre-Robin syndrome.

Cobb angles prior to surgery was an average of 55 (range 46 to 83) degrees. Seven patients had an initial trial of bracing. In 9 patients, surgery was used as the first step because of significant deformity and fear of rapid progression.

Patients were instrumented with subcutaneously placed rods without fusion as described by Moe, and were immobilized in a Risser cast postoperatively. At the sixth month, the cast was removed and the patient was instructed to wear a Milwaukee brace full time.

Fourteen Harrington rods, 4 Isola rods and 1 TSRH rod were used as the initial instrumentation.

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Later, 3 of the outgrown Harrington rods were replaced with Isola rods and 3 broken Harrington rods were replaced with the same kind of rods. The newer instrumentation systems were used according to Harrington's distraction principle. All of the patients were followed regularly every 6 month. Periodic distractions were performed when an angle loss of 15° from the corrected curve occurred. The average time period between distractions were 9 (range 6 to 15) months.

Posterior fusion as a definitive surgery was performed in 5 patients after an average of 55 months (Range 11 to 90) after initial surgery. The average age at the time of definitive surgery was 12.5 (Range 10 to 13) included 3 Harrington rods and 1 Luque rod inserted segmental spinal instrumentation and 1 Isola system.

RESULTS

While 5 patients have received definite treatment, 11 patients are currently in the study and all 16 are under continuing follow-up. One patient that has shown progress and is candidate for a definitive fusion has refused our recommendation. However this patient is still currently under follow-up and is within our group of patients. The average follow up was 70 (Range 9 to 104) months. Until now the number of surgical procedures performed for the study was 65. This is equal to an average of 4 procedures per patient.

Average postoperative measure of the curves after the first operation was 25 degrees and after the last procedure it was 41 degrees.

Average age at the time of definitive surgery was 12.5 (range 10 to 13) 4 years. One of the patients with idiopathic scoliosis reached the skeletal maturity and has undergone definitive surgery. The remaining 4 patients had uncontrolled severe curves despite the treatment and they were treated by arthrodesis as they were considered to have insignificant growth potential. The average measure of the pre and postoperative curves were 55 and 30 degree, respectively. After an average follow up of 27 (Range 6 to 59) months, measure of the curves was found to be 42. During the definitive operation, it was found that there was fusion only at the extremities of the curves where the hooks were placed.

Eight patients had 14 complications consisting of 3 rod breakages, 2 rod dislocations, 3 infections, 4 hook dislocations and 2 pressure sores over the rods. Seven of these 14 complications including 2 rod breakage occurred in two patients with paralytic scoliosis. Our

treatment method failed in these two patients. One of them was fused before reaching definite skeletal maturity but the other one did not accept fusion. The remaining complications did not affect the course of the treatment.

DISCUSSION

While some of the severe scoliotic curves in young children are readily controlled by orthoses, most of them are not responsive to conservative treatment. Dimeglio (1) reported that posterior arthrodesis performed in children younger than 5 years causes a loss of 5 cm in the sitting height between T1-S1 segments. He also pointed out that this loss increases to 15 cm when perivertebral arthrodesis is performed. When pure posterior arthrodesis is performed in children younger than 10 years with a Risser sign of 0, growth causes the Crankshaft phenomenon (2). Perivertebral fusion is the preferred method of treatment in these patients. Undoubtedly the latter method of treatment may cause short trunk height. Many authors have reported short trunk height, residual lordosis, rib rigidity and adding of rib vertebral joint in the fusion mass as the complications of fusion performed before skeletal maturity (4, 6, 14).

In 1962, Paul Harrington's (5) article has been a guideline for many surgeons. After his study Moe, (13) Marchetti, (9) Mc Niece (12), Gillespie (4) and Tello (16) have reported their experiences with SCR instrumentation without fusion performed according to Harrington's principles (5). The consensus of these papers is that, this treatment method is the most acceptable alternative in the managing of young children with severe scoliosis despite its high complication rate. One of the most important disadvantages of this technique is the need to use braces full time.

In 1979 Luque (7) has opened a new era by performing segmental spinal instrumentation without fusion. This system, later called as Luque-Trolley was superior to Harrington's method and its advantage was that a brace was not necessary. Later, many authors, have reported their experiences with this new treatment method (3, 8, 10, 11, 15, 17). The major disadvantages were; the enhanced possibilities of rods breaking, and the presence of the extensive fibrous tissue around the implants that impedes reoperations (3, 10).

The goals of treatment with this method is to keep the curve at an acceptable degree until the growth potential of the child ends, so that the spinal growth

would not be hampered by the fusion. In our study, the average curve was 55 degrees preoperatively 25 degrees after the first operation, 41 degrees after the final procedure and 50 degrees in the last follow up. These results imply that, at least we were able to stabilize the curve which could probably deteriorate if left untreated. The results at the final follow up indicate that the time interval between distractions should be kept shorter.

Five patients were treated with definitive surgery. Of these, one had this treatment modality as she completed her growth spurt while the remaining four had surgery because of deterioration in their curves. These patients average curves soon after the definitive surgery and the last follow up were 30 degrees and 42 degrees, respectively. This loss of correction was attributed to Crankshaft phenomenon. These results imply that an anterior fusion should be performed for a better outcome.

Fifty percent of the patients had complications and this was comparable with Moe's study (13) it is worthwhile to mention that half of the complications seen in 8 patients occurred in 2 patients with neuromuscular scoliosis. The increased rate of complications in these patients may be due to the collapsing nature of the curves putting more stress on the implants. Our patients population is not enough to support this conclusion.

Another striking result was the lack of complications with the newer instrumentation systems at 21 months of follow up. This was attributed to the ability to form a claw at the proximal hook site and better connections of the rods with hooks. Sagittal curve correction and maintenance of normal curves was possible with newer systems. But even these implants cannot be as stiff as the biologic fusion so that external immobilization still should be used to avoid potential rod failures.

When conservative methods can not control the curvatures of the scoliotic children who still have a significant growth potential, subcutaneous rod instrumentation without fusion is an effective alternative.

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