

## CONGENITAL SCOLIOSIS

### Moderate Term Results of Surgical Intervention

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*Forty-three patients with congenital spinal deformities, that had surgical treatment in Hacettepe University hospitals are presented. Average patient age at the time of surgery was 11.0 years, 15 patients were males 28 were females.*

*Average pre-operative Cobb measurement was 71.1 degrees and was corrected to an average of 58.6 degrees. The patients were analysed according to the different types of surgical procedures utilised. Twenty patients have only had posterior fusions, eight patients both anterior and posterior fusions and 15 patients had anterior or posterior instrumentation procedures. Seventeen patients overall had both anterior and posterior surgeries with or without instrumentations.*

*Average follow-up period was 39,7 years. It was seen that instrumented patients had the best percentages of correction, while those that had two stage surgeries had the best maintenance of their corrections.*

*There were three complete and two incomplete neurologic complications, none in the post fusion only group, two in the anterior and posterior fusion w/o instrumentation group and three in patients that had undergone anterior and posterior surgeries with instrumentations.*

*It is concluded that anterior and posterior surgical procedures coupled with spinal instrumentation do give better cosmetic and functional results but carry a substantial risk of neurologic complications especially if not performed with utmost care.*

Congenital spine deformities have long been overshadowed by the large number of idiopathic deformities and cases of tuberculosis in some countries and only recently have gained the attention of spinal surgeons in major spinal surgery centers. The natural history of congenital spinal deformity can be very mild or incredibly severe and is not as clearly defined as its idiopathic counterpart yet.

Congenital spinal deformities have been classified according to the type of anomalous malformation as:

- defects of segmentation
- defects of formation
- mixed types, which are the most common, as it

is very rare to see cases of pure segmentation or formation defects. The severity of congenital deformities are mostly effected by the type of malformation, the balance of malformation and of less importance is the location of the deformity.

Congenital spinal deformities are known to be the most common cause of non-infectious paraplegia and may cause severe disabilities and even death because of the restriction of the respiratory system and resultant cor-pulmonale.

The treatment of congenital spinal deformities is one of the biggest challenges of spine surgery. In-situ fusions from posterior although being safe, are far from correcting the existing deformity, and progression of the deformity have been a serious problem due to high rates of pseudoarthrosis and probably due to the crank-shaft phenomenon that has been shown to exist in congenital deformities as well. Anterior and posterior in-situ fusion appear to overcome this problem and curve progression is rare and ignorable after this type of surgery, but as can be appreciated without the use of any corrective measure, the ability to correct the existing deformity, which may be very disabling for the patient, is limited. Use of traction between the stages of anterior and posterior surgeries have been advocated so as to obtain adequate correction while the patient is awake and can be readily monitored for any neurologic complication.

Instrumentation of the spine gives the surgeon best correction rates but has been shown to cause an increased risk of neurologic injury. Using distraction instrumentation and vertebral osteotomies have been shown to have a substantial risk of neurologic injury, especially in patients with pre-existing neurologic deficits.

## MATERIAL and METHODS

The retrospective analysis of 43 patients with congenital scoliosis that were treated surgically is presented. Average age at the time admittance to our hospital was 11.0 +/- 4.4 years, ranging from one to eighteen years. 15 patients were male and 28 female.

Average Cobb measurement at the time of surgery was 71.1 +/- 21.7 degrees (median 69.8 deg.) ranging from thirty-three to one hundred and thirty degrees.

One patient had a myelomeningocele, one a mediastinal neuroenteric cyst, one Klippel-Feil syndrome, one had congenital dislocations of both hips, one bilateral pes equino varus, and three had diastometamylia along with their congenital scoliotic deformities.

The patients were divided into three groups for the analysis of their correction ratios and into four groups for the analysis of the maintenance of the correction and the comparison of the complication incidences of different treatment modalities. The first group consisted of twenty patients to whom only posterior in-situ fusions were performed, the second group of eight patients that had both anterior and posterior fusions with or without strut grafting and the third group of fifteen patients that have been instrumented from either anterior or posterior, with or without the fusion of the reverse side. The fourth group for the analysis of the losses in correction or the progression of the deformities and the rate of complications consisted of fifteen patients, eight of them from the second group and seven from the fourth, that had both anterior or posterior surgeries with or without instrumentations.

The instrumentations used were single or double Harrington rods in six patients, one with sublaminar wiring of two segments, Hartshill rectangles in five patients, Webb-Morley anterior instrumentation in one patient and Alici, C-D and Isola instrumentations in one patient each.

Average follow-up period was 39.7 +/- 34.2 years overall, 60.3 +/- 37.5 months for the first group, 21.6 +/- 13.0 months for the second, 21.9 +/- 19.7 months for the third and 19.0 +/- 12.4 months for the fourth group.

Four patients had symptoms of neurologic involvement at the time of surgery, three of them spastic paraparesias, and one incomplete anterior cord syndrome in a predominantly kyphotic patient. There were four neurologic injuries related to surgery. Three patients had complete paraplegias and one had incomplete paraplegia, one of the three complete lesions resolved partially, while the incomplete one resolved completely after instrument removal.

Seven patients had to have repeat surgeries, three of whom had anterior fusions added to their posterior fusions because of progression, two had osteotomies of the posterior fusion mass, anterior discectomies and third stage posterior instrumentations, two had operations for instrument removal immediately preceding the definitive surgery and one of these patients also had an operation for exploration of the anterior fusion mass because of the progression of the deformity.

Cast immobilisation for periods varying from three to twelve months were used in thirty-five patients, and eight patients were braced, the average overall immobilisation period being 8.2 +/- 3.4 months.

## RESULTS

The average preoperative Cobb measurement of our patients was 71.1 degrees and was decreased to an average of 58.6 degrees. The average of percentage of correction, defined as the percentage of decrease of the Cobb measurement of the deformity that was achieved by surgery in this study was 17.0 +/- 20.6 percent. The highest correction obtained by surgery was seventy percent in one patient. Twenty of the patients were found to have no correction by surgery.

Average preoperative measurement for the first group of patients was 64.3 degrees, ranging from 33 degrees to 100 degrees, which could be corrected to only 60.7 degrees, ranging from 25 degrees to 110 degrees due to a collapsing deformity. Average correction in this group was 2.5 percent maximum correction being 21 percent of one patient.

Average preoperative measurement for the second group was 77.5 degrees ranging from 50 to 110, which was corrected to an average of 65.6 degrees, ranging from 35 to 100 degrees. Average correction in this group was 14.6 percent maximum being 33 percent.

As for the third group of patients who were instrumented, average preoperative measurement was 76.9 degrees that was corrected to 49.4 degrees with an average correction of 37.5 percent ranging from 0 to 70 percent. The percentage of correction achieved in the instrumented group was significantly higher than the other patients ( $p < 0.00001$ ).

The loss of correction that had been obtained or the progression of the deformities were analysed in four groups of patients that were described above. The average rate of progression in the first group was 29.6 percent, maximum being 100 percent. Average rate for the second group was 10.0 percent, with a maximum of 40, average rate of the third group was 25.1 percent,

highest value being 140 percent of one patient whose instrumentation had to be removed because of a neurologic complication and the spine collapsed to a worse deformity than that existed before the surgery. The average rate of progression for the fourth group, consisting of patients that had both anterior and posterior surgeries was 16.3 percent, with a median of 0.4 percent, the patient described above causing the arithmetic mean to rise.

The difference in the rate of progression between neither the instrumented patients and the others ( $p = 0.91925$ ) nor those with two sided surgeries and the others were significant ( $p = 0.18730$ ).

In spite of the fact that three patients that were instrumented out of fifteen had neurologic complications, the effect of instrumentation on neurologic complications could not be demonstrated ( $p = 0.4430$ ). On the other hand, two stage anterior and posterior surgeries were found to have significant risks of neurologic injury ( $p = 0.0129$ ). Pre-existing neurologic involvement did not significantly increase the risk of neurologic complications ( $p = 0.1202$ ). Sub-laminar wiring, that had been used in seven patients in the present series could not be shown to have any adverse neurologic effects ( $p = 0.3600$ ).

## DISCUSSION

The series presented here is the retrospective analysis of our hospital's experience on the surgical treatment of congenital scoliosis, that is spread over a period of fifteen years. The knowledge on the deformity, and surgical technologies have consistently evolved during this long period rendering the use of a standard surgical modality almost impossible, giving us the chance to compare different types of treatment used. The severity and rigidity of the deformities in these different groups were similar, only significant difference between the groups can be found in the observation periods, anterior surgery for congenital scoliosis having a six years history in our hospital.

Analysing the data presented above, it appears that surgical instrumentation of the deformities leads to significantly higher correction rates than low-risk fusions, but it should be kept in mind that although the difference could not be shown to be significant, instrumented cases have a higher incidence of neurologic complications.

It is interesting to see that the progression rates of deformities have been more or less similar between the groups compared, partly due to complications. The

seemingly better rates for the preservation of correction and halting the progression of the deformities in the instrumented patients or those having undergone two stage fusions were devastated by the high rates of complications encountered in these patients. It should also be kept in mind that the follow-up periods of the latter groups are shorter, making an unbiased comparison for long term results almost impossible.

Our series has an unacceptable rate of neurologic complications (five out of forty-three patients, 11.7 percent) some of which could have been avoided by more careful preoperative planning and better surgical techniques. Having analysed the patients retrospectively, we concluded that we could have avoided the neurologic complications in two of our patients. One of these were due to the violation of the spinal canal during posterior decortication and the other was due to a misinterpretation of the mechanics of the existing deformity.

Of the other three patients one had an incomplete neurologic injury because of the sublaminar wires that had completely resolved after they were removed, one had a vascular complication during anterior surgery, most probably decreasing the blood supply of the cord, and the last patient, a two years old girl with high thoracic deformity had acute respiratory distress after her second stage anterior surgery, necessitating a tracheostomy, causing the released spinal column to collapse because of the dislodgement of the grafts.

It is concluded that, so as to achieve better results in the surgical treatment of congenital spine deformities, it is of utmost importance to decrease the high rate of complications which we think will only be possible by having such interventions performed only by surgeons experienced on the subject.

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