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Surgical treatment of adult idiopathic scoliosis – comparison of two instrumentations

Accepted: 22 January 2002 / Published online: 26 April 2002
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Abstract In this study, 22 women patients with adult idiopathic scoliosis treated surgically with Cotrel-Dubousset instrumentation (CDI) or Texas Scottish Rite Hospital instrumentation (TSRHI) were followed up for 56.2 ± 4.0 months. The overall immediate and final corrections were respectively 21.5 ± 4.0 (58%) and 26.6 ± 2.90 (48%), giving a loss of correction of 5.1 ± 1.00 (10%). No significant differences were found in these two parameters between the two groups. The functional outcomes were good in 21 patients. There was no difference between CDI and TSRHI in deformity correction.

Résumé Nous avons traité chirurgicalement 22 malades féminins atteints de scoliose idiopathique de l'adulte avec l'instrumentation Cotrel-Dubousset (CDI) ou l'instrumentation de l'Hôpital du Texas Scottish Rite (TSRHI). Ils ont été suivis pendant 56.2 ± 4.0 mois. La correction immédiate et la correction finale étaient respectivement de $21.5 \pm 2.4^\circ$ (58%) et de $26.6 \pm 2.9^\circ$ (48%), avec une perte de correction de $5.1 \pm 1.0^\circ$ (10%). Les résultats fonctionnels étaient favorables pour 21 malades. Basé sur notre expérience et conclusions, les résultats de la chirurgie chez l'adulte avec scoliose idiopathique étaient favorables. Il n'y avait aucune différence entre CDI et TSRHI dans la correction de la difformité.

Introduction

Idiopathic scoliosis in adults may lead to progression of the curve, disabling pain and fatigue, cardiopulmonary symptoms and high rates of mortality and morbidity [9]. Surgical treatment is more difficult than that of adoles-

cent idiopathic scoliosis [6,32], with a high rate of complications [1, 9, 12, 14, 18, 24, 30,32]. However, favourable surgical results have been reported with improvement of pain relief, social function, physical function and self-image among the patients in whom fusion is achieved [1, 9, 12, 14, 18,30].

Cotrel-Dubousset instrumentation (CDI) has become the treatment of choice for idiopathic scoliosis since its introduction in 1984 [12,27]. It was designed to provide sufficient stability to achieve three-dimensional correction through distraction and compression of hooks or screws and derotation of the rod. The design eliminated the requirement of post-operative bracing [8,10]. Although the design of implants is different from CDI [5], the Texas Scottish Rite Hospital instrumentation (TSRHI) introduced in 1988 uses the same principles for correction through compression, distraction and derotation [25]. It has been shown to be biomechanically superior to CDI in providing stability [16]. Satisfactory results have been obtained by using these forms of instrumentation in the surgical correction of adolescent idiopathic scoliosis [2, 3, 4, 5, 8, 11, 13, 20, 21, 25, 26, 28]. However, there is little information on their use for the treatment of adult idiopathic scoliosis [2,26]. We compared the long-term results following the treatment of adult idiopathic scoliosis using these two methods of instrumentation.

Materials and methods

Twenty-two women patients with adult idiopathic scoliosis were studied; 11 were treated with CDI (CDI group) and 11 with TSRHI (TSRHI group). All operations were performed between December 1989 and July 1996 by a senior orthopaedic surgeon. The operations consisted of posterior correction with instrumentation and fusion with autogenous bone graft. After correction of the curve an intra-operative wake-up test was used to monitor the neurological status of the patient [31]. Mobilisation started on the third post-operative day and the patients were reviewed at 6 weeks and 3, 6 and 12 months after operation. The patients were thereafter reviewed annually to a mean of 104 months (56.2 ± 4.0). At each visit, a triple film of the whole spine was taken. The operat-

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ing time, estimated blood loss, coronal curves, flexibility of the curve and rotation of the apical vertebra were analysed. The coronal curves were measured using a standard triple film and a side-flexion film as described by Cobb [22]. Rotation of the apical vertebra was determined by the method described by Perdriolle [23]. The rotational angle of the adjacent vertebra was compared by determining whether the pedicle of the apical vertebra was obscured by the implant [29]. Parameters from the radiographs were recorded by two surgeons who were not involved in the surgery.

The severity of back pain, the frequency of using analgesia, physical conditions (conditions of working and daily living) satisfaction with the surgical results and the willingness to choose surgery again under the same pre-operative circumstances were assessed by questionnaire [21]. Each patient was interviewed and examined by an attending orthopaedic surgeon who was not involved in the surgery. Data were expressed as a mean±standard error of the mean (SE). Statistical analysis was performed by the Student's *t*-test and *P*<0.05 was considered to be statistically significant.

Results

The mean age of the patients was 26.8 (20–58) years at the time of surgery. According to the King-Moe classification [17], five patients belonged to type I, five to type II, four to type III and one to type IV. The remaining seven were denoted as thoracolumbar or lumbar [19]. The coexistence of back pain and deformity was the most important indication for surgery, although three patients had only back pain and six had only deformity.

The overall mean operating time was 307.0±13.0 minutes. Although the implantation of TSRHI was slightly less time consuming, there was no significant difference in the operating time between the two groups (CDI 322.3±16.04 min, TSRHI 291.08±20.6 min *P*>0.05). The mean blood loss was 1169.8±134.1 ml with no significant difference between the two groups (CDI 1353.2±214.9 ml, 986.4±160.2 ml, *P*>0.05).

Before operation, the overall coronal flexion curve was 25.09±2.90 (50%). The overall immediate correction was 21.5±2.040 (58%) and the final correction was 26.6±2.090 (48%), giving a loss of correction of 5.1±1.00 (10%). Although there were no significant differ-

ences in the coronal flexion curve, immediate correction and final correction between the two groups (*P*>0.05), the TSRHI group (7.3±1.70) had a significantly higher loss of correction than the CDI group (2.9±0.90) (*P*=0.025) (Table 1).

The overall immediate correction of the rotation of the apical vertebra was 24.0±2.50 (23%) and the final correction was 25.5±2.50 (17%), giving a loss of correction of 1±1.10 (5%). There was no significant difference in these values between the two groups (*P*>0.05).

Complications occurred in four patients. There was one intra-operative dural tear, which was successfully treated by primary repair. One patient had CD pedicle screw breakage at the caudal segment without related symptoms. Further surgery was performed on the remaining patients because of late complications and impingement of the device on the skin.

The patient with non-union requested implant removal due to skin impingement; however, she declined further surgery for the pseudarthrosis, and her post-operative subjective outcome was worse than her pre-operative condition. These patients received conservative treatment for more than 6 months before operation; 16 suffered from back pain and 11 required regular analgesia. At follow-up, 14 were free from pain and none required analgesia, apart from one with a non-union who required analgesia occasionally. One had occasional minor back pain but with improvement from the pre-operative situation and did not require analgesia. After operation, 15 patients reported improvement in physical function, six recovered to the pre-operative stage and the patient with non-union experienced slight restriction in her physical activity. All except the latter returned to their pre-operative working capacity and activities of daily living. Sixteen patients were very satisfied with the results of surgery, four were satisfied and one was not satisfied but considered the result acceptable; the patient with non-union was disappointed with the results. Seventeen patients would definitely have undergone the operation again under the same pre-operative circumstances; three probably would have, one was not sure and the patient with non-union definitely would not have.

Table 1 Correction of the major curve in 24 women patients with adult idiopathic scoliosis by Cotrel-Dubousset instrumentation (CDI) or Texas Scottish Rite Hospital instrumentation (TSRHI)

Parameter	CDI (n=11)		TSRHI (n=11)	
	Degree (mean±SE)	Correction (%)	Degree (mean±SE)	Correction (%)
Coronal curves				
Pre-operative Cobb's angle	47.1±2.7		52.2±3.2	
Pre-operative curve bending	22.1±4.2	55	29.6±3.9	45
Post-operative Cobb's angle	19.5±4.1	60	23.5±2.6	56
Final Cobb's angle	22.5±4.5	54	30.7±3.7	42
Loss of correction*	2.9±0.9	6	7.3±1.7	14
Vertebral rotation				
Pre-operative	34.6±3.4		26.7±3.1	
Post-operative	27.1±4.2	24	20.8±2.6	22
Final	27.8±4.0	22	23.3±3.3	12
Loss of correction	0.6±0.8	3	1.5±2.2	7

**P*=0.025

Discussion

Surgical correction of adult idiopathic scoliosis gives more favourable results than conservative treatment, and coronal and sagittal balance can usually be achieved and maintained by sound fusion [1, 9, 12, 14, 15, 18, 24, 30]. The amount of correction of the coronal curve achieved ranges between 30 and 50%. Reduction of pain is often achieved [6, 7, 18, 30,32]. Patients with adult idiopathic scoliosis may seek medical help because of back pain, deformity, or both [6]. Although in our series 16 patients suffered from low back pain, deformity was the primary indication for surgery in 19. There was no significant difference in the coronal curve correction between the CDI and TSRHI groups, and the overall correction was 58%. After surgical correction, 83% of the patients were free from pain and 68% had significant improvement in physical function. Most were satisfied with the results, and 77% confirmed that they would have undergone the same treatment again given the same pre-operative circumstances.

CDI has been evaluated in 95 patients with adult scoliosis. Although no pseudarthrosis occurred, dislodging of the inferior hook was reported after surgery [26]. This instrumentation for the treatment of idiopathic scoliosis also has been evaluated at 5-year follow-up. The amount of correction was 56% in the thoracic spine and 57% in the lumbar spine. Corresponding losses of correction were 14% and 15% respectively. Results were more favourable for the King-Moe types III and IV than for types I and II [2]. Based on a two-and-one-half-year study of 103 cases of adolescent idiopathic scoliosis, the percentage of correction obtained by TSRHI was favourable. However, loss of correction not infrequently occurred at follow-up. This was thought to be due to inadequate numbers of lumbar hooks, poor hook placement or inappropriate length of lumbar fusion [25]. In our study, we also found a significantly higher loss of correction in the TSRHI group than in the CDI group. This may be due to the difficulties in achieving stable corrections with all screws and hooks simultaneously, which may lead to reduced stiffness of the whole construct and later loss of correction.

In conclusion, low back pain and cosmesis were the two main indications for surgery in patients with adult idiopathic scoliosis. The overall correction and subjective satisfaction among patients in our series was encouraging for both CDI and TSRHI. We did not find significant difference in the corrections of Cobb's angle, rotation of the apical vertebra, operating time or estimated blood loss between the two groups, although loss of correction was significantly higher in the TSRHI group.

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