THE RESULTS OF THE SALVAGE AND THE REVISION PROCEDURES OF SPINAL DEFORMITIES TREATED WITH VARIOUS INSTRUMENTATION SYSTEMS

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ABSTRACT

In the last years, the improvement in the instrumentation systems and perfection of the treatment strategie have led to decrease a great deal in pseudoarthrosis and implant failure rates in the surgical treatment of spinal deformities. In this study, 313 cases were evaluated whom were surgically treated with various spinal implant systems due to their spinal deformities at the 1st Orthopaedic and Traumatology Clinic of Ankara Social security Hospital between December 1989 and December 1993. Of all these 212 patients had idiopathic scoliosis and 101 had vertebral fractures. It was determined that 101 patients had Cotrel-Dubousset Instrumentation (CDI), 151 patients had Texas Scottish Rite Hospital (TSRH) System, 30 patients had Hartshill Rectangle Sublaminar Wiring (HR-SSW) and 31 patients had AO Internal Fixator (AOIF). In the follow-up period, 14 patients had superficial and deep wound infection, 19 patients had rod brekage and hook dislodgement and 7 patients had pseudoarthrosis and revision surgery. The superficial infection have been eradicated without implant removal in 5 patients. The implants were removed in 9 patients whom had deep wound infection and any other instrumentation weren't performed as any pseudoarthrosis area have not been observed during surgery. These patients whom had implant failure were revised with TSRH crosslinked plates or CDI dominos without implant removal. In 10 patients, a one stage posterior instrumentation or anterior release followed by posterior instrumentation has been performed after implant removal and correction losses were significantly restored. In the patients whom had pseudoarthrosis, a solid fusion mass has been obtained after revision surgery. It is suggested that with appropiate planning and adequate fusion, implant failures and pseudoarthrosis rates can be reduced, theremore with the use of easily revised systems, and adventage can be obtained.

Key Words: *Spinal Deformity, revision and salvage operations.*

INTRODUCTION

Revisions or salvage procedures are the most problematic operations in the spinal surgery. Revision is usually difficult due to disorted anatomy caused by the previous spinal fusion. Infection, neurologic deficit rates and systemic complications related to anesthesia are higher than primary operations (1).

PATIENTS AND METHOD

Forty revision operations in 313 patients with spinal deformities treated with various instrumentation systems at the 1st Orthopaedics and Traumatology Clinic of Ankara Social Security Hospital between December 1989 and December 1993 were evaluated in this study. Mean follow-up period was 37.6 (6-65) months. Female-male ratio was 204/109.

212 patients were operated for idiopathic scoliosis and 101 had vertebral fractures.

Fourty-three idiopathic scoliotic patients had anterior release and discectomy followed by posterior fusion either at the same stage or after halofemarol traction. 164 idiopathic scoliotic patients had only posterior and 5 idiopathic scoliotic patients had anterior instrumentation.

101 patients had vertebral fractures, anterior corpectomy with posterior instrumentation or anterior instrumentation was performed in 11 and the remaining 90 had only posterior instrumentation:

Cotrel Dubousset Instrumentation (CDI) was used in 101 and "Texax Scottish Rite Hospital System" (TSRH) was utilized in 151 cases, 30 patients were instrumented with sublaminar wiring using the "Hartshill Rectangle" and AO Internal Fixator (AOIF) was used in 31 cases.

After routine follow-up visits at the 1st, 3rd, 6th, 12th, 24 th and 36th months, the final evaluation was carried out at December 1993. Factors like clinical complaints, infection, deformity, radiological correction, implant failure and pseudoarthrosis, factors that caused the revision surgery and final results were investigated.

RESULTS

Of the 101 patients instrumented with CD technique, 62 had idiopathic scoliosis and 39 had thoracal or lumbar vertebral fractures. High correction percent-

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ages were observed in both spinal deformities, however, 2 patients with vertebral fractures and 6 patients with idiopathic scoliosis had superficial or deep with vertebral fractures and 6 patients with idiopathic scoliosis had superficial or deep wound infections. Three of them were superficial infections at the early postoperative period and resolved with debridement and medical therapy at the postoperative 3rd week without implant removal. Five patients had deep wound infections and the implants were removed averagely 1 year after the operation. These patients had a solid fusion mass therefore a third operation for instrumentation was not indicated.

In the CDI group 17 implant failures were observed in 10 (9.9%) patients. There were two DTT breakages, one rod breakage and 14 hook dislodgements. Despite implant failure, 2 of these had a solid fusion and did not require a second instrumentation. In 2 patients with pseudoarthrosis the implants were removed and revision was performed with the TSRH system. In the remaining 6 idiopathic scoliotic patients, the implants were removed due to serious loss of correction, followed by single posterior osteotomy and release with posterior instrumentation in 2 patients. In the remaining 2 patients, after anterior discectomy and release, posterior instrumentation was performed. A significant amount of correction was obtained in these cases.

One L1 fractured patient in the CDI group with a claw at the fractured vertebra by mistake was revised at the post operative 3rd month. He had a kyphotic deformity at he thorocolumbar junction. Extending the instrumentation proximally corrected the deformity.

All of the 31 AO spinal instrumentation patients had vertebral fractures. 4 had screw penetration of the anterior cortex and 10 screws were malpositioned. Screw breakage was seen in 6 patients (%19.4) between the 6th month to 2nd year. Two of these (6.5%) had pseudoarthrosis and was revised with TSRH instrumentation and fusion after implant removal. 3 patients had a solid fusion mass despite broken screws and these screws were remover but did not necessitate a new procedure. One broken screw was noted in a patient with no loss of correction and a solid radiological fusion and reoperation was not considered. One patient had deep wound infection and had debridement after implant removal. One patient died of pulmonary embolism on the postoperative 8th day.

Thirty patients underwent instrumentation with the Hartshill system. Ten had vertebral fractures and 20 had idiopathic scoliosis. One patient with thoracal 3-4 fracture dislocation died on the postoperative 16th day with cardiopulmonary arrest. Two patients were debrided after deep wound infection. Six patients had wire breakage and rod migration. In 2 patients pseudoarthrosis was determined radiologically and these patients were instrumented with TSRH and ISOLA systems and fusion after implant removal. The remaining 4 patients had a significant loss of correction and after implant removal they underwent anterior release, and 3 weeks of halo femoral traction, and they had a posterior TSRH in instrumentation.

Of the 151 TSRH instrumentation patients, 69 had vertebral fractures and 82 had idiopathic scoliosis. Superficial infection was observed in 3 patients in this group. Of these, 2 had idiopathic scoliosis and were managed with medical treatment and debridement without implant removal, one patient with vertebral fracture had deep wound infecton and the implants were removed. Pseudoarthrosis wasn't observed in any of the patients in this group. Four patients (2.7%) had implant failure which was hook dislocation. One of these patients was revised with pedicular screws. One patient with idiopathic scoliosis was instrumented by extending the instrumentation level and correction of the progressive secondary proximal curve was achived with axal linked plates. Two patients with hook dislodgements were reoperated and the hooks were placed to their original sites. In TSRH instrumented idiopathic scoliosis patients a high correction rate was obtained.

The highest infection rates were observed in CDI group and in the "Hartshill Rectangle" group with 7.9% and 6.6% respectively. Patients instrumented with TSRH system had the least infection rate by 1.9%. When all the patients were included a 4.5% of infection rate was observed.

We found a statistically significant difference between the different instrumentation systems. The highest implant failures. The highest implant failures were observed in HR-SSI and AOIF group with 26.6% and 19.4% respectively. The least implant failure was seen in the TSRH system.

Also a statistically significant difference was noted in pseudoarthrosis rates. The HR-SSI, AOIF and CDI group patients had 6.6% and 2.9% pseudoarthrosis rate respectively. THe TSRH group had a solid fusion in all patients.

When all the patients were included, 14 (4.5%) patients had superficial and deep wound infection. 5 of

these patients were treated with medical therapy and debridement without implant removal and the implants were removed in 9 patients.

Twenty-eight patients (8.9%) had implant failures and 3 of these were revised with CDI-domino and TSRH-croslinked plates without implant removal. The implants were removed in 15 (6.1%) patients, 10 of 28 patients had a serious loss of correction and an anterior and/or posterior release and posterior refusion and instrumentation with TSRH system (8 patients) or ISOLA system (2 patients) was performed.

Of the 313 patients, 7 (2.2%) had pseudoarthrosis and a short segmental refusion was performed with ISOLA in a patient and TSRH system in 6 patients. All of these patients had a solid fusion at the last follow-up.

DISCUSSION

Although hundreds of reports are available on primary treatment of spinal deformities, a few devell on revision surgery (2). The frst classical report has been presented by Cummine in 1979 (3). In this study the results of revision surgery on 59 idiopathic scoliotic patients were reported and all patients except 2 had solid fusion.

Osteotomy of fusion mass and recorrection was first reported by Meiss in 1941 in a 18 year old patient (4). Floman reported high correction rates with osteotomy in 55 patients (1982) (5). LaGrune reported that his best results were observed with both anterior and posterior fusion in his series of 55 patients with a mean follow-up period of 6 years (6).

Three main reasons for revision surgery on spine are implant failure and severe correction loss, pseudoarthrosis and infection. Implant failure is usually associated with pseudoarthrosis, and infection may lead both implant failure and pseudoarthrosis (1).

In this study 40 revision in 313 surgically instrumented patients were evaluated. Pseudoarthrosis rate is about %2 in highly developed systems (1). Pseudoarthrosis must be revised and refusion and instrumentation must be performed. In this study, when all the patients were included 2.2% pseudoarthrosis rate was observed and this is in harmony with the literature. The highest pseudoarthrosis rates were observed in AOIF and HR-SSI instrumented patients. None of TSRH instrumented patients had pseudoarthrosis.

The infection rates in spinal surgery is reported to be below 1% (1, 2). Our infection rate of 4.5% is higher than this. Despite this high rate, infection resolved with (%2.4) or without (91.6) implant removal and debridement with antibiotherapy. The low infection rates in patients operated with TSRH system was thought to be due to its ease of application short operation time and experience of the surgical team with this system.

Various implant failure rates are reported with different implant systems (1, 7, 10). In our study implant failure were observed in 8.9% of the patients. The highest failure rates were 26.6% and 15.4% respectively in the HR-SSI and AOIF instrumentation group. In the CDI and TSRH instrumentation groups, 3 patient were revised with CDI-domino and TSRH crosslinked plates. In 10 patients with implant failure and/or significant correction loss, anterior release followed by posterior TSRH or ISOLA instrumentation was performed and correction losses were recovered in all of these patients. The best results were obtained in TSRH group with lowest infection and implant failure rates.

Winter et al. reported the results of 60 patients who had revision surgery with CDI and obtained solid fusion in all of their patients (2). In our study 10 patients who had revision surgery with TSRH system are evaluated. A significant correction is obtained with TSRH system and all the cases achieved a solid fusion mass.

Spinal revision surgery is usually difficult if complex spinal deformities are to be corrected. Sublaminar wiring has high complication rates such as rod migration or neurologic complications with wire problems (1). Revision of these patients are also dangerous as broken wires can cause neurologic damage during removal. Lenghtening the instrumentation level by TSRH crosslinked plates and CDI dominos is possible and this advantage can present a lot of alternatives to the surgeon. However, when the screws on the blockers and hooks of CDI system is broken, removal of the implants are very difficult. However revision surgery is easy with the TSRH system as loosening of the nuts are adequate for removal. Thus ease of revision when compered with other systems is thought to be a major advantage of this system.

In light of these findings it is suggested that pseudoarthrosis rates can be lowered with a good planning and adequate fusion. Easily revised systems in salvage or revision procedures can be more advantageous.

Table 1. The distrubation of complications of the patients with spinal deformity used revision surgery according to type of the instrumentation.

		CDI	(n : 101)	AOIF	(n : 31)	HR-SSI	(n : 30)	TSRH	(n : 151)
		No.	%	No.	%	No.	%	No.	%
IMPLANT	Brekage of the screw, rod, wire and DTT							4	27
FAILURE	Dislocation of hook	14	-	-	-	-	-	-	-
	TOTAL	10	9.9	6	19.4	6	20	4	2.7
INFECTION	Superficial	3	2.9	-	-	-	-	2	1.3
	Deep	5	4.9	1	3.2	2	6.7	1	0.6
PSEUDOARTROSIS		2	1.9	2	6.5	2	6.7	-	-

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