Repair of lumbar spondylolysis using Morscher material

14 children followed for 1–5 years

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ABSTRACT – We evaluated the results of spondylolysis repair in children and adolescents with the Morscher system. 14 patients (8 girls) with symptomatic spondylolysis unresponsive to closed treatment were operated on. Mean age at operation was 12 (7–15) years. The average follow-up was 33 (16–66) months. Results were assessed clinically according to the Henderson classification and radiographically. Clinical results were excellent in 9 patients, good in 4 and poor in 1. Radiographs showed that fusion was obtained in 12 patients, it was doubtful in 1 and 1 patient had non-union. Loosening of the screw on one or both sides was noted in 8 patients and necessitated removal of the osteosynthesis material which, however, did not alter the final outcome. The satisfactory results obtained in our series are similar to those reported in the literature.

Spondylolysis occurs in about 6% of the normal population (Fredrickson et al. 1984) and is often asymptomatic. For symptomatic cases, closed treatment is successful in most patients. Surgical treatment is indicated only for patients who have persistent pain. Posterolateral arthrodesis has been the usual procedure, but it eliminates motion at the fused level. In spondylolysis or spondylolisthesis with minimal slipping, Kimura (1968) introduced direct repair of the defect which offered the advantage of preserving the mobility of the segment. Various methods have been described using wire, screws or hook-screws (Buck 1970, 1979, Rigault et al. 1973, Morscher et al. 1984, Nicol and Scott 1986). We report our experience with the Morscher system (Morscher et al. 1984) in children and adolescents.

Patients and methods

We reviewed the records of 14 children and adolescents (8 girls) operated on with the Morscher hook-screw system between 1993 and 1998 (Table). During this 5-year period, we used the Morscher technique in all patients with spondylolysis or slight spondylolisthesis where surgery was indicated. We did no other isthmic repairs or conventional posterolateral fusion. The mean age at the time of operation was 12 (7–15) years. All the patients had type IIA spondylolysis (Wiltse et al. 1976). 2 patients had only spondylolysis, 12 patients had spondylolysis associated with grade 1 spondylolisthesis (Meyerding 1931), where the amount of slipping never exceeded 8 mm. The site of spondylolysis involved L5 in 11 and L4 in 3 children. 3 children also had a spina bifida occulta and 1 had a 10° thoracic scoliosis. All children had had chronic and disabling pain for more than 1 year, despite treatment with a lumbar orthosis and restriction of sports and physical activities for mean 12 (3–25) months, 10 complained of low back pain alone and 4 children had both back and radicular pain.

Before operation, we did no systematic evaluation of the adjacent disk by discography or MRI. As proposed by Louis (1988), we considered the

Patients and results

A	B	C	D	E	F	G	H	I	J	K	L	M
1	M	14y 1m	LBP	L4	4	Spina bifida	13	24	E	Fusion	Screw breakage	
2	F	11y 10m	LBP	L5	3		4	16	G	Fusion	Loosening	13
3	M	15y 7m	LBP	L4	2		25	41	E	Fusion		
4	F	10y	LBP	L5	6		23	43	E	Doubtful	Loosening	28
5	M	8y 8m	BRP	L5	4	Spina bifida	4	25	E	Fusion		
6	F	11y 10m	LBP	L5	7		21	66	E	Fusion		
7	F	11y 9m	LBP	L5	6		3	26	G	Fusion	Loosening	14
8	F	15y 3m	LBP	L5	5		7	25	G	Fusion	Loosening	12
9	F	10y 6m	BRP	L5	3	Spina bifida	11	40	P	Non-union	Loosening	23
10	F	14y 10m	BRP	L5	8		4	24	E	Doubtful	Loosening	21
11	F	13y 4m	BRP	L5			4	36	E	Fusion		
12	M	15y 4m	LBP	L5	4	Scoliosis 10°	22	24	G	Fusion		
13	M	7y 9m	LBP	L5			22	50	E	Fusion	Loosening	41
14	M	14y 6m	LBP	L4	4		11	24	E	Fusion	Loosening	18

A Case
B Sex
C Age at operation
D Symptoms
  LBP low back pain
  BRP back and radicular pains
E Level
F Mm of slipping
G Other findings
H Months of preoperative treatment
I Months of follow-up
J Clinical result
  E excellent
  G good
  P poor
K Radiographic assessment
L Complications related to the screws
M Months until reoperation

disk space satisfactory, if its height was at least two thirds its normal height and if there was no slip of more than 10 mm. In all 14 children, the adjacent disks were normal on plain radiography. We used the operative technique described by Morscher et al. (1984). Postoperative bracing for 3 months was advised. After 6 months, the patients were allowed to resume sports.

The patients were reviewed after mean 33 (16–66) months. Results were assessed clinically, using the subjective assessment described by Henderson (1966). The patients were also evaluated radiographically by plain anteroposterior and lateral views to assess the presence of bone union of the pars, screw loosening and screw breakage.

Results

At final follow-up, we found a satisfactory clinical result in 13 patients. 9 patients were excellent (no pain, return to normal occupation and normal sport), 4 were good (occasional pain after strenuous activity, return to normal occupation and less strenuous sport). 1 patient had a poor result (persistent pain, unable to return to occupation and to practice sport).

Radiographic assessment showed healing of the defect in 11 cases (Figure 1). There was some doubt about the consolidation in 2 patients (cases 4 and 10) since the radiograph showed some trabeculation of bone across the pars defect. Nevertheless the patient had a good clinical outcome. The patient with non-union (case 9) had the poor clinical result. This girl, 11 years old, had a spondylolisthesis grade 1 of L5, associated with a spina bifida occulta. She had a recurrence of low back pain after 6 months. Radiography showed loosening of the screw. A second operation was carried out 22 months after the first. The osteosynthesis material was removed and there was evidence of non-union of the defect. A posterolateral arthrodesis was performed between L5 and S1. The pain disappeared after this second procedure.

There were no immediate operative complications. We did not note any infection or neurologic complication. 8 patients had loosening of the screw on one or both sides (Figure 2). One of them was the girl with non-union. In the 7 remaining patients, the screw tip became displaced into the subcutaneous tissue and caused local pain. There was radiographic evidence of fusion across the de-

Figure 1. Case 13.

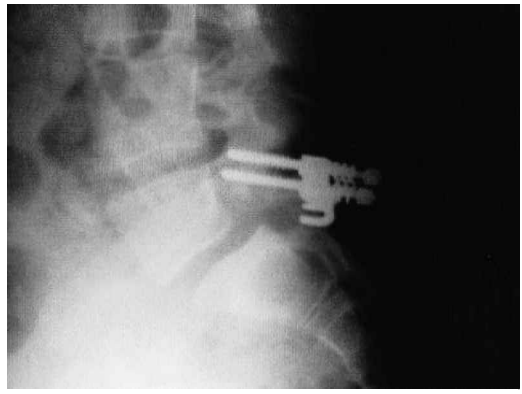
Spondylolysis with minimal spondylolisthesis.

After 2 years, Morscher construct and healing of pars defect.

Oblique view showing the position of the hook-screw construct with healing of pars defect.

fect in 6 and doubtful fusion in 1 case. These 7 patients needed further surgery to remove the Morscher system. It was performed at an average of 21 (12–41) months after the first operation.

Figure 2. Case 4.



Loosening of the screws at 2 years' follow-up.

During reoperation, we did not note any mobility of the posterior arch that appeared to be continuous with the rest of the vertebra. At follow-up, the result was rated good in 3 patients and excellent in 4 patients.

In 1 patient (case 1), a radiograph taken at 1 year showed a screw breakage on one side. However, fusion was achieved on both sides and the patient was free of pain and was recorded as having an excellent result.

Discussion

Kimura (1968) was the first to use only a bone graft without osteosynthesis of the pars interarticularis. His results were good in 63 of 69 patients. However, the patients had to remain recumbent for 2 months, followed by external immobilization by cast for another 4–6 months. Buck (1970) was the first to use internal fixation with a screw across the defect in order to stabilize the bone graft and allow early mobilization of the patient. He obtained good results in 66 of 75 patients (Buck 1979). Morscher et al. (1984) introduced the method of the hook-screw, where the screw is put into the lateral mass, providing a solid grasp of the dysplastic vertebral arch.

The various techniques reported in the literature do not appear to favor one surgical technique over another. Results have been found to be satisfactory in 60%–90% (Buck 1979, Morscher et al. 1984, Bradford and Iza 1985, Van der Werf et al. 1985,

Beckers 1986, Pedersen and Hagen 1988, Roca et al. 1988, Albassir et al. 1990, Hefti et al. 1992, Johnson and Thompson 1992, Hardcastle 1993, Jeanneret 1993, Dreyzin and Esses 1994). It is important to note that all the studies reported in the literature mixed adults and children. One of the keys to a successful outcome of any pars interarticularis repair is patient selection (Songer and Rovin 1998). According to Szypryt et al. (1989), there is some evidence that spondylolysis in those older than 25 years is associated with a higher prevalence of disc degeneration than that observed in the normal population. The primary reason reported for the failure of this technique is treatment of a patient with degenerative disc disease (Bradford and Iza 1985, Johnson and Thompson 1992, Dreyzin and Esses 1994, Tokuhashi and Matsuzaki 1996). Consequently, success declines as the age of the treated patient increases (Bradford and Iza 1985, Nicol and Scott 1986, Hefti et al. 1992, Johnson and Thompson 1992) and all the series showed better results in patients under the age of 30 years.

With the Morscher system, we had good results in 13 of our 14 patients, including only children, and adolescents and one young adult. If we compare the results in those under 30 years in the literature, it seems that whatever the technique used, results are good in almost all patients. With the Buck technique, proper placement of the screw just through the defect is reported to be difficult (Beckers 1986, Songer and Rovin 1998). Furthermore, this technique reduces the area available for bone grafting. The Scott technique (Nicol and Scott 1986) requires greater surgical exposure, with extensive stripping of the muscle to expose the transverse process completely. Placement of the wires under the transverse processes is difficult and can lead to substantial bleeding and there is a risk of nerve root injuries. Furthermore, several cases of wire breakage have been reported (Bradford and Iza 1985, Nicol and Scott 1986, Johnson and Thompson 1992).

The Morscher technique seems easier to perform. It can be carried out even in cases of spina bifida occulta. Compared with other techniques, it does not need extensive dissection. According to the literature, the biggest problem seems to be the screw placement with penetration of the inferior articular process of the vertebra above and transpedicular placement (Songer and Rovin 1998). In our experience, the main problem with the Morscher technique is the high incidence of screw loosening. Dreyzin and Esses (1994) also reported this. Since the hardware is bulky, screw loosening led to swelling and pain in more than half of the patients and required removal of the material. It did not alter the final outcome.

Recently, new techniques have been reported which appear to have some mechanical advantages. With the Gillet and Petit technique (1999), the strength of the hardware obviates the need for post-operative immobilization. In addition, the hardware does not interfere with the bone grafting procedure. The cable-screw construct described by Songer and Rovin (1998) provides a strong and even compression across the pars repair by simultaneously tensioning the cables, and the flat-headed screw has a low profile, reducing swelling. According to Kakiuchi (1997) and Tokuhashi and Matsuzaki (1996), the use of internal fixation with pedicle screw, rod and laminar hook provided more rigidity and might be more stable against sagittal and torsional displacement.

Isthmic repair should also be compared with posterolateral arthrodesis, whicht was the standard technique previously. The results of isthmic repair are comparable to those achieved by fusion operation (Henderson 1966). The disadvantage of fusion is the resulting loss of segment motion, which increases the load on the adjoining segment. Direct repair appears to be a logical and less drastic alternative. Since it does not sacrifice the mobility of the segment involved, it has the theoretical advantage of restoring the anatomy and causing less restriction of spinal movement.

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