Anterior lumbar vertebral translation following translaminar screw fixation

A report of five cases

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Summary. *Translaminar screw fixation is a good procedure for posterolateral spinal fusion of one or two motion segments. Anterior translation of the upper fused vertebra occurred in 5 of our patients following this procedure. A further fusion with pedicle screw fixation was needed in 2 of them. This complication has been previously reported after decompression operations on the lumbar spine. Translaminar screwing produces slight posterior distraction which pushes forward the upper vertebra. This procedure should be avoided in cases with even minimal anterior translation before operation. Translaminar screw fixation is an ideal technique for fusion of a degenerated segment when the upper vertebra has slipped posteriorly.*

Résumé. *La fixation par vis translaminaire, développée par F. Magerl, est reconnue comme étant une bonne procédure pour les fusions postéro-latérales d'un ou deux segments mobiles. Chez cinq patients, nous avons observé une complication consécutive à cette technique, il s'agit de la translation de la vertèbre craniale fusionnée. Deux d'entre eux ont nécessité une refixation par vis transpédiculaire. Cette complication n'a été reportée précédemment qu'après des décompressions de la colonne lombaire, mais jamais suite à une fusion, quelque soit le type d'instrumentation utilisé. Un des effets secondaires de la légère distraction inhérente à la fixation translaminaire est le déplacement vers l'avant de la vertèbre supérieure.*

Pour cela, ce système ne devrait pas être utilisé dans le cas de translation ventrale, même de degré minime. Par contre, la fixation de type vis translaminaire reste une procédure de choix, lorsque dans le segment dégénéré, la vertèbre craniale a glissé postérieurement.

Introduction

In 1978, Magerl described a procedure for posterior fusion of one or two levels of the lumbar spine by inserting screws across bilateral articular facets; the anchorage in the upper vertebra was enhanced by passing the screws through the lamina as well as the articular facets. A hole is drilled from the base of the spinous process through the inferior part of the contralateral lamina, between its cortices, and across the joint facets into the base of the transverse process of the lower vertebra. The translaminar screws cannot be applied as lag screws, because of their divergence, in cases of anterior vertebral translation. This technique is a modification of the transarticular screw fixation first described by King [10] and modified by Boucher [4]. The advantages are that it has a comparatively easy learning curve and an insignificantly increased operating time in cases where the procedure is combined with partial undercutting facetectomy or discectomy [1–3]. Screw insertion through the lamina avoids contact between muscles and metal because only the two screw heads project above the level of the bone. Several authors have reported very encouraging results, with excellent clinical improvement and

Table 1. Summary of clinical data, type of operation and complication in five patients with ventral vertebral translation following trans-laminar screw fixation. (TSF = translaminar screw fixation, UD = undercutting decompression, FI = fixateur interne)

Patient	Operation	Follow up (in months)	Bony Fusion	Complaints	degree of displacement (%)	further operation
1	TSF L4-S1 UD L5 both sides	6	yes	Back and radicular pain	25	FI L4-S1 UD L5
2	TSF L4-S1 UD L5 left	42	yes	Back and leg pain Weakness	20	no
3	TSF L4-S1 UD L5 on both sides	18	Pseudarthrosis L4L5	Backpain	5	FI L4-S1
4	TSF L3-S1 UD L4 and L5 on both sides	12	yes	no	10	no
5	TSF L4-S1 UD L5 and S1	12	? (Patient rejected dynamic radiography)	Back pain Referred pain		

high fusion rates. The complications recorded are transient nerve root palsies, breakage of screws, root injury through a broken drill bit and dural leaks [5, 6, 8, 13–15]. The incidence of complications is low.

Between 1987 and 1992, 206 cases of lumbar spinal stenosis were treated by the senior author (AB), by the combined procedures of partial undercutting facetectomy with preservation of at least two-thirds of the facet joints and translaminar screw fixation [1, 2, 3]. The same technique was used in 48 cases in which discectomy was combined with a primary fusion (because of disc displacement). The translaminar fusion was performed in one or at the most two motion segments.

We have recorded 5 cases in which the upper fused vertebra moved forward, in 3 with slight, and in 2 with marked, displacement (Table 1). In 2 cases, after initial relief, the patients complained of worsening back pain compared with their pre-operative condition. These 5 cases are now described in order to point out an incorrect indication for the translaminar fusion procedure.

Case reports

Case 1

Three months after a partial undercutting facetectomy on the left side of the L5/S1 motion segment in February 1991, a woman, 52 years of age with rheumatoid arthritis, developed severe lower back and leg pain in both L5 dermatomes. Lumbar myelography showed a severe cuff-like encirclement of the dural sac and marked instability at L4/L5 (Fig. 1a). In October 1991, a partial undercutting facetectomy at L4/L5 on both sides and a translaminar screw fixation of L4/L5 and L5/S1 was carried out (Fig. 1b). The patient's complaints cleared up quickly. Six months later, severe root pain recurred in the

L5 dermatome on the left side, both at rest and more severely while walking. The lateral radiograph showed anterior translation of L4 (Meyerding's grade 2) (Fig. 1c). At operation in June 1992, widening of the decompression of the left L5 root, a transpedicular fusion L4/S1 and wiring of the spinous processes L4 and L5 were carried out; no instability of the L4/L5 and L5/S1 segments was detected.

Case 2

A woman, 54 years of age, suffered from right-sided root pain in the right L5 dermatome despite the hemilaminectomy and disc excision carried out 10 months earlier at L4/L5. Shortly after, severe root pain developed in the left L5 dermatome, mainly in the lower leg. Both the lateral plain radiograph and the MRI showed a slight forward translation of L4 (Fig. 2a). The MRI also revealed severe encirclement of the dural sac at the operated level. In July 1992, a partial undercutting facetectomy at L4/L5 was performed on both sides. On the right, dense and almost calcified scar tissue was found at the site of the previous operation. The lower facet joint of L4 and the upper part of L5 had been removed almost completely. Extreme instability of this segment was the result which was partly responsible for the severe scarring. A translaminar screw fixation of L4/L5 and L5/S1 was performed (Fig. 2b). On the right side, the resected lower facet of L4 was replaced with an autologous bone graft fixed by the screw. Three months later, the patient reported a significant improvement. She was able to walk for two hours. In spite of this, the radiographs showed a forward slip of L4 (Fig. 2c).

Case 3

In April 1991, a bilateral partial undercutting facetectomy of L4/L5 and translaminar screw fixation of both caudal lumbar motion segments without distraction was performed in a patient, 59 years of age, who suffered from low back and cramp-like pain in both L5 dermatomes. The symptoms were due to stenosis and degenerative instability of the L4/L5 and L5/S1 segments. After a short period of improvement, similar complaints to those before operation recurred. Functional myelography showed slight anterior translation of L4, nearly the

same annular entrapment as before operation, and a pseudoarthrosis in the L4/L5 segment. An attempt to achieve fusion by augmenting the translaminal screw fixation of the L4/L5 segment, using a H-shaped autologous bone graft and wiring between the spinous processes of L4 and L5, failed. In October 1992, a transpedicular fusion from L4 to the sacrum was carried out with immediate lasting improvement.

Case 4

A woman, 49 years of age, suffering from root pain in the L3, L4, and L5 dermatomes on both sides, was treated by partial undercutting facetectomy at the L3/L4 and L4/L5 levels and translaminal screw fixation of L3 to S1 in September 1995. Dynamic lumbar myelography showed a constriction of the thecal sac at L3/L4 and L4/L5 with slight forward displacement of L3. Transpedicular fixation, which had been planned, was not carried out in order to avoid skin irritation by the implant in an extremely thin patient. Three months later, new forward translation of L4 and a further slight forward movement of L3 was found. In spite of this, the patient was free from pain. The bisegmental displacement has remained unchanged.

Case 5

A woman, 50 years of age, suffered from low back and leg pain in the L5 and S1 dermatomes on both sides. Radiological imaging showed narrowing of the lateral recesses in both segments. Bilateral partial undercutting facetectomy and translaminal screw fixation of L4/L5 and L5/S1 had been performed 18 months previously. Three months later, slight displacement of L4 was found, without any other radiological signs of instability. Even though she has been suffering from back pain and slight referred pain in the legs, she appreciated the improvement in her condition and does not want further surgery.

Discussion

Forward lumbar translation following decompression procedures without instrumentation is a well known complication. Shenkin and Hash reported a 10% chance of postoperative spondylolisthesis after bilateral lumbar multiple-level decompressions [16]. Sienkiewicz observed five cases of postoperative forward displacement and suggested that contributing factors were osteoporosis and ligament laxity [17]. White and Wiltse attributed this phenomenon to normal disc height [18]. Other authors have published similar results depending on the extent of the posterior spinal decompression [7, 9, 11]. Congenital anatomical variations of the sagittally orientated facet joints could play the main role in causing the forward displacement of the upper vertebra. Although it occurs most commonly when the joints have been substantially resected, forward displacement can also follow non-destructive decompression.

We have found that displacement can even occur after a preserving decompression and instrumented fusion. In our 5 patients, a partial undercutting facetectomy, which left the lateral two-thirds of the joints intact, had been carried out. In case 2, one joint, which had been almost completely resected at a previous operation, was replaced with an autologous bone graft, according to a procedure which we have occasionally used with good results in secondary fusion.

In every case of translaminal fusion, no matter what the reason for operation, slight upward shifting of the inferior facets of the upper vertebra is seen as the screw passes across the joint, even after tapping across the facet. This implies slight forward displacement of the upper vertebra. It is impossible to avoid the upper vertebra being pushed forward as a mechanical consequence of translaminal screw fixation which produces slight distraction (Fig. 3). A fusion in slight flexion occurs, even if no distraction is intentionally applied. The reduced lordosis produces an additional strain in an anterior direction [9].

Consequently, translaminal screw fixation is ideal for an unstable motion segment in which the upper vertebra has displaced posteriorly. It is not suitable for cases with forward translation, even if it is minimal or unobservable, before taking functional lateral radiographs or functional myelography of the lumbar spine. In some cases, translaminal screwing cannot avoid forward movement of the upper vertebra of the fused segment. It is remarkable that displacement can occur even when an apparently solid fusion has been achieved (case 1). Ingrowth into bone grafts is probably not impeded by the displacement of the upper vertebra.

Our experience indicates that transpedicular instrumentation is mandatory for segments with even minimal forward displacement of the upper vertebra. Translaminal screw fixation is ideal for suitable cases with backward displacement of the upper vertebra or with no vertebral displacement.

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