

## Direct screw fixation of the spondylolysis without fusion

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### Keywords

Spondylolysis · Low grade spondylolisthesis ·  
Direct screw fixation · Fixation without fusion ·  
Lysis repair

### Introduction

Spondylolysis of mostly the interarticular portion of the fifth lumbar vertebra (L5) may be painful even if there is no spondylolisthesis L5/S1 present or maximum Meyerding grade I. The pain may be related to a chronic inflammation due to the mobile arch of L5, which in rare cases may even cause some radicular irritation of the root L5 passing around the pedicle L5 into the foramen L5/S1 or the origin of the root S1. The spondylolysis is a congenital nonunion of the interarticular portion of the vertebra and may vary in size and therefore be in more or less tight contact with mostly the L5 root.

If a painful spondylolysis occurs in a young patient with a still intact disc height and structure and without a relevant spondylolisthesis (>Meyerding I) and L5/S1 instability, a direct repair of the spondylolysis without fusing the segment may be the indication of choice [2, 8, 9]. This is specifically true after having tried unsuccessfully a conservative treatment for at least 6 months.

The direct fixation maybe performed either by a wiring technique [1–3, 9, 10], a direct screw fixation technique or

a combination of both. The direct screw fixation technique is either done with a compression screw alone or with a device, which is a combination of a 3.5 mm type malleolar screw and a hook acting together as a compression device for the interarticular nonunion portion [8]. In the recent years combinations of pedicle screws and a hook rod construct have been advocated [4–7].

### Case description

An 18-year-old adolescent male patient suffers from increasing back pain, which started by occasional pain when performing sports 3–4 years ago, and which has now become the rule after any physical effort. The back pain also is now more and more combined with some strange sensations irradiating into the left leg improving regularly when lying down. An intensive conservative treatment with back exercises and stretching of the tight hamstrings was not successful. The patient considers this pain problem as a relevant limitation of his quality of life and of his need for physical activities. Otherwise healthy, he suffers also from a lack of growth hormone, which he needs to substitute on a daily base.

He is a normal looking 18-years-old male patient with his clinical examination demonstrating some tightness of the hamstrings but normal neurological findings in terms of sensory and motor function as well as reflexes.

Already in the simple conventional X-ray the lysis is visible and can be confirmed in the oblique views. No functional X-rays were done, since they would not have influenced the decision making for surgery. Since the disc height was considered normal and the patient did not show any component of a discogenic back pain, no further imaging tests like CT and MRI were performed. A direct infiltration of the interarticular lytic zone under image

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intensifier, however, has been done and demonstrated excellent pain relief for a short period of time (3 weeks).

### Surgical procedure

The generally anaesthetized patient is put in prone position for this surgery, and the surgeon has to make sure that there is free space under the operating table at the level of the lumbosacral spine, since there is not only a need for lateral, but also a-p views of the spine by the image intensifier during the surgery. The spinous process of L4, L5 as well as S1 is palpated or checked by image intensifier when necessary, before a short midline incision over these spinous processes is done. Dissection of the paravertebral muscles from the arch of L5 and partially of L4 is done to identify the facet joint of L4/5 and the whole arch of L5. Where the arch of L5 meets the facet joints L4/5, the interarticular portion of L5 is prepared on both sides by isolating and removing the pseudarthrotic connective tissue in the depth. There the stump of the interarticular portion emerging into the pedicle and the superior facet of L5 can be isolated and freshened together with the corresponding surface of the arch L5 to prepare a healing surface for the later bone graft interposition under compression.

As device for the fixation the hook-compression-screw described by Morscher [8] is used. This device consists of a 3.5 mm malleolar type threaded screw without screw head. Instead of a head at the end of the screw there is a machine thread over, in which a modified Harrington type laminar hook is inserted followed by a spring and two nuts. The spring is considered to guarantee a not completely rigid fixation of the hook, which is compressed against the lamina and therefore compressing the spondylolysis gap through the two nuts tightened over the machine thread. Two nuts are used to secure that one nut cannot loosen out.

Under vision and control by lateral as well as a-p projection of the image intensifier the stump is drilled in the direction of the pedicle laterally out and up after having first positioned a K-wire to check on the right direction of the planed drilling. A 2 mm drill is used. The screw hole is tapped. The lamina L5 is then prepared for the seat of the hook by adding a little laminotomy. Finally, the composite of the screw with the hook loosely inserted at the end of the machine threaded part of the screw is positioned over the arch of L5 with the screw in the direction of the drilled hole and the hook seated on the prepared lamina. The screw part with the malleolar type thread is then inserted into the prepared drill hole to the point, where the thread is fully inserted into the bone. Compression is then applied on the prepared spondylolysis space by inserting and tightening a spring and two nuts at the end of the machine threaded screw. First the tightening is done just to hold together the montage, the final tightening is done only when the

contralateral side is prepared, too. Then the nuts are tightened alternating to the same degree.

Finally some fine cortico-cancellous bone chips, which are even made smaller by cutting them with a bone nibbler, are taken from the posterior sacral surface with a fine bone gauge. This bone material is then stuffed into the remaining spondylolysis gap around the screw shaft with the intention to get finally a bony fusion of this nonunion.

The wound is closed over a drain, which usually can be removed on the first postoperative day.

### Postoperative procedure

The patient can be mobilized on the first postoperative day over the border of the bed into the sitting position. An elastic brace with some plastic reinforcement rods of the posterior lumbar support is then fitted. The brace is applied ideally when standing to have an optimal fit. This brace is carried by the patient as a protection brace for the first 3 months postoperatively.

From the first postoperative day the patient is performing isometric exercises twice a day for the abdominal and paravertebral muscles. The patient can go into a pool for walking exercises as soon as the wound healing is secured, and start bicycle after four weeks. X-ray controls preferentially with oblique views are done after 6 weeks, 3, 6 and 12 months postoperatively. Rotation around the axis of the spine and forward bending is not allowed in the first 3 months postoperatively.

### Discussion and conclusions

This is a straightforward technique of repairing a spondylolysis without spondylolisthesis in young symptomatic patients mostly of L5 after unsuccessful conservative treatment. The goal obviously is to avoid an unnecessary fusion in a young patient. There are, however, reports, which challenge this procedure since their long-term observations of both, patients with fusion and patients without fusion but with direct spondylolytic repair do not demonstrate any difference in terms of outcome [11]. Occasionally the lysis may exist at the level of L4, L3 or very rarely even higher or sometimes on more than just one level. Two or three level procedures have been done in the past.

As possible complications screw breakage, hook dislocation, loosening of the nuts and non-healing of the repaired nonunion may occur. Care has to be taken, when placing the screws to avoid nerve root injury. The root at risk is L5 exiting around the pedicle of L5 and obviously underneath the bony stump of the interarticular portion. If the screw is positioned too deep in the sagittal plane then it may interfere with the L5 root. Also the bone graft has to

be packed not too deep into the lytic zone in order not to interfere with the root L5.

Techniques with a screw only, by using it as a compression screw passing through the lamina and the lytic interarticular portion have been described [3]. Also here the risk of the screw breakage is not waived nor is there a guarantee not to injure the nerve root L5. Before screw techniques have been described, there were already cases described treated with a figure of eight tension banding wires. The problem in this technique is breakage of the wire [2, 10].

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