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Review article

## Surgical treatment of degenerative spondylolisthesis

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### ABSTRACT

Degenerative spondylolisthesis is a common pathology, often causing lumbar canal stenosis. There is, however, no strong consensus regarding the various medical and surgical treatments available. Surgery is indicated mainly for perceived functional impairment; when the indication is accepted, several questions determine the choice of surgical strategy. Improvement in neurological symptoms is one of the main treatment objectives. For this, it is useful to perform radicular decompression. Some authors recommend indirect decompression by interbody fusion (ALIF, TLIF, XLIF), others by means of an interspinous spacer but the most frequent technique is direct posterior decompression. In degenerative spondylolisthesis, functional results seem to be improved by associating stabilization to decompression, to prevent secondary destabilization. The following risk factors for destabilization are recognized: anteroposterior hypermobility, angular hypermobility and large disc height. Two stabilization techniques have been described: “dynamic” stabilization and (more frequently) fusion. Spinal instrumentation is frequently associated to fusion, in which case, it is essential for fusion position and length to take account of pelvic incidence and the patient’s overall pattern of balance. Posterolateral fusion may be completed by interbody fusion (PLIF or TLIF). This has the theoretic advantage of increasing graft area and stability, restoring local lordosis and opening the foramina. Surgical treatment of degenerative spondylolisthesis usually consists in posterior release associated to instrumented fusion, but some cases can be more complex. It is essential for treatment planning to take account of the patient’s general health status as well as symptomatology and global and segmental alignment.

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### 1. Introduction

Degenerative spondylolisthesis is defined as forward slippage of a vertebra with respect to the underlying vertebra, without rupture of the posterior arc [1], distinguishing it from lytic spondylolisthesis. It thus usually induces lumbar canal stenosis, even though the slippage is always moderate [2] (Figs. 1 and 2). The usual levels are L4–L5, in 73% of cases, or L3–L4, in 18% of cases. It is a common pathology with prevalence estimated, by Jacobsen, at 2.7% in males and 8.1% in females [3]. Paradoxically, despite this high frequency, there is no strong consensus on treatment, regarding medical options, surgical options or choice between medical and surgical attitudes.

The Spine Patients Outcomes Research Trial (SPORT) recently compared efficacy between surgical treatment by decompression or decompression with fusion versus medical treatment and natural progression [4]. The study has been widely criticized but seemed to show superiority for surgery at 2 and 4 years’ follow-up,

especially when radicular compression predominates over low back pain. However, as is always the case in spine pathology (apart from cases of objective severe neurologic disorder), indications for surgery are essentially based on perceived functional impairment; when the indication is accepted, three questions guide the choice of technique.

### 2. Whether to perform decompression?

The main objective of surgery in degenerative spondylolisthesis is to improve neurologic functional symptomatology. As symptoms are *prima facie* directly related to radicular compression, decompression seems the logical attitude.

However, hypermobility and slippage aggravate compression, and stabilization of the involved level, with decompression, may also be considered [5,6].

#### 2.1. Anterior interbody fusion

The most frequently cited option in the literature is anterior interbody fusion, possibly associated to posterior instrumentation, now usually performed percutaneously. Although not new, this

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**Fig. 1.** Standing radiograph: example of L4–L5 degenerative spondylolisthesis. A. Alignment on lateral full spine radiograph. B. View in flexion. C. Centered lumbar view.

approach has been updated by the advent of minimally invasive techniques.

Takahashi et al. reported long-term results in 39 patients managed by anterior decompression and interbody fusion [7]; on survival analysis, 76% of patients were satisfied at 10 years and 60% at 20 years.

More recently, Oliveira et al. reported results in 21 patients treated by XLIF (extreme lateral lumbar interbody fusion) for lumbar canal stenosis, both isolated and associated to degenerative spondylolisthesis [8]. XLIF enabled foramen decompression and increased central canal diameter but with a risk of interbody implant impaction, correction loss and recurrent root pain.

Ahmadian et al., in 2013, reported a similar series of 31 patients treated for L4–L5 or L5–S1 degenerative spondylolisthesis by XLIF associated to percutaneous posterior internal fixation without direct canal decompression [9]. At 2 years' follow-up, there was highly significant functional improvement on the Oswestry Disability Index (ODI) and the Short Form 36 (SF36) quality-of-life scale.

Marchi et al., in a prospective observational study, likewise found significant (54%) improvement in ODI in 52 patients treated for degenerative spondylolisthesis by isolated XLIF [10], but with weakening of the psoas muscle in 19.2% of cases and paresthesia of the anterior side of the thigh in 9.2%. The 2-year fusion rate (86.5%)

was high but cage impaction occurred in 17% of patients, requiring surgical revision in 13%.

Thus, several doubts persist regarding this type of indirect decompression and its limitations remain to be defined:

- As hyperlordosis aggravates stenosis, what balance is to be struck between anterior imbalance, gain in lordosis and severe canal stenosis?
- What should be done in case of multilevel stenosis: is treatment of the olisthetic level alone sufficient?
- What are the limits in terms of age and osteoporosis?

The technique probably has its role but this is not clearly defined in the literature. To avoid certain complications associated with the transpsoas minimally invasive approach and classical retroperitoneal anterior approaches such as parietal weakness and neural lesions, Silvestre et al. developed anterior fusion on a minimally invasive retroperitoneal approach, with a 4-cm incision enabling fusion of up to 3 levels [11]. Twenty of the 179 patients in this series showed postoperative complications: 2.2% scar pain, 1.7% sympathetic plexus lesion symptoms, 2.2% neurologic impairment, and 1.1% iliac vein wounds; there were, however, no cases of parietal hernia or retrograde ejection.

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