Management of lumbar spondylolisthesis: A retrospective analysis of the contribution of minimally invasive surgery for lumbar spondylolisthesis

Abstract

Study Design :Retrospective cohort studyJanuary 2016 to January , 2024

Objective : The objective of our study consists of studying the contribution of minimally invasive surgery for lumbar spondylolisthesis in patients treated in the Neurosurgery department of the Ibn Sina University Hospital in the city of Rabat, during a period of 8 years

Summary of Background Data. The past two decades have witnessed a surge in minimally invasive spine surgery, mirroring advancements in other surgical disciplines. These techniques prioritize minimizing muscle damage compared to traditional approaches, thereby aiming to reduce complications associated with surgery.Thisstudy reviews the value of these approache in the treatment of spondylolisthesis

Methodology:

A retrospective analysis of 29 patients who underwent interbody fusion for lumbar stenosis using minimally invasive (MI) TLIF was performed. Patients were monitored, Visual Analog Score (VAS), Meyrding score and Average percentage gain ,The results of recently published series are reported

Results :
The average age of patients is 54 years with extremes of 34 and 70 years.sex ratio of 6.25
The clinical picture was dominated by low back pain in 61% as well as radiculalgia was reported in 81.7%, intermittent claudication 26;8% deficit 15.4% sphincter disorder 3.4%
In our series, the predominant location of spondylolisthesis was at the level of L4-L5 in 46% of patients, and L5 - S1 in 42%.All patients benefited from prior medical treatment with failure. In 61.5% of patients, the failure of medical and orthopedic treatment was the indication for surgeryin these patients.Surgical treatment was required in all patients in our study, using the minimally invasive transforaminal interbody fusion method.Clinically, 62% of our patients have a very good progress, 26% a good progress and 4% an average progress.Neurological recovery was required in all our patients who had previously presented a neurological deficit.The average percentage of gains in the patients included in our study is 65%, ranging from 6.6% to 100%.

Conclusion :

Our study has shown the significant benefit of minimally invasive spondylolisthesis surgery carried out by well-trained practitioners. The treatment always begins with medical and

orthopedic treatment, but depending on the evolution of the disease, we often resorts to surgical treatment. .

Minimally invasive surgery concretely meets the required objectives, in particular the reduction of the risk of hemorrhage and infection, rapid postoperative recovery and the preservation of the muscles.

Keywords: Lumbar stenosis, minimally invasive spine surgery, transforaminal lumbar interbody fusion, spondylolisthesis, transforaminal lumbar interbody fusion

Introduction :
Degenerative spondylolisthesis (DS) is a disorder that causes the slip of one vertebral body over the one below due to degenerative changes. It differs from spondylolytic spondylolisthesis by the absence of a pars interarticularis defect (spondylolysis), i.e., in DS, the whole upper vertebra (vertebral body and posterior part of the vertebra including neural arch and processes) slips relative to the lower vertebra. Both DS and spondylolytic spondylolisthesis are commonly seen as incidental findings in asymptomatic patients. (5)

2. grading SL, Meyerding‘s classification of slippage is mostused (I: 25%, II: 26%–50%, III: 51%–75%, IV: 76%–100%, V:>100% SL). While Grade I patients with Grade II SL are treatedconservatively, Grade III and above are candidates for surgery.This necessity is apparent in patients with instability. Thereis yet again a conundrum about the treatment modalitysimilar tolumbar spinal stenosisLSS. However, unstablelumbarsspondylolisthesis (ULS) usually requires decompressionand fusion 2 . This approach has been further strengthened bycombining posterior fusion with interbody fusion, whichresulted in higher fusion rates, higher correction rates ofdeformity, stability of the correction, and improved clinicaloutcomes.[6]

The most widely used techniques for lumbar interbody fusiondue to its excellent clinical results and fusion rates are PLIFand TLIF.[10] In this paper, we haveretrospectively analyzedthe results of patients treated by MI TLIF. 2

4. Posterior lumbar interbody fusion (PLIF) first described by Cloward in the 1940‘s using autologous bone graft was the staple diet for spondylolis- thesis of all kinds; this was followed by the introduction of the TLIF technique, described initially by Harms.[4] A well-functioning Bovie, Cobb‘s elevators, and self-retaining retractors have been the foun- dation for a gratifying exposure since the inception of spine sur- gery. Advancing technology and tireless enthusiasm of the spine surgeons have replaced this armamentarium with new less invasive and highly sophisticated tools 4

Lymbar stenosis (LS). spondylolisthesis (SL). lumbarspinal stenosis (LSS). Unstablelumbarspondylolisthesis (ULS)

Materials and method

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Results :

The average age of patients is 54 years with extremes of 34 and 70 years.sex ratio of 6.25
The clinical picture was dominated by low back pain in 61% as well as radiculalgia was reported in 81.7%, intermittent claudication 26;8% deficit 15.4% sphincter disorder 3.4%.

Based on the Meyerding classification, we note that 57.7% of the population studied had an SPL grade I, 23.1% had a grade II while 3.8% had a grade III.
No patient presented with grade IV and V SPL.
In our series, we note a predominance of ante-listhesis with a rate of 57.9%, on the other hand retrolisthesis is found in 42.1%.
69% of patients (20 patients) had isthmic lysis, and 31% patients (9 patients) had degenerative spondylolisthesis.
In our series, the predominant location of spondylolisthesis was at the level of L4-L5 in 46% of patients, and L5 - S1 in 42%.

All patients benefited from prior medical treatment with failure

In 61.5% of patients, the failure of medical and orthopedic treatment was the indication for surgeryin these patients.

Surgical treatment was required in all patients in our study, using the minimally invasive transforaminal interbody fusion method.

in the 5 post-operative days the intensity of the pain was:
- zero for 61% of patients
- estimated at 1 in 33.5% of patients -
- Infection: No infectious complications were noted.

- Bleeding: Our study did not note any significant intra- and post-operative bleeding.
Medium-term development:

Clinically, 62% of our patients have a very good progresswith disappearance of symptoms and functional impotence., 26% a good progress (no functional impotence with low intermittent pain). and 4% an average progress.

Neurological recovery was required in all our patients who had previously presented a neurological deficit.
The average percentage of gains in the patients included in our study is 65%, ranging from 6.6% to 100%.
the majority (65.4%) have a recovery of 5 to 19mm
patients aged between 30 and 39 years old were able to have a recovery of 15 to 19mm, while the majority of patients between 40 and 69 years old as well as those between 70 and 79 years old had a recovery of 5 to 9mm.
For patients with a slip of 5 to 9mm, the majority gained between 0 to 4mm.
Whereas for patients with a slip of 10 to 14 mm, the gain was mainly between 5 to 9 mm.
For patients with a slip of 15 to 19 mm, the majority recovered between 10 to 14 mm.

Discussion

This study showed that the average age of our patients at the time of the intervention was 54.3 years. We noted through the analysis of our results that they agree with the literature data illustrated in table 1.
After 50 years of age, both women and men begin to develop DS, with women having a faster rate of development than men. For elderly Chinese (65 years, mean age: 72.5 years) (5)

Table1Average age of patients at the time of the intervention

Etude	Age moyen
YasuchikaAoki 2020 (98)	64.4
Michael Karsy 2020 (99)	50.3
ZoherGhogawala 2016(100)	67
David H. Ge 2018 (101)	56.5
Yang2015 (102)	44.6
Baoshan Xu 2020 (103)	66
Ivar M. Austevoll 2021 (104)	66

Bounnit 2018 (105)	60
Notre série	54.3

The male/female ratio was 1/5. This is consistent with the majority of studies(5). The existing data also suggest that menopause may be a contributing factor for the accelerated development of spondylolisthesis in post-menopausal women.
Low back pain is the most common initial sign and constitutes the main reason for consultationHENSIGER(7) .
Radiculalgia was reported by 81.7% of our patients. Ivar M. Austevoll2021 75%This could be explained by the absence of early conservative treatment due to the delay in consultation.
Based on the Meyerding classification, we note that 57.7% of the population studied had an SPL grade I, 23.1% had a grade II while 3.8% had a grade III.It should be noted that the results of the different radiological examinations may differ depending on the cooperation of the patient and the good control of the examiner. According to Daniel Son et al (8) (9) a slight variation in the positioning of the patient or in the inclination of the gantry can lead to a variation of 10 to 15% in the amplitude of the vertebral movement. Patient positioning and direction of the X-ray beam must be precise to enable optimal measurement. (10)

we note that the L4-L5 location is the most frequent in almost all studies, which supports our results(8 9)
Therapeutic management of spondylolisthesis includes a medical, orthopedic and surgical component. (11)
Some studies have shown that glucocorticoid infiltrations only offer short-term effectiveness in relieving symptoms, with long-term failure, which is consistent with KRAIWATTANAPONG et al (12).
BELL et al (156) studied a group of symptomatic patients who wore an orthosis for almost two years, coupled with physical therapy. During this study, an improvement in symptoms, with absence of progression of slippage in all patients was noted.
The study by STEINER and MICHELI (15) which focused on the installation of a splint for 6 months showed that 78% of patients had an excellent result.
Surgical treatment was required in all patients in our study, using the minimally invasive transforaminal interbody fusion method.The aim was above all to eliminate the painful symptoms and the neurological deficit

Comparative studies between minimally invasive surgery (Mis TLIF) and conventional surgery have been carried out by:WANG et al (14) in 2010 whose results raised advantages for the minimally invasive technique with regard to postoperative pain and hospital stay;GOLDSTEIN et al (13). The minimally invasive technique presents less postoperative pain, less blood loss as well as a reduction in the length of hospitalization and the risk of postoperative infection; while the rate of intraoperative complications were close, as were the functional results;

Literature data have shown that the development of interventional radiology and specialized instrumentation, minimally invasive fusion techniques have theoretically allowed surgeons to perform fusions with a reduction in iatrogenic injury, hemorrhage and duration. hospitalization. (16) (17)

The comparative state of the different complications according to the different techniques with Mini TLIF carried out in our patients and those of Tamburrelli (208) show that there is a clear reduction in the aforementioned complications compared to other techniques, this justifies the interest of the mini-TLIF in the management of spondylolisthesis. This data is shown in the table 2

Table 2 : Comparative table of complications linked to SPL surgical techniques:

Étude	Technique	Complications			
		Douleurs	Infections	Transfusion	Others
Kirby 2018 (151)	PLF	10.4%	6%		CSF leak (1.4%) Pseudarthrosis (0.7%)
Oikonomidis 2019 (204)	PLIF/TLIF		9.6%	4.8%	Revisionsurgery for screwdisplacement (1.6%)
Turcotte 2018 (205)		9.5%	1.5%	8.9%	Embolie pulmonaire (0.7%) TVP (1.2%)
Pui Yin Cheung 2016 (206)		29,8%			Radiologicalinstability (7.8%)
P. Ver 2018 (207)		20%			Neurologicaldeficit (24.8%)
Urquhart 2018 (153)		15.9%	10.3%		CSF leak (4.6%)

Tamburrelli 2018 (208)	Mini-TLIF	14.22%	0%	0%	0%
Notre étude	Mini-TLIF	30%	0%	0%	

Clinically, 62% of our patients have a very good progress, 26% a good progress and 4% an average progress.
Neurological recovery was required in all our patients who had previously presented a neurological deficit.

In view of the functional results observed in comparison with the data in the literature we deduce that the complete reduction of slippage should not constitute the main objective of the treatment but that the main objective must be the restoration of the adapted segmental lordosis to the morphotype. (18)

Conclusion :

Our study has highlighted the significant interest in minimally invasive spondylolisthesis surgery performed by well-trained practitioners.
Treatment always begins with medical and orthopedic treatment, but depending on the progression of the disease, surgical treatment is often used. The determining factor in determining the indication for surgery is the failure of medical and orthopedic treatment and the persistence or even worsening of the symptoms. Minimally invasive surgery concretely meets the required objectives, in particular the reduction of the risk of hemorrhage and infection, rapid postoperative recovery and the preservation of the muscles.

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