

# Epidemiological, Clinical and Radiological Study of Patients Operated on for Spondylolisthesis in the Neurosurgery Department of CH “the Luxembourg” in Bamako

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## Abstract

**Introduction:** Spondylolisthesis is defined as a permanent anterior sliding of the vertebral body accompanied by the pedicles, the transverse processes and the posterior joints in relation to the underlying vertebra. The prevalence of spondylolisthesis varies between 4% and 9%, according to different authors in France, China and Japan. In Africa, some African authors find a spondylolisthesis rate of 9.93%. The objective of this study was to study the clinical and radiological aspects of spondylolisthesis at the Mother-Child Hospital of Bamako. **Methods:** Prospective and retrospective descriptive study carried out in

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the neurosurgery department of CH Mother-Child Luxembourg in Bamako from 2010 to 2018. Result: We collected 42 patients operated on for spondylolisthesis out of 145 patients, *i.e.*, 29% of the department's activities. The average age of our patients was 51 years old, with extremes of 20 and 75 years old. The sex ratio was 0.81 in favor of women. 61.9% of our patients performed work requiring physical strength. Neurogenic claudication was the predominant clinical sign with 88.1% of cases. CT was the most common way of exploration in 57.1% of cases and CT myelo in 47.6% of cases. Disc herniation was associated with spondylolisthesis in 23% of cases. Spondylolisthesis was grade 1 in 59.6% of cases and was responsible for mixed stenosis in 73.82% of cases. All our patients underwent laminectomy. The evolution at 6 months postoperative was favorable in 64.3% of cases. Conclusion: The diagnosis of spondylolisthesis is radiological and makes it possible to define the type of lesion according to its etiology and its severity, but also to highlight the conflicts with the nervous system which will have to be cured. Field and household work, pregnancy, carrying loads or children on the back could be incriminated.

## Keywords

Spondylolisthesis, Radiology, Operated

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## 1. Introduction

Spondylolisthesis is defined as a permanent anterior sliding of the vertebral body accompanied by the pedicles, the transverse processes and the posterior joints in relation to the underlying vertebra [1].

Etiologies are multiple (isthmic, degenerative, dysplastic, traumatic and pathological) [2], but the most common is acquired bilateral isthmic lysis. The prevalence of spondylolisthesis varies between 4% and 9%, according to different authors in France, China and Japan [3], but it would probably be underestimated in the black population. In Africa, some African authors find a spondylolisthesis rate of 9.93% [4].

It is important here to define and discuss the place of these different radiological examinations in the positive diagnosis on the one hand and also in the exploration of the consequences of the instability and the repercussions on the intra-spinal structures on the other hand. These examinations range from standard frontal and lateral thoracolumbar X-rays in load or dynamic, which are the least expensive first-line examination and very profitable from the point of view of a positive diagnosis. CT and MRI are more effective in assessing the impact of spondylolisthesis on the dural sac and the roots in order to guide the therapeutic gesture. The treatment of spondylolisthesis is most often conservative, but surgical management is sometimes necessary for the forms of disabling radicular pain, which persists despite well-conducted medical and orthopedic treatment.

In Mali, the prevalence of spondylolisthesis is not known. The absence of the

previous study in Mali, the importance of the radiological exploration of this pathology and the indications of the examinations, which relate the lesions observed with the clinical symptomatology pushed us to carry out this study.

The objective of this study was to study the clinical and radiological aspects of spondylolisthesis at the Mother-Child Hospital of Bamako.

## **2. Methodology**

### **2.1. Type and Framework of Study**

Our prospective and retrospective descriptive study was carried out in the neurosurgery department of the CHU Mother-child “the Luxembourg” in Bamako over a period of 9 years from 2010 to 2018.

### **2.2. Study Population**

The study involved a series of 42 patients who performed imaging examinations and operated on for spondylolisthesis in the Neurosurgery Department of the Mother and Child Hospital Center “Luxembourg” during the study period.

### **2.3. Inclusion Criteria**

All patients who presented with spondylolisthesis on one of the radiology examinations of the Luxembourg imaging department and operated on in the Neurosurgery department whose clinical and radiological records were usable were included.

### **2.4. Criteria for Non-Inclusion**

All patients with unusable files not explored radiologically or not operated.

### **2.5. Data Collection**

The data was collected from a pre-established survey sheet, including epidemiological, clinical and radiological data.

The type of spondylolisthesis was specified by the presence of degenerative lesions (degenerative spondylolisthesis or SLD) or by the presence of isthmic lysis of traumatic origin (spondylolisthesis by isthmic lysis or SLI).

The qualitative variables were described by means and the quantitative variables by numbers and percentages.

### **2.6. Statistical Analysis**

We used SPSS version 21.0 software for data analysis and Microsoft Office 2016 Pack for text and table entry.

### **2.7. Ethical Considerations**

The collection of data was carried out with respect for the anonymity of the patients and the confidentiality of their information; the surname and first name of the patients were coded in order to preserve anonymity.

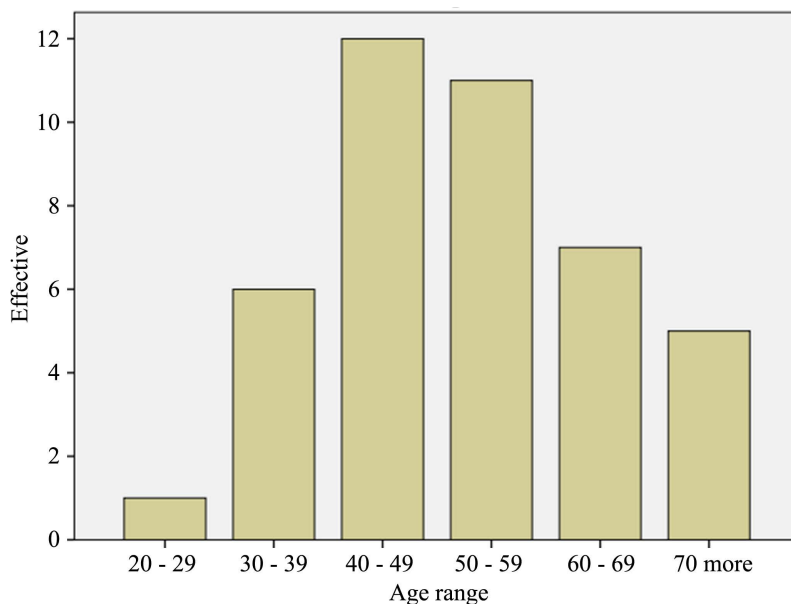
### 3. Results

We collected 42 patients operated on for spondylolisthesis out of 145, *i.e.*, 29% of patients operated on for spondylolisthesis during the study period. The average age of our patients was 51 years old with extremes of 20 to 75 years old. The female sex was the most frequent (with a sex ratio of 0.81). Housewives were the most concerned socio-professional stratum 40.5% of patients. The majority of our patients came from Koulikoro and Bamako with 42.9% and 40.5% respectively. Patients performing strength work dominated the study 61.9%. Root claudication was the most common clinical sign, 88.1% of patients; radiculalgia came in second place with 85.7% of patients. 33.3% of our patients had clinical signs that evolved within a year. CT was the most performed radiological examination in 24 cases, *i.e.*, 57.1%. It was noted 48.66% of cases of spondylolisthesis by isthmic lysis and 54.56% of cases of degenerative spondylolisthesis. Spondylolisthesis was linked to isthmic lysis in 57.1% of cases to disc herniation in 54.8% of our patients. Three floors and more were affected by degenerative lesions in a third of cases (35.7%). Spinal statics showed good sagittal balance in 59.5% of cases, with multiple isthmic lysis in 4 cases. 59.6% of our patients had grade I spondylolisthesis, *i.e.*, 59.6%. Canal stenosis was noted in all our patients and it was predominantly mixed, *i.e.*, 73.8%. All our patients underwent laminectomy associated with osteosynthesis (81% of cases). The postoperative course was simple for 85.7% of patients and complicated for 14.3% of patients. The clinical evolution was favorable in 64.3% of cases at 6 months postoperative.

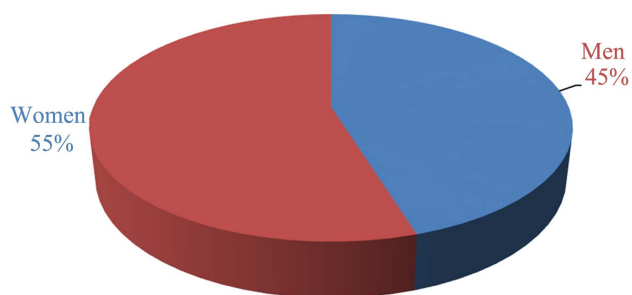
Rehabilitation including abdominal and lumbar muscle strengthening exercises, was performed and followed by a third of our patients (33.3%). It has improved the clinical situation by 33.3%. The other patients, for lack of means, did not undergo rehabilitation (**Figure 1** and **Figure 2** and **Tables 1-3**).

**Table 1.** Distribution of patients according to profession.

Profession	Number	Percentage
Retirement or informal activity informelle	2	4.8
Manual Trades	6	14.3
<b>Housewife</b>	<b>17</b>	<b>40.5</b>
Teachers	2	4.8
Military	4	9.5
Tradesmen	6	14.3
Health worker	1	2.4
Administrators	1	2.4
Contractors	1	2.4
Imam	1	2.4
Health	1	2.4
<b>Total</b>	<b>42</b>	<b>100</b>



**Figure 1.** Distribution of patients according to age groups.



**Figure 2.** Distribution of patients by sex.

**Table 2.** Distribution of patients according to workload.

Workload	Workforce	Percentage
Group I: Sedentary people or informal activity	4	9.5
Group II: Business that does not require significant physical effort	12	28.6
<b>Group III: Force work</b>	<b>26</b>	<b>61.9</b>
<b>Total</b>	<b>42</b>	<b>100.0</b>

**Table 3.** Distribution of patients according to clinical signs.

Clinical signs	Workforce	Percentages
Low back pain	28	66.7
Radicalgies	36	85.7
<b>Radicular lamination</b>	<b>37</b>	<b>88.1</b>
Genito-sphincter disorders	12	28.6
Paraparesis	10	23.8

**Imagery: (Tables 4-10)**

The postoperative course was simple for 85.7% of patients and complicated for 14.3% of our patients.

All our patients benefited from a systematic AP and postoperative profile X-ray. CT and MRI were performed when necessary during the evolution.

**Table 4.** Distribution of radiological examinations carried out by each patient.

Examinations	workforce	Percentage
MRI CT	1	2.4
MyeloTDM alone	15	35.7
MyeloTDM + RxDyanamiq	3	7.2
MyeloTD + TDM + RX	1	2.4
RX TDM	37	7.2
<b>TDM</b>	<b>18</b>	<b>42.9</b>
TDM then Myelo	1	2.4
<b>Total</b>	<b>42</b>	<b>100.0</b>

**Table 5.** Distribution of patients according to the radiological examinations carried out.

Review	Workforce	Percentages
<b>Radiography</b>	<b>7</b>	<b>16.7</b>
TDM	24	57.1
Myeloscan	20	47.6

**Table 6.** Distribution of patients according to the number of floors affected.

Lesional levels	Effective	Percentage
A floor	13	31.0
Two floors	14	33.3
<b>Three floors and more</b>	<b>15</b>	<b>35.7</b>
<b>Total</b>	<b>42</b>	<b>100.0</b>

**Table 7.** Distribution according to the state of balance of the spine.

Balance	Ee	Effective	Percentage
<b>Good balance</b>	<b>13</b>	<b>25</b>	<b>59.5</b>
Straightness	14	12	28.6
Hyperlordosis	15	2	4.8
Humpback		2	4.8
Scoliosis		1	2.4
<b>Total</b>	<b>42</b>	<b>42</b>	<b>100.0</b>

**Table 8.** Distribution of patients according to the grade of spondylolisthesis.

Grade	Workforce	Percentage
<b>Grade 1</b>	<b>25</b>	<b>59.6%</b>
Grade 2	5	11.9
Spondylolisthesis but of unspecified grade	12	28.5
<b>TOTAL</b>	<b>42</b>	<b>100%</b>

**Table 9.** Distribution of patients according to the type of canal stenosis.

Type of stenosis	Effective	Percentage
Central stenosis	11	26.2
<b>Mixed stenosis</b>	<b>31</b>	<b>73.8</b>
Total	42	100

**Table 10.** Distribution of patients according to intraoperative incidents.

Interoperative complication	Effective	Percentage
<b>No</b>	<b>30</b>	<b>71.4</b>
Hemorrhage	9	21.4
Dural gap	2	4.8
Dural breach	1	2.4
<b>TOTAL</b>	<b>42</b>	<b>100%</b>

## 4. Iconographs

These few images of illustrations talk about bilateral isthmic lysis, the decline of the posterior vertebral wall in the event of lysis, the disc damage that can occur and the treatments that we can offer (**Figures 3-8**).

## 5. Discussion

### 5.1. Epidemiology (Figure 1 and Figure 2, Table 1 and Table 2)

We collected 42 patients operated for spondylolisthesis out of 145 patients operated on the lumbar spine during the study period, *i.e.*, 29%. The prevalence of this pathology in the world would vary between 4% and 9%, according to Hu SS [3]. Its frequency is poorly evaluated in our country because of the multiplicity of the course and the management of patients.

The average age of our patients was 51 years old. Koné P. [5] found an average age equal to 48.53 years. This relatively early age can be explained by the harsh living and (country) working conditions in our towns and villages.

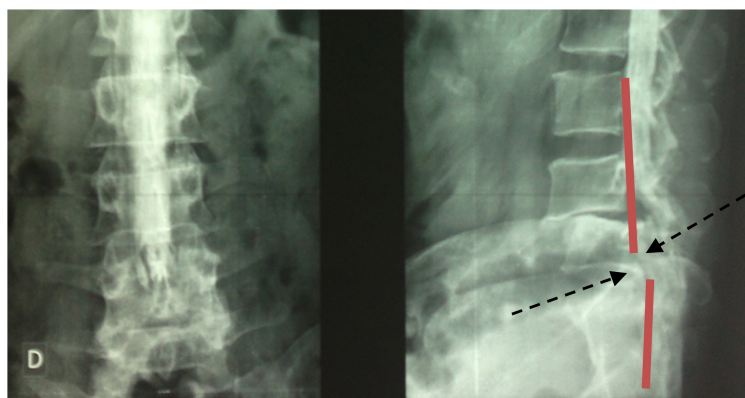
Spondylolisthesis was more common in women in our study, as in the study by Sanoussi [6] (55%) in 2006, but not blatantly. Our result agreed with the study by Koné P. [5] who found (66.7%). This female predominance could be



**Figure 3.** TDM aspect of a bilateral isthmic lysis indicated by the arrows.

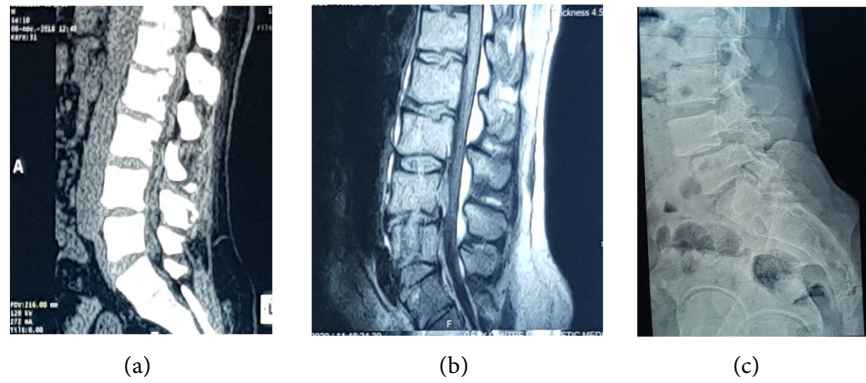


**Figure 4.** Dynamic profile earthworm radiography showing the importance of spondylolisthesis (Meyering 3 Grade).



**Figure 5.** Additional myelographs showing the importance of canal stenosis (arrows, shot taken not loaded, not dynamic).

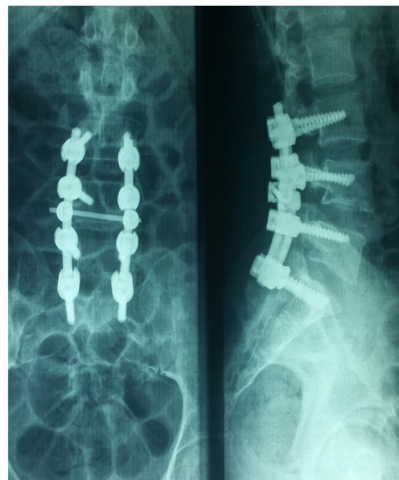




**Figure 6.** ((a)-(c)) In the same patient TDM (4(a)) and MRI (4(b)) showing isthmus lysis, disc pinching, signal anomaly in hypo-T2, but no instability. However, this is found on the standard RX (c).



**Figure 7.** Standard radiography showing a rupture of titanium implant (arrow) following a trauma (passenger of a "SOTRAMA" vehicle having had an impact) in connection with a reduction in disc height which increased constraints.



**Figure 8.** Post-operative control radiography of a spondylolisthesis by multi-stage isthmus lysis. Note the restoration of lumbar lordosis.

explained by the harshness of household chores involving women on the one hand, and also by the mechanical constraints of the work which is always done in bending in our countries (fieldwork, laundry, cooking activities, sweeping, drawing water, carrying loads on the back) increasing the pressure on the discs and on the posterior elements (isthmuses, joints) [7]. Moreover, in addition to women, our sample also includes other populations at risk; in particular, the military, sportsmen and forced laborers who were male just like in the study of [7] which found 55.84% of forced workers.

Our patients mainly came from Bamako and its surroundings in 83.4% of cases, which can be explained by geographical proximity and easier access to health structures and to radiological and diagnostic examinations.

### 5.2. Clinic (Table 3)

The duration of evolution of the symptomatology was more than 2 years. This result is compatible with that of Lamini [8] who found 2.3 years. This could be explained by cultural considerations (resisting pain, mystical considerations), reluctance to intervene for fear of complications, difficulties in accessing care, or else a lack of knowledge of the real nature of the pathology. This has the effect of lengthening the therapeutic course.

Radiculalgia and neurogenic claudication, which reflect a neurological conflict, were at the forefront in 88% of our patients. The study by Abdoulatif A., [7] found 89.63% respectively. The frequency of these signs could thus motivate the consultation and the performance of radiological examinations with the aim of possibly surgical management, contrary to the data of Koné P. [5], who found a frequency of 48.8% and in which the treatment was conservative.

### 5.3. Radiological Study: (Table 4 and Table 10)

CT and myeloscanner were the most performed first-line examinations in our study with 57.1% and 47.6% respectively.

This could be explained by the clinical symptomatology already evolved at the time of the consultation, making conventional radiography useless because it requires at least an analysis of the bone content and structures. Moreover, sometimes patients have already taken conventional radiographs and the next step, given the symptoms, is therefore CT.

Myeloscanner, an invasive examination, was also performed by some of our patients.

These examinations were sometimes associated in some patients with myelography, coupled with dynamic X-rays in 3 cases, allowing a very good dynamic analysis of the content.

Our results were compatible with those found by Abdelli [9] 42.1% CT, 53.33% in Ranib [10]. CT therefore remains the best compromise between cost, accessibility, exploration of the container and content for the operative planning, but remains a source of irradiation. Our results were different from those of

Koné P. [5] where conventional X-ray represented 91.1% of radiological examinations performed in Rheumatology. These were patients treated in rheumatology in a conservative manner that did not necessarily require exploration of the contents, hence the interest in cross-sectional imaging (CT and MRI) [11] for operative planning.

MRI was performed one patient in our series, as it is difficult to access due to cost and lack of available devices. And yet she has undeniable advantages in the exploration of spinal content, disc quality, soft tissue and stenosis [12].

Spondylolisthesis by isthmic lysis was the most common in our study with 57.1% of cases, 66.6% of which were women. These data were compared to the results of Abdoulatif who found 53.89% spondylolisthesis by isthmic lysis, 60% in the study by Ranib M. [10].

The mean age difference between isthmic lysis spondylolisthesis (48.66 years) and degenerative spondylolisthesis (54.56%) in our study was also found by other authors Abdoulatif A. [7], but with an age of lower benefit for spondylolisthesis by isthmic lysis (31 years for Abdoulatif A. [7]) and comparable ages for degenerative spondylolisthesis. However, spondylolisthesis due to isthmic lysis remains the prerogative of young subjects with an average age varying between 25 and 30 years [13].

The most affected lesion level was L4 - L5 with 75% for spondylolisthesis by isthmic lysis and degenerative spondylolisthesis, which was also found by Koné P. [5] with 66.6% of cases. We found 37.1% lysis of L4 and 34.5% lysis of L5. The same findings were made by Koné P. [5] Who found 48.9% and 37.8% of cases respectively. Other authors, such as Abdoulatif [7], instead found L5 lysis in 60% of cases. These results were different from those found in our study, because their sample was smaller and the study was prospective. The floor lysed here is very heavily used during bending movements for household chores and field work in our countries.

The multiple isthmic lysis found in 4 patients in our study could be related to familial, dysplastic or constitutional factors as reported by Wiltse [2].

The most common grade of listhesis was Meyerding grade 1 with 83% of cases. This frequency could be explained by an under-evaluation of the grade because the examinations carried out (CT) are not covered. The presence of foraminal stenosis related to Gill's nodules will lead to glaring symptoms, despite the low relative grade. In comparison, Newman [13] found 51%. It should be noted that our study concerned symptomatic or deficient spondylolisthesis with already a clinical indication for surgery, also found by Iba Ba [4]. Nevertheless, all the patients followed a first-line conservative treatment (analgesics, NSAIDs, lumbostat, rehabilitation). This was also found in the study by Iba Ba [4].

#### 5.4. Associated Lesions

A herniated disc was associated in 54.8% of our patients. This was explained by Butler, according to whom disc degeneration would be one of the primary factors of spondylolisthesis [14].

More than two floors were affected by degenerative lesions, which could testify to the duration of the evolution of the pathology before its management.

When analyzing the type of stenosis, the most frequent was a mixed central and foraminal stenosis in 73.8%, which explains well by the anteroposterior reduction of the canal and foramina during spondylolisthesis.

### 5.5. Processing

The treatment consisted of a surgical gesture of sagittal stabilization by a rigid arthrodesis (81%) but also a recalibration of the canal and the foramen (71%). This has also been described in other studies [4].

### 5.6. Type of Intervention: (Table 10)

Gill's operation was performed in 12% of cases because fixation is not systematic considering the fact that listhesis allows the spine to regain sagittal neo-balance [15] [16]. This intervention, although having good results, has tended to be less used for several decades [17].

It should therefore be noted that a reduction, even partial, thus makes it possible to correct lumbar hyperlordosis, pelvic retroversion and certain olisthetic scoliosis. A systematic reduction is not necessary because a new equilibrium has been established as described by Lapras [16]. Too much reduction can then lead to stretching injuries and neurological disorders that did not exist preoperatively.

Laminectomy performed in 100% of cases was associated with discectomy (38%) and foraminotomy (71.4%). Stabilization by osteosynthesis was performed in 81% of cases and currently remains the standard. It must absolutely take into account the pelvic parameters and the sagittal balance of the spine. It was associated with a lordosing interbody cage placement when necessary.

Intraoperatively, 23.5% of patients required a blood transfusion because of epidural bleeding and 7.2% had dural tears. This could be explained by the stenosis of the canal which exposes to adhesions between the sac and the yellow ligament, but also by the presence of numerous epidural varices due to the compression.

### 5.7. Evolution

The postoperative course was satisfactory in 85.7% of cases, unlike Kone P. [5] who found only 38.5% good progress in non-operated patients. This indicates a benefit of nerve decompression surgery and stabilization of the spine compared to conservative treatment, when there is resistance to medical treatment if the indication is well established and the procedure is well performed [16]. The 14.3% of cases developed complications such as abscess of the psoas-iliac muscles, paraparesis having evolved for 6 months.

### 5.8. Postoperative Radiological Assessment and Follow-Up

All our patients benefited from a systematic postoperative X-ray, as well as scan-

ners or MRI in case of suspicion of recurrence, infection or residual compression, the latter being more indicated because of metallic artifacts on the CT scan. In relation to the material in place. However, the implants must be MRI compatible (titanium).

The main limitations of our study were the absence of cervico-dorso-lumbar spine TV radiographs to study the sagittal balance of the spine and curvatures, the cost of additional examinations and the retrospective nature of the study.

## 6. Conclusions

The diagnosis of spondylolisthesis is radiological and makes it possible to define the type of lesion according to its etiology and its gravity, but also to highlight the conflicts with the nervous system, which will have to be the subject of a cure.

Field and household work, pregnancy, carrying loads or children on the back could be incriminated.

The standard X-ray is the first examination recommended because of its simplicity, its cost and the fact that it is carried out under load. Myelography is a sensitive examination, describing the stenosis well and specific but remains invasive. Cross-sectional imaging is of great benefit, with images in the three planes allowing fine exploration of the canal, foramina and discs. Standardization of exploration is therefore necessary with well-oriented parasagittal, frontal and axial sections or reconstructions.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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