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Long term postoperative results and quality of life after surgery for lumbar spinal stenosis in sub-sahara African countries, the case of Cameroon: A cross-sectional study

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ABSTRACT

Objectives: Lumbar spinal stenosis is a frequent and disabling disease of the elderly. However, the impact of its surgery on the long term (≥5 years) postoperative results and quality of life has not yet been evaluated in our setting.
Methods: The study population consisted of 224 patients operated between 2010 and 2017 at the Yaounde Central Hospital and the Yaounde General Hospital, of whom 33 were evaluated. Long term postoperative results were defined as reoperations, indication for reoperation, time elapsed to reoperation and control-X ray findings. Quality of life (QOL) was evaluated using the Oswestry Disability Index (ODI) and Numerical Pain Rating Scale (NRS), and compared to reported preoperative values. The one-way analysis of variance and Kruskal–Wallis tests were used for associations between patient characteristics and quality of life outcomes.
Results: Participants had a mean age of 57.3 years. 21% of participants were reoperated at least once, two years later on average due to reappearance of their clinical pictures. QOL significantly improved from being crippled (mean ODI 67.5%) and having severe pain (mean NRS 8) before surgery, to moderate disability (mean ODI 34.4%, $p < 0.01$) and moderate pain (means NRS 4, $p < 0.01$) five years later. Having large family support was the only factor independently associated with improved ODI and NRS ($p = 0.01$).
Conclusion: Lumbar spinal stenosis surgery is still beneficial five years later. Large cohort studies need to be conducted in our setting.

1. Introduction

Lumbar spinal stenosis (LSS) is the narrowing of the lumbar spine vertebra in the areas of the central canal, lateral recesses or intervertebral foramina (neural foramina) resulting in nerve root impingement, most often due to degenerative changes.[1,2] Prevalence estimates of degenerative LSS vary between 11 and 39% world-wide.[3] Actually, 266 million individuals have degenerative spine disease each year, with low- and middle-income countries having 4 times as many cases as high income countries.[4] Moreover, LSS is the most common reason for spinal surgery in individuals above 65 years and is a highly disabling condition with profound impacts on the quality of life of patients.[5–7]

Most symptomatic patients initially receive conservative treatment modalities. The standard of care when conservative management fails or in severe cases, is surgery.[8,9] Owing to the fact that quality of life is an important indicator for assessing outcomes after surgery and rehabilitation, concerns have grown for evaluating LSS patients after surgery. Indeed, though surgery significantly improves quality of life compared to conservative management, studies have shown that the effects of surgery fade over time, being less effective beyond two years.[10] Moreover, it has been shown that patients operated for LSS are 3.9 times likely to be reoperated at an adjacent level and reoperation rates vary

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Table 1
Oswestry disability index interpretation.

Score (%)	Interpretation
0 to 19	Minimal disability
20 to 39	Moderate disability
40 to 59	Severe disability
60 to 79	Crippled
80 to 100	Bed-bound or exaggerative patients

from 11 to 15 %.[11,12] Many studies abroad have evaluated the quality of life of patients after surgery for LSS both in short (1 year) and long term (5 years and above).[6,7,13–17] In Africa, a plethora of studies have evaluated the epidemiological, clinical and therapeutic aspects of LSS.[9,18–21] Studies conducted in Cameroon and others sub Saharan African countries showed that LSS affects a younger population (40–60 years) compared to Western countries (65–70 years) and thus, incapacitates people who are still in the working population.[9,18,20] To our knowledge, only one study in Africa, conducted in Cameroon, has evaluated the quality of life of patients operated for LSS one year after surgery. So there are lack of local data in this topic concerning long term results and quality of life after surgery.

We therefore sought to investigate the long-term postoperative results and quality of life of patients using standardized tools such as the Oswestry Disability Index and the numerical rating scale so as to better precise the indications and benefits of surgery. This is relevant in our setting taking in account that the population are relatively young and the cost of surgery is supported by the patient. Understand long term result after surgery and quality of life are helpful for a reasonable decision making.

2. Materials and method

2.1. Study population

The study population consisted of LSS patients operated from the 1st of January 2010 to the 31st of December 2017 at the Yaounde Central Hospital (YCH), and the Yaounde General Hospital (YGH). We included patients who gave their informed consent. We did not include patients from whom consent could not be obtained and excluded those with incomplete medical records.

2.2. Procedure

We screened the medical files and operating room registries of the YCH and the YGH from January to March 2023. Participants were then called in April 2023 to: explain the purpose, benefits and risks of the study and schedule onsite meetings. For participants who could come to the study sites, we administered questionnaires and performed a control X-ray of the lumbar spine to those who had received a fusion procedure

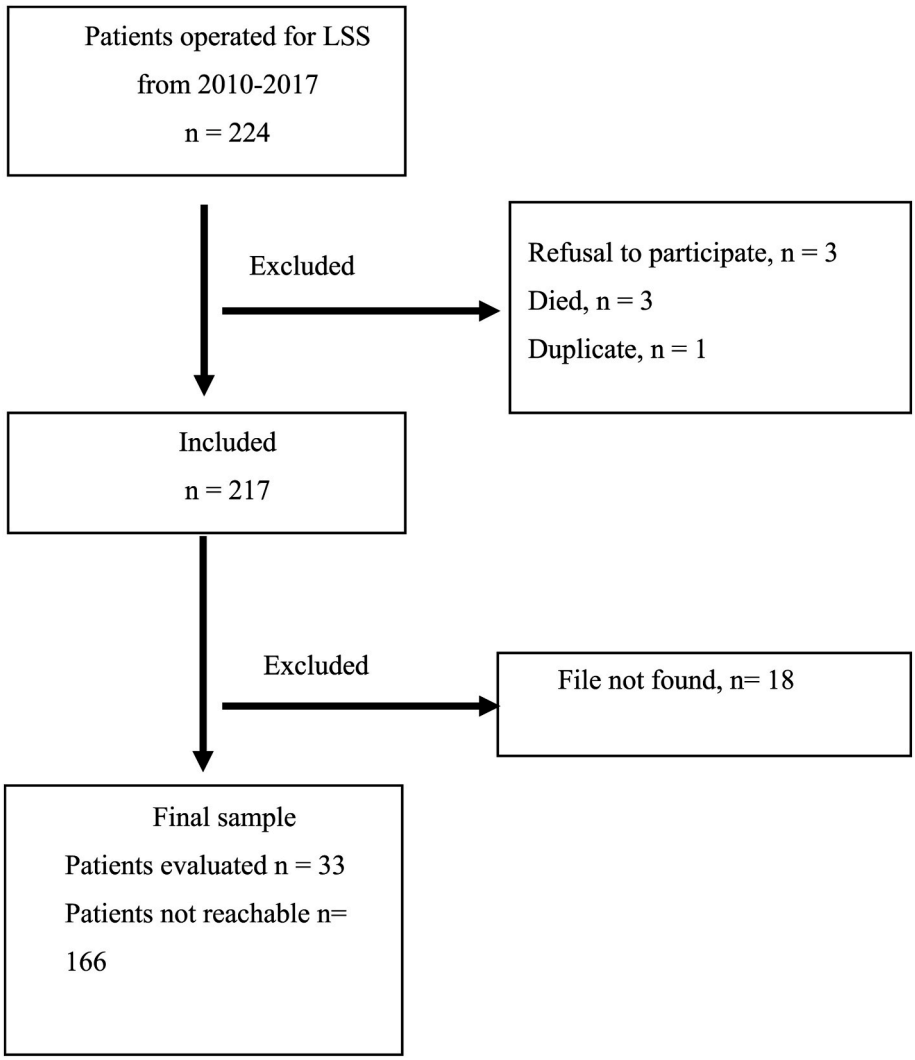

Fig. 1. Flow chart of participants.

Table 2
Sociodemographic profile of operated patients not reachable. N = 166.

Characteristic	*n* (%)
Age	
40–49	39 (23.49)
50–59	67 (40.36)
60–69	42 (25.30)
70–79	18 (10.83)
Sex	
Female	125 (75.30)
Male	41 (24.70)
Level of education	
Primary	56 (33.73)
Secondary	57 (34.33)
University	31 (18.67)
None	21 (12.65)
Marital status	
Single	13 (7.83)
Free-union	16 (9.63)
Married	111 (68.86)
Divorced	9 (5.42)
Widow(er)	17 (10.24)
Profession	
Housewife	67 (40.36)
Civil worker	39 (23.49)
Retired	12 (7.22)
Farmer	34 (20.48)
Others	14 (8.43)
Number of children	
0–1	9 (5.42)
2–4	66 (39.76)
5–9	91 (54.82)

during their initial surgeries. This was done from May to June 2023. The questionnaire was administered in French and English and comprised of four sections: sociodemographic profile, clinical and therapeutic profile, postoperative results and quality of life outcomes. Plain radiography was done at the Yaounde Emergency Centre (YEC). Participants who could not travel to the study sites were administered consent forms and questionnaires online and through phone calls. Usually in our department of neurosurgery, patients stay with a booklet where scheduled fellow up information's were consigned, since lack digitalization of medical file. The X-ray films were then sent online to the principal investigator.

3. Outcome measures

The surgical outcomes were the long-term postoperative results, which we defined as: reoperations, indication for reoperation, time elapsed to reoperation and control X-ray findings. Quality of life outcomes were evaluated using the Oswestry Disability Index version 2.1[22] and the Numerical Pain Rating Scale (0–10),[23,24] and compared to patients' reported preoperative values. The ODI is a ten-section pain questionnaire used to evaluate functional disability after surgery (Table 1).

3.1. Statistical analysis

The data collection form was coded with CSPro (Census Survey Processing) and analysis was conducted using R statistical software 4.2.3 (R Foundation for Statistical Computing, Vienna, Austria). Qualitative variables were expressed as frequencies and percentages, while quantitative variables were expressed as means and standard deviations or medians and interquartile ranges. The ODI response scores per section were reverse coded on a six-point Likert scale (from extremely dissatisfied to extremely satisfied) to better appreciate the changes for every section. The one-way analysis of variance and Kruskal–Wallis tests were used to check for associations between patient characteristics and quality of life outcomes. The paired-t test was used to analyze differences between the preoperative and current ODI and NRS. Multivariate linear regression was used to find factors independently associated with increased or decreased quality of life.

Table 3
Clinical and radiologic profile of patients not reachable N = 166.

Characteristic	Value
Body Mass Index	31.6 ± 9 kg/m^2
Comorbidities	123 (74.10)
Osteoarthritis	128 (77.11)
Hypertension	92 (55.42)
Previous back surgery	26 (15.66)
Diabetes	32 (19.28)
HIV	7 (4.21)
Clinical presentation	
Low back pain	48 (28.92)
Neurogenic claudication	148 (89.16)
Lower extremity weakness	32 (19.28)
Bowel/bladder symptoms	14 (8.43)
Diagnosis	
LSS without instability	74 (44.58%)
LSS with spondylolisthesis	92 (55.42%)
Levels of stenosis	
Two levels	69 (41.57%)
Three levels	81 (48.80%)
More than three levels	16 (9.64%)

Values are expressed as either the number (%) or the mean ± SD.

Table 4
Sociodemographic profile of participants.

Characteristic	*n* (%)
Age	
40–49	8 (24.0)
50–59	14 (42.0)
60–69	9 (27.0)
70–79	2 (6.1)
Sex	
Female	27 (82.0)
Male	6 (18.0)
Level of education	
Primary	13 (39.0)
Secondary	10 (30.0)
University	7 (21.0)
None	3 (9.1)
Marital status	
Single	1 (3.0)
Free-union	1 (3.0)
Married	26 (79.0)
Divorced	1 (3.0)
Widow(er)	4 (12.0)
Profession	
Housewife	13 (39.0)
Civil worker	9 (27.0)
Retired	3 (9.1)
Farmer	2 (6.1)
Others	8 (24.3)
Number of children	
0–1	2 (6.1)
2–4	11 (33.0)
5–9	20 (61.0)

4. Results

Of the 224 patients operated between 2010 and 2017, we did not include 7 patients (3 participants died before 2023, 3 participants refused to participate and there was one duplicate file). For the remaining 217 patients: 166 patients could not be reached through phone calls, 18 medical records were absent (and were excluded), and 33 patients were effectively evaluated. The flow chart of participants is shown in Fig. 1.

Table 5
Clinical and therapeutic profile of participants.

Characteristic	Value
Body Mass Index	30.9 ± 9 kg/m^2
Comorbidities	24 (72.7)
Osteoarthritis	16 (67.0)
Hypertension	13 (54.0)
Previous back surgery	7 (29.0)
Diabetes	2 (8.3)
HIV	1 (4.9)
Clinical presentation	
Low back pain	18 (55.0)
Neurogenic claudication	16 (48.0)
Lower extremity weakness	5 (15.0)
Bowel/bladder symptoms	2 (6.1)
Diagnosis	
LSS without instability	17 (52%)
LSS with spondylolisthesis	16 (48%)
Levels of stenosis	
Two levels	13 (39,40%)
Three levels	16 (48.48%)
More than three levels	4 (12.12%)

Table 6
Surgical outcomes of participants.

Characteristic	Value
Reoperations	7 (21.2)
Number of reoperations	
1	5 (15.2)
2	1 (3)
>2	1 (3)
Time elapsed to reoperation	24 ± 60 months
Indication	
Reappearance of clinical picture	6 (18.2)
Replacement/Removal of fusion materials	1 (3)
Control X-ray findings	
Normal	13 (76.5)
Hardware fractures	2 (11.8)
Pseudarthrosis	1 (5.9)
Adjacent segment disease	1 (5.9)

Values are expressed as either the number (%) or the median ± IQR.

Table 7
Association between age, sex, body mass index, comorbidities, fusion and reoperation.

Variable	Reoperation *n* (%)		
	Yes	No	*p*-value
Age			0.80
40–49	2 (25%)	6 (75.0%)	
50–59	3 (21.4%)	11 (78.6%)	
60–69	2 (22.2%)	7 (77.8%)	
70–79	0 (0.0%)	2 (100%)	
Sex			0.30
Male	0 (0.0%)	6 (100.0%)	
Female	7 (25.9%)	20 (74.1%)	
Body Mass Index			**0.03**[a]
Normal	1 (20.0%)	4 (80.0%)	
Overweight	4 (57.1%)	3 (42.9%)	
Obesity class I	0 (0.0%)	11 (100.0%)	
Obesity class II	0 (0.0%)	4 (100.0%)	
Obesity class III	0 (0.0%)	1 (100.0%)	
Comorbidities			
Osteoarthritis	2 (12.5%)	14 (87.5%)	**0.02**[a]
Hypertension	5 (38.5%)	8 (61.5%)	0.39
Previous back surgery	5 (71.4%)	2 (28.6%)	**0.01**[a]
Diabetes	0 (0.0%)	2 (100.0%)	0.99
HIV	0 (0.0%)	1 (100.0%)	0.99
Arthrodesis			0.99
Yes	5 (23.8%)	16 (76.2%)	
No	2 (16.7%)	10 (83.3%)	

[a] Statistically significant.

Table 8
Association between the sociodemographic profile and ODI.

Characteristic		Oswestry Disability Index	
Variable	mean ± sd (%)	median ± IQR (%)	*p*-value
Age			0.14
40–49	28.3 ± 11.5	30.4 ± 19.6	0.31
50–59	30.7 ± 13.3	28.5 ± 13.0	0.33
60–69	40.4 ± 20.1	42.2 ± 35.6	0.30
70–79	57.7 ± 6.2	57.7 ± 0.0	0.06
Sex			
Male	35.7 ± 22.7	28.0 ± 41.7	0.82
Female	34.1 ± 15.0	33.3 ± 17.8	/
Level of education			0.32
Primary	30.8 ± 16.3	28.9 ± 17.8	0.31
Secondary	35.0 ± 17.1	30.7 ± 26.2	0.88
University	33.4 ± 15.2	34.0 ± 24.2	0.85
None	50.3 ± 11.1	48.9 ± 0.0	0.07
Marital status			
Married	33.6 ± 14.7	29.5 ± 17.8	0.60
Others[b]	37.3 ± 22.0	33.3 ± 44.2	/
Profession			0.23
Housewife	30.9 ± 13.0	30.0 ± 18.9	0.31
Civil worker	32.1 ± 13.9	33.3 ± 22.1	0.63
Retired	51.6 ± 20.7	60.0 ± 0.0	0.05
Others[c]	36.3 ± 20.1	28.5 ± 35.7	0.70
Number of children			**0.01**[a]
0–1	63.4 ± 4.7	63.4 ± 0.0	**0.03**[a]
2–4	39.6 ± 14.2	34.0 ± 20.0	**0.12**[a]
5–10	28.6 ± 14.0	27.4 ± 21.0	**0.01**[a]

[a] Statistically significant.
[b] Single, free-union, divorced, widow (er).
[c] Trader, seamstress, computer scientist.

Table 9
Associations between clinical characteristics and Oswestry Disability Index.

Characteristic		Oswestry Disability Index	
Variable	mean ± sd (%)	median ± IQR (%)	*p*-value
Body mass index			0.15
Normal	49.6 ± 23.7	60.0 ± 32.7	0.09
Overweight	36.1 ± 18.2	28.9 ± 38.0	0.94
Obesity class I	33.3 ± 8.6	34.0 ± 10.0	0.99
Obesity class II	**19.0 ± 8.2**	**19.0 ± 15.5**	**0.03***
Obesity class III	41.4 ± 0.0	41.4 ± 0.0	0.50
Comorbidities			0.67
Hypertension	36.0 ± 16.4	33.3 ± 26.5	0.50
Diabetes	42.3 ± 34.6	42.3 ± 0.0	0.71
Osteoarthritis	33.7 ± 17.0	31.1 ± 27.6	0.95
Previous back surgery	**46.8 ± 20.3**	**60.0 ± 33.3**	**0.04***
Clinical symptoms			
Low back pain	34.5 ± 17.5	29.5 ± 27.5	0.98
Neurogenic claudication	34.1 ± 14.6	34.0 ± 17.2	0.91
Lower extremity weakness	28.4 ± 13.7	34.0 ± 25.9	0.56
Bowel/bladder symptoms	52.3 ± 20.4	52.3 ± 0.0	0.13
Diagnosis			
LSS without instability	36.7 ± 19.3	34.0 ± 38.8	0.42
LSS with spondylolisthesis	32.0 ± 12.3	29.5 ± 17.1	/

4.1. Descriptive data

The mean age of participants was 57.3 ± 9 years, and the most represented age group was 50–60 years (42%, $n = 14$). The sex ratio of 1:5. Tables 2 and 4 show the sociodemographic profile of not reachable patients and participants. Seventy height percent ($n = 26$) of participants were obese with a mean BMI of 30.9 ± 5 kg/m^2. The main comorbidities found were Knee/hip osteoarthritis (67%, $n = 22$) and hypertension (55%, $n = 18$). Low back pain (55%, $n = 18$) and neurogenic claudication (48%, $n = 16$) were the most frequent clinical presentations. Fifty-two percent ($n = 17$) of participants were diagnosed of LSS without instability and 63.6% ($n = 21$) were treated by standard laminectomy ± spondylodesis. Tables 3 and 5 show the clinical and

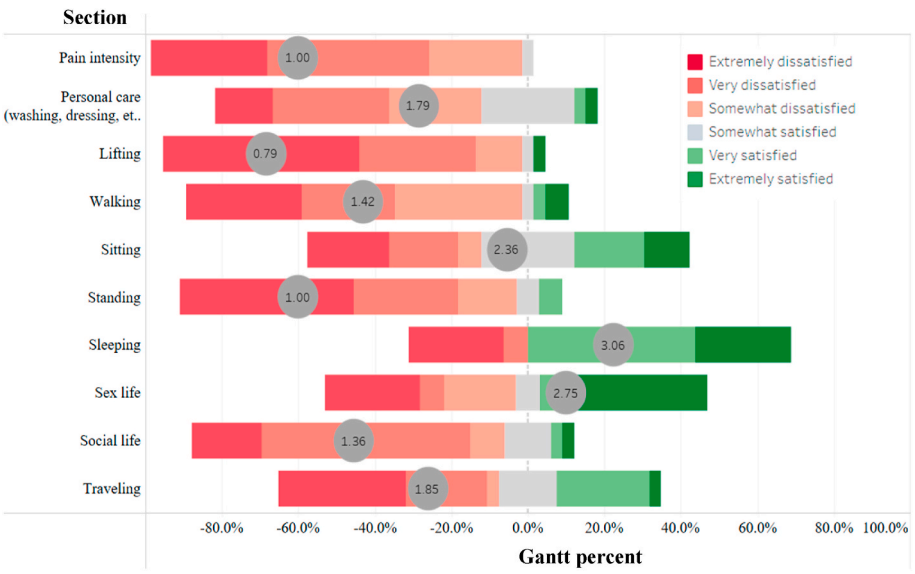

Fig. 2. Gantt chart of preoperative Oswestry Disability Index. The numbers within circles are the average reverse coded response scores per section.

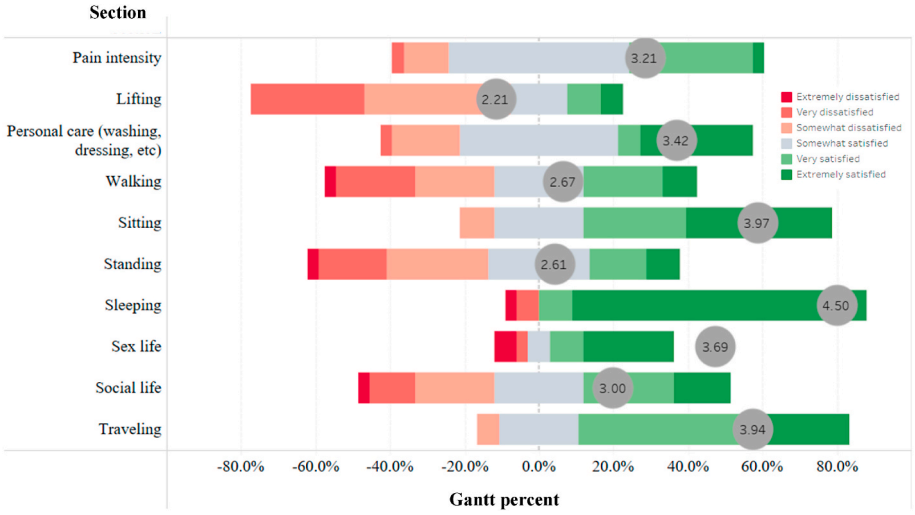

Fig. 3. Gantt chart of current Oswestry Disability Index. The numbers within circles are the average reverse coded response scores per section.

radiological profile of patients not reachable and participants.

4.2. Surgical outcomes

Seven participants had been reoperated at least once (reoperation rate = 21.2%) due to reappearance of their clinical picture. The median time lapse between the first surgery and a subsequent reoperation was 24 ± 60 months. Of the 17 control X-rays which were done, 76.5 % (n = 13) were normal. Other findings included: hardware fractures (11.8%, n = 2), adjacent segment disease (5.9%, n = 1) and pseudoarthrosis (5.9%, n = 1). Tables 6–9 show the surgical outcomes of participants.

4.3. Quality of life outcomes

Before surgery, 45% (n = 15) of participants were crippled with a mean ODI of 67.5 ± 17.5%, and 93.9% (n = 31) had severe pain with a mean NRS of 8 ± 2. At the time of evaluation, 48.5 % (n = 16) of participants were moderately disabled and 48.5 % (n = 16) had moderate pain. This improvement was statistically significant ($p < 0.01$ for both ODI and NRS). There was an overall improvement in all sections of the ODI. The most altered sections of the ODI were lifting and standing while the least altered sections were sitting and sleeping (Figs. 2 and 3). The ODI and NRS were not statistically different for patients who were operated five years ago compared to those who were operated more than five years ago (p = 0.75 and p = 0.10 respectively) (Figs. 4 and 5). The median ODI of patients who underwent spondylodesis was lower (28.9 ± 20.0%) compared to patients who underwent laminectomy alone (38.0 ± 36.2%), but this difference was not statistically significant (p = 0.14) (Fig. 6). We conducted multivariate linear regression taking into account our most significant factors to control for confounding. We found out that the large family support (number of children) and age were statistically significant irrespective of confounding. Bivariate analysis showed that having many children (large family support) was significantly associated with decreased ODI (p = 0.01) while previous back surgery was significantly associated with an increased ODI (p = 0.04). Having many children was the only factor independently associated with decreased ODI (Table 10).

5. Discussion

Lumbar spinal stenosis is a disabling condition and a frequently operated disease in neurosurgical departments. Prior to this study, the

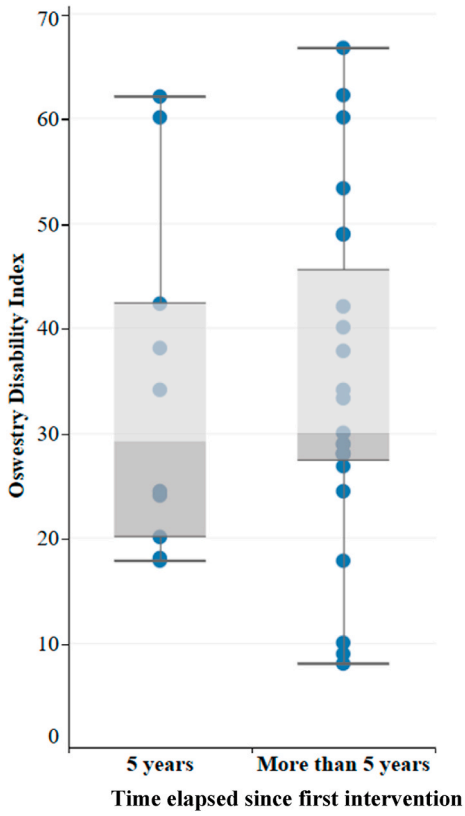

Fig. 4. ODI and time elapsed since the first intervention.

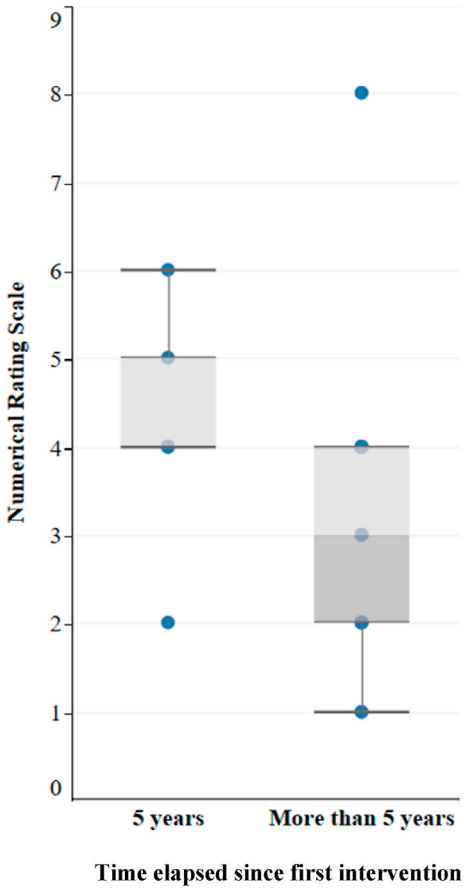

Fig. 5. NRS and time elapsed since the first intervention.

long-term postoperative results and the impact of surgery on quality of life at least five years since the first surgery had not yet been evaluated in Africa. Less than a quarter of patients were reoperated at least once two years later, and they had a moderate quality of life five years since the first surgery.

The mean age of 57 years at diagnosis was similar to previous studies conducted in Cameroon.[9,18,20] This shows that LSS affects a younger age group in Africa compared to Western countries. There is limited knowledge to account for this disparity. It may be due to activities specific to African populations as well as genetic and environmental factors. Most participants were obese with females with osteoarthritis and hypertension. Indeed, increasing weights in turn increase load on the lumbar vertebrae thereby accelerating the degenerative processes and resulting in poorer quality of life outcomes. Hypertension has been speculated to occur through an indirect mechanism as LSS may be associated with peripheral vascular compromise to the cauda equina nerve roots.[25]

Most patients were operated by conventional laminectomy and spondylodesis. This was different from a previous study in Cameroon in 2010 in which all the patients had been operated by laminectomy alone due to lack of fusion materials.[9] Thus, this highlights an improvement in neurosurgical care in our setting. Reoperation rates worldwide vary from 11 to 15% with a median time lapse of 3.4 years.[12,26] Conventional laminectomy that is still performed in our setting as opposed to minimally invasive laminectomy which has been shown to have superior outcomes.[27]

The Oswestry disability index of these patients before surgery were similar to a previous study in Cameroon evaluating quality of life outcomes one year after surgery.[20] The significant improvement five years later corroborates a 10-year cohort in Finland.[17] The latter also revealed that quality of life outcomes were not significantly different at five and ten years since the first surgery. This complements previous literature. Though the effects of surgery over time may fade over time being least effective beyond two years,[10] they may be maintained from five to ten years.

Though we did not find studies investigating the association between family support here represented by number of children and LSS outcomes, Cardoso et al. in 2016 reported better postoperative recovery after open cholecystectomy in patients who had increased family support. This can be explained by the fact that having many children may provide social support and give patients a sense of purpose thereby increasing their psychological well-being. On the other hand, previous back surgery may worsen disability due to the increased risk of adjacent segment degeneration.[28]

5.1. *Limitation of the study*

The small sample size mainly due to not reachable patients hinders its external validity and made it difficult to find significant associations. Electronic medical records still lag in Sub-Saharan Africa, but considerable efforts are being made to increase their adoption.[29] Digital health records were established at our study sites in 2022. Thus, studies conducted after this date will likely not suffer from this limitation. Also, recall bias was encountered as patients had to report their preoperative quality of life outcomes, which was minimized by considering only the ODI sections that they were confident reporting about.

Since many patients live very far from the neurosurgical center, they keep a booklet were yearly fellow up is mentioned. To minimize this bias, we also consider this booklet even by phone. Besides when we compare the characteristics of patients that could not be reach there is no significate difference concerning sociodemographic, clinical and radiological profile. Despite these limitations, the present study shows that surgery maintains a moderate quality of life in the long term, and may therefore improve its perception among LSS patients.

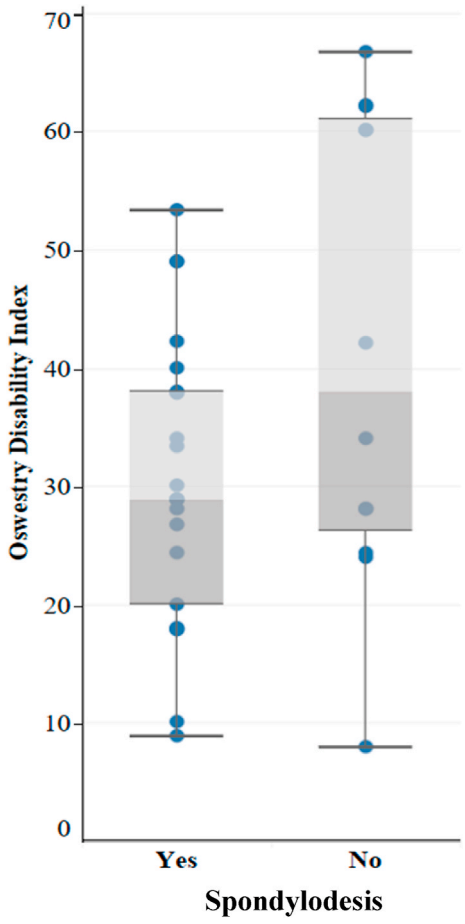

Fig. 6. ODI distribution with respect to spondylodesis

Table 10
Multivariate regression and Oswestry Disability Index.

Characteristic	B	Beta	*p*-value
Variable			
Number of children	−15.9	−0.6	0.001*
Age	0.6	0.3	0.04*
Previous surgery	−3.5	−0.2	0.37

6. Conclusion

LSS surgery maintains a moderate quality of life in the long term. Body mass index, past history of osteoarthritis, previous back surgery and large family support are factors to consider in the process of decision making for surgery. Prospective large cohort studies should be conducted in our setting to better analyses the impact of surgery on quality of life.

Ethical concerns

Ethical clearance was obtained from the Institutional Review Board from the Faculty of Medicine and Biomedical Sciences of the University of Yaounde I (IRB/FMBS-UYI). Administrative authorizations were obtained from the Yaounde Central Hospital, the Yaounde General Hospital, and the Yaounde Emergency Centre. Informed consent was obtained from participants.

Authors Contribution

Bello Figuim: Conceptualization, writing, editing of the manuscriptHaman Nassourou Oumarou and Ndome Toto orlande: critical revisions of the manuscriptCelestin Bilong Mbangtang: Literature review, data collection, analysis and writing of the manuscriptDjientcheu Vincent De Paul: supervision, validation and critical revisions of the manuscript.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Abbreviations

BMI: Body Mass Index
LSS: Lumbar spinal stenosis
NRS: Numerical Rating Scale
ODI: Oswestry Disability Index
QOL: Quality of Life
YCH: Yaounde Central Hospital
YEC: Yaounde Emergency Centre
YGH: Yaounde General Hospital