The Results of Microsurgery without Fusion for Lumbar Synovial Cysts: A Case Series of 50 Patients

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■ OBJECTIVES: **The treatments described for spinal synovial cysts range from percutaneous puncture to arthrodesis. There is a fear of postoperative instability after surgical resection of cysts, mainly when they are associated with degenerative spondylolisthesis. The objective of the article is to address the postoperative instability and recurrence rate of the symptoms after microsurgery without fusion.**

■ METHODS: **We report a consecutive series of 50 patients with lumbar synovial cysts operated on with microsurgery without arthrodesis. Functional status was assessed postoperatively by the MacNab success scale and by self-assessment using the Weiner scale, the 36-item short-form health survey (SF-36), and the Oswestry scale. The presence of preoperative and postoperative instability was determined with static and dynamic lumbar spine X-rays before surgery and in the last follow-up at 2 years to evaluate the presence of spondylolisthesis before and after surgery. Facet inclination angle and stage of disc degeneration at the level of the cysts were evaluated. Disc degeneration was defined by the modified Pfirrmann grading system.**

■ RESULTS: **The mean Oswestry index was 12 ± 12.6% (median 8, 0–53). Based on the MacNab scale, 98% were considered excellent and good. The Weiner scale showed that low back pain was present in 16% of patients postoperatively. There was significant improvement of leg strength and pain in 96% and 94%, respectively. Only 3 patients were reoperated on with late fusion. Total surgical resection was obtained in all cases, with a late fusion rate of only 6% and no recurrence at the operated site.**

■ CONCLUSIONS: **The microsurgical treatment for synovial cysts without arthrodesis presented excellent and good results in the majority of cases. It is necessary to carry out prospective randomized studies to clarify the best therapeutic options.**

INTRODUCTION

The term "lumbar synovial cyst" (LSC) refers to a cyst that arises in the zygapophyseal joint capsule of the lumbar spine and is the result of degeneration of a facet joint of the spine. Most synovial cysts develop in the lower portion of the lumbar spine.[1] They are uncommon and often produce no symptoms. In 1950 they were related to nerve root compression and considered to be a possible cause of sciatic pain.[2]

To date, there have been few reports and a limited number of studies that describe the prevalence of symptomatic synovial cysts of the facet joint.[3] The global prevalence of these lumbar facet joint cysts has yet to be scientifically studied, and the mechanism of their formation is not fully understood.[4-6] In a study with 303 lumbar spine magnetic resonance imaging (MRI) scans, it was found that the prevalence of synovial cysts of the lumbar facet joint was 2.3% for anterior cysts and 7.3% for posterior cysts. Their occurrence was associated with the severity of facet joint osteoarthritis and spondylolisthesis, but not with disc disease.[7] Some authors have demonstrated a relation between sagittal lumbar facet inclination >50° as a factor of instability in

Key words
- Fusion
- Lumbar synovial cysts
- Microsurgery
- Spondylolisthesis

Abbreviations and Acronyms
LSC: Lumbar synovial cysts
MIS: Minimally invasive surgery
MRI: Magnetic resonance imaging
VAS: Visual Analogue Scale

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the presence of degenerative spondylolisthesis.[8] Coronal facet inclination <50° in patients with LSC is suggestive of stability.[9]

The treatments described for LSC range from percutaneous puncture to arthrodesis.[10-12] The results obtained have been greatly variable, with high recurrence rates. It should be emphasized that there is a fear of postoperative instability because cysts are often associated with degenerative spondylolisthesis.[1,13]

This study presents the results in 50 patients with LSC operated on with microsurgery without arthrodesis to address the postoperative instability and recurrence rate of the symptoms.

Because of the limited number of studies evaluating the results of treatment of facet cyst without arthrodesis, we have outlined this work to reveal the effect of this intervention on a sample of cyst patients operated on without arthrodesis.

MATERIALS AND METHODS

In a retrospective analysis of prospectively collected data, all consecutive patients with symptomatic lumbar synovial cysts who did not improve after conservative treatment or who already had motor deficit, operated on in a single private institution between January 1998 and January 2016, were evaluated. Exclusion criteria were patients with LSC associated with other degenerative pathologic conditions that showed signs of instability and patients who underwent arthrodesis at the same surgical time. Fifty patients underwent LSC microsurgery. The primary objective of this study was to evaluate the efficacy of the microsurgical treatment for LSC with evaluation of cyst recurrence at the same level and on the same side. The secondary objective was to evaluate the appearance of late postoperative instability with worsening of spondylolisthesis and need for arthrodesis.

The demographic characteristics considered were gender, age, clinical signs, symptoms, cyst level, and onset of symptoms. All removed cysts were histologically evaluated.

Functional status was assessed postoperatively by the Macnab[14] success scale and by self-assessment using the Weiner scale,[12] the 36-item short-form health survey (SF-36),[15] and the Oswestry scale,[16] The presence of preoperative and postoperative instability was determined by static or dynamic lumbar spine X-rays before surgery and in the last follow-up at 2 years to evaluate the presence of misalignment (spondylolisthesis) before and after surgery. Spondylolisthesis was graded according to Meyerding.[17]

Facet inclination was defined as the angle formed by connecting the 2 endpoints of each facet on a preoperative axial lumbar MRI (midsection through the disc) and a line connecting the 2 ventral points of each facet joint[9] (**Figure 1**).

The stage of lumbar intervertebral disc degeneration was defined by the modified Pfirrmann grading system at the level of involvement on the sagittal MRI.[18]

This study was approved by the Research Ethics Committee of Hospital Biocor and registered in the Research Registry (research registry 4700). Informed consent was obtained from all patients. No patients were lost to follow-up. The number of cyst recurrences after surgery and the need for arthrodesis after excision were noted. The minimum follow-up time was 2 postoperative years.

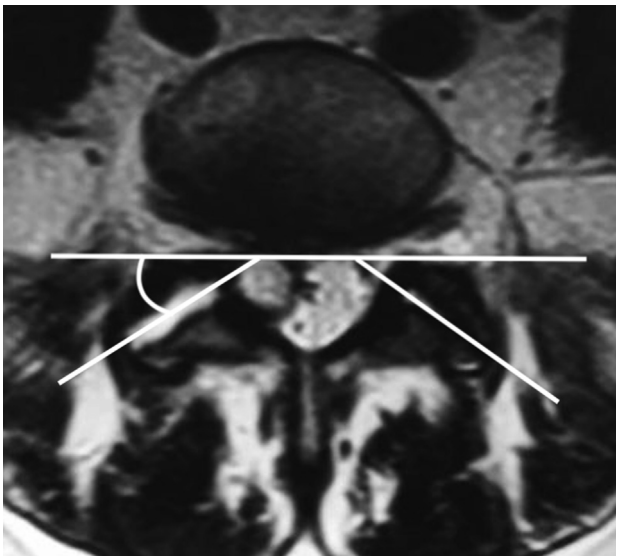

Figure 1. Axial T2-weighted magnetic resonance image showing coronal facet inclination angle on the side of the cyst.

Statistical Analyses

The ages were expressed by descriptive statistics as the mean, median, and standard deviation and amplitudes. Sex was expressed as the percentage of occurrence in each gender. The signs and symptoms were expressed as the mean of occurrence in the sample studied.

Surgical Technique

Using an interlaminar approach with the patient under general anesthesia, a 2.5-cm lumbar linear incision was performed in the midline, centered on the level to be operated on, with aperture of the fascia and subfascial dissection to the lamina. With the aid of a microscope, it was possible to perform flavectomy, partial hemilaminectomy with resection of about one-third of the medial articular facet, and visualization of the dural sac, the nerve root affected, and the cyst. Dissection was performed carefully, with removal en bloc or in fragments.

RESULTS

Fifty patients underwent lumbar synovial cyst microsurgery from January 1998 to January 2016. Of the total, 32 were women and 18 were men, with a mean age of 63.3 years (range, 39–80 years). The mean length of hospital stay was 2.1 days, the mean follow-up time was 7.3 years, and the mean duration of symptoms before surgery was 5 months (range, 1–12 months). The patients' most common complaint was root pain (88%), followed by low back pain (46%). Neurologic deficit was present in 56% of the patients, and sensory alteration was present in 46%. The most frequent level of synovial cyst was L4–L5 in 38 patients (76%), followed by L5–S1 in 11 (22%) and L3–L4 in 1 patient (2%). The symptoms

Table 1. Characteristics, Symptoms, and Levels in Patients with Lumbar Synovial Cysts

Characteristic	Present Series (n = 50)
Mean age (years)	63.3 ± 9.78 (median 63.5; interquartile range 14.5)
Sex	
Female	32 (64%)
Male	18 (36%)
Symptoms	
Radiculopathy	44 (88%)
Back pain	23 (46%)
Neurogenic claudication	10 (20%)
Motor deficit	28 (56%)
Sensory deficit	23 (46%)
Bilateral symptoms	7 (14%)
Mean duration of symptoms (months)	5 ± 3.25 (median 3)
Mean length of hospital stay (days)	2.18 ± 0.6 (median 2)
Right side	30 (60%)
Left side	20 (40%)
Spondylolisthesis	21 (42%)
Level	
L3–L4	1 (2%)
L4–L5	38 (76%)
L5–S1	11 (22%)

and clinical signs of the patients evaluated in this study are described in Table 1.

The mean Oswestry index was 12 ± 12.6% (median 8, 0–53). It should be noted that 80% of the patients had excellent results, 16% had good results, and 4% were unchanged.

The SF-36 quality of life data are shown in Table 2.

Based on the MacNab scale, 74% of the results obtained were considered excellent, 24% good, and 2% fair.

Based on self-assessment by the Weiner scale (Table 3), low back pain was present in 16% of patients postoperatively. In this group of patients, we did not notice worsening of spondylolisthesis; a specific characteristic is that they were in a higher age group (average age, 65 years). Also, there was a significant improvement of leg strength and pain in 96% and 94%, respectively.

Grade I spondylolisthesis was present in 42% of cases (21 patients). Two patients with previous spondylolisthesis were reoperated on 2 years postoperatively because of worsening of the listhesis; 1 of them had rheumatoid arthritis.

In subsequent follow-up, the worsening rate of preoperative symptomatic spondylolisthesis was very small (Figure 2), and development of listhesis postoperatively was not noted.

The mean facet angle was 37.53° ± 8.42° (median, 35°) on the side of the cyst and 40.74° ± 7.6° (median, 40°) on the contralateral side.

Lumbar intervertebral disc degeneration according to the modified Pfirrmann grading system was evaluated: grade 1 (0), grade 2 (3), grade 3 (9), grade 4 (6), grade 5 (8), grade 6 (15), grade 7 (7), and grade 8 (2).

The cysts were removed completely in all cases. There were no relapses at the operated site.

Two years after surgery, 1 patient with an L4–L5 cyst on the left presented with a contralateral cyst at the same level and was reoperated on with arthrodesis (Figure 3). The same patient presented degeneration above the operated level 3 years later and again underwent L3–L4–L5 arthrodesis.

During the operation there was incidental durotomy in 3 patients (6%), who were immediately treated with tamponade and use of biologic glue, so no other procedures were necessary. There were no infections in the patients who were operated on.

DISCUSSION

LSCs were initially considered very rare.[19] After the advent of MRI, a more adequate prevalence was estimated.[20] Janssen et al.[21] found that in 19,010 patients who underwent MRI, there was a prevalence of 6.5%, 54% of which were symptomatic and 46% of which were incidental findings. In surgical findings, the incidence was approximately 0.01% to 2.2%.[1]

In our service, among 2532 surgeries on the lumbar spine for degenerative causes, the synovial cyst was responsible for the symptoms in 50 patients (1.9%). There were 30 surgeries for lumbar intervertebral disk hernias for each surgery for lumbar synovial cyst excision during the same period.

Women were the most affected (64%); the mean age was 63.3 years (range, 39–80 years), and the most common level was L4–L5 in 38 cases (76%).

Most cysts arise from the posterolateral region of the tectal sac.[22] In the extraforaminal location, synovial cysts are rare, and only 14 cases have been described.[23] Domenicucci et al.,[24] based on a neuroradiologic investigation and operative results of 34

Table 2. Median Values Obtained for Each Component of SF-36 Quality of Life

Physical Functioning	Physical Role Functioning	Bodily Pain	General Health Perceptions	Vitality	Social Role Functioning	Emotional Role Functioning	Mental Health
77.80 (50–100)	76.22 (0–100)	69.98 (20–100)	69.95 (20–100)	82.20 (35–100)	86.59 (25–100)	76.42 (0–100)	78.55 (36–100)

SF-36, 36-item short-form health survey.

Table 3. Postoperative Results of the Weiner Self-Assessment

Complaint	Patients Having		Patients Symptom Free
Numbness or tingling in the legs	Same 3 (6%)	Worse 1 (2%)	46 (92%)
Weakness in the legs	Same 1 (2%)	Worse 1 (2%)	48 (96%)
Pain/symptoms in the same site	12 (24%)	Mean VAS 4.7 (2–8)	38 (76%)
Back pain	8 (16%)	Mean VAS 6.5 (4–7)	42 (84%)
Radiculopathy	3 (6%)	Mean VAS 7 (5–9)	47 (94%)
Additional surgery	3 (6%)		-

VAS, Visual Analogue Scale.

cases, proposed a classification of cysts as internal, medium, medium-internal, and medium-lateral; however, this classification is purely anatomic.

Recently, Campbell et al.[25] proposed a classification based on the percentage of vertebral canal compromise and the degree of spondylolisthesis; this was effective for identifying patients with a higher probability of cyst recurrence. Those authors concluded that cysts occupying more than 50% of the channel and spondylolisthesis >15% are more likely to recur and should therefore be stabilized during the same operation.

The pathogenesis of synovial cyst remains controversial. The most cited theory associates the degenerative process of the

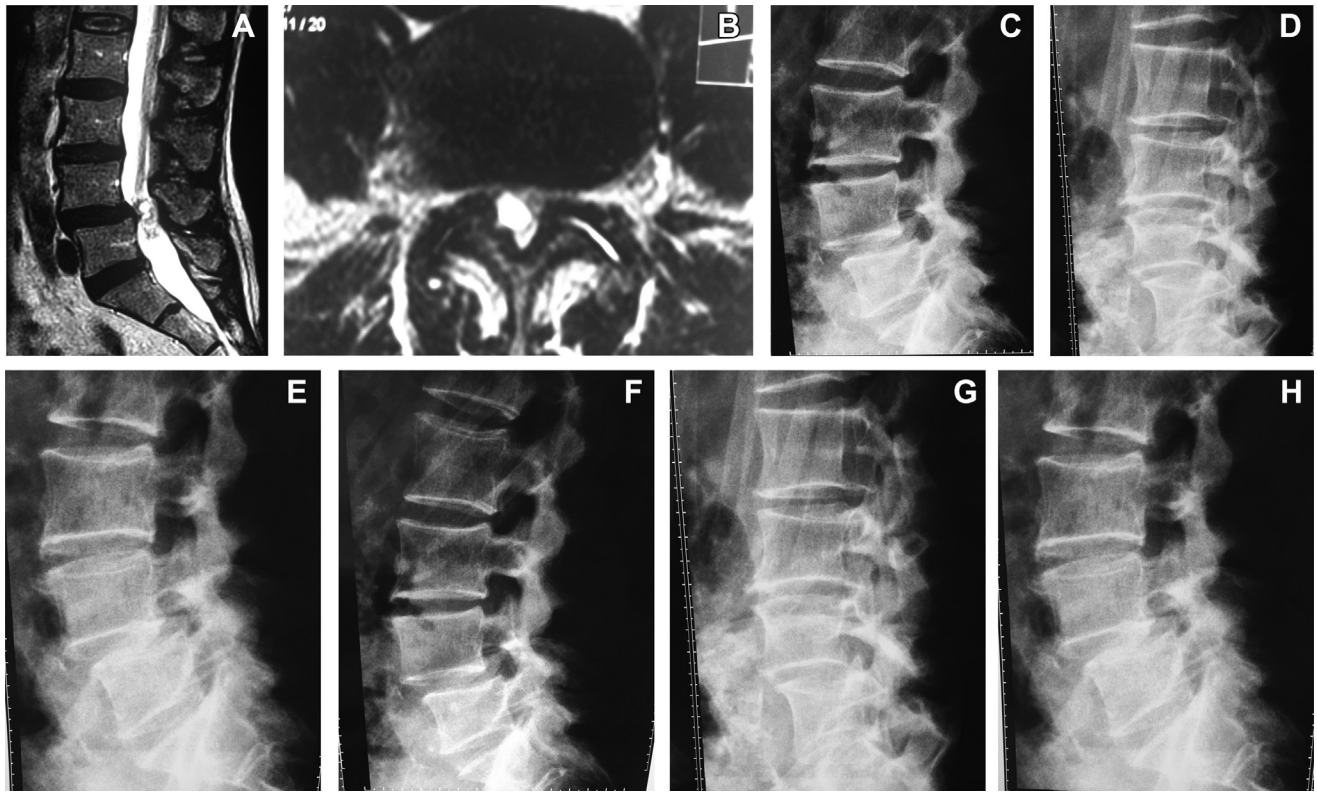

Figure 2. (**A**) Sagittal T2-weighted magnetic resonance image demonstrating a synovial cyst at L4-L5 with grade 1 spondylolisthesis. (**B**) Axial T2-weighted image showing the synovial cyst arising from the right facet joint. Preoperative lateral X-rays: (**C**) static, (**D**) flexion, and (**E**) extension showing L4–L5 spondylolisthesis Meyerding grade I. Two-year postoperative lateral X-rays: (**F**) static, (**G**) flexion, and (**H**) extension demonstrating no worsening of L4–L5 spondylolisthesis Meyerding grade I.

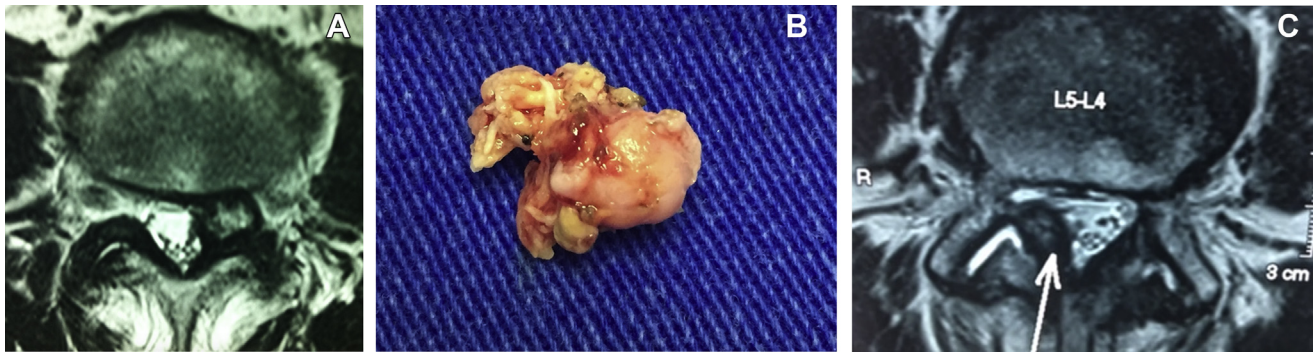

Figure 3. (**A**) Axial T2-weighted magnetic resonance image demonstrating a left cyst at L4–L5. (**B**) The cyst was completely removed en bloc. (**C**) Two years postoperatively, the same patient presented with a contralateral cyst at the same level (*arrow*).

synovial joint with joint hypermobility and microtrauma, leading to a defect in the joint capsule and herniation of the synovium.[26,27] Wilby et al.[28] suggested that cysts are commonly caused by a pre-existing intraligamentous bundle-branch block due to scar tissue resulting from osteoarthritis of the joint. Other theories include cell metaplasia and proliferation of ectopic synovial remains[29] and extrusion of synovial fluid with mucinous degeneration of solely articular connective tissue.

A defect of the joint capsule secondary to stress would result in output of the synovial tissue into the vertebral canal.[4] In common with all these theories is instability in the facet joint.[30]

Spontaneous resolution of the cyst has been described in the literature[31-33] as a result of cyst rupture, which produces a local inflammatory reaction because of the presence of prostaglandins, proteases, and cytokines. Because of this phenomenon, the strong adhesion of the cysts to the dura mater, which is the result of intermittent small ruptures, hinders the resection of the cyst and exposes the risk of incidental durotomy.[33]

The presence of spondylolisthesis varies between 23% and 88% (mean, 31.5%).[1,34] In the present study, we obtained a similar result, with 42% of patients presenting with spondylolisthesis. Instability has led some authors to perform arthrodesis as the first therapeutic choice in these cases.

Kulkarni et al.[9] objectively analyzed lumbar spinal instability in patients with facet cysts. They concluded that there was adequate spinal stability (<11° angulation and 3.5-mm translation) and low correlation with the stages of disc degeneration (in 30 cases, 17 were Pfirrmann grade 2). In the same report, the authors found that the mean facet angle on the side of the cyst was 42.62° ± 6.1°, suggesting the presence of adequate residual stability.

In our series, the mean facet angle on the side of the cyst was 37.53° ± 8.42° (median, 35°) and 40.74° ± 7.6° (median, 40°) on the contralateral side, suggesting residual stability at the level of the cyst. The majority of patients in our series (64%) were Pfirrmann 5 to 8.

In a recent systematic review, facet arthropathy and degenerative disc disease at the level of the synovial cysts were present in 89.3% (range, 79.0%–94.8%) and 48.8% (range, 43.8%–53.9%), respectively.[34]

Fusion associated with cyst resection has been proposed by some authors to avoid cyst recurrence and to improve postoperative low back pain.[12,35,36] Some researchers condition the fusion according to cyst size, involvement of adjacent structures, degree of anterolisthesis, and degeneration of the articular facets.[37,38]

In the series by Weiner et al.,[12] 17% of patients who had fusion associated with cyst withdrawal required long-term surgery at adjacent levels.

Gupta and Lutz[39] consider it risky to recommend preventive fusion to reduce the rate of relapse of the cyst, especially when one considers that the risk of relapse is low. Bruder et al.,[1] in a review article with 2798 cases, found a 2.2% relapse rate and a 2.8% late fusion rate. In series with long follow-up, cyst recurrence rate and late fusion were 7.4% and 8.6%, respectively.[1,12] In the present study, patients needed late fusion in only 6% of cases.

There is a variable range of therapeutic possibilities. Conservative treatment with analgesic agents, anti-inflammatory agents, physical therapy, brace and electric stimulation of the nerve and chiropractic manipulation yields high failure rates.[40-42] Percutaneous corticosteroid injection produces success rates between 57% and 75% in 1 year.[11]

In 2 meta-analyses evaluating percutaneous procedures, satisfactory results were found in only 55.8% and 58%, respectively, with high rates of need for posterior surgery, and with results lower than those of surgery.[43,44] Noninvasive treatments are reserved for patients in whom there are contraindications to surgery.[12]

The surgical technique for cyst withdrawal remains the subject of debate. Medial facetectomy has been proposed as a measure to decrease the relapse rate.[1,41]

Minimally invasive tubular resection has been advocated by some authors[45-48]; however, in a large series, the incidence of dural injury was higher (approximately 12.5%).[47]

Vergara et al.[49] compared minimally invasive surgery (MIS) with the open standard in 37 patients with synovial cysts (24 MIS and 13 open standards). The length of hospital stay and postoperative pain were lower in the MIS group (15 hours vs. 24 hours and 0.9/10 vs. 4.7/10 VAS) than in the open standard group.

Nevertheless, there was no significant difference in terms of duration of surgery or intraoperative and postoperative complications. One MIS patient experienced cyst recurrence. Similar results were obtained in the series by Scholz et al.[50] when comparing 50 patients undergoing standard open microsurgery with 24 patients undergoing MIS. No difference was observed in relation to late fusion, recurrence of cyst, Oswestry scale, or dural lesion.

Komp et al.[51] described 94 patients operated on with endoscopy over a period of 18 months, with 74 of them being followed up and evaluated for 2 years. Interlaminar and transforaminal endoscopy was used in 90% and 10% of patients, respectively. All patients presented with radicular pain and neurogenic claudication, and 60.6% presented neurologic deficits. The surgical time was 14 to 43 minutes (mean, 22 minutes). The recurrence rate and the rate of incidental durotomy were similar (2.1%).

Oertel et al.,[52] with a follow-up of less than 1 year, described 11 cases using assisted endoscopy and obtained good results in 81.8% and total withdrawal of the cyst, but with dura mater lesions in 36% and need for new surgery 9%.

Microsurgical resection of the synovial cyst has produced good results and a low incidence of relapse and secondary instability.[53,54]

The microsurgical cyst removal technique involving minimal damage to the bony structures used in this study was effective because there were no recurrences at the operated site. Only 1 patient presented with a cyst at the same operated level on the contralateral side.

There were some limitations to this study. First, it was a retrospective observational study with prospective data collection. Second, there was no control group, mainly because of the rarity of the pathologic condition.

CONCLUSIONS

The microsurgical treatment for lumbar synovial cysts without arthrodesis had excellent and good results in the majority of cases, with low complication rates. Total surgical resection was obtained in all cases, with a late fusion rate of only 6%. The worsening rate of preoperative symptomatic spondylolisthesis was small. It is necessary to carry out prospective randomized studies to clarify the best therapeutic options.

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