Lumbar Synovial Cysts: Microsurgical Treatment and Outcome in 40 Cases: Review and Critical Analysis of the Literature

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Abstract
Background: Intraspinal synovial cysts (SCs) are uncommon benign growths that occur adjacent to the spinal facet joints. Surgical resection is the treatment of choice for symptomatic patients, but, much debate continues regarding the indication of concomitant fusion to prevent delayed instability. In this study, we report a retrospective review of 40 patients treated for lumbar SCs with microsurgical technique, and analyse the related literature in order to better understand and manage this pathology.

Methods: All patients were evaluated with CT-scan and MR imaging. Follow-up review was available in 38 (95%) patients with a mean period of 22.8 months. Postoperative outcomes, cyst recurrence, delayed instability or worsening of previous instability was noted.

Results: Over 80% of patients presented degenerative spinal disease. Ten patients (25%) presented spondylolisthesis; 36 patients underwent resection of the cyst by flavectomy and partial facetectomy; 3 patients required subtotal facetectomy; 1 patient underwent concomitant arthrodesis. Thirty-three patients (86.7%) reported excellent/good results, while 5 patients (13.3%) scored in the range of fair/poor. Four patients developed subsequent instability and were submitted to arthrodesis and posterior fixation. Overall, 5 patients underwent fusion: 1 at the first surgery and 4 (10.3%) due to delayed symptomatic spondylolisthesis. One experienced residual mechanical pain. The remaining patients did not develop new instability or worsening of their listhesis.

Conclusions: Most patients undergoing excision of lumbar SC will not developed new instability or worsening of their listhesis. Indications for surgery were severe intractable low back pain, neurologic deficits. Ten patients were not operated on because of paucity of symptoms, medical contraindications, old age or refusal. Overall, 5 patients underwent fusion: 1 at the first surgery and 4 (10.3%) due to delayed symptomatic spondylolisthesis. One experienced residual mechanical pain. The remaining patients did not develop new instability or worsening of their listhesis.

Keywords
Ganglion cyst; Juxtafacet synovial cyst; Lumbar synovial cyst; Spinal instability; Spondylolisthesis

Introduction
Synovial and ganglion cysts of the spine (also named “juxtafacet synovial cysts” or “intraspinal synovial cysts”) are benign saccular or nodular growths that occur adjacent to the spinal facet joints. Although they may be found at any level of the spine, the majority of such spinal cysts are located in the lumbar region. Intraspinal synovial cysts (SCs) are often asymptomatic and frequently discovered incidentally on imaging studies, but, if large enough to occupy space into the spinal canal or neural foramina, they may result in symptoms from focal nerve root and/or spinal cord compression.

SCs are rare, but refinements in neurodiagnostic imaging have enhanced their identification. Recently, Doyle and Merrilees [1] retrospectively reviewed 303 MR images of the lumbar spine in a symptomatic population and showed the prevalence of anterior lumbar SC to be 2.3%. Of 1800 lumbar CT and MR studies, Eyster and Scott [2] reported 11 (0.6%) instances of SCs involving the lumbar spine. Since their first description in the 1950s, most of the literature on this issue has been limited to case reports or brief case series. Eighteen publications included more than 20 patients, [3-20] with only 2 surgical case series reporting more than 100 non-consecutive patients, over a long period of 22 and 19 years, respectively [10,20].

The aetiopathogenesis of SC remains controversial. However, because most juxtafacet cysts arise from the most mobile level of the vertebral column (L4-L5) in addition to their frequent association with degenerative spinal disease and spondylolisthesis, segmental instability has been advocated as the main causative factor. Nevertheless, the understanding of the relationships between SCs, degenerative changes and spinal instability, remains limited. Consequently, if surgical resection of the cyst for symptomatic patients is widely accepted, [4,5,7,10,12,14,15,18,19] much debate continues regarding the indication of concomitant fusion to prevent delayed spinal instability and/or cyst recurrence.

We present a retrospective analysis of clinical aspects, surgical management and outcome of 40 consecutive patients surgically treated for lumbar SC at a single-institution over a period of 12 years. We also present a review of the related literature, focusing on issues that remain under debate.

Materials and Methods
Patient population and data collection
Of 3938 symptomatic patients evaluated in our institution over a 12-years interval (1999-2010), we found 50 instances of SCs in the lumbar spine (1.27%). Of these 50 patients 40 were treated surgically. Indications for surgery were severe intractable low back and radicular pain, intractable neurogenic claudication and/or neurologic deficits. Ten patients were not operated on because of paucity of symptoms, medical contraindications, old age or refusal. There were 16 (40%) men and 24 (60%) women with a mean age of 63.8 years (range 30-80 years). All patients were evaluated with CT-scan and MR imaging. Patient charts were reviewed for their complex symptoms on presentation, level of the cyst, presence of degenerative spinal conditions, segmental instability or spondylolisthesis. Patients with spondylolisthesis, degenerative alterations or prevalence of back

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pain and claudication, also had dynamic flexion-extension x-rays. Operative notes were reviewed for assessment of surgical procedures such as the extent of bone resection, cyst excision and intraoperative complications. Follow-up data were obtained by direct clinical examination. All patients were evaluated at 1 month after surgery. The patients without spondylolisthesis and good outcomes were re-evaluated with dynamic x-rays at 1 and 2 years. The patients with spondylolisthesis (not treated) and those with poor outcomes were evaluated at intervals of 6 months with dynamic radiographs and, if necessary, with MR imaging. Cyst recurrence, delayed instability or worsening of previous instability was also noted. Postoperative outcomes were graded using the Macnab modified criteria: excellent, complete resolution of symptoms; good, marked improvement but occasional pain; fair, some improvement with significant functional restrictions and the need for pain medications; and poor, no change in or worsening of symptoms [21].

Results

Clinical and radiographic data

Of 40 patients who underwent surgical treatment, the most common presenting symptoms were radiculopathy (100%), low back pain (95%) and neurogenic claudication (90%) with associated sensory loss (70%) and motor weakness (42.5%). The side of the symptoms generally correlated with the side of the SC; however, 2 patients (5%) with monolateral cyst experienced bilateral symptoms. The most common level was L4-L5 (29 patients, 75.7%) (Figure 1). In 8 patients (18.9%) the cysts were located at L5-S1 and in 3 (5.4%) at L3-L4. More than 80% of patients presented degenerative spinal disease (e.g., disc and facet joints degeneration, diastasis of the apophyseal joints, thickened ligamentum flavum) (Figure 2). Ten patients (25%) had radiographic evidence of spondylolisthesis well correlated with the level of the cyst. Nine of these, had Grade I disease (Meyerding classification), 5 of whom without evidence of instability and 4 with minor or doubtful instability and stenosis on dynamic radiographs. One patient presented with unstable Grade II spondylolisthesis with evident canal stenosis.

Operation

In all patients a microsurgical approach was used. In the majority of cases (36 patients) resection of the cyst was obtained through a flavectomy, partial medial facetectomy (no more than one-third) and resection of the edges of the contiguous hemilaminae (about 2 mm). Three patients required a more wide exposure with subtotal facetectomy. One, with unstable spondylolisthesis and considerable degenerative stenosis, required laminectomy and concomitant instrumented fusion, while in 4 patients with minor or no spondylolisthesis and instability, an interspinous stabilization device was inserted. In 25 patients (62%) a complete excision of the cyst was obtained. Subtotal resection was achieved in 15 cases (38%) because of insufficient exposure, firm adhesion of the cyst to the dura, ventral extension or cyst calcification. No surgical complications were recorded.

Clinical follow-up

Follow-up review was available in 38 (95%) of the 40 patients with a mean period of 22.8 months (range 6-60 months). A follow-up at least 6 months was available in all of patients; in 17 patients (47.4%) 12 months or more (9 from 12 to 36 months and 8 from 36 up to 60 months). Considering all symptoms (back pain, radiculopathy, claudication), of the 38 patients, 33 (86.7%) reported good or excellent results. Three (8%) patients scored in the fair range, and 2 (5.3%) scored in the range of poor. Considering each symptom separately, radicular pain improved more than the others, with 35 (92%) of patients who reported good or excellent results. Of the 17 patients who presented with a preoperative motor deficit, 14 (82.4%) had recovered normal motor function at the last follow-up examination.

Recurrence

Recurrence of the cyst at the original site occurred in 2 (5.3%) patients. One of these was reoperated on through a widening of previous partial facetectomy; in this patient preoperative imaging did not show segmental instability and no additional procedures were made. The other patient, developed contralateral and ipsilateral recurrence 1 year and 2 years after surgery, respectively; diagnostic imaging showed progressive segmental instability and a concomitant fusion was performed at the second surgery. One patient, who
had underwent subtotal facetectomy, presented cyst recurrence at the level above the original site 1 year after first operation. His preoperative imaging did not show spondylolisthesis or instability and he underwent cyst excision alone.

**Synovial cysts, spondylolisthesis and instability**

Of the 10 patients with preoperative spondylolisthesis, 1 required concomitant fusion because severe degenerative spinal disease and instability and had a good outcome; 1 showed an increase of its listhesis and required instrumented fusion 19 months after surgery; he had residual back pain at the last follow-up examination. Four patients who received cyst excision alone had good outcome without increasing spondylolisthesis at 1 and 2 years; they are nowadays under observation. Of the 4 patients who received interspinous stabilization, 1 presented asymptomatic slight progression of its vertebral slippage, while the other 3 patients showed no increase in listhesis and had good outcome at a minimum 1 year follow-up. These 4 patients also remain under observation. Of the 28 patients without preoperative spondylolisthesis or instability, who had received cyst resection alone, 3 (7.9%), developed progressive symptomatic instability at 1, 2 and 5 years after cyst excision, respectively. One of these had multiple cyst recurrences. All of the 3 patients underwent instrumented fusion with good recovery of their back pain and claudication. The other 25 patients did not show vertebral slippage.

Overall, 5 patients underwent instrumented fusion: 1 at the first surgery and 4 (10.3%) because delayed symptomatic spondylolisthesis. One experienced residual mechanical pain well controlled by conservative measures. The remaining 32 patients did not develop new instability or worsening of their pre-existent listhesis over time.

**Discussion**

**Definition and pathogenesis**

The term “synovial cyst” or “ganglion cyst” refers to cysts that arise from the zygapophyseal joint capsule. In 1974 Kao et al. [22] proposed the term “juxtafacet cysts” to describe both pathological entities located in the spinal extradural space. SCs are connected to their adjacent joint space and contain clear and serous fluid, whereas ganglion cysts are separate from the joints with which they are associated and contain gelatinous, proteinaceous fluid. Another distinction between these two entities is defined on the basis of the presence or absence of synovial lining cells. However, the differentiation between these two types of cyst is only of histological value, as they share the same clinical characteristics and most likely represent different endpoints of the same pathologic process [23-25].

The most reliable hypothesis about the pathogenesis of SCs is the appearance of defects of the joint capsule, through which the synovial membrane protrudes forming a para-articular cavity filled with synovial fluid, which initially communicates with the joint line. As time goes by, the cyst may degenerate and lose its connection with the adjacent joint, and mixoid or mucoid degeneration can occur, forming the so-called “ganglion cyst”. The defects of the joint capsule may be due to degenerative process, secondary to aging and mechanical stress (e.g., segmental hypermobility, repetitive minor injuries, single macrotrauma), or to congenital fenestration/thinnings of the capsule wall. Currently, it is thought that degenerative processes and segmental instability play the most important role in the development of SC. Trauma, although not so strongly indicted as in some described cases, undoubtedly exercises a cumulative effect in spinal degeneration, as well as acute exacerbation of clinical symptoms [20,22,26-30]. The frequent association with degenerative spinal conditions, (e.g., disc and facet joint degeneration, spondylolisthesis, lumbar stenosis) in addition to the fact that the majority of SCs are located in the most mobile level of the spine (L4-L5) is in favour of the hypothesis of degenerative conditions and segmental instability leading to SC formation [1,6,7,9,12,15,23,29,31-35]. However, the fact that repetitive minor injuries, such as microtrauma of daily activities (compression/stretching of joint capsule), usually happen more at the mobile part of the spine, suggests that the pathogenetic roles of instability and trauma are intertwined [20,23,30,36].

**Synovial cysts and degenerative spinal disease**

Some type of degenerative condition associated with SC is reported in most clinical series. Metellus et al. [12] in their series, observed that 89% of patients presented disc degeneration, while all patients showed some degree of facet joint osteoarthritis on preoperative MR study. In their large series, Lyons et al. [10] reported 46% of patients with degenerative disc disease. Trummer et al. [37] observed that 60% of their reported cases demonstrated hypermobile facet joints. Banning et al. [3] and Xsu et al. [38] noted facet joint arthropathy in 90% and 75% of patients at the site of SC, respectively. Moreover, some authors reported on the development of intraspinal facet cyst after decompression surgery for lumbar stenosis, suggesting that segmental instability at the involved vertebral level may contribute to SC formation [3,32,39]. Furthermore, facet fluid and diastasis of facet joints, considered closely associated with spinal instability, are commonly associated with SC, both in patients who had previously undergone decompression surgery as well in those with primary intraspinal SC [32,40,41]. Spondylolisthesis, commonly considered as a patognomonic sign of segmental instability, is also often associated with SC, with a rate of incidence from 25% [15] up
to 82% [9] of described cases. In the present study more than 80% of
patients showed some radiological evidence of degenerative disorder.
The majority of SCs occurred at the L4-L5 level (75.7%); facet fluid
and diastasis of facet joints were present in 26 patients (65%) (Figure
3), while degenerative spondylolisthesis was found in 10 (25%) cases.
These results are similar to those reported by others.

Clinical findings

As regards the clinical aspects, our findings were also consistent
with the reports found in the literature [8,10,12,14,15,20,23,42].
Radicular pain was the most common reported symptom (100% in
our series), followed by back pain (95%), neurogenic claudication
(90%), sensory deficits (70%), and motor weakness (42.5%). However,
we believe that motor deficits are less frequent than reported in the
literature, because of the difficulty in distinguishing a true motor
impairment from a limited motion due to radicular pain. Indeed,
most of our patients (82.4%) recovered their strength deficit over the
first days after surgery, suggesting that their improvement resulted
from pain relief.

Conservative treatment

Although there have been reports of cysts resolving spontaneously
[43-46], observational or occasional symptomatic treatment are
difficult to justify for patients with severe pain or neurological deficits.
Conservative treatments, including drugs, physical therapy and
bracing, as well as percutaneous epidural, intra-articular or intracystic
injection of steroid drugs, have not been established to be efficacious,
especially in series follow-up over 6 months [12,13,47]. In a recent
study of 101 patients treated with facet joint steroid injection with
attempted cyst rupture, Martha et al. [11] found that percutaneous
treatment is correlated by avoiding subsequent surgery in almost
half the treated patients. However, 55 patients (54%) required
surgery over a period of averaging 8.4 months because of inadequate
symptom relief. A survey of the literature shows that most of patients
who initially received conservative treatment had to undergo some
type of surgery because of absence of sustained benefit [12,47].

Surgical treatment

Regardless of the technique used, surgical excision of the
lumbar SC is largely recommended in all cases of intractable pain or
neurological deficit. From clinical series with a follow-up period of
at least 6 months, excellent or good results from about 60% [6] up
to 94%-100% of cases, [4,12,15,18,28,37,48] with a mean success rate
of 81%, were reported [5,7,10,14,19,23,42]. Our results (86.7% good/
excellent) are consistent to those reported in studies by others.

Although many reports described cyst removal through
wide decompressive procedures, including laminectomy, hemilaminectomy
together with foraminotomy or facetectomy
[6,9,10,20], the vast majority of lumbar SCs may be excised via a
microsurgical approach with little disruption of bone and ligamentous
structures [5,12,14,19]. Indeed, Sandhu et al. [28] and Sehati et al.
[48] reported 2 series of 17 and 19 patients with a mean follow-up of
13 and 16 months, respectively, who were successfully treated with
minimally invasive decompression through a serial dilator/
tubular surgical retractor system. Actually, only a small amount of
cases require a more extensive procedure (e.g., large and ventral cysts,
coexistence of symptomatic lumbar stenosis and, extension of the
cyst into the neural foramen). In these cases a subtotal facetectomy
along with partial hemilaminectomy should suffice for cyst excision
and decompression of both superior and inferior nerve roots.

Cyst recurrence

Since these lesions are not neoplasms, gross-total resection of
SC is not mandatory in order to prevent recurrence. As suggested
by many authors [10,12,15,20,28,42,47,48], recurrence is linked
to preoperative or iatrogenic instability, rather than the degree
of cyst resection. Regardless the extent of cyst excision, the overall
rate of recurrence is low and there are no reports that demonstrate
a significant relationship between the amount of cyst resection and
its relapse. Xu et al. [20] in a cohort of 90 patients underwent either
hemilaminio- or laminectomy without fusion, found a mean rate
of recurrence of 5.8 %, while none of the 74 patients who received
facetectomy with fusion procedures experienced cyst recurrence. In
a detailed review of all reported intraspinal SCs (>1000 cases), the same
authors found that only 1.8% of patients who received decompression
procedures alone developed the same-level of recurrent cyst, even
though in a higher amount of patients the cyst was excised partially.
Furthermore, some authors [10,12,15] reported on the development
of an asynchronic SC, contralateral or rostral to the original level.
This confirms the connection of cyst development with degenerative
phenomena and the lack of a certain relation between the extent of
cyst resection and recurrence. Therefore, wide surgical exposure or
persistent attempts to achieve complete resection of cysts adherent to
the dura, risking iatrogenic instability or neural damage, respectively,
could be avoided. In the present study, although subtotal cyst
resection was achieved in 15 cases (38%), recurrence of the cyst at the
original site occurred in 2 (5.3%) patients, while 1 patient had delayed
recurrence at the level above.

Concomitant and delayed fusion

The indication of spinal fusion as a first-line procedure to
prevent subsequent instability, is still a matter of debate.Xu et al. [20]
found that patients receiving laminectomy alone have an increased
incidence of recurrent mechanical back pain and cyst relapse
compared with those who underwent facetectomy with instrumented
fusion [38.5% vs 7.5% (p-value=0.002) and 7.7% vs 0%, respectively]. Khan et al. [9] in reporting on 39 patients with lumbar SC, observed
that patients who underwent concomitant fusion tended to have
better outcome compared with those who underwent decompression
alone (80% vs 70% excellent/good, respectively). Epstein et al. [6]
found that 11 of 35 patients (31.5%) with stenosis and preoperative
Grade 1 spondylolisthesis experienced progression of their listhesis
2 years after surgery (multilevel laminectomy), concluding that
primary fusion should be considered as a first-line treatment in that
category of patients. On the other hand, Weiner et al. [19] found no
statistically significant differences in the outcome measures between
patients presenting without spondylolisthesis (decompression alone)
and those presenting with one (decompression with concomitant
fusion). Lyons et al. [10] reported that out of 194 patients with
SCs, collected in 3 centers over a period of 22 years, a concomitant
fusion procedure was performed in only 18 patients (9.3%), even
though preoperative spondylolisthesis was diagnosed in 50% of
cases. Delayed fusion was required in 4 others (2.1%) who developed
symptomatic spondylolisthesis. In addition, the authors did not
find any meaningful statistical association between partial and total
facetectomy and the development of symptomatic spondylolisthesis.
Out of 56 patients with SCs reported by Sabo and colleagues [15],
preoperative spondylolisthesis was identified in 15, six of whom
(10.7%) underwent a fusion procedure. The authors reported no
difference in outcome between patients who underwent fusion and
those who did not. In the series of 77 cases reported by Méteulles et
al. [12], no patients had concomitant fusion. At a mean follow-up of 45 months only 1 patient developed symptomatic spondylolisthesis requiring subsequent fusion and no significant difference in outcomes between patients who received laminectomy and those underwent less extensive decompression was found. In the above-mentioned studies of Sandhu et al. [28] and Sehati et al. [48], the authors reported no cases of delayed instability and suggested that cyst removal with minimal bone resection may yield good to excellent results, even in setting of spondylolisthesis. In our series, only 1 patient underwent laminectomy and concomitant fusion, because of evident instability. None of the 3 patients who required subtotal facetectomy developed subsequent instability, while 4 patients (10%), 3 of whom without preoperative symptomatic instability, who very probably will not take stable advantage of cyst excision alone, for the vast majority of patients we have found no clinical or radiographic predictive factors that could suggest which patient will benefit from concomitant fusion. The results reported in the literature are influenced by many variable: 1) patient populations, 2) associated degenerative conditions, 3) length of follow-up and evaluation methods, 3) surgeon’s subjective judgement about the presence and severity of lumbar stenosis and instability, as well as about the extent of decompression to perform. For this purpose we developed a flow diagram that summarizes different possible procedures for management of lumbar SCs, and that we adopted in our series (Figure 4). It is hoped that further research on this issue, such as a multicenter prospective study, will clarify the decision making-process for patients with intraspinal SC.

**Conclusion**

Juxtafacet SCs are uncommon lesions of the spine, mostly occurring in the lumbar region. Their pathogenesis is not well known, although currently it is thought that these cysts are linked to spinal degeneration and segmental instability. Surgical resection is the treatment of choice for symptomatic patients with excellent or good results, also on long-term follow-up studies. Microsurgical approach is the technique that enables the greater resection of the cyst with lesser surgical invasivity. More extensive decompression should be reserved only for the subset of patients with predominant bilateral neurogenic claudication strictly related to spinal canal stenosis. If preoperative lumbar instability is evident, or an extended decompression is required, patients may need primary arthrodesis. However, preoperative spondylolisthesis and other degenerative conditions, as well as performing monolevel laminectomy or subtotal monolateral facetectomy, there are no per se, reliable predictive factors of delayed instability. Therefore, the surgical approach should be tailored to the individual patient and sound surgical judgement combined with clinical, radiographic and intraoperative findings should be used to determine the appropriateness of undertaking concomitant fusion in each patient.

![Figure 4: Flow diagram showing different clinico-radiological features and possible procedures for management of lumbar synovial cysts.](http://dx.doi.org/10.4172/2325-9701.1000139)

