

Lumbar Synovial Cysts

A Review of Diagnosis, Surgical Management, and Outcome Assessment

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Abstract Synovial cysts of the lumbar spine contribute significantly to narrowing of the spinal canal and lateral thecal sac and nerve root compression. Cysts form as a result of arthrotic disruption of the facet joint, leading to degenerative spondylolisthesis in up to 40% of patients. Clinical findings and neurodiagnostic confirmation prompt surgical intervention consisting of varying decompressions with or without primary fusion. Most patients present in their mid-60s, with a male-to-female ratio varying from 2:1 to 1:1. Preoperative symptoms include low back pain, radiculopathy, and neurogenic claudication. Motor and sensory signs usually reflect the anatomic location of the synovial cyst and the level of resultant maximal lumbar stenosis. In descending order of frequency, they are typically found at the L4–L5, L5–S1, L3–L4, and L2–L3 levels. Lumbar synovial cyst surgery includes unilateral or bilateral laminotomies, hemilaminectomies, or laminectomies alone or in combination with in situ or instrumented fusion. Those patients undergoing decompression alone may postoperatively develop progression or the new appearance of olisthy, while those primarily fused rarely show further increase or a new onset of slip. Outcome measures spanning 1- to 2-year postoperative intervals frequently included surgeon-based rather than the current patient-based analysis, the latter including the Medical Outcomes Trust Short Form-36.

Key Words: lumbar synovial cysts, diagnosis, outcomes

(*J Spinal Disord Tech* 2004;17:321–325)

The clinical, neurodiagnostic, surgical management, and outcome assessment of 440 lumbar synovial cysts reported in 15 published series are critically reviewed (Table 1).

Synovial cysts are typically found in the lumbar spine, posterolateral to the thecal sac, where they contribute to central and/or lateral recess stenosis with nerve root compression.^{1–6} Defined by both magnetic resonance (MR) and computed to-

mography (CT) studies, lumbar synovial cysts typically arise from arthrotic overlying facet joints, which may contribute to attendant degenerative spondylolisthesis. Synovial cysts are often accompanied by significant spondylostenosis requiring laminectomy rather than laminotomy or hemilaminectomy for adequate decompression. In certain instances, the presence of olisthy or instability necessitates simultaneous fusion. The majority of outcome studies use a surgeon-based scale, with very few series based upon patient-based analysis like the Medical Outcomes Trust Short Form-36.⁷

FREQUENCY

Of 1800 lumbar CT and MR studies performed over an 18-month interval, Eyster and Scott⁸ reported 11 (0.6%) instances of synovial cysts involving the lumbar spine. Of 440 cases of synovial cysts reported in 15 series, the smallest study consisted of a single case report,⁹ while the largest series presented by Lyons et al¹⁰ included 194 cases followed over an average 6-month follow-up interval. The actual numbers of patients in these studies reported in ascending order therefore varied from 1 to 194 (see Table 1).^{1–6,8–16}

Synovial cysts occur more frequently in the lumbar spine than in the cervical or thoracic regions. In the study of Howington et al,³ 29 (94%) lumbar synovial cysts were found along with 1 (2%) thoracic and 1 (2%) cervicothoracic cyst. Similarly, Friedberg et al² encountered 23 (85%) lumbar synovial cysts, but only 1 (5%) cervical and 2 (10%) thoracic cysts.

AGE AND SEX

Patients with lumbar synovial cysts typically present in their mid-60s. In the Trummer et al study,¹⁴ the average age of patients with synovial cysts involving the lumbar spine was 65 years, the mean age in the Lyons et al series¹⁰ was 66 years, with other studies presenting a range from 28 to 94 years.^{4,10,13} Male-to-female ratios vary from nearly 2:1 (13 M/6 F) in Hsu et al⁴ to nearly 1:1 (100 M/94 F) in Lyon et al¹⁰ and to the approximate 1:2 ratio (4 M/9 F) in Onofrio and Mih.¹³

PREOPERATIVE SYMPTOMS AND SIGNS

Lumbar synovial cyst symptoms include unilateral or bilateral radiculopathy as reported in 55–97% of cases.^{3,4,6,10}

Received for publication March 16, 2003; accepted September 4, 2003.
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TABLE 1. Lumbar Synovial Cysts Reported in the Literature

Series	No. of Patients in Series
Marion and Kahanovitz ⁹	1
Yuh et al ¹¹	5
Jackson et al ¹²	6
Yarde et al ⁶	8
Eyster and Scott ⁸	11
Onofrio and Mih ¹³	13
Hsu et al ⁴	19
Trummer et al ¹⁴	19
Artico et al ¹	23
Friedberg et al ²	23
Salmon et al ¹⁵	28
Howington et al ³	29
Parlier-Cuau et al ⁵	30
Banning et al ¹⁶	31
Lyons et al ¹⁰	194

Neurogenic claudication was observed in 25–44% of patients, typically in those with underlying spinal stenosis.^{3,6,10} Neurologic deficits accompany synovial cysts in 18% of patients.^{3,6} These specifically include motor deficits in 26.3–40% of patients,^{4,10} sensory deficits in up to 45% of patients,¹⁰ and reflex abnormalities in 57% of patients.¹⁰ Cauda equina syndromes were observed in 13% of Lyons et al's 194 cases.¹⁰

NEURODIAGNOSTIC STUDIES

Preoperative dynamic x-rays revealed an increased incidence of facet arthrosis with or without grade I spondylolisthesis.¹³ On 0.6–8% of lumbar MR and CT studies, synovial cysts occurred in a juxta-articular, posterolateral, epidural location within the lumbar spinal canal.^{12,17} Hsu et al⁴ observed that significant facet joint degeneration was noted on 75% of x-ray studies and MR examinations. Banning et al¹⁶ noted facet joint arthropathy in 90% of patients at the site of synovial cysts, with 12 (38%) of the 31 patients demonstrating accompanying degenerative spondylolisthesis. Trummer et al¹⁴ observed that 12 of 19 patients demonstrated hypermobile facet joints, while 6 (32%) showed spondylolisthesis. Lyons et al¹⁰ fused 18 (9.2%) of 194 patients with lumbar synovial cysts for documented preoperative instability based on preoperative MR and CT studies where cysts often extended into the yellow ligament underlying degenerated facet joints. In the Howington et al study of 29 cases,³ each cyst was also accompanied by significant arthropathy of the overlying facet joint.

MR SCANS OF SYNOVIAL CYSTS

On preoperative MR studies, synovial cysts are hypointense to isointense on T1-weighted images and are often ac-

companied by peripheral hypointensity reflecting microcalcification and old hemorrhage into the capsule (Figs. 1–3).^{11,18,19} On T2-weighted studies, the central portions of synovial cysts are hyperintense, while on gadolinium-enhanced studies, peripheral capsular enhancement is seen. CT and myelo-CT examinations reveal hypodense to isodense cystic centers with hyperdense rims reflecting calcification of the capsule (Fig. 4).

MR VERSUS CT SCANS OF SYNOVIAL CYSTS

Salmon et al¹⁵ determined that MR was more sensitive than CT in documenting the presence of a synovial cyst and that the diagnostic accuracy of the MR was 77% compared with 56% for CT only and 42% for myelography alone. In the Hsu et al series,⁴ a 60% frequency of bilobed cysts both ventral and dorsal to the spinal canal was demonstrated utilizing the combination of facet arthrography, CT, and MR. Others reported that cysts were often filled with “air” (nitrogen).^{3,6,11,12,19}

LEVELS OF SYNOVIAL CYSTS

Eighty-eight percent to 99% of all synovial cysts occur in the lumbar spine, while cervical (1–4%) and thoracic (0–8%) lesions are only rarely encountered.^{2,4,20} The majority of synovial cysts are found at the L4–L5 level, considered the most mobile lumbar level, and are typically observed in descending order at the L5–S1, L3–L4, and L2–L3 lev-

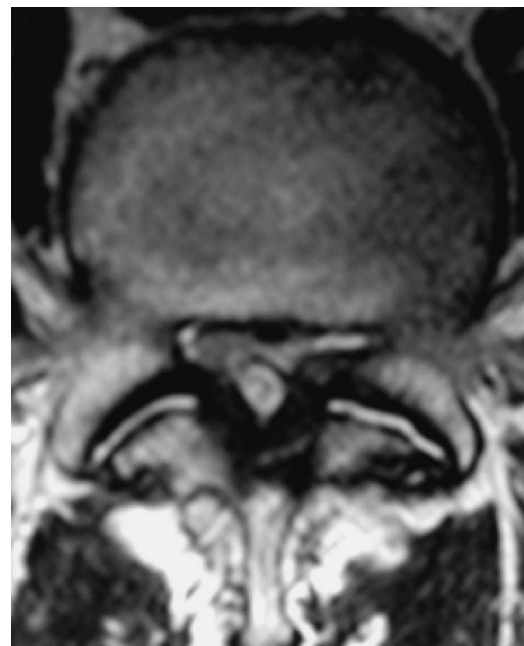


FIGURE 1. Transaxial T1-weighted MR scan showing a left-sided synovial cyst at the L5–S1 level resulting in significant lateral thecal sac and nerve root compression.

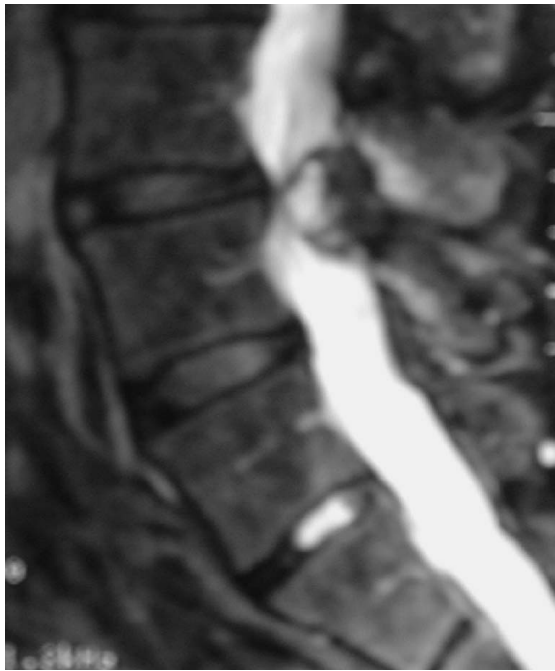


FIGURE 2. T2-weighted left parasagittal unenhanced MR scan demonstrating posterolateral L3–L4 synovial cyst. Note the inhomogeneity of the contents of the cyst, which markedly compresses the thecal sac.



FIGURE 3. A right-sided parasagittal T2-weighted MR scan demonstrating significant posterolateral thecal sac compression at the L3–L4 level. Also observe the grade I retrolisthesis indicating the presence of instability.

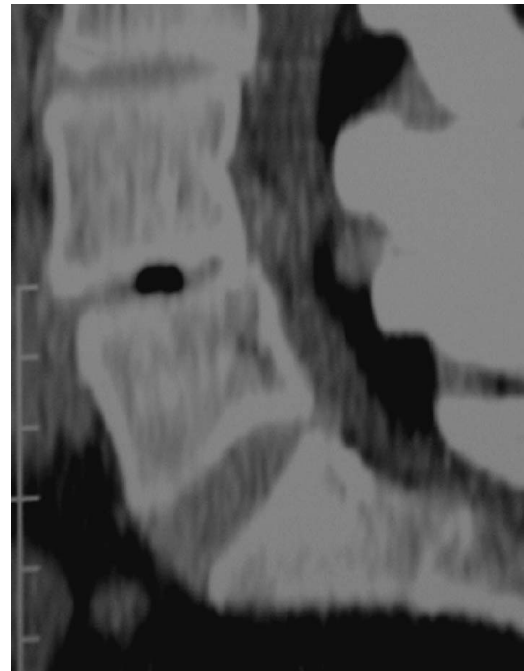


FIGURE 4. Parasagittal three-dimensional CT study demonstrating posterolateral synovial cyst at the L4–L5 level.

els.^{4,6,10,12,15,16} Salmon et al¹⁵ noted that 18 of 28 cysts were at L4–L5, 6 at L5–S1, and 4 at L3–L4. Hsu et al⁴ observed that 68.4% of cysts were found at L4–L5 and 21.1% at L5–S1, with 5.2% at L1–L2 and 5.2% at L2–L3. Banning et al¹⁶ observed that 51% of the cysts in their series were found at the L4–L5 level, while Lyons et al¹⁰ observed that 64% of cysts occurred at the L4–L5 level.

CONSERVATIVE MANAGEMENT OF SYNOVIAL CYSTS

Parlier-Cuau et al⁵ reported that one-third of patients with lumbar synovial cysts respond favorably within 1–6 months to the injection of steroids into the facet joints. Additionally, three of four patients in the series of Hsu et al⁴ with 19 total patients experienced short-term relief of symptoms following facet joint injection of steroids but later required surgery.

SURGERY

The surgical management or extent of decompression is mandated by the degree of co-existent spondylosclerosis. Many studies rely heavily on laminectomy to adequately decompress or excise the synovial cyst and deal with the attendant stenosis.^{1,2,4,6} To remove a unilateral synovial cyst in a stenotic spinal canal, for example, at the L4–L5 level, usually a partial laminectomy of L3, full laminectomy of L4, and partial laminectomy of L5 are required. Superiorly, ventrally, and foraminally, the exiting L4 nerve root and thecal sac must be differ-

entiated from the synovial cyst, which often fills the lateral gutter, extending toward the cephalad L3–L4 interspace. Working across the table under the operating microscope allows for the initial decompression of the bony stenosis with a rotating Kerrison rongeur. This is followed by removal of hypertrophied and often ossified yellow ligament in the lateral, foraminal, and often extreme lateral subarticular regions. Ipsilateral dissection with identification of the superior nerve root and thecal sac follows, allowing for resection of the synovial cyst, often in a layered fashion. First, the cyst may be “guttered” or decompressed, removing the often thick, viscous contents. Second, it is ascertained whether or not a clean dural plane exists ventrally between the capsule of the cyst and underlying theca. If a plane is identified, the synovial cyst may be entirely removed. However, if there is ossification or marked adhesion of the ventral aspect of the cyst to the dura, decompression alone without excision should suffice, while also avoiding or risking a cerebrospinal fluid fistula.

OUTCOME MEASURES

Most series report average 6-month (134/194 patients,¹⁰ 30 patients⁵), 1-year (8 patients),⁶ or 2-year (29 patients)¹⁶ outcomes following surgery for lumbar synovial cysts. Howington et al³ reviewed a series of 29 lumbar cysts treated over a period of 10 years: The minimum follow-up was only 1 year. Lyons et al¹⁰ studied 194 patients with lumbar synovial cysts but with only an average 6-month postoperative follow-up interval.

Laminectomy Alone

The majority of studies reported outcomes following laminectomy utilizing varied surgeon-based measures (Odom’s criteria, MacNab’s criteria, Prolo’s criteria): excellent: no residual symptoms/signs; good: mild residual symptoms/signs; fair: minimal to no improvement; and poor: worse.^{1,2,13,15,16} In the Artico et al study¹ of 23 cysts, laminectomy resulted in total cyst excision in 18 patients and subtotal removal in 5; 18 good/excellent results were reported, while 5 demonstrated no neurologic improvement. In the 23 patients with synovial cysts of Friedberg et al,² all treated with laminectomy, 15 demonstrated excellent and 7 good responses, while 1 remained the same postoperatively. Of the eight patients treated with laminectomy in the series of Hsu et al,⁴ three showed excellent and four good responses, while one remained the same postoperatively. Of the 13 patients of Onofrio and Mih,¹³ undergoing laminectomy for synovial cysts, all 13 exhibited good to excellent results. Two years following surgery in the Banning et al series of 31 patients with synovial cysts (29 undergoing laminectomy with 2 having laminectomy accompanied by fusions),¹⁶ 20 patients exhibited good/excellent responses, while 11 had fair outcomes. Of the 28 patients having synovial cysts excised via laminectomy in the series of Salmon et al,¹⁵ 26 demonstrated good/excellent

outcomes with only 2 showing fair/poor results. Lyons et al¹⁰ had 194 patients with lumbar synovial cysts: 176 had laminectomy alone, while 18 had simultaneous fusions. Six months postoperatively, good/excellent results were reported in 91% of patients, while 9% demonstrated fair/poor outcomes. Of interest, only four of the patients of Lyons et al developed postoperative instability warranting a secondary fusion.

Laminectomy with Primary Fusion

Patients with lumbar synovial cysts accompanied by degenerative spondylolisthesis may further benefit from simultaneous fusion. In the study of Fischgrund et al²¹ of 67 patients with lumbar stenosis and degenerative spondylolisthesis, laminectomy was combined with randomly assigned noninstrumented or instrumented fusions at the segment of listhesis. Two years postoperatively, patients undergoing the noninstrumented fusions demonstrated an 85% incidence of good to excellent outcomes despite a lower 45% incidence of radiographically documented fusion. On the other hand, for those having instrumented fusions, a lower 76% incidence of good to excellent results was reported despite a higher 82% frequency of x-ray-confirmed arthrodesis.

PATHOLOGY

In most adult postmortem studies, the synovium of the lumbar facets typically extends beyond the articular surfaces of the joint and into the yellow ligament.²² Pathologically, the synovium exhibits an epithelial lining that could be differentiated from cystic degeneration of the yellow ligament.^{23,24}

COMPLICATIONS

Postoperative complications reported by Lyons et al¹⁰ in their series of 194 patients included cerebrospinal fluid fistula (3 patients), postoperative instability warranting secondary fusion (4/176 patients undergoing laminectomy), discitis (1 patient), epidural hematoma (1 patient), seroma (1 patient), phlebitis (1 patient), and death (1 patient from unrelated cardiac disease). Banning et al¹⁶ observed that of their 31 patients with synovial cysts, recurrent cysts were observed in 3% of cases, 9% (3 patients) required subsequent surgery including two spinal fusions (6%), while an additional 9% (3 patients) developed postoperative cerebrospinal fluid fistulas.

CONCLUSIONS

Patients with lumbar synovial cysts typically present in their mid-60s with symptoms of radiculopathy and neurogenic claudication. Both MR and CT studies, including myelo-CT examination, document the location of the synovial cyst and the presence of spondylostenosis. Also demonstrated are the associated facet arthropathy and a unique incidence of spondylolisthesis. The optimal surgical management may well include not only laminectomy but also simultaneous fusion

where disruption of the facet and the joint capsule, particularly in the presence of olisthy, renders their spines unstable.

ACKNOWLEDGMENTS

The author appreciates the editorial assistance of Dr. Joseph A. Epstein and Ms. Sherry Grimm.

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