

Amir M. Khan
Federico Girardi

Spinal lumbar synovial cysts. Diagnosis and management challenge

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Abstract Sophisticated and newer imaging capabilities have resulted in increased reporting and treatment options of spinal lumbar synovial cysts (LSS). Most of the patients with lumbar cysts tend to be in their sixth decade of life with a slight female predominance. The incidence of LSS is thought to be less than 0.5% of the general symptomatic population. They may be asymptomatic and found incidentally or the epidural growth of cysts into the spinal canal can cause compression of neural structures and hence associated clinical symptoms. Most of the symptomatic LSS patients present with radicular pain and neurological deficits. Spinal synovial cysts are commonly found at L4-5 level, the site of maximum mobility. They may be unilateral or bilateral and at one or multilevel. MRI is considered the tool of choice for its diagnosis. The etiology of LSS is still unclear,

but underlying spinal instability, facet joint arthropathy and degenerative spondylolisthesis has a strong association for worsening symptoms and formation of spinal cysts. Synovial cysts resistant to conservative therapy should be treated surgically. Resection and decompression with or without fusion and instrumentation remains an appropriate option. Synovial cysts may recur following surgery. The optimal approach for patients with juxtafacet LSS remains unclear. The best surgical treatment option for each particular individual should be tailored depending upon the symptoms, radiological findings and other co morbidities.

Keywords Lumbar synovial cysts · Spondylolisthesis · Conservative treatment · Surgical treatment · Resection and decompression · Spinal fusion

A. M. Khan (✉) · F. Girardi
Orthopaedics, VA medical center,
7A11-130 W Kingsbridge road,
Bronx, NY 10468, USA
E-mail: dramirkhan@hotmail.com
Tel.: +1-347-2752000
Fax: +1-815-3333960

Introduction

In 1885, Baker first described the formation of synovial cysts adjacent joints to a joint [3, 4]. Synovial cyst occur throughout the body, in the spine they may occur anywhere in cervical [23, 25, 37], thoracic [2, 13] and in the lumbar spine [1, 7, 12, 13, 18, 21, 22, 33, 35, 36, 38, 39, 56]. It was in 1950 that it was first described to cause symptoms of spinal nerve compression; Kao et al. later confirmed this in 1968 [27, 28, 55].

In the last decade, improved imaging capabilities such as computed tomography (CT) and magnetic resonance

imaging (MRI) have resulted in increase reporting, diagnostic yield and treatment options of spinal synovial cysts. The exact etiology of spinal synovial cyst is still unclear. To date debate continues regarding its origin, cause, pathology and the best treatment.

Incidence, age and sex

Eyster et al. reviewed approx. 1,800 MRIs and CTs over one and half year and found 11 (0.6% of) cases of lumbar synovial cysts of the spine [16]. However Doyle

et al. [14] found a prevalence of 2.3% anterior and 7.3% posterior spinal cyst in a review of 303 retrospective analyses of MRIs. Similarly Lemish et al. [33] identified 10 cysts in 2,000 reviews of CT lumbar spines. Synovial cysts in the spine occur predominantly in the lumbar as compared to thoracic and cervical areas [19].

Most of the patients with lumbar cysts tend to be in their sixth decade of life with a range that is varied from as early as 28 years to as late as 94 years [34]. A female bias has been reported often [34], but others refute that [16]. A female to male ratio of 1:1 [34] to 2:1 [22, 39, 54] and 3:1 and 4:1 has been reported [21, 41].

Presenting signs and symptoms

They may be asymptomatic and found incidentally [20, 56]. The epidural growth of cysts into the spinal canal causes compression of neural structures and their associated clinical symptoms. The clinical presentation of a cyst depends on its volume, site and its relationship to the surrounding bony and neural structures.

Most of the symptomatic patients present with radicular pain and neurological deficits. A history of low-back pain invariably precedes the radicular pain (range from 50 to 93%) [21, 54]. Most commonly occurring symptom of synovial cysts of the spine is painful radiculopathy, which may be unilateral or bilateral, reported in 57–100% of cases [21, 54].

Neurogenic claudication is the next most frequently reported symptom ranging from 10 to 44% [34, 41]. This is followed by neurological deficits which includes sensory deficits (range 10–43%), motor deficits (range 20–27%) and reflex abnormalities (up to 57%) [22, 34, 44, 54]. Other sign and symptoms including cauda equina syndrome (range 1–13%) [7, 21, 22, 32, 34, 43, 56], lateral recess [15] and spinal stenosis syndromes [18, 32] have also been reported.

Diagnostic imaging

Plain radiographs have little diagnostic importance in identifying synovial cyst but are useful in excluding other conditions, such as spondylosis, degenerative spondylolisthesis and metastatic lesions.

Computed tomography scanning and MRI are the two neuro-diagnostic imaging modalities recommended for characterization of synovial cysts and preoperative planning. MRI will demonstrate not only the nature of the cystic lesion, but also its relationship to the thecal sac. On MR imaging, synovial cysts appear as well circumscribed, smooth, extra-dural in location and adjacent to facet joints. The proteinaceous content of the cyst can demonstrate greater signal intensity than the surrounding CSF on both T1 and T2 weighted images [24, 30, 38].

The typical appearance of a cyst on a CT scan can be altered by its content e.g., gas [18, 45, 49], calcification [37], blood [23], inflammation and the osseous structure involvement. Calcification within cyst wall appears low signal intensity on both T1 and T2 weighted images whereas hemorrhagic cysts display increase intensity compared to CSF probably due to T1 shortening caused by methemoglobin. MR imaging is considered to be diagnostic imaging of choice in the workup of suspected synovial cysts [20, 24]. (See Figs. 1 and 2, for sagittal and cross section of MRI, respectively).

Level of cysts

The majority of synovial cysts in the lumbar spine occur at the L4–L5 level, the site of maximum mobility. The predilection for cysts to occur adjacent to this facet joint level has been attributed to the amount of degenerative spondylosis and spinal instability [2, 7–11, 17, 21, 22, 25, 26, 29, 31, 40, 46–49, 53, 56]. The range of this finding varies from 51% found by Banning et al. to 80% in the series by Trummer et al. [6, 54].

L5–S1 is considered to be the next most frequent site of developing lumbar cysts; this is followed by L3–4 and then L2–3. Synovial cysts are found equally on both sides of the spine and can be found at two or more levels in one patient [21, 34, 41, 54].

Development and associations

Development of lumbar cysts has been linked with degenerative spondylosis, spinal instability and trauma. Banning et al. [6] noted 90% of his patients with facet arthropathy. Hsu et al. [22] recorded 75% of his patient with degenerative arthropathy on radiological imaging.

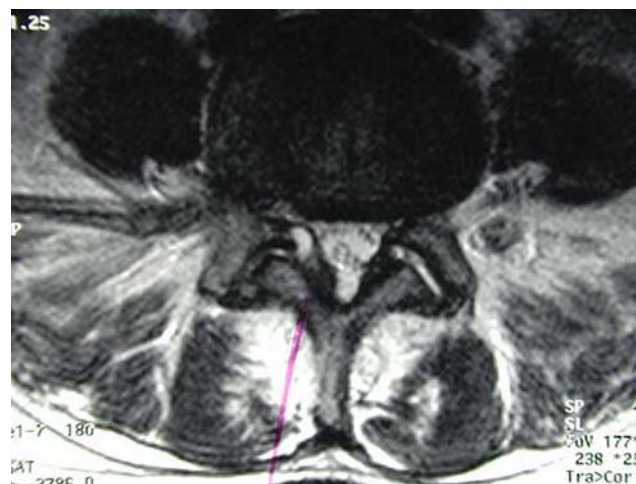


Fig. 1 Cross sectional MRI with the synovial cyst of the spine



Fig. 2 Sagittal MRI with the synovial cyst of the spine

Trummer et al. [54] noticed a hypermobile facet joint in 60% of his patients. Pirotte recorded 54% of his patients with spondylolysis [41].

Perhaps the most interesting finding is its association with spondylolisthesis. Rheust et al. [42] described 38% of patients having an association of it with synovial cysts, gave one of the earliest descriptions of spondylolisthesis in 1980s. The association of spondylolisthesis with cysts varies in other studies; Parlier et al. [39] noted 60% of his patients with spondylolisthesis. Both Lyon et al. [34] and Salmon et al. [45] found 50% of their patients with degenerative spondylolisthesis. Similarly Trummer et al. found 33% and banning 41% [6,34]. Sabo et al. [44] found 15 of his 56 patients with spondylolisthesis and strongly advocated the use of routine dynamic flexion and extension films for its accurate diagnosis.

Lyon et al. [34] also reported 11% and Howington et al. [21] 18% of their patients with prior surgery and subsequent development of spinal synovial cyst; others have failed to record this observation.

Pathology

Cysts are internally lined with cuboid or pseudostratified columnar epithelium and filled with clear or straw color fluid [22, 30, 44, 51]. The distinction between synovial cysts (with a synovial lining) and ganglion cysts (with out a lining) is a histological one. As other authors have discussed, there is no clinical relevance to differentiating between ganglion and synovial cysts, as their presentations, treatments and prognoses are identical [21, 38, 44]. Others explain synovial and ganglion cysts to be a specific point in a cycle of cyst formation and degeneration [21, 22].

These cysts can on rare occasion hemorrhage and bleed into surrounding soft tissues and or spinal canal causing acute compression of the spinal cord [5, 26, 34,

48, 52]. The incidence of hemorrhagic cyst varies: Lyon et al. [34] reported 18 of his 194 patients to none reported by others.

Conservative management

Conservative treatment modalities include no treatment, bed rest, oral analgesics, physical therapy, orthopedic corsets, chiropractic care, CT-guided needle aspiration and intra-articular injection of corticosteroid drugs and cyst punctures [1, 8–10, 33, 34].

Direct cyst puncture by means of a translaminar CT has been tried but most cyst recur after 6–12 months. Most believe that residual synovium, cyst type and osmotic load of the contrast are contributing factors to poor results [1, 31].

First report of facet joint steroid injection in a symptomatic cyst was reported by Casselman [10] in 1985. Since then steroid and local anesthetics or a combination of both have been injected intra-articularly for therapeutic relief of symptoms with the aid of imaging techniques and with variable results [8–10, 15, 22, 39, 50].

Hsu et al. [22] treated 4 of his 11 cases with epidural steroid injection with short-term relief of symptoms in 3, and 2 of 3 patients had short-term relief with intra-articular injections. Follow-up data was available for 5 months only.

Slipman et al. [50] treated 14 patients with transforaminal epidural steroid injection and physical therapy. Eight of the patients failed non-surgical treatment.

Sauvage et al. [51] treated 13 patients with intra-articular steroid injections. Failure rate were 31 and 58% at 1 and 6 months, respectively. Similarly Parlier et al. [39] treated 28 patients with at least one intra-articular steroid injection. A failure rate of 33 and 64% was reported at 1 and 6 months, respectively.

Few series have found that steroid injections provide acceptable long-term results [1, 8, 39]. However, these treatments often show short-term or no improvement at all [22]. Causes of failures include rarity of cyst involution, inadequate aspiration of fluid, inability to install steroids properly and inability to puncture and cyst recurrence. Aspiration of the cyst fluid is often difficult and increased failure is also attributed to the ball-valve effect as negative pressure is applied [30, 32]. We suggest a conservative trial of all the above modalities for a period of 6 months after which surgical options should be considered [29, 34, 44].

Surgical evaluation and outcome

Surgical treatment is largely recommended in all cases of intractable pain or neurological deficit. The surgical

technique will depend on the site, size and associated other factors of the cysts, e.g., duration of symptoms and involvement of surrounding structures etc. in general current therapy for synovial cysts includes excision of the mass (total or partial) and lumbar decompression [34, 36, 44, 53, 56].

Removal of unilateral cyst in a stenotic spinal canal may involve a partial above or below the level and full (or partial) laminectomy at the level of lesion. The nerve root and thecal dural sac are differentiated from the synovial cyst and its thick viscous fluid to avoid injury to cause cerebrospinal fluid leak and fistula.

Additional spinal fusion procedures (with or without instrumentation) are performed if the spine is deemed unstable/olisthesis or significant spondylosis is noted. Onforio et al. [38] reported 8 of 12 patients while Kurtz et al. [32] reported three of four with spondylolisthesis, none underwent spinal fusion. Of the 15 patients with spondylolisthesis in the series by Sabo et al. [44] series, six had spinal fusion. No difference in outcome was found in patients having fusion from those who did not. Forty-six patients had excellent outcomes while 12 had occasional pain and 1 had a poor outcome [44].

Approximately half of patients had grade 1 spondylolisthesis in the series reported by Lyons et al. only 18 patients with spinal instability had fusion. Ninety-one percent of patients had good pain relief with 82% of patients had motor relief. Forty-seven patients were lost in the follow-up [34]. Howington et al. [21] reported a

similar finding, one patient deemed to have spinal instability underwent spinal fusion, no separate outcome of spinal fusion results were mentioned in either of the above series. Khan et al. [29] noted a better outcome with patients undergoing fusion surgery for their group of patients with spondylolisthesis and synovial spinal cysts than those without fusion.

Pirotte et al. reported 100% postoperative relief immediately after surgery. Five patients developed symptoms of sciatica within the first year. No spondylolisthesis or fusion was reported in his series. Others have mentioned an association between spinal cysts and spondylolisthesis/instability and better surgical outcomes without any mention of the results of its different type of procedures. However as there are no randomized clinical control trials to prove or disapprove optimum treatment for patients with cysts and spondylolisthesis, it is our view that the treatment of cysts in these situations should be tailored according to individual situation with aim to remove symptomatic cysts and aim to achieve optimum stabilization of the spine. Results of other surgical and non-surgical outcomes are summarized in Table 1. (See Figs. 3 and 4, showing intraoperative dissection of lumbar synovial cyst, of the spine and a dissected synovial cyst respectively).

One of the detail records of postoperative complication comes from Lyon et al. [34]. His series noted (three patients with) cerebrospinal fluid fistula, (one patient each with) discitis, epidural hematoma, seroma, deep

Table 1 Showing different studies of synovial cyst of the spine with their outcomes

Study	No. of pts	Gender	Side of cyst	Primary procedure	Primary fusions	Follow-up duration	Delayed fusion	Outcomes	Other
Lyon et al.	194	94F 100M	Rt = Lt	Lam/res	18	6 m min	4	134(91%) good, 82% motor relief	47 lost f/u
Howington et al.	28	21F 7M	15Rt 13Lt	Lam/res	1	40 m avg	1	88% and 21% relief of rad. & back pain resp.	
Pirotte et al.	46	38F 8M	/	Lam/res	/	12 m min.	/	100% imm. Postop pain relief	5 rec. cysts
Trummer et al.	19	7F 12M	6Rt 12Lt	Lam/res	/	3 m min.	/	17 pts exc. 2 good	1 rec. cyst
Sabo et al.	56	32F 24M	30Rt 25Lt	Lam/res	7	12 m avg	2	46 pts exc. 12 occ. Pain 1 poor	4 rec. cysts
Banning et al.	31	19F 11M	22Rt 11Lt	Lam/res	2	24 m avg	/	20 exc/good, 11 fair	3 rec. cysts
Hsu et al.	19	13F 6M	8 bilobed	Lam/res	/	14 pts 1.5 years	/	3 exc. 4 good	6 cons.3/4 epi. steroid inj
Salmon et al.	28	22F 6M	1 bilateral	Lam/res	/	range 3–10 years	/	26 exc/good, 2 fair/poor	
Parlier et al.	30	21F 9M	/	Epi. steroid inj	/	12 m min	/	50% exc/good, 18 fair/poor	2 lost f/u
Bureau et al.	12	8F 4M	/	Epi. steroid inj	/	23 m avg	/	74% exc, 1 fair, 2 poor	6 cyst regress
Khan et al.	39	11F 28M	20Rt 22 Lf	Lam/res	26	26 m	4	Fusion = 80% exc/good, 8%poor	Nonfusion = 69%exc/good, 15%poor

Pts Patients, *Rt* right, *Lt* left, *Lam/res* Laminectomy and resection, *Epi* epidural, *Inj* injection, *m* months, *f/u* followup, *rad* radicular, *Exc* excellent, *Imm* immediate, *postop* postoperative, *rec* recurrent

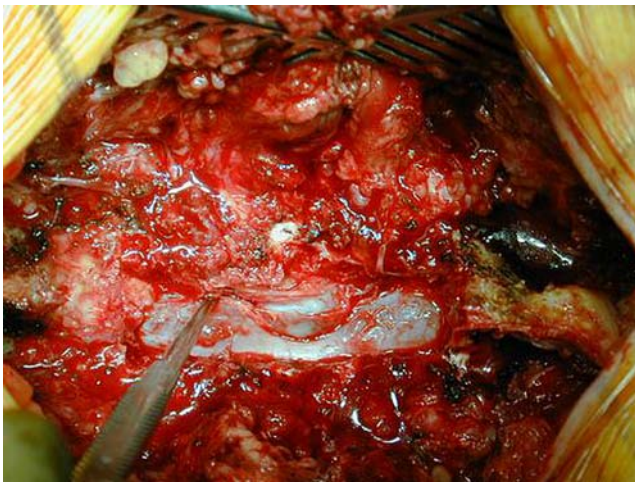


Fig. 3 Intraoperative dissection of lumbar synovial cyst of the spine



Fig. 4 A dissected lumbar synovial cyst of the spine

vein thrombosis and death. Banning et al. [6] recorded three of his patients (9%) while Salmon et al. [45] reported five patients with postoperative cerebrospinal fluid leaks. Trummer et al. [54] noted no postoperative complications in his series of patients.

Pirotte et al. noted five of his 46 patients had developed recurrent cysts within the first year of follow-up. Trummer et al. noted one recurrent cyst. Similarly Banning et al. [6] found 3% and Sabo et al. [44] noticed 4 of his patients with recurrent cysts. Khan et al. [29] found only one recurrent cyst in their follow-up of patients. We conclude that removal of synovial cysts with subsequent adequate fixation (with or without instrumentation) should be strongly considered to prevent recurrent symptoms and cysts at the site of removal especially if the spine is deemed unstable.

Conclusion

Improved imaging capabilities have resulted in increase reporting, diagnostic yield and treatment options of spinal synovial cysts. A majority of patients with lumbar cysts tend to be in their sixth decade of life. There is a slight female predominance. A variable incidence has been described in the literature; it is thought that it may be less than 0.5% of the general symptomatic population. They may be asymptomatic and found incidentally. The epidural growth of cysts into the spinal canal causes compression of neural structures and their associated clinical symptoms. Most of the symptomatic patients present with radicular pain and neurological deficits.

Spinal cysts are commonly found at L4–5 level, the site of maximum instability. They may be unilateral or bilateral and at one or multilevel. MRI is the tool of choice for diagnosis. The etiology is still unclear but underlying spinal instability, facet joint arthropathy and degenerative spondylolisthesis has a strong association for worsening symptoms and formation of spinal cysts.

Synovial cysts resistant to conservative therapy should be treated surgically. Resection and decompression with or without fusion and instrumentation remains an appropriate option. Synovial cysts may reoccur following surgery. It appears that the optimal approach for patients with juxtafacet cysts remains unclear. The best surgical treatment approach for each particular individual should be tailored depending upon the symptoms, radiological findings and other co morbidities.

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