

# Lumbar Synovial Cyst, Literature Review: Challenges of the Surgical Management, the Role of Minimal Invasive Techniques and Endoscopy

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## Abstract

The management of symptomatic lumbar synovial cysts is still a challenge and a matter of debate with no existing strong consensus. There are different treatment techniques and strategies, the most debated matter is to fuse or not to fuse, efficiency of less invasive techniques. One of our purposes was to provide an updated review of a literature about treatment of juxta facet synovial cysts and as standard surgical strategies are inconsistent, we present a small series of patients treated using different approaches, most of them were treated with MISS techniques, endoscopy, providing good results.

## Keywords

Lumbar Synovial Cyst, Lumbar Decompression, Facet Joint

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## 1. Introduction

William Marrant Baker, surgeon and lecturer in general anatomy and physiology at St. Bartholomew's Hospital and Evelina Children's Hospital, was the first to describe synovial cysts (SC) in 1885. The SC are contiguous with facet joints, arising through a defect in the wall of the joint capsule, caused by instability, degenerative changes, trauma and inflammatory diseases like rheumatoid arthritis, causing narrowing of the spinal canal and provoking neurogenic claudication or radicular symptoms. It is thought that the incidence may be less than 0.5% of the

general symptomatic population [1]. SC are polymorphic, there are bilateral lumbar SC cases reported in the literature [2], there are reports of rare localization of SC is the foraminal space [3], reports of gas-containing SC, a case report recently published [4] with reference of 9 other cases published, reports of hemorrhagic SC [5] [6], as well as calcified SC with surrounding normal bone remodeling [7], extremely rare in adolescents [8].

The etiology is still unclear but underlying spinal instability, facet joint arthropathy and degenerative spondylolisthesis have a strong association for worsening symptoms and formation of spinal cysts [1]. Segmental instability contributes to the pathogenesis and recurrence of SC, and degenerative spondylolisthesis is thought to be a predisposing factor [9] [10]. Researchers support the theory of degenerative micro traumatic pathogenesis of synovial cysts [11], mostly appearing in L4 - L5 segment due to its high mobility. There is a theory that excessive mobility of the zygapophyseal joint might result in synovial membrane herniation outside of injured joint capsule, confirmed by the fact that the most common location of SC is at the highest spinal mobility, at the L4 - L5 segment [12] [13] [14].

There are publications about hemorrhagic SC, some authors affirm the traumatic etiology of hemorrhage, like a case of a hemorrhagic facet joint cyst secondary to trauma causing acute bilateral foot drop 12 days after trauma in a patient treated with aspirin [5]. Several years before a case of posttraumatic hemorrhagic synovial cyst was published with radiculopathy symptoms 4 months after trauma and a review of 31 cases of hemorrhagic juxta facet cysts reported in the literature [6].

True SC have a thick wall lined by synovial cells, containing granulation tissue, numerous histiocytes and giant cells. In contrast, pseudo-cysts lack specialized epithelium, have a collagenous capsule filled with myxoid material, and may be classified into ganglion cysts, originating from periarticular fibrous tissues and ligamentous cysts, arising from the ligamentum flavum or even from the posterior longitudinal ligament [11]. Another publication based on 3 cases of hemorrhagic SC more specifically on histological examinations showed an inflammatory reaction within the cyst and the consequent formation of neoangiogenic vessels [15]. This could be an explanation for intracystic hemorrhage and worsening of neurologic symptoms.

About one third of lumbar SC are associated with degenerative spondylolisthesis. Segmental instability is thought to contribute to the pathogenesis and recurrence of SC and lumbar fusion has been advocated as a treatment of choice in the presence of spondylolisthesis. In patients with spondylolisthesis, minimally invasive resection of lumbar synovial cysts without fusion could minimize surgically induced segmental instability while providing good pain relief [16].

Synovial cysts with clear, serous liquid have an isointense signal in T1-weighted images and a hyperintense signal in T2-weighted images [12] [13] [14] [17], or variable intensity on T1-weighted and hyperintensity on T2-weighted images. The contours of the mass may enhance after injection of gadolinium. The cyst has

variety of MR imaging signal intensities, presumably due, at least in part, to the variable cyst contents including hemorrhage of different ages [18] [19] [20]. Facet SC may contain complex fluid because of internal debris or hemorrhage [21].

Nonsurgical management in patients with SC-induced radicular pain does not appear to be as successful of a surgery [22]. There are publications of small series of patients treated conservatively with steroid injections with short time improvement or unsatisfactory results [23] [24] [25] [26] [27]. Few publications have provided long term positive results [28] [29].

Surgical treatment consists in the decompression of neural structures, differentiation of the cyst from neural elements and removal of the cyst with or without fusion. Some authors consider that lumbar fusion should not be considered as the first line of treatment in patients with SC and degenerative lumbar spondylolisthesis [16]. In his series of 60 patients, including 15 with listhesis, Sabo and coauthors found no difference between clinical outcome of fused and non-fused patients [30].

However, as there are no randomized clinical control trials to prove or disprove optimum treatment for patients with cysts and spondylolisthesis, the treatment of cysts in these situations should be tailored according to individual situation with the goal to remove symptomatic cysts and aim to achieve optimum stabilization of the spine [1]. The same authors consider that the 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 [1].

Synovial cyst recurrence occurs in 1.8% to 3% after decompression and excision of synovial cysts but there are no reports in patients after decompression and fusion, although hospital stay is longer and blood loss is higher in patients treated with decompression and fusion [18] [31].

Endoscopic surgical procedures are gaining more popularity due to their less invasiveness, good effectiveness and the field approached in this article also has more acceptance. We will present some cases of SC treated surgically, focusing on endoscopic solution. Until the present day, there are few references and series published approached with endoscopy.

We will present some cases including different surgical approaches.

## 2. Case 1

SC aggravating the preexisting canal stenosis due to advanced spondylosis, in a patient with neurologic claudication and signs of radiculopathy. Treated through laminectomy and cyst resection, no fusion was decided because of poor bone quality and state of health, with good recovery of walk and radiculopathy symptoms relief (**Figures 1(a)-(c)**).

## 3. Case 2

SC compressing the S1 root with radiculopathy symptoms in a very spondylotic

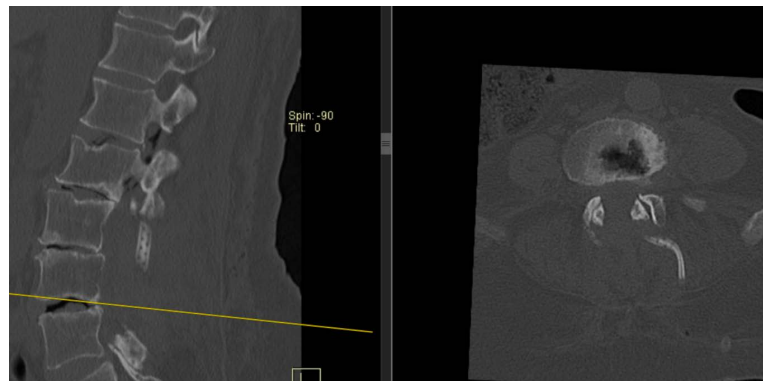
spine, treated with fusion L5 - S1, laminectomy, unilateral facetectomy and cyst resection with immediate symptoms disappearance (**Figure 2(a)** and **Figure 2(b)**).

#### 4. Case 3

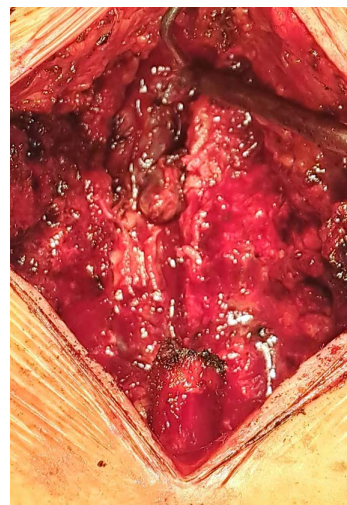
L4 - L5 SC cyst in a young woman with radiculopathy symptoms and axial pain, treated through MISS TLIF with good pain relief (**Figure 3(a)** and **Figure 3(b)**).



(a)

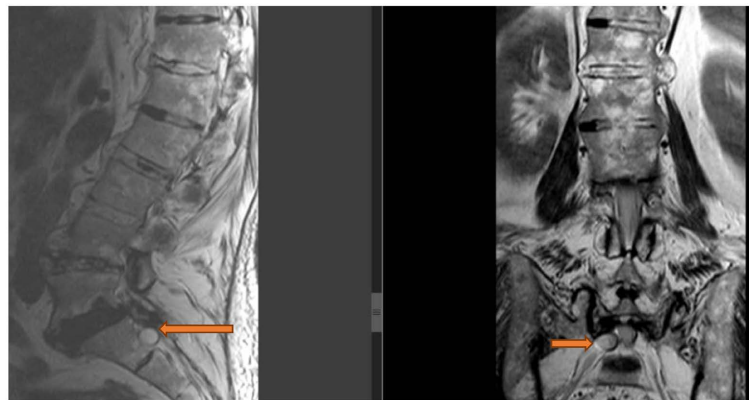


(b)



(c)

**Figure 1.** (a) Preoperative MRI, revealing L4 - L5 SC, compressing the exiting root; (b) Postoperative CT, showing wide three level laminectomy for canal stenosis and SC removal; (c) Intraoperative picture, depicting SC before resection.

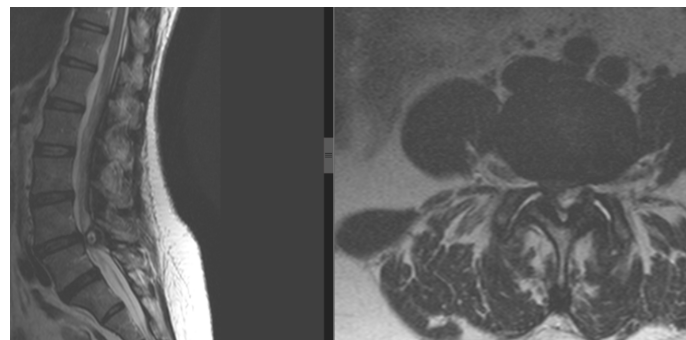


(a)

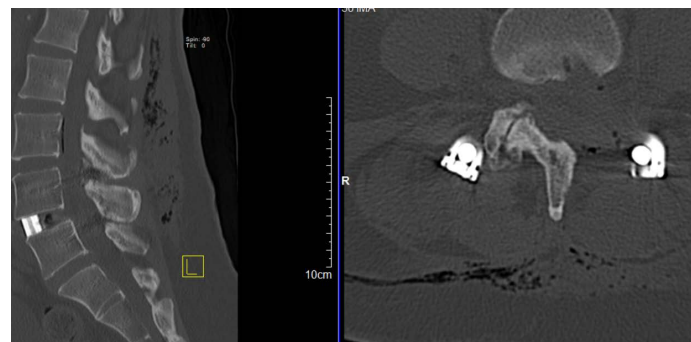


(b)

**Figure 2.** (a) MRI revealing SC compressing S1 root; (b) Postoperative CT scan showing the bony window after facetectomy.



(a)



(b)

**Figure 3.** (a) MRI: SC L4 - L5, hypersignal of bilateral of facet joints; (b) Postoperative CT scan: left MISS TLIF, hemilaminectomy.

### 5. Case 4

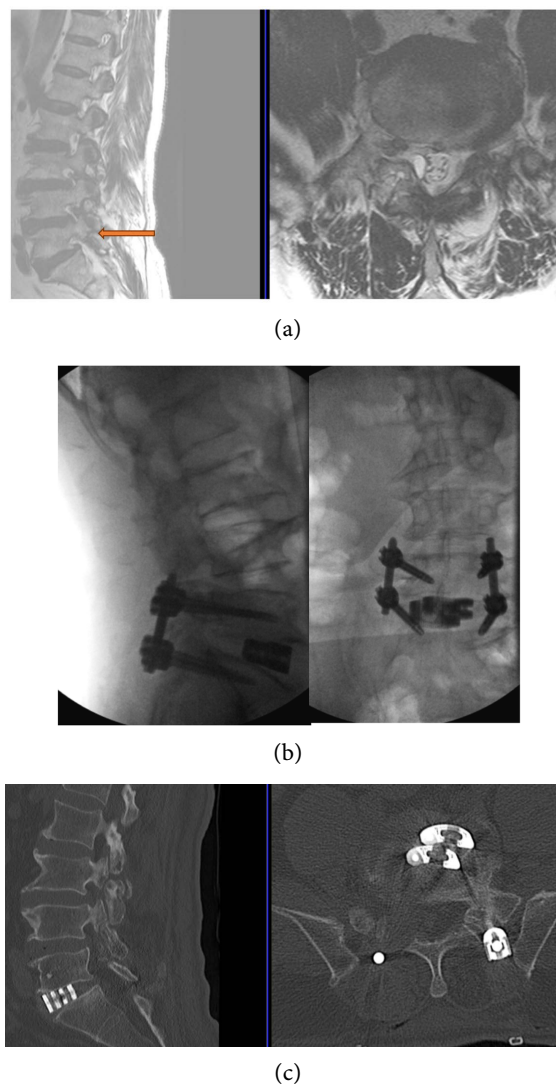
Right sided L5 - S1 SC, with radiculopathy and low back pain in a patient with bilateral isthmic lysis, treated through MISS TLIF with 2 cages because of huge inter vertebral space with immediate pain disappearance (**Figures 4(a)-(c)**).

### 6. Case 5

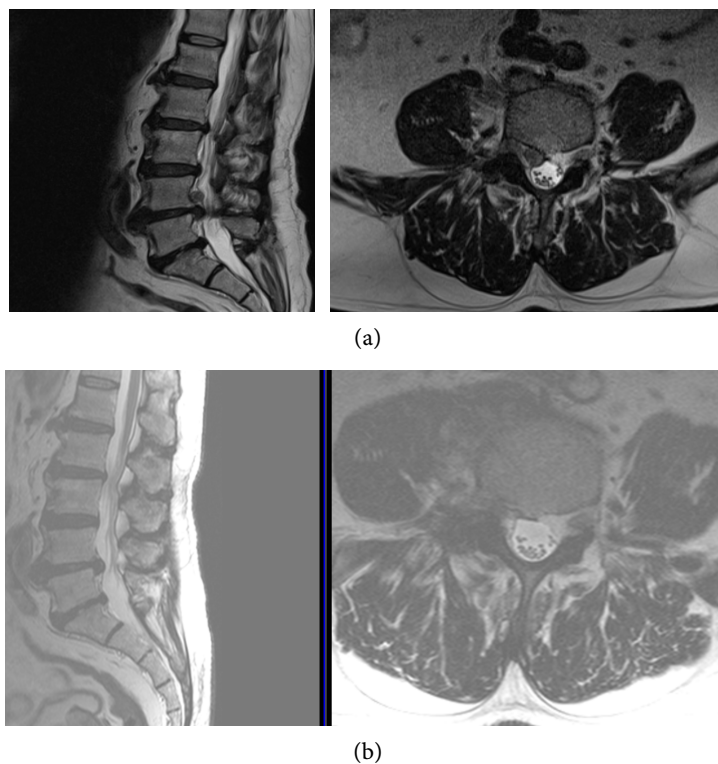
SC with L4 root compression and radiculopathy symptoms, treated through transforaminal endoscopic resection with good postoperative results (**Figure 5(a)** and **Figure 5(b)**).

### 7. Case 6

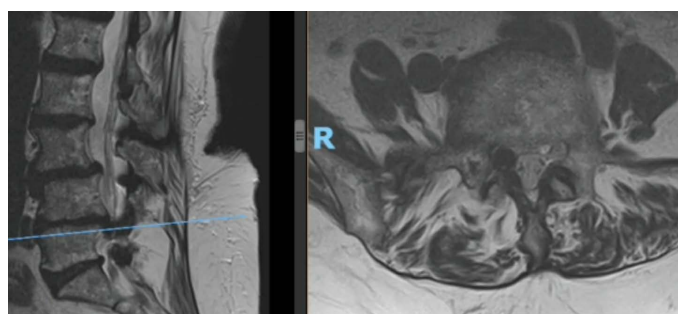
83 years woman with right sided radicular pain, MRI revealed SC L4 - L5 (**Figure 6**).



**Figure 4.** (a) MRI: L5 - S1 isthmic lysis, right sided SC; (b) Intraoperative picture L5 - S1 fusion, double cage TLIF; (c) SC scan proving adequate arthrodesis material positioning.



**Figure 5.** (a) Preoperative MRI revealing SC L4 - L5 on the right side and L4 - L5 disc herniation; (b) Postoperative MRI proving SC resection.



**Figure 6.** MRI: degenerative spondylosis, SC adjacent to facet articulation L4 - L5 on the right side.

She was selected to translaminal cyst removal and during the surgery it was found gas content of the cyst as seen in the video (**Appendix**).

The postoperative course was uneventful with resolution of radicular pain.

## 8. Discussion

SC excision, endoscopic or open without fusion, provide better results in patients without proven instability, but a degree of facetectomy might be necessary in order to prevent cyst relapsing [32] [33]. Complications rarely exceed 2% including dural tear, nerve root injury, epidural hematoma, wound infection and deep vein thrombosis [34] [35]. Recurrent cyst is reported in 2% of patients in follow-up [28].

The available literature suggests that fusion may be a more effective treatment option for reducing post-operative back pain and cyst recurrence compared to decompression [21]. There is a surgical strategy according with SC localization: facet cyst (type 1) compresses the dural sac without affecting the neural root and can be resected by an ipsilateral laminotomy. A contralateral approach is appropriate for the excision of a lateral facet cyst (type 3) in the neuroforamen. In mediolateral facet cysts (type 2) compressing the dural sac and the neural root, the surgical approach should be individually determined depending on the lamina width and the angle of the facet joints. A segmental stabilization should be considered in patients with a proven spondylolisthesis (type 4) [36]. The contralateral approach to SC for type 2, 3 could be neglected in all cases with instrumented fusion, because ipsilateral foraminectomy offers a wide surgical way for cyst removal.

There are many different approaches to treating SC, the most widely adopted being the posterior approach decompression and cyst resection alone, showing good outcomes reported in the literature [37] [38]. Because of association between SC and spinal instability, lumbar decompression alone has been associated with a risk of cyst recurrence, recurrence of symptoms especially axial back pain and progression of instability, with the need for revision surgery [31] [38]. To avoid these risks, lumbar fusion is performed as part of the same procedure. However, according to some publications, it is only necessary in 1% - 5% of cases [38] [39]. Although past publications have suggested that lumbar decompression and fusion could outperform lumbar posterior decompression [31] [40], this problem has never been assessed systematically before. Previous systematic reviews did not stratify data according to different treatment techniques [37] or incompletely reported comparative data on patients treated with fusion [38] [39].

Postoperative appearance of symptomatic SC proves the theory of spinal instability importance in the etiology of cysts: the intraoperative lesion of facet joint capsule during decompression facilitates it and also outlines the importance of fusion [41].

Based on 69 surgical cases of SC series results, it is recommended, together with the resection of the cyst, the instrumentation of the segment to avoid its recurrence and the management of axial pain [42]. On the other hand, a publication of 141 cases with 9 years follow up states that 7% of patients needed surgery due to cyst recurrence and 9% required a delayed stabilization procedure after the initial operation [43].

Synovial cysts should be considered in the differential diagnosis of any spinal extradural masses [17].

## 9. Conclusions

Conservative treatment can be considered as the first therapeutic option in patients without neurological deficits, as spontaneous regression of these cysts is possible [44]. Some studies have reported spontaneous resolution of SC with complete remission of clinical and radiological findings [45] [46].



Surgical treatment is the gold standard due to high recurrence rate and poor outcome with conservative therapy. Surgical treatment of the SC is indicated in the cases with no effect on conservative therapy, recurrent cysts, patient with difficult pain management or neurological deficit. Instrumented spinal fusion surgery is recommended in cases of spinal instability [12].

SC can be effectively treated with minimally invasive surgical techniques, as these approaches diminish soft-tissue injury and blood loss, resulting in earlier ambulation and short hospital stay, decreasing the risk of progressive instability and the need for fusion, particularly in the presence of preexisting spondylolisthesis [47] [48].

We are likely to accept the resection of SC and fusion in the majority of cases with minimal suspicion of abnormal movement of the approached segment, in cases of spondylosis or already rigid listhesis, neural elements decompression and resection of SC is recommended. MISS surgery and fusion is the best choice due to all related advantages of these kinds of approaches.

Endoscopic surgery is applicable for removal of SC [49] and is each more and more adopted as a treatment option: it provides efficient pain relief by coagulation and removal of SC under endoscopic direct visualization and nerve root decompression. The risk of destabilization of the operated segment is nil.

A recent case publication preliminarily elucidated the feasibility and effectiveness of endoscopic technique in the treatment of lumbar SC [50] [51]. The advantage of endoscopic techniques is prompt recovery, minimal structural disturbance and cost-effectiveness [51]. Both transforaminal and translaminar approach can be used for L4 - L5 lesion or above, but a transforaminal approach is most recommended considering the wide foramen space and small interlaminar window. For the L5 - S1 level, a translaminar approach is the best choice because of the iliac crest interfering with transforaminal trajectory, as well as the advantage of larger interlaminar window. The approach should be decided individually according to the surgeon's preference, type of anesthesia, imaging findings and comorbidities [50].

## Conflicts of Interest

The authors have no ethical conflicts to disclose.

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## Abbreviations

Synovial Cysts: SC

## Appendix

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