

Spontaneous Hemorrhagic Synovial Cysts of the Lumbar Spine and Early Fusion: Case Report and Review of the Literature

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Introduction

Synovial cysts, a variant of juxtafacet cyst that is lined by synovium, have been shown to be a cause of radicular symptoms, back pain, neurogenic claudication, and even cauda equina syndrome [1,2,3]. Infrequently, synovial cysts are hemorrhagic, via mechanisms not fully understood [4,5] It is suggested that most cases may be secondary to anticoagulation therapy, vascular anomaly or trauma [6]. Synovial cysts most commonly appear in the lumbar spine and are associated with degenerative changes, spondylolisthesis and facet joint arthropathy [7]. While hemorrhagic synovial cysts are cited in the literature as a potential rare cause of radicular symptoms and back pain, there is a paucity of literature regarding their presentation, diagnosis, and treatment. In the current study, we describe the diagnosis and surgical management of two patients presenting with hemorrhagic synovial cysts of the lumbar spine. The cases presented highlight the importance of recognizing hemorrhagic synovial cysts both on pre-operative imaging and intra-operatively. Timely diagnosis and appropriate surgical intervention in patients presenting with hemorrhagic synovial cysts of the lumbar spine is paramount to resolving their accompanying pain and sensorimotor symptoms.

Materials and Methods

Two representative cases of patients who presented to the University of Illinois at Chicago Hospital are discussed. A review of the literature discussing natural history, diagnosis, and treatment of hemorrhagic synovial cysts of the lumbar spine was conducted. IRB institutional approval was obtained prior to beginning the study.

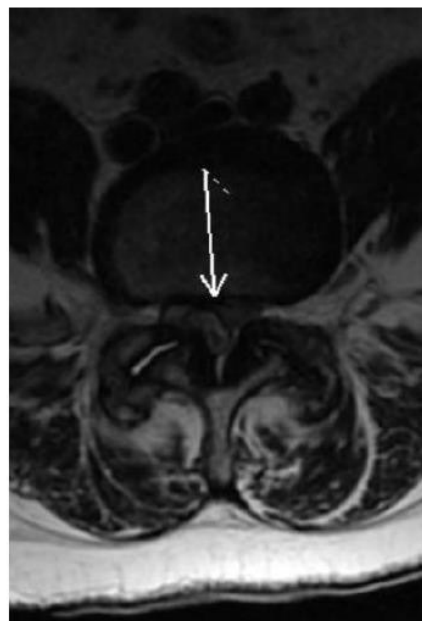
Results

Case 1

The patient is a 64-year-old female with a 20-year history of lower back pain and subjective lower extremity weakness who presented to the emergency department with acute worsening of bilateral lower extremity weakness. On physical exam, the patient had full strength in all muscle groups with the exception of dorsiflexion of the left lower extremity that was 2/5. All sensory modalities were intact. Reflexes were normal and symmetrical bilaterally. MRI of the lumbar spine demonstrated a cystic lesion at L4-L5 level with compression of nerve roots, in addition to severe stenosis and a grade I spondylolisthesis at L4-L5 (Figure 1A and 1B).



Pre-operative Sagittal T2



Pre-operative Axial T2

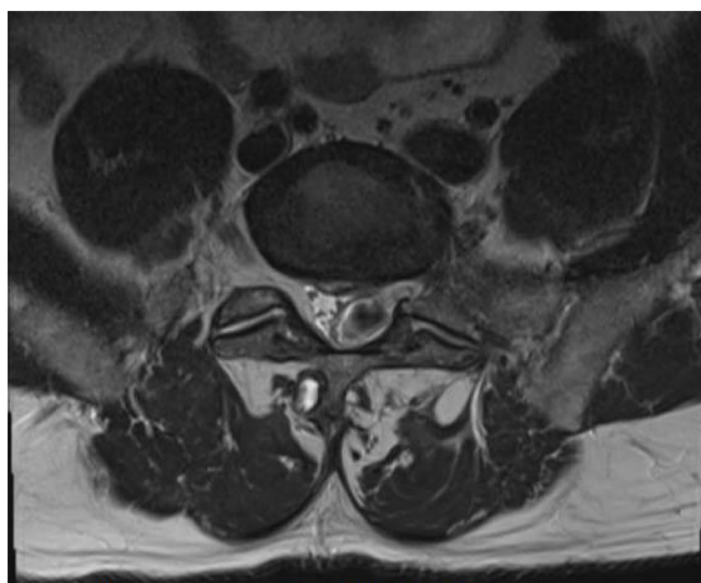
Figure 1: Sagittal (A) and Axial (B) T2 weighted MRI images for Case 1 with demonstration of L4-5 hemorrhagic synovial cysts and nerve root compression as well as grade I spondylosthesis.

The patient was taken to the operating room for a decompression and posterolateral lumbar interbody fusion at L4-L5. Intraoperatively, a cystic lesion draining dark fluid suspicious for chronic hemorrhage was encountered and noted to arise from the left L4-L5 facet joint. The fluid and cyst capsule were sent to pathology, which confirmed the findings of a hemorrhagic synovial cyst.

Post-operatively, the patient neurological exam was unchanged. At her clinic follow-up appointment, the patient was noted to have recovered from her motor weakness and be full strength throughout all muscle groups in the lower extremities. Additionally, she reported resolution of her back pain and significant improvement in lower extremity pain.



Pre-operative Sagittal T2 L5-S1



Pre-operative Axial T2 L5-S1 hematoma

Figure 2: Sagittal (A) and Axial (B) T2 weighted MRI images for Case 2 with demonstration of significant degenerative changes from L4-S1, with associated synovial cysts of L5-S1 and epidural mass which further confirmed to be epidural hematoma from the hemorrhagic cyst.

Case 2

The patient is a 57-year-old male, who presented to the emergency department following six days of inability to sustain an erection and acute onset of severe lower back and bilateral lower extremity pain (left greater than right in an L5 distribution) during attempted sexual intercourse. On physical exam, the patient's lower extremity sensation and motor functions were intact. MRI of the lumbar spine demonstrated significant degeneration at L4-L5 and L5-S1 with a grade I spondylolisthesis at L4-L5 as well as a left sided epidural mass at L5-S1, compressing the exiting nerve roots (Figure 2 A and 2B).

The patient was taken to the operating room for a L4-L5 laminectomy with complete facetectomies and foraminotomies at L5-S1 as well as a L3-S1 posterior lumbar fusion. At the level of L5-S1 on the left side, it was noted that under the L5-S1 yellow ligament and the L5-S1 facet joint, there was the presence of a dark purplish

substance, which was consistent with epidural hematoma. This thickened jelly substance was in clear relationship with the

facet joint on this side. Fragments of this material were sent to pathology, which characterized the specimen as "hemorrhagic, with fragments of synovial lining suggestive of synovial cyst". With the use of fine instruments, this hematoma was dissected from the epidural space where it was found to be tracking down the left-sided L5-S1 foramen. Once this hematoma was removed, the spinal elements were widely decompressed. Of note, at the time of surgery, it was noted that the level of L3-L4 was also very unstable and an intraoperative decision was made to place pedicle screws also into the L3 pedicles bilaterally. Post-operatively, the patient presented a normal neurological examination. At his follow-up clinic appointment, the patient noted resolution of all presenting symptoms.

Discussion

We present two cases of hemorrhagic synovial cyst. We searched PubMed, Web of Science and the Wiley online library of science and found 51 case reports on hemorrhagic synovial cysts (41 patient cases, some with multiple cysts) of the spine (Summarized in Table 1).

Table 1:

Year	Study	Age of patient(s)	Sex	Symptomatic Lesion(s)	Hemorrhage Risk Factor	Presentation Symptoms	Spondylolisthesis	Surgery details	Cyst recurrence/Future fusion required
1983	Pendleton et al	52	M	L4-5, Non hemorrhagic Ganglionic cyst	Unknown	Back pain, Radiculopathy	Yes	Laminectomy and decompression	NA
1987	Jabre et al	60	M	C6-7 Hemorrhagic synovial cyst	Unknown	BLE weakness, neck pain, incontinence and LUE radiculopathy	no	Laminectomy and decompression	4 months, no
1988	Reust et al.	77 and 24	2 M	L4-5 Hemorrhagic synovial cyst	None identified	Back pain and radiculopathy	NR	Laminectomy and decompression	12 months, no
1989	Eyster and Scott	43-68 (11 patients)	6M 5F	L4-5, x9, L3-4 x 1, L5-S1 x 1, Hemorrhagic synovial cyst	None identified	Back pain, Radiculopathy	10 no, 1 yes	NR	NR
1992	Summers and Quint	60	M	L2-3 Hemorrhagic synovial cyst	Unknown	Back pain, radiculopathy and BLE numbness	Yes	Laminectomy and decompression	NA
1994	Tatter and Cosgrove	48	F	L3-4, Non hemorrhagic synovial cyst	Unknown	Cauda Equina Syndrome	NR	Laminectomy and decompression	NA
1995	Yarde et al.	42-78 (8 patients)	5 M 3 F	2 x L4-5, 3 x L5-S1, 4 hemorrhagic	None identified	Back pain, weakness and radiculopathy	2 of 5	Laminectomy and decompression in 3, PSF in 2	1 mo, no
1997	Howling and Kessel	51	M	L4-5, Hemorrhagic synovial cyst	None identified	Sudden severe back pain, Radiculopathy, Loss of L5 sensation	yes	Laminectomy and decompression	NA
2000	Kaneko et al	55	M	L3-4, Hemorrhagic synovial cyst	Trauma	Back pain, Radiculopathy	Yes	Laminectomy and decompression	2.5 yrs, No

2005	Eck et al	77	M	L3-4, Hemorrhagic synovial cyst	Anticoagulation	Back pain, Radiculopathy	Yes	PSF and decompression	NA
2006	Ramieri et al.	68-75 (3 patients)	1 M 2F	L3-4, 4-5 and L5-S1, hemorrhagic synovial cyst	None identified	Radiculopathy and acute on chronic back pain	Yes x3	Laminectomy and decompression	1 year, no
2008	Boviatsis et al.	58-69 (7 patients)	3 M 4 F	L3-4 x 1, L4-5 x 6, Non hemorrhagic synovial cyst	Unknown	Radiculopathy	No	Laminectomy and decompression	mean 12 months, no
2010	Cicendez et al.	72	F	L3-4 Hemorrhagic synovial cyst	None identified	Back pain and RLE radiculopathy and weakness	NR	Laminectomy and decompression	3 weeks, no
2011	Xu et al	68	M	L3-4, Hemorrhagic synovial cyst	Trauma	Back pain, Radiculopathy	Yes	PSF and decompression	6 months, No
2014	Timbo et al.	67	M	L2-3 Hemorrhagic synovial cyst	Anticoagulation	worsening of pain, with initial irradiation to the RLE	NR	Laminectomy and decompression	1 month, no
2015	Cannarsa et al.	36	M	L2-3 Hemorrhagic synovial cyst	None identified	Back pain, radiculopathy, weakness	Yes	Initially laminectomy and decompression, PSF after 4 weeks	4 weeks, yes
2017	Kim et a.	56	F	L4-5 Hemorrhagic synovial cyst, developed after L4-5 discectomy	None identified	back and left leg pain	Yes	Initial microdiscectomy PSF in 6 months	6 months, yes
2020	Sadeh et al.	57 and 64	1 M 1F	L4-5 and L5-S1, Hemorrhagic synovial cyst	None identified	Radiculopathy and acute back pain	Yes x 2	Laminectomy and decompression and PSF	None, 3 months follow up

Of the cases reported, the average age at presentation was 64.08 ± 1.95 (SEM) years. Hemorrhagic synovial cysts were more common in males (56.9%) than females (43.1%). The average age of the females at presentation was 69.1 ± 2.2 years compared to 61.00 ± 2.66 years for males. The majority of cases (95%) were located in the lumbar spine, most commonly at L4-L5 (21%), followed by L3-L4 (12%). There was a single case of sacral hemorrhagic synovial cyst at S1-S2, and two cases of thoracic involvement at T4-T5 and T11-T12 levels. Howling and Kessel reported that 80% of synovial cysts are seen at the L4-L5 level as this is the most mobile segment within the lumbar spine, and synovial cysts are frequently associated with lumbar degenerative spondylolisthesis and therefore instability [8].

Spinal instability, facet joint arthrosis, degenerative spondylolisthesis, and microtrauma may also lead to juxtafacet cyst [11]. It has been proposed that in the occurrence of microtrauma or spinal instability the high vascularization of the cysts alone is enough to prompt hemorrhage [13], albeit there have been reports of hemorrhagic synovial cyst with no associated trauma or coagulopathy [5,11,14]. Several theories have been proposed on

the origin and pathogenesis of synovial cysts. Eyster et al. suggest that hemorrhagic synovial cysts arise from a defective joint capsule, likely secondary to chronic degenerative disease within facet joints, [9] which goes along with the more common location at the lumbar spine level. Other theories suggest degeneration of the collagenous tissue of the joint capsule and neoformation from articular tissue resulting from chronic irritation and inflammation [2,10]. The reason for hemorrhage into a juxtafacet cyst is not fully identified [1]. Several predisposing factor have been associated with hemorrhagic synovial cysts, including anticoagulation treatment, trauma, vascular anomalies, disc herniation and neoangiogenesis [5,11,12].

Patients with synovial cyst present with a variety of motor and sensory symptoms, and depends on location, size and relationship of the cyst with the adjacent structures [3,15-16]. Intermittent low back pain, radicular symptoms, neurogenic claudication and, rarely, cauda equina syndrome [3,15-16]. A literature review performed by Cansara et al. found that leg pain (88%) was the most common clinical findings in patients with hemorrhagic cysts followed by back pain (70%), sensory changes including numbness, tingling,

paresthesia (60%) and weakness (51%). There were only two cases of incontinence or other urologic changes, albeit some are incidental findings as some are asymptomatic [17]. Patients with hemorrhagic synovial cyst may present with acute onset of neurological deficit and/or symptoms of pain [5,11,12]. Exacerbation of pain may be caused by acute hemorrhage inside the cyst, although it has not been clearly established if the enhanced pain is due to expansion of the cyst, leading to radicular compression, or due to inflammation resulting from hemorrhage [2]. Ramieri et al. mentioned that the expansion of the cyst, after hemorrhage is the cause of symptoms, because this occurs even in rare cases of fast growth of the cyst without bleeding [11]. But, in fact, the cause of the acute onset of symptoms in the sudden intracystic hemorrhage is still under debate. The definitive diagnosis is usually done at the time of histologic examination [11]. In a review of 23 cases by Rameri et al., they found that blood or hemosiderin deposits were noticed, signifying bleeding in all reported cases. Imaging is a useful tool for diagnosing hemorrhagic synovial cyst. Several imaging techniques have been used over the years including myelography, CT scan and MRI. The latter has been found to be the best modality for diagnosing [8,12] albeit CT provides abundant information as it pertains to the nature, type and evolution of the cyst [19,20]. Great variability arises from hemorrhagic synovial cyst on MRI signaling, which can be attributed to the hematic content of the cyst [1]. Cansara et al. in their review of 44 cases found that most cysts (93%, 26/28) were found to be hyperintense or heterogeneously hyperintense on T1-weighted MRI images. In 6 cases, contrast enhancement on the peripheral rim of the cyst and the facet joint capsule, was noted after gadolinium injection on T1-weighted imaging. With T2-weighting, there is a mixed picture; among 23 cases, 30.4% were hypointense, 34.7% were heterogeneous and 34.7% were hyperintense. On MR imaging, non-hemorrhagic synovial cysts are typically T1-hypointense and T2-hyperintense [17].

Surgical decompression via laminectomy and cyst excision is the current standard and was the treatment of choice in majority of the cases reviewed [17]. Depending on cyst size, medial facetectomy was also performed. Posterior fusion and stabilization were performed in only 3 cases, which warranted stabilization of the spine. of the 40 cases with documented postoperative outcomes, the majority of patients (75%) had complete resolution of symptoms. Improved symptoms were noted in the remaining 25% of cases. There were no recorded cases of continued or worsening symptoms [17]. Synovial cysts result in nerve root compression as well as changes in the joints thereby leading to degenerative spondylolisthesis in up to 40% of patients, therefore the goal of surgical intervention had been decompression with or without fusion. Epstein [18] (2004) reported a larger proportion of patients who underwent laminectomy and instrumented fusion reported higher incidence of symptom recovery of about 32%. In the laminectomy alone group, 9% of patients eventually required subsequent fusion surgeries due to instability. Similarly, a case series of 167 synovial cysts patients by Risheng and colleagues found that, although uncommon, only patient that underwent decompressive surgeries without fusion had the recurrence of the cysts and required further surgery, likely due to the fact that the underlying instability itself

contribute to cysts formation in these highly mobile segments. The same study also reports a higher incidence of mechanical back pain secondary to instability in patients that underwent hemi- or full laminectomies requiring future fusion surgeries. Other reviews and case series such as those from Ramhmdani et al. [19] (2019) and Lyon et al. [20] (2000), also come to similar conclusions, which were that effective decompression without fusion increases the likelihood of further surgical intervention for instrumented fusion for mechanical back pain and recurrence of cysts.

In our cases, we made the decision to proceed with fusion surgery based on our experience as well as the evidence presented earlier in order to avoid the need for reoperations. These findings could be explained by two principles; one is that the synovial cysts development is itself product of a vicious cycle of instability, which initially results in cysts formation and later to hemorrhage, and thus presence of the synovial cysts could be hint for potential instability that needs to be considered and investigate prior to surgery. Secondly, adequate decompression of the cysts, which often involves the stabilizing elements of spine, results in iatrogenic instability, providing that there was no instability from the cyst to begin with, and therefore a complete decompression requires fusion for providing stability. Therefore, although fusion surgery has its own reported downsides such as longer hospital stays and potential risk of durotomy, however, considering the economical and patient burdens of re-operation for fusion, it is wise to seriously consider the instability elements in synovial cysts and entertain the option of fusion in the initial surgery to improve outcomes and prevent the need for re-operation, especially if hemorrhage is present.

Conclusion

Symptomatic hemorrhagic synovial cysts of the lumbar spine are known to be a marker of future instability and a predisposing factor to spondylolisthesis. Patients may benefit from early decompression and fusion, as opposed to decompression alone, in cases of hemorrhagic synovial cysts of the lumbar spine. Given the involvement of the facets by hemorrhagic cysts and necessity for a wide decompression, posterior fusion in addition to decompression would prevent advancement of spondylolisthesis, instability, and the need for future re-operation.

Acknowledgement

None.

Conflicts of Interest

The authors have no conflicts of interest or financial disclosures to report.

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