Clinical Characteristics and Surgical Management for Juxtafacet Cysts of the Lumbar Spine

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Abstract

Retrospective analysis of 10 cases of resection of symptomatic lumbar juxtafacet cysts in nine patients (mean age 65.4 years) investigated the relationship between surgical method and progression of spinal spondylolisthesis or cyst recurrence. Patient characteristics, surgical methods, and postoperative course were reviewed. The most common preoperative symptom, painful radiculopathy, occurred in all cases, followed by motor weakness in five, sensory loss in four, and intermittent claudication in four. All patients underwent bilateral total ($n = 6$) or partial laminectomy ($n = 4$), with minimal ($n = 3$) or no ($n = 7$) facetectomy. Cysts were gross totally resected in eight cases and partially resected in two. Concomitant fixation was not performed. Painful radiculopathy, motor weakness, and sensory disturbance all resolved, resulting in good or excellent outcome in all patients. Postoperative symptomatic spondylolisthesis had not been noted at mean 52.1 months postoperatively. However, new juxtafacet cysts were later detected on the contralateral side to the initial lesion in two patients. Surgical removal of juxtafacet cysts is recommended for immediate symptomatic relief. Concomitant spinal fixation to prevent progression of spinal spondylolisthesis or cyst recurrence depends on cyst size, involvement of surrounding structures, degree of preoperative spondylolisthesis, and facet joint destruction.

Key words: juxtafacet cyst, synovial cyst, lumbar spine, spinal spondylolisthesis, spinal fixation

Introduction

The term “juxtafacet cyst” was first used in 1974 to describe ganglion and synovial cysts within the epidural cavity.²³⁾ Neuroimaging advances are detecting juxtafacet cysts with increasing frequency.^{6,10,11,13,17,19,22,24–26,29,31,32,36,39,41,43)} Juxtafacet cysts are thought to form as a result of arthrotic disruption of the facet joint, leading to degenerative spondylolisthesis.¹²⁾ Unlike ganglion cysts, synovial cysts are connected to the facet joint and contain a synovial lining.²⁸⁾ However, differentiation of these two types of cysts is difficult based only on neurological imaging.¹⁶⁾ Most juxtafacet cysts occur in the lumbar spine, and contribute significantly to narrowing of the spinal canal, and lateral thecal sac and nerve root compression.^{16,21)}

The present study retrospectively reviewed the age and sex distribution, preoperative symptoms, neuroimaging findings, and surgical outcomes of 10

resections of juxtafacet cysts in nine patients, and assessed the relationship between surgical method and progression of spinal spondylolisthesis or cyst recurrence.

Patients and Methods

The clinical records were retrospectively reviewed of nine patients with 10 lumbar juxtafacet cysts who underwent 10 resections in our institution between 1998 and 2006. No patient had sustained traumatic injury inducing spinal instability. Cases 4 and 10 occurred in the same patient who underwent further resection when a new juxtafacet cyst arose in another region. Patient characteristics including age, sex, preoperative symptoms, neuroimaging findings, surgical techniques, and outcomes were investigated. Lateral roentgenography in standing dynamic motion was used to estimate the slip angle, that is, the percentage slip of spondylolisthesis according to the previously proposed scale.⁴⁵⁾ The degree of facet joint osteoarthritis at the cyst level

Fig. 1 Case 5. Sagittal (upper row) and axial (lower row) T₁-weighted (left column), T₁-weighted with gadolinium (center column), and T₂-weighted (right column) magnetic resonance images showing a left L4-5 synovial cyst arising from the adjacent facet joint with a distinct boundary and ring enhancement (arrow), and mild spondylolisthesis at the same spinal level.

was estimated by computed tomography and graded according to the following scale¹¹: 0, normal; 1, slight narrowing of the joint space $\pm$ small osteophytes/hypertrophy; 2, slight to moderate narrowing of the joint space $\pm$ osteophytes/hypertrophy $\pm$ subarticular erosions; and 3, severe narrowing of the joint space $\pm$ large osteophytes $\pm$ subarticular cysts or severe erosions $\pm$ listhesis. Outcome after surgery was graded according to the following scale³⁷: excellent, no further discomfort and return to full recovery; good, normal neurological examination with minimal back or leg pain; and poor, frequent back or leg pain with limitation of daily activity and/or neurological deficit.

Results

Table 1 summarizes the clinical characteristics of the 10 cases of juxtafacet cyst treated by surgical excision. The patients were aged 53 to 88 years (mean 65.4 years). The pre-existing conditions were cerebral palsy (Case 3), Parkinson's disease (Case 9), and diabetes (Case 4/10). Most of the symptoms

Fig. 2 Photomicrographs of a synovial cyst specimen showing cyst wall and myxoid degeneration (A: hematoxylin and eosin [HE] stain, $\times 4$), synovial lining with stratified columnar epithelium (B, magnified section indicated in A: HE stain, $\times 10$), calcification (arrow) and cartilage degeneration (arrowhead) of the cyst wall (C: HE stain, $\times 20$), bony tissue component (D: HE stain, $\times 20$), and variable numbers of fibroblasts and inflammatory cells within thick fibrous tissue (E: HE stain, $\times 20$).

reflected the anatomic location of the juxtafacet cyst and the level of resultant maximal lumbar stenosis. The most common preoperative symptoms were pain and radiculopathy of the lower extremities, affecting all patients, followed by motor weakness of the lower extremities ($n = 5$), sensory disturbance ($n = 4$), and back pain ($n = 4$). Neurogenic claudication was present in four patients; walking distance was limited to 200 m in two of these patients, to 100 m in one, and the other was unable to walk unaided. Cauda equina syndrome and myelopathy were not observed.

Cysts were most commonly located at L4-5 facet joint, the most mobile segment, in seven patients, followed by L2-3 in two and L5-S1 in one (Table 1). Degenerative spondylolisthesis was radiologically confirmed as the precursor to arthrotic disruption of

Table 1 Characteristics of 10 patients who underwent surgical excision of juxtafacet cyst

Case No.	Age (yrs)/ Sex	Symptoms	Cyst level/ Side	Size (mm)	MR imaging (T ₁ /T ₂ /Gd)
1	55/M	lumbago, dysesthesia, leg pain	L4-5/lt	11	low/high/ +
2	73/M	dysesthesia, leg pain, motor weakness, intermittent claudication	L4-5/rt	10	iso/high/NP
3	53/F	lumbago, dysesthesia, leg pain, motor weakness, sensory disturbance	L4-5/rt	4	iso/high/NP
4	71/M	dysesthesia, leg pain	L4-5/lt	10	iso/low/NP
5	62/M	dysesthesia, leg pain, motor weakness, intermittent claudication	L4-5/lt	12	low/high/ +
6	63/M	lumbago, dysesthesia, leg pain, intermittent claudication	L5-S1/lt	10	iso/low/NP
7	55/M	dysesthesia, leg pain, sensory disturbance	L4-5/lt	8	iso/high/ +
8	69/M	dysesthesia, leg pain, motor weakness, sensory disturbance	L2-3/rt	4	iso/high/NP
9	88/M	dysesthesia, leg pain, motor weakness, sensory disturbance, intermittent claudication, lumbago	L2-3/rt	20	low/iso/ +
10	71/M	dysesthesia, leg pain	L4-5/rt	10	iso/low/NP

Continued

the facet joint in four patients, and the vast majority of the patients exhibited grade 1 disease (Meyerding classification³⁰). The mean percentage slip in the patients with degenerative spondylolisthesis was $12.5 \pm 7.3\%$ (range 0–18.6%) in extension and $15.7 \pm 5.9\%$ (6.0–21.7%) in flexion. The average slip angle was $-11.4 \pm 5.6^\circ$ (from -3° to -23°) in extension and $-4.5 \pm 5.5^\circ$ (from $+5^\circ$ to -17°) in flexion, so the difference between extension and flexion was $6.9 \pm 2.7^\circ$ (range 3–13°). Facet joint osteoarthritis at the cyst level was grade 0 in two cases, grade 1 in one, grade 2 in six, and grade 3 in one. T₁-weighted magnetic resonance (MR) imaging showed seven of the 10 cysts as isointense and three as hypointense. Administration of gadolinium-diethylenetriaminepenta-acetic acid caused enhancement in four of the four cysts (Fig. 1). T₂-weighted MR imaging showed six lesions as hyperintense, three as hypointense, and one as isointense. Mean maximum cyst diameter was 9.9 mm (range 4 to 20 mm). Five cysts were located on the right and five on the left of the spine.

All patients underwent bilateral total (n = 6) or partial laminectomy (n = 4), with (n = 3) or without (n = 7) facetectomy, combined with gross total (n = 8) or partial (n = 2) cyst resection without concomitant fusion (Table 1). In all three cases of medial facetectomy, part of the facet joint was removed as the cyst extended into the joint. A mass of compressed tissue attached to the facet joint was found in all cases. Histological diagnosis confirmed the diagnosis of juxtafacet cyst in all cases. As the state of the pathology specimen depended on the

extraction method (piecemeal resection vs. en-bloc resection), the specimens could not be compared in the same way. Proliferation of synovial lining with stratified columnar epithelium was found in only two cases (Fig. 2A, B), with calcification in eight, evidence of cartilage degeneration of the cyst wall in six (Fig. 2C), and bony component in four (Fig. 2D). Varying degrees of fibroblast and inflammatory cell infiltration were observed within the thick fibrous tissue in all cases (Fig. 2E). No surgical complications such as cerebrospinal fluid leakage, hematoma, or infection were observed.

Good relief of preoperative painful radiculopathy was obtained in all patients soon after surgery. Preoperative motor weakness and/or sensory disturbance also improved in all patients within 2 weeks postoperatively. Neurogenic claudication normalized completely within 2 weeks in three of the four patients, and the patient who could not walk unaided was able to walk 20 m after 1 month of postoperative rehabilitation. Lumbago improved within 1 month in three of the four patients.

All patients were followed up as outpatients with neurology and radiology examinations such as radiography and MR imaging to confirm the postoperative progression of spinal spondylolisthesis or cyst recurrence. The follow-up period has continued for 20 to 124 months (mean 52.1 months) from the day of surgery to September 2006 (Table 1). Outcome was excellent in seven patients and good in two. Poor outcome was observed in one patient (Case 4) who underwent initial cystectomy at the left L4-5 facet joint and had good relief of preoperative

Table 1, continued

Facet joint osteoarthritis (grade)*	Spondylolisthesis (% slip, E/F)	Slip angle (°, E/F//F-E)**	Surgery	Postoperative follow up (mos)/Outcome
2	– (0/0)	– 7/– 3//4	L4-5 total LN/facetec(+) /TR	124/excellent
2	+ (15.2/21.7)	– 15/– 2//13	L4-5 total LN/facetec(–) /TR	108/good
0	+ (0/6)	– 10/– 4//6	L-4 partial LN/facetec(+) /TR	105/excellent
2	– (0/0)	– 13/– 6//7	L-4 partial LN/facetec(–) /PR	41/poor***
1	+ (18.6/18.6)	– 5/+ 5//10	L4-5 total LN/facetec(–) /TR	39/excellent
3	– (0/0)	– 16/– 9//7	L5-S1 partial LN/facetec(–) /TR	22/excellent†
2	+ (16.3/16.3)	– 23/– 17//6	L-4 partial LN/facetec(–) /TR	21/excellent
0	– (0/0)	– 9/– 3//6	L-2 total LN/facetec(–) /TR	21/excellent
2	– (0/0)	– 3/0//3	L-2 total LN/facetec(–) /PR	20/good
2	– (0/0)	– 13/– 6//7	L-4 total LN/facetec(+) /TR	20/excellent

*Degree of facet joint osteoarthritis at the cyst level estimated by computed tomography and graded according to Doyle and Merrilees.¹¹⁾ **Slip angle at the cyst level estimated by lateral roentgenography in standing dynamic motion according to White and Panjabi.⁴⁵⁾ ***Cases 4 and 10 were the same patient who underwent staged surgeries. Nine months after the initial cystectomy at the left L4-5 facet joint, a new cyst occurred on the opposite side of the same spinal segment, and was removed after 21 months. †Case 6 had undergone cystectomy at the left L5-S1 facet joint. Five months postoperatively, a new cyst occurred at the right L4-5 facet joint, and was followed up conservatively. E: extension position, F: flexion position, facetec: facetectomy, LN: laminectomy, MR: magnetic resonance, NP: not performed, PR: partial removal, TR: gross total removal.

leg pain and dysesthesia. However, pain in the contralateral leg occurred after 9 months, and MR imaging revealed a new juxtafacet cyst at the right L4-5 facet joint. Juxtafacet cyst later occurred in a new location in Cases 4 and 6. Neither of these patients had demonstrated spondylolisthesis on preoperative radiological studies. Case 4 underwent a second resection to remove the cyst 21 months after the initial surgery. Case 6 underwent cystectomy at the left L5-S1 facet joint, but the second cyst radiologically confirmed 5 months postoperatively at the right L4-5 facet joint remained asymptomatic, and was followed conservatively (Fig. 3). None of the patients have developed symptomatic spondylolisthesis or required subsequent fusion to date.

Discussion

Repeated microtrauma at areas of spinal segmental instability associated with facet joint osteoarthritis is thought to be important in the pathogenesis of juxtafacet cyst.^{4,8,11,38)} The resulting defect in the intervertebral joint capsule becomes surrounded by myxoid degeneration and cyst formation in the collagenous connective tissue.^{15,18,20,40)} Fibroblasts are also thought to excrete increased amounts of

hyaluronic acid in response to repeated stress.^{15,41)} The common finding is degenerative change with proliferation of reactive and inflammatory cells, including synovial cells, and formation of a cystic cavity,²⁶⁾ which can communicate with the joint.²¹⁾

The L4-5 segment, which has the greatest range of motion in the lumbar spine, is the most common location with 51–68% of juxtafacet cysts occurring at this location.^{6,22,28)} In the present series, seven of the 10 cysts occurred at the L4-5 facet joint. The mean age of the patients in our series was 65.4 years, very similar to another series of 440 patients with mean age of approximately 65 years.¹²⁾

A history of traumatic injury has been documented in around 12% of cases of synovial cyst,²⁸⁾ but in none of the present patients. Most synovial cysts originate from the intervertebral facet joint, and extend to the posterior-lateral side of the lumbar canal, but also originate from the yellow ligament,^{1,3,4,31,42,44)} anterior longitudinal ligament,²⁾ posterior longitudinal ligament,^{5,27)} and ligamentum interspinale.³³⁾ Juxtafacet cysts are known to complicate spondylolisthesis as a result of the associated partial destruction of intervertebral joints.²⁸⁾ Coexisting spondylolisthesis was present in four of our 10 cases, and comparable to the frequency of 32%

Fig. 3 Case 6. Sagittal T₂-weighted magnetic resonance images (A, E), myelograms (B, F), and computed tomography myelograms (C, G: at L4-5; D, H: at L5-S1), revealing an abnormal mass attached to the left L5-S1 facet joint (arrow) (A-D), and 5 months postoperatively showing expansion of the dural sac previously compressed by the left L5-S1 cyst, and a new abnormal mass attached to the right L4-5 facet joint (arrowhead) (E-H).

Table 2 Review of reported series showing varying ratio of development of postoperative spinal instability and recurrence of lumbar synovial cyst

Author (Year)	No. of cases	No. of spondylolisthesis (%)	No. of concomitant spinal fixation (%)	Mean follow-up duration (mos)	No. of recurrences of cyst (%)	No. of advances of spondylolisthesis (%)
Onofrio and Mih (1988) ³⁴⁾	12	8 (66.7)	0	34	0	2 (16.7)
Freidberg et al. (1994) ¹⁶⁾	23	NA	0	NA	NA	1 (4.3)
Sabo et al. (1996) ³⁷⁾	60	15 (25)	7 (11.7)	12	4 (6.7)*	2 (3.3)
Lyons et al. (2000) ²⁸⁾	194	74 (38.1)	18 (9.3)	26	3 (1.5)**	4 (2.1)
Sandhu et al. (2004) ³⁹⁾	17	8 (47)	0	13	NA	NA
Khan et al. (2005) ²⁴⁾	39	32 (82.1)	26 (66.7)	NA	1 (2.6)***	NA
Present series	10	4 (40)	0	16	2 (20)†	0

*Three patients developed asynchronous cyst at the same level but contralateral to the previous cyst. One patient developed recurrent cyst at the same location. **Three patients developed asynchronous cyst at the same site and were treated conservatively. ***One patient had recurrence at the site of surgery approximately 5 years after initial surgery. †Two patients exhibited new, asynchronous synovial cyst after 5 and 9 months, contralateral to the initial lesion. NA: not applicable.

previously reported.^{6,43)}

Surgery should be performed if conservative treatment is ineffective for juxtafacet cyst.^{4,7,29,35)} Cysts tend to occur at the segment with greatest motion, so the resultant increased stress is probably a predisposing factor in the development of juxtafacet cysts.²⁸⁾ Accordingly, less invasive surgery, such as small laminectomy with minimal removal of the facet joint, may be required to prevent postoperative joint instability.⁹⁾ Our patients all underwent bilateral laminectomy without facetectomy. Of course, unilateral partial hemilaminectomy using microsurgical techniques may be adequate for some juxtafacet cysts. The advantage of the unilateral approach is that only a minimal amount of paravertebral muscles must be detached, and only on one side and not both as in bilateral laminectomy. However, we performed bilateral laminectomy even for unilateral cysts, because most cysts had expanded over and under the intervertebral joint. Moreover, these cysts were fibrous, tough, and densely attached to the dura mater.³⁷⁾ Therefore, cysts were extracted from both sides unless dural violation or root injury was found, to secure a wide operative field. Immediate good relief of radiculopathy and neurogenic claudication was obtained in all patients.

Concomitant spinal fixation does not clearly have any impact on cyst recurrence or progression of spondylolisthesis (Table 2).^{16,24,28,34,37,39)} A comparatively high rate of concomitant spinal fixation (26 of 39 cases) resulted in only one instance of cyst recurrence.²⁴⁾ On the other hand, cyst extraction without fixation in 12 patients, eight also with spondylolisthesis, resulted in no cyst recurrence.³⁴⁾ Cysts were removed without fixation in 23 cases, with progression of spondylolisthesis in 4.3%.¹⁶⁾ However, concomitant spinal fixation in seven of 60 patients (11.7%)³⁷⁾ and 18 of 194 patients (9.3%)²⁸⁾ resulted in spondylolisthesis in 3.3% and 2.1%, respectively.

The progression to spondylolisthesis was not observed before a mean of 52.1 months in the present series. However, new synovial cysts developed in two patients, contralateral to the original cyst at the same and different levels, after 5 and 9 months. Asynchronous cysts were found on the contralateral side in three of 26 cases of resected juxtafacet cysts at 6, 11, and 14 months postoperatively.³⁷⁾ Asynchronous cyst appeared 6 months after cyst resection, at the same level but on the opposite side.¹⁴⁾ Therefore, new cysts tend to appear on the contralateral side about 6 months to 1 year after cyst resection, possibly because surgery altered the forces acting on the intervertebral joint, causing

increased stress on the contralateral side, inducing collapse of the contralateral facet joint and formation of a new juxtafacet cyst. Surgeons should exercise individual judgment about the necessity for concomitant spinal fixation, based on factors such as cyst size, involvement of surrounding structures, degree of preoperative spondylolisthesis, and facet joint destruction.²⁸⁾ Postoperative follow up is important for patients undergoing cyst decompression without fixation to limit the risk of new listhesis or spondylolisthesis.

Surgical removal of juxtafacet cysts is a safe and effective treatment providing symptomatic relief. The wide operative field acquired by bilateral laminectomy helps to ensure safe and easy resection of cysts from multiple directions. The indications for concomitant spinal fixation are based on cyst size, involvement of surrounding structures, degree of preoperative spondylolisthesis, and facet joint destruction to prevent progression of spinal spondylolisthesis or cyst recurrence.

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Commentary

Juxtafacet and/or synovial cysts can now be identified with neuroimaging. First the CT and now MRI allow us to know preoperatively the pathology. Occasionally, they are found with back pain symptoms only and such cases are treated medically. Operative intervention is needed with progressive or very lax spondylolisthesis. Most cases, as described in this report, have significant radiculopathy.

Removing the cyst does relieve the radiculopathic sciatic-like pain. If the pathology and symptoms are very unilateral, total resection of the lesion is all that is needed.

But we are doing segmental fixation fusions in more and more cases. Flexion-extension x-rays are done. If there is significant movement of 4 mm or more, or if the subluxation is greater than 8–10 mm on any film, we do a fusion with the primary procedure. In this report, 2 of 10 cases (or 20%) required repeat decompressions and fusions in follow up. We try to identify those cases preoperatively.

Incidentally, in many of our deformity cases of degenerative scoliosis, we are finding more and more synovial cysts—some in the canal and some posterior-lateral outside the canal. With deformity correction surgery, we remove these cysts and drill out the joint for fusions.

The authors have done a nice review. And the discussion is fair and balanced. Our practice patterns are very similar with the minor exception of carrying out a few more fusions initially.

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Terao et al. report a retrospective but instructive analysis of symptomatic juxtafacet cysts of 10 patients with a good review in the discussion. As they mentioned, it is described “juxtafacet cysts” or “synovial cyst.” As the authors pointed out, they performed bilateral laminectomy for all of their patients even unilateral cysts. Because of high percentage of coexisting spondylolisthesis, unilateral laminectomy may be better as a minimum invasive surgery.

In the discussion, it is interesting that new cyst was found on the contralateral side in three out of 26 cases of resected juxtafacet cyst about 6 months to 1 year after the first surgery. We have to keep it in mind in our outpatient clinic after the surgery.

Recently we neurosurgeons take care of lumbar disease patients much more than before. Therefore we should know this entity and its surgical managements.

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The article by Drs. Terao, Takahashi, Taniguchi, Ide, Shinozaki, Nakauchi, and Kubota presents a study of 10 patients after resection of juxtafacet cysts. The work seeks to clarify the relationship between the juxtafacet cyst and the presence of indicators of mechanical instability, such as percentage slip of spondylolisthesis, and the degree of facet joint osteoarthritis. The analysis is retrospective, covering a span of approximately 8 years (1998–2006).

The natural history of juxtafacet cysts is not clearly understood.^{1,4)} However, it is believed that spinal instability gives rise to the juxtafacet cysts. Many authors note that the term juxtafacet cyst itself is controversial in term of histological classification, if not in clinical management.^{1–6)} That being noted, the surgical treatment of these cysts, especially in cases of radiculopathy is supported. Terao et al. follow clinical outcome as well, with good outcomes.

This is a high-quality, well-documented, early study. With this first group of 10 patients showing that a longer-term study has value, we would now encourage continuation of this promising work, to enable the power to make conclusions regarding the utility of their classification system. Overall, the work is interesting and will increase in power should the authors continue their study and include additional subjects.

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