Surgical evaluation and management of lumbar synovial cysts: the Mayo Clinic experience

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Object. The authors report a retrospective analysis of 194 patients surgically treated at their institutions for symptomatic lumbar synovial cysts from January 1974 to January 1996.

Methods. Patient characteristics including age, sex, symptoms, signs, and preoperative neuroimaging studies were reviewed. Surgical procedures, complications, results, and pathological findings were correlated with preoperative assessment. One hundred ninety-four patients were surgically treated for symptomatic lumbar synovial cysts. Eighty percent were diagnosed and treated between 1987 and 1996. There were 100 men and 94 women with an average age of 66 years (range 28–94 years). The most common symptoms were painful radiculopathy (85%) and neurogenic single or multiroot claudication (44%). However, sensory loss (43%) and motor weakness (27%) were also presenting symptoms. Eleven percent of patients had undergone previous lumbar surgery prior to being referred to the Mayo Clinic. Preoperative neurological examination demonstrated motor weakness (40%), sensory loss (45%), reflex changes (57%), and variants of cauda equina syndrome (13%). In 19% of patients, normal neurological status was demonstrated. There was equal left/right-sided laterality, and eight patients presented with bilateral synovial cysts. The most commonly affected level was L4–5 (64%). All patients underwent laminectomy and resection of the cyst. Concomitant fusion was performed in 18 patients in whom clinical evidence of instability had been observed. However, subsequent fusion was required in only four patients who developed symptomatic spondylolisthesis. Surgery-related complications included cerebrospinal fluid leak (three patients), discitis (one patient), epidural hematoma (one patient), seroma (one patient), and deep vein thrombosis (one patient). One patient died 3 days after surgery of cardiac dysrhythmia. Follow-up data obtained for at least 6 months postoperatively were available in 147 patients. Of these, 134 (91%) reported good relief of their pain and 82% experienced improvement in their motor deficits.

Conclusions. Lumbar synovial cysts are a more common cause of lumbar radicular pain than previously thought. Surgical removal of the cyst is a safe and effective treatment for symptomatic relief in patients with lumbar synovial cysts. A concomitant fusion procedure may be performed in select cases. In this study, only a few patients developed symptomatic spinal instability requiring a second operation.

KEY WORDS • synovial cyst • lumbar spine • radicular pain • resection

SYNOVIAL cysts arise from the adjacent facet joint. They most commonly arise at the L4–5 level. Debate continues regarding the cause of synovial cysts, with trauma, and segmental instability–related causes being the most often reported. Although widely recognized for their propensity to cause nerve root and cauda equina compression, lumbar synovial cysts are often cited as uncommon causes of painful radiculopathy or variants of cauda equina syndrome. We report the findings obtained in this series from our institutions that indicate that lumbar synovial cysts are a more common cause of painful radiculopathy than previously reported. To better understand the significance of lumbar synovial cysts we report this retrospective review. The surgical evaluation and treatment of these lesions are discussed.

Clinical Material and Methods

We conducted a retrospective analysis of 194 patients with symptomatic lumbar synovial cysts who were surgically treated at the Mayo Clinic Rochester, Mayo Clinic Scottsdale, and Mayo Clinic Jacksonville from January 1974 to January 1996. This study includes 12 patients previously described by Onofrio and Mih from the Mayo Clinic Rochester. Disease in 80% of these patients was diagnosed and treated from 1987 to 1996. There were 100 men and 94 women with an average age of 66 years (range
28–94 years). Patient characteristics including age, sex, symptoms, neurological status, and neuroimaging studies were reviewed. Surgical procedures, results, complications, and pathological findings were correlated. Examination of follow-up status was conducted by chart review, and neurological outcomes were assessed based on relief of symptoms and improvement in preoperative neurological function.

Results

One hundred ninety-four patients underwent surgery for the treatment of symptomatic lumbar synovial cysts. The most common presenting symptoms were radiculopathy (85%) or neurogenic claudication (44%), with associated sensory loss (43%) and motor weakness (27%) (Table 1). Acute-onset symptoms, defined as those that developed in fewer than 7 days, occurred in 10% of patients. All patients suffered from either lumbosacral radicular or neurogenic claudicatory pain on presentation. Eleven percent of the patients had undergone previous lumbar spine surgery elsewhere prior to their referral. Twenty-two percent of patients presented with symptoms of both radicular and claudicatory pain.

Neurological examination on presentation demonstrated motor weakness (40%), sensory loss (45%), reflex changes (57%), and variants of cauda equina syndrome (13%). A completely normal preoperative neurological status was demonstrated in only 19% of the patients. There was an equal distribution of left- and right-sided cysts, and eight patients presented with bilateral symptoms associated with bilateral synovial cysts. The side on which the symptoms were manifest generally correlated with the side of the synovial cyst; however, 21% of patients experienced bilateral symptoms, and patients with large cysts occasionally presented with contralateral symptoms. The most common level was L4–5 (64%). There was a history of traumatic injury in only 12% of the patients. In 58% of the patients, a previous diagnosis of degenerative disc disease had been made, and 62% of the patients had symptoms consistent with a diagnosis of spinal stenosis.

One hundred forty-seven (76%) of the 194 patients were assessed preoperatively for spondylolisthesis. Of those, spondylolisthesis was diagnosed in 50%, and the vast majority (98%) had Grade 1 disease (Meyerding classification). The level of the spondylolisthesis correlated well with the level of the synovial cyst. The correct preoperative diagnosis of lumbar synovial cyst was made radiologically in 109 of the 194 patients. Radiological accuracy dramatically improved with the advent of MR imaging. On 2% of the preoperative MR imaging studies a significant intracyst hemorrhage was demonstrated. This finding did not, however, correlate with the acute onset of symptoms in all cases.

All patients underwent laminectomy and resection of the synovial cyst. One hundred ninety patients underwent gross-total resection of the synovial cyst, and four underwent partial resection. Histopathological examination of synovial cysts was performed in 161 of the cases, of which 18 had histological evidence of intracyst hemorrhage. Findings on MR imaging were highly correlated with the radiological presence of intracyst hemorrhage and pathological findings. A partial hemilaminectomy was performed in 103 patients, and a total hemi- or bilateral laminectomy was performed in 86 patients. On five operative reports the extent of the laminectomy was not specified. In addition, the degree of facetectomy was assessed. One hundred fifty-nine patients underwent a medial facetectomy, 23 underwent a total facetectomy, and 12 patient records were inconclusive as to the degree of facetal removal. A concomitant spinal fusion procedure was performed in 18 patients, and a delayed fusion procedure was required in four others who developed symptomatic spondylolisthesis. In three of the four patients requiring delayed fusion preoperative evidence of spondylolisthesis was not demonstrated. No statistical significance for the development of symptomatic spondylolisthesis based on the degree of laminectomy and facetectomy could be identified. Concomitant spinal fusion (with or without the placement of instrumentation) was more commonly undertaken when a total laminectomy or facetectomy was performed in the presence of an existing spondylolisthesis.

The complications were cerebrospinal fluid leak (three patients), discitis (one patient), epidural spinal hematoma (one patient who underwent fusion), seroma requiring drainage (one patient), and deep venous thrombosis (one patient). One patient died 3 days after surgery of cardiac dysrhythmia. Pathological analysis confirmed intracyst hemorrhage in 10% of the cases.

Follow-up review of at least 6 months was available in 147 (76%) of the 194 patients. The mean follow-up period in this group was 26 months (range 6–168 months). The remaining 47 patients were lost to follow up within the first 6 weeks to 6 months postsurgery. Although the vast majority of these 47 patients reported relief of their preoperative symptoms, we considered 6 months as a minimum follow-up period for this study. The analysis of outcome data was conducted in the 147 patients for whom at least 6 months of follow-up review had been obtained. Of the 147 patients, 134 (91%) reported good or excellent relief of their preoperative radicular pain. Eighty-two percent of patients, in whom preoperative motor deficits were demonstrated, experienced improvement in their motor deficits. Seventy-nine percent of patients with preoperative sensory deficits reported subjective improvement following surgery. These results are similar to those reported in studies by others.

Discussion

In 1974, Kao and coworkers proposed the term “juxta-
facet cyst” to describe synovial and ganglion cysts located in the spinal extradural space. In 1983 Pendleton and colleagues also grouped these together in their report, recognizing that they arose at the joint capsule of the facet joint. Many authors have described these lesions and recognized their propensity to cause nerve root and cauda equina compression. Initially thought to be uncommon, synovial cysts have been more recently reported as increasingly recognized causative agents of lumbosacral radicular and/or claudicatory pain. Refinements in neurodiagnostic imaging and the advent of MR imaging have markedly enhanced the preoperative identification of these lesions.

Distinction between synovial cysts (presence of a synovial lining) and ganglion cysts (absence of a synovial lining) is determined more at pathological than at clinical examination. The surgical treatment is identical, and the prognosis is the same. These cysts can hemorrhage, giving rise to acute symptoms. An intracyst hemorrhage was clinically or pathologically confirmed in 18 of our cases. Although there was a trend identified with the acute onset of symptoms and intracyst hemorrhage, it was not statistically significant. The MR imaging characteristics of these synovial cysts can be quite variable depending on the cystic fluid components and the viscosity of the cystic fluid. Because the lesion anatomically arises from the facet joint, recognition of this feature also helps to differentiate it from an intervertebral disc fragment or nerve root lesion (Fig. 1). There are, however, reported cases, noted at the time of surgery, of a synovial cyst arising from the ligamentum flavum without evidence of attachment to the facet joint. In our series the preoperative diagnosis was confirmed radiologically in 109 (56%) of the 194 cases. Early in the study, approximately 20% of the synovial cysts were diagnosed using myelography coupled with high-resolution computerized tomography. The key to diagnosis is the identification of a mass dorsolateral to the neural elements. The advent of MR imaging has markedly improved diagnostic capability and is currently the imaging modality of choice.

Much debate remains regarding the cause of synovial cysts. Traumatic injury and segmental instability are the most often cited potential causative factors for the development of synovial cysts. Several authors have reported their surgery-related results for lumbar synovial cysts, but they did not comment on the presence or absence of spondylolisthesis at the site of the cyst and/or any subsequent surgery. Onofrio and Mih both have reported their series of 12 patients with lumbar synovial cysts, of whom eight had preoperative spondylolisthesis at the site of the cyst and two developed increased spondylolisthesis. They did not perform fusion procedures in any of those patients and the patients remained asymptomatic. Kurtz and coworkers have reported finding preoperative spondylolisthesis in three of their four patients undergoing resection of a lumbar synovial cyst; in none of these cases was fusion required, and the patients reported experiencing excellent resolution of radicular pain. Of the four patients without preoperative spondylolisthesis reported by Liu and colleagues, one developed symptomatic spinal stenosis requiring subsequent decom-

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**FIG. 1.** Preoperative MR studies. **Upper:** Axial T-weighted image demonstrating a synovial cyst arising from adjacent facet joint on the left that has resulted in the impingement of the exiting nerve root (arrow). **Center:** Sagittal T-weighted image revealing a synovial cyst arising from the L3–4 facet joint and resultant stenosis (arrow). **Lower:** Axial T-weighted image demonstrating a synovial cyst arising from right L3–4 facet joint, causing distortion of the thecal sac and lateral recess stenosis that has affected the exiting nerve root (arrow).
pression and fusion 8 months after the original surgery. Freidberg, et al. have reported the development of delayed spinal instability in one of 26 patients treated for lumbar synovial cyst. Sabo and colleagues have reported on 60 juxtafacet cysts found in 56 patients. They identified preoperative spondylolisthesis, degenerative in nature, in 15 patients of whom six underwent a fusion procedure. In one of these six patients a nonunion developed requiring a second fusion procedure. One patient without preoperative symptoms underwent posterolateral arthrodesis at the initial operation. The authors reported no difference in outcome between patients who underwent fusion and those who did not. These results compare favorably with our experience. Twenty-two patients underwent spinal fusion in this series. Of those, 18 procedures were concomitant fusions and four were performed after the patients developed delayed symptomatic spinal instability. The decision to perform concomitant fusion was based on the judgment of the operating surgeon at the time of initial evaluation of the patients. Of the four patients requiring spinal fusion for delayed symptomatic spondylolisthesis, only one was shown to have preoperative spondylolisthesis. There did not appear to be any meaningful statistical association between partial (82%) and total facetectomy (12%) and the development of symptomatic spondylolisthesis. In 50% of the patients in our series spondylolisthesis was present at the level of the synovial cyst. Of these, the vast majority were Grade I. Interestingly, only a minority of patients were judged to require a concomitant fusion preoperatively, and even fewer required a second operation for symptomatic spinal instability. The small number of patients developing delayed spinal instability makes the statistical confirmation of a causal relationship between the extent of facetectomy or laminectomy and spinal instability difficult. However, we found that the trend in this series favored total facetectomy, as opposed to the extent of the laminectomy, as being more related to the development of delayed spinal instability. Whether fusion is performed in these patients should be based on the surgeon’s sound judgment on a case-by-case basis. Because more than half of the patients in this study presented with a Grade I Meyerding spondylolisthesis, as well as a motion segment associated synovial cyst, it is possible that increased stress placed upon the motion segment may be a predisposing factor in development of synovial cysts.

As Onofrio and Mihi have consistently reported, synovial cysts are usually markedly adherent to the underlying dura and nerve root. This was noted in our patients as well. There were three (1.6%) cases of cerebrospinal fluid leakage in the 194 patients. All leaks were repaired directly without additional postoperative complications. Meticulous surgical technique to avoid inadvertent dural entry or nerve root trauma must be followed. This is particularly true in cases of larger cysts that tend to be more adherent to the dura than their smaller counterparts. The magnification and illumination of the operating microscope offer advantages in the more difficult cases. These cysts are located anterior to the ligamentum flavum but posterior to the neural elements, as they arise from the facet joint. Gross-total resection of the synovial cyst was achieved in 190 of 194 patients and in 146 of the 147 patients available for extended follow-up review (Fig. 2). Aggressive resection to achieve gross-total removal of the synovial cyst, risking nerve root injury, should be avoided once the nerve root is decompressed. The risk of synovial cyst recurrence at the original site has been reported to be low. Several authors have noted the development of an asynchronous synovial cyst. In our series, three patients developed symptomatic recurrent synovial cysts, despite having undergone initial gross-total resections at the same location. Three patients developed an asynchronous lesion. All patients were treated conservatively. Some authors have reported observing spontaneous resolution of symptomatic synovial cysts. Other authors have advocated nonsurgical management or percutaneous aspiration of the cyst but generally nonsurgical treatment has not been as effective.

**Conclusions**

Lumbar synovial cysts are a relatively common cause of radicular pain. Advances in neuroimaging have aided in improved preoperative recognition of these lesions. Surgical resection and nerve root or cauda equina decompression can be performed with low risk and an expectation of good to excellent surgery-related outcome. Sound surgical judgment combined with pre- and intraoperative findings should be used to determine the appropriateness of undertaking concomitant fusion in each patient.

**References**

Lumbar synovial cysts


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