The Prevalence of Incidental and Symptomatic Lumbar Synovial Facet Cysts

Stein J. Janssen, MD, Paul T. Ogink, MD,† and Joseph H. Schwab, MD, MS†*

Study Design: This was a retrospective cohort study from 2 affiliated tertiary care referral centers for spine disease.

Objective: The purpose of this article was to assess the prevalence of incidental (ie, asymptomatic) and symptomatic lumbar synovial facet cysts on magnetic resonance imaging. Secondarily, we assessed whether the prevalence increases with age. In addition, we assessed differences in patient and cyst characteristics between asymptomatic and symptomatic facet cysts.

Summary of Background: The prevalence of symptomatic and asymptomatic synovial facet cysts in the lumbar spine has been incompletely established, and, although many studies demonstrate an association with degenerative spine disease, no cumulative increase in prevalence of synovial facet cysts with increasing age has been presented.

Methods: We included 19,010 consecutive patients who underwent a dedicated lumbar spine magnetic resonance imaging between 2004 and 2015. Our outcome measures were symptomatic and asymptomatic facet cysts. A symptomatic cyst was defined as a cyst with symptoms of radiculopathy on the same side as the cyst.

Results: The overall synovial facet cyst prevalence was 6.5% [95% confidence interval (CI), 6.1-6.8]; 46% of the facet cysts were incidental and 54% were symptomatic. Increased age was independently associated with a higher likelihood of having a synovial facet cyst [odds ratio (per 10 y), 1.24, 95% CI, 1.20-1.29; $P<0.001$]. Large cyst size (odds ratio, 1.64; 95% CI, 1.23-2.20; $P=0.001$) and anterior location (odds ratio, 1.39; 95% CI, 1.08-1.79; $P=0.010$) of the synovial facet cyst were the only factors independently associated with having radiculopathy.

Conclusions: Approximately 1 in 15 patients have at least 1 synovial facet cyst. Having a facet cyst—symptomatic and asymptomatic—is strongly associated with increased age supporting the theory that degenerative disease underlies its development. Large cyst size and anterior location of the cyst are associated with an increased likelihood of having neurological symptoms.

Level of Evidence: Level III, diagnostic study.

Key Words: facet, cyst, synovial, ganglion, prevalence, incidental, spine, degenerative, symptoms

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Facet cysts are round, fluid-containing lesions that can arise anywhere around the facet joint in the epidural, foraminal, or paravertebral area and are most common in the lumbar spine.[1,2] These cysts can be histopathologically classified into synovial, ganglion, and ligamentum flavum cysts; however, this distinction is of no clinical relevance and therefore often ignored.[3–7] Facet cysts can compress the nerve root, leading to radiculopathy, but they can also be asymptomatic and found incidentally.[8–10] Considering all spine conditions that can cause radiculopathy, facet cysts are regarded as an uncommon cause of radiculopathy. However, because of the improving diagnostic accuracy of magnetic resonance imaging (MRI) they are found more often.[11–15] Previous studies demonstrate an association of facet cysts with degenerative spine disease, and some suggest an association with spinal instability.[1,3,4,6,7,14,16–19]

The reported prevalence of facet cysts varies widely, and most previous studies are relatively small or used computed tomographic (CT) scan as the diagnostic modality, leading to uncertainty as regards its true prevalence.[1,2,8,9,11,20–23] In addition, previous studies did not differentiate symptomatic from asymptomatic facet cysts. Several previous studies mention that facet cysts are most commonly found in patients in their sixth decade[3,13]; however, if facet cysts are manifestations of a degenerative process, one would expect the prevalence to increase with age.

Our study therefore aims to assess the prevalence of incidental (ie, asymptomatic) and symptomatic lumbar synovial facet cysts on MRI. Secondarily, we assessed whether the prevalence of lumbar synovial facet cysts increases with age and what other factors are associated with its prevalence. In addition, we assessed differences in patient and cyst characteristics between asymptomatic and symptomatic facet cysts.

METHODS

Study Design

This retrospective study was approved by our institutional review board, and a waiver of informed consent

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From the *Department of Surgery, Onze Lieve Vrouwe Gasthuis, Amsterdam, The Netherlands; and †Department of Orthopaedic Surgery, Orthopaedic Spine Service, Massachusetts General Hospital, Harvard Medical School, Boston, MA.

This study was approved by our IRB (#2015P000647/MGH).
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The authors declare no conflict of interest.

Reprints: Stein J. Janssen, MD, Department of Surgery, Onze Lieve Vrouwe Gasthuis, Oosterpark 9, Amsterdam 1091AC, The Netherlands (e-mail: steinjanssen@gmail.com).

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was granted. We included all patients 18 years of age or above who underwent a dedicated lumbar spine MRI with or without contrast between 2004 and 2015 at 1 of 2 affiliated tertiary care spine referral centers. Exclusion criteria were as follows: (1) scans made at outside institutions, (2) incomplete or cancelled scans, and (3) scans made for research purposes. We only kept the first lumbar spine MRI per patient so as to avoid violation of the statistical rule of independence.[24] All 19,010 eligible patients were included in this study.

Outcome Measures and Explanatory Variables

Our outcome measure was the presence of a synovial facet cyst. We identified patients with a possible synovial facet cyst by searching radiology reports of all 19,010 included patients for the words "synovial," "facet," "ligament," or "flavum" in combination with "cyst," including common misspellings, synonyms, and plural form. This word-based query flagged 1631 radiology reports; 2 research fellows (S.J.J., P.T.O.) manually reviewed these radiology reports to confirm the presence of a synovial facet cyst. Findings that were described as probably, likely, presumably, or suggestive of a facet cyst were counted as a synovial facet cyst (n = 187). Tarlov, perineural, intraosseous, or subchondral cysts were not counted as synovial facet cysts.[7] MRI reports at our institutions are structured in a standardized manner, starting with a comparison of the current imaging study to previous imaging studies, then findings with pathology described per level per side, and ending with an impression describing the major findings including a conclusion. To assess the accuracy of MRI reports, we randomly reviewed 100 MRIs (8 patients with and 92 patients without a facet cyst, according to the MRI report). We found no lumbar facet cysts among the 92 patients who had no facet cyst on the basis of the MRI report, and all 8 facet cysts that were identified in the MRI report were found at the described location and side upon reviewing the MRI.

Subsequently, we determined whether the synovial facet cyst was symptomatic or incidental (ie, asymptomatic) on the basis of the presence of radiculopathy or not. Presence of radiculopathy was based on physicians' notes in the medical record before MRI and was defined as follows: radiculopathy, radicular pain, leg pain, sensory deficits, motor weakness, and sciatica. We defined a symptomatic cyst as a cyst with symptoms of radiculopathy on the same side, regardless of the presence of other pathology. We defined an asymptomatic cyst as a cyst with no symptoms of radiculopathy on the side of the cyst. We did not consider nonradiating low back pain as a symptom of a synovial facet cyst.

Explanatory variables for the entire cohort were the following: age, sex, race, and MRI indication.

Additional explanatory variables for patients with a synovial facet cyst were as follows: the number of cysts per patient, side (left/right), level, cyst size, and cyst location based on MRI reports. We included synovial facet cysts at level T12-L1 through L5-S1. Cyst size was recorded as continuous (largest noted diameter in mm in the radiology report) and dichotomized into small ($\leq$ 6 mm, or noted as small, tiny, minimal, minuscule, or very small in the radiology report) versus large (> 6 mm, or noted as large, moderate, or extensive in the radiology report). Cyst location was dichotomized into anterior versus posterior on the basis of its described relationship to the facet joint in the MRI report.[1]

Statistical Analysis

The prevalence of incidental, symptomatic, and overall synovial facet cysts was reported as a percentage of the total number of patients with 95% confidence interval (95% CI).

We used multivariable logistic regression analysis to assess whether age was associated with having a synovial facet cyst, while accounting for sex, race, and MRI indication. Findings were presented as odds ratios with 95% CIs, and *P*-values. An odds ratio demonstrates the odds of having an outcome in 1 group as compared with another (for categorical variables) or per unit increase for continuous variables (eg, odds ratio per 10 y increase in age in our analyses). In addition, we categorized age into 18 to 30 (n = 1358), 30 to 40 (n = 2117), 40 to 50 (n = 3426), 50 to 60 (n = 4071), 60 to 70 (n = 4125), 70 to 80 (n = 2962), and > 80 (n = 1276) years and presented the percentage of incidental, symptomatic, combined (ie, having both a symptomatic and an incidental facet cyst), and overall synovial facet cysts per age group in a histogram.

Subsequently, we assessed what factors were associated with having a symptomatic versus asymptomatic synovial facet cyst. However, as a single patient can have multiple cysts, these analyses need to be accounted for within subject correlation, as multiple cysts within a single patient cannot be seen as independent cases. We therefore performed a generalized estimating equation analysis using a binomial distribution and a logit link function. This accounts for within subject correlation of multiple cysts within a single patient using an exchangeable correlation structure with robust SEs. Odds ratios, 95% CIs, and *P*-values from a generalized estimating equation are interpreted like those derived from logistic regression model. We accounted for missing values (as reported in the table legend) by using multiple imputation (×40) to estimate missing values (assumed to be at random) on the basis of all remaining explanatory variables.

A 2-sided *P*-value <0.05 was considered significant. Statistical analysis was performed using Stata 14.0 (StataCorp LP, College Station, TX).

Baseline Characteristics

Of all 19,010 included patients, 52% were female individuals, and 84% were white (Table 1). The overall mean age was 56 years. Radiculopathy (58%) and back pain (61%) were the most common indications for MRI.

Among the 19,010 included patients, there were 1228 patients with 1553 synovial facet cysts; 78% had 1 cyst (n = 956) and 22% had $\geq$ 2 cysts (n = 272) (Table 2). Most cysts were at the L4-L5 level (43%), followed by the L5-S1 level (28%).

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TABLE 1. Baseline Characteristics

All Patients	N = 19,010 n (%)
Age (mean ± SD) (y)	56 ± 16
Sex	
Male	9034 (48)
Female	9976 (52)
Race	
White	15,929 (84)
Black	892 (4.7)
Hispanic/Latino	801 (4.2)
Asian	461 (2.4)
Indian	30 (0.20)
Other/unknown	897 (4.7)
Indication for MRI	
Radiculopathy	10,980 (58)
Back pain	11,508 (61)
Nonspecific pain	819 (4.1)
Trauma	1339 (7.0)
Tumor	2158 (11)
Cauda equina symptoms	325 (1.7)
Spine malformation	514 (2.9)
Inflammation	651 (3.4)
Other neurological symptoms	1443 (7.6)
Previous surgery	883 (4.6)
Missing/other indications	931 (4.9)
No. indications	
0	931 (4.9)
1	7768 (41)
2	7971 (42)
3	2099 (11)
4	230 (1.2)
5	11 (0.06)

MRI indicates magnetic resonance imaging.

RESULTS

Prevalence of Synovial Facet Cyst

Among the 19,010 patients, we found an overall synovial facet cyst prevalence of 6.5% (95% CI, 6.1-6.8) (1228/19,010). These 1228 patients had 1553 synovial facet cysts, of which 46% (721/1553) were incidental, and 54% (832/1553) were symptomatic. The prevalence of having ≥ 1 incidental synovial facet cyst was 2.7% (95% CI, 2.5%-3.0%) (518/19,010), the prevalence of having ≥ 1 symptomatic synovial facet cyst was 3.2% (95% CI, 3.0%-3.5%) (617/19,010), and the prevalence of having both ≥ 1 incidental and ≥ 1 symptomatic synovial facet cysts was 0.49% (95% CI, 0.39%-0.59%) (93/19,010).

Age and Synovial Facet Cysts

Increased age was independently associated with a higher likelihood of having a synovial facet cyst [odds ratio (per 10 y increase in age), 1.24; 95% CI: 1.20-1.29; $P < 0.001$] (Table 3). The prevalence of a synovial facet cyst increased linearly from 3.2% at 18 to 30 years, to 9.8% at 80 years or above (Fig. 1).

In addition, we found that black, Hispanic/Latino, and Asian race were associated with a lower likelihood of having a synovial facet cyst as compared with the white race.

Symptomatic Versus Asymptomatic Synovial Facet Cyst

We found that large cyst size (odds ratio, 1.64; 95% CI, 1.23-2.20; $P = 0.001$) and anterior location (odds ratio, 1.39; 95% CI, 1.08-1.79; $P = 0.010$) of the synovial facet

TABLE 2. Synovial Facet Cyst Characteristics

Patients With Facet Cyst	1228 Patients/ 1553 Cysts
No. cysts per patient [n (%)]	
1 cyst	956 (78)
2 cysts	230 (19)
3 cysts	31 (2.5)
4 cysts	11 (0.90)
Side per cyst [n (%)]	
Left	746 (48)
Right	807 (52)
Level per cyst [n (%)]*	
T12-L1	18 (1.2)
L1-L2	59 (3.8)
L2-L3	113 (7.3)
L3-L4	245 (16)
L4-L5	673 (43)
L5-S1	441 (28)
Cyst size continuous (mean ± SD) (mm)*	7.1 ± 4.0
Cyst size, dichotomized [n (%)]*	
Small	779 (73)
Large	285 (27)
Cyst location [n (%)]*	
Posterior	584 (57)
Anterior	438 (43)

*Level of cyst is missing for 4 cysts (0.26%), cyst size in mm is missing for 973 cysts (63%), dichotomized cyst size is missing for 489 cysts (31%), location of the cyst is missing for 531 cysts (34%).

TABLE 3. Multivariable Logistic Regression Analysis of Factors Associated With Having a Facet Cyst (n = 19,010)

Variables	Odds Ratio (95% CI)	*P*
Age (per 10 y)	**1.24 (1.20-1.29)**	**< 0.001**
Male sex	0.94 (0.84-1.06)	0.334
Race		
White	Ref.	Ref.
Black	**0.70 (0.51-0.96)**	**0.029**
Hispanic/Latino	**0.67 (0.47-0.97)**	**0.034**
Asian	**0.56 (0.35-0.91)**	**0.019**
Indian	0.61 (0.08-4.49)	0.625
Other/unknown	0.95 (0.71-1.26)	0.709
Indication for MRI		
Radiculopathy	1.63 (0.95-2.78)	0.074
Back pain	1.54 (0.90-2.63)	0.113
Nonspecific pain	1.25 (0.68-2.30)	0.475
Trauma	1.05 (0.58-1.90)	0.867
Tumor	0.84 (0.47-1.49)	0.553
Cauda equina symptoms	0.65 (0.29-1.50)	0.315
Spine malformation	1.49 (0.79-2.82)	0.221
Inflammation	**0.39 (0.18-0.85)**	**0.018**
Other neurological symptoms	0.95 (0.53-1.73)	0.876
Previous surgery	1.00 (0.54-1.86)	0.995
Missing/other indications	**0.61 (0.42-0.89)**	**0.010**
No. indications	0.75 (0.43-1.30)	0.311

C-statistic for complete model: 0.64.
Bold value indicates significance (two-tailed $P < 0.05$).
CI indicates confidence interval; MRI, magnetic resonance imaging; Ref., reference.

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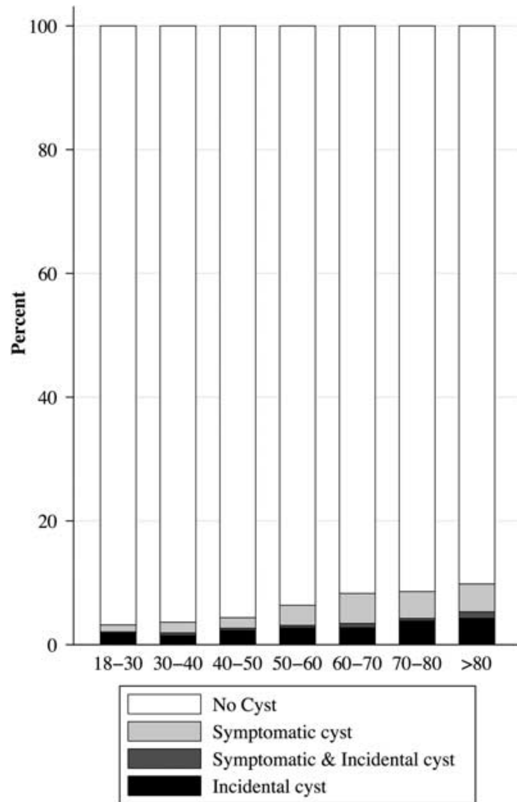

FIGURE 1. Histogram demonstrating the increase in prevalence of overall, symptomatic, combined, and incidental synovial facet cyst with increasing age. The overall prevalence of synovial facet cyst: 18 to 30, 3.2% (n = 43); 30 to 40, 3.6% (n = 76); 40 to 50, 4.4% (n = 148); 50 to 60, 6.4% (n = 255); 60 to 70, 8.3% (n = 335); 70 to 80, 8.6% (n = 249); > 80, 9.8% (n = 122). The prevalence of symptomatic synovial facet cyst: 18 to 30, 1.1% (n = 15); 30 to 40, 1.7% (n = 36); 40 to 50, 1.7% (n = 58); 50 to 60, 3.3% (n = 130); 60 to 70, 4.9% (n = 196); 70 to 80, 4.4% (n = 126); > 80, 4.5% (n = 56). The prevalence of combined symptomatic and incidental synovial facet cyst: 18 to 30, 0.22% (n = 3); 30 to 40, 0.43% (n = 9); 40 to 50, 0.35% (n = 12); 50 to 60, 0.40% (n = 16); 60 to 70, 0.69% (n = 28); 70 to 80, 0.41% (n = 12); > 80, 1.1% (n = 13). The prevalence of incidental synovial facet cyst: 18 to 30, 1.9% (n = 25); 30 to 40, 1.5% (n = 31); 40 to 50, 2.3% (n = 78); 50 to 60, 2.7% (n = 109); 60 to 70, 2.8% (n = 111); 70 to 80, 3.8% (n = 111); > 80, 4.3% (n = 53).

cyst were independently associated with having radiculopathy (Table 4).

When comparing symptoms of radiculopathy on the basis of dichotomized cyst size, we found that 68% (n = 195) of the 285 large synovial facet cysts were symptomatic and 32% were not (90/285), compared with 47% (n = 370) of the 779 small synovial facet cysts that were symptomatic and 53% that were not (409/779). Cyst size was missing for the remaining 489 cysts (Table 2). When comparing symptoms of radiculopathy on the basis of the location of the cyst, we found that 63% (n = 278) of the 438 anterior synovial facet cysts were symptomatic and 37% were not (160/278), compared with 50% (n = 291) of the 584 posterior synovial facet cysts that were symptomatic and 50% that were not (293/584). Cyst location was missing for the remaining 531 cysts (Table 2).

TABLE 4. Multivariable Analysis of Factors Associated With Having a Symptomatic Facet Cyst (ie, Radiculopathy)

	Generalized Estimating Equation (n = 1553)	
Variable	**Odds Ratio (95% CI)**	***P***
Age (per 10 y)	1.07 (0.99-1.16)	0.064
Male sex	0.87 (0.70-1.09)	0.228
Race		
White	Ref.	Ref.
Black	1.57 (0.86-2.89)	0.144
Hispanic/Latino	1.30 (0.64-2.60)	0.468
Asian	1.04 (0.40-2.67)	0.936
Indian	1.25 (0.99-1.59)	0.063
Other/unknown	1.17 (0.68-2.01)	0.568
Side		
Left	Ref.	Ref.
Right	1.17 (0.93-1.47)	0.181
Level*		
T12-L1	0.53 (0.20-1.40)	0.201
L1-L2	0.82 (0.47-1.42)	0.478
L2-L3	0.77 (0.53-1.13)	0.183
L3-L4	0.90 (0.68-1.20)	0.475
L4-L5	Ref.	Ref.
L5-S1	0.83 (0.66-1.04)	0.112
Cyst size, dichotomized*		
Small	Ref.	Ref.
Large	**1.64 (1.23-2.20)**	**0.001**
Location*		
Posterior	Ref.	Ref.
Anterior	**1.39 (1.08-1.79)**	**0.010**

*Level of cyst is missing for 4 cysts (0.26%), dichotomized cyst size is missing for 489 cysts (31%), location of the cyst is missing for 531 cysts (34%).
Bold value indicates significance (two-tailed $P < 0.05$).
CI indicates confidence interval; Ref., reference.

No patient characteristics—age, sex, race—nor spine level or side were associated with having radiculopathy symptoms from a synovial facet cyst.

DISCUSSION

The prevalence of symptomatic and asymptomatic facet cysts in the lumbar spine has been incompletely established, and, although many studies demonstrate an association with degenerative spine disease, no cumulative increase in prevalence of synovial facet cysts with increasing age has been presented. In our retrospective cohort study, we found that ~1 in 15 patients had at least 1 synovial facet cyst and that about half were symptomatic and half were asymptomatic. In addition, we demonstrated a linear association of age with probability of having a facet cyst—both symptomatic and asymptomatic. Lastly, we found that large cyst size and anterior location of the cyst were associated with an increased likelihood of being symptomatic.

There were several limitations. First, because of the setting of this study, our data should be interpreted as most representative for an urban tertiary care referral center for spine disease. Baseline data and indications for MRI can be used to assess how well our data compares with other institutions. Second, we retrospectively searched radiology

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reports and did not review all of the imaging studies ourselves. Therefore, our data reflects the radiologists' interpretation, and it is possible that cysts have been overlooked; however, MRI reports are structured in a way to describe all anatomic regions. Our estimated prevalence might therefore be conservative, and the actual prevalence of facet cysts may be higher. However, we believe that only small and most likely not clinically relevant cysts have been missed. We reviewed 100 MRIs to assess the accuracy of MRI reports and found no facet cysts that were missed or facet cysts that were incorrectly identified. Third, we applied a broad definition for symptomatic cysts—same side radiculopathy or sensory or motor deficits regardless of other spinal pathology and its dermatomal distribution—as description of symptoms in medical records were not always sufficiently specific. Therefore, the proportion of cysts considered symptomatic might have been overestimated, as other concomitant pathology might have caused the neurological symptoms.

Von Gruker (1880) is regarded as the first to describe an intraspinal ganglion cyst during an autopsy in 1880.[7,16] Since then, many studies reported the prevalence of facet cysts: during surgery, on CT scan, and on MRI. Two studies reported on intraoperatively encountered facet cysts; Zoch[23] found 1 intraspinal ganglion cyst among 8488 lumber surgeries (prevalence: 0.01%), and Sachdev et al[9] found 31 periarticular cysts in a series of 1400 lumbar laminotomies (prevalence: 2.2%). Another 2 studies reported on facet cysts diagnosed using CT scan; Eyster and Scott[11] found 11 cases of lumbar symptomatic synovial cysts in about 1800 lumbar CT scans (prevalence: 0.61%), and Lemish et al[8] found 10 patients with lumbar facet joint synovial cysts in 2000 spinal CT examinations (overall prevalence 0.5%). However, the prevalence of facet cysts on CT scan is most likely an underestimate, because of its relatively low sensitivity, as compared with MRI.[14,17] Despite this, there remains substantial variation in the prevalence of facet cysts reported on lumbar spine MRIs: Modic et al[20] found 2 patients with synovial cysts in 25 patients who underwent MRI for acute lumbar radiculopathy (overall prevalence: 8%). Doyle and Merrilees reviewed 303 lumbar spine MRIs of symptomatic patients and found 30 cysts in 27 patients for an overall prevalence of 8.9% of which 19 caused neurological symptoms (6.3% symptomatic) and 11 did not (3.6% asymptomatic). Park et al[21] reported 10 patients with an incidental finding of synovial cysts among 1268 patients who underwent MRI of the lumbar spine for herniated intervertebral disk disease (incidental prevalence: 0.79%). Rajeswaran et al[2] reported 41 synovial cysts in 22 patients of 98 asymptomatic junior elite tennis players (incidental prevalence: 22%). Varghese et al[22] reported on incidental findings on MRI for low back pain and found 130 extraspinal synovial cysts among 1269 patients (incidental prevalence: 10.2%). Hence, prevalence of lumbar facet cysts on MRI varies from 0.8% to 22%, which is probably largely explained by differences in definition, imaging quality and settings, and patient sample. The prevalence in our study falls within this range: an overall prevalence of 6.5%: 2.7% incidental, 3.2% symptomatic, and 0.49% with both an asymptomatic and a symptomatic cyst.

Few studies looked at an association of age and other factors with having a facet cyst. Park et al[21] demonstrated that younger patients had a higher prevalence of facet cysts, whereas sex distribution was comparable. Varghese and colleagues demonstrated no association of facet cyst prevalence with age or sex. The study by Doyle and Merrilees is—as far as we know—the only study demonstrating an association of older age with having a facet cyst; the median age in the facet cyst group was 64 versus 52 years in the group with no facet cyst. Our study also demonstrated a clear association of age with having a facet cyst. This supports the theory that degenerative spine disease underlies facet cyst development. We found no association of sex with having a facet cyst; this is in contrast to several other studies that found a female predominance.[4–6,17–19,25] New secondary findings, in our study, are a lower prevalence among blacks, Hispanics/Latinos, and Asians, as compared with whites.

No previous studies—as far as we know—looked at the difference between symptomatic and asymptomatic cysts. As 1 might expect, we found an association of larger cyst size and anterior location with having neurological symptoms; this could be explained by the (more substantial) encroachment of the neuroforamen or spinal canal. Interestingly, no other factors, such as age, race, or level, were associated with having neurological symptoms from a facet cyst.

CONCLUSIONS

In conclusion, ~1 in 15 patients have at least 1 synovial facet cyst and about half of them are symptomatic and half are asymptomatic. Having a facet cyst—symptomatic or asymptomatic—is strongly associated with increased age, supporting the theory that degenerative spine disease underlies development of facet cysts. Large cyst size and anterior location of the cyst are associated with an increased likelihood of having neurological symptoms.

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