Original Article

Incidence of spinal epidural lipomatosis in patients with spinal stenosis

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ABSTRACT

Introduction: Spinal Epidural Lipomatosis (SEL) is believed to be a rare disorder. The incidence and prevalence of clinically symptomatic SEL in patients with spinal stenosis has never been reported in the literature. Our study aims to determine the prevalence, incidence, and associated risk factors of SEL in patients with the diagnosis of spinal stenosis.

Methods: This is a retrospective study. We reviewed the charts of 831 patients with the diagnosis of spinal stenosis over a 30 month period. All patients had spinal MRIs. Grading of SEL was performed using the Borré method.

Results: 52 patients (21 female and 31 male) had symptomatic moderate and severe SEL. We found a prevalence of 6.26% and an annual incidence of 2.5%. SEL was most commonly seen at L5-S1 level. 27% had received corticosteroids. All SEL patients were overweight and 79% were obese.

Conclusions: SEL is not uncommon in patients with spinal stenosis. SEL should be considered as a possible diagnosis in those with symptoms of spinal stenosis especially in those with associated risk factors.

1. Introduction

Spinal Epidural Lipomatosis (SEL) has traditionally been referred to as a rare medical disorder. It is defined as an abnormal deposition of adipose tissue in the epidural space which encroaches on the spinal cord or cauda equina. This direct mechanical compression can cause spinal stenosis and nerve compromise. Clinical manifestations are identical to that of degenerative stenosis and can include back pain, progressive lower extremity weakness and numbness, and neurogenic intermittent claudication. The condition can be idiopathic, but it is often associated with obesity, endocrinopathies (such as the high cortisol state seen in Cushing Disease/Syndrome), systemic steroid use, and epidural steroid injections.^{1–16} The lumbar and thoracic vertebrae are the most common areas implicated in the disease.^{1–16} The first reported case of SEL was seen by Lee et al. in 1975.⁹ After which, many other case reports have been reported in the literature.^{1–16}

We performed a retrospective analysis in a community setting in the Pacific Northwest, U.S.A to identify the true incidence and rate of SEL in patients with spinal stenosis. It is also noted that many of these patients have concurrent degenerative spinal canal compromise creating a lower threshold for the SEL to be associated with a symptomatic presentation.

2. Materials and methods

For this study, an exemption was granted by our Institutional Review Board (IRB). We retrospectively reviewed data from 831 patients diagnosed with spinal stenosis in the community clinic of a solo-practicing, board certified orthopedic spine surgeon between December 2012 and June 2015 (30 months). The data was collected from an electronic medical record system (Centricity). A report was run for all patients with ICD-9 codes 724.02, 724.03, 214.8 representing asymptomatic spinal stenosis, symptomatic spinal stenosis, and lipoma of other specified site (spinal epidural lipomatosis), respectively. Our clinic began coding specifically for spinal epidural lipomatosis (SEL) as 214.8 in December of 2012. All patients included in our study had an MRI scan of their lumbosacral spine. The MRI scans were performed at many facilities and with magnets of differing strengths. All patients were diagnosed in an ambulatory setting. A total of 831 patients with spinal stenosis (724.02, 724.03) were seen in our clinic during this 30 month period. All MRIs were reviewed by the senior author.

The diagnosis of spinal epidural lipomatosis (SLE) in our study was made according to the MRI grading system proposed by Borré et al.² All MRIs of SLE were reviewed by the primary and senior authors. There were fifteen MRIs that were performed by an outside facility and not

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imported into our Picture Archive and Communication System (PACS). These MRIs were not available for a second review to reconfirm the SEL grade, and we used the diagnostic report for diagnosis and grading.

Exclusion criteria for this retrospective study were pathologies including extradural abscess, spondylitis, diskitis, herniated discs, epidural hematoma, extradural tumor, compression fractures in lumbar region, acute lumbosacral trauma, and pathologic fracture due to metastases. We did not exclude previous spinal surgery. We did not include Borré Grade 1 SEL patients in our lipomatosis group because they are rarely if ever symptomatic.²

Patient demographics and characteristics such as age, sex, body mass index (BMI), available comorbidity data, history of steroid injections, presence of radicular pain, history of systemic steroid use, prior spinal surgery, level of spinal lipomatosis, and level of canal spinal stenosis were all obtained through review of the patient records.

A two tailed Z-Score was used to compare population proportions for statistical analysis. Significance was set at p-value < 0.05.

3. Theory

Borré et al. was the first study to evaluate a series of MRIs for SEL.² In their study, axial images of the MRI were used to measure the antero-posterior ratio of epidural fat to the spinal canal width, in addition to the ratio of epidural fat to the dural sac measurements. SEL was classified into 3 grades. Grade 1 is defined as the epidural fat occupying 40–50% of the antero-posterior canal width or the thecal sack measuring 100–150% of the width of the epidural fat. Grade 2 is defined as the epidural fat occupying more 50–75% of the antero-posterior canal width or the thecal sack measuring 30–100% of the width of the epidural fat. Grade 3 is defined as the epidural fat occupying more than 75% of the antero-posterior canal width or the dural sack measuring less than 30% of the width of the fat (Figs. 1 and 2). Grade 3 is also defined when there is presence of the stellate thecal sac, or the “Y” sign² (Fig. 3). Their paper was the first to propose an MRI grading system for SEL. To our knowledge, the incidence and prevalence of SEL in patients with a symptomatic spinal stenosis has not been reported in the literature.

4. Results

4.1. Demographics

In reviewing MRIs and medical records of 831 patients with spinal stenosis, we were able to find 52 patients (21 female and 31 male) with moderate and severe spinal lipomatosis (Grade 2 and Grade 3, respectively). That is a rate of 6.26% for SEL in our population group or an

Fig. 1. Grade 3 Spinal Epidural Lipomatosis. Note stenosis caused by the epidural fat and the stellate formation of the dural sac seen on an axial T1 MRI image.

Fig. 2. Grade 3 Spinal Lipomatosis. Note the stenotic appearing dural sac due to the large amount of epidural fat seen on an axial T1 MRI image.

Fig. 3. Grade 3 Spinal Epidural Lipomatosis: Note the classic “Y” sign seen on an axial T1 MRI image.

incidence of 2.5% per year. A total of 32 patients (21 males and 11 females) had SEL Grade 2 at a rate of 3.85% of the total population group, or an incidence of 1.54% per year. Twenty patients (10 men and 10 females) had SEL Grade 3 at a rate of 2.41% of our population group or an incidence of 0.96% per year (Table 1). The average age of patient with SEL was 62 years old.

Table 1
The Demographic Distribution of Patients with Spinal Epidural Lipomatosis.

Spinal Stenosis Population	Lipomatosis Grade		
	None or Grade 1	Grade 2	Grade 3
Sex			
Male	??	21	10
Female	??	11	10
Total	759	32	20
Age			
< 45		45–64	> 64
2		23	27

4.2. Spinal level

The most common single level for SEL was located at L5-S1 ($n = 12$). The most common levels involved in multi-level SEL were L4-5 and L5-S1 ($n = 35$ for each level).

4.3. Sex

Thirty-one total patients with SEL were male, representing 60% of the patients with SEL. Twenty of the male patients had Grade 2 SEL, representing 68% of the male patients with SEL. There were 21 female patients with SEL, representing 40% if all patients with SEL. There was no difference in SEL distribution between the sexes when comparing male patients and female patients with Grade 2 SEL. There was a Z-Score of 1.1172 with a p-value of 0.26272. The distribution SEL grade three was equal with 10 patients from each sex (Table 1).

4.4. Concomitant factors

Multiple factors were examined in each patient. Prior studies and research have demonstrated a high occurrence rate of in SEL patients with previous epidural steroid injections (ESI), higher body mass index (BMI), prior spine surgeries, systemic steroid use, diabetes mellitus (DM), and other endocrinopathies.^{1–16}

Seventeen patients had epidural steroid injections (ESI) prior to diagnosis of SEL, giving a rate of 33%. Thirty-Five percent (7/20) of the Grade 3 patients had ESI. Thirty-one percent (10/32) of the Grade 2 SEL had ESI. There was no difference seen when comparing Grade 2 to Grade 3 SEL patients who received epidural steroid injections, with the Z-Score of 0.2805 and a p-value of 0.77948.

The average BMI in the total SEL group was 36.80. The average BMI in the SEL Grade 2 and Grade 3 groups were 36.65 and 37.06, respectively.

Fourteen patients with SEL (9 men and 5 women) had received systemic steroids in the current or recent past, for a rate of 27% in our population.

Eight patients with SEL (7 men and 1 women) had a diagnosis of DM, for an overall rate of 15% in our population.

Eight patients with SEL (6 men and 2 women) were diagnosed with hypothyroidism, giving an overall rate of 15%.

Seventeen patients with SEL (14 men and 3 women) had prior surgeries in the lumbosacral level for a rate of 33%. Eight patients with SEL Grade 3 and nine patients with SEL Grade 2 had prior surgeries.

Two patients with SEL (0 men, 2 women) had no medical problems, epidural steroid injections, systemic steroid use, or any other known concomitant factors for SEL development.

Seventy-five percent (39/52) of the patients with SEL had radicular pain. Eighty-five percent (17/20) of the Grade 3 SEL patients had radicular symptoms, whereas sixty-nine percent (22/32) of the SEL Grade 2 patients had radicular symptoms. There was no difference seen when comparing Grade 2 to Grade 3 SEL patients who had radicular symptoms, with a Z-Score of 1.3166 and a p-value of 0.18684.

5. Discussion

Spinal Epidural Lipomatosis is an abnormal hypertrophy of the natural epidural adipocytes. Although encapsulated fat or lipomas can occupy the epidural space, spinal epidural lipomatosis is believed to be a separate entity.^{1–16} The pathogenesis of SEL includes direct compression of the spinal cord and/or nerve roots by hypertrophied adipose tissue, with resultant indirect vascular compromise leading to venous engorgement and ischemia. Due to the similarity in clinical presentation, SEL is often misdiagnosed as spinal stenosis or degenerative joint disease. When coupled with increased obesity rates and exogenous steroid use, this may help explain why SEL is likely an underdiagnosed entity. Spinal Magnetic Resonance Imaging (MRI) is the test of choice

for diagnosis, although Computed Tomography (CT) can also reveal thecal sac compression by excess epidural adipose in patients that are unable to undergo an MRI scan.^{2,11,12,15} Management of SEL includes can range from conservative therapy to surgical intervention. Conservative therapy includes administration of NSAIDs, weight loss, and reduction in steroid dosage if applicable. When conservative treatment fails, surgical decompression and resection of adipose tissue can be performed for progressive and/or disabling symptoms.

Buthiau et al. were the first to report a case where the epidural fat was seen expanding on CT exams after about a year of systemic steroid use, thus confirming spinal lipomatosis to be a distinct entity.⁴ Borré et al. were the first to devise a grading scale for SEL utilizing MRIs. They Graded SEL from Grade 0 to Grade 3. Grade zero and one were symptomatic patients with normal epidural fat (Grade 0) or minimal hypertrophy of the epidural fat (Grade 1). Grades 2 and Grade 3 had increasing epidural fat hypertrophy and represent those patients with resulting symptoms.²

The frequency of symptomatic SEL in patients with spinal stenosis has not been well defined in the literature. In our study, we report a rate of 6.26% for symptomatic SEL in our population, with an incidence of 2.5% per year. Our reported SEL Grade 2 rate is 3.85% with an incidence of 1.54% per year, and a SEL Grade 3 rate of 2.41% with an incidence of 0.96% per year. Our rate and incidence of symptomatic SEL, Grade 2 and Grade 3, were lower than that reported by Borré et al., yet higher than that reported by Sugaya et al.¹⁵ Our reported frequency of SEL may differ from the previous reported frequencies because we reviewed the MRIs of only patients who were diagnosed with spinal stenosis and SEL. Data collected by Borré and Sugaya was collected by reviewing all MRIs that presented to their facility.^{2,15} The frequency of SEL was first reported by Borré, at a rate of 2.1% for Grade 3 SEL, and an incidence of 2.18%. They reported a rate of 6.5% for Grade 2 SEL with an incidence of 4.1%. Their rate of symptomatic SEL (Grade 2 and 3) was 8.6% with an incidence of 6.2%.² Sugaya et al. recently reported a rate of 0.33% of Grade 3 SEL, with an incidence of 0.09% per year.¹⁵ They did not include Grade 1 or 2 SEL in their study. Table 2 lists the rates of SEL grades in these previous studies and Table 3 presents the incidence of SEL in the corresponding studies.

Systemic corticosteroid use has been reported as the strongest associated risk factor for SEL. The first reported case of SEL was from a patient who underwent a renal transplant and was receiving exogenous corticosteroids for immunosuppressive therapy.⁹ We report fourteen patients who had received systemic steroids which represents a rate of 27% of all SEL patients in our study. Our reported rate is lower than that of reported by Fogel et al. who performed a meta-analysis of all reported cases of SEL in 2004, finding a rate of 55%.⁷

Epidural steroid injections are contraindicated in the treatment of SEL. There is fear that the steroids could lead to further hypertrophy of the epidural fat. We report 17 patients had epidural steroid injections (ESI) prior to diagnosis of SEL for a rate of 33%. Seven patients had Grade 3 SEL and 10 had Grade 2 SEL. These differences did not reach statistical significance. (Z-Score of 0.2805, p-value of 0.77948). Epidural steroid injects may be another associated risk factor for SEL, but further research is needed.

Spinal epidural lipomatosis has a strong correlation with obesity. Borré reported that 87% of their reported cases of SEL were obese.² Sugaya reported that 60% of their cases were also obese.¹⁵ The average

Table 2
The Prevalence of Spinal Epidural Lipomatosis in from current and past research.

Prevalence	Spinal Epidural Lipomatosis Studies		
	Current Study	Borré	Sugaya
Grade 2	3.85%	6.5%	N/A
Grade 3	2.41%	2.1%	0.33%
Total	6.26%	8.6%	N/A

Table 3
The Incidence of Spinal Epidural Lipomatosis from current and past research.

Incidence	Spinal Epidural Lipomatosis Studies		
	Current Study	Borrè	Sugaya
Grade 2	1.54% per yr	4.1% per yr	N/A
Grade 3	0.96% per yr	2.2% per yr	0.09% per yr
Total	2.5% per yr	6.3% per yr	N/A

BMI in our SEL group was 36.80. Seventy-nine percent of our patients were obese (BMI > 30) and 100% were overweight (BMI > 25). Four of our patients had only one risk factor for SEL consisting of obesity.

Diabetes Mellitus was never reported as an associated risk of SEL in the literature. We report 8 patients with SEL (7 men and 1 women) who were diagnosed with DM, giving an overall rate of 15%. Previous literature does not mention DM as an associated risk factor. More research will be needed in this area for further clarification.

Thyroid disease has been associated with the development of SEL in the past. We report 8 patients with SEL with hypothyroidism, for an overall rate of 15%. All of our reported patients had other associated risk factors such as systemic steroid use or obesity. Borrè found no cases of SEL in patients with hypothyroidism,² and Fogel also found no cases of SEL with isolated hypothyroidism in their meta-analysis.⁷ Hypothyroidism does not appear to be an associated risk factor for SEL.

We present two patients who have no known risk factors for SEL. Both patients were women and represented 3% of our SEL population. This is lower than other reported rates or idiopathic SEL which range from 17% reported by Fogel and 7.6% reported by Borrè, but higher than the 0% reported by Sugaya.^{2,7,15}

Previous reports and studies have shown that the majority of SEL is seen in men.^{1–16} We however, report closer to even distribution of SEL with 21 female patients and 31 male patients.

The most common single level for SEL in our patient population was located at L5-S1 (n = 12). The most common levels involved in multi-level SEL were L4-L5 and L5-S1 (n = 35 for each level). This was also reported as the most common levels in previous papers.^{2,7,15} Many of our older patients had concurrent degenerative spinal stenosis with levels identified in addition to those involved with SEL.

Our paper does have noted weaknesses. The most obvious weakness is that our paper is a retrospective study. A strength of our study, however, is that all our patients were evaluated and had MRIs reviewed by a single spinal surgeon. After the reports were made by our EMR system, all MRIs of patients diagnosed with SEL were reviewed once again by the first author and senior author to confirm the diagnosis. There were fifteen MRIs that were performed by an outside facility which were unavailable for a secondary review, and thus their grade of SEL was directly obtained from the medical chart. Our patients were seen in an ambulatory clinic and not all the MRIs were done in our facility, creating another possible weakness. The MRIs came from different facilities of varying quality, which could create inconsistency in analysis. All magnets were 1.5T or greater. An additional weakness of our paper is that data was obtained for patients with either a diagnosis of asymptomatic or symptomatic stenosis. This may have included patients who only had lateral recess or foraminal stenosis, not involving the central canal. Any patients meeting this isolated diagnosis would not have been excluded from our general stenotic population. Inclusion of these patients would decrease our rate of SEL in our population of patients with diagnosed central spinal stenosis. Furthermore, patients

were diagnosed with spinal stenosis and spinal epidural lipomatosis with MRI scans. Our study could have missed a few patients who could not have MRI scans and who may have been diagnosed with spinal stenosis and SEL by CT scan only. This would decrease the true prevalence of SEL in our patient population. An additional weakness of our paper is that no treatment options nor patient reported outcomes were able to be reported. Many patients were lost to follow up making presenting this information impossible. The final weakness of our study is that our study population was from the Northwest United States and represents a large Caucasian population. This data may not be applicable to other populations. Future research should include patient reported outcomes from their treated SEL.

6. Conclusion

SEL deserves attention as an identifiable cause of radiculopathies typically attributed to spinal stenosis, with a higher incidence than previous reports. Practitioners should be alert to the possibility of SEL as a possible diagnosis for stenosis-type symptoms particularly when provided with a “benign” imaging reading. It should be considered in any patient with obesity, endocrinopathies, and exogenous steroid use. MRI and CT scans are both great tools in diagnosing SEL. It is important to avoid steroid usage once this diagnosis is identified.

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