Spinal angiolipomas: A puzzling case and review of a rare entity

ABSTRACT
Patients with spinal epidural abscesses (SEAs) may have a variable presentation. Such an infection has a typical appearance on magnetic resonance imaging (MRI) and enhances with gadolinium. We present a case that was a diagnostic challenge where pre- and intra-operative findings resulted in conflicting impressions. The mimicker was a spinal angiolipoma (SAL). The authors then provide a thorough review of this rare spinal neoplasm. A 55-year-old man presented with back pain, paresis, paresthesia, and urinary retention. MRI was indicative of a longitudinal epidural thoracic mass with a signal homogeneous to nearby fat, curvilinear vessels, and lack of enhancement. Although at emergent surgery, the lesion was found to contain abundant purulent material. Microbiology was positive for methicillin-resistant Staphylococcus aureus and consistent with SEA without evidence of neoplasia. While the imaging features were suggestive of an angiolipoma, the findings at surgery made SEA more likely, which were validated histopathologically. The diagnosis of SEA is often clear-cut, and the literature has reported only a few instances in which it masqueraded as another process such as lymphoma or myelitis. The case highlights SEA masquerading as an angiolipoma, and further demonstrates to clinicians that obtaining tissue diagnosis plays a crucial role diagnostically and therapeutically. SALs, on the other hand, are slow-growing tumors that can be infiltrating or noninfiltrating. They typically present with chronic symptoms and T1-MRI shows an inhomogeneous picture. Complete surgical excision is standard of care and patients tend to do well afterward.

Keywords: Angiolipoma, back pain, epidural abscess, magnetic resonance imaging, spinal cord compression, spine neoplasms

INTRODUCTION
Angiolipomas, by definition, tend to be benign tumors that may be found in areas such as the neck, trunk, and forearm usually presenting subtly and have a benign course.[1,2] Although rare, spinal angiolipomas (SALs) also form an important subset from a clinical perspective. In the literature, around 200 cases of SAL have been recorded; accounting for <2% of all spinal neoplasms.[3-6] They have been documented as early as 1890, but the first description was in the 1900s by Liescher. Sixty years later, Howard and Helwig would coin the term angiolipoma after describing the defining characteristics of the tumor.[9]

The neoplasm occurs predominantly in the thoracic region of the spinal cord, particularly T2–T5 and both intra- and extra-dural forms have been reported.[6-11] The predilection to this location might be due to the relatively poor blood

Faris Shweikeh1,2, Ajleeta Sangtani2, Michael P Steinmetz3, Peter Zahos4, Bohdan Chopko2,5
1Summa Health System, Northeast Ohio Medical University, 2College of Medicine, Northeast Ohio Medical University, Rootstown, 3Department of Neurosurgery, Case Western Reserve University, MetroHealth Medical Center, Cleveland, OH, 4Department of Neurosurgery, New York Medical College, Valhalla, NY, 5Department of Neurosurgery, Stanford University, Palo Alto, CA, USA

Address for correspondence: Dr. Faris Shweikeh, College of Medicine, Northeast Ohio Medical University, 4209 State Route 44, Rootstown, OH 44272, USA. E-mail: fshweikeh@neomed.edu

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Shweikeh F, Sangtani A, Steinmetz MP, Zahos P, Chopko B. Spinal angiolipomas: A puzzling case and review of a rare entity. J Craniovert Jun Spine 2017;8:91-6.
supply within this area. Angiolipomas are similar to lipomas histologically, but include an additional vascular component and are therefore considered to be similar to hemangiomas as well. The clinical presentation of SAL may mimic that of other spinal space occupying lesions such as spinal epidural abscess (SEA) and therefore adds a certain degree of diagnostic complexity.

In terms of SEA, estimates have indicated that it occurs in approximately 2–3 admissions per 10,000 hospital admissions. The diagnosis is usually suspected with characteristic clinical signs and symptoms, distinctive radiographic findings, and confirmed microbiologically. The thoracolumbar regions are a common location. Moreover, a number of risk factors have been elucidated along with SEA, including diabetes mellitus, intravenous drug abuse, alcohol abuse, immunodeficiency, and invasive spine procedures. We present a case of a patient with a SEA that mimicked an angiolipoma on both clinical and imaging features and review the literature.

**CASE REPORT**

A 55-year-old man with an unremarkable medical history presented with a multiple week history of lower back pain radiating to the upper scapula and a 2-day history of urinary retention. He had a history of chronic back pain that had worsened in the more recent weeks before the presentation. The patient was seen 4 days prior for an upper respiratory infection and back pain in the emergency department and given nonsteroidal anti-inflammatory medications. His vital signs were within normal limits. Initial physical examination showed irregular gait, stiffness, and weakness in his left lower extremity. His weakness was in the L4–L5 and S1 area, and he exhibited decreased sensation in the L5 distribution and positive straight leg raise. He had no clonus, negative Babinski, and 2+ reflexes. The rectal tone was normal.

There were no any abnormalities on his blood tests, including no elevation in white blood cells or a left shift. A magnetic resonance imaging (MRI) of the thoracic spine showed an epidural longitudinal mass spanning T3–T8. The majority of the mass demonstrated a signal homogeneous to nearby fat. Curvilinear vessels were also present within the mass. There was significant spinal cord compression most evident at T6 and T7 without enhancement [Figure 1]. There was no apparent spinal cord or disk enhancement with contrast. There was no evidence of hemorrhage or concerning findings for an abscess. The most likely findings on imaging combined with the signs, symptoms, and chemistries were those related to an angiolipoma.

The patient was emergently taken to the operating room for decompression of the spinal cord. He underwent posterior T3–T8 laminectomy, with resection of epidural fat and saline irrigation. The lesion was found to contain purulent material with necrotic epidural fat from T3–T8. No tumor remnant or capsule was found. Initial gram stain was positive for *Staphylococcus aureus*, with final cultures positive for methicillin-sensitive *S. aureus*. Overall, the histopathology was consistent with epidural abscess. A thorough examination of necrotic fat found no evidence of angiolipoma or any other neoplasia.

Postoperatively, the patient’s weakness significantly improved with mild residual weakness persistent on his left extremities. The patient was sent to rehab for strengthening, and eventual resolution of all symptoms. He completed a 6-week course of intravenous antibiotics. At most recent outpatient follow-up, MRI revealed no lesions (though the Institutional Review Board/Ethics Committee approval and patient consent were not sought for this case presentation, neither were required).

**DISCUSSION**

In usual cases, patients with SEA have a significant history of medical problems and arrive with acute back pain and constitutional systemic signs and symptoms. Imaging of the lesion is distinctive, demonstrating iso- or hypo-intensity...
on T1-MRI and hyperintensity on T2.\textsuperscript{[15,19]} Gadolinium administration usually results in a typical ring-enhancing lesion with a nonenhancing center.\textsuperscript{[16]} Diagnosis should be confirmed using tissue histopathological analysis, with \textit{S. aureus} being the most frequently isolated microbe.\textsuperscript{[16]} SAL, on the other hand, is an even less common entity, comprising 0.04\%–1.2\% of all spinal neoplasms.\textsuperscript{[10,14,20,21]} These tumors occur predominantly in the thoracic spine, particularly T2–T5. While similar to lipomas, they include an additional vascular component likening them to hemangiomas, representing an intermediate subsistence between the two neoplasms.\textsuperscript{[10,14,20,21]}

**Pathology**

The tumor is composed of mature adipose fat cells and vascular components, and to be classified as a SAL, more than 50\% of the cells must be fat cells.\textsuperscript{[8,22,23]} The benign nature of the tumor has also been described as a mixture of developed adipocytes and dividing miniature vessels containing fibrin, as well as a neoplasm or a congenital malformation of pluripotent mesenchymal stem cell origin.\textsuperscript{[2,7]} The tumor has been described, in certain cases, to deteriorate more rapidly resulting in hemorrhage, thrombosis, vascular steal phenomena, or expand into a larger tumor volume.\textsuperscript{[2,12,13,17]} In certain cases of SAL, significant amounts of smooth muscle can be appreciated, further classifying the tumor as an angiomyolipoma. Without an adventitia, the smooth muscle may mesh into the surrounding tissue, or into cartilage or osteoid tissue in the vicinity.\textsuperscript{[29]} The tumor can result in eroded pedicles, trabeculation of vertebral bodies or mediatinum, and/or spinal cord compression.\textsuperscript{[22,20]} In certain cases, the trabeculations present as vertical striations of the vertebral bodies, which is also characteristic of spinal hemangiomas.\textsuperscript{[30]}

**Clinical presentation**

Patients with angiolipoma present with progressive neurological deficits and pain in the affected regions related to progressive spinal cord compression, gradually worsening over the course of approximately 1 year [Table 1].\textsuperscript{[26,32–34]} More rapid onset of symptoms may be attributed to vigorous exercise, which increases blood flow to the tumor and exacerbates epidural bleeding, leading to neurologic symptoms. Patients may also present with gait disturbances and urinary hesitation.\textsuperscript{[9,24]} Symptoms may mimic a demyelinating disorder, such as multiple sclerosis and are worsened in pregnant females due to increased epidural pressure that further compresses the spinal cord.\textsuperscript{[12,22]}

In contrast, SEA has been associated with verified comorbidities\textsuperscript{[16–18]} and the infection usually manifests itself in middle-aged persons with fever, chills, and malaise.\textsuperscript{[17,18]} Clinical presentation can vary with the time-frame and starts as fevers with chills that progress to spinal pain with neurological symptoms and culminates with bowel and/or bladder dysfunction.\textsuperscript{[17,18,27]} The presence of a fever can be variable, but back pain is almost always present\textsuperscript{[12,18]} tending to be over the affected region and exacerbated by movement.\textsuperscript{[27]}

**Diagnosis**

Plain film radiography is a poor indicator of a SAL, only occasionally indicating pedicle erosion.\textsuperscript{[23]} Although evidence of bone deterioration may be present, computed tomography scans of angiolipomas show little to no contrast enhancement and can thereby be distinguished from vertebral. Therefore, T1-MRI is the standard because it alludes to the presence of a lipid tumor with vascular components resulting in an inhomogeneous picture.\textsuperscript{[7,9,12,21,25]} The level of vascularization correlates with hypointense regions, but iso- or hyper-intense regions may also be appreciated, usually within homogenous intensity in any one patient. The T1-imaging can be used, therefore, to rule out lipomas, which would not have the hypointense regions correlated with vascularization.\textsuperscript{[4,8,12,22,24]} It can be distinguished from spinal vascular malformations, such as fistulas because of the latter present with enlarged subarachnoid vessels on T1-imaging.\textsuperscript{[33]}

Suppression of the high signal intensity in fat-suppressed T1-imaging can exclude methemoglobin and melanin, which would consequently differentiate between spinal epidural angiolipomas with flow voids and arteriovenous malformations as well.\textsuperscript{[34,37]} In addition, T2-MRI generally shows hyperintense regions, but the results are variable.\textsuperscript{[10]} Gadolinium enhancement can also contribute to diagnosis by eliminating extradural lipomatosis, which are not enhanced by IV injected contrast, from the differential diagnosis.\textsuperscript{[12,13,34]} In addition, angiography may be used for embolization of the tumor, which helps with removal,\textsuperscript{[20]} though it is difficult to distinguish from certain diagnoses, such as metastases and meningiomas.\textsuperscript{[34]}

**Treatment and outcome**

Treatment depends on tumor characterization. Noninfiltrating undergo total excision, which is usually possible because the tumor does not adhere to the dura underneath.\textsuperscript{[29]} In cases of infiltrating type, surgery is always recommended while radiation is sometimes included [Table 1].\textsuperscript{[22,24]} That being said, consensus and hence clear guidelines remain hazy on treatment. This may be due to a combination of the disease entity being rare in addition to the heterogeneous biological behavior that ultimately entails individualizing treatment modalities.\textsuperscript{[14]} Outcomes after surgical resection tend to be favorable.\textsuperscript{[22]} In fact, a literature review revealed no differences in outcomes between infiltrating and noninfiltrating.\textsuperscript{[39]}
Table 1: Characteristics of recent reported cases describing thoracic spinal angiolipomas

| Authors (Reference) | Age/ Gender | Location/Levels involved | Associated conditions | Duration of Symptoms | Presenting problem | Imaging (description on MRI/CT) | Treatment | Outcome |
|---------------------|-------------|--------------------------|-----------------------|----------------------|-------------------|-------------------------------|-----------|---------|
| Sim, 2015           | 58 F        | T2 – T6                  | Obesity, DM2, Asthma   | 4 months             | Burning in bilateral hands/shoulders, back pain | Enhancing fat w/ extradural mass | T2 – T6 laminectomy | Uncomplicated post-operative course; persisting 4/5 dorsiflexion, 5/5 power in others |
|                     | 42 F        | T1 – L2                  |                       |                      |  |  |  |  |  |
|                     | 39 M        | T3 – T6                  |                       |                      |  |  |  |  |  |
|                     | 26 F        | L5 – S1                  |                       |                      |  |  |  |  |  |
| Nadi, 2015          | 50 F        | T6 – T9                  | -                     | 10 year              | Back pain mid-dorsal area; progressive LE weakness and stiffness | Inhomogeneously enhancing hyperintensity on T2WI and on fat suppression T1WI | T11 – L2 laminectomy | Uneventful postoperative course; Mild residual spasticity and hyperreflexia |
| Regato, 2015        | 65 F        | T8 – T10                 | -                     | 6 weeks              | LE dysesthesia and neurogenic claudiation | T1: dumbbell-shaped hyperintense mass with hypointense regions | T3-T7 laminectomy | Uneventful recovery, symptom free and no recurrence after 6 months |
| Da Costa, 2014      | 43 M        | Thoracic                 | -                     | 32 hours             | Sudden onset thoracic pain, paraplegia | T1 w/Gd: slight tissue cavitation peripherally T2: mixed lesion, hyperintense areas, isointense surrounding | L5/S1 hemilaminectomy |  |
| Si, 2014            | 21 patients | 3L; 16T; 2C              | (Various)             | 12 hrs – 360 months | Fat: hyperintense on T1/T2 Vascular: isointense on T1, hyperintense on T2 | Fat: hyperintense on T1/T2 Vascular: isointense on T1, hyperintense on T2 | Total resection in all 21 | Better prognosis in IA vs IB (based on JOA score) Mean recovery rate: 93.9% in IA vs 45.5% in IB |
|                     | (1/01-2/13) |                         | (Various)             |                      |  |  |  |  |  |
|                     | 9 M; 12 F   |                         | (Various)             |                      |  |  |  |  |  |
| Prasad, 2014        | 26 M        | T5-T9                    | -                     | 6 months             | Progressive spastic paraparesis with autonomic involvement sensory level | hyperintensity/isointensity on T1; & hypointensities on T2 | enbloc laminoplasty | Initial deterioration followed by gradual recovery |
| Fujisawa et al., 2013 | 64 F       | T5-T8                    | Hypertension Healthy with no prior medical history | 3 months | Left leg dysesthesia, back pain, spasticity, gait disturbances, hyperreflexia, ankle clonus, urinary retardation | T1WI: Isointense masses T2WI: Hyperintense masses | T5-T8 laminoplasty | Hyperreflexia was the only abnormality |
|                     | 65 M        | T5-T7                    | T5-T7                 | 2 years              |  |  |  |  |  |
| Meng et al., 2013   | 63M         | T3-T4                    | Varicose vein of lower limb | 1 year              | Bilateral hypesthesia difficulty urinating, paraparesis, hyperreflexia | T1WI: inhomogeneous isointense mass T2WI: hyperintense fusiform Post-contrast T1: low signal | T3-T4 laminectomy with total resection |  |
| Han et al., 2012    | 58 M        | T3-T5                    | Not mentioned         | 9 months             | Paraparesis and hypesthesia of the lower extremities; hyperreflexia on the R leg | CT: mass along posterior epidural space MR: infiltrating mass | T3-T5 laminectomy | Improved muscle strength and sensation |
| Ghanta et al., 2012 | 56 M        | T4-T6                    | Multiple subcutaneous lipomas | 3 months | Hypoesthesia in lower extremities, ambulatory difficulties | TW1: hypointense mass | T4-T6 laminectomy | No neurological abnormalities after 5 years |
| Haj et al., 2011    | 65 F        | T4-T7                    | Mild degenerative disc disease; renal mass | 9 months | Bilateral hypesthesia, paraparesis, progressing to T10, hyperreflexia, difficulty urinating | hyperintense at T5-T7 | T3-T7 posterior laminectomy | Patient regained muscle strength, lingering hypesthesia |
Overall, good clinical outcomes have been reported among the different types.\[6,39\]

Not many cases of SEA have been reported to mimic other forms of pathology, and none have been reported that mimicked SAL. Previously reported as masquerading entities include lymphoma, vertebral fracture, transverse myelitis, and disc herniation, as summarized in Table 2. Our case highlights SEA masquerading as an angiolipoma. Despite being a relatively rare entity, SAL is a clinically relevant subset of benign tumors.

**CONCLUSION**

Although patients with SEAs may present with classic signs and symptoms, this presented case highlights the potential variability in the infection’s characteristics and diagnostic challenges. In this case, the indolent course in the patient’s symptomatology and imaging traits of the thoracic spinal mass were highly suggestive of an angiolipoma, but the findings at operation and the pathology confirmed the lesion to be a SEA. Contradictory diagnostic and therapeutic impressions in medicine remain as part of the foundation for abstract thought, intellectual curiosity, though as our case illustrates, and in most clinical situations, it presents an obstacle to the surgeon.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**REFERENCES**

1. Hanck JL, Muñiz AE. Cervical spondylodiscitis, osteomyelitis, and epidural abscess mimicking a vertebral fracture. J Emerg Med 2012;42:e43-6.

2. Benvenuti-Regato M, De la Garza-Ramos R, Caro-Osorio E. Thoracic epidural spinal angiolipoma with coexisting lumbar spinal stenosis: Case report and review of the literature. Int J Spine Surg 2015;9:67.

3. da Costa MD, Paz Dde A, Rodrigues TP, Gandolfi AC, Lamis FC, Stavale JN, et al. Hemorrhagic onset of spinal angiolipoma. J Neurosurg Spine 2014;21:913-5.

4. Nadi MM, Nadi AM, Zabara MY, Ahmad TM. Management of infiltrating spinal epidural angiolipoma. Neurosciences (Riyadh) 2015;20:159-63.

5. Si Y, Wang Z, Pan Y, Lin G, Yu T. Spinal angiolipoma: Etiology, imaging findings, classification, treatment, and prognosis. Eur Spine J 2014;23:417-25.

6. Sim K, Tsui A, Faldor I, Kaye AH, Gaillard F. Four cases of spinal epidural angiolipoma. J Clin Neurosci 2016;25:134-9.

7. Prasad GL, Sinha S. Spinal intradural subpial angiolipoma: Case report and review of literature. Surg Neurol Int 2014;5:164.

8. Anjiyolipom TS, ve Literatürün IO. Thoracic spinal epidural angiolipoma: Report of two cases and review of the literature. Turk Neurosurg 2013;23:271-7.

9. Haji FA, Patel YK, Ang LC, Megyesi JF. A case of mistaken identity: Spinal epidural angiolipoma. Can J Neurol Sci 2011;38:357-9.

10. Han SR, Yee GT, Choi CY, Lee CH. Infiltrating spinal angiolipoma. J Korean Neurosurg Soc 2012;52:161-3.

11. Tsutsumi S, Nonaka Y, Abe Y, Yasumoto Y, Ito M. Spinal angiolipoma in a pregnant woman presenting with acute epidural hemorrhage. J Clin Neurosci 2011;18:849-51.

12. Chotai S, Hur JS, Moon HJ, Kwon TH, Park YK, Kim JH. Spinal angiolipoma – Case report. Neurol Med Chir (Tokyo) 2011;51:539-42.

13. Park JH, Jeon SR, Rhim SC, Roh SW. Lumbar spinal extradural angiolipoma: Case report and review of the literature. J Korean Neurosurg Soc 2008;44:265-7.

14. Meng J, Du Y, Yang HF, Hu FB, Huang YY, Li B, et al. Thoracic epidural angiolipoma: A case report and review of the literature. World J Radiol 2013;5:187-92.

15. Bakar B, Tekkok IH. Lumbar periradicular abscess mimicking a fragmented lumbar disc herniation: An unusual case. J Korean Neurosurg Soc 2008;44:385-8.

16. Shweikeh F, Saeed K, Bukavina L, Zyck S, Drazin D, Steinmetz MP. An institutional series and contemporary review of bacterial spinal epidural abscess: Current status and future directions. Neurosurgery 2014;74:E9.

17. Akhaddar A, Albouzidi A, Elmostarchid B, Gazzaz M, Boucetta M. Sudden onset of paraplegia caused by hemorrhagic spinal epidural angiolipoma. A case report. Eur Spine J 2008;17 Suppl 2:S296-8.

18. Akhaddar A, Gazzaz M, Derraz S, Rifí L, Amarti A, Aghzadi A, et al. Spinal epidural angiolipomas: A rare cause of spinal cord compression. A report of 8 cases and review of the literature. Neurochirurgie 2000;46:523-33.

19. Patel D, Baron EM, Enochs WS, Ruth C, Harrop JS, Vaccaro AR. Spinal epidural abscess mimicking lymphoma: A case report. Orthopedics 2008;31:402.

---

**Table 2: Summary of previous case reports involving spinal epidural abscess mimicking a different disease entity**

| Authors (Reference) | Age/sex | Location/ levels | Mimicked pathology | Presentation | Origin of infection | Imaging (description on MRI/CT) |
|---------------------|---------|-----------------|--------------------|--------------|-------------------|---------------------------------|
| Hanck and Muñiz\[1]\ | 75/female | C6-C7 | Vertebral fracture | Low back and right leg pain | *Staphylococcus aureus* from infective endocarditis | MRI: C6-C7 cortical endplate erosion and loss of disk space |
| Bakar and Tekkok\[10]\ | 71/female | L5-S1 | Disc herniation Lympoma | Bladder infection | Not identified | MRI: No abnormalities |
| Patel et al.\[14\] | 55/male | T8-T10 | Transverse myelitis | Severe back pain | Dental procedure | T1/T2-weighted MRI: Hypointense mass that enhanced uniformly with gadolinium |
| Rao et al.\[18\] | 28/female | C6-T2 | | Urinary retention and constipation; HIV+ | Minor trauma from a pat on the back | MRI: Extrudal collection |

---

MRI - Magnetic resonance imaging; CT - Computed tomography
20. Fujiwara H, Kaito T, Takenaka S, Makino T, Yonenobu K. Thoracic spinal epidural angiolipoma: Report of two cases and review of the literature. Turk Neurosurg 2013;23:271-7.
21. Ghanta RK, Koti K, Dundamudi S. Spinal epidural angiolipoma: A rare cause of spinal cord compression. J Neurosci Rural Pract 2012;3:341-3.
22. Hungs M, Paré LS. Spinal angiolipoma: Case report and literature review. J Spinal Cord Med 2008;31:315-8.
23. Kuroda S, Abe H, Akino M, Iwasaki Y, Nagashima K. Infiltrating spinal angiolipoma causing myelopathy: Case report. Neurosurgery 1990;27:315-8.
24. Preul MC, Leblanc R, Tampieri D, Robitaille Y, Pokrupa R. Spinal angiolipomas. Report of three cases. J Neurosurg 1993;78:280-6.
25. Diyora B, Nayak N, Kukreja S, Kamble H, Sharma A. Thoracic epidural angiolipoma with bilateral multilevel extraspinal extensions: A rare entity. Neurol India 2011;59:134-6.
26. Konya D, Ozgen S, Kurtkaya O, Pamir NM. Lumbar spinal angiolipoma: Case report and review of the literature. Eur Spine J 2006;15:1025-8.
27. al-Anazi A, Ammar A, Shannon P, al-Mulhim F. Spinal extradural angiolipoma. Br J Neurosurg 2000;14:471-2.
28. Petrella G, Tamburrini G, Lauriola L, Di Rocco C. Spinal epidural angiolipoma complicated by an intratumoral abscess. Case report. J Neurosurg 2005;103 2 Suppl:166-9.
29. Samdani AF, Garonzik IM, Jallo G, Eberhart CG, Zahos P. Spinal angiolipoma: Case report and review of the literature. Acta Neurochir (Wien) 2004;146:299-302.
30. Rabin D, Hon BA, Pelz DM, Ang LC, Lee DH, Duggal N. Infiltrating spinal angiolipoma: A case report and review of the literature. J Spinal Disord Tech 2004;17:456-61.
31. Rocchi G, Caroli E, Frati A, Cimatti M, Savlati M. Lumbar spinal angiolipomas: Report of two cases and review of the literature. Spinal Cord 2004;42:313-6.
32. Andalus N, Balko G, Bui H, Zuccarello M. Angiolipomas of the central nervous system. J Neurooncol 2000;49:219-30.
33. Eddleman CS, Jeong H, Cashen TA, Walker M, Bendok BR, Batjer HH, et al. Advanced noninvasive imaging of spinal vascular malformations. Neurosurg Focus 2009;26:E9.
34. Leu NH, Chen CY, Shy CG, Lu CY, Wu CS, Chen DC, et al. MR imaging of an infiltrating spinal epidural angiolipoma. AJNR Am J Neuroradiol 2003;24:1008-11.
35. Rao U, Prasad S, Rajivanshi P, Gupta B. Spinal epidural abscess in HIV positive patient masquerading as transverse myelitis. J Assoc Physicians India 1999;47:248.
36. Provenzale JM, McLendon RE. Spinal angiolipomas: MR features. AJNR Am J Neuroradiol 1996;17:713-9.
37. Garg A, Gupta V, Gaikwad S, Deol P, Mishra NK, Sharma MC, et al. Spinal angiolipoma: Report of three cases and review of MRI features. Australas Radiol 2002;46:84-90.
38. Ledermann HP, Schweitzer ME, Morrison WB, Carrino JA. MR imaging findings in spinal infections: Rules or myths? Radiology 2003;228:506-14.
39. Gelabert-González M, García-Allut A. Spinal extradural angiolipoma: Report of two cases and review of the literature. Eur Spine J 2009;18:324-35.