Differential diagnosis of epidural lesion of the spine: MR and CT correlation

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Learning objectives

The purpose of our educational exhibit is to review the normal anatomy of the epidural space of the spine, to evaluate and differentiate the epidural lesions of the spine by the location, signal or attenuation, and related structures on MR and CT images, and to suggest an algorithm for differential diagnosis of the epidural lesions of the spine.

Background

The epidural space of the spine is a narrow space between spinal dura and surrounding vertebral canal, extending from foramen magnum to posterior sacroccocygeal ligament. Because it is a closed space within the bony canal, many clinically significant epidural space lesions are typically small and difficult to differentiate from each other.

Therefore, we review typical cases and imaging characteristics of the epidural space lesions and suggest an algorithm for differential diagnosis of the lesions. This algorithm may be helpful to differentiate various epidural space lesions of the spine.

Findings and procedure details

Normal anatomy of the epidural space of the spine

The epidural space of the spine is a narrow space between the spinal dura and surrounding osseous structures and ligaments of the spine, extending from the foramen magnum to the posterior sacroccocygeal ligament. It contains mainly fat, loose areolar tissue, and vessels. CT and/or MR images show the normal epidural space of the spine as fat attenuation/signal intensity.

Normal variants and pseudolesions

Epidural lipomatosis

Epidural lipomatosis is abnormal deposition of fat within the spinal epidural space. It usually affects patients with obesity or corticosteroid use, but sometimes it is idiopathic. It results in the collapse of the thecal sac and may be symptomatic. CT/MR images show large amount of epidural fat within the spinal epidural space and collapsed the thecal sac with decreased size. (Fig 1)
Prominent venous plexus

Epidural venous plexus is a network of veins located within the anterior epidural space. It is poorly visualized with CT/MR imaging usually, and if visible, it is seen as low signal intensity due to signal void. Prominent venous plexus mimics the disc sequestration, masses or other pathologic lesions. Tortousity, continuity with other vascular structure and enhancement may help differentiate it from other lesions. (Fig 2)

Disease category

Epidural hematoma

Accumulation of blood within the epidural space of the spine may be developed after trauma, after surgery, by complication of anticoagulants, or spontaneously. Ovoid or fusiform shape lesion may be seen in normally fat-filled epidural space. Its density or signal intensity on CT/MR images differ over time. It sometimes is not well evaluated with CT but cliearly depicted at MR. (Fig 3,4)

Tumor

Most tumorous conditions of the epidural space of the spine are usually direct extension from the primary or secondary tumors originated from vertebrae or paraspinal soft tissue. But tumors sorely within the epidural space are rare. Benign and malignant tumors of the epidural space of the spine has been reported on literature. Because it is narrow closed space, tumors typically appears as elongated shape masses. Imaging findings of tumorous conditions are determined by the characteristics of the primary lesions. We experienced a few cases of benign and malignant tumors in the epidural space of the spine. Examples of the cavernous hemangioma and lymphoma are described below. (Fig 5,6)

Infection - Epidural abscess

Epidural abscess is usually associated with direc extension of infection from spondylodiscitis (about 80%), but spread from remote infection site is also reported. CT images show osteolytic lesions or disc space narrowing, suggesting spondylitis and/or discitis. Gadolinium enhanced MR is the imaging choice for diagnosis. MR imaging patterns are devided into two stages : phlegmon and abscess. In phlegmonous stage of infection, diffuse soft tissue inflammation results in homogeneous enhancement of the region. In abscess stage, progressed inflammation results in fluid collection with enhancing wall. (Fig 7)

Degenerative disease
(1) Disc diseases

Disc diseases are common with aging and degeneration. Disc herniation usually compresses anterior epidural space and thecal sag. Extruded or sequestrated discs may be located between the posterior longitudinal ligament (PLL) and the osseous spine, or extend through the PLL into the epidural space.

Extruded disc within epidural space is differentiated from other disease by continuity with the parent disc.

Sequestrated disc within epidural space may mimic other space occupying lesions including hematoma or masses. Inflammatory changes due to disc fragment result in peripheral enhancement on CT/MR images. Degenerative changes of adjacent discs, vertebrae and ligaments may be helpful for differential diagnosis. (Fig 8)

(2) Ossification of ligaments

Some ligamentous structures of the spine lie between the osseous structure and the epidural fat. Posterior longitudinal ligament (PLL) lies in anterior epidural space, and ligamentum flavum (LF) in posterior epidural space. Degeneration and ossification of these ligaments may compress the spinal cord.

On CT images, it is not difficult to differentiate the ossification of PLL or LF from other pathology, because calcification is easily seen on CT images. On MR images, ossification of PLL or LF is usually seen as low signal intensity on both T1- and T2-weighted images. Peripheral enhancement may be seen due to inflammatory reaction. (Fig 9, 10)

Algorithm for differential diagnosis of the epidural lesions of the spine

Location

Disc diseases are usually affect the anterior epidural space due to its anatomy. Epidural abscess associated with spondylitis is also typically seen in the anterior epidural space. Epidural inflammation/abscess after procedures are commonly seen in the posterior epidural space, due to posterior approach of these procedures. OPLL is common at cervical spine and

Attenuation/signal intensity

Epidural lipomatosis and ossification of PLL or LF are easily diagnosed by its characteristic CT attenuation or MR signal intensity. Signal intensity of epidural hematoma is variable with time, usually heterogeneous on both T1- and T2-weighted MR images. Signal intensity of sequestrated disc fragment is usually intermediate to low signal intensity on both T1 and T2 weighted images, similar to parent disc.
Imaging finding of the related structures

Epidural abscess is usually combined with spondylodiscitis, so imaging findings of spondylodiscitis such as bone marrow edema, bony erosion, or inflammatory change of paravertebral soft tissue are often observed with the epidural abscess. Epidural hematoma after trauma may be combined with fracture or contusion of the adjacent vertebral column. Disc disease or other degenerative disease in epidural space also combine with degenerative changes of disc, ligament and vertebrae.

Images for this section:

![Images](https://example.com/)

Fig. 2: Prominent venous plexus. Un-enhanced axial CT image of L4 upper body level (a) shows ill-defined soft tissue density lesion in the anterior epidural space (black arrowhead). T2-weighted axial (b) and sagittal (c) MR images show multiple ovoid shape low signal intensity lesions in the anterior epidural space of L4 and L5 bodies level (white arrow). Bulging discs are also noted at L3/4 and L4/5 disc spaces. This multiple low signal intensity lesions in anterior epidural space may mimic sequestrated disc or other masses. Enhanced T1 weighted fat-saturated sagittal image (d) show bright enhancement with internal signal void of this lesion (black arrow), the same signal intensity as venous plexus.
of other lumbar spine level (white arrowhead). Thus, this lesions are thought as the prominent epidural venous plexus.

**Fig. 3:** Epidural hematoma. 85-years old female with history of taking antiplatelet agent for several years. (a) Un-enhanced sagittal CT image shows fusiform shape lesion in posterior epidural space of T11-L2 level (black arrow). Note that it shows higher density than spinal cord. (b) T1-weighted sagittal MR image shows heterogeneous fusiform shape high signal intensity lesion at posterior epidural space of T11-L2 level (white arrow). This lesion is heterogeneous low signal intensity on T2-weighted sagittal MR image (c). Note that increased signal intensity of the spinal cord at this level (black arrowhead). Post-enhanced T1-weighted fat-saturated sagittal MR image (d) shows bright enhancement of this lesion. Note that heterogeneous enhancing lesion in the spinal cord at T12 upper body level (white arrowhead). These spinal cord lesion is suggested as compressive myelopathy due to epidural hematoma.
Fig. 4: Epidural hematoma. 85-years old female with history of taking antiplatelet agent for several years. After 2 weeks later, follow-up MR imaging was performed. T1-weighted sagittal MR image (a) and T2-weighted sagittal MR image (b) shows decreased size of the lesion, probable resolving state of epidural hematoma. Note that improved but remained signal change in the spinal cord at T12 body level (arrow).
Fig. 5: Epidural cavernous hemangioma. 65-years old male was performed T-spine MR imaging due to lower back pain. T1-weighted sagittal (a) and axial (b), T2-weighted sagittal (c) and axial (d) MR images show fusiform shape elongated soft tissue mass in posterior epidural space of T5-T7 level. This mass is about 5cm in length, and homogeneous intermediate signal intensity on T1-weighted images and high signal intensity on T2-weighted images. Note that spinal cord is compressed by this mass (*). There is no evidence of bony involvement on this MR images. Post-enhanced T1-weighted sagittal (e) and axial (f) MR images show homogeneous enhancement. After surgery, this mass was confirmed cavernous hemangioma.
Fig. 6: Epidural lymphoma. 74-years old female with history of diffuse large B cell lymphoma was performed MR due to newly developed motor weakness of both lower extremities. T2-weighted (a) and T1-weighted (b) sagittal images shows that elongated fusiform shape mass is in the epidural space. This mass is isointense to muscle on T1-weighted image, and slightly hyperintense on T2-weighted image. Post-enhanced T1-weighted fat-saturated sagittal MR image (c) shows homogeneous enhancement. Note that this mass is involving body of T8 (*). Axial T2-weighted (d), T1-weighted (e) and post-enhanced T1-weighted fat-saturated (f) MR images show the homogeneous mass in right and posterior aspect of epidural space, involving T8 body(*) and right 8th rib (arrow). Also, this mass is involving right neural foramina of T7/8, T8/9, T9/10 disc space level (not included). The spinal cord is severely compressed by this mass (arrowhead). It is consistent with spinal involvement of lymphoma.
Fig. 7: Epidural abscess. 53-years old female was performed MR and CT imaging for lower back pain. T2-weighted (a), T1-weighted (b) and T2-weighted fat-saturated sagittal(c) images show that bone marrow edema and erosion of endplates in T12 and L1 vertebral bodies. Localized fluid collection is seen at anterior epidural space of T10-L1 level (white arrow), thought to be epidural abscess associated with spondylitis. Anterior subligamentous abscess is also seen at T10-L2 upper body level. Post-enhanced T1-weighted fat-saturated sagittal MR image(d) shows diffuse enhancement of this anterior epidural space of T10-L1 level (black arrowhead), suggesting anterior epidural space. Also geographic enhancement of involved vertebral bodies and endplates of T12 and L1 (*), and wall enhancement of anterior subligamentous abscess are also seen (white arrowhead). Bone window setting sagittal CT image(e) shows geographic osteolytic lesions of the T12 and L1 vertebrae. Soft tissue window setting post-enhancement axial CT image of T12 lower body level(f) shows enhancing soft tissue lesion at anterior epidural space and around vertebral body. Note that small low density lesion with enhancing wall at anterior epidural space(black arrow), suggesting fluid collection.
Fig. 8: Sequestrated disc. 63-years old male was perfored MR imaging due to lower back pain. T2-weighted sagittal MR images of median (a) and left paramedian (b) levels, T2-weighted axial MR image of L5/S1 disc level (c) and the same levels of T1-weighted MR images below(d,e,f). Disc protrusion is noted at L5/S1 level (a,d, arrowhead). Extruded disc is migrated left-superior direction (b,e, white arrow). Axial images show small ovoid shape lesion at left foraminal zone (c,f, black arrow). This lesion is isointense to muscle on T2-weighted image and slightly hyperintense on T1-weighted image, similar to the signal intensity of intervertebral disc. This lesion is thought to be sequestrated disc fragment. Mild disc bulging is also noted at L4/L5 disc space level.
Fig. 9: Ossification of posterior longitudinal ligament (PLL). 79-years old male was performed CT and MR due to neck pain and radiating pain to the left upper extremity. Bone window setting sagittal (a) and axial (b) CT images show calcification along PLL at C4-C6 level. This lesion is seen as low signal intensity on both T2-weighted (c) and T1-weighted (d) MR images (arrowhead). Note that multilevel bulging discs in visible cervical spine.
Fig. 10: Ossification of posterior longitudinal ligament (PLL) and ligamentum flavum (LF). 79-years old female was performed CT and MR. Bone window setting sagittal (a) and axial (b) CT images show ossification of PLL (arrow) at T6/7 disc level to T8 upper body level and ossification of LF (arrowhead) at visible thoracic spine. T2-weighted fat-saturated sagittal (c) and T2-weighted axial (d) MR images also show the ossification of PLL (arrow) and LF (arrowhead). Ossification of PLL and LF result in severe central canal stenosis in this level, most severe at T7/T8 disc level.
Conclusion

We reviewed normal variants and pseudolesions and various disease entities of the epidural lesions of the spine. Because the epidural space of the spine is a narrow and closed space within the bony canal, it is typically difficult to differentiate many epidural space lesions.

But if radiologists experienced with the imaging findings of the typical epidural lesions of the spine, especially its location, signal intensity or attenuation and related structures, and get used to the algorithm for differential diagnosis of the epidural lesions of the spine, it may be helpful to differentiate the various epidural lesions of the spine.

Personal information

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References


