Epidural spinal lesions - pictorial review

Poster No.: C-2102
Congress: ECR 2019
Type: Educational Exhibit
Authors: C. Pinheiro¹, C. T. F. Perry da Câmara², T. V. P. Morais², M. P. Ferreira², M. C. Diogo²; ¹Lisbon/PT, ²Lisboa/PT
Keywords: CNS, Neuroradiology spine, Musculoskeletal spine, MR, CT, Diagnostic procedure, Education, Myelography, Trauma, Infection, Metastases
DOI: 10.26044/ecr2019/C-2102

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.

www.myESR.org
Learning objectives

- To review the **CT and MRI findings** of acquired epidural spinal lesions with illustrative cases.
- To give some clues to aim the correct diagnosis and diagnostic **pitfalls**.
- To perform a **differential diagnosis** combining imaging as well as the patients’ medical history and clinical evaluation.
Background

The **spinal dural sleeve** is a thick, vascularized connective tissue layer that extends from the foramen magnum, to the filum terminale and continues along the filum to the coccyx[1].

The rostrally fusion of spinal and periosteal layers of dura mater at foramen magnum prevents its' intracranial extension [2].

Laterally the dura continues outward around the nerve roots as the dural root sleeves [1].

The **epidural or extradural spinal space**, which is space between the dura mater and the bony spinal canal [3], is a potential space that extends from the foramen magnum to the sacrum. It is divided into divide into anterior, lateral and posterior compartments by anchoring plicae and meningovertebral ligaments [4].

Posteriorly, it's the space between the dura and the ligamentum flava and periosteum of the vertebral bodies, pedicles and laminae and it is most ample at the upper thoracic levels [4]. Anteriorly, the dura is fused with the posterior longitudinal ligament and the annular ligament at the level of each intervertebral disc.

It contains fat tissue-predominantly on the its posterior component, spinal nerves, epidural veins and arteries. The epidural space communicates freely with the paravertebral space via intervertebral foramina [3].

Common **signs and symptoms** of epidural space lesions are related to spinal cord or radicular compression.

**MRI** is the gold standard for spine imaging [4]. Its superior soft tissue visualization and contrast differentiation between normal and pathologic tissues allow early diagnosis and accurate anatomic localization of the lesion [1]. But spinal CT is frequently the first imaging method, especially in an emergent or trauma situation. **CT scan** can elucidate a space occupying lesion, particularly it has a hemorrhagic component, into the spinal canal. It is also a great method providing information on the bony spinal components [1].

Epidural space lesions arise from outside the dura mater and can be grouped into **intrinsic** (arising primarily on the epidural compartment) and **extrinsic** (secondarily involving the epidural compartment).

In both groups infectious, benign and malign neoplasms, traumatic, degenerative and miscellaneous lesions can be found (Fig. 1)
# Differential Diagnosis of Spinal Epidural Space Lesions

<table>
<thead>
<tr>
<th>I. Intrinsic</th>
<th>II. Extrinsic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Miscellaneous</strong></td>
<td><strong>Degenerative</strong></td>
</tr>
<tr>
<td><strong>Traumatic</strong></td>
<td><strong>Infective/Inflammatory</strong></td>
</tr>
<tr>
<td>Hemorrhage, Pseudomeningocele, Fibrosis.</td>
<td>Vertebral osteomyelitis, Pott's spine (Tuberculosis). Pannus (Rheumatoid Arthritis).</td>
</tr>
<tr>
<td><strong>Infective</strong></td>
<td><strong>Traumatic</strong></td>
</tr>
<tr>
<td>Pyogenic Abscess, Tuberculosis or Fungal Granuloma, Hydatid cyst.</td>
<td>Vertebral fracture with retropulsion, Post vertebroplasty cement leak, Post-op spondylolisthesis.</td>
</tr>
<tr>
<td><strong>Neoplastic</strong></td>
<td><strong>Neoplastic</strong></td>
</tr>
<tr>
<td><strong>Benign</strong></td>
<td><strong>Malignant</strong></td>
</tr>
<tr>
<td>Lymphoma, Metastases.</td>
<td>Plasmacytoma, Multiple Myeloma, Metastasis, Lymphoma, Chordoma, Ewing Sarcoma, Chondrosarcoma, Rhabdomyosarcoma, Neuroblastoma, Osteosarcoma</td>
</tr>
</tbody>
</table>

**Fig. 1:** Differential diagnosis of epidural spine lesions

Findings and procedure details

INTRINSIC GROUP

• Traumatic: Hemorrhage

Spinal epidural hematoma is an infrequent but very serious cause of acute neurologic deficit due to spinal cord compression that needs an early diagnosis and rapid surgical treatment [5]. Most cases are "spontaneous." [6]. Traumatic situations occurs between 0.5% to 1.7% of all spinal injuries [5]. Besides trauma other non-spontaneous causes include coagulopathy, pregnancy, disc herniation, tumor, and arteriovenous fistula or malformation [7]. They tend to occur more frequently in the cervicothoracic region in the dorsal epidural space [1]. MRI is the gold standard in recognizing the real cause of cord compression. The mosaic appearance is due to the different intensity areas caused by the hemoglobin degradation products is a pathognomonic sign of disease [8].

Case 1:

An 81-year-old female patient, with a chronic myeloproliferative neoplasm, was admitted in the context of a pulmonary embolism. During the hospital stay, and under anticoagulation therapy, she had an accidental fall. Twenty-four hours later, bilateral distal limb mild paresis and bladder dysfunction signs and symptoms developed.

To rule out a post-traumatic complication an urgent spinal CT scan and a MRI confirmed the epidural hematoma (Fig. 2).

The patient underwent spinal decompression surgery with little symptom improvement.

• Infective: Pyogenic epidural abscess

Or spinal epidural empyema is an uncommon infection of the spinal extradural spaces with abscess formation. There are two types: primary, after the trauma, iatrogenic manipulation or direct introduction of pathogens into the epidural space; and secondary: in case of hematogenous dissemination of microorganisms present outside the epidural space [3].

Patients with diabetes mellitus, intravenous drug abuse, chronic renal failure, excessive alcohol ingestion, immunodeficiency, and local steroid injections are at greater risk factors for developing these infections. S. aureus is the most common agent [1].

Surgical drainage and prolonged antibiotic therapy remain the ideal treatment [3].

Case 2:
A 45-year-old male patient, with history of non-treated C hepatitis and active intravenous drug abuse was admitted in the emergency room with severe lower back pain, fever and a right groin mass. There was a history of femoral vein self-puncture 8 days prior. Four months before this event, he was hospitalized and treated for bacterial endocarditis.

The initial examinations (chest, abdominal, pelvic and spine CT) were normal.

During the hospital stay, he developed respiratory distress due sepsis and was admitted in the intensive care unit.

One month after the admission he underwent a second spine CT scan that revealed L1-L2 spondylodiscitis with epidural empyema (Fig. 3).

EXTRINSIC GROUP

- **Degenerative: herniated disk**

Many degenerative spine changes, such as herniated disc, may cause mass effect on the epidural space.

Disk herniation is a displacement of intervertebral disk material beyond its normal confines, resulting from a perforation of the annulus fibrosis and posterior longitudinal ligament [9]. It can cause compression of the anterior epidural space/ thecal sac, with lateral or medial irritation of nerve root or cauda equina [4].

Most sequestrated and extruded fragments show peripheral contrast enhancement, attributed to an inflammatory response with granulation tissue [4].

**Case 3:**

A 54-year-old female patient with secondary progressive multiple sclerosis with sudden onset high degree of disability with the need of a wheelchair to move. A brain and spine MRI were performed, with no new demyelinating lesions, but showing a cervical disk herniation with granulation tissue causing cord compression with edema.

She was hospitalized in the Neurosurgery department and with a conservative approach, she clinically improved (Fig. 4).

- **Infective: Pott's spine /Tuberculosis (TB)**

Pott's disease or Pott's spine refers to a tuberculous infection of the spine and adjacent soft tissue. While it is uncommon in the western world, there has been an increasing number of cases HIV-related, presented as multidrug-resistant tuberculosis with rapid progression and a higher mortality rate [1].
Spinal tuberculosis accounts for 2% of all cases of TB, 15% of extrapulmonary TB, and 50% of all cases of skeletal TB [10]. The diagnosis remains difficult because it is an indolent disease [1].

**Case 4:**

A 64-year-old male patient with an HIV infection under irregular medical treatment, was admitted in the emergency room with a one-month history of fever, night sweats, persistent cough and weigh loss. Recently he had developed mid-back pain and was unable to walk due to limb paresis. He also complained of urinary incontinence.

An emergent spine CT scan followed by a MRI suggested spinal tuberculosis. A CT-guided percutaneous biopsy of the paravertebral lesion confirmed the diagnosis (Fig.5).

- **Benign neoplastic: Neurofibroma**

Neurofibromas are commonly associated with neurofibromatosis type 1 (NF1), particularly when multiple, but can also occur sporadically [1]. NF1 is a common autosomal dominant disorder in which affected individuals develop both benign and malignant tumors [11].

Neurofibromas develop as discrete focal cutaneous/subcutaneous tumors or more diffuse plexiform neurofibromas that grow along the length of nerves frequently involving multiple nerve fascicles, branches and plexuses [11].

Plexiform neurofibromas associated with NF1 show malignant degeneration in 3% to 5% of cases [1]. They can cause local pain, radiculopathy and spinal cord compression.

**Case 5:**

A 11-year-old girl with the diagnosis of NF1 with associated left giant spinal and paraspinal thoracolumbar plexiform neurofibroma and progressive scoliosis - partially corrected with surgery, was admitted in the emergency room because walking abnormalities due to left limb pain. She also complained of back pain and urinary retention. At physical examination there was a paraparesis with left-limb plegia.

A spinal cord compression was suspected, confirmed with the spine MRI that elucidate neurofibroma growth causing marked cord compression and edema, compatible with malignant transformation - neurofibrosarcoma confirmed on histopathology (Fig. 6).

- **Benign neoplastic: Schwannoma**

Schwannomas are benign, encapsulated nerve sheath tumors composed of proliferating Schwann cells. They are usually solitary lesions and are most commonly sporadic [1]. Multiple schwannomas occur with neurofibromatosis type 2 (NF2).
Together with neurofibroma, they represent the most common primary neoplasia in the spine as well as in the intradural extramedullary space [12]. They are more frequent in adults and if presented in a young child, investigation for NF2 is mandatory.

On imaging schwannomas and neurofibromas are mostly indistinguishable.

Although most of these tumors (both schwannomas and neurofibromas) are entirely intradural, they can also be entirely extradural [1].

Case 6:

A 26-year-old female patient, with an irrelevant past medical history, attended the emergency room with a neck and left upper limb pain. The CT scan revealed an intraspinal canal lesion.

The MRI confirmed the presence of an expansive lesion. The tumor was surgically removed, with the histopathology result of schwannoma (Fig. 7).

- **Malignant neoplastic: Multiple Myeloma**

Multiple myeloma is characterized by multifocal malignant proliferation of monoclonal plasma cells within the bone marrow. It accounts for approximately 1% of all malignant diseases and represents about 10% of hematologic malignancies [13]. It is multicentric disease, with the most common localization being the spine [14]. The bone marrow involvement causes cortical disruption and invasion of the surrounding tissue. Bone pain, pathologic fractures and a spinal cord compression are the most common findings.

Case 7:

A 53-year-old female patient with a known multiple myeloma, presented with progressive paraplegia and a recent onset of severe back pain. An emergent spine MRI was requested confirming disease progression and spinal cord compression (Fig. 8).

- **Malignant neoplastic: metastases**

Spine is the most common osseous site for metastases [15] and third most common after lung and liver metastases. Breast, prostate, thyroid, kidney, and lung cancers are common primary tumors found. [3]. Pain is the most frequent symptom and, in both osteolytic or osteoblastic metastases an epidural component may cause radiculopathy and cord compression [1]. Posterior elements, especially the pedicles, may be involved by this disease [3].

Case 8:
An 83-year-old female patient with a medical history of breast cancer treated 14 years ago, was admitted in the emergency room for a pneumonia. During her hospital stay, she developed progressive paraparesis and urinary retention.

The MRI revealed spinal osteolytic lesions and spinal cord compression (Fig.9).

- **Malignant neoplastic: lymphoma**

Lymphoma is the most common malignancy of the epidural space [1].

Plasmablastic lymphoma is a rare aggressive variant of diffuse large B-cell lymphoma, the most common subtype of non-Hodgkin lymphoma [16]. It was initially proposed as a novel entity in 1997 in a series of HIV-positive patients [17]. It has very rarely been described as presenting with a paravertebral mass or in association with cord compression [17, 18, 19]. Treatment for cord compression includes laminectomy, chemotherapy, and radiotherapy [17].

**Case 9:**

A 33-year-old male patient was admitted into hematologic department because of worsen of lower back pain and paraparesis. He had been diagnosed with a plasmablastic lymphoma 4 months prior to this event. He also had an HIV infection known in the last 10 years but only under medical treatment in the last 8 months. Two weeks before this hospitalization, the spine MRI revealed disease progression with resulting cord compression (Fig. 10).

- **Malignant neoplastic: Mesenchymal chondrosarcoma**

Chondrosarcoma is the third most common primary malignant bone tumor, encompassing 10% to 25% of all primary bone sarcomas [1]. Mesenchymal chondrosarcomas are rare malignancies of the bone and soft tissues and represent 10% of all primary chondrosarcomas [20]. They are more aggressive, occurring in younger patients, with lower survival rates and have a high propensity to metastasize to the lungs, lymph nodes, and other bones [21,22].

Extra skeletal mesenchymal chondrosarcoma is relatively frequent in association with the meninges, but rarely in the spinal region [20].

**Case 10:**

A 13-year-old girl was admitted in the emergency due to 2-month history of progressive walk abnormalities. She also presented signs and symptoms of bladder and bowel dysfunction.
The spine MRI showed an extradural thoracic solid lesion, involving the right intervertebral foramina from T1 to T5. Because of the rapid-clinical deterioration a hematologic disease was consider. She underwent spinal decompression surgery and the histopathology report confirmed a mesenchymal chondrosarcoma (Fig.11).
Images for this section:

**Fig. 2:** A: Sagittal spinal CT scan; B and C: Sagittal T2WI; D and E: Axial T2WI. An heterogeneous prominent epidural mass extending from T3 to T8, measuring 8mm in anteroposterior length, spontaneously hyperdense (A: blue asterisk), with variable signal intensity on T2W imaging - Mosaic appearance (red arrow). It determines left deviation and compression of the spinal parenchyma with marked edema (yellow arrowhead).

© Centro Hospitalar Lisboa Central - Lisbon/PT

**Fig. 3:** A: Sagittal spinal CT scan; B: Sagittal T2/STIR; C: Sagittal FS T1WI+Gadolinium (Gd); D: Sagittal FS T1WI+Gd; E: Sagittal T2/STIR; F: Axial T2WI. Osteolytic lesion at L1-L2 level with a possible abscess formation (red arrow), with an epidural empyema with
septations (blue asterisk) involving the cervical, thoracic and lumbar-sacral spine, in a circular mode, with cord compression and edema (yellow arrowhead).

© Centro Hospitalar Lisboa Central - Lisbon/PT

**Fig. 4:** A: Sagittal T2/STIR; B: Axial T2WI; C: Axial T1WI+Gd; D: Sagittal T1WI+Gd; E: Sagittal STIR. Median disk herniation (red arrow) with associated inflammatory enhancing tissue (green arrow), determining mass affect over the cervical spinal cord, with resulting edema (yellow arrowhead), that resolved (E). T2/STIR hyperintense demyelination lesions (blue asterisks) of the cord in the context of Multiple sclerosis.

© Centro Hospitalar Lisboa Central - Lisbon/PT
**Fig. 5:** A: Sagittal Spinal CT scan; B: Sagittal T2WI; C: Axial T2WI; D: Axial T1WI+Gd; E: Sagittal FS T1WI+Gd. Extensive osteolytic lesion at the T9-T10 level (red arrow), with marked disk height reduction and a large paravertebral, foraminal and anterior epidural mass (orange thunder). MRI allowed a better delineation and characterization of the infectious lesions' expansion, with multiple well circumscribed paraspinal and epidural collections (blue asterisk), with well-defined enhancing margins causing mass effect and edema (yellow arrowhead) of the spinal cord (green arrow).

© Centro Hospitalar Lisboa Central - Lisbon/PT

---

**Fig. 6:** A: Coronal FS T2WI; B Coronal T2WI; C: Sagittal T2WI; D and E: Axial T2WI. Left convex scoliosis of the lumbar spine. Giant left thoracic and abdominal plexiform neurofibroma (orange thunder) with increased size and malignant transformation (B, D
and E), extending into spinal central canal, through intervertebral foramina, determining posterior displacement and compression of the spinal cord (green arrow).

© Centro Hospitalar Lisboa Central - Lisbon/PT

**Fig. 7:** A: Sagittal T2/STIR ; B: Coronal T2WI ; C: Axial CT scan ; D: Axial T2WI ; E: Sagittal FS T1WI+Gd; F: Coronal T1WI+Gd. On CT scan (C) a left posterior arch bone expansion/remodeling lesion with intra spinal canal insinuation (red arrow) from C5 to C7. It's a heterogenous mostly solid lesion, with cyst components (blue asterisk), with vivid gadolinium enhancement. It determines mass effect with right displacement of the spinal cord (green arrow).

© Centro Hospitalar Lisboa Central - Lisbon/PT
Bone lesions involving the vertebral bodies and posterior arch elements, with associated paravertebral masses, with anterior, posterior and lateral epidural spaces extension (blue asterisks), with spinal cord right displacement (green arrow), and compression from T2 to T5 - cordedema (yellow arrowhead). Note the bony elements with patchy low T1 and STIR signal regions of bone marrow replacement.
Fig. 9: A: Sagittal T2WI ; B Axial T2WI C: Axial FS T1WI+Gd; D Sagittal T1WI+Gd. Osteolytic lesions involving the right pedicle of T6 (B) and contiguous intervertebral foramina, with associated paraspinal and extradural soft tissue mass (blue asterisk), that extends from T2 to T9, with bilateral compression of the spinal cord (green arrow) - note the cord edema (yellow arrowhead).

© Centro Hospitalar Lisboa Central - Lisbon/PT
Fig. 10: A: Sagittal T1WI; B and C: Sagittal FS T1WI+Gd; D and E: Axial FS T1WI+Gd. Diffuse bone marrow infiltration resembling a "salt and pepper" pattern. (A). Tumor progression (C, D and E) with several epidural masses blue asterisk), extending into the intervertebral foramina, mainly on the thoracic spine, with cord mass effect (green arrow).

© Centro Hospitalar Lisboa Central - Lisbon/PT
**Fig. 11:** A: Coronal T2WI; B: Coronal FS T1WI+Gd; C: Sagittal FS T2WI; D: Axial T2WI. Right extramedullar and extradural solid lesion (blue asterisk), with iso-to-hyper signal on T1 and T2, presenting flow voids (red arrow). Upper limit C7-T1 disk and lower limit T4-T5 disk. The spinal cord is displaced and compressed to the left (green arrow).

© Centro Hospitalar Lisboa Central - Lisbon/PT
Conclusion

Many of these lesions present with insidious neurological deterioration suggesting spinal cord compression. Patients often go to the emergency room where Spinal CT - in most cases being the first imaging method - may show intra spinal canal lesions or bone remodeling/ destruction.

**MRI imaging is the gold standard method** to correctly evaluate the lesions true extension, as well as its signal intensity features and mass effect over the spinal canal.

A **systematic approach** combined with relevant clinical information, including age of the patient, medical history and neurological examination is crucial to aid the correct diagnosis.
References


