Imaging Of Cystic Paravertebral Masses: Differential Diagnosis and Key Discriminators
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Discuss key anatomic structures of the thoracic paravertebral compartment

Describe characteristic imaging appearances of various cystic paravertebral masses with pathologic correlation

Give a focused, organized differential diagnosis for a cystic paravertebral mass

Narrow the differential diagnosis based on clinical history and key distinguishing imaging features
Key Anatomy

- Prevascular
- Visceral
- Paravertebral

**Superior border**: Thoracic inlet

**Inferior border**: Diaphragm
• Prevascular

• Visceral

• **Paravertebral**

  *Anterior border:* 1 cm posterior to anterior vertebral body margin

  *Posterolateral border:* Posterior chest wall at transverse process of the thoracic spine
• The paravertebral compartment of the thorax contains numerous different anatomic structures, and pathology in this space can present in multiple ways.
• Cystic paravertebral masses of the thorax share common imaging characteristics but have a broad differential diagnosis.
• While the term cyst implies a fluid filled structure lined by epithelial cells, not all cystic paravertebral masses are true cysts.
• Infectious, post-traumatic, vascular, developmental, and benign and malignant neoplasms can present as a cystic paravertebral mass in the chest.
Key Epidemiology

- Cysts comprise 15-20% of all mediastinal masses
- Bronchogenic cysts comprise 50-60% of mediastinal cysts
- Up to 20% of mediastinal cysts lack histological features to allow classification
32 year old woman with neurofibromatosis type 1. PA chest radiograph shows a mass in the apex of the right hemithorax with obtuse margins relative to the mediastinal contours. This mass ascends above the clavicle, suggesting a posterior mediastinal mass. Large right axillary mass is partially imaged.
32 year old woman with neurofibromatosis type 1. PA chest radiograph shows a mass in the apex of the right hemithorax with obtuse margins relative to the mediastinal contours (arrow). This mass ascends above the clavicle, suggesting a posterior mediastinal mass. Large right axillary mass is partially imaged.
32 year old woman with neurofibromatosis type 1. Axial contrast-enhanced CT image shows an expansile soft tissue attenuation mass centered in the right paravertebral compartment and right neuroforamen, eroding the adjacent vertebral body and displacing mediastinal contents anteriorly. Also noted is an enormous right axillary mass with faint internal septations.
32 year old woman with neurofibromatosis type 1, lateral thoracic meningocele and right axillary malignant peripheral nerve sheath tumor. Erosion of the neuroforamen by a cystic mass and the associated nerve sheath tumor are keys to the diagnosis of lateral thoracic meningocele.
Axial CECT (left), axial T2W MR (center), and axial T1W (right) show a fluid filled cyst in the paravertebral compartment. The lesion is fluid density on CT, T2 hyperintense and T1 hypointense consistent with simple fluid. Foregut duplication cysts are developmental in origin and fall within the broader category of bronchopulmonary foregut malformations. Duplication cysts can be subdivided into bronchogenic cysts, neurenteric cysts and esophageal duplication cysts.
Axial T2 weighted image with fat saturation (left) and axial T1 weighted image shows a fluid-filled cyst in the paravertebral compartment. Even in the paravertebral compartment, neurenteric cysts are rare in the absence of a vertebral body segmentation anomaly. Duplication cysts are usually asymptomatic but can result in mass effect on the esophagus resulting in dysphagia or they can be complicated by infection, hemorrhage and/or rupture.
Axial CT angiogram and coronal T1W MR of a 21-year-old male with coccidioidomycosis reveal a paraspinal abscess with associated osteomyelitis (white arrows) in addition to a cavitary lung lesion invading into the chest wall (white arrowhead). Pulmonary cocci can be acute, chronic, or disseminated. Chronic coccidioidomycosis can result in cavitary lesions and occasionally empyema. In the paraspinal location, this can result in osteomyelitis by direct extension.
58 year old man with beta-thalassemia. PA and lateral chest radiographs show lobular opacities projecting over the lower thoracic spine. The bones are demineralized and the process appears bilateral.
58 year old man with beta-thalassemia. Axial CECT and sagittal T2 weighted MRI show corresponding paravertebral masses with focal T2 hyperintensities (arrow) indicating cystic regions in extramedullary hematopoiesis. Bone demineralization is also present. Bilaterality and positioning about the lower thoracic spine are characteristic of this process.
58 year old man with beta-thalassemia. Extramedullary hematopoiesis occurs as a compensatory mechanism in blood element deficiency disorders and stem cell disorders. In a patient with anemia and bilateral paraspinal masses, this entity should be considered high on the differential diagnosis.
29 year old man with lateral thoracic meningocele. Coned-down frontal and lateral chest radiographs show a rounded, well circumscribed posterior mediastinal mass.
Contrast-enhanced axial CT better defines the lesion as a cystic mass arising from the spinal canal and expanding the left neural foramen. Smooth expansion without erosive changes suggest benignity. The mass follows CSF signal on the axial T2 MR image. There is dural ectasia, which causes smooth scalloping of the posterior margin of the vertebral body. The thoracic cord is visible and displaced into the left neural foramen. The margins of the mass are contiguous with the thecal sac, confirming the diagnosis of lateral thoracic meningocele. Protrusion of the thecal sac through a neural foramen is known as meningeal dysplasia.
29 year old man with lateral thoracic meningocele. A diagnosis of lateral thoracic meningocele should prompt a search for other stigmata of neurofibromatosis type 1 or Marfan syndrome.
Axial non-contrast chest CT demonstrates a right paravertebral mass emerging from the neural foramen, consistent with known history of schwannoma. The focal T2 hyperintensity on axial MR T2WI corresponds to cystic regions, an uncommon presentation of this tumor.
Coned-down PA and lateral chest radiographs demonstrate an ovoid mass silhouetting the left paratracheal stripe and localized to the paravertebral region on the lateral image. Ascent above the clavicle on the PA radiograph alone suggests localization to the posterior compartment.
Contrast-enhanced axial CT through the upper chest demonstrates a circumscribed, ovoid, paravertebral soft tissue mass with central low attenuation and faint peripheral solid enhancement. Note the lack of osseous erosion or invasion into adjacent structures, suggesting benignity.
The differential diagnosis for a mass with these characteristics includes nerve sheath tumor (neurofibroma and schwannoma), as well as paraganglioma, foregut duplication cyst, and sympathetic ganglion tumors (ganglioneuroma and neuroblastoma).
Coronal T2WI with fat saturation shows a right paravertebral mass spanning multiple vertebral segments. This appears contiguous with several neural foramina. The mass is predominantly T2 hyper-intense but contains some internal T2 hypo-intense components.
Axial T1 pre- and post-contrast MR images with fat saturation further defines the lesion as isointense to skeletal muscle with relatively homogeneous solid enhancement following administration of gadolinium. The mass is well circumscribed and does not appear to invade adjacent structures or erode bone.
The differential diagnosis includes plexiform neurofibroma and sympathetic ganglion tumor. If the mass showed malignant features such as irregular bony erosion or invasion into adjacent tissues, considerations would include neuroblastoma in a child or malignant peripheral nerve sheath tumor.
Osseous Tumors

Axial T1 post-gadolinium fat saturated image shows an aggressive, enhancing mass centered in the paravertebral compartment. Internal low attenuation areas are consistent with cystic spaces within the tumor (arrow). Surgical hardware causes significant dephasing artifact in the thoracic spine. The differential diagnosis includes sarcoma or malignant neurogenic tumor. Chondrosarcoma is the most common primary chest wall malignancy in the adult and may be centrally necrotic at presentation.
Coned-down PA chest radiograph shows a smoothly marginated mass in the left posterior mediastinum, projected behind the left proximal clavicle. Axial CECT shows a lobulated, low attenuation mass in the left paravertebral compartment with erosion of the adjacent neuroforamen and extension into the central canal.
Osseous Tumors

Axial T2 (left) and T1 post-gadolinium with fat saturation (right) images show an infiltrating mass centered in the left paravertebral compartment, obliterating the central canal and eroding into vertebral body. Fluid signal regions internally (arrow) indicate small cystic regions. The differential diagnosis for this tumor includes myxoid chondrosarcoma, schwannoma, or malignant neurogenic tumor. Upon resection, this rare chondroid lipoma has cystic regions.
The modern compartment system of the mediastinum on CT is defined by anatomic boundaries, which aids in the classification of mediastinal masses.

The anterior border of the paravertebral compartment is 1 cm posterior to the anterior margin of the vertebral body. The posterolateral borders of the paravertebral compartment extends along the margins of the thoracic vertebral bodies to the tips of the transverse processes.

The differential diagnosis for a paravertebral mass is broad and includes neurogenic neoplasms, extramedullary hematopoiesis, congenital foregut cysts, intrathoracic meningoceles, paraspinal abscesses, and cystic neural masses.
Extramedullary hematopoeisis should be considered in any patient with known sickle cell disease, thalassemia, or chronic anemia of any cause presenting with bilateral paravertebral masses.

Patients with neurofibromatosis type 1 will present with nerve sheath tumors such as neurofibromas (plexiform and solitary), schwannomas, and may also have intrathoracic meningoceles.

Features of osseous erosions or invasion of the chest wall or visceral compartment suggest an aggressive etiology such as malignancy or infection. The most common chest wall malignancy in adults is chondrosarcoma.


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