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Imaging Features of Lymphangioleiomyomatosis: Diagnostic Pitfalls

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Abstract

OBJECTIVE—The objective of this article is to illustrate CT findings that may be misinterpreted and lead to unnecessary biopsy or surgical procedures in patients with lymphangioleiomyomatosis.

CONCLUSION—Sequelae of pleurodesis, acutely hemorrhagic renal angiomyolipomas, and lymphatic involvement with lymphangioleiomyomatosis including enlarged lymph nodes and lymphangioleiomyomas are common benign conditions seen in patients with lymphangioleiomyomatosis that may be misdiagnosed on CT for malignancy and may prompt unnecessary biopsy and surgery. Ruptured abdominal pelvic lymphangioleiomyomas may be mistaken for appendicitis and other acute abdominal pelvic events.

Keywords

lung disease; lymphangioleiomyoma; lymphangioleiomyomatosis; pleurodesis; renal angiomyolipoma

Lymphangioleiomyomatosis is a rare idiopathic disorder that affects predominantly premenopausal women [1]. Its characteristic histologic and pathologic features are proliferation of atypical smooth-muscle cells (lymphangioleiomyomatosis cells) that result in replacement of the lung parenchyma with thin-walled cysts and the development of renal angiomyolipomas, lymphadenopathy, and lymphangioleiomyomas [1–4]. Recent guidelines recommend that patients with lymphangioleiomyomatosis or suspected lymphangioleiomyomatosis undergo baseline abdominal-pelvic CT to identify renal angiomyolipomas, enlarged lymph nodes, and lymphangioleiomyomas to plan management and follow the evolution of the disease [5]. The imaging findings of these abnormalities and the sequelae of their treatment may be confused with malignancies and other entities that may prompt unnecessary biopsies and surgical interventions [6]. Because the extent of lung disease may be severe and may result in decreased lung function, avoidance of surgery and other invasive procedures that might require ventilatory management is of particular importance in patients with lymphangioleiomyomatosis [7].

In this article, we illustrate examples of CT findings that may pose diagnostic dilemmas and suggest appropriate management.

Pleural Masses Resulting From Pleurodesis

Approximately half of patients with lymphangioleiomyomatosis require pleurodesis as treatment of recurrent or symptomatic pneumothorax or chylous pleural effusions [7]. Rupture of the thin-walled cysts distributed diffusely in the lungs—the most common feature of lymphangioleiomyomatosis—results in pneumothorax in up to 55% of patients [7] (Fig. 1). Proliferation of lymphangioleiomyomatosis cells in the lymphatics disrupts their walls and allows chyle to leak into the pleural space and form chylous pleural effusions [1]. The effusions may be large and may cause atelectasis, dyspnea, cough, and chest pain [7, 8].

The sequelae of all types of pleurodesis (mechanical, talc, chemical) include pleural calcification and pleural masses in approximately 23% and 14%, respectively [9] (Fig. 2). The masses may be solid or complex and because of their calcification may be confused with mesothelioma or other pleural malignancies [9] (Fig. 3). If a pleural mass is discovered in a patient with lymphangioleiomyomatosis, an inquiry for a history of pleurodesis should be made. If the patient has had pleurodesis, immediate biopsy should not be recommended; instead, the patient should be followed with imaging and biopsy should be reserved for enlarging masses.

Hemorrhagic Angiomyolipomas Confused With Renal Malignancy

Renal angiomyolipomas are benign masses that contain fat, blood vessels, and muscle and are present in up to 27% of patients with lymphangioleiomyomatosis [10] (Fig. 4). A major complication of them is hemorrhage that may present with flank pain or shock [6]. On CT or sonography, a hemorrhagic angiomyolipoma may appear as a complex renal mass that may be misdiagnosed as hemorrhagic renal cell cancer [6] (Fig. 5). This misdiagnosis may prompt nephrectomy instead of the accepted management for hemorrhaging angiomyolipoma, which is arterial embolization or partial nephrectomy [11]. These patients are commonly young (mean age, 42 years) and frequently have bilateral renal masses that may develop future complications. Hence, it is especially important to avoid unnecessary nephrectomy and conserve as much renal tissue as possible to preclude or delay the need for a renal transplant or dialysis.

Thus, if a heterogeneous renal mass is discovered in a patient with lymphangioleiomyomatosis, the radiologist should look for fat in the mass to establish the diagnosis of angiomyolipoma.

Lymphatic Involvement With Lymphangioleiomyomatosis Confused With Malignancies

Lymphangioleiomyomatosis cells infiltrate the lymphatics resulting in enlargement of lymph nodes that may be confused with adenopathy [3, 4] (Fig. 6). In up to 29% of patients, lymphangioleiomyomatosis cells may obstruct lymphatics resulting in complex masses termed “lymphangioleiomyomas” [6] (Fig. 7). When large, they may compress adjacent organs and cause symptoms that include back pain, abdominal pain, urinary frequency, constipation, and lower extremity edema [6].

Lymphangioleiomyomas have imaging characteristics similar to lymphoma and other neoplasms that may lead to biopsy or other surgical interventions. Indeed, patients may be diagnosed with lymphangioleiomyomatosis only on biopsy of lymphangioleiomyomas to rule out a malignant neoplasm [12, 13] (Figs. 7 and 8).

Lymphangioleiomyomas have been shown to exhibit diurnal variation in size, enlarging during the day and shrinking during the night [12] (Figs. 9 and 10). This variation in size can

be detected on imaging and the diagnosis of lymphangioleiomyomas can be established with CT, ultrasound, or MRI [12, 14]. Although ultrasound may be considered the modality of choice, given that it is readily available and has no associated radiation exposure, some lymphangioleiomyomas may not be completely imaged with ultrasound because of patient body habitus or interference from bowel gas, thus precluding exact measurement of the lymphangioleiomyomas and making the diagnosis less secure [12, 14]. Diurnal variation has been postulated to result from increased flow of chyle from the gut after meals and increased flow of lymph from the lower extremities with normal daily activity, such as walking and exercising [12].

Awareness of the high prevalence of lymphangioleiomyomas in patients with lymphangioleiomyomatosis and the phenomenon of diurnal variation should help the radiologist establish the diagnosis of lymphangioleiomyomas and avoid unnecessary surgical intervention.

Discovery of a mediastinal, retroperitoneal, or pelvic mass in a patient with a history of lymphangioleiomyomatosis or with lung or renal findings suggestive of lymphangioleiomyomatosis should prompt consideration of lymphangioleiomyomas. Morning and afternoon CT, sonography, or MRI should be performed to evaluate for diurnal variation in size. If the mass increases in size, then the diagnosis of lymphangioleiomyomas is secured. If the mass does not increase in size, then follow-up or biopsy is warranted to exclude the possibility of neoplasm [12].

Rupture of Lymphangioleiomyoma Mimicking Acute Appendicitis

Lymphangioleiomyomas may rupture and release chyle into the peritoneal cavity resulting in a chemical peritonitis and acute abdominal symptoms that may mimic appendicitis [15, 16]. CT may reveal free abdominal fluid and a complex mass. Given this clinical scenario, the likely diagnoses include acute appendicitis. However, in patients with lymphangioleiomyomatosis, given the high frequency of lymphangioleiomyomas, previous imaging studies should be reviewed to determine whether the patient has lymphangioleiomyomas [6]. Evidence of rupture of lymphangioleiomyomas as the cause of the acute symptoms includes a decrease in the size of the mass between the previous and current imaging studies and free fluid in the abdomen and pelvis (Fig. 11).

Conclusion

Common abnormalities in patients with lymphangioleiomyomatosis can have imaging and clinical features that may be mistaken for malignancies and other conditions in need of biopsy or surgical intervention. Awareness of these features and clinical scenarios should allow the radiologist to determine the correct diagnosis and prevent unnecessary therapeutic and surgical interventions in these patients who may be at increased surgical risk because of underlying lung disease.

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Fig. 1.
34-year-old woman with severe involvement of lungs with lymphangioleiomyomatosis.
Axial high-resolution CT image of chest with patient prone shows diffuse replacement of
lung parenchyma with thin-walled lung cysts of various sizes.

Fig. 2. 57-year-old woman with lymphangioleiomyomatosis and history of pleurodesis to treat recurrent pneumothoraces. Axial enhanced CT image shows large noncalcified heterogeneous pleural mass that has remained stable during 5 years of follow-up.

Fig. 3. 79-year-old woman with lymphangioleiomyomatosis and history of pleurodesis. Axial enhanced CT image shows right pleural thickening and calcification and left complex pleural mass that has been stable during 3 years of follow-up.

Fig. 4. 32-year-old woman with lymphangioleiomyomatosis. Axial enhanced CT image of abdomen shows multiple right renal masses (*arrow*) with fatty components diagnostic of angiomyolipoma.

Fig. 5. 43-year-old woman with lymphangioleiomyomatosis who presented with sudden right flank pain. Axial enhanced CT image shows complex right renal mass that contains areas that measure less than -16 HU in attenuation and are consistent with fat (*arrow*) diagnostic of renal angiomyolipoma. Note fluid in subcapsular space (*arrowhead*) consistent with previous hemorrhage.

Fig. 6. 42-year-old woman with lymphangioleiomyomatosis. Axial enhanced CT image shows enlarged retroperitoneal nodes (*arrows*).

Fig. 7. 49-year-old woman who presented with abdominal pain. Axial enhanced CT image of abdomen shows complex retroperitoneal mass (*arrow*) provisionally diagnosed as lymphoma until biopsy established diagnoses of lymphangioleiomyoma and lymphangioleiomyomatosis.

Fig. 8. 54-year-old woman who presented with pelvic pain. Axial enhanced CT image of pelvis shows complex right pelvic mass (*arrow*) originally diagnosed as ovarian cancer. After four courses of chemotherapy with no change in size of mass, oophorectomy was performed and diagnoses of lymphangioleiomyoma and lymphangioleiomyomatosis were established. Note on this study patient also has ascites (*arrowhead*) and complex left pelvic mass.

Fig. 9. 33-year-old woman with lymphangioleiomyomatosis and pelvic lymphangioleiomyoma
A and B, Axial delayed enhanced CT images of pelvis show perivesical mass (*arrow*) increased in size between 9:00 am (**A**) and 4:00 pm (**B**). Note that perirectal masses did not increase in size to same extent as perivesical mass.

Fig. 10. 42-year-old woman with lymphangioleiomyomatosis who presented with complaints of right pelvic pain and dysuria

A, Axial CT image of pelvis shows multiloculated right pelvic mass (*arrow*) that compresses and displaces bladder (*arrowhead*) to left.

B, Sonogram of pelvis obtained using transabdominal approach at 8:30 am shows multiloculated right pelvic mass (*arrows*) that measures $8.9 \times 5.5 \times 9.4$ cm (volume, 453 cm^3).

C, Repeat sonogram obtained on same day at 4:00 pm shows mass (*arrows*) has increased in size. Mass now measures $9.2 \times 5.7 \times 11.8$ cm (volume, 617 cm^3) and contains more cystic spaces than it did when sonogram was obtained earlier in day (**B**).

Fig. 11. 44-year-old woman with lymphangioliomyomatosis and retroperitoneal lymphangioliomyoma

A, Baseline enhanced axial CT image of lower abdomen showed large retroperitoneal lymphangioliomyoma (*arrow*) and normal appendix (*arrowhead*).

B, Four months after **A**, patient presented with right lower quadrant pain initially diagnosed as appendicitis. CT image shows collapse of lymphangioliomyoma (*straight arrow*) and fluid in right paracolic gutter (*curved arrow*) adjacent to slightly thickened appendix (*arrowhead*) indicating rupture of lymphangioliomyoma.