



Thymic carcinoma vs. lung carcinoma—a radiologist perspective: extended abstract

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Introduction

Differentiating thymic carcinoma from lung carcinoma is relatively straightforward in the majority of cases from an imaging standpoint. There are a minority of cases, however, when large masses involve the lung parenchyma as well as the mediastinum, that differentiation can be difficult. This overlap of anatomic spaces makes distinguishing the origin of the tumor difficult with imaging. While there are no conclusive means to differentiate these tumors, some patterns can be helpful.

Imaging modalities

Contrast enhanced CT is the most common imaging modality utilized to evaluate thymic and lung carcinoma primarily due to the following: it can be obtained rapidly, is widely available, and can characterize the tumor as well as extent of local and distant spread (1). MRI is performed in patients who wish to avoid radiation exposure, are allergic to CT contrast, or have renal dysfunction. MRI is most often utilized to answer specific questions, often involving a cystic component of tumors or extent of local invasion (2). Routine FDG PET/CT has an overall limited use specifically in the differentiation of thymic carcinoma from lung carcinoma since both tumors are aggressive and metabolically active. Some patterns of spread can favor one diagnosis, for example drop pleural metastases in thymic carcinoma and multi-nodal and extrathoracic metastases in lung carcinoma. FDG PET/CT can also be helpful in staging and in the assessment of treatment response.

Newer PET/CT agents are being developed and studied.

Gallium 68 DOTATATE is a radiotracer that is more specific for neuroendocrine tumors and has been shown to help identify thymic neuroendocrine tumors and metastasis. Hephzibah *et al.* recently reported that in a known neuroendocrine tumor, Gallium 68 DOTATATE detected orbital, supraclavicular, mediastinal, and hilar metastasis that were not identified by FDG PET/CT (3).

Another new quinolone based radiotracer acts as a fibroblast activation protein inhibitor, or FAPI, and shows promise evaluating tumors which overexpress fibroblast activation protein. Yang *et al.* reported Gallium 68 FAPI uptake in a thymic squamous cell carcinoma, differentiating the tumor from lymphoma (4). Gallium 68 FAPI uptake has also been reported in at least 28 other cancer types, which limits utilization specifically in the differentiation of thymic carcinoma from lung carcinoma, but it does reflect the potential role of receptor specific and tumor specific imaging in the future for mediastinal mass evaluation (5).

Recent literature

Recent studies have discussed methods to differentiate various WHO classifications of thymoma from thymic carcinoma and to differentiate thymic carcinoma from other prevascular tumors such as lymphoma and germ cell tumors (6,7). Various imaging tools to differentiate between prevascular mediastinal tumors include CT, MRI, and dual-energy CT, SUV max thresholds, MRI DWI/ADC characteristics and maps, CT and MRI perfusion parameters, and radiomics (8-13). Unfortunately, there is no literature specifically addressing how to differentiate between thymic carcinoma and lung carcinoma.

Clinical patterns

There are a few clinical patterns that do somewhat differentiate between thymic carcinoma and lung carcinoma. Thymic carcinomas are quite rare, occurring in approximately 1.5 persons per million. Thymic carcinomas are more common in Asian and Pacific Islanders. While associated paraneoplastic syndromes, such as myasthenia gravis, are common with thymoma, they are quite rare in thymic carcinoma, with only a few case reports in the literature. Conversely, lung carcinoma is quite common, being the overall third most common form of malignancy, with the most common risk factor being smoking. Due to significant overlap, however, clinical patterns are of limited benefit alone to differentiate between these two tumors.

Imaging patterns

While there are no imaging findings that conclusively differentiate between thymic carcinoma and lung carcinomas, there are patterns that make one more likely than the other.

Several image findings suggest thymic carcinoma over lung carcinoma. Areas of pleural nodularity or spread, called drop metastases, especially when unilateral, are classic in thymic carcinoma, with the caveat that pleural metastasis can be seen in lung carcinoma. A second common pattern in thymic carcinoma is areas of cystic change. As previously discussed, MRI can help evaluate the cystic component of a tumor. While lung cancers can have areas of necrosis, true cystic change is less common.

Alternatively, there are several imaging characteristics that suggest lung carcinoma instead of thymic carcinoma. First, multi-station nodal disease is more common in lung carcinoma as thymic carcinoma more commonly presents with local nodal disease. A second pattern suggestive of lung carcinoma is adrenal metastasis. While thymic carcinoma can metastasize to the adrenal glands, this is much more common in lung carcinoma. A third imaging pattern suggesting lung carcinoma over thymic carcinoma is widespread metastasis. Finally, in the setting of underlying smoking-related emphysema, lung cancer is statistically more common. It should be noted, however, that patients with thymic carcinoma can also have smoking-related emphysema.

Conclusions

It is sometimes difficult by imaging alone to differentiate

between thymic carcinoma and lung carcinoma. There are a variety of imaging patterns, however, that suggest one or the other. In problematic cases, a multidisciplinary team approach combining clinical, radiologic, and pathologic information is useful. While the newer PET radiotracers such as Gallium 68 DOTATATE and Gallium 68 FAPI do not specifically differentiate thymic carcinoma from lung carcinoma, they do point to the continued need for research into tumor specific and receptor specific imaging that may offer additional benefit in the future.

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