LEARNING OBJECTIVES

After completing this CME-SAM activity, physicians should be better able to:

- Identify the epidemiology of thymic epithelial neoplasms.
- Compare the relative advantages and disadvantages of CT, MRI, and FDG-PET for the evaluation of thymic epithelial neoplasms.
- Accurately apply the 2004 WHO classification and clinical Masaoka-Koga staging system.

ANSWERS

*1. Which of the following paraneoplastic syndromes is MOST COMMONLY associated with thymoma?
   (a) Hypogammaglobulinemia
   (b) Myasthenia gravis
   (c) Pure red cell aplasia
   (d) Cushing syndrome

   Answer is B. As many as half of thymoma patients present with systemic complaints and paraneoplastic syndromes due to secretion of hormones, antibodies, or cytokines by the tumor. Of these paraneoplastic syndromes, myasthenia gravis is the most common and occurs in 30% to 50% of patients with thymoma. It is more commonly encountered in women.

   Answer A is incorrect. Hypogammaglobulinemia occurs in 10% of thymoma patients.

   Answer C is incorrect. Pure red cell aplasia occurs in 5% of thymoma patients.

   Answer D is incorrect. Thymic carcinoid is rare and accounts for about two per cent of all carcinoid tumors. Rarely, carcinoid tumors of thymus, not thymoma, may be associated with Cushing syndrome due to ectopic ACTH production.

   Please see the following references for further study:

*2. In regards to the clinical Masaoka-Koga staging of a newly diagnosed thymoma, which of the following statements is CORRECT?
   (a) By CT, a 2-cm mediastinal lymph node is suggestive of stage III thymoma.
   (b) A 2-cm FDG-avid nodule in the ipsilateral major fissure constitutes stage IVb disease.
   (c) It is most important to distinguish between stage I + II and stage III + IV disease.
   (d) The clinical Masaoka-Koga staging is assigned by the radiologist, the pathologic staging by the surgeon.

   Answer C is correct. The treatment of completely resected Masaoka-Koga stage I or II is surgery alone. In treating more advanced disease, in particular locoregional spread into neighboring mediastinal organs (stage III disease), neoadjuvant chemotherapy is usually administered prior to surgery to increase the likelihood of complete resection. Although the treatment scheme may seem straightforward, it is based on the Masaoka-Koga staging system, a postsurgical staging system that relies on microscopic identification of disease spread. However, since patients with advanced disease, that is, stage III or IV, receive neoadjuvant chemotherapy, this advanced stage should be identified preoperatively, by imaging. Thus the most important role of the radiologist staging thymoma is to identify stage III and IV disease.

   Answer A is incorrect. Although a 2-cm mediastinal lymph node constitutes lymphadenopathy by CT and would be suggestive of metastatic involvement, mediastinal lymph node involvement is considered stage IVb disease, not stage III.

   Answer B is incorrect. An FDG-avid nodule in the fissure would be suggestive of a pleural metastasis. However, per the Masaoka-Koga staging system, pleural metastasis is consistent with stage IVa disease.

   Answer D is incorrect. The Masaoka-Koga stage is assigned after surgery. At surgery, the specimen must be marked and its orientation communicated to the pathologist; without good communication between the surgeon performing the thymectomy and the pathologist, there may be failure to recognize tissue in the specimen such as mediastinal pleura, which may lead to incorrect staging. However, the final Masaoka-Koga staging is confirmed by the pathologist, not the surgeon, who must determine if there is any microscopic invasion through capsule, abutting mediastinal organs, or other details that can change staging dramatically.

© 2013 Lippincott Williams & Wilkins www.thoracicimaging.com | 1
Thus, when SUVmax is high, a biopsy is usually needed to differentiate lymphoma from other tumors.

aggressive than thymoma. Although low-grade thymoma tends to have lower grade FDG activity, there is overlap of the longer used. What used to be called type C thymoma is now a different entity, thymic carcinoma, which is much more

Answer D is incorrect.

thymic cancer but not in those with thymoma.

Answer is B. Studies assessing the use of FDG-PET in thymic epithelial malignancies have reviewed only small cohorts of 10 to 51 patients. Early results consistently showed that FDG uptake is much higher in thymic carcinoma than in thymoma, which correlates with the more aggressive nature of thymic carcinoma.

Answer A is incorrect. In general, CT is superior to MRI in the diagnosis of most anterior mediastinal tumors. In a study assessing the diagnostic accuracy of CT versus MRI in 127 patients with anterior mediastinal tumors (thymoma, thymic carcinoma, thymic cyst, mature teratoma, malignant germ-cell tumor, and lymphoma), the correct first choice diagnosis was made by CT in 61% patients, by MRI in 56% patients, and by a combination of CT and MRI in 86% of patients. CT was equal or superior to MRI in the diagnosis of all anterior mediastinal tumors except for thymic cysts.

Answer C is incorrect.

The classification type C thymoma, described in the 1999 WHO classification of thymoma, is no longer used. What used to be called type C thymoma is now a different entity, thymic carcinoma, which is much more aggressive than thymoma. Although low-grade thymoma tends to have lower grade FDG activity, there is overlap of the SUVmax between many of the anterior mediastinal tumors, such as thymic carcinoma, lymphoma, and paraganglioma. Thus, when SUVmax is high, a biopsy is usually needed to differentiate lymphoma from other tumors.

Please see the following references for further study:


*4. A 10-cm anterior mediastinal mass abutting the superior vena cava is seen on a low-dose chest CT scan done as screening for lung cancer. Biopsy confirms this to be a thymoma. The patient had documented anaphylaxis to iodinated contrast agents two years ago. The thoracic surgeon is asking you to stage this thymoma for treatment planning. Which imaging modality would be the best choice for this patient?

(a) Magnetic resonance imaging
(b) Contrast-enhanced CT
(c) FDG-PET/CT
(d) Indium-111 Octreotide SPECT

The answer is A. Once the diagnosis of thymoma is made, the most important task for the radiologist is to stage thymoma appropriately prior to surgery. Distinguishing early disease, stage I or II, from more advanced disease, stage III or IVa, is the most important aspect of this staging, as patients with early disease proceed to surgery whereas those with more advanced disease receive neoadjuvant therapy and then proceed to surgery if possible. Although contrast-enhanced CT is recommended currently for the staging of thymoma, there has been no published study showing which imaging modality is more accurate for this application, CT or MRI. Imaging of the mediastinal vessels is of utmost importance as their involvement constitutes stage III disease. Thus, in a patient at risk for a severe hypersensitivity reaction to iodinated contrast, as in this case, MRI would be ideal; black blood or white blood imaging techniques, even without the use of intravenous contrast, would be able to identify locoregional spread, while imaging the entire hemithorax would enable assessment of the pleura for pleural metastases.

Answer B is incorrect. Although contrast-enhanced CT of the chest is recommended for routine staging of thymoma, the risk of this modality should be weighed against the benefit it provides. Patients with a prior allergic-type reaction to iodine have a risk as high as 35% of a second reaction. If the patient had life-threatening hypotension or laryngeal edema as part of the reaction to contrast medium, it would be better to evaluate local invasion with MRI and avoid this unnecessary risk.
Answer C is incorrect. FDG uptake as measured by SUVmax has not yet been proven useful in differentiating early thymoma, stage I or II, from more advanced disease, stage III and IV. Although it may demonstrate unexpected metastatic disease in patients with thymic cancer, this has not been the case with thymoma, which rarely presents with distant metastatic disease. Since FDG-PET/CT is usually performed with no intravenous iodinated contrast, with a large field of view, its value for vascular invasion is reduced, and thus it cannot replace good vascular imaging, which can be achieved with contrast-enhanced chest CT or with MRI.

Answer D is incorrect. Staging with indium-111 octreotide has been replaced with CT scan or MRI. Indium-111 octreotide SPECT provides no information on vascular involvement and demonstrates only tumor deposits larger than 15 mm.

Please see the following references for further study:

*5. In regards to the 2004 WHO classification of thymoma, which statement is true?
(a) This classification is used for selection of the surgical approach.
(b) Type B3 has a worse outcome than combined type A through B2.
(c) Type B1 thymomas are usually larger than type AB thymomas.
(d) Type A is assigned when the tumor is completely encapsulated.

The correct answer is B. Although the 2004 WHO classification system cannot be used to predict clinical outcome, type B3 classification has been shown to have a worse outcome than the other types combined. The FDG uptake of thymoma is variable, but the most aggressive classification, type B3, does have increased FDG avidity compared to more indolent histologic types, A through B2.

Option A is incorrect. Treatment decisions are based on the Masaoka-Koga staging and not on the histologic classification. Option C is incorrect. Although, in general, type B3 thymoma does tend to present at a higher stage, there are no data showing that type B1 thymoma is significantly larger than type AB thymoma. Outcome does not differ significantly between type B1 thymoma and type AB.

Option D is incorrect. Type A thymoma refers to the histologic appearance of the cells, not the staging or surrounding tumor infiltration. Thus, type A thymoma is assigned when the cells appear as bland spindle or oval epithelial tumor cells with few or no lymphocytes. The description of “when the tumor is completely encapsulated” refers to stage I of the Masaoka-Koga staging, not histologic classification.

Please see the following references for further study:

*6. Which of the following statements in regard to thymoma epidemiology is correct?
(a) The ratio of male to female incidence is 2:1.
(b) The incidence declines after the age of 60 years.
(c) Thymoma is more common in whites than in other ethnic groups.
(d) The incidence is higher in smokers than in nonsmokers.

Answer B is correct. Thymoma is rare in children, though the tumor affects relatively young patients; it rises in incidence with age, as expected with other malignancies, but then declines after the age of 60 years.

Answer A is incorrect. The incidence of thymoma is one to five cases per million people per year; men and women are affected equally.

Answer C is incorrect. The incidence of thymoma is higher in African Americans and Asians than in other ethnic groups.

Answer D is incorrect. Thymoma is not known to be associated with smoking.

Please see the following reference for further study: