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Recurrent Thymoma with Lung, Pleural, and Splenic Metastases Demonstrated on F-18 FDG PET/CT

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Abstract

Thymomas are rare, slow-growing, and less aggressive anterior mediastinal tumors of epithelial origin. Its propensity for extra-thoracic spread is uncommon. Regional assessment by chest CT-scan has been the imaging modality of choice for disease staging and restaging. However, there are reported cases of hematogenous metastases to the brain, liver, pancreas, and kidneys but very rarely to the spleen. We reported a case of recurrent thymoma with metastases to the lung, pleura, and spleen. F-18 FDG PET/CT scan revealed mild hypermetabolism in these metastatic lesions. Thus, with whole body imaging an extensive survey enabled the timely detection of these indolent tumors.

Subject Areas

Diagnostics, Oncology, Radiology & Medical Imaging

Keywords

Thymoma, Metastasis, Spleen, F-18 FDG PET/CT

1. Introduction

Thymomas are uncommon, indolent tumors of epithelial origin affecting mostly Asians, African Americans, and Pacific islanders aged 40 - 70 years old. The etiology is unknown and is said to be of genetic predisposition. Thymomas spread locally and are less invasive than thymic carcinoma. [1] [2] Complete tumor resection is the mainstay of treatment with a 5-year survival rate of approximately

90% for grossly and microscopically encapsulated thymomas. [2]

The lung is its most common metastatic site. [3] Since extra-thoracic metastasis is low at 3% - 6%, chest CT-scan has been the imaging modality of choice for initial staging and follow-up. [2] [3] [4] However, there are some cases of distant metastases to the brain, liver, pancreas, kidneys, and intraperitoneum. [5]-[10] In the literature search, there were only a handful of cases of thymoma with splenic metastasis. Patients reported in the 1990s, both had liver and spleen metastases discovered only during autopsy. But with active disease surveillance through diagnostic imaging, early intervention halted disease progression in recent years. Here we present the FDG avidity of pulmonary, pleural and spleen metastases in a patient with recurrent thymoma.

2. Case Presentation

This is a case of a 60-year-old, female presenting with a benign right thyroid nodule. Her chest x-ray had an incidental finding of anterior mediastinal mass. Chest CT and F-18 FDG PET/CT scans were performed for disease staging that showed a 4.8 cm hypermetabolic soft tissue mass in the anterior mediastinum with SUV_{max} of 5 (**Figure 1(a)**). There was no other abnormal hypermetabolic lesion, suggesting metastasis. The patient underwent total thymectomy with adjuvant radiation therapy. Biopsy revealed a 7.3 × 5 × 4 cm thymoma type B3 with invasion to soft tissue, had infiltrative border but with a clear margin of resection. Post-operative PET/CT showed no residual tumor (**Figure 1(b)**).

Two years from the time of diagnosis, the patient developed a 6 mm subpleural nodule in the posterior basal segment of the left lung on a CT-scan. The nodule was indeterminate for metastasis, thus close chest x-ray and CT-scan monitoring were done. With the significant increase from 6 mm to 9 mm in the next eight months, F-18 FDG PET/CT was requested for further evaluation. Hypermetabolic lesions were noted in the left pleura SUV_{max} 3.0 (**Figure 1(c)**) and left lower lung SUV_{max} 1.9 (**Figure 1(d)**). These were resected and a biopsy reported metastatic thymoma. After surgical intervention, there were no residual FDG-avid lesions seen (**Figure 1(e)**). The patient was disease-free for the next two years. Then, there was a recurrence of the mediastinal mass on the CT-scan. The resected mass measured 2.3 × 0.9 × 0.6 cm; consistent with thymoma type B3, clinically recurred.

Two years from the time of primary tumor recurrence, there was pleural seeding in the left mid to upper hemithorax on chest CT-scan. On F-18 FDG PET/CT, there were metabolically active lesions seen in the left pleura SUV_{max} 4.9 and in the capsular area of the spleen SUV_{max} 2.9 (**Figure 1(f)**). Resection and biopsy of the above findings showed metastatic thymoma in the left pleura and its adjacent 8^{th}-11^{th} ribs and in the 2.3 × 2.1 × 0.7 cm splenic mass.

3. Discussion

Thymomas, previously are divided into three types: benign encapsulated, type 1 malignant (invasive thymoma) and type 2 malignant (thymic carcinomas) thymomas.

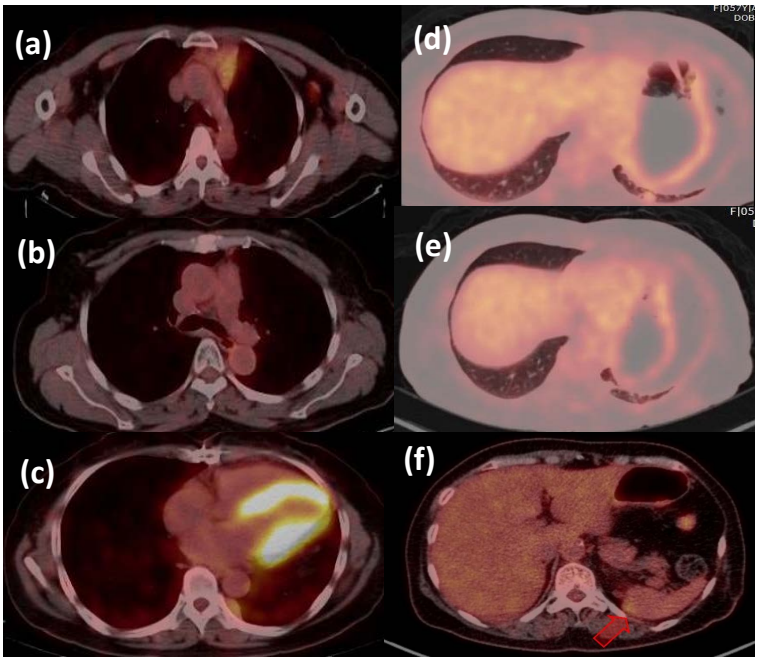

Figure 1. Transaxial F18-FDG PET/CT images of a 60-year old female with a hypermetabolic mass in the anterior mediastinum (SUV_{max} 5), consistent with Type B3 thymoma. (b) Post-total thymectomy with adjuvant radiation therapy scan showed interval resolution of FDG uptake in the surgical site. However, thymoma clinically recurred with metastases to the pleura (c), lung (d), and spleen (f) with low-grade FDG uptake. Post-resection of left lower lung hypermetabolic lesion (e).

The recent classification by WHO is based on five histological subtypes (A, AB, B1, B2, and B3) and can be further divided according to the presence of spindled (A, AB) or epithelioid neoplastic epithelial cells (B1-B3). Thymic carcinoma, on the other hand, exhibits a definite cytologic atypia similar to those histologic features observed in carcinomas of other organs. [11]

In particular, Type B3 thymoma is mainly composed of epithelial cells exhibiting mild or no atypia. [11] Despite features of low-grade neoplasm, about 5% of invasive thymomas have distant metastasis, occurring on an average of 3.6 months from the time of diagnosis to development of extra-thoracic metastasis. [4] Meanwhile, recurrent cases were mostly intrathoracic and pleural with a median time from operation to progression of 20 months. [12] About 1.8% of thymomas metastasized to the lymph nodes and 1.2% had hematogenous spread. [4] Frequent metastatic sites for thymic epithelial tumors were the lung followed by bone and liver. One hypothesis for the rare splenic metastasis by epithelial cancers is the exposure of the transiting granulocyte and cancer cells to pro-apoptotic signals as they undergo pooling within the spleen. [13]

The 5-year overall and progression-free survivals of thymoma patients were 89% and 75%, respectively. [4] Significant factors for survival are the clinical stage of Masaoka (based on the degree of local invasion) and the completeness of resection. [4] The time to progression from relapse was shorter for those with in-

complete resections (8 mos vs 29 mos for complete resection). [12] Thus, assessment of surgical resectability of the primary tumor and the tumor spread is key to a patient's disease-free survival.

The advantage of PET/CT lies in its ability to physiologically and anatomically image the entire body in one session. Glucose transporter and hexokinase mediate the cellular uptake of F-18 FDG in epithelial cells. Findings of thymic hypermetabolism may represent normal physiologic uptake (in the first two decades of life), hyperplasia (post-chemotherapy rebound), lymphomatous infiltration, primary thymic neoplasm or metastatic disease. [14] The intensity of FDG uptake reflects metabolic activity and correlates with tumor growth rate. Low-grade thymomas (type A and B1) have low, heterogeneous uptake as compared with high-risk thymoma (type B2, B3) and thymic carcinoma, which are more likely to have high and homogenous activity. [15] Using an SUV cutoff of 5 in differentiating thymic carcinoma from thymoma; sensitivity, specificity, and accuracy were 84.6%, 92.3%, and 88.5%, respectively. [14]

Other case reports likewise presented low FDG avidity with lung [16], pleura [6], or spleen [17] metastasis. For splenic metastasis, Metser *et al.* [18] reported that F-18 FDG PET could reliably discriminate between benign and malignant solid splenic masses in patients with known 18F-FDG–avid malignancy (SUV of benign 1.87 ± 0.32 vs malignant lesions 7.86 ± 5.57; $p < 0.01$). This borderline metabolic activity warrants the PET reader to look closely in the spleen and not totally rule out metastasis despite mild FDG uptake, which still harbors malignancy.

4. Conclusion

A growing body of diagnostic evidence has shed light on the use of whole-body imaging to detect distance metastasis, particularly for aggressive pathologies. Here we presented the case of invasive thymoma with disease recurrence and a rare metastasis to the spleen. The use of F18-FDG PET/CT was valuable for staging and restaging, especially since patients can be asymptomatic even in advanced cases. Despite low FDG avidity of thymoma metastases PET/CT scan was still able to facilitate early detection that led to timely intervention.

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Engels, E.A. (2010) Epidemiology of Thymoma and Associated Malignancies. *Journal of Thoracic Oncology*, **5**, S260-S265. https://doi.org/10.1097/JTO.0b013e3181f1f62d

[2] NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines) Thymomas and Thymic Carcinomas, Version 2.2019. https://www2.tri-kobe.org/nccn/guideline/lung/english/thymic.pdf

[3] Vladislav, T., Jain, R., Alvarez, R., Mehta, R., Gökmen-Polar, Y., Kesler, K., *et al.*

(2012) Extrathoracic Metastases of Thymic Origin: A Review of 35 Cases. *Modern Pathology*, **25**, 370-377. https://doi.org/10.1038/modpathol.2011.178

[4] Kondo, K. and Monden, Y. (2003) Lymphogenous and Hematogenous Metastasis of Thymic Epithelial Tumors. *The Annals of Thoracic Surgery*, **76**, 1859-1864. https://doi.org/10.1016/S0003-4975(03)01017-8

[5] Yoshida, A., Shigematsuz, T., Moril, H., Yoshida, H. and Fukunishi, R. (1981) Non-Invasive Thymoma with Widespread Blood-Borne Metastasis. Virchows Arch Pathol Anat, **390**, 121-126. https://doi.org/10.1007/BF00443902

[6] Gajendra, S., Sahoo, M.K. (2016) ^{18}F FDG-PET/CT of Malignant Thymoma with Pleural and Diaphragmatic Metastases. *Lung India*, **33**, 116-117. https://doi.org/10.4103/0970-2113.173057

[7] Gembala, R.B., Hare, J.L. and Meilahn, J. (1993) Intraabdominal Metastatic Thymoma. *American Journal of Roentgenology*, **161**, Article 1331. https://doi.org/10.2214/ajr.161.6.8249753

[8] Hietala, S.-O., Hazra, T.A. and Texter, J.H. (1978) Malignant Thymoma with Renal Metastases: Report of a Case. *Acta Radiologica Diagnosis*, **19**, 337-342. https://doi.org/10.1177/028418517801900207

[9] Nomori, H., Watanabe, K., Ohtsuka, T., Naruke, T., Suemasu, K. and Orikasa, H. (2004) Pulmonary Metastasis 12 Years after Resection of Thymoma with Microscopic Capsule Invasion. *Japanese Journal of Clinical Oncology*, **34**, 630-633. https://doi.org/10.1093/jjco/hyh105

[10] Rosen, V., Christiansen, T. and Hughes, R. (1996) Metastatic Thymoma Presenting as a Solitary Pulmonary Nodule. *Cancer*, **19**, 527-532. https://doi.org/10.1002/1097-0142(196604)19:4<527::AID-CNCR2820190408>3.0.CO;2-Z

[11] Marx, A., Chan J., Coindre, J.M., Detterbeck, F., Girard, N., Harris, N., *et al.* (2015) The 2015 World Health Organization Classification of Tumors of the Thymus: Continuity and Changes. *Journal of Thoracic Oncology*, **10**, 1383-1395. https://www.jto.org/article/S1556-0864(15)33512-7/pdf

[12] Huang, J., Rizk, N., Travis, W., Riely, G., Park, B. and Bains, M. (2009) Comparison of Patterns of Relapse in Thymic Carcinoma and Thymoma. *The Journal of Thoracic and Cardiovascular Surgery*, **138**, 26-31. https://doi.org/10.1016/j.jtcvs.2009.03.033

[13] Peter, A.M. (2012) Why the Spleen Is a Very Rare Site for Metastases from Epithelial Cancers. *Medical Hypotheses*, **78**, 26-28. https://doi.org/10.1016/j.mehy.2011.09.033

[14] Ferdinand, B., Gupta, P. and Kramer, E. (2004) Spectrum of Thymic Uptake at ^{18}F-FDG PET. *RadioGraphics*, **24**, 1611-1616. https://doi.org/10.1148/rg.246045701

[15] Otsuka, H. (2012) The Utility of FDG-PET in the Diagnosis of Thymic Epithelial Tumors. *The Journal of Medical Investigation*, **59**, 225-234. https://doi.org/10.2152/jmi.59.225

[16] Kawagishi, S., Maniwa, T., Watari, H., Sakata, R., Omura, A., *et al.* (2022) Small-Sized Type a Thymoma with Pulmonary Metastasis: A Case Report. *Surgical Case Reports*, **8**, Article No. 15. https://doi.org/10.1186/s40792-022-01366-0

[17] Aoki, Y., Miki, A., Nakano, T., Sasanuma, H., Sakuma, Y., *et al.* (2018) Thymoma with an Isolated Splenic Metastasis Eight Years after Extended Thymectomy: A Case Report. *BMC Cancer*, **18**, Article No. 1249. https://doi.org/10.1186/s12885-018-5165-0

[18] Metser, U., Miller, E., Kessler, A., Lerman, H., Lievshitz, G., Oren, R., *et al.* (2005) Solid Splenic Masses: Evaluation with ^{18}F-FDG PET/CT. *Journal of Nuclear Medicine*, **46**, 52-59.