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Case Report of Malignant Pulmonary Parenchymal Glomus Tumor: Imaging Features and Review of the Literature

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Abstract

Glomus tumor is rare tumor which arises from glomus body and most frequently found in the soft tissue of the extremities. The lung is rare ectopic site, and a malignant glomus tumor arising from pulmonary parenchyma is particularly uncommon. To date, the knowledge on imaging features of pulmonary parenchymal glomus tumor has been scarce. To deepen our understanding on their imaging features, we report a case of malignant glomus tumor arising from pulmonary parenchyma confirmed with surgical histopathology and immunochemistry and review the medical literature on pulmonary parenchymal glomus tumors with emphasis on their imaging features.

Keywords

Glomus tumor; pulmonary; malignant; CT; imaging

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Introduction

The glomus body is a highly specialized neuromyoarterial apparatus located in the subungual dermis that plays an important role in temperature regulation by controlling blood flow through digital capillary networks [1]. It was first described by Masson in 1924 [2]. Rarely, neoplasia can develop in glomus bodies and accounts for less than 2% of all soft tissue neoplasms [3] and these so-called glomus tumors most frequently occur in the distal upper and lower extremities [4]. However, occasionally glomus tumors can be encountered at ectopic sites including the gastrointestinal tract, female reproductive tract, cardiovascular and respiratory systems [5, 6, 7]. Respiratory tract glomus tumors most commonly arise from the trachea and bronchial airways; involvement of the pulmonary parenchyma is rare and the majority of pulmonary glomus tumors in the literature are benign [1,6,7,11–33]. We report a case of malignant primary pulmonary glomus tumors arising from the lung parenchyma (PGT) encountered at a tertiary cancer center and review the literature with emphasis on their imaging features.

Case report

A 66-year-old female, non smoker, with no other significant medical history presented with a palpable lump in her left breast. Mammography and ultrasound demonstrated a solid breast mass. Core needle biopsy showed a fibroepithelial lesion suspicious for Phyllodes tumor. A pre-operative chest radiograph revealed a 5.3 cm well-circumscribed coin-like mass in the right lower lung [Fig 1]. She had no respiratory complaints including dyspnea, wheeze, cough or hemoptysis.

Subsequent contrast enhanced CT chest [Fig 2] showed a $4.5 \times 3.8 \times 3.9$ cm, partially enhancing mass in the right middle lobe, abutting the oblique fissure, right diaphragm, and right lateral pleura. The mass contained tortuous vessels in the enhancing peripheral component and central nonenhancing area suspicious for necrosis. No calcification was identified. There was no pleural effusion or thoracic adenopathy and no evidence of metastatic disease. A PET-CT scan [Fig 3] showed FDG avidity at the periphery of the right middle lobe mass with SUVmax 3.7 and a central photopenia corresponding to the central nonenhancing component on CT [Fig 2] and FDG avidity in the left breast mass with SUVmax 3.8. There was no other FDG avid lesion suspicious for another primary disease or metastases in addition to the known lung and breast masses. The imaging differential diagnoses of the right middle lobe mass included solitary fibrous tumor and primary lung carcinoma, and less likely metastasis from low grade malignant Phylloides. The patient subsequently underwent left mastectomy and right lobectomy given the size and location of the pulmonary mass.

Grossly, the tumor was well-defined, gray tan measuring $4.5 \times 4.1 \times 3.3$ cm. [Fig 4]. Microscopically, it was composed of epithelioid smooth muscle cells with a low mitotic rate 1/50 HPF and uninvolved resection margins [Fig 5]. Immunohistochemical analysis showed positivity for smooth muscle actin [Fig 6], collagen IV, CD 34 (focal and strong), and BCL-2 (diffuse and strong) [Fig 7] expression. The tumor cells were negative for TTF-1, STAT6, EMA, AE1:AE3, Laminin and HMB45. The Ki-67 stain showed a proliferative

index of less than 10%. The histologic morphology and immuno-profile were consistent with malignant PGT. The diagnosis of the left breast mass was consistent with low grade malignant Phyllodes tumor.

Completion lobectomy was subsequently performed; the lung parenchyma, bronchial and vascular margins were negative and five resected lymph nodes were negative for tumor. The patient has had no recurrent or metastatic disease in the 13 months following surgery.

Discussion

Glomus tumor arising from the pulmonary parenchyma (PGT), shares the same histopathological appearances and immunohistochemical characteristics of glomus tumors that arise elsewhere in the body, most frequently in the subungual soft tissue of the extremities [8]. They have the ultrastructural and immunohistochemical features of smooth muscle [9, 10], which are helpful in diagnosing the tumor despite their ectopic site. They typically affect older patients, and grow to a large size with greater histologic atypia compared to their musculoskeletal counterparts [11]. The exact incidence of PGT, particularly malignant type, is unknown and may be misdiagnosed as hemangiomas or venous malformations in some cases making the accurate assessment of incidence even more difficult [12].

At the time of this manuscript writing, our search of the English-language literature excluding glomus tumors of tracheo-bronchial origin revealed only 21 individual case reports of PGT which included 24 patients. Among these reports, only 5 cases (20%) were reported as malignant PGT [11, 12, 13, 14, 15]. The average age of affected patients with diagnosis of PGT (benign or malignant) was 47, ranging from 19 to 74 years old. Male to female ratio was 1.8:1. The vast majority of PGT were solitary lesions (20/24) with only 4 cases with more than one pulmonary nodule at initial diagnosis [11, 15, 16, 17]. All reported cases of malignant PGT were solitary lesions [11, 12, 13, 14, 15].

The size of the published cases of PGT was variable on chest radiograph and CT (mean: 3.6 cm with range 1.0 – 9.7 cm) and the tumors were described as either pulmonary nodules or masses, occasionally with the term “coin lesion” [18, 19] as noted in our case. Both benign and malignant PGT were well-circumscribed solid masses at imaging and none of previous cases reported internal calcification or cavitations at imaging. Heterogeneous peripheral contrast enhancement with lack of central enhancement was described in all benign and the 5 malignant cases in contrast-enhancement CT, reflecting the peripheral vascularity of the tumor [11, 12, 13, 14, 15, 20, 21, 22]. There was also considerable overlap in size of the benign and malignant PGT with the largest tumor measuring 9.7 cm being classified as benign [1,6,7,11–33]. These imaging features are also shared by other more common primary pulmonary tumors such as carcinoid and solitary fibrous tumor (also known as hemangiopericytoma) and these entities were considered as primary differential diagnoses at presentation in the previously reported cases [24].

MRI was performed in one case of benign glomus tumor and demonstrated the predominant signal intensity of the peripheral component of the mass to be isointense to muscle on T1-

weighted images and hyperintense to muscle on T2-weighted images, with hyperintense signal in the central portion of the mass on both T1- and T2-weighted images [20]. In post-contrast T1-weighted images, the tumor showed avid contrast enhancement peripherally in the early phase with subsequent centripetal filling with contrast and lack of central enhancement. FDG PET was performed in 5 cases (4 benign and 1 malignant) with 1 lesion demonstrating no FDG uptake [24] and 4 lesions showing low to moderate FDG uptake with reported SUVmax ranging from 4.5 to 5.2 [1, 12, 22, 23] and the malignant lesion showed low to moderate uptake, without reported SUVmax.

In terms of histopathologic features, immunohistochemical staining results were available in 18/24 patients. Thirteen out of 15 patients tested, were positive for smooth muscle actin (SMA) stain and one of the two patients with negative SMA stain stained positive for vimentin. Other positive immunostains reported included vimentin, reticulin, and desmin. Surgical management, including lobectomy or wedge resection, was performed in all 24 patients of primary PGT [1,6,7,11–33].

The differential diagnosis of PGT at imaging and histology is wide and therefore it is particularly difficult to make the diagnosis preoperatively on percutaneous biopsy specimens [24]. The differential diagnoses with imaging features and histologic morphology similar to those of PGT include carcinoid, haemangiopericytoma/solitary fibrous tumor, smooth muscle neoplasms (especially epithelioid leiomyoma), primitive neuroectodermal tumors (PNET), paraganglioma, and metastases [11]. Immunohistochemical staining is very useful to differentiate between these entities. Glomus tumors stain positive for SMA unlike hemangiopericytoma, and variably for desmin unlike carcinoid, PNET or paraganglioma; the tumor also shows prominent intercellular reticulin, laminin, and collagen type IV staining, while they are generally negative for all neuroendocrine markers [11].

Malignant glomus tumors have necrosis, increased mitotic counts, focal cystic degeneration and atypia [11]. However, differentiating benign from malignant glomus tumors is challenging and controversial with no well-defined or accepted criteria, in particular for visceral tumors [25]. In our case, the tumor was diffusely and strongly positive for BCL2 expression, which is antiapoptotic marker and is reported in malignant PGT [11]. Interestingly, locally infiltrative growth and vascular invasion are not uncommon in glomus tumors at ectopic sites without correlation with clinical behavior [25] and rarely glomus tumors have been classified as malignant on the basis of aggressive clinical behavior [26]. The largest reported series of malignant glomus tumors primarily comprise musculoskeletal glomus tumors; and report that the size (>2 cm), presence of mitotic atypia, and deep location are the most important features of such malignant glomus tumors [25, 26, 27].

Clinical prognosis of benign PGT is excellent when a complete resection is achieved [28], none of the benign PGT was reported as fatal or developed locally recurrent or malignant disease with reported follow-up ranging from 4 to 60 months [1,6,7,11–33]. On the other hand, the prognosis of malignant PGT is guarded. Our literature search showed that two of the 5 pathologically malignant glomus tumor developed either local recurrence with pulmonary metastases or pulmonary and nodal metastases [11, 15] while two were alive without local recurrence or metastatic disease after 12 and 23 months of follow-up

respectively [12, 13]. The fifth patient died of an unrelated cause less than one month following surgical resection [14]. Our patient has no evidence of recurrence in a 13 month-follow-up.

Operative surgical management is the accepted gold standard treatment in the literature. In view of their “unpredictable behavior” Santambrogio et al advocate lung resection and recommend reserving wedge resection for smaller, peripheral lesions, or if the clinical condition of the patient precludes more extensive surgery [24]. On the other hand, De Cocker et al state that wherever possible a sublobar resection by means of a wedge, anatomical segmentectomy or sleeve resection is the preferred therapy [1, 28, 29]. Lobectomy is reserved for central tumors where the intersegmental plane cannot be developed in order to obtain resection margins free of disease [29].

Conclusion

Malignant PGT is a rare tumor which presents as a well-circumscribed non-calcified mass with peripheral contrast enhancement at imaging and with variable metabolic activity at PET. Because of the overlapping imaging and histologic features with benign and malignant PGT and other more common pulmonary tumors, immunochemistry plays an important role in establishing the correct diagnosis. Given the guarded prognosis of malignant PGT, thorough examination and correlation of imaging, histopathology, immunochemistry, and complete surgical resection are essential.

References

1. De Cocker J, Messaoudi N, Waelput W, Van Schil PE. Intrapulmonary glomus tumor in a young woman. *Interact Cardiovasc Thorac Surg*. 2008; 7:1191–3. [PubMed: 18682431]
2. Masson P. Le glomus neuromyoartériel des régions tactiles et ses tumeurs. *Lyon Chir*. 1924; 21:257–80.
3. Goldblum, JR.; Weiss, SW. Perivascular tumors. In: Strauss, M., editor. *Enzinger and Weiss's soft tissue tumors*. St Louis: Mosby; 2001. p. 985-1035.
4. Vandevender DK, Daley RA. Benign and malignant vascular tumors of the upper extremity. *Hand Clin*. 1995; 11:151–81.
5. Marchvsky A. Lung tumors derived from ectopic tissues. *Semin Diagn Pathol*. 1995; 12:172–84. [PubMed: 7638449]
6. Koss M, Hochholzer L, Moran CA. Primary pulmonary glomus tumor: a clinicopathologic and immunohistochemical study of two cases. *Mod Pathol*. 1998; 11:253–8. [PubMed: 9521471]
7. Ariizumi Y, Koizumi H, Hoshikawa M, Shinmyo T, Ando K, Mochizuki A, et al. A primary pulmonary glomus tumor: a case report and review of the literature. *Case Rep Pathol*. 2012; 2012:782304.10.1155/2012/782304 [PubMed: 23050181]
8. Kapur U, Helenowski M, Zayaad A, Ghai R, Vigeneswaran W, Rajan P. Pulmonary glomus tumor. *Ann Diagn Pathol*. 2007; 11(6):457–9. [PubMed: 18022133]
9. Murad T, von Hamm E, Murthy MS. Ultrastructure of a hemangiopericytoma and a glomus tumor. *Cancer*. 1968; 22:1234–49.
10. Venkatachalan MA, Grealley JG. Fine structure of glomus tumor: similarity of glomus cells to smooth muscle. *Cancer*. 1969; 23:1176–84. [PubMed: 4305105]
11. Gaertner EM, Steinberg DM, Huber M, Hayashi T, Tsuda N, Askin FB, et al. Pulmonary and mediastinal glomus tumors-report of five cases including a pulmonary glomangiosarcoma: a clinicopathologic study with literature review. *Am J Surg Pathol*. 2000; 24(8):1105–14. [PubMed: 10935651]

12. Kleontas A, Barbetakis N, Asteriou C, Nikolaidou A, Baliaka A, Kokkori I, et al. Primary glomangiosarcoma of the lung: A case report. *J Cardiothorac Surg.* 2010; 5:76. [PubMed: 20920354]
13. Hishida T, Hasegawa T, Asamura H, Kusumoto M, Maeshima A, Matsuno Y, et al. Malignant glomus tumor of the lung. *Pathol Int.* 2003; 53:632–6. [PubMed: 14507322]
14. Zhang Q, Wang S, Divakaran J, Yu L, Mao Y, Liu L, et al. Malignant glomus tumour of the lung. *Pathology.* 2010; 42(6):594–6. [PubMed: 20854085]
15. Hohenforst-Schmidt W, Woitow M, Zarogoulidis P, Machairiotis N, Gschwendtner A, Huang H, et al. Glomus tumor in the lung parenchyma. *J Thorac Dis.* 2012; 4(6):663–6. [PubMed: 23205298]
16. Altorjay A, Arato G, Adame M, Szanto I, Garcia J, Forrai G, et al. Synchronous multiple glomus tumors of the esophagus and lung. *Hepatogastroenterology.* 2003; 50:687–90. [PubMed: 12828061]
17. Concatto NH, Irion KL, Marchiori E, Gosney JR, Asante-Siaw J, Hochegger B. An unusual cause of multiple pulmonary nodules: glomus tumors of the lung. *Lung.* 2014; 192(4):629–30. [PubMed: 24714807]
18. Alt B, Huffer WE, Belchis DA. A vascular lesion with smooth muscle differentiation presenting as a coin lesion in the lung: glomus tumor versus hemangiopericytoma. *Am J Clin Pathol.* 1983; 80(5):765–71. [PubMed: 6314802]
19. MacKay B, Legha SS, Pickler GM. Coin lesion of the lung in a 19-year-old male. *Ultrastruct Pathol.* 1981; 2(3):289–94. [PubMed: 6270859]
20. Ueno M, Nakashima O, Mishima M, Yamada M, Kikuno M, Nasu K, et al. Pulmonary glomus tumor: CT and MRI findings. *J Thorac Imaging.* 2004; 19:131–4. [PubMed: 15071335]
21. Huang Y, Chen K, Sun K, Cui J, Chen Y, Min X, et al. A primary pulmonary glomus tumor complicated with hyperpyrexia and anemia. *Ann Thorac Surg.* 2013; 95(2):e29–31. [PubMed: 23336911]
22. Gebauer F, Quaas A, Izbicki JR, Vashist YK. Glomangioma of the lung: a case report and review of the literature. *J Med Case Rep.* 2014; 8:5. [PubMed: 24386948]
23. De Luca G, Sessa R, Petteruti F. Huge glomus tumor of the lung. *Asian Cardiovasc Thorac Ann.* 2014; 22(1):106. [PubMed: 24585658]
24. Santambrogio L, Nosotti M, Palleschi A, Gazzano G, De Simone M, Cioffi U. Primary pulmonary glomangioma: a coin lesion negative on PET study: Case report and literature review. *Thorac Cardiovasc Surg.* 2011; 59(6):380–2. [PubMed: 21432758]
25. Folpe AL, Fanburg-Smith JC, Miettinen M, Weiss SW. Atypical and malignant glomus tumors: analysis of 52 cases, with a proposal for the reclassification of glomus tumors. *Am J Surg Pathol.* 2001; 25(1):1–12. [PubMed: 11145243]
26. Gould EW, Manivel JC, Albores-Saavedra J, Monforte H. Locally infiltrative glomus tumors and glomangiosarcomas. A clinical, ultrastructural and immunohistochemical study. *Cancer.* 1990; 65:310–8. [PubMed: 2153045]
27. Enzinger FM, Weiss SW. *Soft Tissue Tumors.* St. Louis, MO: CV Mosby; 1995. p. 701-13.
28. Takahashi N, Oizumi H, Yanagawa N, Sadahiro M. A bronchial glomus tumor surgically treated with segmental resection. *Interact Cardiovasc Thorac Surg.* 2006; 5:258–60. [PubMed: 17670562]
29. Lucchi M, Melfi F, Ribechini A, Dini P, Duranti L, Fontanini G, et al. Sleeve and wedge parenchyma-sparing bronchial resections in lowgrade neoplasms of the bronchial airway. *J Thorac Cardiovasc Surg.* 2007; 134:373–7. [PubMed: 17662775]
30. Katabami M, Okamoto K, Ito K, Kimura K, Kaji H. Bronchogenic glomangiomyoma with local intravenous infiltration. *Eur Respir J.* 2006; 28(5):1060–4. [PubMed: 17074921]
31. Dalfior D, Parisi A, Cannizzaro C, Bontempini L, Di Pace C, Menestrina F, et al. Pulmonary glomus tumor. *Int J Surg Pathol.* 2008; 16(1):81–4. [PubMed: 18203793]
32. Rössle M, Bayerle W, Löhrs U. Glomangioma of the lungs: a rare differential diagnosis of a pulmonary tumour. *J Clin Pathol.* 2006; 59(9):1000. [PubMed: 16935981]
33. Tang CK, Toker C, Foris NP, Trump BF. Glomangioma of the lung. *Am J Surg Pathol.* 1978; 2(1): 103–9. [PubMed: 205136]

Figure 1.
Frontal view of the chest radiograph shows a well-circumscribed round mass in the right lower lung.

Figure 2.

Contrast-enhanced axial CT image of the right middle lobe mass. The mass shows tortuous vessels (arrowhead) in the peripherally enhancing component (arrow) and non-enhancing central component (*).

Figure 3.
Fused axial PET/CT image showing FDG avidity with central photopenia in the right middle lobe mass with SUV 3.7 (arrow). Left breast Phyllodes tumor also shows FDG avidity with SUV 3.8 (arrowhead).

Figure 4.
Gross pathology specimen. The tumor is gray-tan well defined rubbery and measures $4.5 \times 4.1 \times 3.3$ cm. No necrosis is identified.

Figure 5. Histology (H&E stain 100×). The tumor cells are monotonous with round uniform low grade nuclei growing in a peri-vascular fashion. No mitotic activity is apparent.

Figure 6. Immunohistochemistry (100×). The smooth muscle actin (SMA) stain is diffusely positive in tumor cells.

Figure 7.
Immunohistochemistry (100×). Tumor cells show strong cytoplasmic staining with BCL2.