



## Case report

## Myopericytoma-like tumors of the lung: Report of two cases

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## ABSTRACT

Myopericytoma is a benign neoplasm presenting cells with different shapes, from oval to spindle, and myoid showing with perivascular growth, which frequently originates from the skin and soft tissues of distal extremities, trunk, head, and neck regions. These tumors rarely have been reported to occur in visceral sites. There is only one case of myopericytoma showing pulmonary involvement with multiple nodules. Although most myopericytomas behave in a benign manner, some cases of malignant myopericytoma arising in both superficial soft tissue and visceral locations have been described. We describe two cases of pulmonary tumors with myopericytoma-like features.

## 1. Introduction

The term myopericytoma was been introduced for the first time by Requena et al. [1] as a designation for myofibroma originating from myopericytes. The concept of pericytic classification was established by Granter et al. [2]. In 2002, the World Health Organization suggested the use the term of myopericytoma. These tumors, in addition to having a heterogeneous appearance, are clinically and morphologically distinct from other entities such as hemangiopericytoma, myofibroma, and angioleiomyoma [3].

The histological features of the tumors are the presence of numerous blood vessels with a concentric perivascular arrangement of ovoid, plump, spindled, and/or round myoid cells with eosinophilic cytoplasm. The neoplastic cells are diffuse and immunoreactively positive for vimentin, smooth muscle actin, and often for h-caldesmon, whereas desmin is usually negative [4].

Although some cases of malignant myopericytoma have been identified [5], most myopericytomas are benign. The reduced number of mitoses, the absence of nuclear atypia, and the absence of metastasis and necrosis lead to a diagnosis of benignity of the lesion [5].

## 2. Cases presentation

## 2.1. Case 1: material and methods and results

A routine radiological examination of a 68 year old woman showed a subpleural mass with a diameter of 3.8 cm in the lower lobe of the left

lung. A subsequent CT scan showed a subpleural lesion of approximately 4 cm in diameter with well-defined margins and a calcified core. The calcified area mimicked the classic hamartochondroma calcification. For that reason and its other radiological features it was given a preoperative diagnosis of hamartochondroma. After a follow-up of two years, a decision was made to remove the tumor to look for evidence of slower growth. The surgery consisted of the partial (limited) resection of the tumor of the left lower lung lobe.

Gross examination showed an operative sample that measured 5 × 2 × 1.5 cm. The tumor mass had a maximum diameter of 4 cm. It was located approximately 1 mm from the pleura and 1 cm from the margin of surgical resection. There was a cleavage plane between the tumor and the lung parenchyma and the tumor was in the proximity of the visceral pleura. The tumor appeared well circumscribed but not capsulated and was fasciculated, brownish in color and of variable consistency with a hard calcified core of approximately 2 cm. The remaining parenchyma was normal.

Microscopic examination showed a soft tissue neoplasm with biphasic aspect consisting of a spindle cell component with leiomyoma-like features and an epithelioid component with a pericytic appearance. The tumor contained numerous thin-wall blood vessels, often appearing dilated, similar to vascular lacunae. The myopericytic cells were located near the vessels. There was an area of metaplastic ossification. Mitotic activity was 2 mitoses in 10 high power fields (HPF) in the epithelioid component and 1 mitosis in 10 HPF in the spindle cell component. There were no areas of necrosis or atypia (Fig. 1).

The immunohistochemical profile was expressed through

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independent evaluation by two pathologists (LR, ML). The epithelioid component was positive for Smooth Muscle Actin (SMA), WT-1, BCL2, CD56, and was weakly positive for estrogen. The epithelioid cells were also negative for S100 protein, CK AE1-AE3, EMA, desmin, PgR, CD10, and HMB-45.

The spindle cell component was strongly positive for SMA, desmin, and CD56; weakly positive for BCL2 e WT-1; and negative for cytokeratin AE1/AE3, EMA, S-100, PGR, HMB-45, CD34, CD31. The proliferative index (assessed by Ki67) was slightly more elevated in the epithelioid component (2%) compared to the spindle component (<1%). Immunostaining with CD31 and CD34 showed the presence of a marked vascular proliferation. CK AE1/AE3 staining revealed linear epithelial clefts in the context of neoplasia (Case1, Fig. 1).

## 2.2. Case 2: material and methods and results

A 63-years-old woman presented cough and hemoptysis. Endoscopic examination showed an endobronchial mass of about 3 cm that was biopsied in another hospital. It was given a preoperative diagnosis of benign neoplasm of vascular origin and a right thoracotomy and lower lobectomy were performed.

Gross examination showed an operative sample that measured 10 × 8 × 4.5 cm. The lobar bronchus was approximately 5 cm long. After the incision, an endobronchial lesion was seen with a maximum diameter of approximately 3.6 cm that protruded into the lumen and was confined to the bronchial wall. The tumor was approximately 1 cm from the bronchial margin. It appeared well circumscribed but was not capsulated. It appeared polypoid, with a fasciculated and homogeneous appearance, whitish in color, and of a hard elastic-like consistency.

Microscopic examination showed a soft tissue endobronchial neoplasm characterized by the presence of numerous vascular lacunae medium to large in size, surrounded by epithelioid and spindle cells. Mitotic activity was 0 mitosis in 10 HPF in both epithelioid and spindle cell components. There were no areas of necrosis or atypia.

The immunohistochemical profile was expressed as a percentage. Both epithelioid and spindle components were strongly positive for smooth muscle actin, specific muscle actin, desmin and CD56, ER, CD34, BCL2 and WT-1; both components also expressed the progesterin receptor in approximately 10% of the cells and were negative for cytokeratin AE1/AE3, EMA, S-100, HMB-45 and CD31. The proliferative index (assessed by Ki67) was <1% in both components. Immunostaining with

CD31 demonstrated the presence of a marked vascular proliferation.

CK AE1/AE3 staining revealed linear epithelial clefts, but that aspect was less evident than in case 1 and was mainly located at the periphery of the lesion (Fig. 2, case 2).

## 3. Discussion

### 3.1. Similarities and differences between the two neoplasms

The cases described had similarities and differences. Both tumors had unique locations, and net margins were not encapsulated. Moreover, microscopically, they were two soft tissue tumors, negative for epithelial markers and characterized by a dual cellular component and rich vasculature. To immunohistochemical analysis, the neoplastic cells are positive for WT1, BCL2 and myoid markers (specific muscle actin, smooth muscle actin, desmin, CD56); but they are negative for S100, HMB45, CD31 and progesterin receptor.

Nevertheless, case 1 had a morphologic and immunohistochemic biphasic appearance while case 2 had only a morphologic dual component [5].

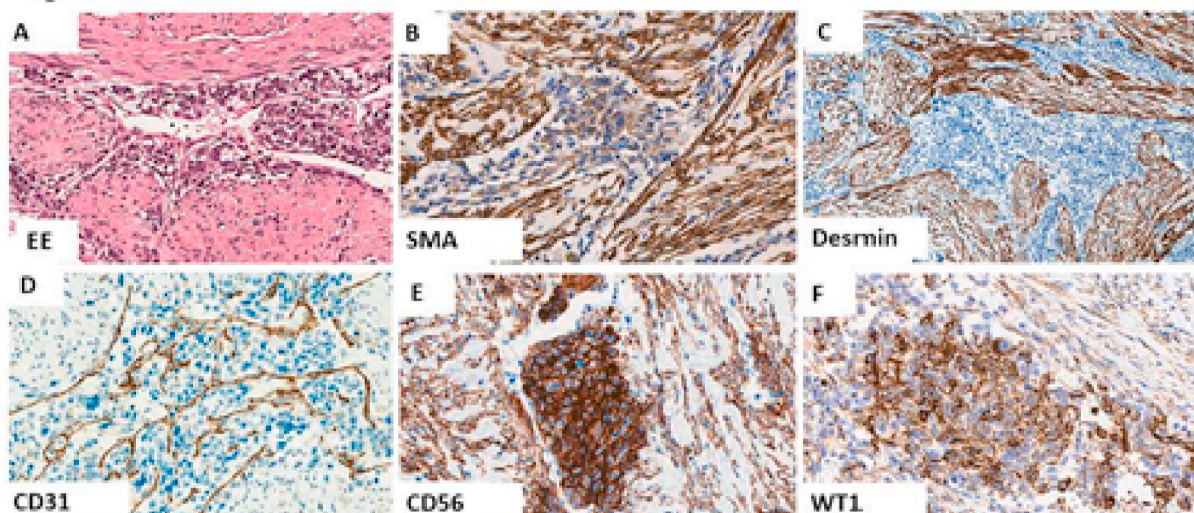
Both tumors were characterized by an epithelial cleft but in case 1 that feature was more evident. Only case 1 showed an area of bone metaplasia. Furthermore, the locations of the two neoplasms were different (peripheric in case 1 and endobronchial in case 2) and case 1 appeared to be characterized by greater heterogeneity and multiple areas of mesenchymal differentiation.

### 3.2. Localization

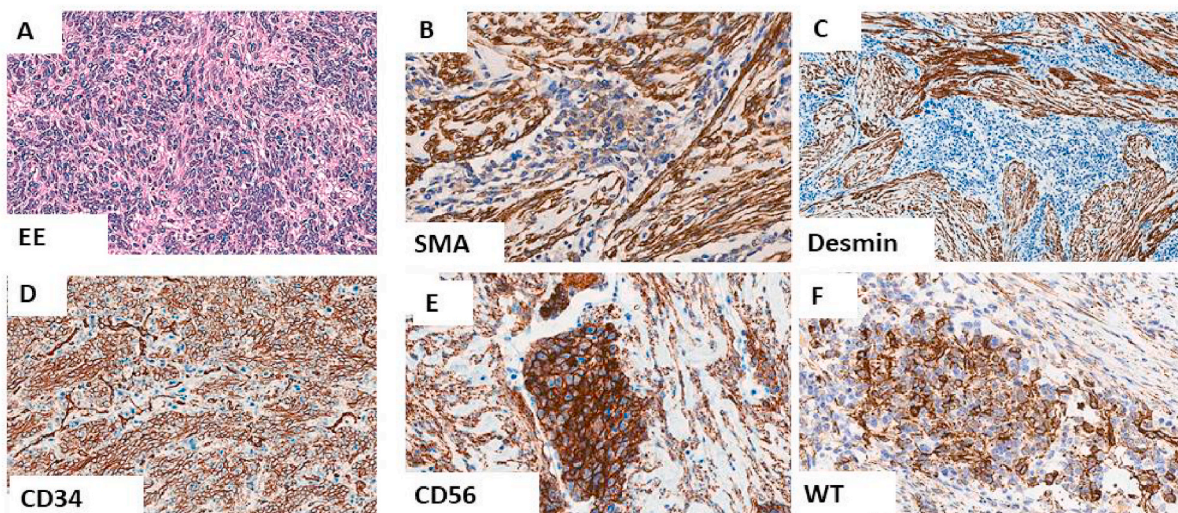
Only one case of lung myopericytoma was found in the literature, and it presented as parenchymal multiple nodules [5]. The cases described above each presented as a single subpleural site (case1) and endobronchial site (case 2). This suggests that the presentation of lung neoplasms could be single or multiple, peripheric, or central.

### 3.3. Origin of the tumor cells

We believe that the clinical, radiological and histological features of the case 1 tumor suggest a hamartomatous origin of the neoplasm. It displayed the radiological appearance of a hamartochondroma with calcifications. Furthermore, case 1 was characterized microscopically by



**Fig. 1. Pulmonary MPC, Case 1.** The tumour has a biphasic appearance, being made of spindle smooth muscle cells and of large nests of epithelioid pericytes with clear cytoplasm (A). Smooth muscle cells are intensely stained for SMA (B) and desmin (C); pericytes are SMA-positive and desmin-negative. Pericytes were strictly associated with CD31<sup>+</sup> capillary vessels (D). Smooth muscle cells were stained for CD56 (E) and were negative for WT1 (F). Pericytes were CD56-positive and WT1-positive.



**Fig. 2.** Pulmonary MPC, Case 2. The tumour has a monomorphic appearance, being made of an intimate admixture of epithelioid and spindle cells (A). Immunostaining reveals the organization of the tumour in small fascicles positive for SMA (B) and Desmin (C), CD34 (D) and CD56 (E). Most tumour cells exhibit nuclear staining for WT1 (F).

multiple mesenchymal differentiation areas and an epithelial cleft, similar to a hamartochondroma tumor. Some benign vascular tumors are categorized as hamartomatous neoplasms [6], but no hamartochondroma lung neoplasms have been described in the literature as having myopericytoma aspects. We hypothesize that this type of neoplasm should be classified as mesenchymal hamartomas [7].

Based on both immunohistochemical and ultrastructural studies, myopericytoma is recognized as a tumor derived from the perivascular myoid cell that shares features of both smooth muscle cells and glomus cells. Candidates for the progenitor cell of origin for the myopericyte include the myofibroblast or the pericyte, both of which exhibit properties of modified smooth muscle cells rather than endothelial cells. The pericyte is viewed as a pluripotential resting stem cell capable of differentiating along smooth muscle, pericyte, glomus cell, osseous, fibroblast and adipocyte cell line [8]. Based on that description, one could hypothesize a common origin of myopericytic-like neoplasms from pluripotent mesenchymal stem cells that can differentiate into multiple mesenchymal structures. This may explain the heterogeneity of these tumors and the presence of areas of differentiation in mesenchymal structures such as bone, smooth muscle, adipose tissue etc. It also would reinforce the hypothesis of a hamartomatous origin.

### 3.4. The differential diagnosis

The differential diagnosis of these tumors includes epithelial neoplasms, glomus tumors, and other perivascular and mesenchymal tumors. Differential diagnosis of epithelial neoplasms is facilitated by immunohistochemical profiles.

Glomus tumors are composed of glomus cells, blood vessels, and smooth muscle cells. Depending on the prevalent tumor component, glomus tumor classifications have been subdivided into solid glomus tumor, glomangioma, and glomangiomyoma [9]. Because both glomus tumors and myopericytomas exhibit similar morphologic and immunophenotypic features (smooth muscle actin+, caldesmon+, desmin-), the distinction between a myopericytoma with a glomus tumor-like component and a glomus tumor may be somewhat arbitrary [9].

Another member of the perivascular cell tumor group is angioleiomyoma. It is composed of well differentiated smooth muscle cells arranged around vascular channels that express smooth muscle actin, caldesmon, and desmin [9].

Myofibroma is another member of the category of perivascular myoid cell tumors, histologically characterized by biphasic growth of

immature-appearing, plump spindled tumor cells associated with numerous thin-walled, branching, solitary, fibrous tumor-like vessels associated with more mature spindled tumor cells with abundant eosinophilic cytoplasm, and arranged in bundles and whorls. In addition, the tumor cells of myofibroma are positive for smooth muscle actin but are usually negative for caldesmon [9].

Also included in the differential diagnosis of perivascular myoid cell tumors is hemangioma. This tumor is composed of variably sized and anastomosing blood vessels.

Angiomyolipoma is the prototypical member of the perivascular epithelioid cell tumor (PEComa) family and represents the most common mesenchymal tumor. Therefore, angiomyolipoma, particularly when it adopts a predominant appearance of epithelioid and spindle-shaped myoid cells with a prominent vascular component, is likely to enter into the differential diagnosis of myopericytomas [9]. Histologically, the closely arranged, narrow, thin-walled vasculature accompanied by a concentric perivascular arrangement of tumor cells in myopericytoma contrasts to the less prominent, branching, and frequently thick-walled vessels surrounded by a radiating perivascular distribution of PEComa epithelioid cells. Immunohistochemically, PEComa contrasts more sharply to myopericytoma by its coexpression of melanocytic and smooth muscle cell markers.

In the latest WHO classification of soft tissue tumors, myopericytoma and myofibroma are listed under the same heading, with the latter appearing as a histologic variant of the former [9]. Although glomus tumors, angioleiomyoma, myofibroma, and myopericytoma are currently classified as distinct entities, the presence of hybrid cases with overlapping morphological and immunohistochemical features emphasizes the existence of a continuous spectrum of perivascular myoid tumors [9]. Given the close relationship of these lesions, it has been suggested that a tumor be designated as myopericytoma or another member of the perivascular tumors depending on the predominant growth pattern [9].

### 4. Conclusions

In conclusion, due to the rarity of the lesion and its heterogeneous morphology, the histologic diagnosis of a tumor with myopericytic aspects may be difficult, especially intraoperatively. For this reason, it is recommended to proceed with an extensive sampling and an adequate immunohistochemical characterization.

### Declaration of competing interest

The authors of this article certify that they do not have affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

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