Ganglioneurofibroma Arising Within the Extralobar Pulmonary Sequestration

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Case report

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Abstract

Background: Neurogenic tumor arising within the pulmonary sequestration (PS) is rare.

Case Presentation: A 42-year-old asymptomatic female was referred to our hospital for work-up of extralobar PS. The independent feeding artery from the thoracic aorta was confirmed by three-dimensional computed tomography angiography (3D-CTA). Extrapulmonary lesions were excluded by whole-body radiographical examinations. Uniportal thoracoscopic resection of the sequestrated lung and mediastinal lymph node sampling was performed successfully. Finally, ganglioneurofibroma within the PS was confirmed by pathological staining. The patient was discharged from the hospital on the 3rd postoperative day without tumor recurrence a year after surgery.

Conclusion: Preoperative 3D-CTA is useful to verify the aberrant vessels of PS; whereas an elaborate diagnostic work-up after a timely resection is necessary for possible subsequent management and follow-up plan.

Background

Ganglioneuroma is a rare, benign and well-differentiated neurogenic tumor, which is mostly localized in the posterior mediastinum [1]. It usually grows very slow and displaces the surrounding anatomical structures without infiltration [2]. To date, no specific serum biomarkers have been established for the diagnosis of neurogenic tumors. Pulmonary sequestration (PS) is mainly defined as a non-functioning lung tissue that has an unusual feeding artery mostly arising from the aorta, without certain pathological diagnostic criteria [3]. The etiology of PS is unknown. To our knowledge, neurogenic tumor originated in the sequestered lung is rare. Herein we presented a case of ganglioneurofibroma arising within an extralobar PS, followed by a brief literature review.

Case Presentation

This report was approved by the Institutional Review Board of Xuzhou Central Hospital, and written informed consent was obtained from the patient. The clinical data was presented anonymously for privacy concern. A 42-year-old asymptomatic female nonsmoker was admitted in June 2019 because the chest x-ray indicated a shadow in the left thorax (Fig. 1A). The blood tests showed that the tumor biomarkers such as carcinoembryonic antigen, alpha-fetoprotein, neuron-specific enolase, and cytokeratin-19 fragment were all in normal range. Further contrast-enhanced computed tomography (CT) revealed a homogenous mass located in the posterior mediastinum with a feeding artery from the thoracic aorta and an effluent vein into the left inferior pulmonary vein (Fig. 1B and 1C).

Based on these findings, an extralobular PS was empirically diagnosed. Uniportal thoracoscopic resection of the sequestrated lung was scheduled and performed after a multidisciplinary evaluation. A thorough preoperative work-up including abdomen CT, and whole-body bone emission CT was conducted, which excluded the other suspicious lesions. Meanwhile, three-dimensional CT angiography (3D-CTA) was utilized [4], which clearly demonstrated the anomalous vessels of the PS (Fig. 1D).

Fast-track surgery protocol was utilized. The single-incision surgery was performed successfully as the margin of the lesion was easily identified. However, frozen-section stain showed the diagnosis of ganglioneurofibroma (Fig. 1E). R0 resection was achieved while the sampled mediastinal lymph nodes were tumor-negative. The operation time was 70 minutes, while the estimated blood loss was about 20 mL. Ultrasound-guided serratus anterior plane block using a bolus of liposomal bupivacaine was used for analgesia. In addition, postoperative chest drainage was avoided.

The pathological staining confirmed the diagnosis of ganglioneurofibroma arising within the extralobar PS (Fig. 1F); whereas the immunohistochemistry tests of the specimen indicated positive expression of SRY-related HMG-box 10 protein, neuron-specific enolase, S-100, chromogranin A and synuclein. The patient played an uneventful course and was discharged from the hospital on postoperative day 3. During the one year follow up, the patient reported satisfactory quality of life while residual pleural effusion or tumor recurrence was not identified.

Discussion And Conclusions

The coexistence of lung malignancy and PS is extremely rare. The present case revealed synchronous primary ganglioneurofibroma arising within the extralobar PS, and the outcome was satisfactory after a timely radical resection. Although chest radiographs can identify findings suspicious of PS in most cases, 3D-CTA is the preferred imaging modality for identifying the aberrant feeding arteries and effluent veins of the sequestrated lung to diminish iatrogenic massive hemorrhage.
Thoracic neurogenic neoplasms may originate from any nervous structure in any mediastinal compartment or in the chest wall due to the complex anatomy of the nervous system [5]. Schwannoma and neurofibroma represent the most common mediastinal neurogenic tumors that rarely degenerate into malignant tumors; whereas the sympathetic ganglia tumors include benign ganglioneuroma and malignant ganglioneuroblastoma and neuroblastoma [6]. The treatment options for neurogenic tumors vary depending on the presentation, but most often the surgical resection is recommended because the patients with malignant neurogenic tumors still have poor long-term survival prospects [7]. Nearly one-half of adult PS patients are asymptomatic [8]; however, a timely resection should always be considered as the optimal treatment. In theory, preoperative embolization of the aberrant blood supply in the PS may mitigate the risk of intraoperative bleeding; however, our present case confirmed the safety of uniportal thoracoscopic surgery without vascular intervention. Similarly, biopsy and staging are not appropriate when a radical resection could be achieved. The objective of a timely resection is to facilitate the differential pathological diagnosis [9].

We searched PubMed, Web of Science, Scopus, Embase, Europe PMC, Cochrane Library and Google Scholar for similar reports up to January 2020. Key words and MeSH terms in title or abstract including “pulmonary sequestration” and “concurrent” or “synchronous” and “tumor” were used. No restriction was made regarding the publication language. Finally a total of 12 case reports were summarized and listed in Table 1. These cases demonstrate the probability of PS in the differential diagnosis for asymptomatic mediastinal masses with adjacent lung involvement. The tumor findings were reported in both intralobar and extralobar PS; whereas most the patients were admitted due to non-specific manifestations PS ranging from cough, recurrent hemoptysis to pneumonia. The tumors included benign and malignant types such as epidermoid cancer, squamous cell carcinoma, bronchial carcinoid, lymphoepithelioma-like carcinoma, sclerosing haemangioma, adenocarcinoma, ectopic adrenocorticotropic hormone-producing pulmonary carcinoid, malignant pigmented perivascular epithelioid cell neoplasm. Surgical resection is recommended as the first treatment option for PS to avoid repeated infection, recurrent hemorrhage and potential primary or secondary malignancy. A timely resection always provides a satisfactory prognosis.
Table 1
Previous reports of tumor arising within the pulmonary sequestration

| Author, year | Age | Gender | Smoking history | Type of sequestration | Manifestation on admission | Tumor type | Treatment | Prognosis |
|--------------|-----|--------|-----------------|-----------------------|-----------------------------|------------|-----------|-----------|
| Hertzog, 1963 [10] | NR | NR | NR | NR | NR | Epidermoid cancer | NR | NR |
| Bell-Thomson, 1979 [11] | 69 | Male | NR | Intralobar | NR | Squamous cell carcinoma | NR | NR |
| Peroš, 1980 [12] | NR | NR | NR | NR | NR | Cancer | NR | NR |
| Juettner, 1985 [13] | 45 | Male | NR | Intralobar | NR | Bronchial carcinoid | Lobectomy | 7 years, alive |
| Gatzinsky, 1988 [14] | 50 | Female | Smoker | Intralobar | Impotective cough | Carcinoma | Lobectomy | NR |
| Morita, 1994 [15] | 59 | Male | NR | Intralobar | Fever | Squamous cell carcinoma | Segmentectomy | 10 months, alive |
| Hekelaar, 2000 [16] | 31 | Female | Nonsmoker | Intralobar | Digital clubbing and coughing | Primary lymphoepithelioma-like carcinoma | Pneumectomy after recurrence within 2 years after the initial thoracotomy | 4 years, alive |
| Ahmetoğlu, 2003 [17] | 2 | Girl | None | Extralobar | NA | Sclerosing haemangioma | NA | NA |
| Simoglou, 2015 [18] | 67 | Male | Smoker | Intralobar | Hemoptyis | Adenocarcinoma | Lobectomy | 28 months, alive |
| Sato, 2015 [19] | 67 | Female | Nonsmoker | Extralobar | Asymptomatic | Ectopic ACTH-producing pulmonary carcinoid | Surgery | The serum ACTH was normal |
| Mengoli, 2016 [20] | 34 | Male | Nonsmoker | Extralobar | Recurrent hemoptyis | Malignant pigmented perivascular epithelioid cell neoplasm | Surgery | 5 months, alive |
| Kayawake, 2020 [21] | 50 | Female | NR | Intralobar | Asymptomatic | Adenocarcinoma | Wedge resection | 20 months, alive |
| The present case | 42 | Female | Nonsmoker | Extralobar | Asymptomatic | Ganglioneurofibroma | Resect the sequestered lung | 12 months, alive |

Abbreviations: ACTH, adrenocorticotropic hormone; NR, not reported.

In summary, we present the case of concurrent ganglioneurofibroma originated within the extralobar PS. A thorough pathological diagnosis of PS is necessary for a possible subsequent management plan. Uniportal thoracoscopic surgery assisted with 3D-CTA as an alternative to multi-port procedure and thoracotomy is safe for extralobar PS.

**List Of Abbreviations**
PS, pulmonary sequestration; CT, computed tomography; 3D-CTA, three-dimensional CT angiography; VATS, video-assisted thoracoscopic surgery

**Declarations**
Ethics approval and consent to participate

This report was approved by the Institutional Review Board of Xuzhou Central Hospital, and written informed consent was obtained from the patient.

Consent for publication

Written informed consent was obtained from the patient for publication of this report and any accompanying images.

Availability of data and materials

The data of the present case is available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

MZ performed the surgery and wrote this paper. YYL contributed to the preparation of the figures and tables. All authors contributed to preparation of the paper and to the perioperative treatment of the patient. All authors approved the final manuscript.

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**Figures**

![Figure 1](image1.png)

**Figure 1**

A The chest X-ray revealed a mass in the left thorax; B The CT showed that the mass was located in the posterior mediastinum with a feeding artery (indicated by arrow) from the aorta; C The effluent vein within the lesion was noticeable (indicated by arrow). D Preoperative 3D-CTA revealed the feeding artery and the effluent vein. E Frozen-section staining showed the diagnosis of ganglioneurofibroma (hematoxylin-eosin staining, x40). F Magnified pathological image confirmed the ganglioid cells and Schwann cells (hematoxylin-eosin staining, x400).

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