

Clinical, Pathological and Radiologic Features of Minute Pulmonary Meningothelial-like Nodules

Zhexu Wen

Fudan University Shanghai Cancer Center

Yang Zhang

Fudan University Shanghai Cancer Center

Fangqiu Fu

Fudan University Shanghai Cancer Center

Zelin Ma

Fudan University Shanghai Cancer Center

Chaoqiang Deng

Fudan University Shanghai Cancer Center

Xiangyi Ma

Fudan University Shanghai Cancer Center

Hong Hu

Fudan University Shanghai Cancer Center

Yihua Sun

Fudan University Shanghai Cancer Center

haiquan Chen (✉ hqchen1@yahoo.com)

Fudan University Shanghai Cancer Center <https://orcid.org/0000-0002-1305-971X>

Research Article

Keywords: GGO, benign nodule, minute pulmonary meningothelial-like nodule

Posted Date: March 29th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-315906/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Version of Record: A version of this preprint was published at Journal of Cancer Research and Clinical Oncology on July 21st, 2021. See the published version at <https://doi.org/10.1007/s00432-021-03744-x>.

Abstract

Objectives: Reports about the radiologic features of minute pulmonary meningothelial-like nodules are sparse. This study aims to investigate the radiologic features of minute pulmonary meningothelial-like nodules.

Method: From January 2016 to April 2019, 7589 patients underwent pulmonary resections at Fudan University Shanghai Cancer Center. Postoperative pathology records were reviewed retrospectively. Fifty-nine patients with minute pulmonary meningothelial-like nodule were included. The identification of minute pulmonary meningothelial-like nodules in pathology specimen included pathologically confirmed in resected nodules, and discovery in the peripheral tissue of other resected nodules incidentally. We went back and checked all the pre-operative scans of patients to analyze surgical decision and observe any change of visible minute pulmonary meningothelial-like nodule over time. Clinic, radiologic and pathological features were collected.

Result: 59 patients included 10 men and 49 women, with a mean age of 57.7. 5 patients had history while 54 patients were non-smokers. 79 minute pulmonary meningothelial-like nodules was found. Of them, 36 nodules were not visible on computed tomography scan. 43 nodules were visible on computed tomography scan, with an average size of 5.3mm in 29 patients. Computed tomography appearance included pure ground-glass opacity in 36, mixed in 2 and solid nodules in 5. Nearly half of patients had a pre-operative follow-up more than 6 months (13/29, 44.8%). The median pre-operative radiologic follow-up was 4.9 months. Approximately 90% of patients underwent pulmonary surgery because of other malignant nodule on chest computed tomography scan (52/59, 88.1%).

Conclusion: Most minute pulmonary meningothelial-like nodules tend to present as ground-glass opacity, especially pure ground-glass opacity. Continuous computed tomography monitoring revealed no radiologic change over time. Continuous computed tomography monitoring was necessary part of management of minute pulmonary meningothelial-like nodule.

Introduction

Minute pulmonary meningothelial-like nodules (MPMNs) are discovered identified in autopsy or resected lung specimens¹. These benign pulmonary nodules are usually asymptomatic, which does not require surgical treatment. However, with the development and popularization of thin-section chest CT scan, some MPMNs can visible on chest CT scan and presented as simulate malignant nodules. Few studies had reported radiologic appearance of MPMNs. In this study, we included 59 cases of MPMNs, described their features and discussed their management.

Methods

Patients:

From January 2016 to April 2019, 7589 patients underwent pulmonary resections at the departments of Thoracic Surgery Fudan University Shanghai Cancer Center. To recognize patients with MPMN, their postoperative pathology records were reviewed retrospectively. Fifty-nine patients with MPMN were included. Clinic features were collected, including sex, age and smoking history.

This study was approved by the Committee for Ethical Review of Research (Fudan University Shanghai Cancer Center IRB 2008223-9). Due to the retrospective nature of this study, informed consent was waived.

Pathology specimen and chest CT scan:

The identification of MPMNs in pathology specimen contained two different scenarios. Some MPMNs were pathologically confirmed in resected nodules, and the other MPMNs were discovered in the peripheral tissue of other resected nodules incidentally. In the first scenario, MPMN could be seen and located on chest CT scan, while in the second scenario, MPMN was not visible on chest CT scan. We went back and checked all the pre-operative scans of patients to analyze surgical decision and observe any change of visible MPMN over time. Radiologic and pathological features were collected, including location of nodules, diameter of nodules on CT scan, CT appearance of nodules and pathological reports.

Results

59 patients included 10 men and 49 women, with a mean age of 57.7. 5 patients had history while 54 patients were non-smokers. Main diagnosis was minute pulmonary meningothelial-like nodules in 14 patients, adenocarcinoma in 42 patients, atypical adenomatous hyperplasia in 2 and metastatic lung cancer in 1. 46 patients had single minute pulmonary meningothelial-like nodule, 13 patients had more than one nodules. 79 minute pulmonary meningothelial-like nodules was found. Of them, 36 nodules were not visible on CT scan because they were incidentally discovered in resected lung specimens. 43 nodules could be observed on chest CT scan, with an average size of 5.3mm in 29 patients. CT appearance included pure ground-glass opacity in 36, mixed in 2 and solid nodules in 5. For those 29 patients with measureable nodules on CT scan, nearly half of patients had a pre-operative follow-up more than 6 months (13/29, 44.8%). The median pre-operative radiologic follow-up was 4.9 months. Approximately 90% of patients underwent pulmonary surgery because of other malignant nodule on chest CT scan (52/59, 88.1%). Five patients underwent surgery on account of malignant finding of MPMN (5/59, 8.5%). Owing to long-term CT-scan follow-up revealed no change in size, two patients underwent resection of MPMN (2/59, 3.4%).

Details of clinicopathological, radiologic features and reasons of surgical decision were shown on Table 1, 2 and 3.

Discussion

Minute pulmonary meningothelial-like nodules (MPMN) was first described by Korn in 1960². Since this kind of lesion was composed of nests of epithelioid, similar to “carotid body tumors” and associated with pulmonary vessels, Korn named them “pulmonary chemodectomas”. However, subsequent studies showed a series of different opinion about MPMNs³⁻⁷. Warnock and Gaffey reported “pulmonary chemodectomas” had similar structural and immunohistochemical features of meningothelial cells^{3,4}. And a new item “minute meningothelioid nodule” was accepted. Mukai reported some MPMN immunostaining positive for myosin and vimentin, suggested its origin from muscle cells⁶. Weissferdt reported that MPMN was associated with CNS meningiomas in common genetic pathways⁷. However, Ionescu reported MPMN lacked mutational damage, while meningiomas showed high frequency of loss of heterozygosity, suggested its reactive origin⁵. Not a common sense about mechanism of MPMN was reached, on the other hand, radiologic reports about MPMN were sparse.

Our study reported clinical, pathological and radiologic features of 59 cases of MPMN, and discussed management of these patients. Frequency of MPMN was 0.77%, lower than previous studies based on operation (7.0%-13.8%)^{6,8,9}. Actual number of frequency might be larger because some MPMNs were discovered incidentally. Female was in the majority in our study (49/59, 83.1%), which was in accordance with previous reports^{8,9}. 79 MPMNs were identified in pathology specimens. Of them, 36 nodules had no definite location on CT scan because they were discovered in the peripheral tissue of other resected nodules incidentally. The remaining 43 nodules were visible on chest CT scan, with an average size of 4.5mm. CT appearance included pure ground-glass opacity in 36, mix in 2 and solid nodules in 5. No specific imaging features were observed on chest CT scan. Though most MPMNs presented as pure ground-glass opacity (36/43, 83.7%), some MPMNs could still simulate malignant nodule (Figure1, Figure2). Considering little was known about mechanism of MPMN, there was no means to use CT imaging to identify benign meningothelial-like lesions which can be ignored rather than resected. It was still difficult to differentiate MPMN from malignant nodules based on CT appearance.

In fact, most patients with MPMN underwent surgery because of other malignant nodule on chest CT scan (52/59, 88.1%) instead of MPMN, that means the resection of MPMNs were additional. Those malignant nodule on chest CT scan were confirmed as lung cancer pathologically, which explained the majority of patients’ main diagnosis was malignant cancer (43/59, 72.9%). Long-term CT-scan follow-up for two patients revealed persistent ground-glass opacity, and no change in size on chest CT scan, finally underwent resection of MPMNs (Figure 3, Figure 4). Moreover, five patients underwent resection in consequence of malignant finding of MPMN.

That arouse a requirement about the management of MPMN or suspected MPMN. Surgical decision partly based on continuous monitoring of nodules. For those 29 patients with visible MPMN on chest CT scan, nearly 50% patients had a pre-operative follow-up more than 6 months (13/29, 44.8%). Part of other benign lesions presented as ground-glass opacity such as inflammatory lesion may disappear on chest CT scan over time, so to avoid unnecessary pulmonary resection, CT surveillance would be useful for management of MPMN. Considering smaller GGN after 5 years of stability still had possibility of

growth¹⁰, management of MPMN may include long-term CT surveillance. What's more, finding a means of CT imaging to differentiate MPMN from other kind of nodule would play a big role in establishing the standard management of MPMN.

This study has several limitations. Due to the occasionality of some MPMNs, some patients may miss diagnosis. Furthermore, we selected patients underwent pulmonary surgery, so patients with MPMN choose CT follow-up instead of surgical treatment were not included.

In summary, most minute pulmonary meningothelial-like nodules tend to present as ground-glass opacity, especially pure ground-glass opacity. Continuous CT monitoring revealed no radiologic change over time. Continuous CT monitoring was necessary part of management of MPMN.

Declarations

Funding:

Supported by National Natural Science Foundation of China (NSFC1548), Shanghai Shenkang Hospital Development Center City Hospital Emerging Cutting-edge Technology Joint Research Project (SHDC12017102) and Shanghai Municipal Health Commission Key Discipline Project (2017ZZ02025).

Conflict of interest statement

The authors declare that they have no conflict of interest.

Authors' contributions: Z.W. and Y.Z contributed equally to this article.

Ethics approval: The research was approved by the Committee for Ethical Review of Research (Fudan University Shanghai Cancer Center IRB# 090977-1). Informed consent was waived because of the retrospective nature of this research.

References

1. Matsuoka T, Uematsu H, Iwakiri S, et al (2012) Minute pulmonary meningothelial-like nodules [MPMNs] incidentally detected at surgical biopsy for ground-glass opacity [GGO]. *Kyobu geka. The Japanese journal of thoracic surgery* 65:1063-6
2. Korn D, Bensch K, Liebow AA, et al (1960) MULTIPLE MINUTE PULMONARY TUMORS RESEMBLING CHEMODECTOMAS. *American Journal of Pathology* 37:641+
3. Churg AM, Warnock ML (1976) SO-CALLED MINUTE PULMONARY CHEMODECTOMA - TUMOR NOT RELATED TO PARAGANGLIOMAS. *Cancer* 37:1759-1769
4. Gaffey MJ, Mills SE, Askin FB (1988) MINUTE PULMONARY MENINGOTHELIAL-LIKE NODULES - A CLINICOPATHOLOGIC STUDY OF SO-CALLED MINUTE PULMONARY CHEMODECTOMA. *American Journal of Surgical Pathology* 12:167-175

5. Ionescu DN, Sasatomi E, Aldeeb D, et al (2004) Pulmonary meningothelial-like nodules - A genotypic comparison with meningiomas. *American Journal of Surgical Pathology* 28:207-214
6. Niho S, Yokose T, Nishiwaki Y, et al (1999) Immunohistochemical and clonal analysis of minute pulmonary meningothelial-like nodules. *Human Pathology* 30:425-429
7. Weissferdt A, Tang XM, Suster S, et al (2015) Pleuropulmonary Meningothelial Proliferations Evidence for a Common Histogenesis. *American Journal of Surgical Pathology* 39:1673-1678
8. Mizutani E, Tsuta K, Maeshima AM, et al (2009) Minute pulmonary meningothelial-like nodules: clinicopathologic analysis of 121 patients. *Human Pathology* 40:678-682
9. Mukhopadhyay S, El-Zammar OA, Katzenstein ALA (2009) Pulmonary Meningothelial-like Nodules New Insights Into a Common but Poorly Understood Entity. *American Journal of Surgical Pathology* 33:487-495
10. Lee HW, Jin KN, Lee JK, et al (2019) Long-Term Follow-Up of Ground-Glass Nodules After 5 Years of Stability. *Journal of Thoracic Oncology* 14:1370-1377

Tables

Table 1 Clinical features of 59 patients

Clinical features	
Age(years)	
Mean	57.7
Range	41-74
Gender	
Male	10(16.9)
Female	49(83.1)
Smoking history	
Present/Former	5(8.5)
Never	38(91.5)
Main diagnosis	
MPMN	14(23.7)
AAH	2(3.4)
AIS/MIA	21(35.6)
Invasive adenocarcinoma	21(35.6)
metastatic lung cancer	1(1.7)
Numbers of MPMN	
1	46(78.0)
2	7(11.9)
3	6(10.1)

Table 2 radiologic features of 43 nodules (29 patients)

Radiologic features	
Size(mm)	
Mean	4.5
Range	1.9-12.6
Location	
RUL	3(7.0)
RML	2(4.7)
RLL	19(44.2)
LUL	5(11.6)
LLL	14(32.6)
Appearance	
Pure	36(83.7)
Mixed	2(4.7)
Solid	5(11.6)

Table 3 Reasons of surgical decision (59 patients)

Reasons of surgical decisions	
Other malignant nodule	52(88.1)
Malignant finding of MPMN	5(8.5)
Long-term CT-scan follow-up	2(3.4)

Figures

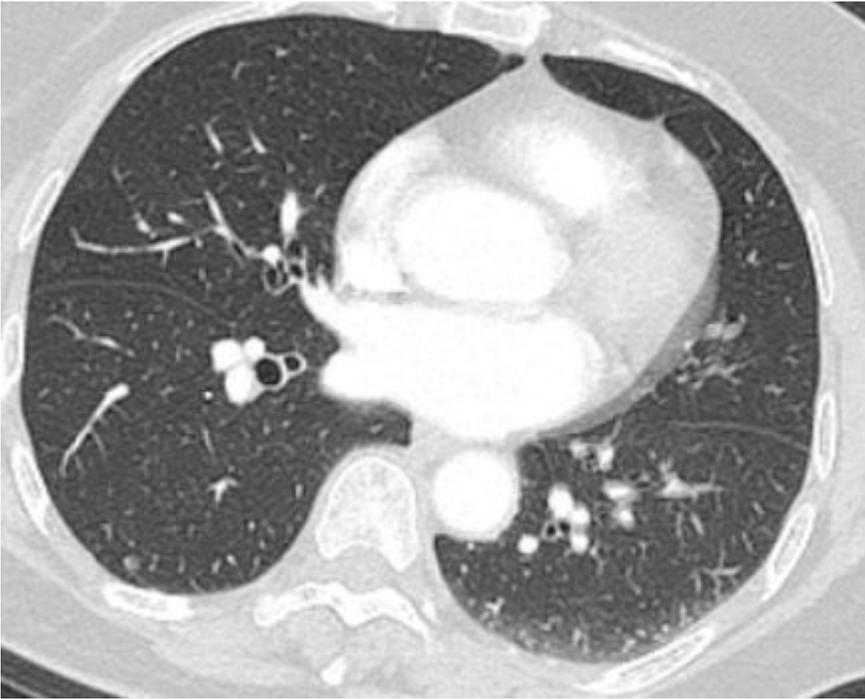


Figure 1

A MPMN located in right lower lobe presents as ground-glass opacity on chest CT scan.



Figure 2

A MPMN located in left lower lobe presents as solid nodule on chest CT scan.

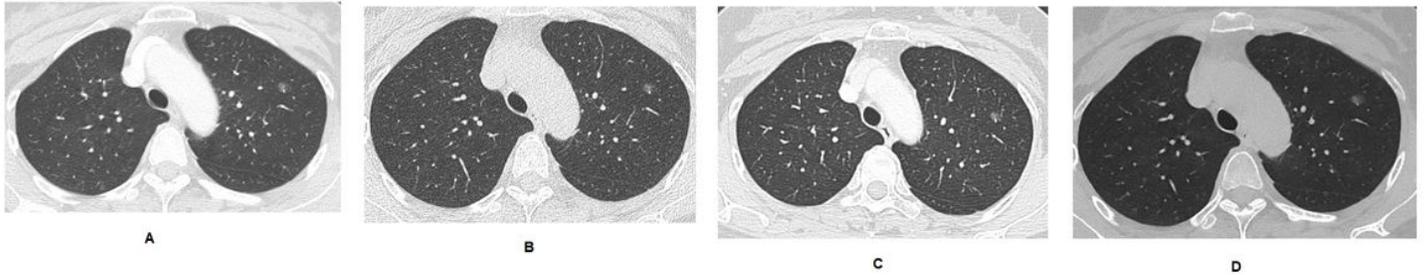


Figure 3

a: A 50-aged female patient was first examined a pure ground-glass opacity in June, 2016. b: Continuous CT chest scans were conducted in Sept, 2017. c: Next continuous CT chest scans were conducted in July, 2018. d: Latest continuous CT chest scans were conducted in Mar, 2019.

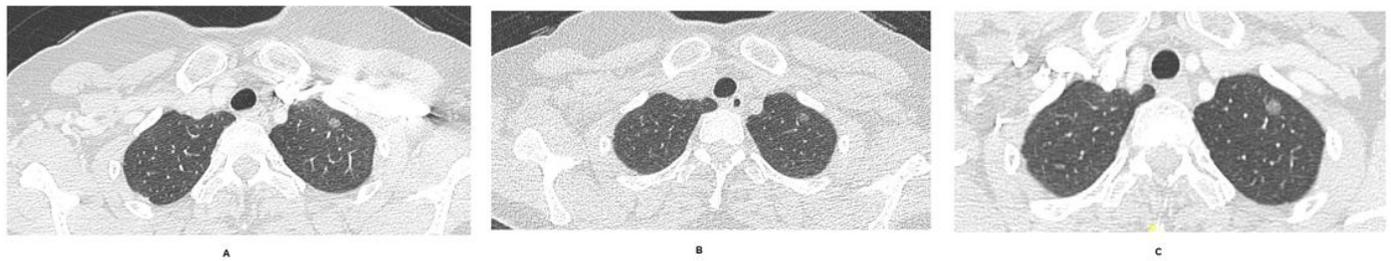


Figure 4

a: A 47-aged female patient was first examined a pure ground-glass opacity in Oct, 2014. b: Continuous CT chest scans were conducted in Jan, 2015. c: Latest continuous CT chest scans were conducted in June, 2018.