Case Reports in Oncology

Case Rep Oncol 2020;13:1097–1102
DOI: 10.1159/000509999
Published online: September 18, 2020

Case Report

Successful Resection of a Giant Pulmonary Colloid Adenocarcinoma via Median Sternotomy

Daisuke Nakamura[a] Ryoichi Kondo[a] Akiko Makiuchi[a] Hiroko Itagaki[b]

[a]Department of Thoracic Surgery, National Hospital Organization Matsumoto Medical Center, Nagano, Japan; [b]Department of Diagnostic Pathology, National Hospital Organization Matsumoto Medical Center, Nagano, Japan

Keywords
Colloid adenocarcinoma · Giant tumor · Median sternotomy

Abstract
We report on a giant pulmonary colloid adenocarcinoma successfully resected using a median sternotomy approach. A 69-year-old woman visited our hospital owing to a giant mass detected on chest radiography. A giant cystic mass measuring 115 × 90 mm was detected in the right upper lung using computed tomography. We suspected mucinous adenocarcinoma and performed right upper lobectomy and mediastinal lymph node dissection with median sternotomy. The surgical field of view for the tumor and superior vena cava was satisfactory, and compression but not invasion of the superior vena cava and chest wall by the tumor was observed. The tumor was pathologically diagnosed as a colloid adenocarcinoma of stage IIIA with pT4N0M0. The postoperative course was uneventful, with no signs of recurrence at one and a half years after operation. Thus, this case demonstrates that for giant lung tumor surgery, median sternotomy is useful and safe for improving the surgical field of view.

Introduction

Colloid adenocarcinoma of the lung (CA) is extremely rare, accounting for only 0.24% of all lung cancers [1]. According to the 2015 World Health Organization classifications, CA is a subtype of invasive adenocarcinoma [2]. The standard procedures for CA and other primary lung cancers are anteroaxial or posterolateral thoracotomy or video-assisted thoracic surgery. However, in patients with giant lung tumors, normal anteroaxial and posterolateral approaches do not provide sufficient surgical fields of view for resection of the pulmonary vessels. In comparison, median sternotomy allows the vessels of the pulmonary hilum to be

Daisuke Nakamura
Department of Thoracic Surgery
National Hospital Organization Matsumoto Medical Center
2-20-30 Murai-Machi-Minami, Matsumoto, Nagano 399-0021 (Japan)
shu0222@shinshu-u.ac.jp

Case Rep Oncol 2020;13:1097–1102
DOI: 10.1159/000509999

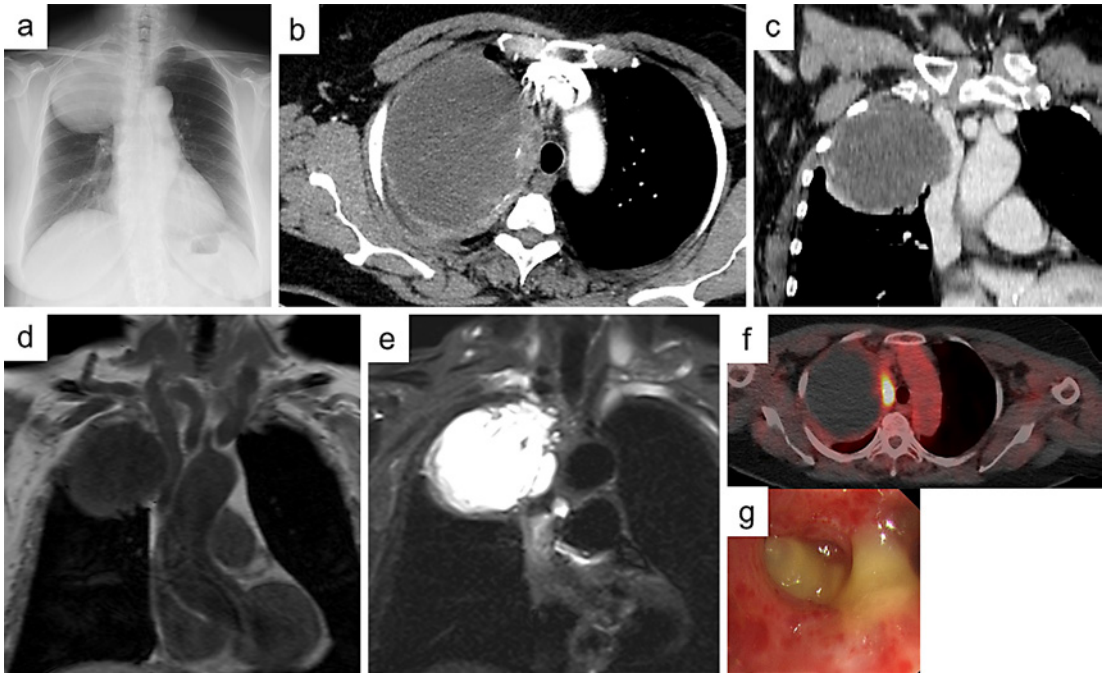

Fig. 1. Imaging findings. **a** Chest radiography showed a well-defined giant mass, approximately 11 cm in size, in the right upper lung field. **b**, **c** Contrast-enhanced chest computed tomography (CT) in the axial (**b**) and coronal (**c**) view revealed a giant cystic mass with calcification in the right lung apex and the absence of invasion of the superior vena cava. **d**, **e** Magnetic resonance imaging in the coronal view revealed low T1-weighted signals (**d**) and high T2-weighted signals (**e**) in the giant mass. **f** 2-[^{18}F]-fluoro-2-deoxyglucose positron emission tomography-CT showed enhanced signal positivity in the cystic wall due to tracer accumulation. **g** Bronchoscopy showed a large amount of mucus in the bronchus in the right upper lobe of the lungs.

more easily and safely detected. This case report describes a giant CA that was safely and successfully resected with an expanded surgical field of view provided by a median sternotomy.

Case Report

A 69-year-old woman visited our hospital after a giant mass was detected on a chest radiograph during routine health screening. She did not present with any respiratory symptoms, such as cough, sputum, chest pain, or dyspnea, and had a good appetite, with no recent weight loss, numbness, or edema. She was unemployed, did not smoke, and had no history of major disease. Chest radiography showed a well-defined giant mass measuring approximately 11 cm in size in the right upper lung field (Fig. 1a). A tumor biomarker test revealed elevated levels of carcinoembryonic antigen (6.4 ng/mL) and carbohydrate antigen 19-9 (953 U/mL), but a normal level of squamous cell carcinoma antigen.

Contrast-enhanced chest computed tomography (CT) revealed a giant cystic mass with calcification and contrast effects in the cystic wall. The mass was located in the apex of the upper lobe of the right lung and measured 115 × 90 mm in size (Fig. 1b, c). The hilar or mediastinal lymph nodes were not swollen. Magnetic resonance imaging (MRI) revealed low T1-weighted signals and high T2-weighted signals in the giant mass (Fig. 1d, e). CT and MRI indicated that the giant tumor compressed the superior vena cava (SVC) but was not invasive. 2-[^{18}F]-fluoro-2-deoxyglucose positron emission tomography-CT (PET-CT) revealed tracer uptake in the cystic wall, with a maximum standardized uptake value of 12.8 (Fig. 1f). A large

Case Rep Oncol 2020;13:1097–1102
DOI: 10.1159/000509999

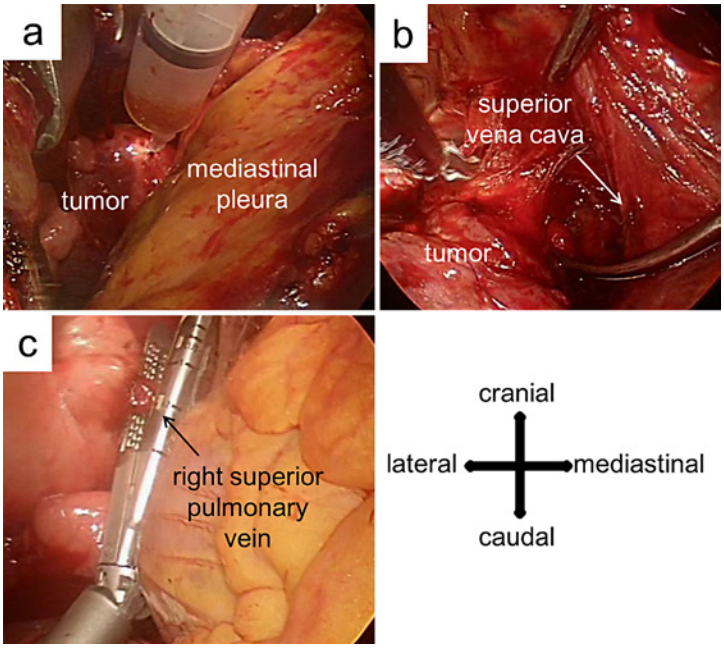

Fig. 2. Intraoperative findings. **a** The mucus in the giant tumor was aspirated. **b** The giant tumor compressed the superior vena cava but was not invasive and could be peeled. **c** The right superior pulmonary vein was resected using a mechanical stapler.

amount of mucus was obtained on bronchoscopy (Fig. 1g), but no malignancy was found on cytology. We made a preoperative diagnosis of suspected mucinous adenocarcinoma (T4N0M0, stage IIIA).

Because the mass was so large, we suspected that it would be difficult to get a sufficient visual field using a normal lateral thoracotomy approach and therefore performed a surgical resection with median sternotomy. The patient was placed in the supine position, and general anesthesia was administered through a double-lumen tube. For the median sternotomy, a sternal incision and a partial right cervical collar incision were made, and a good view of the tumor and SVC in the surgical area was obtained. However, the tumor had adhered to the mediastinal pleura just above the SVC. Because the tumor was tense, the mucus in the tumor was first aspirated as much as possible to determine whether the adhesions could be further visualized and detached (Fig. 2a). Following mucus aspiration, the tumor was found to be compressing the SVC, right subclavian artery and vein, and chest wall, but it was not invasive and could be peeled (Fig. 2b). After peeling the tumor from the major vessels and chest wall, the right superior pulmonary vein and truncus superior artery (A^{1+3}) were taped and resected using a mechanical stapler (Fig. 2c). The ascending A^2 was ligated and cut, the right upper bronchus was amputated with a mechanical stapler, and right upper lobectomy was performed. The hilar and mediastinal lymph nodes (#10, 11s, 2R, and 4R) were also dissected. To complete the operation, the sternum was closed using five pieces of steel wire. The operation time was 358 min, and blood loss was 810 mL.

Pathological examination of the cut surface of the resected specimen confirmed the presence of large amounts of mucus in the tumor (Fig. 3a). Microscopic examination of the specimen revealed tumor cells similar to goblet cells along the cystic wall and disruption of the alveolar cavity by the polycystic mucus. A few tumor cells were floating in the mucin pools (Fig. 3b, c). Immunohistochemistry showed that the tumor cells were positive for cytokeratin (CK) 7, CK20, caudal type homeobox 2 (CDX2), and mucin 2 (MUC2) and negative for thyroid transcription factor-1 (TTF-1) (Fig. 3d–h). According to the histological findings, CA and metastatic mucinous adenocarcinoma originating in the gastrointestinal tract were considered

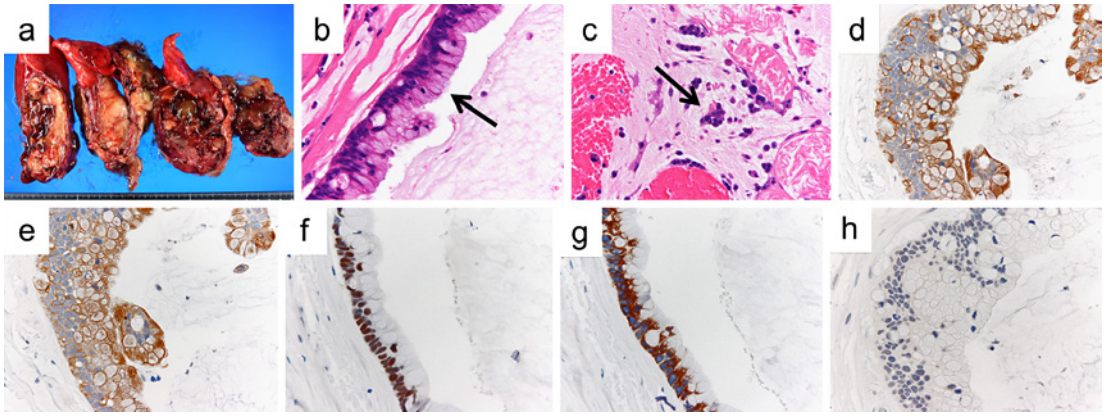

Fig. 3. Histological findings of the resected specimen. **a** The cut surface of the specimen revealed a large amount of mucus in the tumor. **b** Tumor cells resembling goblet cells lined the cystic wall, and the mucus disrupted the alveolar cavity (arrow). Hematoxylin and eosin. Original magnification, ×400. **c** A few tumor cells were floating in the mucin pools (arrow). Hematoxylin and eosin. Original magnification, ×400. **d–h** The tumor cells were immunohistochemically positive for cytokeratin (CK) 7 (**d**), CK20 (**e**), caudal type homeobox 2 (CDX2) (**f**), and mucin 2 (MUC2) (**g**) and negative for thyroid transcription factor-1 (TTF-1) (**h**). Original magnification, ×400.

as differential diagnoses. The latter possibility was ruled out because there was no significant tracer accumulation in the gastrointestinal tract on preoperative PET-CT and no tumor lesions in the gastrointestinal tract on postoperative endoscopy. Therefore, we finally diagnosed T4N0M0, stage IIIA CA.

The postoperative course of the patient was uneventful. A drainage tube was displaced 4 days after surgery, and the patient was discharged 11 days after surgery. Carcinoembryonic antigen and carbohydrate antigen 19-9 values returned to within the normal range 1 month after the operation. Postoperative adjuvant chemotherapy with 4 courses of carboplatin and nab-paclitaxel was administered, with no signs of recurrence at one and a half years after operation.

Discussion

CAs typically present as solid tumors with poor enhancement on contrast CT and low tracer accumulation on PET-CT [3]. The tumor in our case fulfilled the CT requirement for a CA, but not the PET-CT requirement (high tracer accumulation in a portion of the cystic wall was observed). Moreover, the small percentage of malignant cells floating in the tumor mucus made it difficult to preoperatively diagnose CA via transbronchial biopsy or needle biopsy [4]. Hence, CA was not diagnosed pre- or intraoperatively, but only upon postoperative histopathological examination. Instead, owing to low signals on T1-weighted and high signals on T2-weighted magnetic resonance images, the initial diagnosis was mucinous invasive adenocarcinoma.

As previously reported for CA cases [5], the tumor cells in our case focally lined the alveolar wall – with their copious mucin destroying the alveoli – or were found floating in the mucin. Our immunohistochemical results were similar to those of previous CA studies [1, 5]. As classified by Rossi et al. [1], there are two types of CA: (1) the goblet cell type and (2) the signet ring type, which are positive and negative for CDX2 and MUC2, respectively. The tumor in our case expressed these markers (CDX2 and MUC2) and thus apparently was the goblet

cell type, which had a better prognosis than the signet ring type [1]. However, postoperative adjuvant chemotherapy was administered to our patient because the tumor was pathologically diagnosed as stage IIIA.

The tumor in this case was asymptomatic, and giant CAs larger than 10 cm are extremely rare [6]. The definitive treatment for nonadvanced CA is surgical resection, and the most common approaches are lateral thoracotomy and video-assisted thoracic surgery. However, for giant tumors that reach the hilum, as well as for locally advanced non-small cell lung cancers, it is difficult to obtain a sufficient visual field and to approach major blood vessels such as the SVC and pulmonary artery and vein using a normal thoracotomy approach. Median sternotomy is a surgical option for locally advanced non-small cell lung cancer [7, 8]. In our case, compression of the SVC by the giant tumor was expected on CT and MRI. If the tumor could not be dissected from the SVC, reconstruction of the SVC would have been necessary. Therefore, we considered that the median sternotomy approach would be useful in SVC reconstruction to secure the field of view and improve operability. In fact, the giant CA and SVC could be observed well via median sternotomy, and peeling of the adhesions from the SVC was relatively easy. After peeling, a good visual field was secured, and the major vessels could be successfully dissected.

In conclusion, to our knowledge, this is the first report of a giant CA that could be safely removed using a median sternotomy approach to provide a good field of view. Hence, median sternotomy is a viable option for surgical resection of giant CAs.

Acknowledgments

We would like to thank Editage (www.editage.jp) for English language editing.

Statement of Ethics

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

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Funding Sources

None of the authors have any funding to disclose.

Author Contributions

D.N. drafted the manuscript; R.K., D.N., and A.M. performed the operation and managed the perioperative course; H.I. made the pathological diagnosis; R.K. revised the manuscript; all authors read and approved the final manuscript.

References

1 Rossi G, Murer B, Cavazza A, Losi L, Natali P, Marchioni A, et al. Primary mucinous (so-called colloid) carcinomas of the lung: a clinicopathologic and immunohistochemical study with special reference to CDX-2 homeobox gene and MUC2 expression. Am J Surg Pathol. 2004 Apr;28(4):442–52.
2 Travis WD, Brambilla E, Burke AP, Marx A, Nicholson AG, editors. WHO Classification of tumors of the lung, pleura, thymus and heart. 4th ed. Lyon: IARC; 2015. pp. 1243–60.
3 Kim HK, Han J, Franks TJ, Lee KS, Kim TJ, Choi JY, et al. Colloid adenocarcinoma of the lung: CT and PET/CT findings in seven patients. AJR Am J Roentgenol. 2018 Aug;211(2):W84–W91.
4 Travis WD, Brambilla E, Noguchi M, Nicholson AG, Geisinger KR, Yatabe Y, et al. International Association for the Study of Lung Cancer/American Thoracic Society/European Respiratory Society international multidisciplinary classification of lung adenocarcinoma. J Thorac Oncol. 2011 Feb;6(2):244–85.
5 Masai K, Sakurai H, Suzuki S, Asakura K, Nakagawa K, Watanabe S. Clinicopathological features of colloid adenocarcinoma of the lung: a report of six cases. J Surg Oncol. 2016 Aug;114(2):211–5.
6 Graeme CF, Mark EJ. Pulmonary mucinous cystic tumors of borderline malignancy. Hum Pathol. 1991 Feb;22(2):185–90.
7 Igai H, Yokomise H. Intrapericardial approach via median sternotomy for hilar non-small cell lung cancer invading the main pulmonary artery. Interact Cardiovasc Thorac Surg. 2010 Oct;11(4):385–6.
8 Sato H, Toyooka S, Soh J, Hotta K, Katsui K, Yamamoto H, et al. The feasibility of median sternotomy with or without thoracotomy for locally advanced non-small cell lung cancer treated with induction chemoradiotherapy. Ann Thorac Surg. 2016 Sep;102(3):985–92.