

**CASE REPORT****Pulmonary Granuloma Associated with Non-tuberculous Mycobacteriosis Occurring at the Staple Line After Segmentectomy for Lung Cancer: Report of a Case**Mitsuru Yoshino<sup>1</sup>; Yasuo Sekine<sup>1</sup>; Eitetsu Koh<sup>1</sup>;  
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**ABSTRACT** — **Background.** It is difficult to distinguish the development of granuloma along the staple line after segmentectomy from tumor recurrence. **Case.** A 70-year-old male underwent left S<sup>8</sup> segmentectomy with lymph node dissection for early stage IA lung adenocarcinoma using video-assisted thoracic surgery. One year later, a routine chest CT scan disclosed a mass adjacent to the previous segmentectomy site. Although local recurrence of lung cancer was suspected, a bronchoscopic examination showed no recurrence, and the results of a bacteriological examination were nonspecific. Steroid therapy was therefore initiated based on our concern for the potential of organizing pneumonia. The mass lesion subsequently shrank in size, almost disappearing. Interval chest CT, however, demonstrated regrowth of the site of consolidation along the staple line. The steroid therapy was repeated; however, the area of consolidation continued to grow. Completion left lower lobectomy was thus performed, as the possibility of local cancer re-

currence could not be excluded. At the time of thoracotomy, a hard white mass was palpated along the staple line in the left lower lobe. A pathological analysis revealed epithelioid granuloma with caseating necrosis, and *Mycobacterium avium* complex (MAC) grew from a culture of the specimen. Therefore, the lesion was thought to be a granuloma caused by MAC infection at the previous segmentectomy staple line. **Conclusions.** We herein report a rare case of pulmonary granuloma associated with non-tuberculous mycobacteriosis occurring at the staple line after segmentectomy for lung cancer. In addition to local recurrence or secondary primary lung cancer, the possibility of mycobacterial granuloma should be considered in cases in which pulmonary nodules are detected on the staple line after pulmonary resection.

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**KEY WORDS** — Lung cancer, Stapler, Granuloma, *Mycobacterium*, Segmentectomy**INTRODUCTION**

The characteristics of pulmonary nodules appearing after surgery for pulmonary malignant lesions vary in several respects, with malignant lesions being most common, while inflammatory nodules are rare.<sup>1-3</sup>

In this article, we report our experience with a patient who developed a pulmonary granuloma associated with non-tuberculous mycobacteriosis occurring at the staple

line after segmentectomy for lung cancer. In this case, it was difficult to distinguish the granuloma from local recurrence or a new primary lung cancer.

**CASE REPORT**

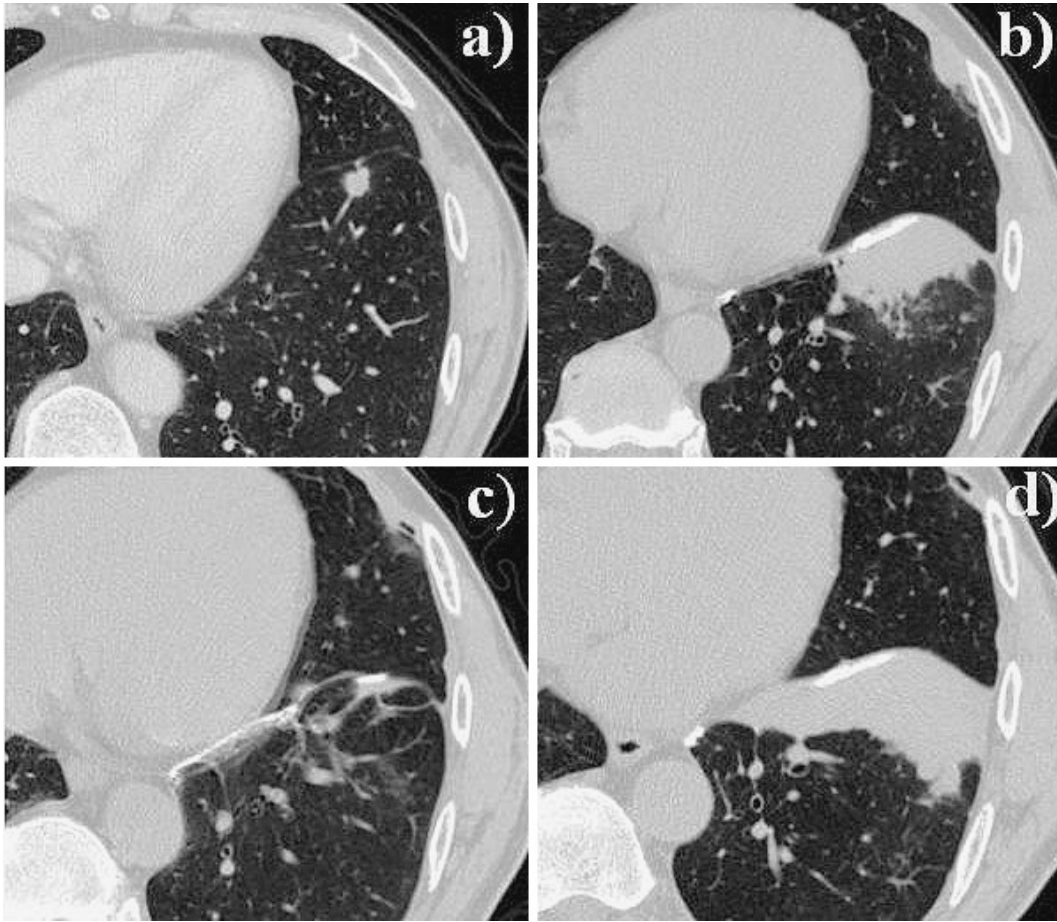
A 70-year-old male was admitted to our hospital with an abnormal pulmonary shadow on CT (Figure 1a). After performing a complete work-up, left S<sup>8</sup> segmentectomy with lymph node dissection was performed for early

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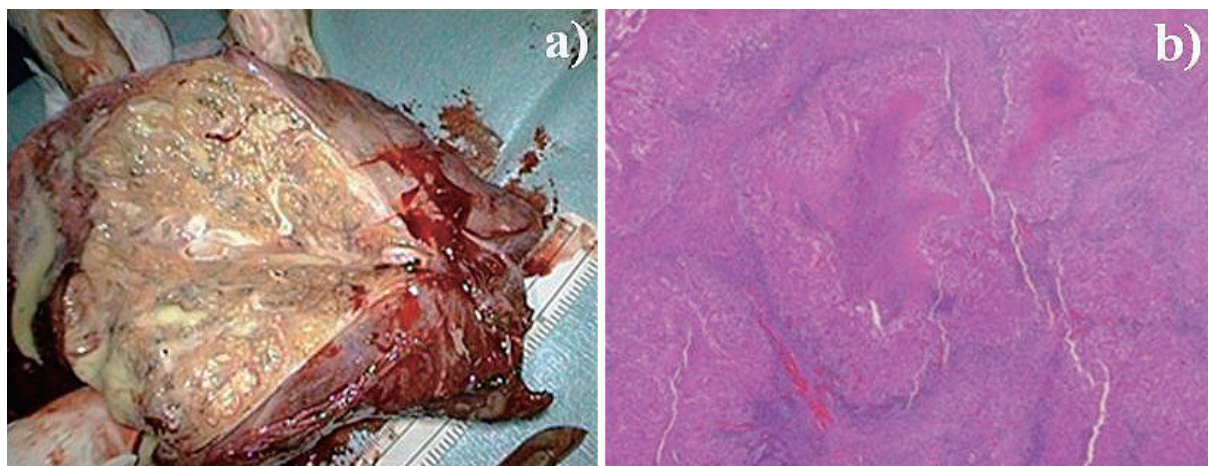


**Figure 1.** (a) Computed tomography (CT) at the time of hospital admission. A small nodule was identified in the left S<sup>8</sup> segment. (b) One year after pulmonary resection, a left pulmonary nodule was detected near the staple line. (c) The pulmonary nodule decreased in size following the administration of steroid therapy. (d) Thirty-nine months later, chest CT showed that the area of consolidation along the staple line had again increased.

stage IA lung adenocarcinoma using the video-assisted thoracic surgery (VATS) technique, in which we employed two staplers to divide the intersegmental plane. One year after the pulmonary resection procedure, a routine chest CT scan showed a mass adjacent to the previous segmentectomy site (Figure 1b) that was metabolically active (SUVmin: 8.8, SUVmax: 11.1) on a positron emission tomography (PET) scan. Therefore, local recurrence of lung cancer was suspected. However, a bronchoscopic examination demonstrated no evidence of recurrence, and the findings of a bacteriological examination of the bronchoalveolar lavage fluid were non-specific. In addition, the patient exhibited no symptoms, and the results of blood studies were all within the normal limits. A diagnosis of organizing pneumonia was suspected, and treatment with steroid pulse therapy for

three consecutive days was initiated in association with the continuation of daily hydrocortisone (30 mg/day), the dose of which was gradually tapered over 10 weeks. Consequently, the mass on CT shrank in size, nearly disappearing (Figure 1c). Thirty-nine months later, chest CT showed regrowth of the area of consolidation 8 cm along the staple line (Figure 1d). Unfortunately, the administration of repeat steroid therapy for 16 weeks had no effect in reducing the size of the mass, which, in fact, continued to grow. Although we recommended repeating bronchoscopy, the patient refused and instead opted for surgery.

Completion left lower lobectomy was thus performed, as the presence of local tumor recurrence was suspected, in addition to posterolateral thoracotomy. At the time of thoracotomy, a hard white mass was palpated



**Figure 2.** Resected residual left lower lobe. (a) Macroscopically, the mass consisted of grey elastic tissue with the inner mass appearing to be an abscess. (b) Histologically, epithelioid cells, multinucleated giant cells and necrotic tissue were seen (H&E, 25 $\times$ ).

along the staple line on the anterior aspect of the left lower lobe, and severe adhesion was observed around the tumor as well as the superior lobe and the interlobar space. Therefore, we encircled the main PA and superior PV prior to dissecting the interlobar PA. Macroscopically, the lesion consisted of grey elastic tissue containing an abscess (Figure 2a). A pathological examination of the resected specimen showed the presence of epithelioid cells, multinucleated giant cells and central necrotic tissue (Figure 2b). Hence, the diagnosis was an epithelioid granuloma with caseous necrosis located at the staple line. While Ziehl-Neelsen staining and a PCR analysis were both negative, a bacterial culture of the resected specimen showed the growth of *Mycobacterium avium* complex (MAC) at four weeks. There was no evidence of malignancy in the resected specimen. Treatment with cefazolin was given for five days during the postoperative period. Since the infectious lesion was surgically removed, additional antibiotics were not administered after the operation.

## DISCUSSION

The differential diagnosis of pulmonary nodules detected at the staple line after pulmonary resection includes local recurrence, second primary cancer, granulomatous disease or other bacterial infections.<sup>1-6</sup> In the current case, local recurrence was initially suspected, and we subsequently performed a bronchoscopic examination. Although a definitive diagnosis was not obtained in this study, we suspected the possibility of organizing

pneumonia, and subsequent steroid therapy was effective in reducing the size of the lesion. However, this treatment was not effective when the lesion grew again over three years later, which suggests that the first CT lesion was organizing pneumonia responsive to steroid therapy, while the second lesion was non-tuberculous mycobacteriosis exacerbated by steroid therapy.

Non-tuberculous mycobacteria multiply in soil and water, and *Mycobacterium avium* and *Mycobacterium intracellulare* account for most pathogens in this group. Generally, MAC does not infect humans with an intact immune system, although it is frequently an opportunistic pathogen in elderly subjects with chronic lung disease or those with decreased immunity. In the present case, it was not certain whether the infection occurred *de novo* after the first operation, or if our patient had been infected previously. In any event, we speculate that the long-term steroid therapy induced the deterioration of the *Mycobacterium* infection. It may therefore be valuable to repeat the bronchoscopic examination if the area of consolidation again increases.

Delays in wound healing and foreign substance reactions to the staples are thought to be causes of staple infection resulting from obstacles in ventilation and the bloodstream near the staple-suture line.<sup>6-8</sup> Because the staple line is poorly ventilated and poorly perfused, this area is susceptible to infection during the postoperative period.<sup>8</sup> In addition, the use of limited resection for lung cancer via segmentectomy using staplers may disturb the venous drainage in the intersegmental plane. There-

**Table 1.** Clinicopathologic Features of Mycobacterial Granulomas Occurring at the Staple Line After Lung Resection for Lung Cancer (Reported Cases)

| Case | Author                 | Age (y) | Sex | Primary site       | Primary operation                | Histology | Stage | Interval | Origin bacteria          | Treatment       |
|------|------------------------|---------|-----|--------------------|----------------------------------|-----------|-------|----------|--------------------------|-----------------|
| 1    | Tanaka <sup>9</sup>    | 50      | F   | lt. S <sup>3</sup> | lt. upper division resection     | Ad        | IA    | 5y       | <i>M. tuberculosis</i>   | wedge resection |
| 2    | Kono <sup>7</sup>      | 60      | M   | lt. S <sup>6</sup> | lt. S <sup>6</sup> segmentectomy | Ad        | IA    | 2y       | <i>M. intracellulare</i> | lobectomy       |
| 3    | Matsuoka <sup>10</sup> | 62      | F   | rt. S <sup>3</sup> | rt. upper lobectomy              | Ad        | IA    | 4y6m     | <i>M. avium</i>          | wedge resection |
| 4    | Furukawa <sup>8</sup>  | 57      | F   | rt. S <sup>8</sup> | rt. S <sup>8</sup> segmentectomy | Ad        | IA    | 4y       | <i>M. avium</i>          | bilobectomy     |
| 5    | Murakami <sup>11</sup> | 72      | F   | rt. middle lobe    | rt. middle lobectomy             | Ad        | IA    | 8y       | NA                       | lobectomy       |
| 6    | Our case               | 70      | M   | lt. S <sup>8</sup> | lt. S <sup>8</sup> segmentectomy | Ad        | IA    | 3y8m     | <i>M. avium</i>          | lobectomy       |

Ad: adenocarcinoma, M: *Mycobacterium*, NA: not available.

fore, the surgeon must adjust the point of stapling in order to obtain an adequate margin around the tumor. Presumably, the vascular supply to the portion of the remaining segment may thus be compromised, with subsequent progression to ischemic infarction and/or fibrosis. Another possibility is that, while dividing the blood supply to these segments, a portion of the arterial supply or venous drainage in the remaining segment is removed, possibly leading to ischemia due to thromboembolism.<sup>7-10</sup>

There are five prior case reports describing the development of mycobacterial granulomas near the staple line after surgical resection for lung cancer. The characteristics of these patients, including the present patient, are shown in Table 1.<sup>7-11</sup> All patients were found to have early disease, and most underwent segmentectomy, with the final diagnosis made after several years. In such cases, segmentectomy using staples may have an effect on the incidence of granuloma formation, which is thought to be an important long-term adverse event of lung tissue stapling.

## CONCLUSION

We herein reported a rare case of pulmonary granuloma associated with non-tuberculous mycobacteriosis occurring at the staple line after segmentectomy for lung cancer. In addition to local recurrence or secondary primary lung cancer, the possibility of mycobacterial granuloma should be considered in cases in which pulmonary nodules are detected along the staple line after pulmonary resection.

本論文内容に関連する著者の利益相反：なし

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