

Intraoperative indocyanine green fluorescence imaging to assess lung viability in middle lobe torsion



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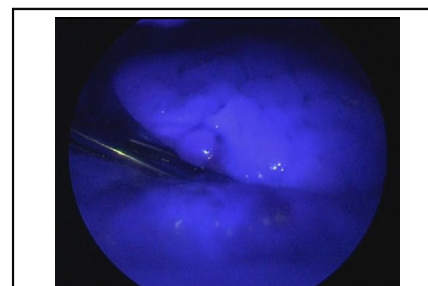
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Intraoperative indocyanine green fluorescence imaging demonstrating good perfusion to the right middle lobe.

CENTRAL MESSAGE

We report the first case of the use of intraoperative indocyanine green fluorescence imaging to assess lung viability in middle lobe torsion.

▶ Video clip is available online.

CASE REPORT

A 70-year-old female non-smoker presented with a 2.9×1.8 cm right upper lobe solid mass and a separate 1.0×0.6 cm ground glass opacity in the apical segment of the right lower lobe incidentally detected on a computed tomography image of the thorax, abdomen, and pelvis done for evaluation of normocytic normochromic anemia. She underwent a right video-assisted thoracoscopic right upper lobectomy and S6 segmentectomy (en bloc resection) and mediastinal lymph node dissection. The surgery was performed routinely without complications.

Initial immediate postoperative chest radiograph (CXR) was unremarkable. However, her CXR on postoperative day 1 showed interval development of opacities over the right upper zone suggestive of middle lobe collapse. The patient was asymptomatic. She had an episode of low-grade temperature of 37.8°C but her heart rate and blood pressure remained within normal limits and she maintained oxygen saturations of between 98% and 100% on 2 L/minute oxygen supplementation. Aggressive chest physiotherapy with incentive spirometry was initiated and regular mucolytics were prescribed.

Despite this, a repeat CXR on postoperative day 2 revealed persistent right middle lobe collapse. Urgent

bronchoscopy was performed under sedation. On examination of the right side airways, the right upper lobe stump was visualized, the right lower lobe orifice was edematous but the right middle lobe orifice was occluded and the bronchoscope could not be passed beyond the obstruction (Figure 1). Flushing of normal saline also failed to reopen the right middle lobe orifice.

Urgent video-assisted thoracoscopic surgical re-exploration was performed for concerns of right middle lobe torsion (Video 1). Intraoperatively, the right middle lobe was collapsed with torsion around its bronchovascular pedicle of approximately 180° . Detorsion of the right middle lobe was performed. After detorsion, the right middle lobe was congested but otherwise able to reinflate well with positive pressure ventilation. A 0.5 mg/kg dose of intravenous indocyanine green (ICG) (Diagnostic Green GmbH) was administered and intraoperative imaging with an ICG fluorescence capable camera system (Karl Storz) showed good perfusion of the right middle lobe (Figure 2). Thus, we concluded that the right middle lobe was still viable and did not require a middle lobectomy. Suture pneumopexy with the use of Prolene 4-0 sutures was performed to anchor

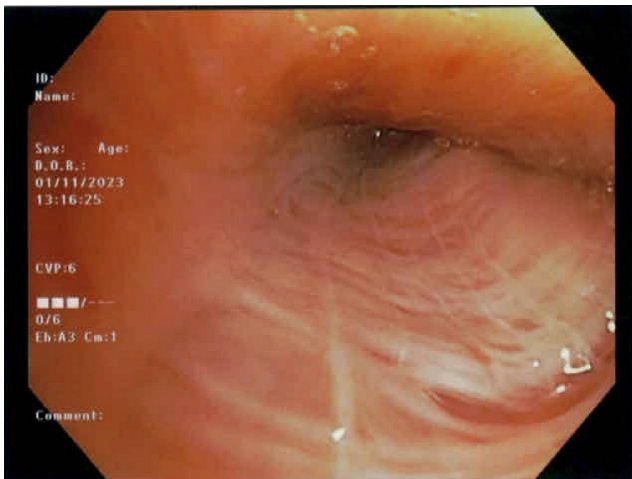


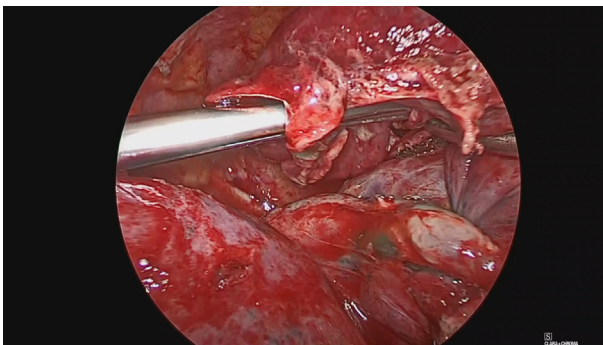
FIGURE 1. Bronchoscopy before surgical re-exploration revealed an occluded right middle lobe orifice.

the right middle lobe to the right lower lobe. Postoperative bronchoscopy showed that the right middle lobe orifice was patent compared with preoperatively.

CXR on postoperative day 3 following surgical exploration and detorsion of the right middle lobe showed reduced opacities in the right upper zone consistent with re-expansion of the right middle lobe (Figure E1). The patient remained afebrile and hemodynamically stable and was discharged on postoperative day 6.

DISCUSSION

Intraoperative imaging with ICG fluorescence has gained increasing popularity in thoroscopic surgery in recent years. Its current applications include pulmonary nodule localization and intersegmental plane identification for sublobar resections. We report the first case to the best of our knowledge on the use of ICG fluorescence as an adjunct for the assessment of lung viability during thoroscopic surgical exploration for lung torsion.



VIDEO 1. Right video assisted thoroscopic exploration and detorsion of the right middle lobe. Video available at: [https://www.jtcvs.org/article/S2666-2507\(24\)00176-7/fulltext](https://www.jtcvs.org/article/S2666-2507(24)00176-7/fulltext).

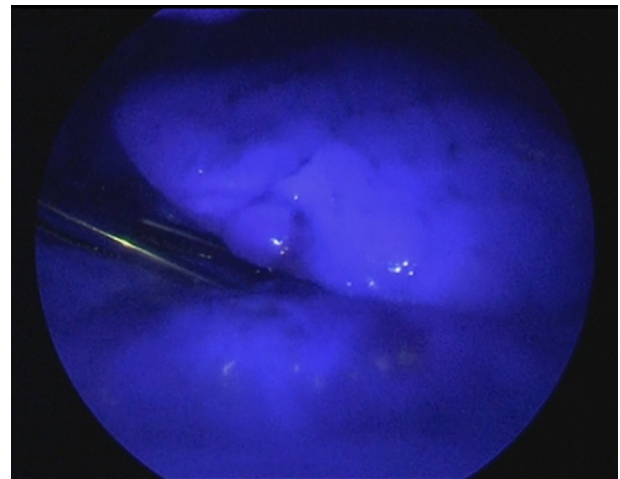


FIGURE 2. Intraoperative indocyanine green fluorescence imaging demonstrating good perfusion to the right middle lobe.

Lung torsion is defined as parenchymal rotation on its bronchovascular pedicle. It is a rare complication following lung resection, with reported incidence <1%.¹ In a systematic review on predictors of survival in lung torsion, Dai and colleagues² found that right middle lobe torsion after upper lobectomy was most frequently reported; this was the case for our patient. The exact causes for this phenomenon are poorly understood, although it has been postulated that a complete interlobar fissure, disruption of intrathoracic attachments, and a lack of adhesions may predispose to it.³ Regardless, timely intervention is required because prolonged obstruction of the bronchovascular pedicle can compromise the pulmonary arterial and venous circulation and result in pulmonary infarction and necrosis. Although much emphasis has been placed on securing a timely diagnosis of lung torsion before the onset of necrosis, a review of available literature on the topic revealed gaps in knowledge on the assessment of lung viability. There is a lack of objective reporting on the intraoperative assessment of lung viability in lung torsion, with only a few cases describing the gross appearance of a swollen blue-black hemorrhagic lung.⁴ ICG has gained recognition as a useful adjunct for the assessment of real-time perfusion of bowel and we propose future studies look into role of ICG as an adjunct in cases where intraoperative assessment of lung viability is deemed to be indeterminate or borderline.⁵ As in cases involving the bowel, ICG should be used only as an adjunct for assessing viability given that the sensitivity of this technique in cases where the lung may be necrosed is not known. We acknowledge the limitations of the study being a single case report.

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Conflict of Interest Statement

The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

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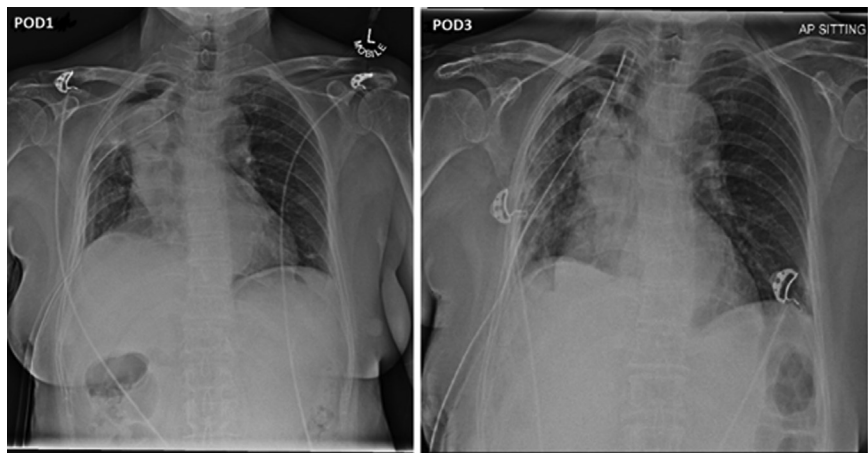


FIGURE E1. Serial chest radiographs showing development of collapse of the right middle lobe on postoperative day (*POD*) 1 and re-expansion of the middle lobe after surgical re-exploration and detorsion of the middle lobe on the chest radiograph done on *POD* 3.