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Commentary: Is indocyanine green the god of salvation?

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Pulmonary segmentectomy is an old technique, but the best way to perform this procedure is still being investigated. The operation has been performed mainly for benign pulmonary lesions, such as tuberculosis, or for lung malignancy in compromised patients. In this situation, segmentectomy has not always been the best way to go, and sometimes the procedure is very similar to wedge resection. On the other hand, the situation is different for intentional segmentectomy. Since the North America Lung Cancer Study Group determined the best surgical procedure for lung cancer to be pulmonary lobectomy instead of sublobar resection, pulmonary lobectomy has been the standard.¹ Pulmonary segmentectomy should result in the noninferior outcome, and this thesis is being investigated in phase 3 trials in the United States and Japan.^{2,3} The final results will be reported and segmentectomy could be indicated for more patients in the world.

Yotsukura and colleagues⁴ report the feasibility of indocyanine green (ICG) imaging for pulmonary segmentectomy. The outcome was surprisingly successful in terms of demarcation of the intersegmental line by ICG imaging. Compared with the residual segment inflation method,⁵ this method was better—especially in performing complex segmentectomy. The results may contribute to thoracic surgeons increasingly prescribing segmentectomy for lung cancer from now on.

In our opinion, the authors' indication of segmentectomy is potentially problematic. They performed this procedure for 244 out of 996 patients, and this 24% is too many,

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CENTRAL MESSAGE

Indocyanine green imaging is not always better than conventional methods for demarcation of the intersegmental plane.

even considering that some were for benign lesions (2.9%) or malignancies in compromised patients. Their indications are as follows: "...in Japan Clinical Oncology Group 0802 (small [diameter ≤ 2.0 cm] peripheral non-small cell lung cancer, excluding radiologically determined noninvasive cancer) and Japan Clinical Oncology Group 1211 (predominant ground glass opacity lung adenocarcinoma ≤ 3.0 cm in diameter)." However, these 2 trials are ongoing and the results are unknown. How do the surgeons in the National Cancer Center Hospital explain the benefit for segmentectomy instead of lobectomy? Segmentectomy using ICG has been reported and frequently used by thoracic surgeons.⁶ This method was used for identifying the intersegmental plane and the authors confirmed this fact. Conclusions were the feasibility of the ICG methods compared with the method of resection of inflated segments by transbronchial jet ventilation. The conclusions should be premature, for the outcome of sublobar resection should be evaluated by local control and prognosis at least 3 years after operation, which was among the lessons from the Lung Cancer Study Group trial. Among the most important steps for segmentectomy is identification of the intersegmental plane, and they reported ICG was better in performing complex segmentectomy rather than simple segmentectomy compared with jet ventilation. However, demarcation tended to be poorer in patients with obstructive lung disease ($P = .072$). The intersegmental plane should be identified in the pulmonary parenchyma rather than surface pleura, and this is the significant disadvantage to the ICG method. Staplers were mainly used for segmentectomy in this study, but some segmentectomies should be performed by other

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means, such as electro cautery. The feasibility of ICG should be reported in this situation. Complex segmentectomy cannot always be performed by stapler, and this results in more morbidity.³ This is confirmed by the study, although it was not statistically significant ($P = .089$). In the near future, 2 important trials will be reported, and thoracic surgeons need to prepare to perform segmentectomy for more patients.

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