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学位論文の題名	Preoperative percutaneous needle indigo carmine and lipiodol mixture marking in lung segmentectomy (肺区域切除におけるインジゴカルミンとリピオドール混合液による術前経皮的針マーキング) European Journal of Cardio-Thoracic Surgery 2022, 62(4), ezac432
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1 **Abstract**

2 **Objectives:** Recent advancements in radiological diagnostic and surgical techniques have
3 gradually facilitated the widespread use of pulmonary segmentectomy for lung malignancies.
4 Ensuring appropriate margin distances is important for both achieving oncological benefits
5 and preserving pulmonary function following segmentectomy. For successful nodule
6 localization and appropriate surgical margin distances in pulmonary segmentectomy for
7 patients with lung malignancies, the effectiveness and feasibility of preoperative marking
8 using an indigo carmine and lipiodol mixture remain unclear.

9 **Methods:** Patients who underwent thoracoscopic pulmonary segmentectomy with (marking
10 group, n = 69) and without (non-marking group, n = 265) preoperative marking at our
11 institution from January 2013 to March 2020 were retrospectively reviewed and compared in
12 terms of surgical outcomes. All markings were performed using a fine needle to
13 percutaneously inject an indigo carmine and lipiodol mixture under the guidance of computed
14 tomography fluoroscopy.

15 **Results:** Successful localization was achieved in 66 (96%) patients, of whom 62 (94%)
16 underwent dye pigmentation and four (6%) underwent intraoperative fluoroscopy. On images,
17 the marking group showed a significantly longer distance between the lung surface and
18 tumor (mm, 9 (1–17) vs. 0 (0–10); $p < 0.01$) and smaller maximum tumor size (mm, 16 (11–
19 21) vs. 17 (13–23); $p = 0.03$) and consolidation tumor ratio (0.4 (0.3–1) vs. 0.8 (0.4–1); $p <$
20 0.01) than the non-marking group. Both groups had comparable operative outcomes,
21 perioperative complications, pulmonary function changes, and surgical margin distances
22 (mm, 20 (15–21) vs. 20 (15–20); $p = 0.96$) without any local recurrence on the surgical
23 margin. Propensity score-matching analysis also showed similar findings for both groups.

24 **Conclusions:** Thoracoscopic pulmonary segmentectomy with preoperative marking using an
25 indigo carmine and lipiodol mixture may be an acceptable therapeutic option for small
26 malignancies located deep lung parenchyma.