



# Preferred management of post-operative chest tube placement after lung resection

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## The goals of postoperative chest tube placement

Thoracic surgeons routinely place chest tubes after lung cancer surgeries (1). Postoperative chest tube placement has two purposes. The first is for diagnosis. Surgeons can diagnose postoperative complications early by using fluid from the chest tube. Intrathoracic bleeding, chylothorax, and empyema require early diagnosis and rapid treatment. The second purpose is drainage. Pleural fluid accumulation can cause breathing difficulties after lung resection, eventually leading to atelectasis and pneumonia (2). A thoracic tube can drain pleural effusion to prevent the occurrence of these complications, as well as air leak to prevent postoperative pneumothorax. However, chest tube-associated complications, such as pain, tube-related infection, and delayed wound healing, have been reported (3,4). Thus, thoracic surgeons must discuss and decide what the preferred technique of chest tube insertion is, how many days the chest tube needs to be placed, and whether or not tube placement after surgery is actually necessary.

In this editorial comment, I focus on the thoughtful article (4) “Randomized trial of modified chest tube placement vs routine placement after lung resection” and discuss the preferred management of chest tubes. Finally, I hope that optimal management of the chest tube will reduce tube-related complications and the invasiveness of the

procedure.

## Preferred technique of chest tube insertion

Yun *et al.* provided important suggestions based on their randomized controlled trial (4). Lung cancer patients were divided into two groups according to the technique of chest tube placement: routine chest tube placement (RCP) and modified chest tube placement (MCP). In the RCP group, the chest tube was directly inserted into the thoracic cavity through the camera port incision under direct visualization or video guidance. In the MCP group, the chest tube was tunneled from the camera port incision to the upper adjacent intercostal space subcutaneously using forceps and into the thoracic cavity. Although various institutions already use MCP instead of RCP, this study is significant because the authors, through a prospective randomized controlled trial, were able to show that MCP was more effective than RCP in reducing chest tube-related complications.

The study demonstrated that patients in MCP group had a lower incidence of peritubular pleural fluid leakage (after surgery: 39.6% *vs.* 18.4%,  $P=0.007$ ; after chest tube removal: 26.7% *vs.* 11.2%,  $P=0.005$ ) and peritubular air leakage or entry (14.9% *vs.* 5.1%,  $P=0.022$ ), and required fewer dressing changes ( $5.02\pm 2.30$  *vs.*  $3.48\pm 0.94$ ,  $P<0.001$ )

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compared to those in the RCP group. In addition, patients in the MCP group had higher satisfaction with wound healing than those in the RCP group (96.9% vs. 90.1%,  $P=0.051$ ). Importantly, no significant difference between the two groups in terms of total drainage volume, duration of chest tube placement, postoperative complications, and postoperative pain were observed. The MCP procedure may reduce the risk of air suction into the thoracic cavity during chest tube removal. Based on these results, MCP is considered an effective and safe procedure.

Surgeons should consider not only efficacy and safety, but also the patients' comfort postoperatively. The RCP method caused more peritubular leakage of pleural fluid even after chest tube removal and required more frequent dressing changes compared to the MCP method. Moreover, increased fluid leakage, as seen with the RCP method, may result in insufficient wound healing. From the perspective of patient comfort, MCP is the optimal procedure.

### Optimal duration of chest tube placement after surgery

The enhanced recovery after surgery (ERAS) protocol has been widely used during the perioperative period of lung cancer surgery. The introduction of the ERAS protocol for patients with lung cancer has improved patient outcomes, reduced the length of stay, and lowered costs (5). The ERAS protocol suggests that classical conservative chest tube removal strategies are unnecessary and impair patient recovery. In the past, the classical chest tube removal strategy was necessary because many thoracic surgeries had been performed using the thoracotomy approach, therefore, intrathoracic bleeding occurred frequently and the amount of pleural effusion was large (6). Minimally invasive surgeries are currently performed worldwide, and advancements in device manufacturing have contributed to a decrease in the amount of pleural fluid and air leakage (7). A recent review article on ERAS reported that a chest tube can be removed when: (I) air leak is no longer present and the pleural fluid output is <500 mL in the last 24 h, and (II) there is no evidence of chylothorax, pus, or active bleeding (5). Consequently, tube removal on the first postoperative day is reasonable and will almost certainly result in better objective (e.g., length of stay and opioid use) and patient-reported outcomes (e.g., pain and comfortable spending).

Yun *et al.* reported that the average duration of chest tube placement after surgery is 3.09 days in the RCP group

and 2.97 days in the MCP group (4). The chest tube was removed when the drainage volume was <200 mL for 24 h, without air leakage. If the chest tube removal protocol in ERAS was followed, the duration of chest tube placement may have been shortened, and subsequently, the total incidence of peritubular fluid or air leakage may have decreased.

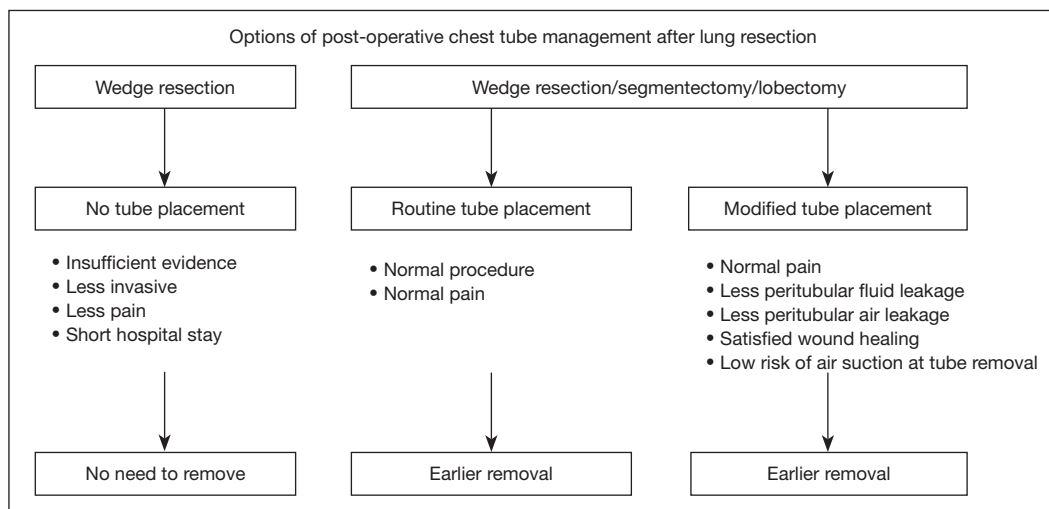
### Optimal judgement on tube placement or no placement after surgery

Thoracic surgeons should now discuss the clinical issue of "Is a chest tube really required?". Omitting chest tube placement is the most effective method to enhance early recovery. We previously demonstrated that when wedge resections are performed, omitting chest tube placement decreased postoperative pain, length of stay, and cost, with no increase in postoperative complications (3). A review article showed that not inserting a chest tube was feasible not only in cases of wedge resection, but also in cases of lung biopsy or mediastinal surgery (8). Observational studies, however, were included in this review, indicating a risk of bias. Thus, although omission of chest tube placement in selected cases is likely beneficial, further trials are required to better define this patient subgroup.

In the study by Yun *et al.*, a significant difference between RCP and MCP was observed in terms of severity of peritubular pleural fluid leakage in patients undergoing lobectomy or segmentectomy, but not in those undergoing wedge resection (4). Therefore, for a less invasive and more comfortable patient experience postoperatively, omitting the chest tube is a potential option.

### Limitation

In the aforementioned studies, the surgical approaches were limited to multiportal video-assisted or robotic lung resection. However, these results lack information regarding thoracotomy or chest wall adhesions. As these cases are associated with the risk of intrathoracic bleeding or a large amount of pleural effusion, a thoracic drain should be placed. Moreover, these results lack information regarding uniportal video-assisted thoracoscopic surgery, which has recently been widely performed. Some reports have shown no significant differences between the uniportal and multiportal approaches in terms of the postoperative complications and chest tube duration (9,10). Based on these reports, the preferred management strategy proposed



**Figure 1** Options of post-operative chest tube management after lung resection.

in this study may also be applied for uniportal video-assisted thoracoscopic surgery.

In conclusion, thoracic surgeons may opt to not insert a chest tube when performing a wedge resection. However, if chest tube placement is decided, MCP is preferred. Moreover, early chest tube removal is desirable to promote rapid postoperative recovery (Figure 1). Optimal chest tube management would make the procedure less invasive and patients more comfortable in the postoperative period.

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