Editorial Commentary

No drain policy for "ultimate" enhanced recovery after surgery

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It is a great honor to write an Editorial Commentary for the article "No drain after thoracoscopic major lung resection for cancer helps preserve the physical function", which was published recently in *Annals of Thoracic Surgery*. First, I would like to congratulate Dr. Ueda and colleagues for their excellent contributions to the study of chest-tube management; that is, a no-chest-drain policy (NCDP) after thoracoscopic major lung resection (1-3). We read this valuable study with great interest.

Use of chest drain tubes after thoracic surgery is crucial to evacuate air leaks and/or pleural effusions. All surgeons want to remove a chest tube as soon as possible because delayed removal might exacerbate pain, delay recovery of lung function and the six-minute walking distance, and prolong hospitalization (4).

Previously, we demonstrated, using Neurometer® (Neurotron, Baltimore, MD, USA), that chest-tube insertion was an important factor leading to impairment of the intercostal nerves in thoracic surgery. Neurometer could be used to measure peripheral-nerve function objectively based on the current perception thresholds (5,6). In that study, nerve impairment recovered rapidly after removal of the chest tube. Thus, we found that continuous oppression of intercostal nerves by a chest tube is harmful.

Conventional chest tubes are relatively rigid. Thinner and softer tubes seem to alleviate damage to intercostal structures. The silastic flexible Blake® drain (Ethicon, Somerville, NJ, USA) has been developed recently and is expected to overcome the rigidity and thickness mentioned above. Nakamura and colleagues (7) used this new drain in 420 cases of thoracic surgery. The drain functioned efficiently even during postoperative bleeding, prolonged air leaks, and chylothorax. Most importantly, no patients complained of discomfort resulting from placement of a Blake drain. Nakamura and co-workers concluded that a Blake drain is an acceptable option for general thoracic surgery. Thus, it may be worthwhile to assess intercostal-nerve damage using thinner, softer drains, such as the Blake drain. Use of such chest drains could alleviate pain around the insertion site. We are using this drain for video-assisted thoracoscopic surgery if an air leak is not identified intraoperatively.

Management of chest drains remains a critical aspect following lung resection because it influences the recovery phase and duration of hospital stay. Refai and colleagues (8) reported that removal of a chest tube reduced pain and improved ventilator function regardless of surgical access, and these effects were particularly noticeable in the early postoperative phase. Although a chest drain is indispensable for thoracic surgery, it can cause pain and reduce pulmonary function and mobility irrespective of the surgical approach (5,6,9). However, management of a chest drain seems to be inconsistent and sometimes based on institutional and personal experiences.

Surgery is evolving towards approaches that ensure minimal invasiveness and fast recovery. Enhanced Recovery After Surgery (ERAS®) principles are used widely in thoracic surgery to reduce morbidity, the risk of postoperative complications, and duration of hospital stay. Increased compliance with an ERAS pathway is associated

with improved clinical outcomes (reduction of morbidity and shorter hospitalization) after resection for primary lung cancer (10). Early mobilization appears to be an influential factor to achieve ERAS.

In addition, the European Society of Thoracic Surgeons (ESTS) published guidelines regarding ERAS (9). With respect to management of chest tubes, they had four main recommendations: (I) routine application of external suction should be avoided; (II) digital drainage systems reduce variations in decision-making and should be used; (III) the chest tube should be removed even if the daily serous effusion is of high volume (≤450 mL/24 h); (IV) a single chest tube should be used instead of two chest tubes after anatomic lung resection (though the evidence for this recommendation is not high).

In addition, other similar articles (4,11,12) have been published, including a meta-analysis on chest-tube management that provided almost identical recommendations to that of ESTS. However, few reports have focused on a NCDP after surgery for lung cancer. In two separate single-center studies in Japan (13,14), when using a wedge resection, the authors reported that a group that did not use a chest drain (n=132) had a significantly shorter postoperative stay in hospital (4.6 *vs.* 6.7 days) than a group that did use a chest tube (n=201), and that not using a chest drain did not increase the prevalence of postoperative morbidity or complications. In those studies, patients were selected very carefully based on the absence of: (I) air leaks during an intraoperative sealing test; (II) emphysematous bullae; (III) severe pleural adhesions; (IV) prolonged pleural effusion necessitating chest-tube drainage preoperatively. However, for most thoracic surgeons, a NCDP is worrisome because chest-drain insertion is simple and not time-consuming or labor-intensive.

The procedure described by Ueda and colleagues was: (I) confirmation of pneumostasis after port sites had been closed with chest tubes; (II) careful assessment of air leaks until removal of the tracheal tube; (III) if no air leaks had been detected, the chest tube was removed in the operating theatre. Their method for checking for air leaks, then removing the chest drain under spontaneous breathing after extubation of a tracheal tube, is safe and reasonable. This method is acceptable for most thoracic surgeons because we sometimes encounter unexpected air leaks after extubation of the tracheal tube, which is not identified in the decubitus position, air-leak test or mechanical ventilation.

For thoracic surgeons to promote a NCDP, intraoperative pneumostasis seems to be a very important factor. Ueda and colleagues introduced a procedure involving combined use of bioabsorbable mesh and fibrin sealant (2,3), and demonstrated that its method is superior to the conventional method using fibrin sealant alone with regard to the overall duration of chest drainage. Despite this method, some patients (6.9%) had a chest drain *in situ* for 7 days, which seems acceptable. However, continuous efforts have been made to predict prolonged air leaks using quantitative computed tomography (15) and a more sophisticated suture method using pieces of bioabsorbable meshes as pledgets. Many surgeons have adopted this method willingly because the NCDP obtained from using sealants should alleviate pain, increase mobilization and patient satisfaction, and shorten hospital stay, and compensate for the expense of the sealants. Ueda and co-workers also demonstrated that the reduced postoperative pain derived from a NCDP would result in preservation of ventilator capacity and exercise capacity in the early-postoperative phase. Measuring the respiratory function consecutively was another excellent feature of the article by Ueda and colleagues.

Nevertheless, the article by Ueda and colleagues had several limitations. First, the study cohort was small and the study was from a single center, and the study had a retrospective non-randomized design. Secondly, a validation study was conducted (2), but it was carried out in the same hospital. Validation in an external cohort should have been done because outcomes would also be dependent upon the skills of a specific surgeon and management of chest tubes. Thirdly, long-term results are required to identify how this NCDP would affect the physical functions and quality life of patients. Finally, silent massive hemorrhage, delayed air leaks, and chylothorax will always be major worries for any thoracic surgeon.

In conclusion, a NCDP after thoracoscopic major lung resection may promote enhanced recovery after thoracic surgery. Nevertheless, prospective, multicenter studies and the accumulation of clinical data are needed for this NCDP to be used more widely.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest

to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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