Intraoperative minimally invasive left bronchial reconstruction using a pericardial flap during robot-assisted esophagectomy

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METHODS

The complete RAMIE procedure with an intrathoracic end-to-side stapled esophagogastrectomy (28-mm diameter) was performed with the DaVinci Xi system (Intuitive Surgical) using 4 trocars for the thoracic part. Written informed consent for the case report was obtained from the patient after full recovery. Ethical approval was obtained from our institutional review board on April 18, 2023 (approval No: F-2023-028).

RESULTS

An 81-year-old male patient (height, 176 cm and weight, 72 kg) underwent RAMIE for stenosing adenocarcinoma of the esophagogastric junction (AEG I) 5 weeks after neoadjuvant chemoradiation (carboplatin/paclitaxel [ie, CROSS protocol]). During chemoradiation, enteral feeding was supplemented using a percutaneous gastrostomy tube. A 41Fr left-sided double-lumen endotracheal tube (DLT) was placed after induction of general anesthesia according to previously described principles.5 Pressures of the proximal and distal DLT cuffs were adjusted within commonly used limits. After uneventful completion of the abdominal part, the patient was positioned in a left-lateral semiprone position. The right lung was deflated and surgery was continued in single (left) lung ventilation. The thoracic part started with careful mobilization of the upper esophagus from the trachea and carina. At this early point, it became evident that the distal cuff of the double-lumen endotracheal tube had perforated the membranous portion of the LMB

CENTRAL MESSAGE

The report demonstrates a minimally invasive repair of a left mainstem bronchus injury during robot-assisted minimally invasive esophagectomy using a pericardial flap and an uneventful course.

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The size of the laceration increased the more the esophageal attachments to the LMB were released. Because ventilation remained sufficient with only minimal leakage, the surgical and anesthesiology team agreed to continue and attempted minimally invasive robotic reconstruction. Thus, the oncological resection of the esophagus was continued and the esophagus was divided with a linear stapler above the tumor. Next, a pedicled pericardial flap was created using the permanent cautery hook and sutures (polydioxanone 4-0) were prepared for the bronchial sutures and flap coverage. The endotracheal tube was deflated, carefully advanced some millimeters by the anesthesiological team, and reinflated to enable immediate robot-assisted suturing and patch closure of the bronchial defect (Figure 1 and Video 1). The patch was further reinforced using a fibrin sealant. The surgical reconstruction was then accomplished using an intrathoracic esophagogastrostomy (Ivor-Lewis) as reported recently.\(^1\) Finally, the LMB was covered using the omentum of the gastric conduit as an additional patch.

In contrast to routine postoperative extubation, the left-sided DLT was replaced with a right-sided DLT immediately after surgery for protective single right lung ventilation. Continuous positive end-expiratory pressure of 5 mbar was applied to the left lung to prevent atelectasis. On the first postoperative day, extubation was uneventful. The further postoperative course showed no complications, especially no signs of emphysema or significant air leakage from the intraoperatively placed chest tube. In accordance, a planned computed tomography chest scan on postoperative day 7 confirmed the absence of pneumomediastinum or anastomotic leakage (Figure 2, A). There was no surgical site infection (Figure 2, B and C). The histopathological stage was ypT3 ypN0 (0 out of 26), L0, V0 R0. The patient tolerated early mobilization and enteral nutrition. He was discharged after 14 days and recovered accordingly at home.
DISCUSSION

The present report demonstrates successful, fully robotic management of intraoperative bronchial rupture, which is a rare but potentially life-threatening complication.\(^6\) Intraoperative laceration of the trachea or main bronchus can be caused extraluminally by radical resection of locally advanced cancers, radiation-induced adhesions, iatrogenic cautery damage, or endoluminally by the DLT or its inflated cuff. No injury was noticed during bronchoscopy after the initial intubation. However, it cannot definitely be excluded that a minor latent endoluminal laceration by the DLT tip gave rise to a subsequent perforation at the cuff site. Neoadjuvant chemoradiation may have also contributed to a more vulnerable tissue texture. A specific risk for bronchial laceration during RAMIE may also be the repositioning of the patient for the thoracic part with the DLT in place. Because ventilation is completely dependent on the left lung during this phase, LMB laceration is highly critical. Recommended intraoperative strategies are the immediate repair using sutures (if feasible) complemented with a pericardial or muscle flap coverage (eg, dorsal latissimus, intercostal, or major pectoral muscle\(^6\)). However, repositioning of the patient with a large left bronchial defect during RAMIE to enable immediate right thoracotomy is critical because ventilation can rapidly deteriorate during this maneuver. Therefore, if ventilation of the left lung can be sustained and the minimally invasive exposure of the bronchial defect is stable, the presented robot approach can be a realistic and feasible strategy toward a further uneventful course. Transient protective right-sided single-lung ventilation is an additional option to optimize the outcome.

References