Simultaneous Esophagectomy and Coronary Artery Bypass Grafting Without Cardiopulmonary Bypass: Report of a Case

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Abstract
We successfully performed off-pump coronary artery bypass grafting (OPCAB) with concomitant esophagectomy in a 77-year-old man with esophageal cancer and severe stenosis of the anterior descending branch of the left coronary artery. Off-pump coronary artery bypass grafting was performed via median sternotomy and esophagectomy was done via the left thoracoabdominal approach. The patient was discharged with a patent graft 8 weeks after surgery. The benefits of OPCAB include that it is less invasive and heparinization can be avoided. This case report demonstrates that simultaneous OPCAB and esophagectomy is advantageous for a selected population with surgically correctable coronary artery disease and resectable esophageal cancer.

Key words Esophageal cancer · Ischemic heart disease · Coronary artery bypass grafting · Esophagectomy

Introduction
It is well known that cancer with coexisting coronary artery disease (CAD) is associated with increased operative morbidity and mortality. Coronary artery disease and cancer have traditionally been treated with separate procedures based on clinical priority, although coronary artery bypass grafting (CABG) is commonly performed first to reduce the risk of perioperative myocardial infarction. However, reports suggest that open-heart surgery can impair immunological function,1 which could result in decreased immune surveillance and tumor spread. In this population subset, simultaneous radical procedures may provide greater benefit than single procedures separated in time. Since open-heart surgery and esophagectomy are both intensively invasive procedures and open-heart surgery for CAD requires systemic heparinization with cardiopulmonary bypass (CPB), concomitant esophagectomy is dangerous and difficult. An alternative approach utilizes off-pump coronary artery bypass grafting (OPCAB) on a beating heart and does not require full heparinization. We successfully treated a patient with CAD and cancer of the esophagus by performing OPCAB with concomitant esophagectomy.

Case Report
A 77-year-old man was admitted to our hospital with a 1-month history of dysphagia. He had undergone right upper lobectomy of the lung for tuberculosis 47 years previously and percutaneous transluminal coronary angioplasty (PTCA) for CAD 5 years previously. Barium studies of the esophagus and esophagoscopy showed an ulcerative and infiltrative tumor, 7.0 cm long, in the lower thoracic esophagus (Fig. 1a). Computed tomography showed metastatic abdominal lymph nodes without tumor invasion into the surrounding tissue or distant metastases (Fig. 1b). The histological diagnosis of a biopsy sample was squamous cell carcinoma. Echocardiography on admission showed normal wall motion (ejection fraction 0.63), but coronary angiography revealed severe stenosis of segment 6 (left anterior descending branch (LAD) proximal; 95%) and segment 7 (LAD mid; 50%) (Fig. 2a).

Since the first stenotic point (segment 6) was near the left main trunk, cardiologists did not recommend PTCA. After careful discussions with the patient and cardiovascular surgeons, we decided to perform esophagectomy and OPCAB simultaneously. Because esophagectomy is a contaminative procedure, separate...
approaches were used for each procedure. We used the right internal thoracic artery (RITA) as the feeding artery to avoid opening the left pleura. The OPCAB was initially done via median sternotomy. The RITA was carefully harvested, and a regional mechanical immobilization platform and looped silicone retractor tapes were placed on the coronary artery to obtain a stabilized operating field. Anastomosis of the RITA to segment 8 (LAD apical) was done using continuous 8-0 Prolene sutures. We administered 1mg/kg heparin intravenously just before dissection of the RITA. On completion of the CABG, the median sternotomy was closed, and fresh skin preparation and draping were done to prevent sternal wound infection. Because the right thoracotomy approach was complicated by the patient’s past surgical history, we performed esophagectomy via a left thoracoabdominal approach. Middle and lower esophagectomy was done with regional lymphadenectomy and insertion of a feeding jejunostomy tube. The middle esophagus was transected 3 cm above the tumor using a stapler. The stomach was mobilized on the right gastroepiploic pedicle and divided with a GIA stapler along a line parallel to the lesser curve. This tube was pulled up and anastomosed to the esophagus using Premium Plus CEEA 25 (United States Surgical, Norwalk, CT, USA). The total operative time was about 11 h, and the estimated blood loss was 940 ml.

The patient had an uneventful early postoperative course. A water-soluble contrast study on day 12 confirmed an intact anastomosis. However, pathology revealed an ulcerative and infiltrative tumor infiltrating through the adventitia with metastases to the perigastric nodes. Warfarin was given via a jejunal feeding tube from day 5, but this resulted in intrathoracic bleeding causing dyspnea on day 12. Fortunately, hemostasis was achieved conservatively, and the patient gradually recovered. Postoperative angiography performed 7 weeks after surgery demonstrated patent grafts (Fig. 2b), and he was discharged home 8 weeks after surgery.

**Discussion**

Patients with severe CAD are at increased risk of perioperative morbidity and mortality secondary to myocardial ischemia during major surgery under general anesthesia. Therefore, CABG is often performed first to prevent perioperative myocardial infarction in patients with severe CAD and resectable cancer. However, patients with surgically correctable CAD and cancer present a dilemma with regard to the priority and timing of each operation. Open-heart surgery and blood transfusion may impair immune-mediated surveillance,1 potentially leading to the acceleration of tumor spread. Furthermore, because the general health of patients with advanced cancer is severely impaired, recovery after CABG may be prolonged.

While simultaneous CABG and esophagectomy may be advantageous for these patients, both operations involve intensively invasive procedures, and systemic full heparinization is required for CPB, posing a high risk of bleeding for the esophagectomy. Several recent reports