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CASE REPORT

Off-pump coronary artery bypass grafting in a tracheostomy patient

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Abstract
In patients who have undergone laryngectomy and have a tracheal stoma, a full median sternotomy substantially increases the risk of wound infection, osteomyelitis, mediastinitis, bleeding, tracheal injury, and poor wound healing. Several reports have been published on sternotomies and skin incisions in tracheostoma patients. Transverse bilateral thoracosternotomy, T-shaped partial sternotomy (manubrium-sparing sternotomy) with transverse skin flaps and anterolateral thoracotomy with partial sternotomy are described as successful approaches to the mediastinum for cardiac surgery. We present a successful case in which off-pump coronary artery bypass grafting (CABG) was performed in a tracheostoma patient using a low T-shaped partial sternotomy and the PAS-Port system. Good long-term results were achieved.

Keywords Coronary artery bypass grafting · Tracheostoma · Lower partial sternotomy · Thoracotomy · Thoracic approach

Introduction

In patients who have undergone laryngectomy and have a tracheal stoma, a full median sternotomy substantially increases the risk of wound infection, osteomyelitis, mediastinitis, bleeding, tracheal injury, and poor wound healing. Several reports on sternotomies in tracheostoma patients have been published; transverse bilateral thoracosternotomy ('clamshell' incision) [1], T-shaped partial sternotomy (manubrium sparing sternotomy) [2], and anterolateral thoracotomy with partial sternotomy [3] are described as successful approaches to the mediastinum for cardiac surgery. In addition, robot-assisted minimally invasive off-pump coronary artery bypass grafting (CABG) in a patient with a permanent tracheostomy was recently reported [4]. Excluding robot-assisted surgery, these thoracic approaches permit adequate operative exposure and separate the tracheostoma from the operative field. In the present case, we elected to perform transverse sternotomy at the second intercostal space and longitudinal median sternotomy to the xiphoid process. We then performed off-pump CABG in our tracheostoma patient using the PAS-Port system (Cardica Inc., Redwood City, CA, USA). The patient demonstrated good long-term results.

Case report

A 67-year-old man who had undergone a total laryngectomy for carcinoma of the larynx, followed by a permanent tracheostomy at 51 years of age, experienced abdominal discomfort and shortness of breath. Electrocardiography showed ST segment elevation at II, III, and aVF. Coronary angiography revealed severe three-vessel disease: there was 90% stenosis at the middle portion of the right coronary artery (RCA), the middle portion of the left anterior descending (LAD) artery, and the distal portion of the left circumflex (LCX) artery. We scheduled emergency CABG for the LAD and RCA, but left the posterolateral artery untreated because the LCX was relatively small, and the majority of the posterior wall was supplied by the RCA. We performed an in situ left internal thoracic artery (ITA) to LAD. For RCA revascularization, we used the saphenous vein graft (SVG) instead of the right gastroepiploic artery (RGEA). This was an emergency case and we intended to harvest both grafts simultaneously.

A spiral tracheal tube was inserted into the tracheostoma to deliver anesthesia, and an adhesive sterile plastic drape was used to isolate the tracheostoma from the surgical field. A longitudinal skin incision was made from approximately 3 cm beneath the second intercostal space

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to the xiphoid process (Fig. 1). The sternum was transected at the level of the second intercostal space and the sternal body was split in the midline. Careful attention was paid not to stretch or injure the left ITA when opening the ITA retractor. The proximal portion of the left ITA was adequately dissected in the surgical field by retracting the manubrium toward the cranium. The off-pump CABG of the LAD artery was performed using the in situ left ITA. Then, bypass of the RCA was performed using the SVG. The PAS-Port system was used for the proximal SVG suture to allow for the rapid, easy, and secure connection of the SVG to the aorta using a stainless-steel implant without the aortic clamp (Fig. 2).

The patient had an uneventful hospital stay and was discharged without any complications (Fig. 1). At the present time (4 years postoperative), the patient has experienced no further cardiac events, and all bypass grafts are finely patent (Fig. 3).

Fig. 1 (left) The patient was positioned supine. A spiral tracheal tube was intubated. White arrowheads and black arrowheads indicate skin incision and transverse sternotomy respectively. (right) The surgical wound is away from the tracheostoma (arrow), and there is no evidence of wound infection or mediastinitis

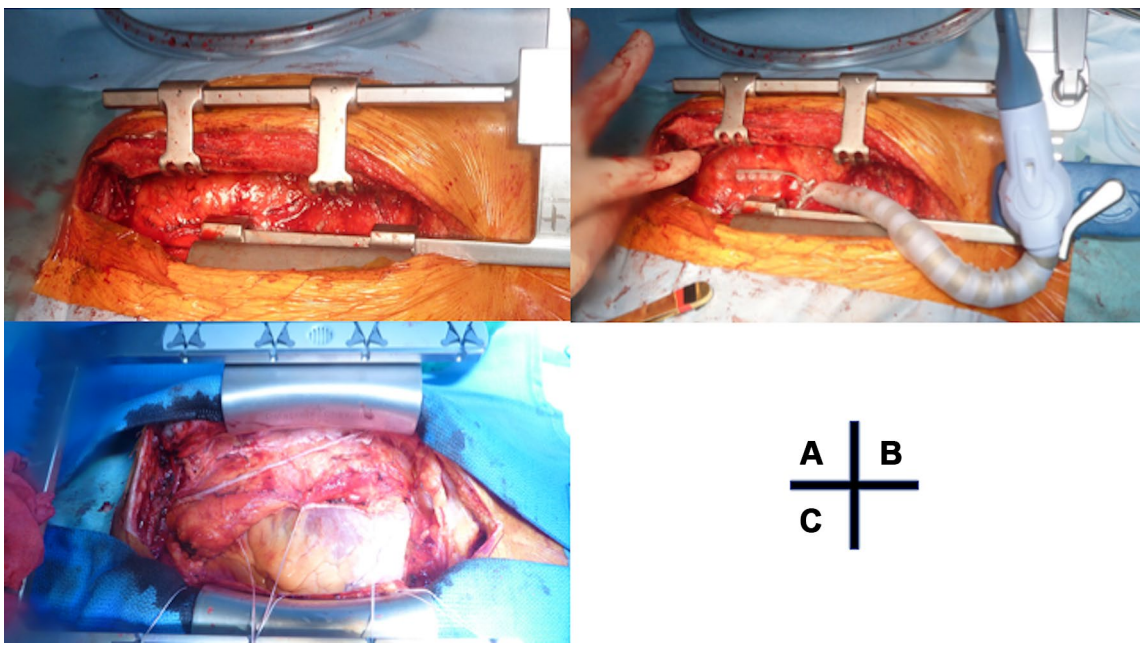

Fig. 2 **a** An internal thoracic artery retractor is placed into position with great caution, avoiding excessive traction on the sternum not to injure the artery. **b** The surgical field during harvesting the left ITA. **c** After completion of harvesting the left ITA

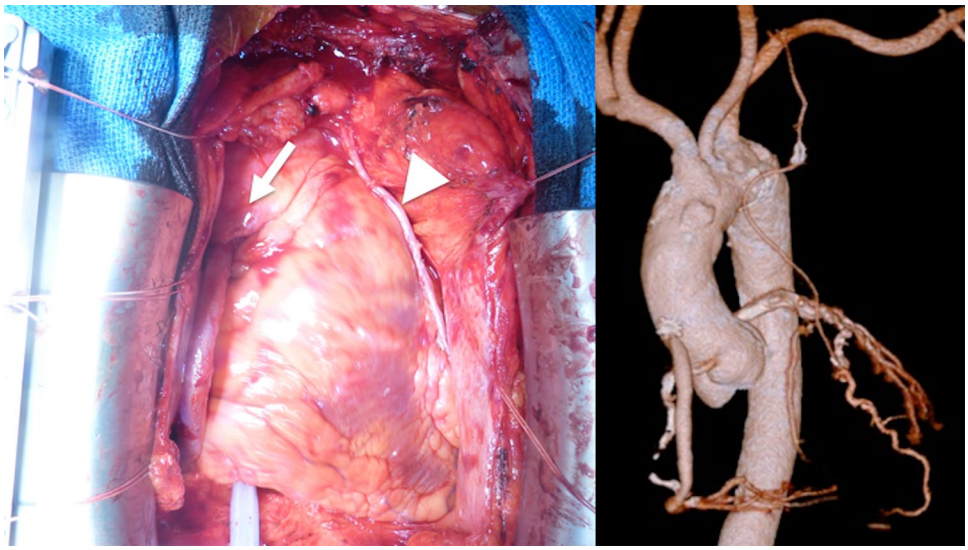

Fig. 3 (left) The surgical field after completion of bypass grafting. White arrowheads and white arrow indicate left ITA and SVG, respectively. (right) The postoperative coronary computed tomography shows the patency of all bypass grafts. (The artifact due to the proximal stent have over emphasize the stenosis of the proximal stump.)

Discussion

In patients who have undergone laryngectomy and have a tracheal stoma, a full median sternotomy substantially increases the risk of developing sternal wound complication. Therefore, Kaiser et al. [2] described the use of an alternative median sternotomy technique for CABG in 1985 that limited the division of the sternum to its lower and middle portion, and preserved the manubrium. Ricci et al. [5] used a similar approach to perform off-pump CABG in a post-laryngectomy patient. Off-pump surgery eliminates the need to place the aortic cannula and the aortic cross-clamp, whose positioning at the upper aspect of the sternal wound may be problematic with an intact manubrium. We used the method by Ricci et al. [5] in conjunction with the PAS-Port system. The device was useful in this case with limited working space while enabling easy, rapid and secure connection of the SVG to the aorta. The PAS-Port system also allows for increased space on the ascending aorta, which is an important option in post-laryngectomy patients with tracheal stomas. Freeland et al. [6] previously described retraction limitations for ITA harvesting, and proposed the use of transverse skin flaps for the gradual, progressive retraction of the manubrium and sternum, for visualization of proximal ITA. However, in the present case, we could dissect the full length of the left ITA without the need for transverse skin flaps. With the use of an ITA retractor, a gentle cranial retraction of the manubrium and dorsal traction of the left lung, we obtained sufficient exposure of the proximal ITA (Fig. 2).

In conclusion, we successfully treated our tracheostoma patient. We propose that a lower half-sternotomy with limited skin incision would be safe and adequate to perform off-pump CABG, and the PAS-Port system would be a useful supportive device in similar patients.

Compliance with ethical standards

Conflict of interest The authors have declared that no conflict of interest exists.

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