Case report - Coronary

Robotic total endoscopic coronary artery bypass hybrid revascularization procedure in a patient with a preoperative tracheostoma

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Abstract

Preoperative tracheostoma presents a significant risk of sternal wound complications, mediastinitis, stoma necrosis and tracheal injury in patients requiring cardiac surgery. Several approaches have been described to limit these risks. Robotic totally endoscopic coronary artery bypass grafting in patients with a tracheostoma has not been reported. We describe a case of completely endoscopic coronary surgery using the daVinci® Si™ system in a patient with a tracheostoma. Single left internal mammary artery grafting to the left coronary artery system was carried out successfully as the first stage of a hybrid revascularization and followed by percutaneous coronary intervention to the circumflex coronary artery. We regard this technique as the most minimally-invasive method of surgical coronary revascularization with a significant potential to reduce the risk of mediastinitis in patients with a tracheostoma.

1. Introduction

Median sternotomy for cardiac surgery on patients with a preoperative tracheostoma portends an increased risk of sternal wound complications, mediastinitis, stoma necrosis and tracheal injury. A transverse thoracosternotomy or clamshell incision is often considered the primary alternative incision, but is highly invasive. A robotic totally endoscopic technique maintains the incisions well away from the tracheostoma and reduces the complexity of harvesting the internal mammary arteries (IMAs) compared to other incisions. We report the first totally endoscopic approach for performing coronary artery bypass grafting (CABG) in patients with preexisting tracheostoma.

2. Case report

A 70-year-old African-American male with a history of hypertension, chronic obstructive pulmonary disease and tongue cancer with glossectomy and tracheotomy presented with left-sided exertional chest pain and pressure radiating to his left arm and jaw. A stress test indicated ischemia in the left anterior descending artery (LAD) and right coronary artery (RCA) territories on the nuclear perfusion scan with a left ventricular ejection fraction of 43%.

Coronary angiography revealed 90% mid-LAD stenosis and 70%–80% lesion of the proximal and mid-circumflex coronary artery. The RCA was diffusely diseased with distal 80% stenosis and was not well suited for either percutaneous intervention (PCI) or bypass. Considering his three-vessel disease and tracheostoma, the patient was advanced for a staged hybrid coronary revascularization procedure consisting of single-vessel totally endoscopic coronary artery bypass grafting (TECAB) with subsequent PCI to the circumflex coronary artery.

Under general anesthesia with a double lumen endotracheal tube, the robot was deployed through ports in the third, fifth and seventh left lateral intercostal spaces (Fig. 1). Multiple pleural adhesions were easily lysed with electrocautery. The left internal mammary artery (LIMA) was harvested in a skeletonized fashion.

An endostabilizer was brought in through a left subcostal port and applied over the LAD. Silastic loops occluded the...
LAD and an arteriotomy was made. The LIMA was sutured to the LAD in an end-to-side fashion with a 7-0 poly [hexafluoropropylene-vinylidene fluoride (VDF)] suture on the beating heart. Severe target vessel atherosclerosis rendered the suturing process difficult, but the anastomosis could be completed with a good overview. The patient was weaned from cardiopulmonary bypass and decannulated after 165 min. Heparin was reversed with protamine and the incisions were closed. The patient was transferred to the intensive care unit on ventilatory support with no vasoactive drips. Ventilation time was 13 hours.

PCI of the circumflex coronary artery was undertaken on postoperative day 6 using two overlapping bare metal stents (3.0 mm×12 mm and 3.0 mm×18 mm, Fig. 2) and the patient was discharged home the following day.

3. Discussion

Preexisting tracheostoma confers an increased risk of mediastinitis following median sternotomy for cardiac surgery and can result in stoma necrosis and tracheal injury [2, 3]. No large series have been reported in the literature...
to guide management of these patients, but a variety of incisions have been suggested to minimize the risk of these complications. These approaches range from the highly invasive clamshell incision to less invasive incisions including variations of the median sternotomy and even endoscopic IMA harvesting with the distal anastomosis hand sewn through a small thoracotomy [4]. These alternative approaches may often include significant surgical trauma, complicate harvesting of the IMAs [5] and limit surgical exposure. Thoracoscopic IMA harvesting has been described as a method for managing patients with tracheostoma requiring CABG [4], however, this approach is technically challenging.

TECAB is a sternum-sparing procedure that eliminates the risk for sternal wound infection if the procedure is completed without conversion. We have found that TECAB significantly reduces the risk of deep thoracic infection, probably because the incisions are small, located away from the tracheostoma, and made through well-vascularized muscle. Instrument exchanges are performed through ports, further reducing the chance of seeding the wound or mediastinum with skin contaminants. Despite requiring a skin incision for exposure of the axillary artery, we consider this approach less invasive than minimally invasive direct coronary artery bypass (MIDCAB) as there are only port sites into the thorax, which has clinical benefits. Whereas there are reports of thoracic wound infections in MIDCAB [6], we are unaware of any published cases of deep thoracic wound infection in TECAB and have not experienced any in over 350 cases that were completed in a completely endoscopic fashion. Operative time for MIDCAB and TECAB are in a similar range [7] and prolonged cardiopulmonary bypass times have not compromised clinical outcomes in our overall series.

Other neck stomas including esophagostomies pose similar challenges to the cardiac surgeon [8]. Not only is the risk of surgical site infection increased, but there is the potential of directly injuring the stoma or compromising the blood supply to the stomal tissues causing necrosis. The approach described herein would be likewise applicable for patients with other neck stoma and for patients at high-risk for sternal wound infections. TECAB has previously been shown to benefit patients with high perioperative risk of sternotomy [9]. Skeletonized IMA harvest under up to 10× magnification may reduce the risk of a compromised blood supply. Multivessel PCI could be an alternative approach in patients at high-risk for sternal wound infection, but would preclude the patient from LIMA revascularization of the LAD, which has been proven in multiple studies to confer improved survival compared to PCI alone.

A hybrid approach with robotic-assisted LIMA-LAD grafting combines the best surgical and percutaneous revascularization techniques while minimizing surgical trauma [10]. We propose that TECAB significantly reduces the risk of mediastinitis in patients with a tracheostoma and provides additional benefits over previously discussed approaches in this patient group.

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References