

Robotic-assisted bilateral internal thoracic artery harvest

Francis P. Sutter, MaryAnn C. Wertan

Lankenau Medical Center, Wynnewood, PA, USA

Correspondence to: MaryAnn C. Wertan. Lankenau Medical Center, 100 Lancaster Avenue, 356 Lankenau MOB East, Wynnewood, PA 19096, USA.
Email: WertanM@mlhs.org.



Submitted Jan 05, 2018. Accepted for publication May 28, 2018.

doi: 10.21037/acs.2018.06.12

View this article at: <http://dx.doi.org/10.21037/acs.2018.06.12>

Harvesting one or both internal thoracic artery(s) (ITA) is accomplished through the same ports and robotic set-up. Robotic port placement and ITA harvest are paramount to successful minimally-invasive coronary practice (1).

Clinical vignette

A 58-year-old male presented with exertional chest tightness and associated exertional dyspnea. A positive stress test prompted cardiac catheterization, revealing a long 95% lesion in the left anterior descending artery (LAD), 80% ostial ramus, 40% left coronary artery (LCx) lesion and a focal 90% right coronary artery (RCA) lesion. The cardiologist and surgeon agreed to hybrid revascularization with robotic-assisted left ITA (LITA) to LAD and right ITA (RITA) to ramus arteries, followed at later date with percutaneous coronary intervention (PCI) to RCA.

Surgical techniques—preparation

Positioning and anesthesia consideration

Firstly, develop a consistent team to work with you for all robotic cases (2). Incremental learning is the key to success of all phases of this operation (2).

Single right lung ventilation is optimal.

Position the patient on the operative table by aligning the left side of their body on the table's edge such that the left shoulder overhangs slightly (2). This positioning lessens impeded manipulations of the superior thoracic robotic arm. Applying gentle pressure on the left shoulder increases the arm's maneuverability. Similarly, gentle pressure on the costal margin can accomplish the same movement for the inferior robotic arm.

Port placement

Create a mental picture and anticipate what you will find within the chest, outlining specific landmarks directly on the 3M™ Steri-Drape™ prior to incision. Draw the sternal midline, the location of the LITA and diaphragm. The location of the patient's diaphragm during thoracotomy is slightly below the level of the step-off between the lower edge of sternum and xiphoid process. Most importantly, know where the heart is! This is easily done by reviewing the chest X-ray or CT scan. Indicate the percentage that the cardiac silhouette occupies of the left hemithorax, and apply that percentage to the chest at approximately the 4th or 5th intercostal space, thus identifying the heart's lateral border. Three ports are necessary. The endoscopic port is placed first. The other two ports are placed 8–10 cm above and below the camera port. The optimal site for the camera port is midway between the suprasternal notch and the xiphoid tip, giving best visualization of the upper and lower portions of the ITA. When placing the camera port and its obturator (a lethal weapon) (3), again reviewing the lateral chest X-ray or CT scan for the heart's anterior position thus avoiding undue injury. During the learning curve (20–30 cases), position the endoscopic port well lateral to the heart. When placing the camera port (and with the left lung collapsed), always disconnect the ventilator to allow air to exit the right lung so the heart shifts medially away from the obturator and camera port. Simultaneously, a Veress needle is placed at the third intercostal space midclavicular line for CO₂ insufflation, further retracting the heart from the chest wall and moving it medially. With any concern about the heart's location and possibility of it being against the chest wall at the camera site, as a precaution place a small finger through first (a larger finger may cause subsequent

continuous CO₂ loss around the endoscope). Avoid injury to the heart! Notify anesthesia of any iatrogenic tension pneumothorax. As the obturator tip passes through the chest wall during port insertion, stay attentive to changes on the electrocardiogram, as premature ventricular contractions are due to the port striking the heart.

The superior and inferior robotic ports are then positioned in a longitudinal and linear fashion, 8–10 cm above and below the camera port, as the bony thorax permits; and the operating table is turned to the right at 25 degrees.

Surgical techniques—exposition

Typically, 8–10 cm of CO₂ pressure is adequate to create space within the chest; up to 14 cm may be used without difficulty. Predominantly, these cases will be LITA to LAD.

With a 30° up endoscope, begin the robotic-assisted mammary harvest, starting where the LITA is easily visible (usually proximally) and move distally. Use the EndoWrist instruments (Intuitive Surgical, Inc., Sunnyvale, California, USA): micro bipolar forceps on the left and the permanent cautery spatula on the right (set at 15 watts; higher wattage risks burning a hole through the ITA). Remove the fat, transversus muscle and parietal pleura from only the posterior vessel, where essentially no branch vessels exist, thus allowing visualization of the entire LITA course. The serpiginous coursing of the LITA can then be seen, which further reduces chances of LITA injuries. LITA dissection can be either pedicled or skeletonized. I prefer skeletonized, because bleeding pedicle branches can sometimes retract into the pedicle and it can be difficult to control bleeding in this branch and stained tissue makes visualization difficult causing inadvertent injury to the LITA. Starting the circumferential LITA dissection distally reduces the risk of bothersome bleeding from the veins on either side of the LITA. Clipping or cauterizing these veins increases venous pressure and dilatation distally; however, the more proximal veins are not distended. These dilated thin-wall veins bleed very easily when manipulated causing distraction and further reducing visualization.

Circumferential dissection is best accomplished by incising the medial side of the LITA first prior to doing the lateral side. It is best to begin 1–2 inches on the medial dissection, and then proceed to the lateral side. Importantly, during skeletonization, retain some anterior attachments of the LITA to the chest wall keeping it suspended and away from harm; do not allow the LITA to drop more than one centimeter from the chest wall. Always watch for the

“pulsatility” in the ITA.

Several techniques have been used, but my preference is to clip arterial branches proximally and cauterize distally. The ITA dissection continues from the bifurcation distally to just short of where the phrenic nerve is intimately associated with the origin of the LITA.

RITA harvest

When performing bilateral ITA harvest, harvest the right ITA (RITA) first (2,3). Place the ports more lateral on the chest, and place the superior and inferior ports an interspace closer to the endoscopic port, compared to placement for only LITA harvest. Also, rotate the table to the right, from 25-degree angle for single LITA harvest to a 35–40-degree angle for BITA. This positioning reduces risk of dissection to any part of the LITA from upward manipulation of the robotic instruments inadvertently causing significant pressure/trauma on the LITA (2). This risk is increased significantly when dissecting the RITA superiorly, above the level where the RITA vein transitions toward the innominate vein. There is no “best” place to begin the dissection across the chest to the RITA, however, the upper one-third of the chest is a safe starting point, where the undissected LITA is easily seen. Make a plane posterior to the LITA and directly up to the posterior sternum (2). Continue to dissect on the posterior sternum until you see the RITA and the right pleura. Open the right pleural cavity. Dissect the RITA using the same technique as the LITA; incising the posterior fat and transversus muscle down to the RITA itself. Be sure to identify the entire course of the RITA before beginning distal circumferential dissection from the bifurcation superiorly. Start the dissection by doing the lateral (inferior) edge prior to the medial (or anterior) side. Clip and transect the internal thoracic vein as it transitions to the innominate, and then dissect superiorly for more length.

Surgical techniques—operation & completion

Subsequent dissection of the LITA is then completed and finally, the distal LITA is transected; it is then either clipped to the pericardial edge or sewn with a 7-0 suture to the target site, which keeps it from rotating. This stitch can be “tied” with 3 or 4 clips. Following this, transect the distal RITA and attach similarly at the target site.

Once the ITA is tacked to the heart, ensure hemostasis, then removal all robotic ports. Enlarge the camera port incision medially, locate target sites and use a Medtronic

non-sternotomy stabilizer. Perform anastomosis on the beating heart using a similar technique as with an open case.

Comments—clinical results, advantages, caveats

Over the past 12 years, I have performed over 1,700 procedures. For the last 9 years, 50% of all coronary artery bypass grafting (CABGs) by all surgeons at this institution were robotic; 22% underwent hybrid revascularization. This technique takes patience and incremental learning, combining beating heart surgery experience and robotic expertise.

Acknowledgements

None.

Cite this article as: Sutter FP, Wertan MC. Robotic-assisted bilateral internal thoracic artery harvest. *Ann Cardiothorac Surg* 2018;7(5):704-706. doi: 10.21037/acs.2018.06.12

Footnote

Conflicts of Interest: FP Sutter participates with Speakers Bureau for Intuitive Surgical, Inc. MC Wertan has no conflicts of interest to declare.

References

1. Trejos AL, Ross I, Scalesse C, et al. Preoperative evaluation of patient anatomy to increase success of robotics-assisted bypass surgery. *Innovations (Phila)* 2010;5:335-40.
2. Sutter FP, Berry T, Wertan MC. Precision incision: robotic coronary revascularization via 3.9-cm minithoracotomy. *Innovations (Phila)* 2012;7:223-8.
3. Canale LS, Bonatti J. Mammary artery harvesting using the Da Vinci Si robotic system. *Rev Bras Cir Cardiovasc* 2014;29:107-9.