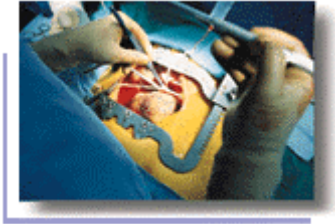


Off-Pump CABG (OPCAB)



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Patient Selection

Beginner beating heart surgeon (< 50 beating heart cases) should AVOID performing OPCAB on patients with:

- cardiomegaly (cardiothoracic ratio > 0.7), as this makes exposure of lateral and inferior walls of LV difficult.
- small (<1.5 mm diameter), intramyocardial, or diffusely diseased targets
- hemodynamic instability
- critical left main CAD
- acute myocardial infarction
- severe LV dysfunction (LVEF < 35%)

Expert beating heart surgeon (> 50 beating heart cases):

With experience, OPCAB can be performed safely in the vast majority (> 90%) of cases.

It is not advisable to perform OPCAB if MULTIPLE unfavorable characteristics are present (for example, cardiomegaly in a patient with LVEF 25% and small targets)

Operative Steps

Operating Room Setup

Keep operating room warm. Avoid radiant heat loss. Monitor closely patient's core body temperature. Target for normothermia.

Ensure that heart lung machine and perfusionist are available. Not necessary to have machine primed.

Have chest roentgenogram on the viewer in the operating room (to assess cardiomegaly before committing to OPCAB).

Confirm availability of stabilizer instrument set of choice.

CO₂ blower and intracoronary shunts of appropriate size must be available.

Make sure anesthesiologist is comfortable with beating-heart surgery, as collaboration crucial for success.

Heparin dose is 1/3 of the standard (1-1.5 mg/Kg). Target ACT is > 300. (Check ACT q 30'.)

Conduit Harvest and Choice

Make LIMA as long as possible (to avoid tension when exposing lateral wall after performing LIMA to LAD anastomosis). Hemi-skeletonization of LIMA (“Suma technique”) preferable as maximal length achieved in fastest way.

Total arterial revascularization is feasible with OPCAB. Liberal use of composite conduits (Y or T graft) with left and right IMA and radial artery is preferred.

Sequence of Grafts

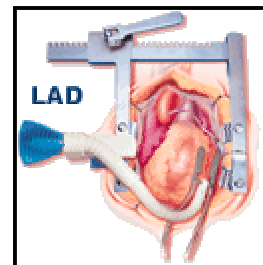
LIMA to LAD *usually* first, but not mandatory
inferior wall grafts (PDA, RCA) *usually* next
lateral wall grafts (OM) *usually* last

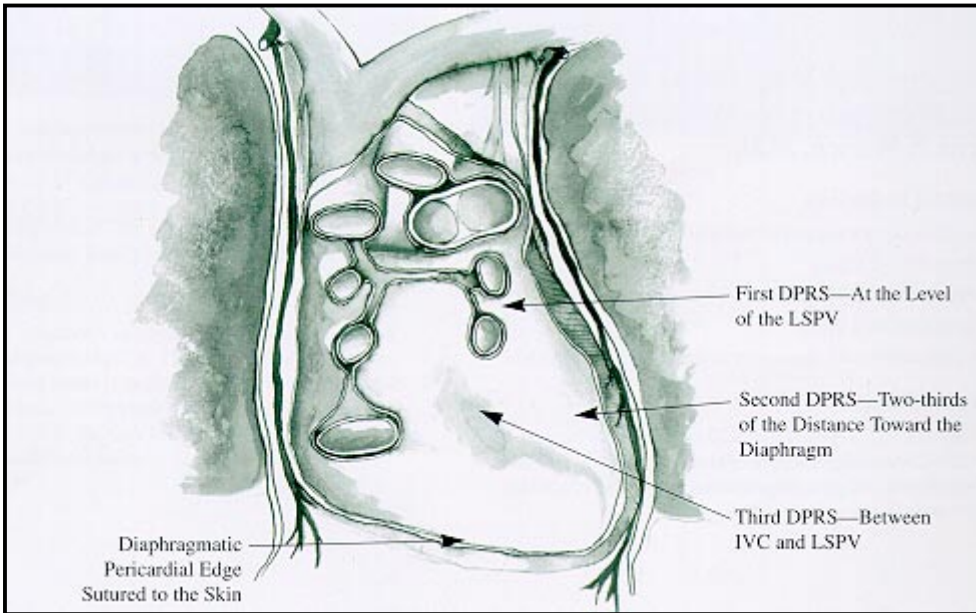
Coronary arteries should be grafted in order of increasing cardiac displacement, i.e. anterior wall vessels followed by inferior wall vessels and finally lateral wall vessels. The idea is that maximal cardiac displacement can be tolerated better by an almost completely revascularized heart. Proximal anastomosis can be done before or after the distal (author preference: proximal first).

Mechanical Stabilization and Heart Positioning for Target Vessel Presentation

Critical for success of OPCAB!!!

Use of a *dedicated* instrument for target vessel stabilization is strongly encouraged, especially for the beginner beating heart surgeon (see preference cards).

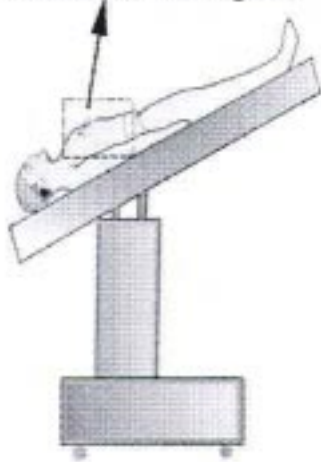




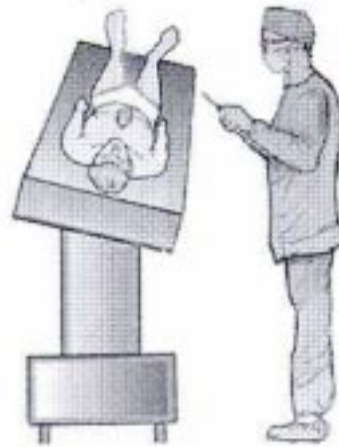
For **Anterior LV wall** presentation (LAD, diagonal, Ramus) a #1 pericardial suture (deep pericardial retraction suture, or DPRS) is placed 1 to 2 cm above the left

superior pulmonary vein (Figure 2), pulled taut and secured to the drapes on the left side of the patient. If necessary, especially for the Ramus, an additional #1 Suture (second DPRS in figure) is placed above the phrenic nerve and caudal to the last suture. Additional deep pericardial sutures are positioned until the target vessel is midline in the sternal incision.

Direction of Apex

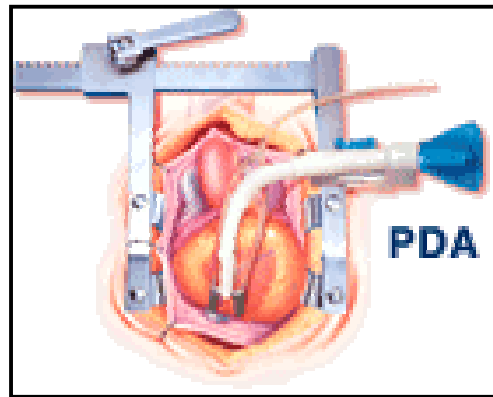


Head Down and Rotated



For **Lateral LV wall** presentation (obtuse marginals, posterolateral branches of right coronary artery) the OR table is placed in steep Trendelenburg position (see above) and the table is raised and rotated toward the right side of the patient (to allow for gravity to displace heart to the right and apex toward the ceiling).

Any suspension suture of the pericardium to the right side is removed at this time to allow the heart to fall toward the right pleural space. Opening of the right pleural space and extending the right pericardial incision toward the inferior vena cava helps achieve this goal. Additional deep pericardial sutures are placed on the posterior pericardial surface on a line drawn from the left inferior pulmonary vein to the inferior vena cava halfway between the cava and pulmonary vein. The placement of these deep pericardial sutures needs to be done deliberately and quickly, because the patient will demonstrate severe hemodynamic changes from the retraction required to temporarily expose the back of the pericardium and place the stitch. This maneuver should be completed in less than 5 seconds. Blood pressure will recover faster if the head-down position and volume loading are utilized.



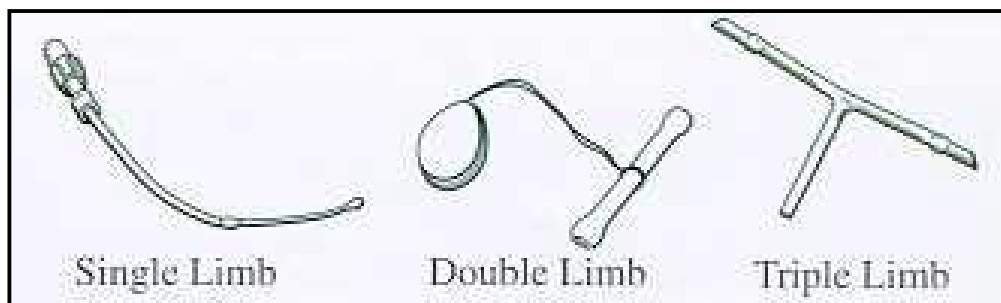
For **Inferior LV Wall** presentation (distal right coronary artery and posterior descending artery), the tension applied to the deep pericardial sutures is modulated to expose the target vessel in the



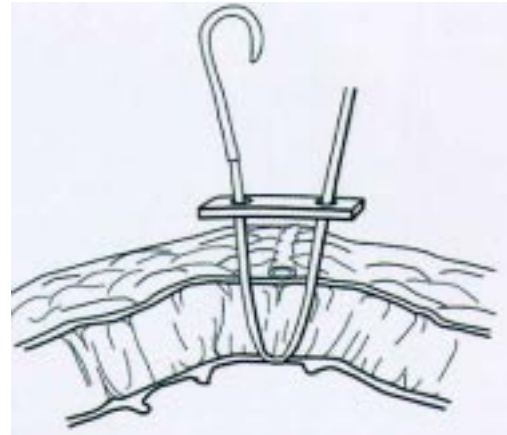
center of the operative field. When grafting the right coronary distribution, the PDA site is preferred to the RCA proximal to the PDA, as the risk of bradycardia secondary to ischemia of the AV node is minimized. For RCA presentation, the OR table is flat and retraction sutures are relaxed.

Anastomosis

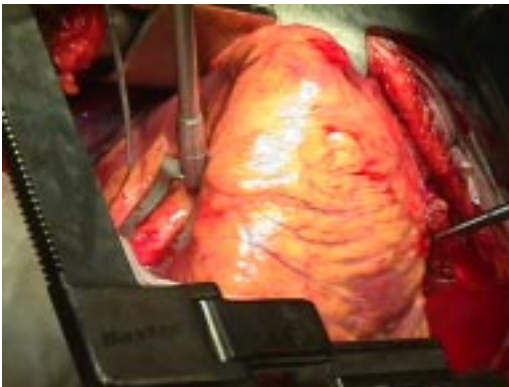
Use of intracoronary shunts is recommended whenever possible, especially for LAD and RCA.



Occlusion of the target vessel is accomplished with an encircling suture passed wide around the vessel proximal to the site chosen for anastomosis. No distal occlusion is necessary.

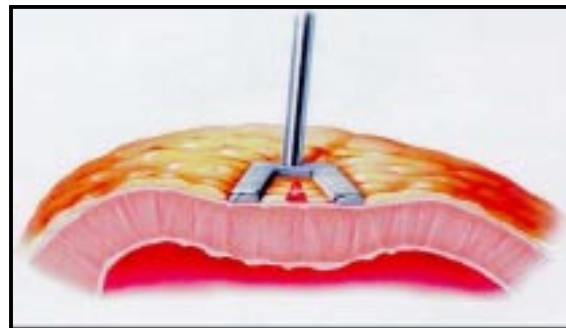


Stabilization of target site is accomplished using one of the many excellent stabilizers available on the market.



Stabilization of PDA using Baxter stabilizer in a patient with dextrocardia

Compression devices work well to provide immobilization of the target vessel.



The anastomosis is performed in a routine manner according to the surgeon's preferences.

Tips and Pitfalls

Meticulous attention to details is critical to success, as the safety margin with OPCAB is reduced compared with on-pump CABG.

Intracoronary shunts are extremely useful in minimizing the amount of ischemia and improving the safety of the operation. At training institutions, the use of shunts allows residents to be trained in OPCAB safely.

Allow extra time to obtain the best presentation and stabilization for OM. Do not compromise your exposure.

CO₂ blower is crucial for beating heart surgery but has to be used VERY sparingly at a flow rate not greater than 5 L/min, to prevent damage to the coronary endothelium. Avoid directing the gas jet distally to prevent gas embolization.

Heparin reversal is not mandatory. Author preference is half-reversal.

In the author's experience, anastomosis of the OM is better performed from the left side of the patient.

Place temporary pacing wires before occluding the RCA proximal to the PDA to manage possible A-V block.

Preference Card

Genzyme OPCAB retractor system



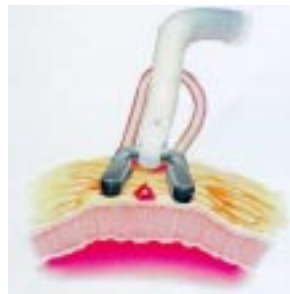
Guidant (formerly CardioThoracic Systems) Ultima II retractor and stabilizer



Guidant Flocoil intracoronary shunt (sizes from 1.5 mm to 2.5 mm in 0.25 mm increments)



Medtronic Octopus 2 (suction stabilizer)



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