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How to Start a Beating Heart Coronary Artery Surgery Program

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ABSTRACT

An important issue that is not addressed in the recent literature on beating heart coronary artery bypass surgery is the question of how to initiate a program in OPCAB in a center where conventional coronary artery surgery has been the routine. It is the aim of this article to describe what we consider to be safe steps for a conventional cardiac surgeon to take to ensure a successful initiation of OPCAB surgery in his or her institution.

While modern OPCAB surgery has experienced major technical advances that have made the procedure more predictably successful than in previous years, these advances require the use of an array of new technology and skills. This article discusses some of the skills and devices, such as modern stabilizers, shunts, and blowers, that the beginning OPCAB surgery team will need to acquire and master when embarking on an OPCAB program.

Initiation of an OPCAB program also requires that the entire surgery team believe in the efficacy of the procedure and approach it with enthusiasm. A team visit to a center that already performs OPCAB is an important element in initiating the new program. It is no longer necessary to learn the procedures by trial and error. Because it will occasionally be necessary to convert from OPCAB to conventional surgery, the team must be thoroughly familiar with both methods and should not be reluctant to rely on the heart-lung machine when the patient's safety requires it.

INTRODUCTION

Beating heart coronary artery bypass surgery, so-called OPCAB, has gained popularity as an alternative method of revascularization. There are several studies in the literature dealing with the technical details [Salerno 2001] and surgical results [Benetti 1991, Buffolo 1992, Calafiore 1998] of OPCAB. However, none of the papers have addressed an important issue: how to initiate a program in OPCAB in a center where conventional coronary artery surgery is the routine. It is the aim of this article to describe what we consider to be safe steps for a conventional cardiac surgeon to take to ensure a successful initiation of OPCAB surgery in his or her institution.

MATERIALS AND METHODS

While OPCAB was attempted as early as 1961 [Goetz 1961], the procedure today is a completely new one that uses advanced technology and skills. Technical advances have made it easier and more predictably successful than 40 years ago. Before embarking on an OPCAB program, the surgeon and the surgery team must acquire and attain mastery of modern stabilizers, shunts, blowers, and other devices.

There are a variety of stabilizers on the market. Once the surgeon becomes familiar with one of them, there probably is no reason to change unless he or she becomes aware of shortcomings of a particular device in the process of mastering its use. Stabilizers for the heart are basically of two types: pressure and suction [Zenati 2001]. Each one has its own advantages, and the surgeon should be familiar with them. Some stabilizers are bulkier than others and some are better for a particular artery. Because stabilizer designs are changing rapidly, the surgeon must be willing to try different models until finding the one that he or she feels most comfortable with.

Exposure of the lateral and posterior arteries requires elevation of the heart either with pericardial sutures or suction cups. There are advantages and disadvantages to either method. Again, while recognizing that the two techniques may complement each other, using just one technique is adequate. In our practice we combine a slight Trendelenburg position with a single pericardial "Lima suture" [Bergsland 1999]. We are thus able to deliver the heart right out of the chest without any significant hemodynamic compromise. Using a pressure stabilizing device, we can then perform distal anastomoses to either the marginals or the posterior vessels without opening the pleura on either side.

Once the artery is presented and stabilized, the beginner surgeon should consider obtaining proximal control of the artery to be bypassed by a snare, a loop suture, or properly designed "bulldogs." We recommend shunting, initially at least, to alleviate concern about ischemia and to extend the time available for completing the anastomosis. There is less likelihood of EKG, hemodynamic, or rhythm disturbances

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during the shunting, and the shunt helps in obtaining a dry field, which makes it easier to take exact bites of the vessels needed for a good anastomosis. Temporary occlusion of the artery with the above-mentioned techniques will facilitate insertion of the shunt by decreasing bleeding. The beginning surgeon may be surprised to see how vigorously a 95% occluded vessel bleeds when an arteriotomy is made for an anastomosis in OPCAB. In such cases of excessive bleeding, desperate attempts to insert shunts can damage the endothelium and create dissections in the native arteries [Pfister 2001]. It is thus important that shunt insertion be facile, swift, and gentle. Once the shunt is inserted, the occlusion of the artery can be reversed. Some surgeons simply snare the artery distally and proximally to the arteriotomy. Because even with the shunt in place there can be some bleeding that obscures the view, a blower may be necessary for better visualization of the vessels being anastomosed. The blower uses CO_2 gas mixed with an adjustable amount of saline to blow the blood out of the field. It is important to be aware that overly aggressive blowing can damage the endothelium and cause dissections, especially in the internal mammary artery and the native coronary arteries [Pfister 2001].

After completing the distal anastomosis, we perform the proximal anastomosis in the usual fashion. However, this sequence can be reversed. In fact, some proximal connecting devices available today only allow you to perform the proximal anastomosis before the distal one. While we have not yet included these devices in our routine, mainly because of cost concerns, they have proven particularly useful in dealing with a difficult ascending aorta with heavy plaques where placing a clamp is contraindicated. Using this kind of proximal connecting device completely avoids handling of the aorta and its inherent risks.

Quality assurance of the anastomosis is essential. Although there is no reliable method of determining whether there is stenosis at the anastomosis, transit time flow measurements (TTFM) will indicate whether or not the graft is patent, the quality of the flow curve (whether the IMA flow is systolic only or diastolic as well), and the actual amount of flow in the artery. If there is no flow, the anastomosis will have to be redone, usually by taking down the original anastomosis, inspecting it to determine the cause of the failure, and redoing it [D'Ancona 2000]. It is our policy not to leave the operating room unless we are satisfied that the anastomosis is adequate as indicated by TTFM. In cases where we expect that an anastomosis may not be patent, such as when a very small artery is opened by mistake, and the surgeon realizes that he or she cannot redo the anastomosis, we simply document in the chart that that anastomosis was not patent in the operating room. This will avoid any surprises in the future if the patient is catheterized for some reason. The surgeon should be alert to the development of new devices that will help in determining patency of anastomoses, whether for on-pump or off-pump surgery.

Maintaining the patient's temperature is a factor to be considered, as over time the patient's core temperature tends to drift. There are a variety of devices available to warm the patient. If you do not use one of these devices (we do not in our institution), remember to turn up the temperature in the room and use warm saline to wet your hands when tying your knots.

DISCUSSION

Willingness and Motivation to Change

While it is obviously important for the cardiac surgeon to master the technique and technology of OPCAB, other equally important factors have to be taken into account before initiating an OPCAB program. Above all, it requires that the entire surgery team believe in the efficacy of the procedure and approach it with enthusiasm. The team should be motivated by a belief that the procedure will result in better patient outcome. Every member of the team, including the surgeon, cardiologist, anesthesiologist, nurses, and perfusionists, also must understand the differences between conventional CABG and OPCAB.

The anesthesiologist will play a major role in the conduct of the operation and must be extremely vigilant throughout the procedure. At no other time is communication with the anesthesiologist so important as during manipulation of the heart, when hemodynamics may change. He or she must constantly monitor the hemodynamics as well as the ventilation of the patient, while keeping an eye on the operative field in order to anticipate catastrophes such as hypotension, arrhythmias, hypoxia, and other metabolic and respiratory abnormalities. Anesthesia should be administered in such a manner that early extubation is possible. In fact, extubation in the operating room at the end of surgery should be the goal of each operation. When that is not possible, the patient can usually be extubated within a few hours after arrival in the ICU if there is no bleeding. It is therefore important that the patient not receive a heavy dose of anesthetics towards the end of the operation. Such an active role requires that the anesthesiologist be highly motivated and dedicated, and that he or she be actively supported by other members of the team.

The perfusionist is another member of the cardiac surgery team whose role will change significantly. Despite the fact that the perfusionist will no longer be needed to run the heart-lung machine in most cases, there will still be situations in which his or her services are required, and sometimes urgently. Perfusionists must be prepared for any eventuality, such as the initiation of cardiopulmonary bypass in a matter of minutes. They must develop a plan for such an eventuality and clearly define the sequence of events that will lead to a quick and clean initiation of CPB. In routine OPCAB, the perfusionist's role does change from an active one with the heart-lung machine to performance of other duties, such as measurements of graft flows, application of cell-saving techniques, and assisting the anesthesiologist with monitoring responsibilities.

The nursing staff must be familiar with both OPCAB and conventional CABG techniques. Most of the instruments and equipment used for conventional coronary surgery are not needed in OPCAB, thereby simplifying the set-up to a great degree. However, in case of emergency, the scrub nurse will have to be prepared to switch to the set-up of the conventional operation.

Visit to a Center That Performs OPCAB

Once the surgeon and the surgery team have become familiar with the matters described above, it is important for them to visit a center that already has a successful OPCAB program in place. The whole team should visit together and spend time observing how their roles are being played successfully by others. The beginner does not have to make the same mistakes that earlier OPCAB surgeons made by trial and error as they learned the procedure—he or she can simply pick up from where the experienced OPCAB surgeon currently is. Similarly, the anesthesiologist will have an opportunity to observe the perioperative management of the patient from the head of the table. Likewise, the perfusionists and the OR nurses will be better able to prepare themselves for the change with the help of useful tips from experienced personnel. This preparation will usually put the team at ease and alleviate the anxiety commonly associated with changes in the operating room. It has been our experience that a site visit to an OPCAB center is the single most important step in the successful initiation of an OPCAB program.

After the Visit

If the whole team is prepared to begin the new program, consider scheduling all patients in the operating room for OPCAB. The surgeon should go over the conduct of the operation with the whole team before the start of the procedure. While it is important that the team at least try to do every case off-pump, remember that patient safety is foremost and that the heart-lung machine may be your best friend. If a case becomes difficult, beating heart surgery with CPB should be attempted. This will give the team a good practice run for OPCAB. Manipulations of the heart should be done gently, and the surgeon should avoid sudden changes in position of the heart until more comfortable with the procedure. Of course, the surgeon as the team leader must lead with calm, and his or her manner should inspire confidence in the rest of the team. Frequent encouragement, constructive criticism, and patience will pay dividends for the surgeon when leading a team of dedicated professionals in a new program of surgery.

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