

Minimally Invasive Coronary Artery Bypass Surgery

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In the hope of decreasing patient trauma and morbidity, cardiothoracic surgeons at the Ochsner Clinic are currently investigating techniques of performing coronary bypass surgery without the use of the cardiopulmonary bypass machine, which can cause complications following surgery in patients with certain coexisting conditions (such as renovascular, cerebrovascular, or pulmonary disease), particularly elderly patients. The initial 15 at-risk patients who underwent off-pump coronary artery bypass have demonstrated extremely encouraging results in reducing previously expected complication rates. Operative and intermediate survival was 100%. Eighty percent (80%) of procedures were accomplished without red blood cell transfusion, 100% were extubated within 24 hours of surgery, and (with the exception of two out-layers who had prolonged stays due to non-cardiac causes) the average length of stay was 5 days with only 18% demonstrating postoperative atrial arrhythmia. We are evaluating our technique to conform to multicenter protocols in the hope of identifying precisely which groups of patients will receive the maximal benefit from this procedure.

Van Meter CH Jr. Minimally invasive coronary artery bypass surgery. The Ochsner Journal 2000; 2: 172-174.

Technological advances and the challenge of delivering cardiovascular services to an ever-aging population with increasing medical comorbidities have led to new developments in the techniques of coronary artery bypass. A surgical technique has been developed that is not only performed through smaller incisions, reducing patient trauma, but results in markedly decreased patient morbidity by performing some coronary bypass procedures “off-pump,” or without the use of the cardiopulmonary bypass machine.

The use of the cardiopulmonary bypass machine revolutionized the ability to safely perform valve repairs or replacements, coronary artery bypasses, repair of congenital heart disease, and virtually all of the procedures performed in modern cardiac surgery. The ability to stop the heart, protect it, and sustain the body’s physiological functions allowing a precise surgical procedure to be accomplished revolutionized the care of all patients with heart disease. However, as in all things, this benefit

did not come without some risks. Despite our efforts to identify and modify all risk factors, some patients still suffer neurological complications, renal insufficiency, and transfusion requirements and/or bleeding problems postoperatively. While the incidence of these complications is quite low, their occurrence rate and magnitude of effect on patient morbidity and general medical condition increase with patient age.

Off-Pump Procedure

By combining the efforts of the cardiac anesthesia team, operating room nurses and surgical assistants, and perfusionists who stand by with traditional cardiopulmonary bypass equipment should it become necessary, we have succeeded in performing coronary artery bypass “off-pump” in a number of patients for whom the bypass system presented a substantial risk. These included patients with extremely poor lung function and lung reserve; severe renal insufficiency bordering on the need for

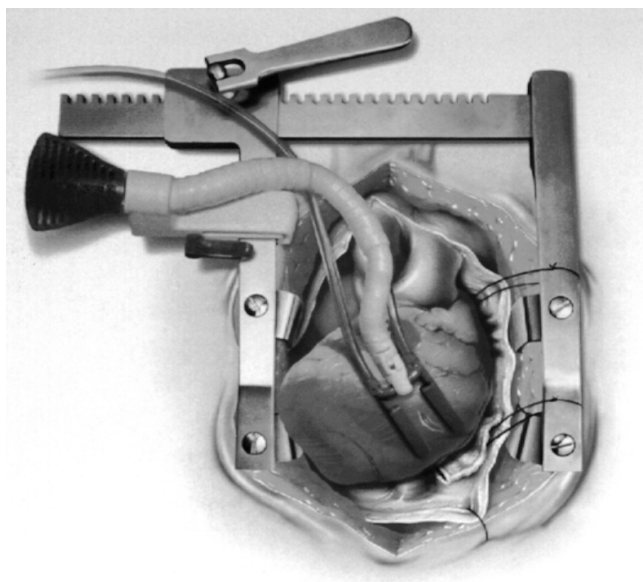


Figure 1. Retraction sutures allow access to the heart.

dialysis support; recent cerebral vascular accidents, a history of neurologic complications, or compromised cerebral circulation; and others for whom the use of the bypass machine would have significantly increased their operative risks. The technique involves the placement of retraction sutures in the posterior pericardium (Figure 1) and modifications in patient positioning on the operating room table to effectively elevate and rotate the heart for exposure while maintaining cardiovascular stability. Stabilization devices are applied at the coronary artery site for anastomosis, and intracoronary shunts are used to maintain blood flow within the vessel being bypassed and improve visibility to allow anastomoses to be performed without stopping the heart (Figure 2). Patency of the grafts is assessed by techniques including flow probe assessment and thermal camera analysis.

Ochsner Results

Our initial 15 patients (14 male, 1 female) undergoing the off-pump coronary artery bypass procedure at Ochsner included patients with severe respiratory disorders such as emphysema, sleep apnea, asthma, and chronic obstructive pulmonary disease. For these patients, preoperative pulmonary function studies indicated a high probability of ventilator dependence under standard cardiopulmonary bypass techniques. An additional

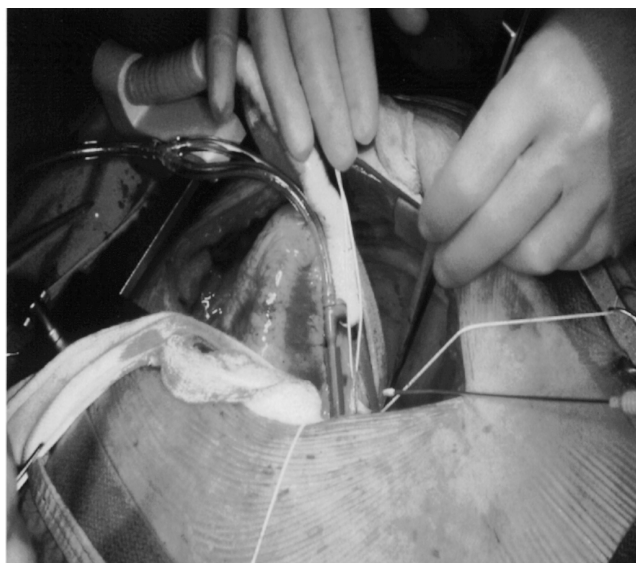


Figure 2. Off-pump coronary artery bypass procedure.

group of patients suffered from severe renal dysfunction, due either to chronic hypertension, diabetes, or renovascular disease. Others had suffered previous neurologic incidents with resultant or persistent neurologic deficits or were at high risk for cardiopulmonary bypass-induced neurologic injury. Based on standard Parsonnet score assessment, this group had an average mortality of 10–20% with conventional coronary artery bypass surgery.

The patients in our initial experience had a 100% operative and intermediate survival with only one patient requiring conversion to cardiopulmonary bypass due to an intramyocardial vessel. Eighty percent (80%) were done without red blood cell transfusion and 100% were extubated within 24 hours of surgery. With the exception of two out-layers who had prolonged stays due to non-cardiac causes, the average length of stay was 5 days. Only 18% demonstrated postoperative atrial arrhythmia, which is slightly lower than the average with on-pump cases; this group underwent an average of two bypasses per case.

Discussion

We have been extremely satisfied with the revascularization outcome in this limited patient population and are conservatively expanding this technique to a larger population requiring coronary bypass. In participation with multiple institutions, we are

evaluating our technique to confirm protocols and identifying precisely which groups of patients will receive the maximal benefit from this procedure assuming that the quality of the bypass grafts may be slightly inferior to that of our traditional technique and the number of bypass grafts per patient may be slightly less than for those treated traditionally.

Initial reports by participating centers indicate the greatest benefit is to patients for whom traditional cardiac surgery carries the greatest risk, frequently elderly patients and those with compromised renal or pulmonary function. The observed versus the expected mortality in these patients has been greatly reduced. Most striking are the early indications of significantly reduced operative mortality in high-risk patients. In populations with less severe medical conditions, there appears to be an increase in the rate of postoperative symptoms, presumably due to a less complete revascularization with the off-pump procedure.

Conclusion

It is apparent that patients with certain co-existing conditions, such as renal vascular, cerebral vascular, or pulmonary disease, suffer complications following coronary bypass surgery. Our initial off-pump surgery results for this patient population are extremely encouraging in their reduction of previously expected complication rates. This project represents an on-going commitment to offer the latest technological and technical advances to our patients and their referring physicians, and we will continue to explore the benefits of this technique to patients requiring coronary bypass.

Suggested Reading

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