In the past five years, coronary surgeons have been inundated with a variety of new techniques that have arisen from the desire of both surgeons and patients to minimize the invasiveness of the operation. While surgeons have primarily focused on eliminating the use of cardiopulmonary bypass, patients seem more focused on diminishing the size of the incision, reducing the musculo-skeletal trauma. Patient attitude is more a function of improved aesthetics and the psychological perception that a smaller incision perhaps means less of an operation. Surgeons, on the other hand, have been more focused on improving their skill at performing coronary bypass surgery without using cardiopulmonary bypass and maintaining the median sternotomy as their access of choice. Learning the off-pump approach is relatively easy, because the classical incision allows the surgeon flexibility in terms of converting the operation to a pump-supported procedure. Industry has aggressively pursued the off-pump techniques, with new devices being brought to market in an ongoing manner.

In the mid-nineties, Heartport™ (Redwood City, California) introduced technology that allowed surgeons to perform multiple-coronary bypass surgery through a small left anterior thoracotomy. This technique was incorporated into the armamentarium of a select group of surgeons who were willing to learn to perform coronary surgery through a smaller incision. The limitation in the development of the Heartport limited-access technique was a function of the lack of comfort that surgeons had working through small incisions as well as technical problems inherent to the technology itself.

Access to the worldwide web has provided patients with a tremendous amount of information, and they frequently approach their surgeons expecting some of the new limited access procedures. The fact is that conflict occurs when a patient wants a specific procedure and the surgeon is interested in offering something different.

A survey was undertaken by our team in which two surgical options were offered to more than 300 “potential” patients. Following presentations to mostly healthcare professionals, as well as some lay people, the basic risks and benefits of coronary surgery with two different techniques were explained (off-pump coronary artery bypass median sternotomy versus ACB via small thoracotomy on pump). Forty-two percent of the male participants and seventy percent of the female participants chose the small incision option. It is of interest that the majority of these healthcare professionals had been exposed clinically to both approaches.

We have developed a technique that intends to diminish the size of the incision, while at the same time virtually eliminates the technical difficulties of the Heartport Port Access system.

Technique. Access to the chest cavity is obtained through a left mini-thoracotomy (approximately 3–4 inches in length). The incision is made at the level of the fourth intercostal space. In females, a sub-mammary approach hides the incision completely. No ribs are resected. The left internal mammary artery is dissected using a non-disposable retractor (Limavator; Genzyme Surgical Products, Tucker, Georgia). Following the opening of the pericardium, cannulation is accomplished. The aortic cannula is brought into the chest through a stab wound at the level of the second intercostal space. Venous drainage is achieved via the right femoral vein with a long cannula placed in the right atrium under transesophageal echocardiographic control.
Cardiopulmonary bypass is initiated and the heart is arrested with the placement of a percutaneous cross clamp (Scanlan-Chitwood; Scanlan International, Inc., St. Paul, Minnesota). Cardioplegia is delivered in an antegrade fashion through the ascending aorta. All distal and proximal anastomoses are constructed under a single period of cardiac arrest. With a flaccid and decompressed heart, accuracy is not compromised. Upon separation from cardiopulmonary bypass, decannulation is accomplished in a conventional manner.

Thirty-eight patients were operated on in a 12-month period. There were 30 males (79%) and 8 females (21%). The average age was 65.1 years (age range, 48–81 years). Twenty-three patients (60%) presented with unstable angina, nine patients (24%) with stable angina, four patients (11%) with acute myocardial infarction and two patients (5%) with heart failure.

The number of grafts per patient averaged 2.9, with twelve double bypasses, seventeen triple bypasses and nine quadruple bypasses. All patients had one internal thoracic artery placed. Average time of cardioplegic arrest was 65 minutes and 103 minutes of extracorporeal circulation. The operation times became shorter as experience was gained.

There were no deaths. There was one peri-operative infarction and one re-exploration for bleeding. There were no neurological deficits. Two patients were intubated more than 48 hours. Only 10 patients (26%) required blood products and 5 patients (13%) developed atrial fibrillation.

**Commentary.** In the ever-changing world of coronary revascularization, surgeons are faced with the need to reduce the invasiveness of their procedures. We are confronted with the option of a more conventional approach (off-pump coronary artery bypass) with a median sternotomy versus a small incision approach. While the former may prove to reduce the risk of neurological injury (particularly in older or high-risk patients), the latter may reflect the choice of a significant number of patients as shown in our preliminary survey.

Efforts to develop robotically-assisted cardiac surgery are geared to reduce the size of the incision. Some of these operations are performed without the use of cardiopulmonary bypass (single or double bypasses). It is doubtful with present technology that multiple coronary artery bypass grafting (CABG) (3–5 grafts) with robotic assistance will be achieved in the near future without extracorporeal circulation.

With industry support and surgeon creativity, more operations are becoming available to revascularize the heart. Today’s cardiac surgeon should have a variety of techniques in order to best balance their patient’s needs and preferences. Conceptually, a patient at low risk for complications of cardiopulmonary bypass is a candidate for the small incision approach, while the high-risk patient may be better served with the off-pump CABG technique.