

# The Heart Surgery Forum®

## EDITORIAL

### What is the “Tipping Point” for the Acceptance of New Technologies in Cardiac Surgery?

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*The Tipping Point* is a book that every cardiac surgeon should read [Gladwell 2000]. Malcolm Gladwell, the author, shows the reader how or “why ... some ideas or behaviors or products start epidemics [revolutions] and other don’t. And what [we] can do to deliberately start and control positive epidemics of our own.” I found the book, strangely enough, in a bookstore at the airport during my flight back from the CTT/STS meeting in Fort Lauderdale, Florida. After being introduced to a sundry of devices and technologies that promise new solutions to old problems, I thought that Gladwell had some poignant ideas in *The Tipping Point* which can help us understand the new world order of cardiac surgery. For example, some of the new technologies which received significant attention at the meetings were robotics, ablative alternatives to the traditional Cox-Maze operation, namely the radiofrequency Maze and the cryomaze as described by Dr. James Cox. Other technologies, which were highlighted, were the LV reconstruction and remodeling operations and gene therapy for adult heart disease.

Robotic devices not only enhance surgical skills but are enabling tools for the delivery of devices to perform endoscopic CABG, ASD repair, ablation of atrial fibrillation, and mitral valve repair, among others [Ducko 1999, Boyd 2000, Chitwood 2000, Czibik 2002]. Implantable cardiac assist devices have the potential to extend the quality of life for patients awaiting heart transplantation [Navia 2000]. Gene therapy can provide solo therapy or can be combined with traditional bypass surgery to treat targets which cannot be revascularized by surgical or stent-based interventions [Chiu 2002]. Radiofrequency or cryoablative technology promises to fundamentally minimize the surgical trauma associated with the traditional “cut and sew” Maze procedure [Cox 2002]. This technology will potentially allow the vast majority of surgeons to become arrhythmia surgeons, a field once reserved for the “arrhythmia specialists” amongst us. More and more patients, with lone atrial fibrillation or chronic atrial fibrillation associated with mitral valvular disease, can now be treated by these minimally invasive operations. But, what determines the

“trigger point” for the acceptance of these operations? That is, which of these technologies will prevail in our surgical practice, and what forces positively influence these “epidemics”?

Many surgical procedures have been described and long abandoned. My mentors in general surgery remembered the cryoprobe used at the University of Minnesota to surgically freeze gastric ulcers with little or no success. Although the majority of newly-described procedures, techniques, and surgical instruments are destined for the surgical history books and museums, many are difficult to evaluate. As Gladwell points out, “ideas and products and messages and behaviors spread just like viruses do” [Gladwell 2000]. Given the significant research efforts made in obtaining FDA approval for these devices, it is very likely that they will be a significant repertoire for the cardiac surgeon of the future. However, it is wise for the young surgeons amongst us to reexamine procedures that were unjustly introduced in our recent memories as “panaceas” for the cure of major surgical disease in order to learn from them.

I happened to witness first hand the dissemination of two major procedures during my training in cardiac surgery, namely the Batista procedure and beating heart coronary artery bypass surgery. Many surgeons visited our institution to see Batista and others perform this operation [Kawaguchi 2001a]. Although the conceptual framework (i.e., volume reduction) upon which the procedure was based was scientifically sound, the assimilation of the Batista procedure into clinical practice did not achieve “epidemic” status as defined by Gladwell. Fortunately, the “epidemic” was contained and the “tipping point” never achieved. Scientific studies have since been performed by several investigators and the procedure has been modified significantly. This has allowed the procedure to be accepted as an alternative therapy to cardiac transplantation in *some* patients with end-stage heart disease with excellent outcomes [Franco-Cereceda 2001, Kawaguchi 2001b].

On the other hand, beating heart surgery is reaching its “tipping point”. The reason why beating heart surgery is blossoming to “epidemic” levels is becoming more and more obvious. It would seem that the “tipping point” for the proliferation of a procedure to “epidemic” levels may have nothing to do with the “hype” associated with the procedure, but rather, the technology available to perform the procedure in a safe manner. Consider the following argument. Despite the best efforts put forward to teach cardiac surgeons beating heart coronary artery bypass surgery in 1996, a simple technological breakthrough was necessary in order

to bypass the marginal branches on a regular basis, case after case after case. Surgeons began to consistently use the “single suture” technique to achieve complete revascularization on the beating heart, avoiding cardiopulmonary bypass [Bergsland 1999]. As time went on, however, superior distraction devices (Starfish™) and exposure devices (Octopus™) enabled well-exposed and stabilized targets for consistently safe coronary revascularization [Spooner 1999]. These simple technological breakthroughs have helped catapult the “beating heart” revolution towards wide acceptance. Although 80% of all beating heart coronary operations are performed by 20% of cardiac surgeons, the horizon is open for wider application of this surgical strategy by an even larger number of surgeons. But, what is the “tipping point” that would allow cardiac surgeons to perform the vast majority of their cases without the heart lung machine? The answer is further modification of the cardiac distraction and displacement devices. The distraction devices were the “little push” that the beating heart problem needed to turn into a near raging “epidemic”. The same argument would apply once distal anastomotic devices become available; as well, teaching cardiac surgery residents beating heart surgery will certainly catapult this procedure from near “epidemic” status to “epidemic” levels [Karamanoukian 1999]. But, to appease level-headed surgeons, I say, time will tell.

To return to my initial query in this editorial, what determines which new procedures achieve the “tipping point” in cardiac surgery? What will determine whether robotic coronary artery bypass surgery will be incorporated into common cardiac surgery practice? What will determine whether LV remodeling and reconstruction procedures will reach the “tipping point” in the surgical treatment of congestive heart failure? What will determine whether transmyocardial laser revascularization and gene therapy will reach the “tipping point” for the alternative therapy of ischemic heart disease? What will determine whether the radiofrequency Maze or the minimally invasive cryomaze reach the “tipping point” in arrhythmia surgery? The answers are simple. It is the endorsement of innovative surgeons who have achieved cult status and respect amongst all cardiac surgeons by having worked in the area of arrhythmia surgery for years, accumulating the wealth of knowledge that is published in the scientific literature. An endorsement of an ablative procedure by such giants in cardiac surgery surely catapults these new technologies to wide acceptance. Surely, surgeons such as Drs. Cox and Gerard Guirardon can provide us with direction for how to go about reaching the “tipping point” in minimally invasive Maze procedures. Surgeons such as Drs. Boyd, Damiano, Chitwood, Falk, and Mohr will lead the way in robotic heart surgery. Drs. Batista, Bolling, McCarthy, amongst others will lead the way in the surgical therapy of congestive heart failure [Bolling 2001]. We should all remember that we stand tall on the shoulder of giants. The “tipping point” for the proliferation of new procedures to “epidemic levels” in cardiac surgery can now be understood. “Epidemics” don’t occur in isolation. We should all participate in these technological breakthroughs to “deliberately start and control positive epidemics” in cardiac surgery.

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