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Beating Heart Bypass Surgery Backgrounder

Beating Heart Bypass Grafting (CABG) Surgery

Once thought impossible, today's evolving surgical approaches allow surgeons to safely and effectively suture coronary artery bypass grafts in place on the surface of the heart without stopping its beating and blood-pumping function. These developing techniques have not replaced conventional coronary artery bypass grafting (CABG) procedures but they are increasingly used as technologies are developed to support them. Evidence suggests important benefits from avoiding use of the heart-lung machine to maintain the patient's blood circulation during the procedure.*

Medtronic introduced its first tissue stabilization system in 1997 to facilitate Beating Heart bypass surgery. Its three newer generations of the Octopus® System further advance the practice and potential of this technique which has been shown to offer significant potential benefits for patients.

How Beating Heart Bypass is Performed

An incision is made in the chest as the heart continues to beat. Positioning and stabilization instruments lift and hold the heart and then stabilize a portion of the heart's surface where the bypass graft will be sutured in place, all as the heart continues to beat. The Medtronic Octopus® System II includes the Octopus®4 Tissue Stabilizer and the Starfish™2 Heart Positioner. Using gentle suction only, they address the primary challenge in Beating Heart bypass surgery, making it possible to access all surfaces of the heart while reducing motion of the small area of surface tissue where the surgeon is sewing the bypass graft.

Potential Patient Benefits of Beating Heart Bypass Surgery

A stabilization system makes it possible to avoid use of the heart-lung machine by enabling the surgeon to carefully work on the patient's heart while it continues to beat. Beating Heart bypass surgery has the same beneficial results as conventional bypass surgery with the heart-lung machine - restoring adequate blood flow and normal delivery of oxygen and nutrients to the heart. Clinical studies suggest that Beating Heart bypass surgery may also have the following advantages:

- *Shorter length of hospital stay:* Patients are often discharged from the hospital

more quickly after beating heart surgery. One report from the medical literature notes a 32% shorter length of hospital stay for off-pump patients, a statistically significant difference.¹

- *Fewer blood transfusion requirements/less use of banked blood or blood products:* Avoiding the heart lung machine has been shown to reduce the use of blood products.^{1,2,3} Fewer patients require blood transfusions when undergoing Beating Heart surgery. These are important considerations in areas where banked blood may be in short supply or where transmission of bloodborne diseases is a concern.
- *Potential avoidance of neurocognitive decline:* While clinical studies have yet to reach a firm conclusion on this point, a study in the New England Journal of Medicine found measurable and persistent neurocognitive decline (memory loss, decline in thinking skills) in patients who had conventional "on-pump" heart bypass surgery utilizing the heart-lung machine.⁴ In two separate studies, postoperative neurocognitive function test scores were significantly better in groups of Beating Heart surgery patients than in groups of patients who underwent conventional procedures.^{5,6}
- *Lower cost:* Beating-heart surgery may cost less than conventional surgery because the heart-lung machine is not used, fewer blood products are needed, and hospital stays may be shorter. A retrospective study by Boyd, et al., found a cost reduction in the patient group that underwent off pump (Beating Heart) CABG.² The saving resulted from shorter ICU stays and hospital length of stays. The study also showed a significant reduction in the need for blood products and the reduction of postoperative complications. Ascione, et al., reported significantly lower transfusion requirements and costs, significantly lower operative costs, lower material and bed occupancy costs, and lower costs related to managing postoperative complications.⁷ A study by Puskas, et al., reported similar results.¹
- *Available to more patients:* Some patients are poor candidates for traditional bypass surgery techniques because of preexisting medical conditions (diabetes, renal problems, patient history of stroke or heart attack, etc.), or the fact that they are very ill. The medical literature refers to these patients as "high risk." Beating Heart surgery, which avoids the heart-lung machine, may make it possible for high-risk patients to undergo bypass surgery. Arom, et. al., found that off-pump CABG carries a significantly lower mortality rate in the high risk population than conventional CABG.⁸

*On occasion a surgeon may convert to use of the heart-lung machine during the procedure if for some reason the patient's condition becomes unexpectedly unstable.

References: 1 Puskas JD, et al. Clinical outcomes, angiographic patency, and resource utilization in 200 consecutive off-pump coronary bypass patients. *Ann Thorac Surg.* 2001;71:1477-1484. 2 BoydW, et al. Off-pump surgery decreases postoperative complications and resource utilization in the elderly. *Ann Thorac Surg.* 1999;68:1490-1494. 3 Ascione R, et al. Beating versus arrested heart revascularization: evaluation of myocardial function in a prospective randomized study. *Eur J*

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