

A photograph of three medical professionals in a hospital hallway. On the left, a woman in light blue scrubs is smiling and looking towards the center. In the center, a man in a white lab coat over a blue shirt, with a stethoscope around his neck, is smiling and looking towards the right. On the right, an older man with a grey beard, also in a white lab coat, is smiling and looking towards the center. The background shows a modern hospital corridor with large windows and glass doors.

TALES FROM THE OR:

How a Leading Surgical Team

IMPROVED CABG OUTCOMES



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Cardiothoracic surgeons perform coronary artery bypass graft (CABG) surgery nearly

ONE-QUARTER MILLION TIMES

annually in the United States.

Cardiothoracic surgeons perform coronary artery bypass graft (CABG) surgery nearly one-quarter million times annually in the United States.

While CABG is one of the most commonly performed cardiac procedures, surgeons increasingly seek to improve outcomes for their patients and hospitals while still overlooking on-the-spot assessment of graft patency, in the OR, before closing the patient.

Graft patency affects long-term CABG outcomes, but despite myriad surgical and technical advances, saphenous vein graft failure (VGF) rates remain unacceptably high.

Dr. Ralf Harksamp, et al. (2013) found "Vein graft failure (VGF) remains one of the leading causes of poor in-hospital and long-term outcomes after coronary artery bypass graft surgery."¹

Failure factors have been well-documented, but methods to assess grafts during on-pump or off-pump CABG procedures have not been routinely determined because the methods for assessment are cumbersome, unreliable, time-consuming, or costly.²



¹<http://www.ncbi.nlm.nih.gov/pubmed/23574989> Ann Surg 2013; 257(5):824-33.

²<http://imaging.onlinejacc.org/article.aspx?articleid=1096966>

Graft failure can have serious consequences.

Researchers discovered 44 percent of patients whose grafts failed were more likely to receive additional revascularizations and have a heart attack within 18 months of CABG surgery.³

There is a solution. Intraoperative flow measurement provides invaluable information on graft patency, allowing cardiothoracic surgeons to make any necessary corrections to a graft before closing the patient.

In the pages that follow, you will learn how a leading surgical team at a New Jersey hospital used intraoperative transit time flowmetry to improve its post-CABG patient outcomes.


Using Intraoperative Transit Time Flowmetry to Determine Graft Patency

The European Society of Cardiology's Guidelines on Myocardial Revascularization states:

"Graft flow measurement may be useful in confirming or excluding a technical graft problem indicated by haemodynamic instability or inability to wean the patient from cardiopulmonary bypass, new regional wall motion abnormalities on transoesophageal echocardiography, or ventricular arrhythmias. **It has also been shown to reduce the rate of adverse events and graft failure ...**"⁴

Though various methods exist to determine flow—feeling for a pulse with a finger, using doppler technologies, etc.—many surgeons fail to consider formal flow measurement; it is often ignored. Informal measurement techniques, however, lack the ability to provide surgeons with the absolute volume flow—a crucial factor in the success of a graft.

The question remains: If you have taken the time to construct a graft, is it not worth also taking the time to measure that graft's flow to ensure the best possible patient outcome?



Measuring flow using transit time ultrasound technology allows you to quantify the blood flow that will reach the areas of the heart, giving you the ability to make data-driven clinical decisions.

³<https://www.dcri.org/research/news/2012-news-archives/patients-who-have-graft-failure-after-cabg-are-more-likely-to-have-heart-attacks>

⁴<http://eurheartj.oxfordjournals.org/content/ehj/35/37/2541.full.pdf>

How Transit Time Ultrasound Technology Improves Patient Outcomes: A Collection of Cases

A Clinical Professor of Surgery at Columbia University's College of Physicians and Surgeons, Dr. Bruce Mindich served as chief of cardiothoracic surgery at a suburban New Jersey hospital from the program's inception in 1988 until 2005. He was instrumental in bringing the off-pump coronary artery bypass procedure to the facility.

Dr. Mindich and his team were one of the first in the country to apply intraoperative **transit time ultrasound technology** to their surgical repertoire. He introduced the patency assessment procedure using a transit-time ultrasound volume flow device. This allowed his team to quickly assess the success of grafts while still in the operating room, greatly improving patient outcomes.

A flow measurement enthusiast, Dr. Mindich kept detailed case records of the effects of measuring flow. His findings revealed a number of insights about the value of patency assessment.

Among those insights, Dr. Mindich and his team found:

“The intraoperative use of flow measurements provide invaluable information in a timely, accurate, cost effective manner allowing for the surgical correction of a surgical problem. This has significantly reduced the complications related to early technically induced graft failure. In an era of rapidly changing surgical techniques this provides documentation of the sine qua non of the operation: **patency**.”⁵



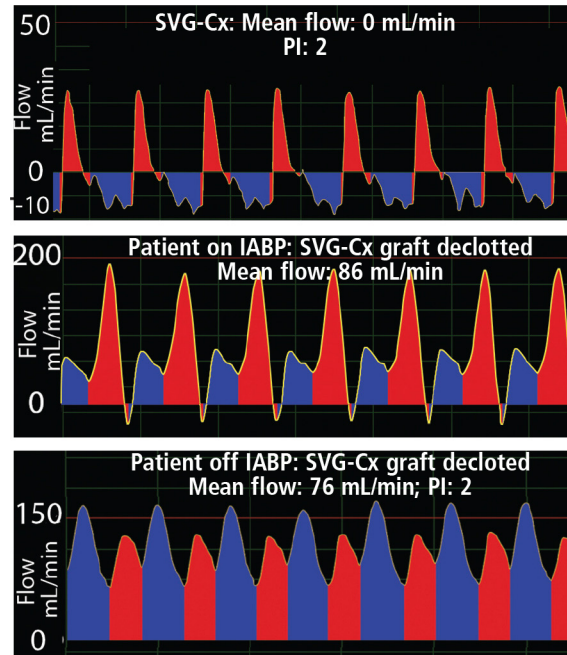
Here are **five cases from Dr. Mindich** and his team demonstrating the effects of transit time flowmetry

ON PATIENT OUTCOMES.

Case No. 1: TTFM Reveals Clot

An 81-year-old male patient with a blocked circumflex coronary artery (Cx) underwent CABG surgery. Dr. Mindich used a harvested saphenous vein graft (SVG) to connect the aorta to the circumflex coronary artery distal to the lesion.

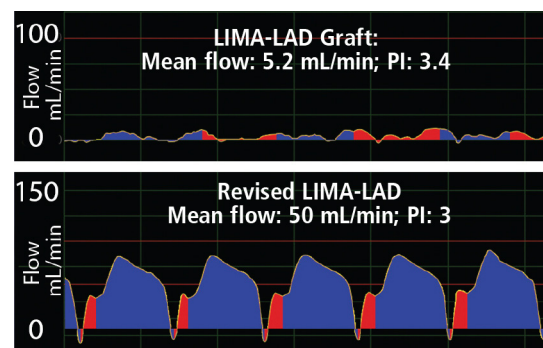
Dr. Mindich measured graft flow after anastomosis of the SVG to the Cx and found 0 mL/min, which clearly indicated a problem. Further investigation revealed a clot in the graft. The patient was placed on IABP support, the graft was declotted and flow was remeasured while the patient was still on IABP support. Flow measured 86 mL/min. When IABP support was removed, flow measured at 76 mL/min, which indicated IABP did not significantly affect graft flow.



Case No. 2: Why Acceptable Mean Flow is Key for Graft Patency Assurance and Decision Making

The case of a 67-year-old male patient with single-vessel coronary artery disease revealed the importance of mean flow when determining graft patency. The patient underwent off-pump CABG, and the LIMA-LAD graft flow first measured 5.2 mL/min. The graft appeared functional and the patient's pulse and pressure appeared normal.

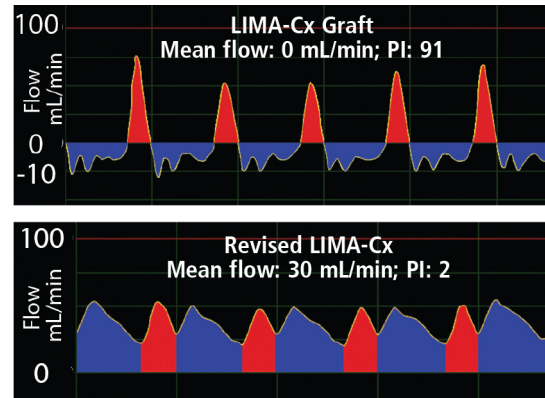
Using TTFM, Dr. Mindich discovered from the waveform that the graft exhibited a damped profile and atypical diastolization. The graft was revised, and flow improved to 50 mL/min with the flow waveform exhibiting a classic LIMA-LAD profile.



Case No. 3: Flow Indicates Need for Graft Revision

A 78-year-old female with a blocked circumflex (Cx) coronary artery underwent CABG surgery with the LIMA. Upon initial flow measurement, flow was found to be 0 mL/min. Based on the flow information and the spiky systolic waveform, Dr. Mindich revised the graft.

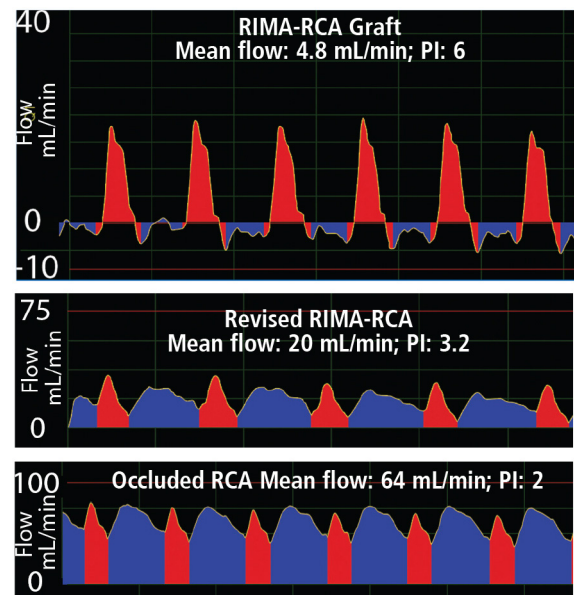
Following the revision, flow was measured at 30 mL/min, and the waveform showed a balanced systolic/diastolic profile.



Case No. 4: RIMA-RCA Graft Flow Suppressed by Competitive RCA Flow

A 60-year-old male with a blockage in his right coronary artery (RCA) underwent CABG with a right internal mammary artery graft (RIMA). Following the RIMA-RCA anastomosis distal to the blockage, flow measured 4.8 mL/min. The low mean flow, high PI and systolic dominant waveform profile, indicated the need for graft revision.

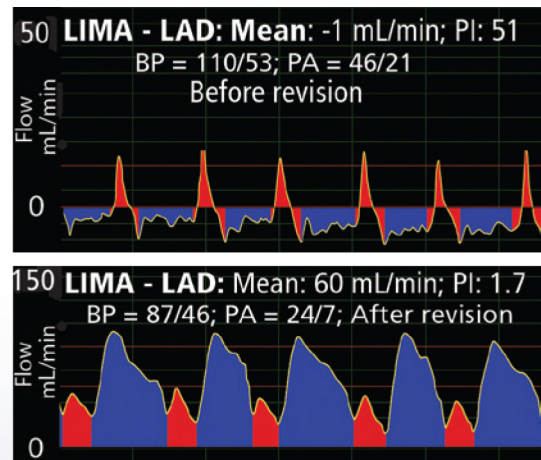
Once the graft was revised, flow improved to 20 mL/min. However, given the size of the patient, this flow was not as high as Dr. Mindich expected. Dr. Mindich suspected there was competitive flow from the native RCA and occluded the RCA near the anastomosis of the graft, which increased mean graft flow to 64 mL/min. An additional graft was placed more distally to the RCA. As a result, runoff improved, competitive flow decreased and graft flow was > 40 mL/min.



Case No. 5: Flow Measurement Reveals Technical Problem with LIMA-LAD Graft

An 80-year-old female underwent CABG surgery for a blocked left anterior descending coronary artery (LAD). Dr. Mindich anastomosed her left internal mammary artery (LIMA) to the LAD distal to the blockage. When measuring flow, Dr. Mindich found the graft had a reading of -1 mL/min with a PI of 51. The patient's blood pressure was 110/53, and her pulmonary arterial pressure was 46/21. Her deteriorating blood pressure, zero mean flow, high PI and waveform profile meant there was a need for graft revision.

After revision, mean graft flow increased to 60 mL/min, PI improved to 1.7 and the waveform exhibited a classic LIMA-LAD profile with a strong diastolic component. In addition, the patient's blood pressure and pulmonary arterial pressure decreased.



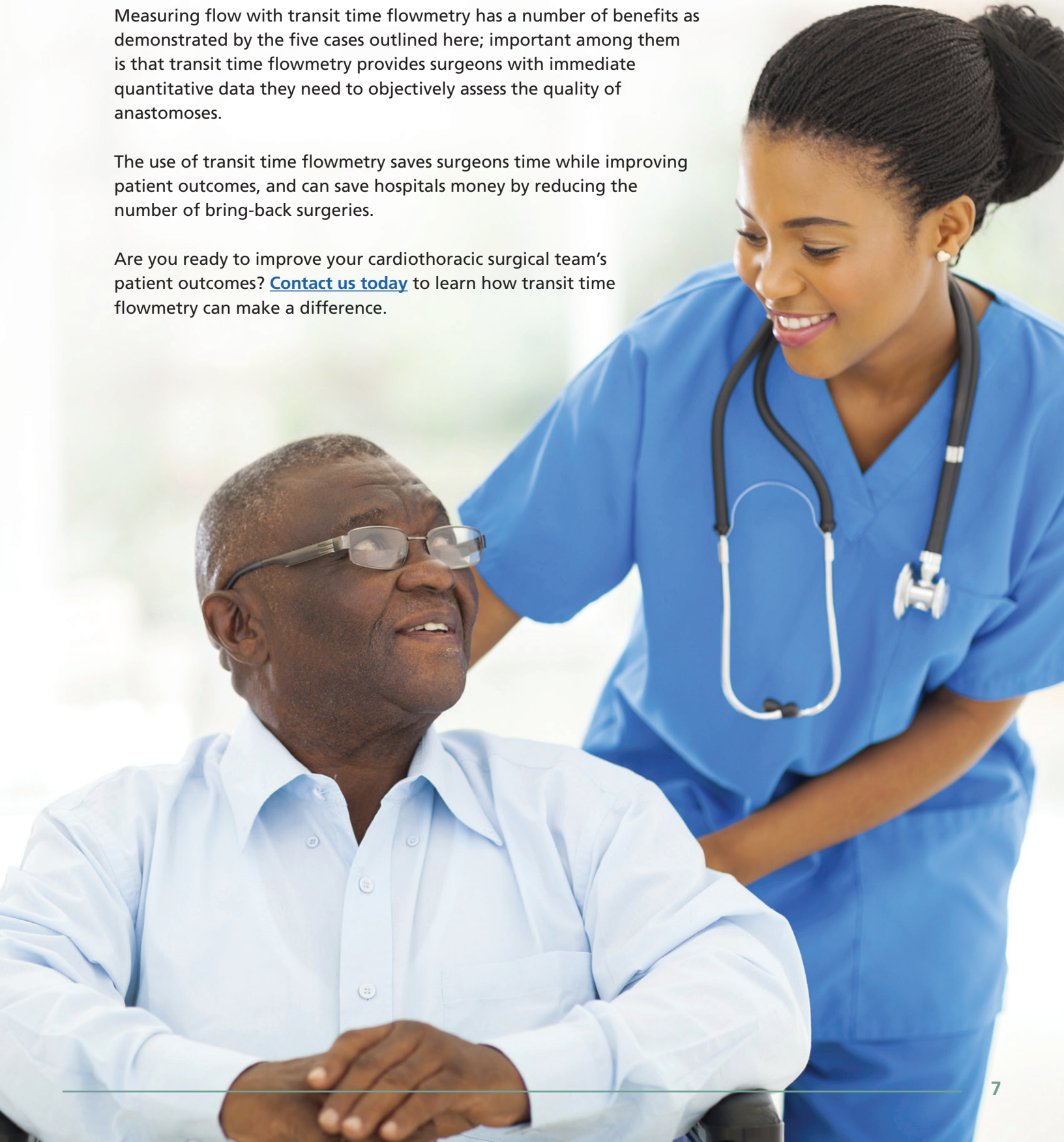
The Importance of Transit Time Flowmetry in Patient Outcomes

Without the use of transit time flowmetry, Dr. Mindich's patients would potentially have suffered adverse effects from surgery. As these cases show, taking time to measure flow with transit time ultrasound technology not only ensures graft patency, but ensures better outcomes for the patient.

Measuring flow with transit time flowmetry has a number of benefits as demonstrated by the five cases outlined here; important among them is that transit time flowmetry provides surgeons with immediate quantitative data they need to objectively assess the quality of anastomoses.

The use of transit time flowmetry saves surgeons time while improving patient outcomes, and can save hospitals money by reducing the number of bring-back surgeries.

Are you ready to improve your cardiothoracic surgical team's patient outcomes? [Contact us today](#) to learn how transit time flowmetry can make a difference.





Transonic Systems Inc. is a global manufacturer of innovative biomedical measurement equipment. Founded in 1983, Transonic sells "gold standard" transit-time ultrasound Flowmeters and Monitors for surgical, hemodialysis, pediatric critical care, perfusion, interventional radiology and research applications. Transonic® also provides pressure and pressure volume systems, laser Doppler Flowmeters and telemetry systems.

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