



Equipment Needed

MIDCAB Probe Set

Conduits	Recommended probe size
IMA	2 or 2.5 mm
Radial artery	3
Gastroepiploic artery	2.5 or 3

Ultrasound Gel (*Aquasonic 100, Parker Labs*)



Transonic HT300-Series Flowmeter



Introduction

Less invasive approaches to coronary bypass surgery call for closer scrutiny of graft patency, including intraoperative confirmation of adequate graft flow. *Transit time flow measurements* provide an important quality assurance check by giving an objective, quantitative assessment of mean graft flow and phasic flow patterns during surgery. Many pioneers of MIDCAB surgery strongly advocate the use of the Transonic Flowmeter to insure optimal patient outcomes and patency rates.

Measurement Technique

Intraoperative flow measurements add no more than 3 - 5 minutes to the case. In preparation for application of the flowprobe, a short segment of the internal mammary artery pedicle is cleared of fat tissue prior to performing the anastomosis.

The appropriate probe size is selected so that the graft will fill at least 75% of the lumen of the probe. Good ultrasonic contact between the probe and the vessel is obtained with sterile saline or ultrasound gel (*Aquasonic 100, Parker Labs*). The gel is applied to the lumen of the probe before placing it on the graft. The probe's flexible segment can be bent as desired for optimal positioning. Avoid placing the probe over surgical clips or sutures. After the probe has been applied, it takes about 30 seconds for mean readings to stabilize. Results are reported in milliliters per minute (mL/min) on the flowmeter's front display.

Recording the Flows

A Transonic HT300-Series Flowmeter is designed to make routine flow assessment quick and easy. Mean flow in mL/min is continuously displayed on a large LED and the measurements, including the phasic flow patterns, are documented using the integrated chart recorder. The optional FlowSound™ is similar to traditional audio Doppler, except that the pitches are proportional to volume flow, not velocity. FlowSound aids the surgeon in localizing a flow obstruction.

The Transonic flowprobe can also be used to determine net direction of flow. An arrow on the body of the probe (Fig. 1) indicates the polarity of the probe when the Invert button is off. The probe is applied from the most convenient angle, irrespective of the polarity of the probe. The Invert button is used to reverse the polarity of a flow reading from negative to positive before taking a printout.

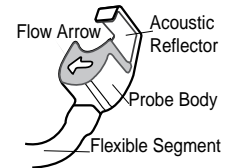


Fig. 1

The Signal Quality Indicator (SQI) gives a constant indication of the acoustic contact. If acoustic contact falls below a minimum acceptable level, an acoustic error will be indicated on the LED. Once the mean flows have stabilized, the auto calibrating chart recorder is used to document the flow measurements, including phasic patterns (Fig. 2).

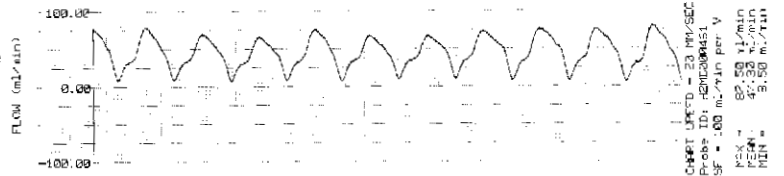


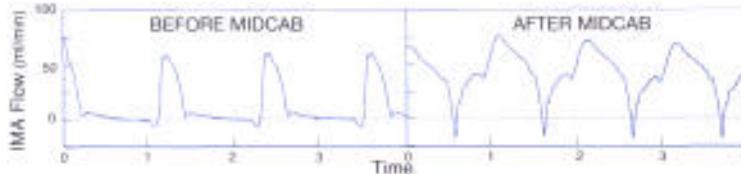
Fig. 2: Sample chart printout courtesy of J. Fonger, MD.

If coronary snares are used for hemostasis, flow measurements are performed before and after release of the proximal snare to assess the relative contribution of competitive flow in the native LAD. If competitive flow is present, the IMA flows will exhibit a distinct phasic pattern related to the degree of proximal LAD stenosis. Mean IMA flows will also be lower, due to the reversal of flow in the graft during systole.¹



Results - Interpreting the Flow Measurement

Arterial conduits are frequently in spasm following manipulation and this is often reflected in relatively low intraoperative flows. Therefore, many surgeons feel it is also important to record the instantaneous flow patterns. Grafting of the LIMA to the LAD produces a diastolization of the flow pattern² which confirms functional graft patency.



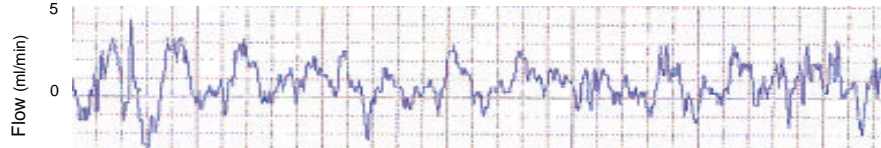
typical LIMA flow patterns, before and after MIDCAB. Before grafting, LIMA flow is predominately systolic; after grafting to the LAD flow is predominately diastolic.

After MIDCAB, the mammary circulation typically produces intraoperative flows from 15 - 50 ml/min/ The gastroepiploic artery, when grafted to the posterior descending artery generally has flows in the range of 10 - 35 ml/min.³

The following criteria are used to determine the presence of acute graft failure:

- a poor quality waveform with excessive noise indicative of turbulent flow
- mean flows of less than 10 ml/min
- lack of a vigorous pulse*

Note: since pulse is a manifestation of pressure, not flow, an occluded graft may still have a distinct pulse. If two or more of the above criteria are met, it is generally felt that the graft is not acceptable and should be revised.



Occluded graft waveform does not exhibit the expected predominant diastolic flow pattern, but instead is turbulent and non-repetitive. Mean flow is < 5 mL/min.

Summary

The Transonic flowprobe provides a convenient and reliable method for assessing adequate flow during surgery, when graft revision is relatively simple.

Acknowledgement

We would like to thank James D. Fonger, M.D., Director , Cardiothoracic Surgery, Washington Adventist Hospital, for his assistance in preparing this information. Questions regarding this procedure can be directed to Dr. Fonger by email to : jfonger@heartnet.org See "Heartnet.org" — An Internet Registry for tracking patient outcomes following MIDCAB

References

¹Kawasuji, M., Sakakibara, N., Takemura, H., Tedoriya, T., Ushijima, T., Watanabe, Y., "Is Internal Thoracic Artery Grafting Suitable for a Moderately Stenotic Coronary Artery?" Journal of Thoracic and Cardiovascular Surgery, Vol. 112, p. 253-259, 1996.

²Mandarino, W., Gorcsan, J., Katz, W.E., Cohen, H.J.A., Griffith, B.P., Zenati, M., "Intraoperative Analysis of Left Internal Mammary Artery Graft Flow Patterns Following Minimally Invasive Coronary Bypass," Journal of the American College of Cardiology, Vol. 31,p. 464-465, 1998.

³Fonger, J.D., Doty, J.R., Sussman, M.S., Salomon, N.W., "Lateral MIDCAB Grafting Via Limited Posterior Thoracotomy," European Journal of Cardiothoracic Surgery, Vol. 12, No. 3, p. 399-404, 1997.

