

T400-Series Surgical Protocol

Dog Left Anterior Descending (LAD) Coronary Artery: Acute and Chronic Blood Flow Measurement

PERIVASCULAR FLOWPROBE RECOMMENDATIONS FOR LAD						
DURATION	WEIGHT (KG)	PROBE	SF-SILICONE FLANGE	CABLE LENGTH	CONNECTOR	CALIBRATION
Acute	10 - 15	MA-1.5PRB	optional	WC100 1 meter	CRA10	GA acute
	18 - 25	MA-2PSB				
Chronic	8 - 12	MC-1.5PRB	suggested	WC40 40 cm	CM4B	GC chronic
	16 - 25	MC-2PSB			CB12	
	20+	MC-2.5PSS			CB12	

Update: Canine LAD Protocol

The use of Transonic® Flowprobes for measurements on canine coronary arteries is a fairly common application, though protocols vary considerably. The following protocol offers suggested techniques for stabilizing the Flowprobe for chronic implant. Some of our customers have found the silicone flange quite helpful in maintaining position of the Flowprobe while allowing the Probe to move in unison with the heart. In other protocols, a section of the pericardium is patched over the Flowprobe to maintain position if the flange would interfere with other instrumentation, or if the Probe is to be used on other vessels where not applicable.

Note: The following protocol was originally written for PR Probes, we recommend using PS Probes when possible due to the smaller Probe size. In acute applications any air within the Flowprobe window (between the Flowprobe and the vessel) must be displaced with gel or some other acoustically appropriate medium to transmit the ultrasound. A closer fitting Probe requires less gel and surface tension tends to hold the gel in place longer.

Objectives

The Probe must be positioned and secured on the cardiac wall so that the paraconal interventricular branch of the left anterior descending (LAD) coronary artery passes through the acoustic window, without rubbing against the bracket. The ultrasonic field of illumination, should be free of fat deposits, and for acute applications, filled with an ultrasonic couplant.



Fig. 1: Dog coronary Flowprobes.



Fig. 2: Flowprobe with SF-silicone flange.

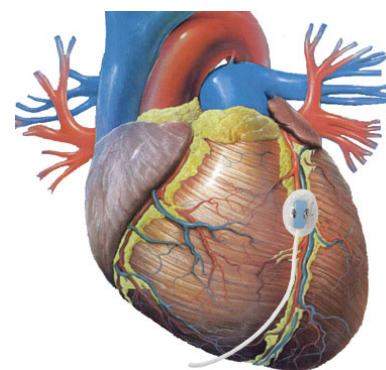


Fig. 3: View of dog heart with Flowprobe implanted on left anterior descending (LAD) coronary artery.

Dog Left Anterior Descending (LAD) Coronary Artery: Acute and Chronic Blood Flow Measurement Cont.

Procedure

1. The Transonic® 2PR Probe consists of three pieces: a blue epoxy body, an L or J-shaped metal bracket and a straight metal bracket with a channel running through its center. Prior to surgery, loosen the Phillips head screw securing the straight bracket and slide it out to open the Probe window. The small hole on the end of the bracket will permit you to conveniently open and close the window using the point of the screwdriver. The Transonic® 2PR-SF Probe has a silicone flange for easier positioning. In its closed position, the metal brackets are flush with both the bottom of the Probe body, and with each other at the opposite end. For acute application, submerge the Probe head in a beaker of saline prior to use.
2. Perform a left thoracotomy through the 4th intercostal space (between the 4th and 5th rib). The apical and cardiac lobes of the lung are retracted dorsally and caudally, and are held away from the operative site by moist packs to expose the mediastinum above and behind the hilus of the lung. This will expose the operative field.
3. The pericardium is then incised perpendicular to the phrenic nerve by picking it up with smooth thumb forceps, nicking it with a scalpel, and extending the incision with Metzenbaum scissors. The incision is started about 0.5-1 cm ventral to the phrenic nerve and is extended to the apex of the heart. For better exposure, the pericardium may be sewn to the thoracic opening, to form a cradle.
4. The origin of the left coronary artery may not be readily visible because it is usually buried in fat under the atrial appendage. The LAD artery, however, can usually be seen as it emerges from the fat in the atrioventricular sulcus.
5. As gently as possible, bluntly dissect the area of the LAD artery which is to receive the Probe from any surrounding fat over a length of 16 mm to 20 mm. Side branches which interfere with the application of the Probe may be tied off with 3-0 cardiovascular silk suture.
6. Applying the PR Flowprobe (Fig. 4)
 - a. Gently slip the L-shaped bracket under the section of the LAD artery; slide the straight bracket to its closed position; tighten the screw.
 - b. To position the Probe properly in relation to the LAD artery and the heart wall, place a suture through the hole in the top of the straight bracket and pull the Probe down into the cardiac wall. This will prevent the Probe from pulling the LAD out of position.
 - c. Place the next suture through the hole in the L-bracket, below the Probe body, and fasten to the cardiac wall. This suture aligns the axis of the Probe with the artery and as such should only hold the Probe to the cardiac wall, not pull the Probe into it. The L-shaped bracket side of the Probe is now flush with the heart wall.
 - d. For an acute experiment, fill the acoustic window not occupied by the LAD with an ultrasonic couplant (e.g., the animal's own blood, held in the window until it coagulates, a steady flow of saline or an ultrasonic coupling gel).

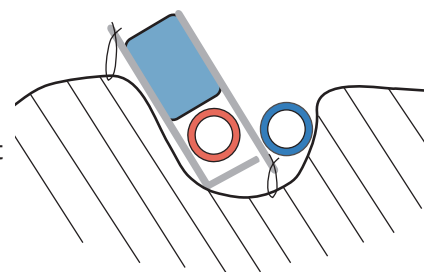


Fig. 4. Cross-sectional view of heart with a Flowprobe installed on lower anterior descending coronary artery.

Dog Left Anterior Descending (LAD) Coronary Artery: Acute and Chronic Blood Flow Measurement Cont.

Procedure cont.

7. Using the 2R-SF Probe (Fig. 5)
 - a. Gently slip the L-shaped bracket under the section of the LAD artery to be monitored, slide the straight bracket to its closed position, then tighten the screw.
 - b. Position the Probe, so that the Probe bracket lies in the atrioventricular sulcus, with the LAD artery running through the acoustic window and perpendicular to it. The silicone flange should be flush with the heart wall, with the Probe body visible and facing outward. The silicone flange is then sutured to the heart wall, to ensure that the LAD artery will not be pulled from its course by the Probe.
 - c. For a chronic application, use four sutures to secure the silicone flange to the cardiac wall. This will keep the Probe axis aligned with the axis of the LAD artery. For an acute application, use two sutures at one end of the silicone flange, then gently lift the other end and insert an ultrasonic couplant in the balance of the acoustic window, not occupied by the LAD artery. Then place the additional two sutures to hold down the other end of the silicone flange.
8. For both the 2R and 2R-SF Probe
 - a. Use an additional suture, silk (3-0 or 4-0) to fasten the Probe cable onto the heart (Fig. 6). The suture point on the heart is chosen to maintain the Probe axis parallel to the LAD. Care should be taken not to make the suture overly tight, as it might then cut through the silicone cable jacket. Due to the curvature of the heart, the cable might have to be elevated to maintain the alignment between the LAD artery and the acoustic window. This can be done by crossing a strain relief loop under the Probe's cable exit, or by suturing a piece of surgical sponge under the cable.
 - b. For an acute experiment, some adjustment of the Probe position may be necessary to achieve an acceptable signal strength. Observe the Probe's ultrasonic coupling by connecting the Probe to the Flowmeter. In its test mode, the digital panel meter displays the Probe size, plus a rough indication of the ultrasonic signal coupling (e.g., "Lo" for low, "Gd" for good). The analog display provides a precise measure for the ultrasonic signal strength (e.g. 0.31 = 310 mV received signal). If this signal is more than 30% below the signal strength of the Probe when submerged in saline, the acoustic window has not been properly filled with the couplant, which should be reapplied.

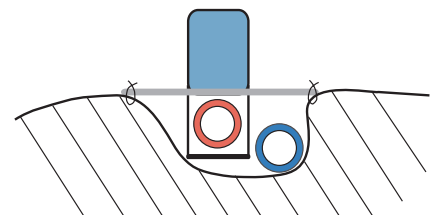


Fig. 5. Cross-sectional view of heart with Flowprobe installed on lower anterior descending (LAD) coronary artery using a silicone flange.

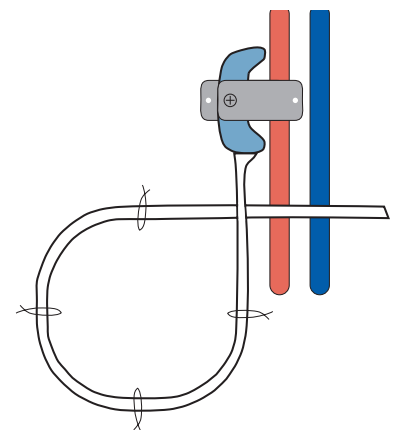


Fig. 6. Strain relief loop elevates Probe and brings it in line with lower left anterior descending (LAD) coronary artery. A surgical sponge may also be used.

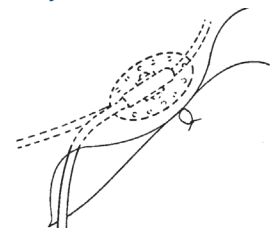


Fig. 7. Restored pericardium following implantation of Transonic probe. Do not overtighten suture(s).

Dog Left Anterior Descending (LAD) Coronary Artery: Acute and Chronic Blood Flow Measurement cont.

Procedure cont.

- For chronic implantations, bring the cable out through a separate stab opening, between the 5th and 6th or 3rd and 4th ribs. This opening is made more dorsal than the incision site, as the motion between the pectoral muscles and ribs will shorten the lifespan of the Probe cable. From there it is tunneled under the skin to a convenient exit on the back of the animal. Close the operative site, following standard surgical procedure. Allow approximately three to five days for the signal to stabilize.

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