T400-Series Surgical Protocol

Rat Ascending Aorta: Acute Blood Flow Measurement

APPLICATION BASICS

Site:	Ascending Aorta
Species:	Rat
Body Weight:	230 grams
Duration:	Acute
Vessel Diameter:	2 mm

PROBE

Size:	2 or 2.5 mm
Reflector:	JS
Connector:	CRA10: 10-pin
Cable Length:	100 cm
Catalog #:	MA-2PSB MA-2.5PSB

FLOWMETER

TS420 Perivascular Module

2PSB

Flow Ranges Observed

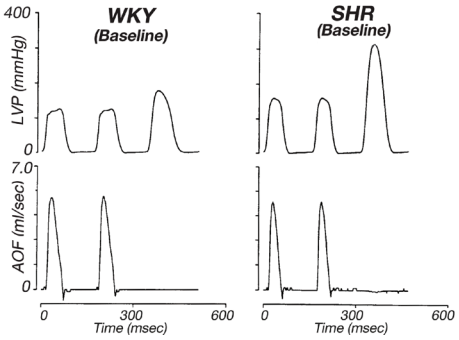

Fig. 1. A typical example of left ventricular pressure (LVP) and aortic flow (AOF) data from in-situ experiment. Baseline data are depicted for 2 steady-state contractions followed by an isovolumetric contraction obtained by occluding ascending aorta in diastole. Left and right panels correspond to data for Wistar-Kyoto (WKY) and spontaneous hypertensive rat (SHR), respectively.

Note: Instantaneous flow in a ketamine anesthetized rat peaked at over 300 ml/min. Cardiac index was 166 ml/kg/min. These values are substantially higher than those in rats anaesthetized with pentobarbital.

Application

Measurement of cardiac output has many applications. One researcher studies vasoconstrictors by combining CO with pressure and flow measurements in peripheral vessels. Another studies the effect of altering isomyosin composition on left ventricular resistance. This application requires high speed (1000 Hz) data acquisition and sophisticated digital signal processing.

Comparative Anatomy

The anatomy of the rat may be initially disorienting to the surgeon familiar with larger animals. The normal rat has a persistent left anterior vena cava and an prominent aortic arch that is slightly rotated to the right. The following mental exercise may aid orientation; visualize grafting an additional vessel to the caudal vena cava of the canine heart in Fig 2. Mentally pull the vessel cranially, then merge and move the common carotid arteries from brachiocephalic trunk to the aorta. The result is the remarkably rat-like presentation shown in Fig 3.

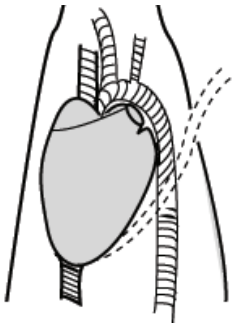

Fig. 2

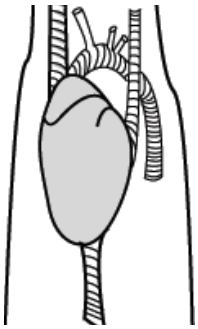

Fig. 3

transonic
THE MEASURE OF BETTER RESULTS.

Rat Ascending Aorta: Acute Blood Flow Measurement Cont.

Surgical Protocol

Anesthetize the rat with ketamine hydrochloride (70 mg/kg IP) and mechanically ventilate. Perform a median sternotomy and open the pericardium taking care to avoid the vagus nerve. Accuracy is greatest when the Flowprobe fits the vessel very closely and a minimum of acoustic gel is needed.

Place the bracket around the ascending aorta just above the coronary arteries. If you are using a Probe with a slide, close the slide. Position the Flowprobe as shown in Fig 4. In this location, the Flowprobe is perpendicular to the curvature of the arch. Incorrect placement is shown in Fig 5. In Fig 5, the sound beam of the Flowprobe is parallel to the arch and flow may be significantly underestimated.

We recommend Surgilube gel as a couplant because its acoustic velocity is within 30 m/sec of blood. Most ultrasonic coupling gels have an acoustical velocity different than blood and tend to lower sensitivity. To apply gel, remove the plunger of a 30 cc syringe and load the syringe with sterile lubricating gel, taking care to prevent the formation of air bubbles. Place a flexible catheter on the tip of the syringe. Insert the flexible catheter through the Probe's acoustic window adjacent to the artery and deposit the gel while withdrawing the syringe. The lubricating gel must replace all air space to be effective as an acoustical couplant. Select test mode on the Meter to verify that signal amplitude is close to 1 Volt. A low signal or an acoustic error can usually be traced to an insufficient amount of gel or an air bubble.

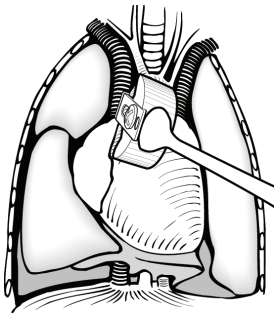

Fig. 4

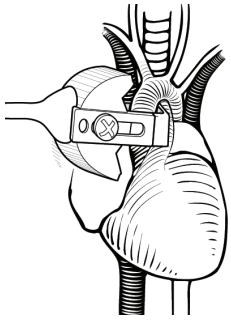

Fig. 5

REFERENCES

Shroff SG et al, "Isomyosin and Systolic Mechanical Properties of the Intact Hypertrophied Left Ventricle," Circ 1987; 76(4): IV-334.

Shroff SG, Motz W, "Left Ventricular Systolic Resistance in Rats with Hypertension and Hypertrophy," AJP 1989; 257: H386-394.

Shroff SG et al, "Relation Between Left Ventricular Systolic Resistance and Contractile Rate Processes," AJP 1989; 257.

Hoffman A et al, "Endothelin Induces An Initial Increase in Cardiac Output Associated with Selective Vasodilation in Rats," Life Sciences 1989; 45(3): 249-255.

For additional references, visit www.transonic.com

transonic
THE MEASURE OF BETTER RESULTS.
www.transonic.com

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. In addition, Transonic provides pressure and pressure volume systems, laser Doppler flowmeters and telemetry systems.

AMERICAS
Transonic Systems Inc.
34 Dutch Mill Rd
Ithaca, NY 14850
U.S.A.
Tel: +1 607-257-5300
Fax: +1 607-257-7256
support@transonic.com

EUROPE
Transonic Europe B.V.
Business Park Stein 205
6181 MB Elsloo
The Netherlands
Tel: +31 43-407-7200
Fax: +31 43-407-7201
europe@transonic.com

ASIA/PACIFIC
Transonic Asia Inc.
6F-3 No 5 Hangsiang Rd
Dayuan, Taoyuan County
33747 Taiwan, R.O.C.
Tel: +886 3399-5806
Fax: +886 3399-5805
support@transonicasia.com

JAPAN
Transonic Japan Inc.
KS Bldg 201, 735-4 Kita-Akitsu
Tokorozawa Saitama
359-0038 Japan
Tel: +81 04-2946-8541
Fax: +81 04-2946-8542
info@transonic.jp