T400-Series Surgical Protocol

Rat Ascending Aorta: Acute Blood Flow Measurement

**APPLICATION BASICS**

<table>
<thead>
<tr>
<th>Site:</th>
<th>Ascending Aorta</th>
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<tbody>
<tr>
<td>Species:</td>
<td>Rat</td>
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<tr>
<td>Body Weight:</td>
<td>230 grams</td>
</tr>
<tr>
<td>Duration:</td>
<td>Acute</td>
</tr>
<tr>
<td>Vessel Diameter:</td>
<td>2 mm</td>
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**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

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**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 a 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.

**Flow Ranges Observed**

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.

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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.

Fig. 2

Fig. 3

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.

REFERENCES


For additional references, visit www.transonic.com