

T400-Series Surgical Protocol

Mouse Femoral Artery: Acute Blood Flow Measurement

APPLICATION BASICS

Site: Femoral artery
 Species: Mouse
 Body Weight: 20-50 grams
 Duration: Acute
 Vessel Diameter: 0.20 - 0.70 mm

PROBE

Size: 0.5 mm
 Reflector: JN
 Connector: CRA10: 10-pin
 Cable Length: 60 cm
 Catalog #: MA-0.5PSB

FLOWMETER TS420 Perivascular Module

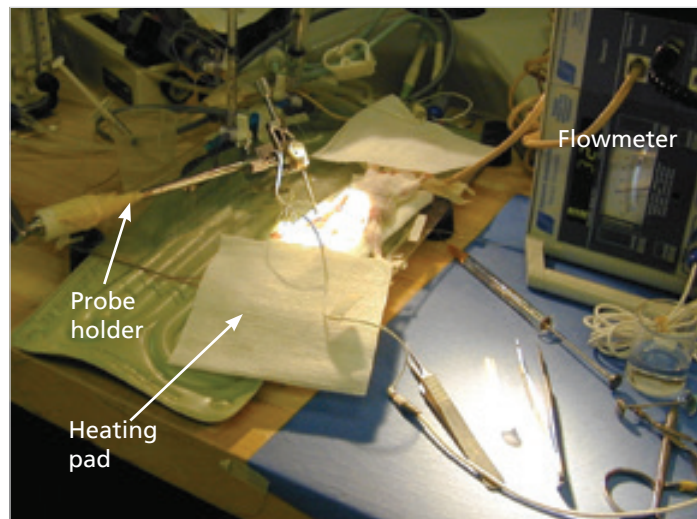
CONSIDERATIONS

Experimental Setup: Measurement Site; Vessel diameter; Maintenance of body temperature.

EXPERIMENTAL SETUP

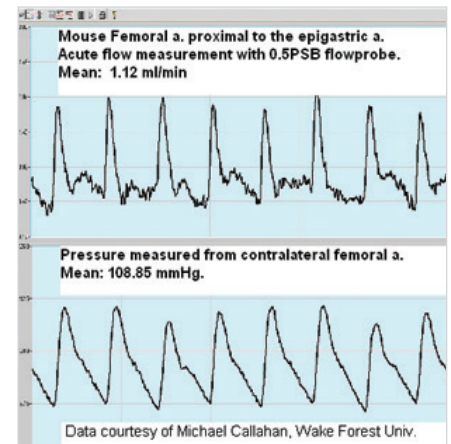
Place mouse on a heating pad with lamp with gauze cover to maintain mouse core temperature. Position Probe holder with magnetic base, adjustable arm, and micro-positioning adjustment adjacent to mouse preparation. Position the Transonic® 400-Series Flowmeter Console nearby for connecting the Flowprobe.

Administer anesthesia per protocol.



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Flow Ranges Observed



Simultaneous Femoral Artery Blood Flow & Pressure Recording

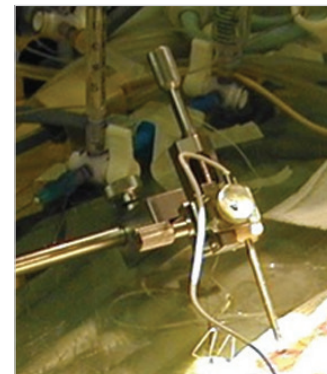


Fig. 1: Experimental Setup: Probe holder with magnetic base, adjustable arm, and micro-positioning adjustment. NanoProbe handle is clamped in a micromanipulator with two-axis adjustment to fine tune and stabilize position of Probe (see close up above). 400-Series Flowmeter Console and heating pad & lamp used with gauze cover to maintain mouse core temperature. Temperature is monitored with an anal Probe.

Mouse Femoral Artery: Acute Blood Flow Measurement Cont.

Surgical Implantation of Flowprobe

PREPARE SITE FOR FLOWPROBE APPLICATION

Prepare the medial thigh for Flowprobe application with a 1.5 cm incision into the medial aspect of the thigh near the body wall. Take care to avoid the epigastric artery which exits the femoral about 7-8 mm from the body wall and travels rostrally in a fat pad attached to the skin.

ISOLATE FEMORAL ARTERY FROM VEIN & NERVE

Use a pair of 45° microblunted Dumont forceps parallel to the vessel to open the sheath covering the femoral artery, vein and nerve. Typically, one small branch of the femoral is located between the abdominal wall and the epigastric a. Removal of the fascia reveals a 3-4 mm section of the femoral a. between the small branch and the epigastric where the Flowprobe can be placed (Figs. 4 & 5 on last page).

Grasp the fat/fascia located rostral to the vessels and pull rostrally. Isolate the nerve from the vessels with a 45° Dumont without touching or damaging the nerve. Pulling on the fascia caudal to the vein will allow it to be separated from the artery. A small branch of the femoral can usually be seen exiting caudally on the femoral artery immediately proximal to the epigastric artery.

POSITION FLOWPROBE & MEASURE FLOW (FIG. 2)

Using the micromanipulator, gently place the 0.5PSB Flowprobe in position over the vessel. Gently lift the femoral a. and place it into the lumen of the Probe. Use a syringe fitted with an angiocatheter, deposit acoustic gel in and around the vessel, being careful not to displace the vessel or damage the Probe reflector. With the micromanipulator holding the Flowprobe steady on the artery, measure flow.

FLOW VALUES

Blood flow in peripheral vessels can be greatly affected by core body temperature and heat loss, anesthesia, vessel spasm and Probe instability. To achieve meaningful measurements, all elements must be controlled.

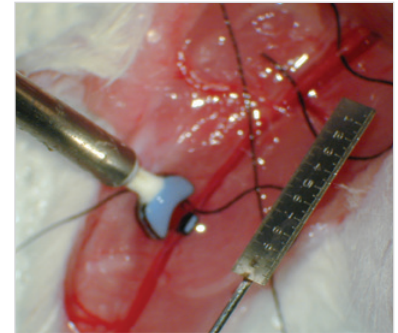
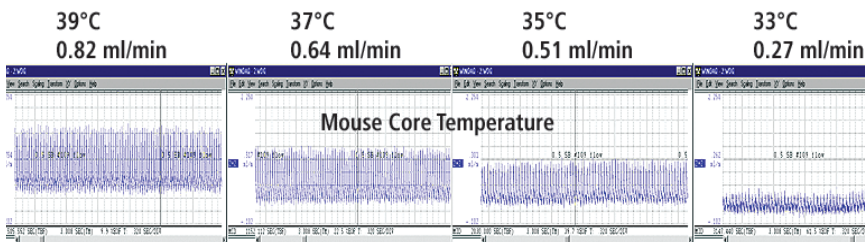


Fig. 2: A 0.5PSB Flowprobe on the superficial femoral artery, distal to the epigastric artery, must be stabilized in a micromanipulator to maintain stable Probe position during flow measurement because the vessel fills <60% of the Probe lumen. Flows at this location are ~0.6 ml/min. Recording of a femoral arterial waveform can be diagnostic of protocol difficulties. The arterial flow pulse should be apparent; an occlusion of the vessel should indicate zero flow baseline and may be nulled, as necessary to achieve true flow values.

Measurement of Femoral Arterial Blood Flow in the Mouse Protocol©
 Courtesy of Michael F. Callahan, Dept. of Orthopaedic Surgery, Wake Forest University School of Medicine, Winston-Salem, NC. ©Wake Forest University School of Medicine, Department of Orthopaedic Surgery; used with permission.



Effect of core temperature on femoral blood flow in a 22 gram CD-1 mouse. Temperature has a profound effect on femoral blood flow as demonstrated by the flow traces of progressively lower core temperatures. (Courtesy MF Callahan)

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Mouse Femoral Artery: Acute Blood Flow Measurement Cont.

Anatomical Landmarks

The segment of the femoral artery proximal to the epigastric a. is typically isolated for acute or chronic flow measurements. The vessel at this point measures ~250-300 μm in 25 g CD-1 mice. Small branches from the femoral are typically found at both locations where the 7-0 silk passes under the femoral artery.

Isolation of the artery from the vein in this position is very challenging. There is less fascia and connective tissue around the sheath of the artery and vein to manipulate the vessel free. The nerve runs immediately adjacent and is very easy to tear. Once isolated, avoid pulling up on the artery which would cause vascular spasm or putting pressure on the vein to cause occlusion.

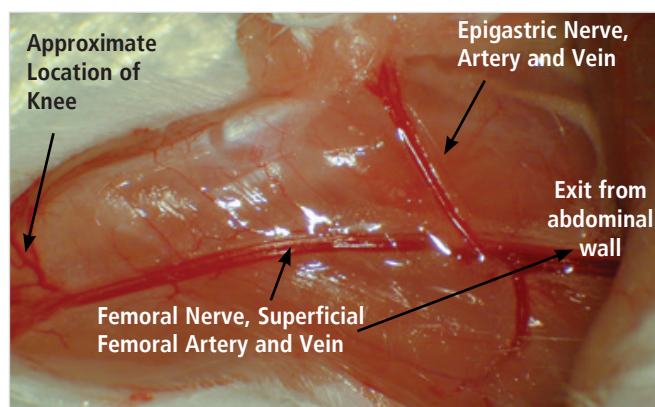


Fig. 3: Figure shows femoral nerve, superficial femoral artery and femoral vein exiting from abdominal wall and running down the leg toward the knee. Note position of epigastric nerve, artery and vein.

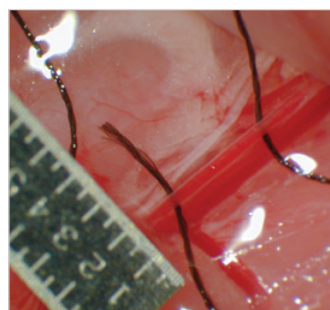


Fig. 4: The femoral artery proximal to the epigastric artery, isolated from the femoral vein, measures ~400 μm diameter with a micrometer. Flow measurements can be made at this location fairly easily.

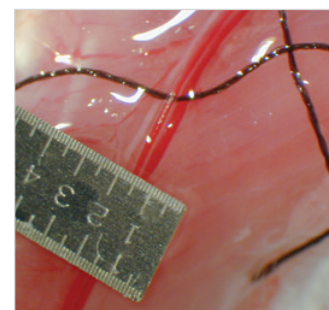


Fig. 5: The superficial femoral artery, distal to the epigastric artery, measures ~200 μm diameter and is very challenging to isolate without damaging the nerve or the vein.

REFERENCES

Wang CH, Chen KT, Mei HF, Lee JF, Cherng WJ, Lin SJ, "Assessment of mouse hind limb endothelial function by measuring femoral artery blood flow responses," *J Vasc Surg.* 2011 Jan 26.

Rickard RF, Meyer C, Hudson DA, "Computational Modeling of Microarterial Anastomoses With Size Discrepancy (Small-to-Large)," *J Surg Res.* 2009; 153(1): 1-11.

Fitzgerald SM, Bashari H, Cox JA, Parkington HC, Evans RG, "Contributions of endothelium-derived relaxing factors to control of hindlimb blood flow in the mouse in vivo." *Am J Physiol Heart Circ Physiol.* 2007; 293(2): H1072-82.



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