



Acute Subpleural Perfusion Measurement in the Dog

APPLICATION

Site: lung, left lower lobe
Species: dog
Vessels: subpleural microvasculature
Body Wgt: 16 - 19 Kg
Duration: acute

PROBE

type: N, 11 gauge fitted with flotation device for costal surface of the lung (Fig. 1)
P for dorsal surfaces (Fig. 2)

SURGICAL APPROACH¹

Anesthetize the dog with sodium pentobarbital (25 mg/kg, I.V.). Intubate and mechanically ventilate following paralysis with 20 mg succinylcholine. Place the dog in the oblique-right side decubitus position. Perform a left thoracotomy at the fourth intercostal space, removing the fifth and sixth ribs to provide adequate exposure of the costal surface of the lobe. Tie off, then excise the upper and middle lobes of the left lung. Administer heparin (700 units/Kg) and exsanguinate the animal via a catheter in the carotid artery. Cannulate the left lower lobe vein and artery. Connect these cannulas to a perfusion system as shown in Fig. 4. Measure arterial and venous flows for the lobe with two 8 mm in-line flowprobes and a T206 flowmeter (Transonic Systems Inc.).

In order to place the laser-Doppler probe on the lung in a reproducible manner without occluding the small vessels under study, the following flotation device may be used. A 14 mm diameter cork (length less than 30 mm) is bored with a 3 mm hole and the large end is glued to a sheet of plastic food wrap. Apply tape to the body of the type N probe so that it will just reach the end of the cork when the probe tip is flush with the plastic wrap. Insert the probe into the cork to the "tape stop." Wet the lung surface with warm saline, then apply the plastic wrap and probe. Fix the fiber optic cable to a stand above the preparation, such that the probe remains perpendicular to the tissue and does not compress the tissue. With this arrangement, the probe may be easily moved from one area of the lobe surface to another by sliding the plastic wrap. The probe may now be connected to the laser-Doppler flowmeter and measurements recorded using a chart recorder or the meter's optional computer interface and WINDAQ software. While the probe moves smoothly with the lung during respiration, in order to avoid motion artifacts, a constant pressure inflation system may be used. Briefly halt ventilation, hold the lung at a pressure of 4 cm of H₂O and record measurements.

In order to make perfusion measurements of the dorsal surface of the lung (in the decubitus position this is the lower side of the lobe) a type P laser Doppler probe may be used by raising the lobe and placing the probe against the ribs, with the probe facing up. During constant pressure inflation, the lobe will hold the probe in place. Another method of fixing the probe would need to be devised if a ventilator were to be used.

FLOW RANGES OBSERVED

20 Perfusion Units with intact circulation
6 Perfusion Units with pulmonary artery occlusion

APPLICATIONS

Studies of the effect of various agents on subpleural blood flow as well as basic research on the nature and timing of microvascular flow in the lung².

ACKNOWLEDGEMENTS

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Laser Doppler **PROTOCOL #102**

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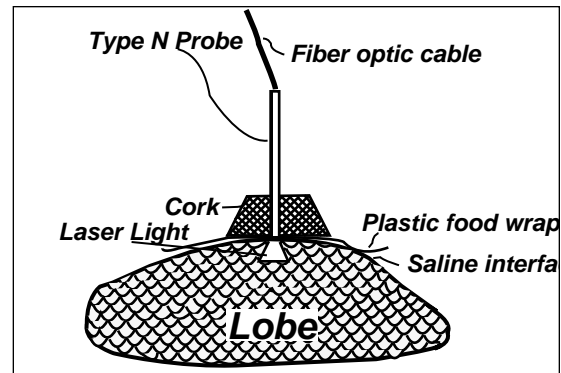


Fig. 1: User-made cork flotation device (see text) allows measurement of tissue perfusion at the costal surface of the lung.

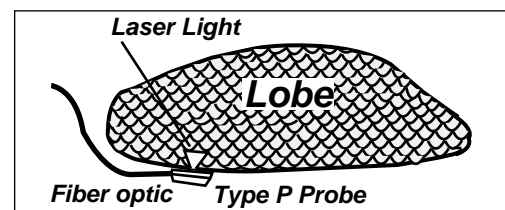


Fig. 2: A standard Type P probe is wedged between the ribs and lung to measure flow at the dorsal surface of the lung.

 **Transonic Systems Inc.**
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34 Dutch Mill Road, Ithaca, NY 14850 USA: Tel: 800-353-3569, 607-257-5300;
Fax: 607-257-7256; Internet: www.transonic.com



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References

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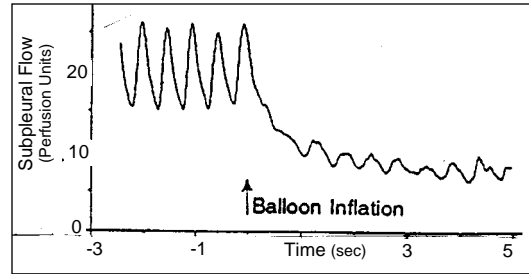


Fig. 3: Normal flow, shown at left, is supplied by both pulmonary and bronchial arteries. Flow drops to show only bronchial component when pulmonary artery is occluded using a balloon catheter.

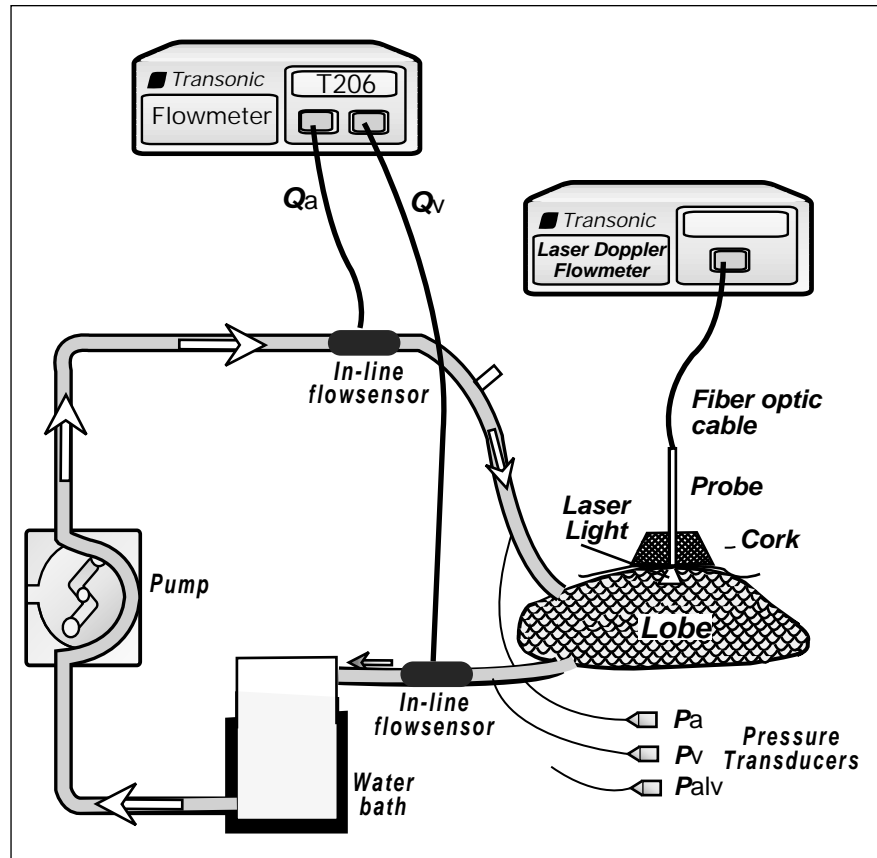


Fig. 4: Experimental setup of the Transonic laser Doppler and transit time ultrasound flowmeter with the in situ perfused lung.

