

A Technic for Collection of Right Duct Lymph Flow in Unanesthetized Dogs.* (28139)

HERMAN UHLEY, SANFORD E. LEEDS, JOHN J. SAMPSON AND MEYER FRIEDMAN
(With technical assistance of Shantilal Patel and R. Martinez)

Departments of Pathology, Surgery and the Harold Brunn Institute, Mount Zion Hospital and Medical Center, San Francisco, Calif.

Warren and Drinker measured lymph flow from the lungs of dogs and demonstrated that pulmonary lymph flows principally to the right lymphatic duct(1). The anatomy of the right duct is frequently so variable and the channels are often so small that cannulation may be impossible(2). Studies of the right duct have been limited due to the technical problems encountered(3); however, it has been possible to develop a method for collecting right duct lymph in anesthetized dogs(4,5). In this paper is presented a modification of the method of right duct lymph previously described in this laboratory, which allows serial collection of lymph in the unanesthetized dog. This technic should be valuable in later studies to determine the temporal changes in lymph flow that may occur during development of heart failure.

Methods. Five dogs were anesthetized with pentobarbital sodium, (29 mg/kg) and given 3 to 5 ml of 2% Evans Blue dye (T-1824) intratracheally. Respirations were maintained by intermittent positive pressure. The right external jugular vein was exposed and a ½ inch segment of that portion which contained the entrance of the right lymphatic channels was isolated with umbilical tape ligatures. Venous tributaries leading into the segment also were ligated. The cephalad end of the isolated vein was cut and fitted over a small polyethylene cannula. After the residual blood was aspirated, the skin incision was closed and the lymph flowing into the venous segment was collected. Thus, by this surgical manipulation, a portion of the vein was made to serve as a fistula for serial collection of right duct lymph (Fig. 1). Intramuscular lipo-heparin, 100 mg, and 600,000 units of penicillin were given daily to prevent clotting

of lymph and infection. With this technic, it was possible to obtain flows in the unanesthetized animal. These lymph flows were measured for 2 successive postoperative days at 15 min intervals from the polyethylene cannula for 1 to 2½ hours.

Results. Right duct lymph flows and protein concentration were obtained in 5 dogs at time of operation and on one or 2 successive days postoperatively in the unanesthetized dogs (Table I). There was no significant change in right duct lymph flow or right duct protein concentration. After the second day, thrombus formation occurred in the jugular collecting channel despite the daily intramuscular administration of heparin. Other methods are being explored to prevent this clotting and permit longer periods of study.

Discussion. Using the "chamber method" of lymph collection(4,5), it was possible to readily obtain studies of lymph flow in various physiologic and pathologic states(6,7). The "chamber method" consists of inserting a 3 inch long tube into the right external jugular vein in the vicinity of the entrance of the lymphatic vessels, and securing the tubing at either end to create an artificial chamber between the vein wall and outside of the tube. Cannulation of the artificial chamber allowed collection of right duct lymph, and eliminated the tedious and often impossible task of cannulating the individual minute lymphatics.

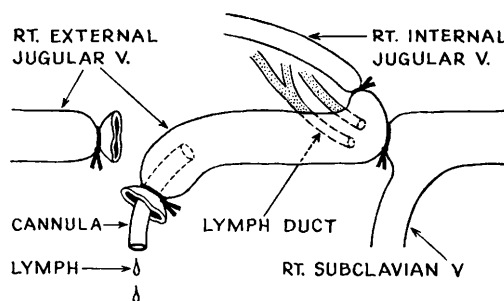


FIG. 1

* Aided by grants from San Francisco Tuberculosis Assn. and Nat. Heart Inst., N.I.H., and William C. Voorsanger Fellowship Fund.

TABLE I. Right Duct Lymph Flow and Protein Concentration in Anesthetized and Unanesthetized States (1st and 2nd day P.O.).

Dog No.	Right duct flow (ml/15 min)			Right duct protein (g/100 ml)		
	Anesthetized	Unanesthetized		Anesthetized	Unanesthetized	
	At operation	1st day P.O.	2nd day P.O.	At operation	1st day P.O.	2nd day P.O.
779	1.4	1.0	—	—	2.70	—
780	1.7	1.9	.6	2.13	2.66	2.64
790	2.5	2.2	2.3	3.48	2.45	3.16
792	1.1	2.8	2.0	2.70	2.44	3.00
809	1.1	3.1	1.7	3.60	2.63	2.20
Avg	1.6	2.2	1.7	2.98	2.58	2.75

Unfortunately, multiple lymph collections could not be made on successive days, hence many important studies on continuous lymph flows in chronic states could not be made. One principal problem was that in the unanesthetized animal, movement of the right shoulder caused the large plastic tube to erode from the external jugular vein. To overcome this problem, and obtain flows in the unanesthetized dog, the external jugular vein was altered so as to form a collecting channel for right lymphatic outflow.

Drinker found that the average lymph flow was 1.1 ml per hour. However, this was a flow from only one of several lymphatics(1). Courtice found right duct flow to be 2.3 ml per hour(8). Using the "chamber" technic, the mean right duct flow was 4.2 ml per hr (5). In this study, the mean right duct flow was 6.4 ml per hour on day of operation, 8.8 ml per hour on the following day, and 6.8 ml per hour on the third day. Protein concentration of right duct lymph was not significantly changed in the unanesthetized state.

Summary. A method of right duct lymph collection from a jugular venous collecting channel which may be used in the unanesthetized animal has been described. There was little evidence of a significant change in right duct lymph flow or right duct protein concentration in anesthetized and unanesthetized animals.

1. Warren, M. F., Drinker, C. K., *Am. J. Physiol.*, 1942, v136, 206.
2. Yoffey, J. M., Courtice, F. C., *Lymphatics, Lymph and Lymphoid Tissue*, Harvard Univ. Press, Cambridge, 1956, p13.
3. ———, *ibid.*, p163.
4. Leeds, S. E., Uhley, H. N., Sampson, J. J., Friedman, M., *Am. J. Surg.*, 1959, v98, 211.
5. Uhley, H. N., Leeds, S. E., Sampson, J. J., Friedman, M., *Dis. of the Chest*, 1960, v37, 532.
6. ———, *Circulation Res.*, 1961, v9, 688.
7. ———, *ibid.*, 1962, v11, 966.
8. Courtice, F. C., *Australian and New Zealand J. Surg.*, 1953, v22, 177.

Received December 26, 1962. P.S.E.B.M., 1963, v112.

Development of Reversible Hematuria and Oliguria Following Elevation of Renal Venous Pressure. (28140)

T. E. EMERSON, L. B. HINSHAW, C. M. BRAKE AND P. F. IAPIETRO
(With the technical assistance of F. Massucci and G. Funkhouser)

Environmental Physiology Branch, Civil Aeromedical Research Institute, Federal Aviation Agency, Oklahoma City, Okla.

Proteinuria has been reported following exercise and during radical changes in body posture(1). Winton(2) also noted its presence

in some instances in the isolated perfused kidney following limited elevation of renal venous pressure. Several explanations of this