

Cannulation of the Cervical Thoracic Duct in the Rat

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Summary

A method is described for cannulation of the cervical part of the thoracic duct in the rat. The volume of lymph flowing from the cervical cannula is approximately 80% higher and its protein concentration by about 18% lower than that of the lymph collected from a cannula introduced into the abdominal part of the thoracic duct.

Cannulation of the thoracic duct and collection of central lymph is one of the most important methods in investigative lymphology. This procedure is usually done in the neck (5). In the rat, however, the cervical part of the thoracic duct and its terminal orifice lie behind and inferior to the clavicle (6), seemingly rendering it inaccessible. Accordingly alternative methods are usually used for cannulating the duct in the abdominal cavity (2, 4). However, the cisterna chyli is poorly developed in the rat (1, 6) and probably fails to collect all the lymph formed in the abdominal organs and lower part of the body. Thus cannulation of the duct at its origin from the cisterna chyli drains only a portion of lymph normally transported by this collecting vessel. To capture the total lymph carried by the thoracic duct in the rat a simplified method was developed for cannulation at the thoracic duct-venous junction.

Material and Methods

Male rats of CFY strain weighing 300 to 450 g were anaesthetized by the intraabdominal injection of 45 mg/kg body weight of pentobarbital.

In 8 animals a longitudinal incision was made on the left side of the neck running from the

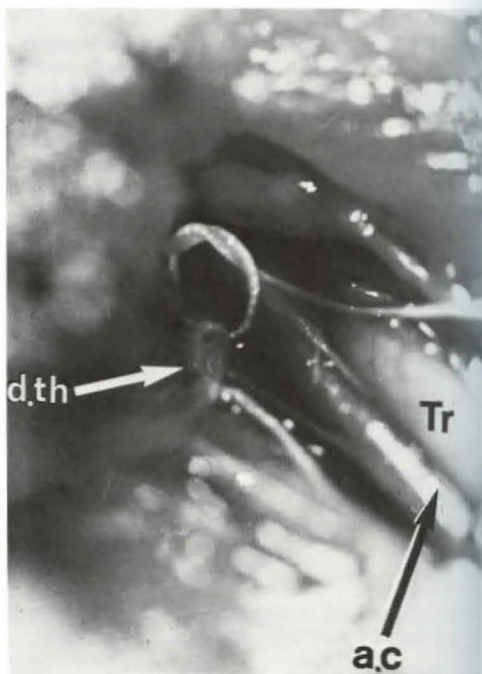


Fig. 1 Cannulation of the cervical part of the thoracic duct in the rat: d.th. = thoracic duct; a.c. = carotid artery; Tr. = trachea

laryngeal cartilage to the clavicle. The superficial and deep muscles were divided and the carotid artery exposed. A suture placed around the artery helps retract this vessel to the left. The clavicle is disarticulated at the costo-clavicular joint. At the tip of the triangle formed by the trachea, the carotid artery and the collar bone the thoracic duct can be seen. A 6/0 suture is laid around the lymph vessel with the aid of an operating microscope

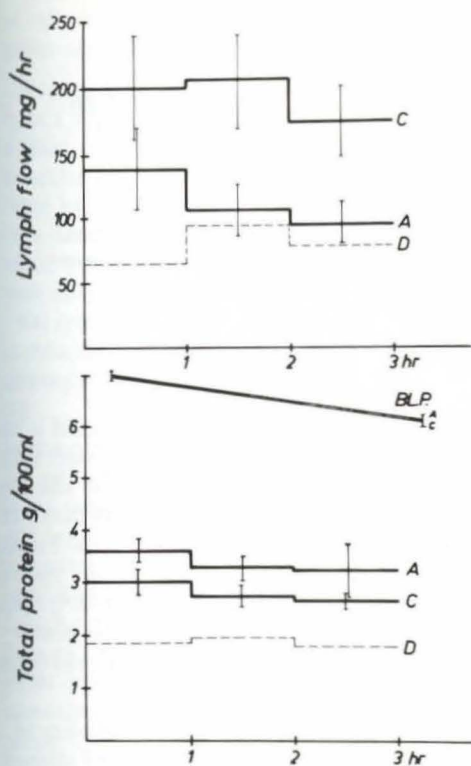


Fig. 2 Flow rate and protein concentration of the abdominal (A) and cervical (C) thoracic duct lymph; D = difference between the flow rate of cervical and abdominal thoracic duct lymph, and protein concentration of the added lymph; BLP = blood plasma protein concentration

and subsequently a PP20 plastic cannula, with a short-bevelled 18 metal tip is introduced into the thoracic duct. Finally, the cannula is secured in the duct by tightening the ligature. During the surgical manipulations special care must be taken to avoid entering the pleura with subsequent pneumothorax.

In another group of 8 animals the abdominal thoracic duct was cannulated according to the method described by *Bollman et al.* (2).

The lymph was collected during 3 hrs in small preweighed heparinized vials. The protein content in lymph and blood plasma was estimated according to *Lowry et al.* (3).

Results

The average lymph flow during the 3 hrs observation time was in the abdominal thoracic

duct 113 ± 22 mg/hr/100 g b.w. and 193 ± 18 mg/hr/100 g b.w. was collected from the cannula introduced into the cervical part of the duct. The flow declined in both groups between the first and third hour of lymph collection, but the change was significant only in the first group.

Protein concentration was higher in the lymph flowing from the abdominal cannula (34 ± 2 mg/ml) than in the cervical thoracic duct lymph (28 ± 2 mg/ml). Lymphatic protein concentration declined also during the observation period (Fig. 2).

Discussion

A simplified method for cannulation of the cervical portion of the thoracic duct in the rat is described. The amount, of lymph flowing from the cervical cannula is nearly 80% higher than the amount collected by abdominal thoracic duct cannulation. On the other hand protein concentration is 18% lower in the cervical than in the abdominal thoracic duct lymph. It is estimated that the lymphatics joining the thoracic duct in the thoracic and cervical regions carry lymph with a protein concentration of less than 20 mg/ml. The decrease of lymph flow and protein concentration during the observation period are probably due to fluid and protein loss from the lymph fistula.

References

1. *Baum, H., Trautmann:* Das Lymphgefäßsystem der Säugetiere. In *Bock-Göppert-Lubosch, Handbuch der vergleichenden Anatomie der Wirbeltiere*, VI. Leipzig 1933.
2. *Bollman, J.L., J. C. Cain, J.H. Grindlay:* Techniques for the collection of lymph from the liver, small intestine and thoracic duct of the rat. *J. Lab. Clin. Med.*, 33 (1948) 1349
3. *Lowry, O.H., N.J. Rosenbrough, A.L. Farr, R.S. Randall:* Protein measurement with the folinphenol reagent. *J. Biol. Chem.* 193 (1951) 265
4. *Reinhardt, W.O.:* Rate of flow and cell count of rat thoracic duct lymph. *Proc. Soc. Exp. Biol. Med.* 58 (1945) 123
5. *Rusznayk, I., M. Földi, G. Szabó:* Lymphology Gustav Fischer Verlag, Stuttgart, 1969
6. *Shdanov, D.A.:* Anatomie comparée du canal thoracique et des principaux collecteurs lymphatiques du tronc chez les mammifères. *Acta Anat.*, 61: (1965) 83