Onderstepoort J. Vet. Res. (1966), 33 (1), 239–241
Printed in the Repub. of S. Afr. by the Government Printer, Pretoria

A TECHNIQUE FOR THORACIC DUCT-PORTAL VEIN ANASTOMOSIS IN THE DOG

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Introduction. Preliminary Report

The lymphatic system may be regarded as a subsidiary of the blood vascular system and its main functions include: the redistribution of fluid in the body; the return of proteins and other particulate matter from the tissue spaces to the blood; the maintenance of the integrity of the tissues; the transport of ingested fats after absorption; the transport of large numbers of lymphocytes to the blood.

Ligation of the lymphatics of the heart may give rise to myocardial degeneration, and ligation of the lymphatics of the kidney may accelerate the development of hydronephrosis (Best & Taylor, 1961).

At least two-thirds of the ingested fats can be recovered in the thoracic duct (Wright, 1955). According to Frazer (1962) the lipid molecules in the intestine are distributed between the oil and water phases according to their partition coefficients. He suggested that lipids in the oil phase pass almost exclusively into the chyle, whilst the water-soluble materials are absorbed into both chyle and portal blood. Long chain fatty acids are absorbed very largely into the lymph, whereas short chain fatty acids with less than 10 C atoms enter the portal blood (Bergström & Borgström. 1956).

Blalock, Robinson, Cunningham & Gray (1937) clearly illustrated the importance of the lymphatic system in dogs and cats by blocking the lymphatics more or less completely.

After fat has been absorbed into the lacteals, the lungs are the first organs to be exposed to the lipids and lung tissue contains substantial amounts of lipids (Markowitz & Mann, 1930).

Questions arising are:

1. Do the lungs participate in blood lipid homeostasis?
2. What would be the effect on the blood lipids and the liver, if the intestinal lymph were shunted through the liver?
3. What would be the effect on the histological structure of the lungs and on the lymphocytes if the chyle were shunted through the liver?
4. What would be the effect of such shunt on fat absorption and the immunity-producing system?

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Received for publication on 4 January, 1966—Editor

THORACIC DUCT—PORTAL VEIN ANASTOMOSIS IN THE DOG

In 1960 Doemling & Steggerda described a method of producing a thoracic duct-venous shunt in the neck of a dog. More recently Chanana & Cronkite (1964) produced semi-permanent Teflon-silastic arterio-venous and thoracic duct-venous shunts in calves to study the effect of extra-corporal irradiation of circulating blood and lymph. These authors pointed out that such shunts may also be utilized for extra-corporeal perfusion of organs and cross circulation studies.

In this paper a technique to effect a shunt between the thoracic duct and portal vein is described. This technique may supply answers to some of the questions raised above and produce an experimental model with many other applications.

Materials and Technique

The experiments were carried out on dogs weighing from 8 to 25 kg. Food was withheld during the twelve hours preceding the operation. Five hours prior to the operation each animal received 200 ml of cream. The ingestion of cream gives consistency to the intestinal lymphatics and renders them clearly visible.

Anaesthesia was induced with intravenous penthothal sodium and maintained with oxygen, nitrous oxide and fluothane after tracheal intubation. After the thoracic cavity was entered, controlled respiration was applied.

The abdominal wall was shaved and cleaned with G 11 germicidal soap. The animal was then draped and surgery followed along the general lines applicable to abdominal surgery. An upper midline incision was used. The xiphoid cartilage was removed. The central upper abdominal viscera were adequately exposed by means of suitable retractors and towels moistened in physiological saline. In order to mobilize the aorta and thoracic duct sufficiently, the right aortic crus was severed when necessary. By careful dissection the inferior vena cava was displaced to the right and the aorta to the left. Great care was required in dealing with the segmental branches of the aorta. Some of them are anatomically intimately related to the intestinal lymphatic trunk and the thoracic duct. The intestinal lymphatic trunk is found in close relationship to the mesenteric vessels. In starved dogs the intestinal lymphatic trunk is not readily noticeable. In dogs receiving cream the lymphatics were filled and clearly visible. The walls of the lymphatic vessels are very delicate and rupture readily on handling. Rupturing prevents further dissection.

Numerous lymphatic branches converge to form the intestinal lymphatic trunk which ends cranially in the cysterna chyli. The cysterna soon subdivides again into two or more branches which subsequently converge to form the thoracic duct proceeding upwards through the thorax. In one animal the cysterna was of such dimensions that it was visible on both sides of the aorta. In animals employed in the present studies the diameter of the thoracic duct varied from 2 to 4 mm. For the purpose of the operation a length of 4 to 6 cm of the thoracic duct was mobilized transabdominally. The right pleural cavity was opened early in the operation. After mobilization of the thoracic duct it was doubly ligated and severed between the ligatures. The caudal segment retained its chyle and could be easily manipulated.

Numerous venous branches from the digestive tract join to form the portal vein. The portal vein subdivides again to supply the lobes of the liver. The early subdivision of the portal vein makes mobilization of a branch of suitable length and diameter difficult. However, a contributory branch of the portal vein draining the spleen, pancreas and part of the duodenum was found to be of adequate length and

diameter. This branch was mobilized, tied off with double ligatures and severed between the ligatures. Some of the venous branches in the mesenterium are also suitable for anastomosis.

In order to join the venous portal branch and the thoracic duct, the portal branch was reflected dorsally through an angle of about 45°. This produced an acute angle at the junction of the venous branch with the portal vein. To maintain an inflow angle the portal vein was released by splitting the covering peritoneum and rotating the vein slightly.

The final anastomosis of the thoracic duct and portal vein was effected by means of Nakayama's small vessel anastomosis clamp.

If the thoracic-portal (Meyer) anastomosis is carried out successfully, no leakage of blood or chyle occurs and chyle flows into the portal vein. Hence the portal branch takes on the appearance of a lymphatic vessel filled with chyle and the flow is centrohepatic.

Thus far the operation has been carried out successfully on three dogs. Two of the animals are alive and in good condition. The third died within twelve hours after the operation. Autopsy did not reveal the cause of death.

Summary

A technique for effecting a thoracic duct-portal vein anastomosis in dogs is described.

Acknowledgements

The authors are greatly indebted to the personnel of the Department of Anaesthesiology of the University of Pretoria who were responsible for the administration of the anaesthesia.

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