cough mechanism was interfered with on the side of the paralyzed diaphragm.

The difference in the rate of elimination of lipiodol from the lung fields of those dogs which were subjected to preliminary phrenicectomy and injection of lipiodol simultaneously into both lower lobes is recorded in Table I. The tabulated results indicate that either right or left phrenicectomy resulted in a slower disappearance of the oil on the side of the paralyzed diaphragm.

TABLE I.
Effect of Phrenicectomy Upon Elimination of Lipiodol from the Lung.
(Preliminary Phrenicectomy Followed by Injection of Oil)

| Amt. Lipiodol Injected Each Lung | Side of Phrenicectomy | Lung from which Oil Disappeared Completely First | No. Days | Retardation of Elimination, Result of Phrenicectomy |
|---|---|---|---|---|
| cc. | | | | |
| 3 | Left | Right | 49 | Marked |
| 5 | Right | Left | 63 | Definite |
| 2½ | Left | Right | 88 | Slight |
| 3 | Right | | | Not appreciable (63 days) |
| 6 | Right | Left | 36 | Marked |
| 3 | Left | Right | 36 | " |
| 4 | Right | Left | 14 | Definite |
| 3 | Left | Right | 14 | " |

In 2 other dogs the oil was injected on the same side both before and after phrenicectomy. In both instances there was retardation of the elimination of oil subsequently to phrenicectomy as compared with that following the original injection.

6458

## Superior Vena Cava Obstruction.

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The effects of superior vena cava obstruction vary according to the degree and location of the obstruction and the suddenness of its development. To determine the tolerance of animals to this condition, to measure the effect on venous pressure and to trace the paths of collateral circulation, experimental obstruction of the superior vena cava was produced in dogs.

The vein was exposed through an intercostal incision and com-

pletely occluded by dividing between ligatures. The usual aseptic technique was followed and the operations were performed under intratracheal ether anesthesia administered with positive pressure.

Obstructions were of 2 types, (1) above the junction of the azygos vein, and (2) including the azygos vein. Two attempts were also made to obstruct the superior vena cava below the junction of the azygos vein but both dogs died within a few minutes. Obstruction above the level of the azygos vein was produced in 7 dogs. One died within 24 hours and 3 died within 12 to 14 days as a result of a propagating thrombus or an empyema. Three recovered. Of the latter, one was sacrificed for study after 30 days. Another was later subjected to azygos vein obstruction and the third is alive after more than 5 months. One dog survived the immediate effects of a 2-stage obstruction of the superior vena cava and azygos vein but died at the end of 21 days from an infected bilateral pleural effusion.

The most striking general results of superior vena cava obstruction were cyanosis of the tongue and oral mucosa and injection of the conjunctivae. Somnolence, listlessness and slow deep respirations were also noted. The dogs with obstruction just above the right atrium, dying within a few minutes, had extreme cyanosis of the upper part of the body. The surviving animals recovered from their cyanosis within 48 hours and developed dilated veins over the thorax and abdomen.

Venous pressure readings were obtained by inserting a needle into the exposed external jugular vein and measuring the height of a column of blood in an attached vertical glass tube. The original pressures varied between 4 cm. and 13 cm. of blood. These pressures were increased 100% (4 readings) immediately after the obstruction. They were 65% higher (3 readings) during the first 9 days and were not significantly increased (3 readings) 14 to 29 days after the obstruction.

The venous pressure after obstruction including the azygos vein was obtained in one dog. The original reading was 6 cm. The pressure 7 days after the second stage procedure (occlusion of the azygos vein) was 16 cm. of blood, an increase of 167%. As this dog died, further readings were not obtained.

*Collateral circulation* was studied by injecting a barium mixture into the veins and taking roentgen-ray films, and by dissection. In one dog methylene blue was added to the injection mixture to facilitate dissection. These injections revealed a system of anastomosing veins which included the following: (1) Superficial veins,

chiefly the thoraco-epigastric, superficial epigastric and a superficial plexus of veins of the thorax and abdomen. (2) Deep veins, including the internal mammary, intercostals, azygos, hemiazygos, accessory hemiazygos, anterior and posterior mediastinal, pericardiaphrenic, phrenic, superior and inferior epigastric, lumbar, and deep anastomosing veins to the back muscles.

When the obstruction was above the junction with the azygos vein, the azygos system was a very important path of return flow to the heart but the abdominal collaterals were not well developed.

In the dog with obstruction of the superior vena cava including the azygos vein the flow of blood in the azygos system was evidently reversed and the superficial and deep abdominal collaterals carrying blood below to the femoral or iliac veins or to the inferior vena cava were much more prominent.

6459

## A Study of Pannus Formation in the Cornea of Rabbits.*

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In the transmission of experimental trachoma to animals, perhaps the most significant and refractory difficulty is the complete lack of corneal involvement. Except in man where infection followed accidental or intentional transfer of trachomatous material. pannus formation has not accompanied folliculosis experimentally induced in a variety of animals. Since the appearance of cicatricial changes and pannus comprise the essential diagnostic differentiation between trachoma and folliculosis, the necessity is obvious for studying the conditions under which vascularization of the cornea is stimulated. While it is not yet clear that the data thus far obtained may be correlated eventually with pannus formation in trachoma, it is of interest that pannus may be evoked by various stimuli. From this point of view the experiments undertaken are here reported.

The experiments have been done on rabbits;† and because the results of a former study indicated that pannus may be a mani-

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† A total of 138 rabbits was used, about half for the experiments described