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Carotid ligation in the rat*

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The effects of unilateral carotid ligation on physiological regulation and learning were studied in laboratory rats. Body weight, water intake, and T-maze performance were not significantly different from that of sham-operated animals. Cannulation of the carotid artery is, therefore, a useful laboratory tool with few undesirable side effects.

The technique of permanent cannulation of the circulatory system in laboratory animals is a useful and widely used approach to many research problems. With this procedure, chronic infusion or withdrawal can be readily accomplished in the unrestrained and unanesthetized animal, while various aspects of the internal environment are changed.

A common procedure for chronic intravascular infusion places polyethylene tubing in the carotid artery or jugular vein (Popovic, Kent, & Popovic, 1963). A most serious limitation to this procedure, however, is that it seals off one of the major blood vessels serving the brain. A rather large segment of the brain thus has an altered pattern of blood flow following the operation.

While studies have assessed the effect of numerous variables using the carotid cannulation procedure (e.g., Popovic & Kent, 1964), the effect of simply tying off the major vessel, without inserting the cannula, has not been described. The effects of carotid ligation on body weight, water intake, and learning are reported here.

METHOD

Subjects

Fifteen male Sprague-Dawley (Flow Laboratories, Dublin, Virginia) rats, weighing approximately 135 g at the start of experimentation, were used.

Apparatus and Procedure

After obtaining baseline measures of body weight and water intake for 12 days, the 15 animals were assigned randomly to one of three groups. Group RT consisted of five animals in which the right carotid artery was tied off. The artery was freed from surrounding tissue and two sutures were tied tightly around the artery, blocking off all blood flow. Care was taken so as not to damage the vagus nerve. Group LT consisted of five animals in which the left carotid artery was tied off at a point equal, in a rostralcaudal direction, to the tie made in the RT group. The sham group consisted of five animals in which the carotid artery was dissected free from adjacent tissue but was not tied off. Three of the sham animals had the right carotid exposed and two had the left exposed.

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Weight and water intake were measured for 17 postoperative days. These variables were measured daily while the rats had ad lib access to food. The animals were housed individually.

Upon completion of the weight and intake measurements, T-maze performance was measured for all animals (Days 18-23). Each rat was deprived of water for 23 h, and the number of correct runs to a water reward (0.2 cc) was determined. Each animal was given 10 trials per day for 6 days.

RESULTS

Weight and water intake following the operation was similar for all animals. Table 1 shows the mean body weight and water intake for each group for Postoperative Days 1, 5, 9, 13, and 17. An analysis of variance failed to yield evidence of any statistical differences between the groups ($p \geq .05$). Water intake and body weight appeared to be unaffected by unilateral carotid ligation.

The mean numbers of correct responses in a T-maze were determined for each group of Ss and are shown in Table 2. It can be seen that over the 6 days of testing, the means were almost identical for all groups; animals with carotid ligations were making about the same number of correct responses as sham-operated Ss and there were no statistical differences between groups ($p \geq .05$).

DISCUSSION

Unilateral carotid ligation in the rat does not appear to alter basic physiological regulation and simple maze performance. Animals with either carotid artery blocked are still able to regulate their water intake and maintain their body weights in a fashion comparable to

Table 1
Mean Body Weight and Water Intake for Each Group for Postoperative Days 1, 5, 9, 13, and 17

	RT		LT		Sham	
Day	Weight	Water	Weight	Water	Weight	Water
1	127	24.8	129	14.6	129	18.0
5	157	31.2	157	32.8	153	37.2
9	183	35.2	183	42.2	179	39.6
13	212	38.0	210	41.4	207	37.8
17	235	39.2	242	45.6	235	40.2

Table 2
Mean Number of Correct Responses for Each Group Over 6 Days of Testing

Day	RT	LT	Sham
18	5.6	5.4	5.2
19	4.8	6.4	6.2
20	7.4	8.2	7.8
21	8.8	8.4	8.0
22	8.8	8.8	8.6
23	9.0	9.4	8.6

sham-operated animals. They are able to perform as well as sham animals in a simple T-maze problem involving a water reward for a correct response.

The findings reported here are in agreement with the data on weight regulation reported by Popovic et al (1963). They showed that cannulated animals were able to maintain their body weights and show normal growth curves in spite of carotid blockage due to cannulation. There were no abnormal tissue reactions or other undesirable side effects reported by Popovic et al (1963) after unilateral carotid intubation.

The results of the present research indicate that weight and water regulation and simple maze learning ability are not impaired when cerebral circulation is altered by unilaterally carotid blockage. In conjunction with the work of Popovic et al (1963), these findings suggest that the technique of cannulation of the carotid artery is a useful laboratory tool with few undesirable side effects.

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