

scribed; results of the identification tests were available in approximately 24 hours. With respect to sensitivity, it appears that as few as 10 infectious virus particles per ml of inoculum are readily detectable within a similar period. Seventy-one of 75 viral isolates examined by the immunofluorescence method were identified as RS virus. The remaining viruses were subsequently identified as 1 mumps virus, 1 simian virus, and 2 adenoviruses. Although serum-neutralization tests indicate the existence of antigenic differences between strains of RS virus(3), no differences in antigenic composition between strains were noted in this study by immunofluorescent staining. A possible reason for this is discussed.

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Effects of Cerebral Ischemia in Various Strains of Rats.* (30487)

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The effects of carotid artery ligation vary among individual patients(1) and among different species(2,3). The present investigation is aimed at elucidation of genetic factors in the causation of this variation, and at development of reproducible model systems for study of cerebral ischemia. The results indicate that survival following bilateral carotid occlusion of rats varies from 0 to 100% according to the strain of origin. Furthermore, mortality can be greatly decreased by allowing a time interval between ligations of the two arteries.

Methods. Female rats of 5 inbred and 3 random bred strains, initial weight 130-190 g, were maintained on Purina Laboratory Chow and tap water in air conditioned quarters at 70°F. Common carotid arteries were doubly ligated and cut under ether anesthesia through a midline longitudinal incision in ventral neck. Injury to nerves was avoided. Left carotid was ligated first. Right carotid was ligated immediately thereafter (herein-

after referred to as "simultaneous"), or after an interval of 1-27 days, through the original incision. Animals that died during or a few minutes after surgery were excluded. Survivors were sacrificed 5 days after the second ligation. Brains were fixed in formalin, cut in frontal slices, embedded in paraffin, and stained with hematoxylin-eosin and Luxol fast blue.

Results. Mortality after simultaneous bilateral carotid ligation varied from 0% to 100% depending on the strain (Table I). The difference between 5 groups with low mortality and 3 groups with high mortality was statistically highly significant ($p < .001$). Early deaths were caused by massive, bilateral, acute cerebral infarction. Among the 44 survivors, there were 20 focal ischemic brain lesions in 16 rats. The distribution was similar to that reported previously(4): cortex 9, corpus striatum 9, hippocampus 1, corpus callosum 1. No deaths followed unilateral (left) carotid ligation and only 2 animals had focal lesions; these occurred in strains distinguished by 100% mortality after bi-

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TABLE I. Carotid Ligation in Various Rat Strains.

Strains	Bilateral ligation		Unilateral ligation	
	Early mortality*	Brain lesions in survivors†	Early mortality*	Brain lesions in survivors†
1. Lewis	0/10	4/10	0/5	0/5
2. Holtzman	1/10	1/9	0/5	0/5
3. Wistar	1/10	4/9	0/4	0/4
4. Sherman	2/10	4/8	0/5	0/5
5. BUF	2/10	3/8	0/4	0/4
6. ACI	10/10	—	0/5	1/5
7. F344	10/10	—	0/5	1/5
8. CD F	8/8	—		

* First 24 hr after bilateral ligation.

† Sacrificed 5 days after ligation.

Inbred rats: 1, 5, 6 and 7 from Microbiological Associates; 8 from Charles River Breeding Laboratories; 7 and 8 both derived from Fischer 344 strain. Random bred rats: 2 from Holtzman Farms; 3 and 4 from Hemlock Hollow Farms.

lateral ligation (ACI and F344). Lesions occurred on either side after bilateral ligation but only on left side after left ligation.

Lethal effects of simultaneous bilateral ligations were ameliorated by a time interval between the two ligations, as previously reported by Chang and Liu(5). In this experiment (Table II), mortality in F344 rats decreased from 97.5% to 0% as the interval increased from 0 to 27 days.

Discussion. These experiments have demonstrated marked strain differences in response to carotid ligation. The results may be influenced by genetic factors, as suggested by the similar response of 2 inbred strains

TABLE II. Effect of Time Interval Between Left and Right Carotid Artery Ligations in F344 Rats.

Interval (days)	Early mortality	Brain lesions in survivors
0	39/40	0/1
1	16/20	2/4
3	16/20	1/4
6	15/20	2/5
9	7/9	0/2
13	4/15	2/11
27	0/10	1/10

derived from the same strain but obtained from different sources (Groups 7 and 8, Table I). The variable outcome of carotid ligation in rat strains is in conformity with the variable outcome of this procedure in different human individuals(1). Differences between susceptible and resistant strains might be due to differences in collateral circulation. Similarly, a time interval between ligations may provide an opportunity for development of anastomotic channels. However, one must consider also possible influences of body temperature(4), responsiveness to stress, activity of carotid sinus baroreceptors, and the pressure, viscosity, red cell count, and oxygenation of the blood(3).

Summary. Early mortality following bilateral common carotid artery ligation varied from 0% to 100% depending on the strain of rats. Lethal effects of bilateral ligation were ameliorated by allowing an interval of time between the 2 ligations. A little less than half of survivors had microscopic ischemic brain lesions. Unilateral ligation caused no deaths and few lesions. Almost any desired degree of cerebral ischemia can be obtained by proper choice of rat strain and timing of carotid ligations. This will facilitate future studies on beneficial or detrimental conditioning factors that might influence the outcome of cerebral ischemia.

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