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A Method for the Experimental Production of Brain Abscess.

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The object of this report is to detail a method for the experimental production of brain abscess. The ultimate aim of our work is to evaluate chemotherapy and the various surgical technics in the treatment of brain abscess.

The problem was first attacked by Malinovski.[1] He found that the injection of a virulent culture into the brain would not produce an abscess unless the area had been previously damaged. His technic was to puncture the cortex with a hypodermic needle and then about 10 days later to inject a culture of a virulent organism. Malinovski obtained abscesses in this manner, but he does not give the percentage of success which attended the use of his method.

Essick,[2] working with cats, was able to produce brain abscess by first traumatizing the brain and then inoculating with organisms, preferably obtained from the pus of other cat brain abscesses. However, most of his animals died within 48 hours of an overwhelming toxemia or meningitis. These abscesses, while satisfactory for a pathological study of acute brain abscess, were followed by death of the animal too soon for surgical intervention or for study of the subacute and chronic lesion. Groff[3] listed many of the unsuccessful methods that had been tried in this laboratory previous to that time, and presented a procedure which gave more or less irregular results. He reported abscesses in 5 dogs which survived for from 3 to 8 days.

The following procedure is suggested as one that will produce abscesses uniformly with survival of the animal for a long enough time to allow evaluation of chemotherapy and varying surgical technics in treatment. Because of repeated failure in this and other laboratories uniformly to produce brain abscesses by intracerebral injection of bacteria alone, local tissue injury was first produced by the method to be described.

Procedure. Under general anesthesia 0.5 cc of a 0.3% solution

1 Malinovski, *Centralblatt f. d. med. Wissenschaften*, Berlin, 1891, **29**, 162.

2 Essick, C. R., *Arch. Neurol. and Psych.*, 1919, **1**, 671.

3 Groff, R. A., *Arch. Neurol. and Psych.*, 1934, **31**, 199.

of sodium ricinoleate (Soricin—Merrell) in melted agar is injected subcortically through a small burr hole. With the removal of the skin sutures, on about the fifth day, 0.02 cc of a 12-hour culture of bacteria (Pneumococcus Type III) is injected through the burr hole into the original site of injection of the sodium ricinoleate.

Fundal examinations and cisternal punctures were made previous to the injection of the culture and at varying intervals afterward. The cerebrospinal fluid pressures, cell counts, and any neurological signs were recorded. In most cases the animals were allowed to die and post mortem examinations were made as soon as possible. The brains were placed in a 10% solution of formaldehyde and sectioned later.

The protocols in Table I show the course of a control group of dogs injected with sodium ricinoleate but not inoculated with organisms. Dogs Nos. 244, 126, and 160 were operated upon on 12-9-40. Fundal examinations and spinal fluid studies were carried out on the seventh, sixteenth, twentieth, thirtieth and forty-fifth postoperative days.

Table II tabulates the typical results of this method with inoculation.

It is not the purpose of this paper to detail the pathological process

TABLE I.

Control Dogs Injected with Sodium Ricinoleate Not Followed by Injection of Pneumococci.

Dog	Post-operative day	Spinal fluid pressure	Spinal fluid cells	Remarks
244	7	140	15	Stitches removed, wound satisfactory
	16	140	10	No neurological signs.
	20	140	7	" " "
	30	140	8	" " "
	45	160	10	
126	7	136	12	Stitches removed, wound satisfactory.
	16	130	12	No neurological signs.
	20	200	12	Dog excited at time. No neurological signs.
	30	180	25	Cannot account for the rise in cells. No neurological signs.
	45	175	740	Cells unaccounted for. Dog does not show any neurological signs; however, it does not appear well.
160	7	160	14	Stitches removed, wound satisfactory.
	16	—	—	
	20	150	5	No neurological signs.
	30	150	7	" " "
	45	150	12	

TABLE II.
Dogs Injected with Sodium Ricinoleate and with Pneumococci.

Dog	Days post-operative when inoculated	Spinal fluid pressure		Spinal fluid cell count		†Optic disc after inoculation	Culture of Abscess	Neurological findings	End results
		Before Inoculation	After Inoculation	Before Inoculation	After Inoculation				
171	1	120	200	5	15	Choked 1 diopter	Pneumo. 7th day	Right hemiparesis 3rd day after inoculation	Died 7th day after inoculation
124	9	110	190	27	8	Choked 2 diopters	Pneumo. 13th day	Right hemiparesis 8th day	Sacrificed 13 days after inoculation
50	8	150	210	4	2,100	Choked 3 diopters	Pneumo. 4th day	Right hemiparesis 3rd day	Sacrificed 4 days after inoculation
127*	4	140	220	5	15	Blurred	Pneumo. 7th day	None	Complete recovery
261*	4	130	140	4	5	No choking	Sterile 7th day	Right hind paw weakness	" "
260	4	150	240	7	15,000	Blurred	Pneumo. in sp. fl. 3rd day	Right fore paw paresis. Stiff neck. Convulsive movements	Died of meningitis 3 days after inoculation
286	4	170	200	8	15	No choking	Pneumo. 10th day	Right hemiplegia, salivation 10th day after inoculation	Died 16 days after inoculation
284	4	150	170	10	10	Normal	Pneumo. 15th day	No neurological signs	Dog died under anesthesia while abscess was being tapped
305*	7	150	160	6	8	"	Anerobic gram pos. rod 10th day	" " "	Abscess drained 10 days after inoculation

*Abscess in these dogs was drained with small rubber tubing. Culture taken at time of drainage.
†Optic disc before inoculation was normal.
Pneumococci disappeared from the abscess in 2 of 19 dogs in which this method was used.

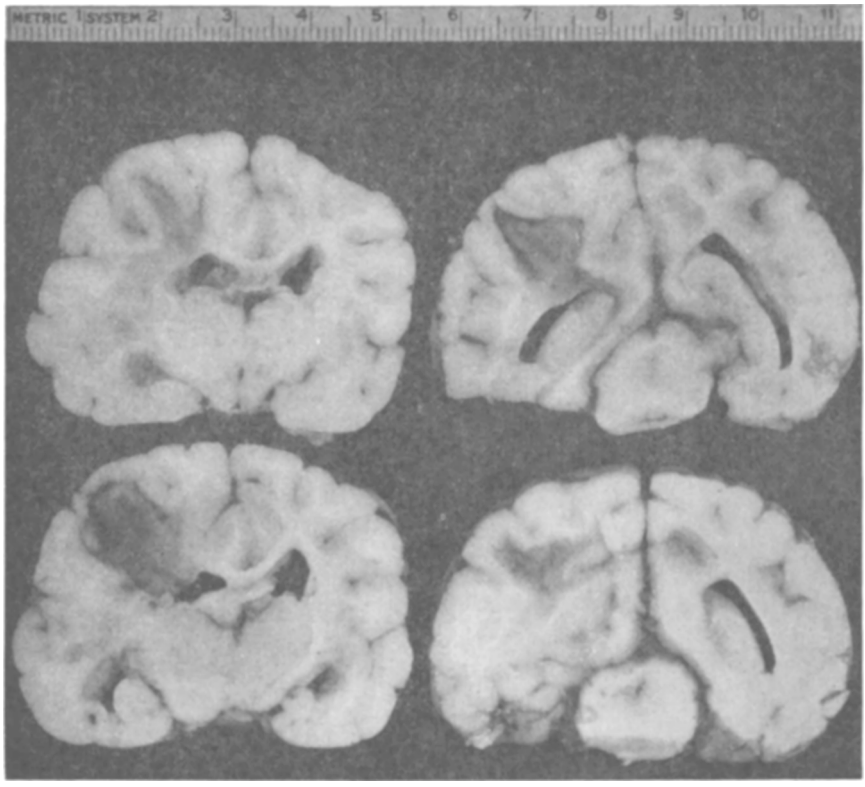

FIG. 1.
Dog No. 124—Coronal sections of the brain.

of these experimental brain abscesses. However, Figs. 1 and 2 are included to show that the experimental abscess conforms in the main to the pathological pictures of brain abscesses from other causes.

Conclusions. 1. A method for the production of experimental brain abscess is reported which will permit the evaluation of chemotherapy and various surgical procedures in the treatment of this lesion. 2. Such abscesses have the gross and microscopic pathological picture of brain abscess from other causes.

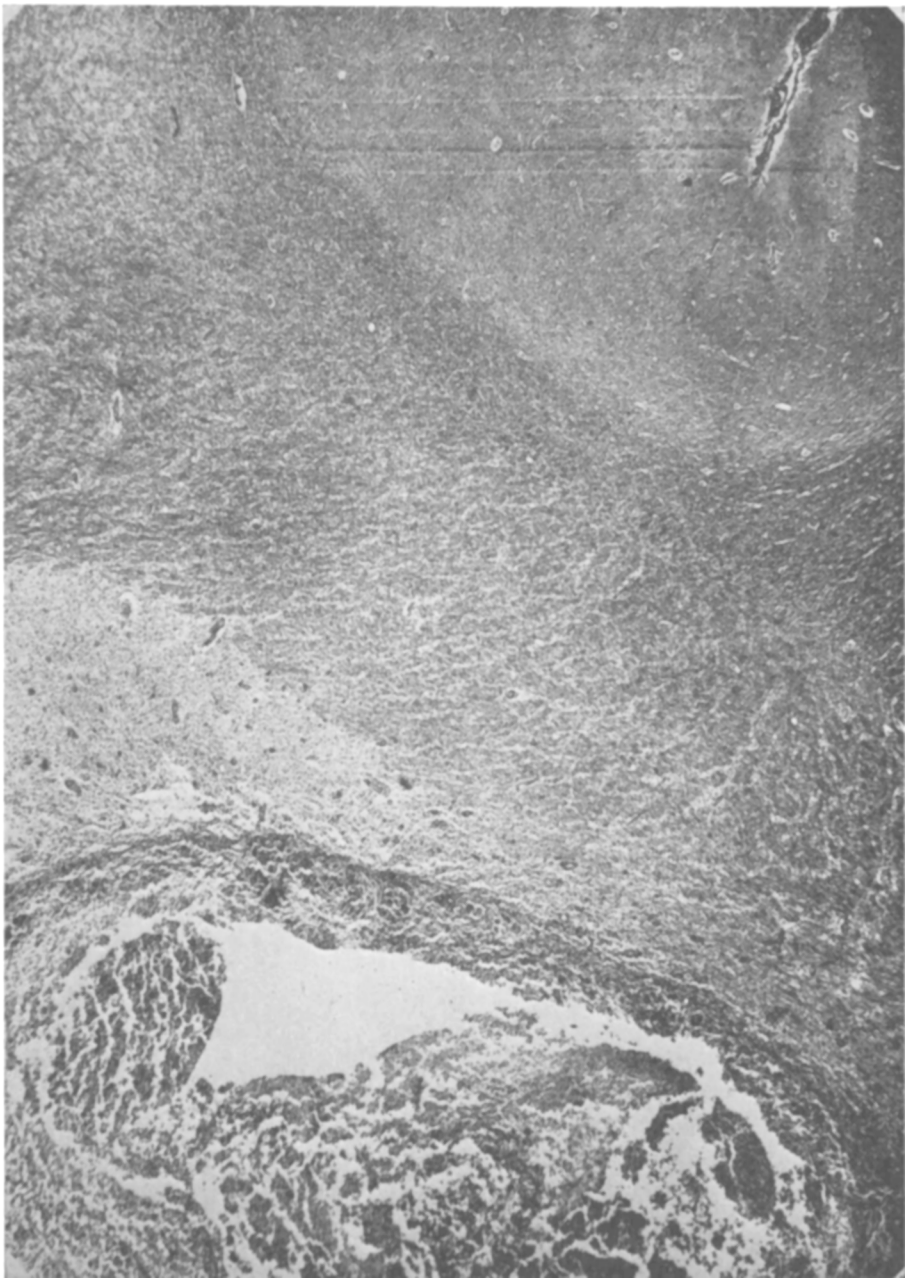

FIG. 2.
Dog No. 124—Photomicrograph showing the necrotic center of the abscess surrounded by an area of infiltration (capsule) and normal brain. × 27.