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Effect of Cocaine upon Protein Content of Regenerated Aqueous Humor.

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The normal aqueous humor resembles in its composition a dialysate of the blood plasma with the normal capillary wall acting as dialyzer. When this aqueous is removed a "second" aqueous is formed which in animals contains considerably more protein than the original fluid. This second or regenerated aqueous is generally thought to be formed by filtration of plasma through abnormally permeable capillary walls. If the paracentesis is done after retrobulbar injection of adrenaline or during stimulation of the sympathetic, the new-formed aqueous contains only slightly more protein than the normal one. In man the difference between the intraocular fluid of new formation and the normal fluid is less marked. Some writers have suggested that there is no increase in the protein content of the human aqueous after paracentesis. More accurate techniques have demonstrated that an increase of protein, although small, does occur (Table I). Two factors have been suggested as possibly having some influence upon the protein content of the second aqueous, *viz.*, the time interval between the withdrawal of the first and the second aqueous and the anesthetic used. Mestrezat and Magitot[1] conclude from their small series of cases that the protein content of the regenerated aqueous in man reaches its maximum about 45 minutes after the first paracentesis. Wessely[2] has pointed out that anesthetics with pronounced vasoconstrictor action like cocaine are likely to lower the protein content of the second aqueous. He has, however presented no proof for this view.

We have had the opportunity to determine the protein content of the first and second aqueous on a small number of practically normal human eyes. Under local anesthesia the aqueous was aspirated by needle puncture and its protein content determined by nephelometry of the opacity produced by precipitation of the protein with sulphosalicylic acid.[3] The second paracentesis was always done from 45 to 65 minutes after the first one, so as to strike the alleged maximum of the protein content.

1 Mestrezat, W., and Magitot, A., *Annales d'oculistique,* 1922, **159**, 401.

2 Wessely, K., *Arch. f. Augenheilkunde,* 1923, **93**, 194.

3 Franuschetti, A., and Wieland, H., *Arch. f. Augenheilkunde,* 1928, **99**, 1.

TABLE I.

Author	Clinical Diagnosis		Protein Content of the First (I) Aqueous	Protein Content of the Second (II) Aqueous	Increase in Protein Content II/I	Interval	Anesthetic
Franuschetti and Wieland	Senile cataract		.021	.097	4.6	23 min.	Cocaine, 2%
	" "		.034	.080	2.35	30 "	"
	" "		.027	.070	2.6	15 "	"
	" "		.030	.140	4.7	15 "	"
Wessely	Keratectasia		.010	.080	8		Holocaine
	Optic atrophy		<.01	.02	at least 2	1½ hrs.	"
	" "		.01	.06	6		"
	" "		.01	.03	3	30 min.	Cocaine
Gilbert	Strabismus, Amblyopia		.015	.175	12	1 hr.	Apocaine
	Optic atrophy		.017	.119	7		?
	Active choroiditis				6-8		?
Dieter	Aphakia		.010	.062	6	73 min.	?
	Cataract		.014	.08	6	1 hr.	?
	"		.024	.07	2.5	1 "	?
	" , Diabetes		.018	.083	4	48 min.	?
Mestrezat and Magitot	Neuritic optic atrophy	R.E.	.01	.025	2.5	3 hr.	Novocaine
		L.E.	.01	.150	15	1 "	"
		R.E.	.01	.085	8.5	1 "	"
	Toxic " "	R.E.	.01	.075	7.5	1 "	"
		L.E.	.01	.200	20	40 min.	"
	Tabetic " "	R.E.	.012	.050	4	25 "	"
		L.E.	.015	.120	8	30 "	"
	" " "		.023	.070	3	30 "	"
	" " "		.030	.110	4	45 "	"
	" " "		.023	.240	10	45 "	"

Our results for the protein content of the normal and the regenerated aqueous were not essentially different from those reported by other authors. The difference in protein content between the second and first aqueous was, however, as a rule more pronounced, which may be a characteristic of the eye of the Chinese. We were chiefly interested in proving or disproving Wessely's view of the rôle played by the local anesthetic. We therefore determined the protein content of the first and second aqueous on 4 eyes of 3 patients twice, the first time using an anesthetic without vasoconstrictor action (pantocaine 1%, butyn 2%) and the second time using cocaine (10%). From 8 to 10 drops of the anesthetic were instilled before each puncture.

TABLE II.

Age	Clinical Diagnosis		Protein Content of the Aqueous First (I)	Protein Content of the Aqueous Second (II)	Increase in Protein Content II/I (approximately)	Anesthetic
20	Bilateral retrobulbar	L.E.	.0070	.270	40	Butyn
20	neuritis	R.E.	.0077	.149	18	"
16	Nutritional edema,	R.E.	.0057	.181	32	Pantocaine
16	normal eyes	L.E.	.0093	.174	19	"
22	Retrobulbar neuritis		.011	.122	11	"
38	Tetanic cataract		.0071	.479	68	"
11	Tumor of the maxilla, normal eyeball		.0080	.533	66	Butyn

TABLE III.

Protein Content of the Aqueous First	Protein Content of the Aqueous Second	Increase in Protein Content II/I (approximately)	Anesthetic
.0120	.0535	4	Cocaine
.0081	.0368	4	"
.0056	.022	4	"
.0112	.0686	6	"

The results given in Table III indicate that cocaine had a definite effect upon the protein content of the regenerated aqueous. The amount of fluid present in the anterior chamber at the time of the second puncture and consequently the rate of fluid production seemed to be independent of the type of anesthetic used. The effect of cocaine upon the protein content of the regenerated aqueous may be due to its vasoconstrictor action and/or—because of its greater and deeper reaching anesthetizing power than that of any of the other anesthetics used—due to the inhibition of axon-reflexes. The effect of other drugs upon the protein content of the regenerated aqueous in man is being studied.