BIOCHEMICAL CHANGES FOLLOWING ELECTROSHOCK*

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EXPERIMENTS with animals have shown that electrostimulation of brain tissue is followed by a number of biochemical changes in the brain. The information obtainable is limited since there are only comparitively few reports about investigations in this field (4).

Previously it has been shown that a rise in glutamic acid concentration in plasma obtained from peripheral veins occurs after electrostimulation in man (3). We have tried to follow this rise in glutamic acid concentration in relation to electroshock in order to evaluate the part played by some organs during the procedure.

Thus venous blood was obtained from brain, kidney, muscles, and liver. The glutamic acid concentration in venous blood from these organs was determined before and after electroshock. Blood samples were taken through a thin catheter introduced through a bared arm vein. The tip of the catheter was directed under fluoroscopy to the desired vein.

Blood from the organ to be examined must be collected within 60 seconds from the electric stimulation of the brain, otherwise admixture of blood from other areas cannot be avoided. In a few instances it was difficult to observe this time limit.

Light anaesthesia with thiopentone was administered during catheterization. During the electroshock complete muscle relaxation was obtained with succinylcholine iodide.

Krebs' enzymatic method was used to determine the glutamic acid concentration in the plasma (1, 2).

The described procedure was carried out in nine schizophrenic patients: five acute and four chronic cases.

In six of these patients (two acute and four chronic) the blood sugar concentration, and the potassium and the phosphate levels in the bulb of the jugular vein were determined in the blood samples as well.

Glutamic acid concentration in relation to electrostimulation (Table I)

In four of the nine patients examined the tip of the catheter was placed in the bulb of the internal jugular vein, in five cases in one of the renal veins.

In three out of the four cases with the catheter in the bulbar part of the

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TABLE I

Patient Chronic (ch) Recent (r) Schizophrenia	Veins	Before Electroshock Glutamic Acid mg. per 100 ml.	Before Electroshock Glutamine mg. per 100 ml.	After Electroshock Glutamic Acid mg. per 100 ml.	After Electroshock Glutamine mg. per 100 ml.
V.A. (ch)	jugular	2·29	5·96	2·31	6·69
F.R. (r)	jugular	3·48	8·32	2·67	9·37
K.B. (ch)	jugular	2·70	7·41	2·31	7·88
J.A. (ch)	renal	0·60	6·48	3·08	5·60
T.D. (r)	renal	0·24	6·92	1·29	6·39
E.V.H. (r)	renal	1·16	8·58	1·92	8·06
M.R. (r)	renal	0·00	6·69	0·17	7·10
H.J. (r)	renal	0·00	8·79	0·98	10·25
M.D. (ch)	axillary	1·60	5·73	3·42	5·46
F.R. (r)	axillary	1·38	9·51	4·46	8·53
J.A. (ch)	axillary	1·39	6·13	4·38	5·47
T.D. (r)	inf. v. cava	0·00	7·94	1·97	7·24
M.R. (r)	inf. v. cava	0·18	6·85	1·87	7·53

TABLE II

Patient	Jugular Vein before Electroshock mg. per 100 ml.		Jugular Vein after Electroshock (number of minutes after) mg. per 100 ml.	
M.D. (ch)	Blood sugar	93	Blood sugar	106
	Phosphate	4·1	Phosphate	4·3
	Potassium	11·9	Potassium	13·2
			(10 minutes)	
V.A. (ch)	Blood sugar	133	Blood sugar	135
	Phosphate	3·2	Phosphate	3·0
	Potassium	13·5	Potassium	14·2
			(2 minutes)	
F.R. (r)	Blood sugar	102	Blood sugar	121
	Phosphate	3·9	Phosphate	4·1
	Potassium	15·3	Potassium	16·1
			(1 minute)	
C.I.A. (ch)	Blood sugar	84	Blood sugar	125
	Phosphate	4·5	Phosphate	4·4
	Potassium	13·5	Potassium	14·2
			(4 minutes)	
K.B. (ch)	Blood sugar	91	Blood sugar	98
	Phosphate	4·0	Phosphate	4·3
	Potassium	14·6	Potassium	14·7
			(1 minute)	
T.D. (r)	Blood sugar	163	Blood sugar	106
	Phosphate	4·0	Phosphate	4·4
	Potassium	13·3	Potassium	14·3
			(½ minute)	

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jugular vein during electrostimulation there was no rise of glutamic acid after the shock. In one case there was a moderate increase which must probably be ascribed to admixture of blood from other venous areas, due to technical difficulties in blood sampling.

In all the five experiments with the tip of the catheter in one of the renal veins there was a fairly pronounced increase in the glutamic acid concentration.

All the five cases in which blood from the veins of the extremities was examined immediately after electroshock revealed pronounced rise in glutamic acid concentration.

Glucose, potassium and phosphate (Table II)

The glucose and phosphate levels before and after electroshock showed no significant variations in the blood from the bulb of the jugular vein.

The blood sugar concentrations varied considerably, above as well as below normal figures. The potassium level in the jugular vein showed a slight increase following electrostimulation.

Control

To control the effect of thiopentone alone and thiopentone-scoline blood, samples were taken before and after the administration of these drugs. They showed a rise in glutamic acid level after administration of succinylcholine iodide.

Discussion

These investigations seem to indicate that the increase of glutamic acid concentrations in plasma after electroshock must probably mainly originate in muscles or in the kidney, or in both. It is not yet possible to offer a satisfactory explanation of the glutamic acid increase in the blood from the two organs mentioned. There is nothing to indicate that the glutamic acid derives from brain tissue. The rise in glutamic acid concentration after scoline alone may be caused by the characteristic twitch often accompanying injections of this substance—possibly by depolarization over a protracted period.

Conclusion

1. Brain tissue has not been found to supply glutamic acid to venous blood following electrostimulation.

Blood from muscles and kidney show a rise in glutamic acid concentration following electrostimulation of the brain.

2. A slight, but significant, increase of potassium concentration in the blood of the jugular vein has been demonstrated.

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