

INVESTIGATIONS INTO GLUTAMIC ACID METABOLISM IN SCHIZOPHRENICS*

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EARLIER investigations (3, 4) have shown an abnormal glutamic acid metabolism in schizophrenic patients.

These changes are, briefly, low glutamic acid level (and high glutamine level) especially in acute cases. Glutamic acid concentrations below 1·2 milligrams per 100 ml. venous blood were ascertained in most of these patients.

In an attempt to explain these observations further investigations have been carried out by us. It has been tried, by venous catheterization, to obtain samples of venous blood from brain, kidney, muscles and liver. Simultaneous samples of arterial blood have been taken and the arterio/venous glutamic acid and glutamine deficiency have been determined in order to elucidate the part played by these organs in glutamic acid metabolism.

The technique has been as follows:

During light pentothal anaesthesia a thin plastic catheter was introduced through a bared arm vein. The tip of the catheter was directed under fluoroscopy to the desired vein of the organs mentioned.

Thus venous blood samples were withdrawn, and arterial blood simultaneously obtained by puncture of the femoral artery.

Analyses of glutamic acid and glutamine concentrations were carried out by H. A. Krebs' enzymatic method (2). Double analyses were invariably performed.

The mean error of single determinations of glutamic acid concentrations according to this method has previously (1, 3) been found to be 0·36 milligram; of glutamine 0·21 milligram per 100 ml.

In 20 normal adults the mean glutamic acid level has been ascertained to be 2·3 milligrams (lowest mean level in normal series: 1·2 milligrams).

In the identical normal series the mean glutamine level was 7·6 milligrams (1, 3).

Catheterization was performed on 11 schizophrenics—in four cases combined with arterial puncture. A control group was made up of six mentally healthy patients with heart diseases. All catheterizations were uncomplicated. In four other cases of mentally healthy persons parallel determinations of glutamic acid and glutamine were made in arterial and venous blood.

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Figure 1 shows the glutamic acid concentration in the control group.

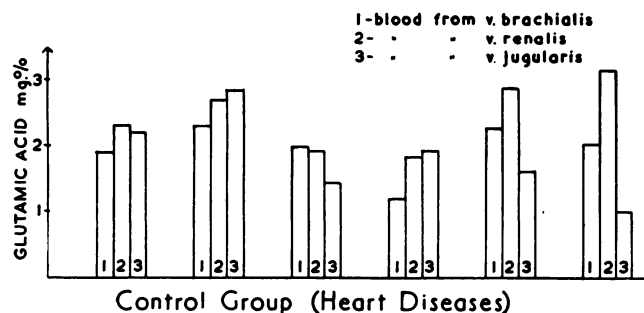


FIG. 1.

The glutamic acid concentrations are above 1.2 mg. in venous blood of muscles, kidney and brain, and the concentrations are of equal magnitudes in the blood of peripheral veins and arteries.

The result from the 11 schizophrenics will be presented in two groups, A and B: chronic and acute cases.

Group A: 5 chronic patients mainly of the catatonic type with clinical pictures unaltered for years and an average duration of the disease of about 15 years.

It appears from Figure 2 that the most constant feature was low glutamic acid concentration in the renal vein; in only one of the five patients (K.B.) this concentration exceeds 1.2 milligrams.

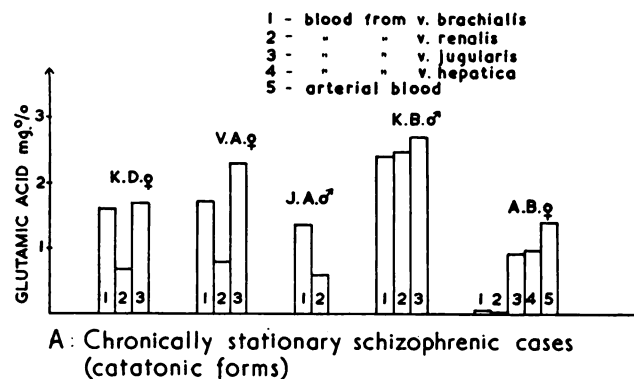


FIG. 2.

In four out of the five patients examined the glutamic acid concentrations in the brachial and jugular veins were above 1.2 milligrams, or within "normal" figures. In one patient (A.B.) low glutamic acid concentrations were ascertained in all blood samples—lowest, however, in the renal and brachial veins. In this patient the glutamic acid concentration was also determined in arterial blood. As far as kidney and extremities are concerned this case presents a pronounced arterio-venous glutamic acid deficiency.

Group B: 6 schizophrenics with comparatively short standing of the disease—1½ to 5 years. They had been able to manage without hospitalization for long periods, but had had to be admitted on account of deterioration.

At the time of examination the patients were in a bad clinical condition. A single patient (E.E.M.) was examined during an interval in the insulin-coma-treatment; the five other patients had remained untreated for at least four months prior to examination.

The results are seen from Figure 3. Four patients showed low glutamic acid concentrations in all regions examined. One patient (F.R.), however, had normal glutamic acid concentrations in all examined veins, and in another (E.V.H.) the concentration was normal in blood from peripheral veins. In this group the glutamic acid concentration was determined in the pulmonary artery of one patient (E.E.M.): it was ascertained to equal that of the arterial blood, which must be taken to indicate that in this patient the glutamic acid does not undergo any changes during pulmonary circulation.

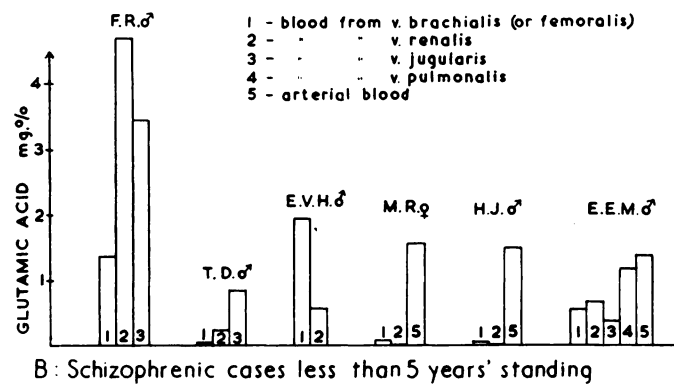


FIG. 3.

In the three cases within this group of patients in which arterial puncture was performed (M.R., H.J., E.E.M.) the glutamic acid concentrations in arterial blood were essentially higher than in the blood of the venous regions.

The glutamic acid concentrations in the blood of peripheral veins do not vary during a period of 20 minutes' anaesthesia.

The glutamine concentrations showed no significant deviation and have, therefore, not been included in the figures here reproduced; they were within "normal" limits.

In summing up it can be stated that the investigations here reported would indicate that the glutamic acid metabolism—especially in schizophrenics with comparatively brief case histories—is abnormal in brain, kidney and muscle tissue, as compared with the metabolism in normal persons.

CONCLUSION

1. In six mentally normal persons the glutamic acid concentrations have been ascertained to be above 1.2 milligrams per 100 millilitres in venous blood of muscles, kidney and brain.

The glutamic acid concentrations in mentally normal persons are of equal magnitudes in the blood of peripheral veins and arteries.

2. In four out of the five chronic schizophrenics examined there are low glutamic acid concentrations in the renal vein: presumably an indication of arterio-venous glutamic acid deficiency.

3. In four out of the six acute cases of schizophrenia examined there are low glutamic acid concentrations in both the jugular and renal veins and in veins of muscles: indicating arterio-venous glutamic acid deficiency in these organs.

4. The glutamine concentrations showed no significant deviations.

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