

Blood pH and Plasma pCO₂ in Mental Disease

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Interest in the acid base metabolism in mental disease has existed almost as long as the relevant estimations have been available to clinicians. In the period from 1920 to 1938 many careful and accurate determinations of the factors involved were carried out, both in Europe and the United States of America. The results, while being sometimes equivocal, for the most part showed that there was no demonstrable change between those suffering from schizophrenia or depression and a normal hospital population. Since 1938 little interest appears to have been taken in the hydrogen ion concentration of the blood and the pCO₂ in mental disease. During recent years great progress has been made in the apparatus for the determination of blood pH and pCO₂ and fairly recently it became possible to estimate the first of these three places of decimals with a reproducibility of 0.005 of a pH unit and an equivalent accuracy for pCO₂. In view of this great improvement in the apparatus available, it seemed worth while to estimate the blood pH and pCO₂ in a large number of chronic mentally ill patients. The facilities and the patients were available in Hollymoor Hospital, so we decided to see whether with the much more delicate instruments now available it was possible to demonstrate any significant difference in the blood pH and pCO₂ between schizophrenics and other mentally ill patients.

PATIENTS

The whole of the patients in two wards, comprising 49 males and 46 females were examined and found to have no physical illness known to affect acid base metabolism. Their psychiatric diagnosis was taken from their notes. Ages varied from 17 to 78. The numbers in the larger diagnostic groups were: schizophrenia 60, epileptics 13. The remainder were

not classified but included depressives and senile dementia.

EXPERIMENTAL

Arterialized blood was obtained in the following manner:

At nine o'clock each morning patients were brought to the laboratory. One hand was held in a water bath, thermostatically controlled at 44° centigrade with variations of less than half degree, for five minutes, timed by a laboratory ringing clock. Fifteen ml. of blood were then immediately removed from one of the veins on the back of the hand. This was placed in two bottles containing just enough heparin solution to stop clotting; the volume of blood was such that it filled the bottles used completely, allowing no dead air space above the blood. Estimation of the pCO₂ was carried out immediately using a Severinghaus apparatus with an E.I.L. Blood pH meter as the electronic voltage indicator. The blood pH was determined on an E.I.L. Blood pH meter using a capillary glass electrode. Both pieces of apparatus were maintained at a temperature of 37° centigrade. In our hands the apparatus gave results reproducible to 0.005 for blood pH and 1 mm. of Hg for pCO₂. Five patients were bled each morning and immediately on completion of the estimation of the pCO₂ levels, blood pH estimation was carried out on all the five bloods. In this manner the pCO₂ estimations were performed within approximately three minutes of bleeding the patient and the blood pH which was done on the second bottle within one hour. The pCO₂ apparatus was calibrated using stored gases of known carbon dioxide content, i.e., oxygen, CO₂ mixture, and the figures used being a mean of six analyses in a gas analysis apparatus. Similarly the pH meter was set with

buffer of pH 7.380 and the scale proved correct with buffer of 6.840 and 9.093.

in Table II. They also show no significant difference between any of the groups examined.

RESULTS

The mean of both estimations as well as all the individual readings fell within the accepted normal range.

The blood pH and pCO₂ figures for the male and female patients and also for the two largest diagnostic groups, schizophrenics and epileptics, were analysed.

Table I gives the means for the pCO₂ figures in the above groups and also comparisons of the means. The comparisons of the standard error of difference between the means show no significant difference in any of the groups.

The figures for pH are grouped and compared

DISCUSSION

The technique employed in this investigation was undoubtedly more rapid and probably more accurate than was available to workers in the first half of the century since then they had to rely on the method either of Van Slyke or modifications of this method for the pCO₂ and either very inferior glass electrodes for the blood pH or even indicators. However, our results confirm the results of previous workers that there is no statistically significant difference in the blood pH or pCO₂ in the types of chronic mental illness examined.

TABLE I

Comparison of pCO₂ Figures in the Male and Female Patients and Schizophrenics and Epileptics

	No. of Patients	Mean pCO ₂ in mm. Hg	Standard Deviation	Standard Error of Difference of Means	c	Degrees of Freedom	Probability P
Male	49	37.38	2.42	0.52	0.06	93	0.95
Female	46	37.41	2.60				
Schizophrenics	60	36.99	2.38	0.51	1.25	91	0.21
Non-schizophrenics	35	37.63	2.40				
Schizophrenics	60	36.99	2.38	0.72	1.75	71	0.08
Epileptics	13	38.25	2.25				

TABLE II

Comparison of pH Figures of the Male and Female Patients and Schizophrenics with Epileptics

	No. of Patients	Mean pH	Standard Deviation	Standard Error	c	Degrees of Freedom	Probability P
Male	49	7.398	0.021	0.00413	0.728	92	0.47
Female	45	7.395	0.019				
Schizophrenics	60	7.400	0.021	0.0049	1.2	90	0.22
Non-schizophrenics	34	7.394	0.024				
Schizophrenics	60	7.400	0.021	0.0052	0.96	70	0.34
Epileptics	12	7.395	0.016				

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