BIOCHEMICAL STUDIES IN ELECTRIC CONVULSIVE THERAPY

By

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FOR this purpose average normal values were studied in 40 normal cases, and 40 mental cases were selected from amongst those who were suffering from various mental disorders who were given electric convulsive therapy.

The biochemical investigations included estimation of blood sugar, plasma proteins, blood urea, N.P.N., uric acid, serum potassium, plasma sodium and plasma chloride.

These estimations were carried out before, immediately after, 2 hours after, 4 hours after, 24 hours after and after 10 electric shocks (after 4 days).

The average normal values of the blood chemistry were observed in the 40 normal cases who were mostly students and doctors of this medical college.

Their age groups were as follows:

TABLE I

Maximum age	45 years
Minimum age	17 years
Average age	25 years

And their blood chemistry was as follows:

TABLE II

	Maximum	Minimum	Average
Blood sugar mg./100 c.c.	120	70	93·9
Plasma proteins g./100 c.c.	7·8	5·2	6·52
Blood urea mg./100 c.c.	39·4	17·5	26·1
Blood N.P.N. mg./100 c.c.	34·5	16·5	23·1
Plasma uric acid mg./100 c.c.	4·2	2·0	3·0
Serum potassium mg./100 c.c.	20·6	15·6	17·6
Plasma sodium mg./100 c.c.	340	314	327·0
Plasma chloride mg./100 c.c.	390	335	358·5

Forty mental cases who were selected for this study belonged to the Mental Hospital, Agra. These belonged to the following age groups (see Table below).

TABLE III

	Age in Years	No. of Cases	Per cent. of Cases
1.	11–20	11	27·5
2.	21–30	20	50
3.	31–40	4	10
4.	41–above	5	12·5

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The disease which they were suffering from belonged to the following groups:

TABLE IV

	Diseases	No. of Cases	Per cent. of Cases
1.	Schizophrenia	17	42
2.	Manic reaction type	10	25
3.	Manic depressive psychosis ..	6	15
4.	Melancholia	3	7·5
5.	Psychoneurosis	2	5
6.	Paranoid	1	2·5
7.	Confusional insanity	1	2·5

BLOOD SUGAR

The changes which occurred in the blood-sugar level (mg./100 c.c. of blood) before and after the E.C.T. were as follows:

TABLE V

	Before Shock	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
Maximum value	118	142	124	112	115	120
Minimum value	70	76	69	69	75	75
Average value	88·3	117·3	100·6	100·6	92·9	96·9

TABLE VI

Blood Sugar mg./100 c.c.	Before Shock	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
65– 69 ..	—	—	1 (2·5%)	—	—	—
70– 80 ..	11 (27·5%)	1 (2·5%)	5 (12·5%)	10 (25%)	7 (17·5%)	6 (15%)
81– 90 ..	12 (30%)	0	7 (17·5%)	10 (25%)	12 (30%)	6 (15%)
91–100 ..	7 (17·5%)	4 (10%)	5 (12·5%)	11 (27·5%)	11 (27·5%)	16 (40%)
101–110 ..	4 (10%)	5 (12·5%)	9 (22·5%)	8 (20%)	4 (10%)	4 (10%)
111–120 ..	6 (15%)	12 (30%)	11 (27·5%)	1 (2·5%)	6 (15%)	8 (20%)
121–130 ..	—	11 (27·5%)	2 (5%)	—	—	—
131–140 ..	—	5 (12·5%)	—	—	—	—
141–150 ..	—	2 (5%)	—	—	—	—

Table VII shows the abnormal blood-sugar levels in the number of cases thus studied.

TABLE VII

	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
Rise	39 (95%)	28 (70%)	21 (52·5%)	21 (52·5%)	32 (80%)
No change ..	—	2 (5%)	7 (17·5%)	17 (42·5%)	8 (20%)
Fall	1 (2·5%)	10 (25%)	12 (30%)	2 (5%)	—

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It was observed from these estimations that immediately after the E.C.T. the blood-sugar value increased in all the cases as shown in the Table VII. In one it fell down by 9 mg. The increase varied from 14 mg. to 55 mg. with an average rise of 21·3 mg. After two hours of the E.C.T. the blood-sugar level showed a tendency towards a decline. In some cases it went below the initial level (Table VII). The maximum rise after two hours was 47·5 mg. and the maximum decrease 8 mg.

In 7 cases the blood sugar rose from that level which was obtained immediately after the shock while in 33 cases it came down.

After 4 hours of the E.C.T. the blood sugar further declined towards the initial level and in some cases even below it. There was a decrease in 38 cases from the value obtained immediately after shock while in one case it increased and in one it was equal.

Comparing these figures with the figures obtained after two hours of the shock it was noticed that in 7 cases (17·5 per cent.) the value showed a rise, in 6 cases (15 per cent.) it was equal and in the remaining it fell down.

After 24 hours of E.C.T. the blood-sugar level was higher in 21 cases (52·5 per cent.) as compared with the initial level and lower in 2 cases only. In one case this value was higher than the value obtained after E.C.T.

After 10 shocks the blood-sugar level was higher in 32 cases (80 per cent.) as compared with the initial reading. In the remaining 8 cases (20 per cent.) it was equal and in none was it less.

Conclusion. From this study we find that immediately after E.C.T. there is a transient hyperglycaemia. This hyperglycaemia gradually declined and reached the initial levels in the next 24 hours. After multiple shocks a slight rise in blood-sugar level was noticed.

Plasma Proteins

The changes occurring in the plasma proteins (g./100 c.c.) before and after E.C.T. were as follows:

Table VIII

	Before Shock	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
Maximum value	7·2	8·0	7·4	7·0	7·4	7·4
Minimum value	5·2	5·7	5·2	5·0	5·3	5·5
Average value	6·21	6·86	6·19	6·03	6·24	6·34

Table IX

Proteins g./100 c.c.	Before Shock	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
5 –5·5 ..	5 (12·5%)	—	7 (17·5%)	7 (17·5%)	5 (12·5%)	3 (7·5%)
5·51–6	11 (27·5%)	4 (10%)	13 (32·5%)	15 (37·5%)	11 (27·5%)	7 (17·5%)
6·11–6·5 ..	13 (32·5%)	7 (17·5%)	9 (22·5%)	10 (25%)	12 (30%)	15 (37·5%)
6·51–7	7 (17·5%)	15 (37·5%)	9 (22·5%)	8 (20%)	10 (25%)	10 (25%)
7·11–7·5 ..	4 (10%)	8 (20%)	2 (5%)	—	2 (5%)	5 (12·5%)
7·51–8	—	6 (15%)	—	—	—	—

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Table X shows the abnormal plasma-protein level in the cases thus studied.

TABLE X

	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
Rise	38 (95%)	18 (45%)	3 (7·5%)	18 (45%)	34 (85%)
No change ..	—	7 (17·5%)	9 (22·5%)	12 (30%)	3 (7·5%)
Fall	2 (5%)	15 (37·5%)	28 (70%)	10 (25%)	3 (7·5%)

It was observed from these estimations that immediately after the electric shock the plasma-proteins level increased in all the cases except 2 (5 per cent.) in which there was a fall, the fall being up to —0·3 g. from the initial level. The rise varied from 0·2 g. to 1·35 g.

After two hours of the E.C.T. the plasma proteins showed a tendency to decline. In some cases the decrease occurred even below the initial levels. The maximum rise at this stage was 0·3 g. and fall —0·6 g. The values were lower in all the cases when compared to the values obtained immediately after shock.

After 4 hours of the E.C.T. in 70 per cent. cases the values were lower than the initial level, in 7·5 per cent higher and in the rest equal. The deviation from the initial level varied from 0·2 to —0·95 g. After 24 hours of the E.C.T. the deviation from the initial figures varied from +0·3 g. to —·92 g. After 10 electric shocks the plasma-protein level varied from 0·6 g. to —0·3 g. as compared to the initial reading, while in the rest it was either equal or increased.

Conclusion. From this study we find that hyperproteinaemia occurred immediately after the E.C.T., which came down to the initial level during the next 2–4 hours. During the next 24 hours the values showed no gross change. After multiple shocks a slight rise in plasma-protein level was observed.

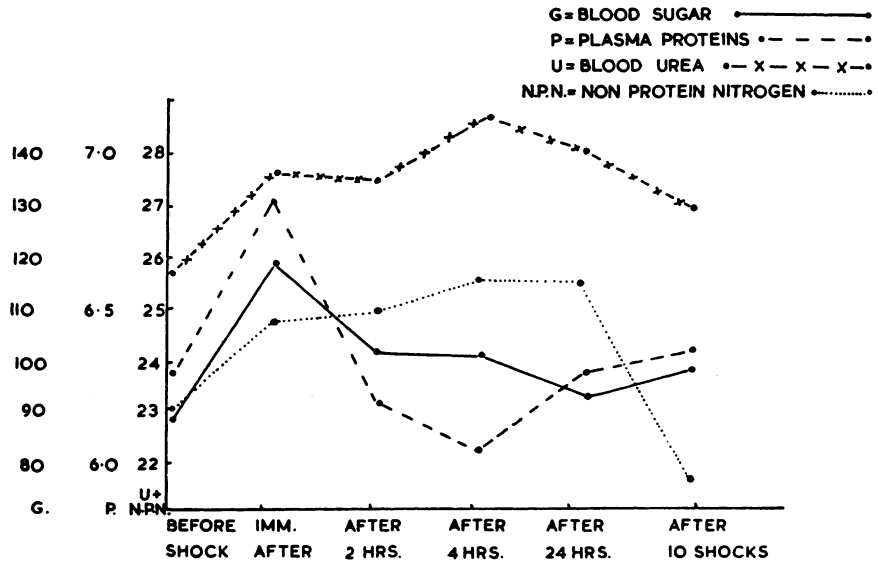


FIG. 1.

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Blood Urea

The changes which occurred in the blood-urea level before and after the E.C.T. were as follows:

Table XI

	Before Shock	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
Maximum value	33·6	37·5	28·9	38·9	37·2	38·9
Minimum value	20·0	19·5	21·9	22·5	20·8	19·5
Average value	25·5	27·5	27·4	28·6	29·0	26·9

Table XII

Blood Urea	Before Shock	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
18 –20 ..	2 (5%)	2 (5%)	—	—	—	1 (2·5%)
20·1–25 ..	21 (52·5%)	13 (32·5%)	13 (32·5%)	9 (22·5%)	12 (30%)	15 (37·5%)
25·1–30 ..	10 (25%)	12 (30%)	15 (37·5%)	17 (42·5%)	14 (35%)	14 (35%)
30·1–35 ..	5 (12·5%)	8 (20%)	9 (22·5%)	11 (27·5%)	10 (25%)	6 (15%)
35·1–40 ..	2 (5%)	5 (12·5%)	3 (7·5%)	3 (7·5%)	4 (10%)	4 (10%)

Table XIII shows the abnormal blood-urea levels in these cases.

Table XIII

	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
Rise	31 (77·5%)	34 (85%)	38 (95%)	34 (85%)	29 (72·5%)
No change ..	6 (15%)	4 (10%)	2 (5%)	4 (10%)	3 (7·5%)
Fall	3 (7·5%)	2 (5%)	—	2 (5%)	8 (20%)

It was found out from these estimations that immediately after E.C.T. the blood-urea level showed a rise in most cases (see above Table). The deviation from the initial level varied from 5·3 mg. to −2·4 mg./100 c.c.

After two hours of the electric shock the blood urea varied from 4·6 mg. to −2·4 mg. as compared to the initial reading. The figures when compared to that obtained immediately after the shock showed a rise in 16 cases (40 per cent.), fall in 17 cases (42·5 per cent.) and no change in the other 7 cases (17·5 per cent.).

After 4 hours of E.C.T. there was found a rise in the blood-urea level in all cases except two in which it remained equal to the initial level, the rise varied up to 6·2 mg.

After 24 hours of the E.C.T. the variations ranged from 7·5 to −1·7 mg./100 c.c. Compared to the level obtained after 4 hours there was found a rise in 15 cases (37·5 per cent.), fall in 19 cases (47·5 per cent.) and no change in the rest.

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After 10 electric shocks the blood-urea level varied from +8·8 to −4·2 mg./100 c.c., as compared to the initial level and on the whole was very slightly higher.

Conclusion. It was found that there was a slight rise in the blood-urea level immediately after shocks which persisted in 85 per cent. cases to a slight degree even after 24 hours. After multiple shocks blood-urea level was found to be very slightly higher, about 1 mg. on an average.

N.P.N.

The changes which occurred in the blood N.P.N. before and after the E.C.T. were as follows:

TABLE XIV

	Before Shock	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
Maximum value	32·0	35·0	34·9	35·0	33·5	34·9
Minimum value	18·0	17·6	19·7	20·3	18·7	17·6
Average value	22·9	24·7	24·8	25·5	25·5	21·6

TABLE XV

N.P.N.	Before Shock	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
15 –20 ..	9 (22·5%)	4 (10%)	1 (2·5%)	—	3 (7·5%)	2 (5%)
20·1–25 ..	21 (52·5%)	19 (47·5%)	24 (60%)	21 (52·5%)	18 (45%)	23 (57·5%)
25·1–30 ..	7 (17·5%)	12 (30%)	12 (30%)	14 (35%)	11 (27·5%)	8 (20%)
30·1–35 ..	3 (7·5%)	5 (12·5%)	3 (7·5%)	5 (12·5%)	8 (20%)	7 (17·5%)

Table XVI shows the abnormal blood-N.P.N. levels in the cases thus studied.

TABLE XVI

	After Shock	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
Rise	31 (77·5%)	34 (85%)	38 (95%)	34 (85%)	39 (72·5%)
No change ..	6 (15%)	4 (10%)	2 (5%)	4 (10%)	3 (7·5%)
Fall	3 (7·5%)	2 (5%)	—	2 (5%)	8 (20%)

It was found from these estimations that immediately after E.C.T. the blood-N.P.N. level showed a rise in most cases (Table XVII). The deviation from the initial level varied from 4·8 to −2·1 mg./100 c.c.

After two hours of the electric shocks the blood-N.P.N. level varied from 4·0 to −3·0 mg. as compared with the initial reading. The figures when compared with that obtained immediately after the shock showed a rise in 17 cases (42·5 per cent.), fall in 17 cases (42·5 per cent.), and no change in the remaining 6 cases (15 per cent.).

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After 4 hours of E.C.T. the blood-N.P.N. showed further rise in most cases. In no case was it found below the initial level. The rise from the initial level varied up to 5·6 mg./100 c.c. When these figures were compared with those obtained immediately after the shock, they were found higher in 26 cases (65 per cent.), equal in 4 cases (10 per cent.), and lower in 10 cases (25 per cent.). The figures compared to the reading after 2 hours were higher in 26 cases (65 per cent.), equal in 11 cases (27·5 per cent.), and low only in 3 cases (7·5 per cent.).

After 24 hours of E.C.T. the variations ranged from +6·8 to −1·6 mg./100 c.c. On the whole there occurred a fall in the values as compared to the values obtained after the shock.

After 10 shocks the deviations from the initial level ranged from 9·5 to −3·5 mg. The blood-N.P.N. level was very slightly higher in most cases.

Conclusion. From this study we found that there was a rise in blood-N.P.N. after E.C.T. which persisted in some degrees even after 24 hours. After 10 electric shocks 72·5 per cent. of cases were found to have a slightly higher blood-N.P.N. level.

Plasma Uric Acid

The changes which occurred in the plasma-uric acid level (mg./100 c.c.) before and after the E.C.T. were as follows:

Table XVII

	Before Shock	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
Maximum value	4·2	4·5	5·1	5·0	4·9	4·3
Minimum value	2·0	2·1	2·4	2·4	2·1	2·0
Average value	2·9	3·2	3·7	3·8	3·4	3·1

Table XVIII

Plasma Uric Acid mg./100 c.c.	Before Shock	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
2 –2·5 ..	8 (20%)	8 (20%)	1 (2·5%)	1 (2·5%)	5 (12·5%)	8 (20%)
2·6–3	14 (35%)	8 (20%)	5 (12·5%)	5 (12·5%)	5 (12·5%)	12 (30%)
3·1–3·5 ..	8 (20%)	13 (32·5%)	7 (17·5%)	6 (15%)	13 (32·5%)	13 (32·5%)
3·6–4	9 (22·5%)	8 (20%)	16 (40%)	17 (42·5%)	11 (27·5%)	6 (15%)
4·1–4·5 ..	1 (2·5%)	3 (7·5%)	6 (15%)	4 (10%)	3 (7·5%)	1 (2·5%)
4·6–5	—	—	4 (10%)	7 (17·5%)	3 (7·5%)	—
5·1–5·6 ..	—	—	1 (2·5%)	—	—	—

Table XIX shows the abnormal plasma-uric acid levels in the cases thus studied.

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TABLE XIX

	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
Rise	30 (75%)	39 (97·5%)	39 (97·5%)	32 (80%)	23 (57·5%)
No change ..	—	1 (2·5%)	1 (2·5%)	6 (15%)	8 (20%)
Fall	10 (25%)	—	—	2 (5%)	9 (22·5%)

It was found from these estimations that immediately after E.C.T. there occurs a marked variation in the uric acid level, a rise occurred in 75 per cent. of cases and a fall in 25 per cent. The deviations varied from +0·6 to −0·6 mg./100 c.c. as compared to the initial reading.

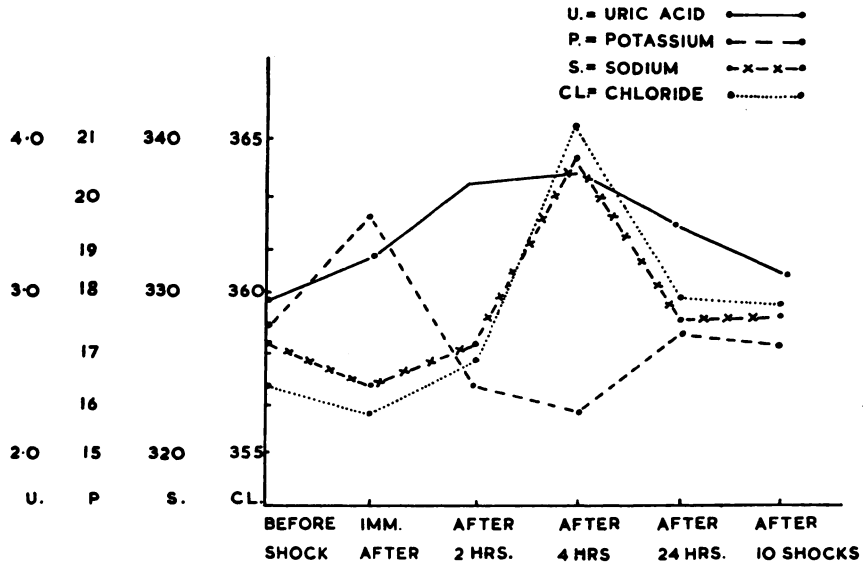
After two hours of the E.C.T. there occurred a further rise in all the cases except one, the rise going up to 1·4 mg./100 c.c. In no cases was a fall observed as compared to the previous reading.

After 4 hours of E.C.T. the maximum rise was 1·3 mg./100 c.c. The values were higher in all cases when compared with the initial readings. As compared with the reading after 2 hours there was found a rise in 18 cases (45 per cent.), fall in 9 cases (22·5 per cent.), and no change in the rest of the cases.

After 24 hours of E.C.T. there was found a slight fall in the uric acid-level which now varied from +1·2 to −0·2 mg. as compared with the initial reading.

After 10 shocks the deviations from the initial levels varied from +1·0 to −0·8 mg./100 c.c., being higher in 23 cases (57·5 per cent.) and lower in 22·5 per cent. of cases.

Conclusion. It was found that a rise in plasma-uric acid level occurred during E.C.T. which was maximum between 2–4 hours after the shock and persisted in some cases up to 24 hours. After multiple shocks the plasma-uric acid increased very slightly.



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Serum Potassium

The changes occurring in the serum potassium (mg./100 c.c.) before and after the E.C.T. were as follows:

Table XX

	Before Shock	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
Maximum value	20·0	21·8	19·2	18·4	19·6	19·4
Minimum value	15·2	16·0	14·0	13·4	15·0	15·0
Average value	17·2	19·3	16·2	15·7	17·2	17·0

Table XXI

Serum Potassium mg./100 c.c.	Before Shock	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
13 –15 ..	—	—	10 (25%)	15 (37·5%)	1 (2·5%)	3 (7·5%)
15·1–16 ..	8 (20%)	1 (2·5%)	8 (20%)	8 (20%)	9 (22·5%)	9 (22·5%)
16·1–17 ..	11 (27·5%)	5 (12·5%)	10 (25%)	11 (27·5%)	11 (27·5%)	12 (30%)
17·1–18 ..	10 (25%)	6 (15%)	6 (15%)	5 (12·5%)	8 (20%)	7 (17·5%)
18·1–19 ..	5 (12·5%)	11 (27·5%)	5 (12·5%)	1 (2·5%)	7 (17·5%)	7 (17·5%)
19·1–20 ..	6 (15%)	4 (10%)	1 (2·5%)	—	4 (10%)	2 (5%)
20·1–21 ..	—	5 (12·5%)	—	—	—	—
21·1 to above ..	—	8 (20%)	—	—	—	—

Table XXII shows the abnormal serum-potassium levels in the cases thus studied.

Table XXII

	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
Rise	37 (92·5%)	4 (10%)	—	5 (12·5%)	9 (22·5%)
No change ..	—	2 (5%)	1 (2·5%)	19 (47·5%)	7 (17·5%)
Fall	3 (7·5%)	34 (85%)	39 (97·5%)	16 (40%)	24 (60%)

It was observed from these estimations that immediately after the shock there occurred a rise in serum potassium in most cases (Table XXII). The deviation from the initial level varied from +3·2 mg. to −1·4 mg. After two hours of the shock there occurred a fall in most cases (87·5 per cent.) as compared to the level obtained immediately after the shock.

The deviation from the initial level varied from 1·4 to −2·4 mg.

After 4 hours of the E.C.T. it was found that in all cases except one in which no change was seen, the serum-potassium level fell and was below the initial values, the fall varying up to −2·8 mg. The fall was minimum at this phase except in 2 cases (5 per cent.) in which the level had slightly risen from the values obtained after two hours of shock.

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After 24 hours of shock there was a rise in the serum-potassium level from the level obtained after 4 hours of the shock. The deviations from the initial level varied from +0·8 to −0·2 mg.

After 10 shocks the deviation from the initial level varied from +1·2 to −2 mg., the average level being slightly lower.

Conclusion. From this study we find that immediately after the E.C.T. there occurred a slight rise in serum-potassium level. During the next 2–4 hours the process reversed and in nearly all the cases there was a fall. After 24 hours the level came up to near the initial level. After 10 shocks the values obtained were slightly lower in most cases.

Plasma Sodium

The changes occurring in the plasma sodium (mg./100 c.c.) before and after the E.C.T. were as follows:

Table XXIII

	Before Shock	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
Maximum value	338	345	340	348	341	338
Minimum value	360	308	310	322	314	316
Average value	327·4	324·6	326·8	338·3	328·4	328·4

Table XXIV

Plasma Sodium	Before Shock	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
305–310 ..	—	4 (10%)	2 (5%)	—	—	—
311–315 ..	—	7 (17·5%)	1 (2·5%)	—	1 (2·5%)	—
316–320 ..	9 (22·5%)	6 (15%)	8 (20%)	—	4 (10%)	6 (15%)
321–325 ..	7 (17·5%)	4 (10%)	5 (12·5%)	1 (2·5%)	8 (20%)	5 (12·5%)
326–330 ..	9 (22·5%)	9 (22·5%)	11 (27·5%)	4 (10%)	11 (27·5%)	15 (37·5%)
336–340 ..	4 (10%)	6 (15%)	7 (17·5%)	13 (32·5%)	3 (7·5%)	4 (10%)
341–above ..	—	3 (7·5%)	—	14 (35%)	1 (2·5%)	—

The following Table shows the number of cases which showed a deviation from the initial plasma-sodium level:

Table XXV

	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
Rise	10 (25%)	17 (42·5%)	40 (100%)	24 (60%)	23 (57·5%)
No change ..	6 (15%)	4 (10%)	—	8 (20%)	5 (12·5%)
Fall	24 (60%)	19 (47·5%)	—	8 (20%)	12 (30%)

It was observed from these observations that immediately after E.C.T. there occurred a fall in the plasma-sodium level in most of the cases (Table

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XXV). The deviation from the initial level varied from +12 to −14 mg. in different cases. After 2 hours of E.C.T. the value showed a tendency to return to the initial levels but still the extremes varied from +10 to −12. As compared to the readings obtained immediately after shock there occurred a rise in 25 cases (62·5 per cent.) and a fall in 12 cases (30 per cent.).

In all cases, after 4 hours of E.C.T. the plasma-sodium level was higher than the initial figures and reached the maximum value the range being up to 18 mg.

After 24 hours of E.C.T. there was seen a decline in the plasma-sodium level, it being lower than the level obtained after 4 hours of shock in 97·5 per cent. of cases and equal in 2·5 per cent. As compared to the initial level it was lower in 20 per cent. of cases.

After 10 shocks the deviations from the initial level varied from +8 to −7 mg. In 57·5 per cent. of cases it was higher than the initial level and lower in 30 per cent. The average value was very slightly higher than the initial value.

Conclusion. It was seen that immediately after the E.C.T. there occurred a slight fall in plasma-sodium level. After 2–4 hours of shock the process reversed and a rise in the plasma level occurred which came down to the initial levels during the next 24 hours. After 10 shocks no marked change occurred. The values remained within the extremes of normal limits at all times.

Plasma Chloride

The changes which occurred in the plasma-chloride level (mg./100 c.c.) before and after the E.C.T. were as follows:

Table XXVI

	Before Shock	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
Maximum value	390	390	385	405	490	390
Minimum value	340	320	320	350	335	335
Average value	357·1	356·0	357·5	365·5	359·7	359·6

Table XXVII

Plasma Chloride mg./100 c.c.	Before Shock	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
320–335 ..	—	5 (12·5%)	5 (12·5%)	—	1 (2·5%)	1 (2·5%)
336–340 ..	9 (22·5%)	4 (10%)	3 (7·5%)	—	3 (7·5%)	3 (7·5%)
341–350 ..	6 (15%)	7 (17·5%)	9 (22·5%)	1 (2·5%)	8 (20%)	10 (25%)
351–360 ..	9 (22·5%)	13 (32·5%)	7 (17·5%)	8 (20%)	9 (22·5%)	10 (25%)
361–370 ..	7 (17·5%)	7 (17·5%)	9 (22·5%)	6 (15%)	7 (17·5%)	8 (20%)
371–380 ..	6 (15%)	3 (7·5%)	5 (12·5%)	9 (22·5%)	9 (22·5%)	6 (15%)
381–390 ..	3 (7·5%)	1 (2·5%)	2 (5%)	9 (22·5%)	3 (7·5%)	2 (5%)
391–405 ..	—	—	—	7 (17·5%)	—	—

Table XXVIII shows the abnormal plasma-chloride levels in the cases thus studied.

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TABLE XXVIII

	Immediately After	After 2 Hours	After 4 Hours	After 24 Hours	After 10 Shocks
Rise	8 (20%)	11 (27·5%)	40 (100%)	17 (42·5%)	15 (37·5%)
No change ..	8 (20%)	10 (25%)	—	18 (45%)	12 (30%)
Fall	24 (60%)	19 (47·5%)	—	5 (12·5%)	13 (32·5%)

It was found from these estimations that immediately after E.C.T. there occurred a fall in the plasma level of chloride in most cases (Table XXVIII). The deviations from the initial level varied from +20 to −25 mg./100 c.c. in different cases.

After two hours of E.C.T. the value had a tendency to return to the initial levels but still the extremes varied from +10 to −20 mg./100 c.c. As compared to the readings obtained immediately after shock there occurred a rise in 22 cases (55 per cent.), a fall in 13 cases (32·5 per cent), and in the remaining 5 cases (12·5 per cent.) no change.

In all cases after 4 hours of E.C.T. the plasma chloride showed a fresh rise and reached maximum value, the range varying up to 30 mg. from the initial values.

After 24 hours of E.C.T. there was seen a decline in plasma-chloride level, it being lower than the level obtained 4 hours after the shock. The figures came down to near about the initial reading with a variation of +15 to −15 mg./100 c.c.

After 10 shocks the deviation from the initial level varied from +10 to −10 mg./100 c.c., the average level being very slightly higher than the initial values.

Conclusion. From this we find that immediately after the shock there occurred a fall in the plasma-chloride level. After 2–4 hours the process reversed and there occurred a slight rise in its level which came down to the initial level during the next 24 hours. After 10 shocks there occurred a very slight rise in the plasma-chloride level. The values remained within the extremes of normal limit in nearly all the readings.

OBSERVATIONS

1. Patients who suffered from the various types of mental disorders did not show any change in the biochemical findings before the electric convulsive therapy was started nor did they show any deviation from the normal cases.

2. There is an immediate transient hyperglycaemia after electric convulsive therapy. The rise in blood sugar gradually declines and in about 4 hours it reaches practically the normal level. After 10 electric shocks have been given slight rise in blood sugar occurs.

3. There is transient hyperproteinaemia occurring after E.C.T. This rise begins to decline and reaches the initial level in 2–4 hours. After multiple shocks a slight rise is maintained for some days.

4. After E.C.T. there is only slight rise in blood urea and non-protein nitrogen which even persisted for 24 hours in some cases. After multiple shocks the blood urea and N.P.N. do not show any marked change in their blood levels.

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5. There is a rise in the plasma-uric acid level which reaches its maximum in 2–4 hours and the normal level in 24 hours. After multiple shocks there is only a slight rise in some cases.

6. A rise in serum potassium occurs immediately after the shock and then it declines in 2–4 hours and reaches even below the initial figures in the next 24 hours. There is no change in this after multiple shocks.

7. Plasma sodium chloride falls immediately after the shock. It slowly rises above the initial value in 2–4 hours time and then again declines to its normal value in 24 hours time. Multiple shocks do not lead to any change.

8. It was observed from these estimations that there was a close relationship between blood urea and N.P.N. A rise in one accompanied rise in the other and vice versa.

9. Immediately after the convulsions there was a transient increase in all (plasma proteins, urea, N.P.N. and uric acid) the above constituents in most cases. After two to four hours it was seen that though the level of plasma protein came down to about the initial level, the level of others remained at the higher levels and an increase in them persisted in most cases and then decreased, but was still higher than the initial levels even after 24 hours.

10. It was observed that in nearly all the cases a rise in plasma sodium was followed by a rise in plasma chloride and a fall in serum potassium and vice versa.

Conclusions

From the above observations we can make out that there is an immediate rise of the blood-sugar proteins, urea, N.P.N., etc.

The rise in the blood urea, N.P.N. and uric acid may be due to the increased protein metabolism during the convulsions.

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