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STUDY ON SERUM ELECTROLYTE AND BIOCHEMICAL ANALYSIS OF PHSYCOTRIC PATIENTS

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1. INTRODUCTION

Psychiatry is a branch of Medicine which is concerned with the manifestations and treatment of the disordered life, his or her relations with other or the capacity to adapt life in society. The field of psychiatry is diverse and extensive. Psychiatry has been described as the oldest art in Medicine and the newest science. Mental disorders were the first type of illness to be recognized.Major Affective Disorders, a part of psychiatric disorders are a heterogeneous group of disorders are a heterogeneous group of disorders characterized by extreme exaggerations and disturbances of mood and affect cognitive and psychomotor functions. There is a marked tendency to periodicity and recurrence throughout the patient's life time.

The two most prevalent and important diagnostic syndromes among the major affective Disorders are serious mental illnesses that cause significant Social, Vocational and Personal disability and sufferings, (Genderson, 1983).It is not possible in the present state of knowledge to achieve an accurate aetiological classification of psychiatric disorders. It is however possible to separate Organic mental states from those in which no demonstrable organic pathologies was known. The acute organic mental state (Toxic and infective mental states) comprise the syndromes – Delirium, Sub-Delirious state and Korsakow's syndrome. The next group are the organic dementias in which there in which there is damage to the brain due to a variety of causes.

The diagnosis of many of the most important mental disorders relies largely upon descriptions of abnormal experiences and behaviours. Affective Disorders are illnesses in which marked mood change is relatively fixed and persistent and is associated with characteristic changes in thinking, attitude and behaviour. The main varieties of such mood changes are Depression, Elations, and Excitement etc and the corresponding disorders are termed depressive states, manic states, psychosis etc.Herbal remedies and concoctions were used for the treatment of mental disorders by HIPPOCRATES and were described by BURTION in his Anatomy of Melancholy, Sir John Floyer's History of cold Bathing (V Edition, 1722),give a vivid description of the first successful treatment of a case of mania. New drugs with potent actions

on the higher functions of the central nervous system had been discovered which have transformed Psychiatric treatment (Klerman, et al., 1974).

Anti-Psychotropic drugs were used to treat the schizophrenias and mania and psychotic ideations in organic brain psychosis, psychiatric depression, mania and other psychoses.They may be effective in drug induced psychosis in that they quickly lower the arousal or activity level and gradually improve socialization and thinking (Mendham, et al., 1973).In 1949, Australian Psychiatrist John, F.J. Cade discovered Lithium's psycho active properties when he administered Lithium to a group of chronically hospitalized Manic patients. He reported that within weeks these patients were markedly improved, some enough to leave the hospital for the first time in years.

The use of Lithium over the last 35 years has dramatically affected both diagnosis and treatment in Psychiatry. Lithium is highly effective for Affective Disorders. Some Alcohol dependent individuals with affective disorders have been successfully treated with Lithium (hartigan, 1963). This has led to further research on a number of conditions including aqqressive states, movement disorders, droug dependencies and organic brain syndromes (McNeil, et al., 1975).A positive response occurs most frequently in individuals who have blood relatives with a diagnosis of manic or hypo manic attack. Lithium alone or combined with cyclic anti-depressants in the acute phases is useful in the prophylaxis of some recurrent unipolar depressions.

2. MATERIALS AND METHODS

Forty one patients of the age group of 20 to 60 years of Recurrent Manic Depressive disorders of both the sexes formed the material for the present study. They were receiving lithium in doses of 500 to 1000 mg per day. The duration of treatment varied from a minimum of 6 months to a maximum of over 5 to 12 years. Their serum Lithium level were estimated regularly and kept within the therapeutic range of 0.6 to 1.2 mEq per liter. 10 clinically normal samples were also obtained. The various diagnostic categories of psychiatric patients included,

1. Manic Depressive Psychosis
2. Endogenous Depression
3. Recurrent Mania
4. Schizo Affective Disorders

3. SEPARATION OF SERUM

About 7ml of intravenous blood was collected in dry bottles from each patient sepately and allowed to clot. Once the clot had retracted, the serum was separted. The separated serum was centrifuged and any suspended cells were removed during centrifugation. The serum samples were used for the following investigations.

1. Estimation of Lithium
2. Estimation of Potassium
3. Estimation of Calcium

4. Estimation of Chloride
5. Estimation of Creatinine
6. Estimation of Urea.

4. ESTIMATION OF LITHIUM

Estimation of Lithium was carried out by ATOMIC ABSORPTION SPECTROPHOTOMETRY BY LEVINE and FAHY, (1945).

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5. ESTIMATION OF POTASSIUM

The estimation of serum potassium was carried out by FLAME PHOTOMETRIC METHOD of MCINITYRE, (1961).

6. ESTIMATION OF CALCIUM

The calcium level in the serum was estimated by TITRIMETRIC METHOD of CLARK and COLLIP, (1925).

7. ESTIMATION OF CHLORIDE

Serum Chloride was estimated by the TITRIMETRIC METHOD of KING and BAIN, (1960).

8. ESTIMATION OF CREATININE

The estimation of Serum creatinine was carried out by COLORIMETRIC METHOD. It involves the ALKALINE PICRATE METHOD of BROD and SIROTA, (1948).

9. ESTIATION OF BLOOD UREA

Blood urea was estimated COLORIMETRICALLY BY DIACETYL MONO OXIME METHOD OF NATELSON, et al., (1951).

10. RESULTS AND DISCUSSION

The Serum electrolytes – Potassium, Calcium and chloride, and the non-protein nitrogenous compounds, Urea and creatinine are studied. The study comprised of Lithium treated psychiatric patients. Serum samples were collected from patients of both sexes between the age group of 20 to 60 years. The results pertaining to the study are dealt here. A comparison is drawn between the normal individual's psychiatric patients.Table I represents the serum levels of potassium, Calcium, Chloride, Creatinine and Urea of the clinically healthy individuals. The results obtained are well within the normal range.

Table I.NORMAL VALUES OF CLINICALLY HEALTHYINDIVIDUALS

S.no	K^+ mEg/L	Ca^{z+} mg/100ml	Cl^- mEq/L	SCR Mg/100ml	BU Mg/100ml
1.	4.8	9.4	99	0.83	18.1
2.	4.0	10.1	100	0.97	16.3
3.	3.9	9.8	105	0.62	15.7
4.	3.6	10.5	101	0.72	14.0
5.	4.1	10.9	97.7	0.89	24.0
6.	4.5	9.8	103	0.76	26.6
7.	5.1	11.0	102.1	0.96	27.6
8.	4.2	9.9	107.5	0.91	31.9
9.	5.0	10.3	103	1.01	20.0
10.	4.4	10.0	101.3	0.65	34.5

Table II (figI), shows the distribution of Psychiatric patients in accordance to the sex and age group. It is clear from the table that the numbers of patients in the age group of 21 to 40 years are more than the patients in the age group of 41 to 60 years. Out of the total patients, 63% of the patients are in the age group of 21 to 40 years and 37% in the age group of 41 to 60 years. Generally, the total number of male patients age significantly higher than the female patients in both age groups.Major depression is approximately twice as common in men as in women. The onset of episodes is decreased in women until the age of 56, when the risk increases. The risk for men in the younger age is higher and increases steadily with age (VenkobaRao, et al., 1978).

Table II. DISTRIBUTION OF PSYCHIATRIC PATIENTS IN ACCORDANCE TO SEX AND AGE GROUP

Age group in years	**Total number of cases**	**Males**	**Females**
21-40	44	29	15
41-60	26	19	7
Total	**70**	**48**	**22**

Table III. MEAN VALUES OF POTASSIUM, CALCIUM, CHLORIDE, CREATININE AND UREA IN NORMAL AND VARIOUS DIAGNOSTIC CATEGORIES OF PSYCHIATRIC PATIENTS

Diagnostic Categories	Number of cases	K^+ mEq/L	Ca^{2+} mg/100 ml	Cl^- mEq/ L	SCR mg/100 ml	BU Mg/10 0ml
NORMAL	10	4.36	10.2	101.9	0.83	22.8
MANIC DEPRESSIVE PSYCHOSIS	41	3.11	8.57	163.4	1.06	18.4
ENDOGENOUS DEPRESSION	13	2.96	7.64	193.3	0.86	16.0
RECURRENT MANIA	12	2.94	9.48	196.5	1.04	21.0
SCHIZO AFFECTIVE DISORDER	4	3.24	9.28	133.8	1.03	19.8

The distribution of the psychiatric patients under various diagnostic categories and the mean values of electrolytes and non-protein nitrogenous compounds are given in table III. The normal values are also represented in the same. Of the 70 patients, 59% were in Manic depressive psychotics, 19% Endogenous depressive cases, 17% recurrentmanics and only 5% schizoaffective disorders.The most frequently occurring disorders is Manic depressive psychosis, while Endogenous depression and Recurrent mania occur normally. The Schizo Affective disorders are rare and occurs usually below 35 years (Fyro, et.al., 1970)The determined serum values potassium, calcium, chloride, creatinine and Urea are compared for various diagnostic categories are cumulated and hereafter discussed generally as psychiatric patients.

Table IV indicates the mean values of the electrolytes potassium, Calcium and chloride in normal and psychiatric patients. The potassium level is found to decrease in psychiatric patients. The calcium level decreases slightly from the normal values. The decrease is however not significant. Figure III draws a comparison between the serum potassium and calcium levels in normal and psychiatric patients.

A prominent two fold increase in chloride levels is also seen in psychiatric patients from the table. Figure IV give a diagrammatic representation of the same also showing variations in the rise between the male and female patients.

TABLE IV
MEAN VALUES OF ELECTROLYTES IN NORMALAND PSYCHIATRIC CASES

SUBJECTS	K+ mEq/L	Ca2+ ca mg/100ml	Cl- mEq/L
NORMAL	4.36	10.2	101.9
PSYCHIATRIC	3.04	8.6	200.0

Serum potassium and total body potassium may tend to decrease slightly, during lithium therapy in depressed patients but the decrease is not likely to be large enough or last long enough to be psychologically significant (Murphy, et al., 1971). Hypokalaemia has been reported in a patient who ingested an overdose of Lithium (Tweeddale, 1977).Hypokalaemia, as noted in psychiatric patients may be due to decreased uptake, increased renal execution and external loses. It can also result mecely from a shift of potassium into cells without any loss of potassium from the body (Drescher, et al., 1958).

The intravenous venous administration of Lithium (as chloride) may result in a fall in serum potassium concentration. It may be partially due to an increase in potassium excretion. Oral administration of Lithium salts results in Hypokalaemia (Singer, et al., 1955).Serum Calcium does not change significantly during Lithium treatment (Arnoff, et al., 1971).
Renal tubular acidosis is a syndrome which has as its outstanding features, an elevation of serum chloride levels in Lithium treated patients (Reynolds, 1958). Persistent hypo parathyroidism may also promote hyperchloreming which may be due to tubular acidosis (Gyory, et al., 1969).

Table V depicts the mean values of non-protein nitrogenous compunds-creatinine and Urea in psychiatric patients and normal individuals. The normal value for Creatinine ranges from 0.1 to 1.4mg per 100ml and for Urea 14.0 to 38.0mg per 100ml. In our study, the mean values are found to be 1.05mg/ 100ml for Creatinine and 17.3mg/100 ml for Urea in psychiatric patients. The value as evident fall within the normal ranges.

Lithium therapy has been shown to interface with renal acidification methanism (Perez, et al., 1975). Renal tubular damage and Oliquric renal failure are known to Occur as a result of Lithiyum treatment for a long time (Redomski, et al., 1950).Lithium is found to have a milk polydipsic-polyurication. Lithium induced impairment of renal concentration capacity has been studied (Bucht, et al., 1950).Lithium is found to have a mild polydipsic-polyurication. Lithium

induced impairment of renal concentration capacity has been studied (Bucht, et al., 1978).The mean values of the electrolytes and non-protein nitrogenous compounds in psychiatric patients with varying durations of Lithium therapy are shown in table VI. The patients are grouped into therapy below one year, one to three years, three to five years and above 5 years. The maximum number of patients in our study are found to be having therapy for a duration of below one year.Only a few patients are found to have THERAPY FOR OVER 5 YEARS. THE SERUM POTASSIUM LEVELS are decreased in all the patients. The decrease is significant in the earlier stages of treatment and insignificant in patients who are on long term therapy. The Urea and Creatinine values shown deviation from normal levels.

TABLE - V
MEAN VALUES OF NON-PROTEIN NITROGENEOUS COMPOUNS IN NORMAL AND PSYCHIATRIC SUBJECTS

SUBJECTS	SCR Mg/100ml	BU Mg/100ml
NORMAL	0.83	22.81
PSYCHIATRIC	1.05	17.3

TABLE - VI
MEAN VALUES OF POTASSIUM, CALCIUM, CHLORIDE, CREATININE, UREA IN PSYCHIATRIC PATIENTS WITH VARYING DURATIONS OF LITHIUM THERAPY

DURATION OF LITHIUM THERAPY	Number of cases	K^+ mEq/ L	Ca^{2+} Mg/100 Ml	Cl^- mEq/ L	SCR Mg/100ml	BU Mg/100 Ml
BELOW ONE YEAR	30	3.05	8.57	203.3	17.0	1.01
ONE TO THREE YEAR	15	3.09	8.81	188.8	17.1	1.1
THREE TO FIVE YEAR	20	3.26	9.32	156.1	18.7	1.02
ABOVE FIVE YEAR	5	3.37	9.5	120.7	18.2	1.07

Lithium carbonate affects ionic fluxes across cell membrane particularly, potassium, Calcium, Chloride, etc. (Carman, et al., 1974). Electrolyte changes may be connected with the increase in adrenocortical activity that has been demonstrated in severe depressive illness (Baey, et al.,

1970).The levels of various electrolyte bending to come to normal over a long period of Lithium therapy indicates that the patient has attained a stable state and is recovering (Durell, 1974).

Renal acidification defects have been observed by many in experimental animals after administering pharmacological doses of Lithium, though the significance of these Lithium induced impairment in renal acidification mechanism is not known (Roscoe, et al., 1976).Lithium treated patients might as a group have a greatest urinary output than normal controls, the glomerular filtration rate has been found to be normal in all Lithium treated patients. Thus Lithium decreases the renal concentration and acidification ability to some degree in some patients (Viol, et al., 1978).

Table VII indicates the relationship between the oral dosage, duration of therapy and serum Lithium levels in psychiatric patients. It is evident that there is a lines relationship between the daily dosage and serum lithium levels and between the daily dosage and duration of therapy. Figure V and VI represents this graphically. Patients who are on long tern Lithium therapy (i.e) for over a period of 5 years, have a minimum dosage for stable state and only a minimum maintenance dosage is given to them. The patients, who are on therapy for just below one year period, have high dosages of Lithium. This shows that the patients are on the initial stages of the disorder which might be severe than the patients who are already on Lithium treatment.

TABLE - VII
DURATION OF LITHIUM THERAPY, ORAL DOSAGAE AND SERUM LEVELS

DURATION OF THERAPY	ORAL DOSAGE IN mgd/DAY	SERUM LITHIUM Level mEq/L
BELOW ONE YEAR	1000	1.0
ONE TO THREE YEARS	800	0.8
THREE TO FIVE YEARS	750	0.7
ABOVE FIVE YEARS	500	0.6

TABLE - VIII
MEAN VALUES OF ELECTROLYTES AND NON-PROTEIN NITROGENOUS COMPOUNDS IN, PSYCHIATRIC PATIENTS UNDER VARYING DOSAGESOF LITHIUM

LITHIUM DOSAGE Mg/DAY	Number of cases	K+ MeG/ L	Ca2+ Mg/100 Ml	Cl mEg/ L	SCR Mg/100ml	BU Mg/10 0ml
500	5	3.67	10.03	118.9	0.89	22.2
750	20	3.72	9.91	127.0	1.00	18.7
800	15	3.9	9.33	134.4	1.12	19.9
1000	30	3.3	8.67	171.7	1.33	27.0

Table VIII represents the mean values of Electrolytes and non-protein nitrogenous compounds for psychiatric patients who are on Lithium therapy with varying daily dosages. The Lithium dosage varies from 500 to 1000mg according to the severity of the disease. The maximum numbers of patients are seen to have a Lithium dosage of 100mg. The serum potassium and calcium levels are decreased in patients who are taking 1000mg of Lithium carbornate. The levels are normal or nearly normal in patients, who are taking 500 to 750mg per day of Lithium carbonate. The serum chloride levels are found to be remarkably increased in patients with the highest dosage per day. The Urea and creatinine values are found to be well within the normal range.

Higher dosages tend to affect the electrolyte levels in body fluids. Lithium has an influence on the ionic balance of psychiatric patients (Glen, et al., 1984).There have been reports that along tern Lithium usage with a consistently high dosage affects glomerularfiltration rate and may cause renal failure (Hallgren, et al.,1979).All forms of hyper adrenocorticism are characterized Lithium toxicity is also reported to cause hypokalaemia (Habibzadeh, et al., 1977).Hypocalcaemia in majority cases may be attributed to disturbances in either the production, metabolism or response to PTH and/or Vitamin D. In our study, since no significant decreases are noted, it is clear that the production and metabolism of PTH and Vitamin D might be normal in Psychiatric patients.Reduction in total serum calcium can be produced by a reduction in the ionized sercum levels (Birge, et al., 1969). Hypocalcaemia is usually associated with hypokalaemia.

In successful treatments of Hyperparathyroidism or thyrotoxicosis, bone formation may exceed resorption. Massive renal deposition results in hypocalcaemia with significant behavioural disturbances (Vincent, et al., 1962).Chronic acidosis with normal glomerular filtration rate also

enhances urinary calcium excretion by a direct tubular mechanism and on this produces hypocalcaemia or a tendency to hypocalcaemia (Gonick, et al., 1973).No significant changes in the electrolytes and non-protein nitrogenous compounds indicates that the psychiatric patients who are under Lithium therapy respond well to the treatment (VenkobaRao, et al.,1977).

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