ALCOHOLISM : NEWER METHODS OF MANAGEMENT

SARADA SUBRAHMANYAM, M. SATYANARAYANA AND K. R. RAJESWARI

Department of Physiology,
Voluntary Health Services Medical Centre,
Adyar, Madras - 600 113

(Received on July 20, 1985)

Summary : Chronic alcoholics were selected from hospitals and A.A. Centres and subjected to different methods of treatment namely, psycho therapy, stereotaxic surgery, nonvolitional biofeedback, Yoga and meditation and extremely low frequency Pulsed Magnetic Field. Each group comprised a minimum of 20 subjects. All were males between the ages of 20 and 45 years. Investigations done were clinical, psychological, biochemical, neurochemical and electrophysiological. Improvement was noticed in allthe patients, the degree varying with the different methods of treatment. The patients were followed up at least for a period of one year.

Kay words : alcoholism psychotherapy stereotaxic surgery
yoga and meditation nonvolitional biofeedback pulshed magnetic field

INTRODUCTION

Alcoholism is the third largest killer disease in the world, cancer and heart attack being the first and second. Alcoholics are those excessive drinkers whose dependence on alcohol has attained such a degree that it shows a noticeable mental disturbance or interference with their physical and mental health. Their inter-personal relations and the smooth social and economic functions are also affected. Understanding the problem of this deadly afflictions is an important step in tackling it. All along alcoholism has been treated as a symptom of a psychological disorder or an environmental factor. Today it

Address for correspondene and reprints : Dr. (Mrs.) Sarada Subrahmanyam, "Springfield" 9, Jagannathan Road, Nungambakkam, Madras - 600 034

has been recognised as a primary disease, a disease, by itself causing mental, emotional and physical problems. It has become an urgent need to find a comprehensive method of treatment, suitable for each individual, thus offering succour to the afflicted as well as to the rest of the family and to the society at large.

Alcohol is the most widely used psycho active substance among human population today. Different disciplines are involved in the treatment and for prevention. These include psychiatry, psychology, occupation therapy, medicine, surgery, physiology and biochemistry. Though many take alcohol, it is surprising that every one does not get addicted.

MATERIAL AND METHODS

Chronic alcoholic subjects were selected from one of the Alcoholic Anonymous (A.A.) Centres, Institute of Mental Health, Dr. Boaz Rehabilitation Centre and from the Institute of Neurology at Madras. All of them were males between the ages of 20-45 years. All the subjects selected in the study were addicted only to alcohol. The general characteristics symptoms were insomnia, fear, irritability, apprehension, tremors, aggressive or depressive behaviour with suicidal tendencies in some. Consciousness was clouded and they were greatly confused with disorientation of time and space. Speech was incoherent and gait unsteady In our study it was found that motivations for alcohol intake were due to factors like curiousity, entertainment in case of company executives, profound influence of peer group or other emotional problems like loss of dear onse or failure in love etc.

The different types of treatment given to them were : (1) Psychotherapy, (2) Stereotaxic surgery, (3) Nonvolitional biofeedback, (4) Yoga and meditation and (5) Extremely Low Frequency Pulsed Magnetic Field. Each group comprised a minimum of 20 subjects. For the successful completion of the treatment two conditions were observed, willingness of the patient for the treatment and the therapist's attitude towards the patient. All the patients had intense desire to get rid of the habit but were helpless.

1. *Psychotherapy with drugs :* The procedure is to withdraw alcohol by reducting the dosage over a period of time. For this the patient was hospitalised end detoxification done by continuous intravenous glucose and antabuse was administered. Suitable therapy - work having a real meaning to the patient so that his energies and feelings were channelled through it was given to them. Alongwith psychotherapy, meditation was practised by about 50% of the subjects in the mornings and evenings.

2. *Cingulumotomy (Stereotaxic Surgery) :* In severe cases who did not respond to other methods of treatment, stereotaxic surgery - bilaternal cingulumotomy was performed in the Institute of Neurology. On the basis of the X-ray measurements and the brain atlas for South Indian subjects, the canula tip of the stereotaxic equipment is guided through a burr hole and bilateral destructive lesions were produced in the cingulum by injecting a mixture of wax, olive oil and myodil, the quantity varying from 0.5 to 0.8 *ml.* The patients were discharged from the hospital normally on the third day. In a few cases sequential surgery had to be performed.

3. *Nonvolitional Biofeedback :* It is a technique by which a physiological function such as electrical activity of the brain is presented to a person usually in the form of visual or auditory signal (17). No active effort and co-operation from the subjects are needed. The monitor consists of an EEG amplifier and four active filters to split the waves into four different bands, delta (0.5-3 5 Hz.), theta (4-7 Hz) alpha (8-13 Hz.) and beta (14-30 Hz). The alpha waves from the tempero-occipital region were fed back to the patient in the form of a flickering light. The frequency of the flicker corresponded with the intensity of the alpha rhythm. This therapy was given to a group of 20 patients.

4. *Yoga and Meditation :* Yoga and meditation are ancient scientific disciplines which serve to co-ordinate different aspects of human personality thus bringing about a state of equilibrium between tbe mind and the body (21). This method was used in patients of a higher economic status in one of the A.A. Centres and in a rehabilitation home. The asanas normally practised by all of them were Vajrasana, Padmasana Shavasana, Makrasana, Bhujangasana and Ardha Halasana. In addition, they practiced pranayma and meditation twice a day in the morning and evening for 30 min for about 3 months in the centres and later at home.

5. *Pulsed Magnetic Field (PMF) therapy :* Our experiments have shown that alternating magnetic fields of frequencies at the extremely low range and amplitude of a few tens of nano-Teslas seem to affect the electrophysiology neurochemistry and biochemistry of human subjects. We have found that one particular window of the magnetic spectrum is highly beneficial not only in alcoholism, but also in certain orthopaedic conditions and psychiatric disorders (23). The subjects were made to sit in a special CMF enclosure fabricated by ourselves and exposed to pulsating magnetic field of low frequency of 0.1 Hz and amplitude of $\pm$300 nT for 30 minutes every day for 30 days. This is a new technique of noninvasive therapy and all the 20 patients who started the treatment completed the course successfully. They were followed up for 9 to 10 months.

INVESTIGATIONS

The investigations carried out were : Clinical (general and neurological examinations), Psychological (modified peraonality rating scale and Weschler's tests), Haemotological (Haemoglobin (Hb) RBC-TC, WBT-TC, ESR and Prothrombin time and ESR) Biochemical (a) Blood Sugar (16), Cholesterol (2), Plasma cortisol (3), Lactic acid (4), PBI (1), Cholines terase (8), Calcium (5), and Magnesium (15); (b) C.S.F. MHPG, HVA & 5-HIAA (12) and (c) Urine-MHPG and HVA (18 and 19), VMA (3), 5-HIAA (20), 17-Ketosteroids (10) and Total Catecholamines (14).

RESULTS

There was clinical improvement in different degrees in response to different methods of treatment. The psychological assessment showed improvement in the affective symptoms in all groups.

Haemogram was done only in cases treated by nonvolitional biofeedback, Yoga and Pulsed Magnetic Field (PMF) therapy. The alcoholics were anaemic. WBC count and ESR were high. After treatment there was a tendency for the restoration of the normal levels. No changes observed in blood sugar and protein bound iodine. Cholesterol and lactic acid were high.

Plasma cortisol was significantly high in alcoholics. After psychotherapy within a period of about 9 months, the cortisol level came down to normal. Immediately after surgery there was an elevation of the plasma cortisol but it was almost normal after 3 months. After nonvolitional biofeedback, PMF and Yoga therapy the levels of plasma cortisol was restored to normal (Table I).

The serum cholinesterase was low in alcoholics and it increased after Yoga and PMF therapy. Calcium and magnesium levels in serum were low in alcoholics After nonvolitional biofeedback, Yoga and PMF therapy they gradually rose up to almost the normal levels (Fig. 1).

In alcoholics 5-HIAA was roughly about half of the normal value in CSF, HVA did not show any perceptible change and MHPG was raised from 20 to 26 *ng/ml* (not significant). In the urine, total catecholamines, MHPG, VMA and 17-ketosteroids were

TABLE I : Biochemical parameters in blood — Comparison between A and B, B and C_1, C_2, C_3, C_4 and C_5 and also between the different groups where the values are significant.

	Groups	*No*	*Sugar (mg/dl)*	*Cholesterol (mg/dl)*	*PBI (μg/dl)*	*Lactic acid (mg/dl)*	*Cortisol (mg/dl)*
A	Normal	20	94±6	164±12	5.1±0.5	9.0±0.9	10.8±0.8
B	Alcoholic	20	97±7 A : B<0.7*	210±13 A : B<0.01**	4.2±0.5 A : B<0.2*	17.0±1.2 A : B<0.001***	26.2±0.5 A : B<0.001***
	AFTER TREATMENT						
C_1	Psychotherapy (9-12 months)	20	92±5 B : C_1<0.5*	180±12 B : C_1<0.05**	4 : 6±0.5 B : C_1<0.5*	11.5±0.9 B C_1<0.001***	12.6±0.8 B : C_1<0.001***
C_2	Cingulumotomy (3 months)	20	91±5 B : C_2<0.4*	180±12 B : C_2<0.05**	5.0±0.5 B : C_2<0.2*	12.0±1.1 B : C_2<0.001***	12.2±0.9 B : C_2<0.001***
C_3	Biofeed Back (6 months)	16	93±6 B : C_3<0.6*	196±12 B : C_3<0.04**	5.1±0.5 B : C_3<0.2*	12.0±1.0 B : C_3<0.001***	10.0±0.8 B : C_3<0.001*** C_1 : C_3<0.02** C_2 : C_3<0.05**
C_4	Yoga and Meditation (12 months)	20	92±6 B : C_4<0.5*	182±12 B : C_4<0.06**	4.8±0.5 B : C_4<0.3*	10.8±0.8 B : C_4<0.001***	10.8±0.6 B : C_4<001*** C_1 : C_4<0.05**
C_5	PMF therapy (1 month)	20	93±6 B : C_5<0.6*	172±11 B : C_5<0.02**	4.9±0.5 B : C_5<0.3*	10.6±0.8 B : C_5<0.001***	10.6±0.5 B : C_5<0.001*** C_1 : C_5<0.02**

P Values *Not Significant ; **Significant ; ***Highly Significant.

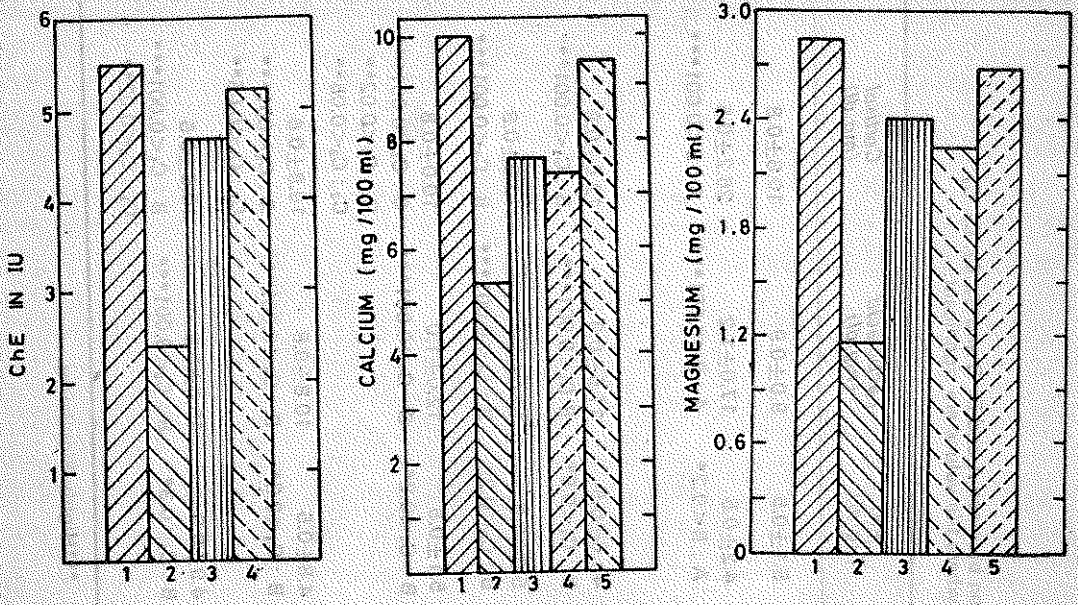

Fig. 1 : Serum Cholinesterase, Serum Calcium and magnesium levels in different types of subjects. (1) Normal, (2) Alcoholic, (3) After biofeedback therapy, (4) After Yaga and (5) After PMF.

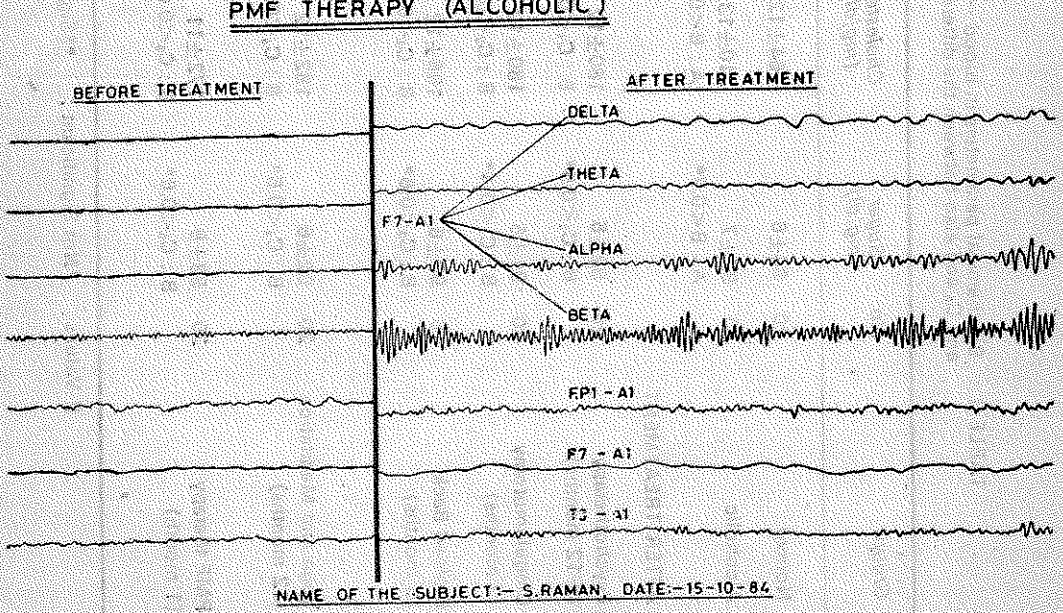

Fig. 2 : EEG record of an alcoholic before and after PMF therapy.

high in alcoholics, whereas HVA and 5-HIAA were within normal limits. After psychotherapy with drugs for a period of 12 months improvement in the amine levels was noted. It was observed that four days after cingulumotomy there was an elevation in 5-HIAA but was restored to normal after treatment. After Yoga and Meditation and PMF therapy for six months and one month respectively there was a significant adjustment in all the amine levels both in the urine and CSF After nonvolitional biofeedback MHPG in CSF and total catecholamines, MHPG, VMA and 17-ketosteroids in the urine came down to normal (22) (Tables II, III, IV).

EEG studies after Yoga, nonvolitional biofeedback and PMF therapy showed an enhancement of the beta rhythm and also alpha. Fig. 2 depicts the enhancement of the brain electrical activity of an alcoholic after PMF therapy.

There was improvement in the condition of the patients in different degrees in response to different methods of therapy. The success rate was 50% by psychotherapy, 43% by psychosurgery, 53% by nonvolitional biofeedback, 62% by Yoga and meditation and 75% by PMF therapy (Fig. 3).

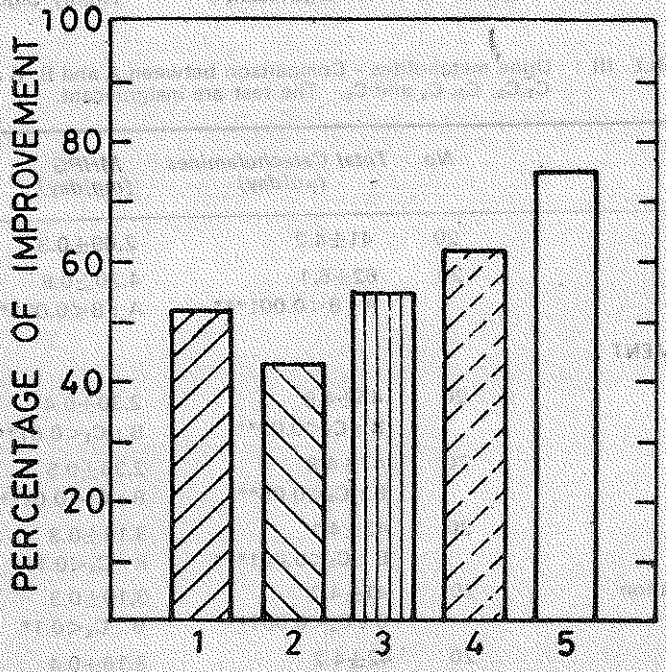

Fig. 3 : Percentage of improvement after different types of treatments (1) Psychotherapy (2) Cingulumotomy (3) Nonvolitional biofeedback (4) Yoga and meditation and (5) P.M.F. therapy

TABLE II : Lumbar C.S.F. – Comparison between A and B, between B and C_2, C_3, C_4 and C_5. Between the groups the values are not significant.

	Groups	*No.*	*5-HIAA*	*MHPG*	*HVA*
A	Normal	15	40.6±4.2	20.6±2.4	40.2±4.0
B	Alcoholic	15	20.6±1.2 A : B<0.001***	26.2±2.6 A : B<0.1*	40.4±3.6 A : B<0.9*
	AFTER TREATMENT				
C_2	Cingulumotomy (3 months)	20	32.4±3.2 B : C_2<0.001***	18.6±2.6 B : C_2<0.02**	40.0±3.2 B : C_2<0.9*
C_3	Biofeedback (6 months)	10	36.6±4.1 B : C_3<0.001***	19.2±2.3 B : C_3<0.05**	39.1±4.0 B : C_3<0.9*
C_4	Yoga and Meditation (12 months)	10	38.8±4.2 B : C_4<0.001***	20.3±2.3 B : C_4<0.05**	39.6±4.1 B : C_4<0.8*
C_5	PMF therapy (1 month)	10	41.0±4.0 B : C_5<0.001***	19.6±2.2 B : C_5<0.05**	40.1±4.0 B : C_5<0.9*

P Values * – Not Significant ; ** – Sigoificant ; *** – Highly Significant

TABLE III : Urine metabolites - Comparison between A and B, B and C_1,C_2, C_3, C_4 and C_5. The rest are insignificant.

	Groups	*No*	*Total Catecholamines (µg/day)*	*MHPG (mg/day)*	*VMA (mg/day)*
A	Normal	20	41±4.2	2.09±0.3	4.8±0.8
B	Alcoholic	20	62±6.1 A : B<0.001***	4.20±0.6 A : B<0.001***	6.9±0.8 A : B<0 05**
	AFTER TREATMENT				
C_1	Phychotherapy (9-12 months)	20	45±4.9 B : C_1<0.02**	2.30±0.4 B : C_1<0.01**	5.0±0.7 B : C_1<0.05**
C_2	Cingulumotomy (3 months)	20	47±4.8 B : C_2<0.05**	2.36±0.5 B : C_2<0.01**	5.0±0.7 B : C_2<0.05**
C_3	Biofeedback (6 months)	20	42±4.1 B : C_3<0.001***	3.14±0.3 B : C_3<0.1*	4.9±0.8 B : C_3<0.05**
C_4	Yoga and Meditation (12 months)	20	41±4.2 B : C_4<0.001**	3.10±0.3 B : C_4<0.1*	4.8±0.8 B : C_4<0.05**
C_5	PMF therapy (1 month)	20	42±4.2 B : C_5<0.4*	3.16±0.4 B : C_5<0.1*	4.9±0.8 B : C_5<0.05**

P Values * – Not Significant ; ** – Significant ; *** – Highly Significant

TABLE IV : Urine metaboltes — Comparion between A and B, B and C_1, C_2, C_3, C_4 and C_5. The others are insignificant.

	Groups	*No*	*5-HIAA*	*HVA*	*17-ketosteriods*
A	Normal	20	4.36±0.9	8.2±1.2	12.0±1.2
B	Alcoholic	20	0.60±0.8 A : B<0.8*	8.2±1.0 A : B<0.9*	19.2±1.9 A : B<0.001***
	AFTER TREATMENT				
C_1	Phychotherapy (9-12 months)	20	4.20±0.7 B : C_1<0.7*	7.9±0.9 B : C_1<0.8*	14.0±1.5 B : C_1<0.02**
C_2	Cingulumotomy (3 months)	20	3.90±0.8 B : C_2<0.05*	7.2±0.7 B : C_2<0.4*	13.6±1.3 B : C_2<0.01**
C_3	Biofeedback (6 months)	20	4.20±0.9 B : C_3<0.9*	8.1±1.1 B : C_3<0.9*	12.8±1.1 B : C_3<0.001***
C_4	Yoga and Meditation (12 months)	20	4.30±0.9 B : C_4±0.4*	8.2±1.2 B : C_4<0.9*	12.4±1.2 B : C_4<0.001***
C_5	PMF therapy (1 month)	20	4.32±0.9 B : C_5<0.4*	8.1±1.2 B : C_5<0.9*	12.2±1.2 B : C_5<0.001***

P Values * — Not Significant ; ** — Significant ; *** — Highly Significant

DISCUSSION

Every state of behaviour, disturbed or undisturbed is dependent on a given functional state of the brain, a state which in principle can be analysed and is influenced by biochemical or physiological (depth electrodes) means To put it briefly, there is no disturbed behaviour without corresponding cerebral substrate. This statement does not mean that behavioural disorders are diseases of the brain. What it does hold is that the pathogenic influence of any kind, be they psychological, environmental or somatic do not affect mental life directly but only indirectly via changes in cerebral organization. The brain takes the role of an intermediary agent.

The important haematological changes seen in this study are decrease of haemoglobin content and RBC-TC. Decrease in acetyl cholinesterase may be the result of toxicity in the blood.

Various reasons have been put forward for the lowering of the levels of magnesium and calcium. Enhanced urinary excretion and poor dietary intake of magnesium can cause a significant reduction of Mg in chronic alcoholics. Hypomagnesemia associated with hypocalcemia in the alcoholics, may be the result of malabsorption. Magne- and calcium deficiency syndrome exhibits in the form of tremors, athetoid movements of the extremities, mental aberration and convulsions. These symptoms were seen in a few alcoholics studied. It is a well-known fact that stored functional pool of the NA-ATP, $Ca^2 \pm Mg^2 \pm$ complex from vesicles in the cytoplasm of the brain tissue were released when catecholamines are metabolised by MAO. Generally alcoholics take less amount of food. Malnutrition may be one of the causes for changes in the biochemical parameters. But all our subjects come under socio economic group I (Ref : Government of India : Standard Industrial and Occupational Classification, Central Statistical Organization, New Delhi, 1962 - Group I) and are not malnourished. Hence it can be presumed that the biochemical changes in the present study are due to alcoholism and not due to malnutrition.

Under normal circumstances the liver converts lactic acid to glycogen. In alcoholics, the alterations in the liver enzyme activities may cause impairment in the conversion of lactic acid to glycogen leading to its accumulation in blood. Chronic alcoholism is one of the principle causes of liver disease (7), Three histologically distinct types of liver damage which often overlap are; fatty liver, alcoholic hapatitis and cirrhosis, Increase in the blood cholesterol, lactic acid and cortisol and in urine, catecholamines, MHPG, VMA and 17-ketosteroids and reduction of 5-HIAA in CSF are significant in alcoholics when compared to the normal subjects (B Group Versus A). The levels of plasma cortisol, catecholamines and their metabolites, and 17-ketosteroids may be attributed to increased adrenocortical activity due to alcohlic stress. The altered metabolism of 5-HT perhaps by its diversion to a reductive pathway producing 5-hydroxy tryptophol may account for the lowering of 5-HIAA levels in CSF and urine(9). Reduced alpha and beta rhythms in alcoholics indicate decreased brain function.

In all the alcoholic groups after treatment (C_1, C_2, C_3, C_4, and C_5) the parameters except sugar and cholesterol in blood; HVA in CSF and 5-HIAA & HVA in urine are found to be significantly lower than before treatment (B Group Versus C_1, C_2, C_3, C_4, and C_5). Comparison between B and C_1, C_2, C_3, C_4, and C_6 are depicted in the Tables II, III and IV.

The increased levels of MHPG in CSF and urine in alcohol addicts indicate that more catechol amines from the cortical, subcortical and hypothalamic neurones are released

The euphoric state after alcohol intake may be due to a selective action on the recticular formation of the brain stem as proposed by Caspers (6).

Insomnia in alcoholics may be due to the fact that alcohol modifies the ratio of REM (rapid eye movement) to non-REM sleep probably controlled by an ascending serotonergic pathway from the raphe nuclei of the brain stem (11).

The ataxic symptoms seen in the alcohol addicts may be partly due to the depressive action of alcohol on the cerebellar Purkinje cells and partly due to the modification of the spontaneous activity and responsiveness of vestibular neurons.

Biofeedback, like Yoga therapy tends to restore the normal equilibrium between the neurotransmitters. The reduction in cortisol, VMA and MHPG may be due to lessened neuronal triggering to the extreneous stimuli. Insomnia in alcoholics disappeared after the PMF therapy. Perhaps the altered ratio of REM to non-REM sleep is set right by the magnetic micropulsations.

In conclusion it can be said that there was clinical improvement in different degrees in response to different methods of treatment as depicted in Fig. 4. The noninvasive PMF therapy seems to be more effective and offers a new hope for the innumerable sufferors of alcoholism.

ACKNOWLEDGEMENTS

We are grateful to the Department of Science and Technology and the Indian Council of Medical Research for the financial assistance for this work.

REFERENCES

1. Acland, J.D. The estimation of serum protein bound iodine by alkaline incineration. *Biochem. J.*, **66** : 177-180, 1957.
2. Anderson, J.T. and A. Keys. In : Microanalysis in biochemistry. 179-181. I.D.P. Wootton, Ed. Churchil Livingston, London, 1974.
3. Armstrong, M.D., A. McMillan and K.N. Shaw. 3-Methoxy 4 - hydroxy D-mandellic acid, a urinary metabolite of noradrenaline, *Acta. Biochem. Biophysics*, **25** : 422-435, 1957.

4. Barker, S.B. and W.H. Summerson. Estimation of lactic acid in blood. *Biol. Chem.*, **138** : 535-537 1941.

5. Baron, D.N. and J.L. Bell. Calcium levels in body fluids. *Clin. Chim. Acta.* **2** : 327-329, 1957.

6. Caspers, H. H. Die Beeinflussung det corticalen Krampferregbarkeit durch das Augsteigends Reticular system des Hirnstammes. II Narkosewirkungen, *Z. Gesamte Exp. Med.*, **129** : 582-600, 1958.

7. Davis, V.K. and M.J. Walsh. Alcohol, amines and alkaloids. A possible biochemical basis for alcohol addiction. *Sc.*, **167** : 1005-1007, 1970.

8. De La Huerga, J., C. Yesinick and H. Popper. Colorimetric method for the determination or serum cholinesterase. *Am. J. Clin. Path.*, **22** : 1126-1129, 1952.

9. Feldstein, A. Ethanol-induced sleep in relation to serotonin turnover and conversion to 5-hydroxy indole acetaldehyde, 5-hydroxy tryptophol and 5-hydroxy indole acetic acid. *Ann. N.Y. Acad. Sci.*, **215** : 71-76, 1973.

10. Glenn, E.M. and D.H. Nelson. 17-Ketosteroids determination in urine. *J. Clin. Endocrin.*, **13** : 911-921, 1953.

11. Jouvet, M. Recherches surles structures nerveuses at les Mechanismes Responsables des Differentes Phases du-sommeil Physiologique. *Arch. Ital. Biol.*, **100** : 125-206, 1962.

12. Korf, J., H.M. Van and J.B. Sebens. Spectroflourimetry MHPG, 5-HIAA and HVA in CSF. *Biochem. Pharmacol.*, **20** : 659-668, 1971.

13. Mattingly, D. Determination of plasma 11-hydroxy corticosteroids. *Ann. J. Clin. Path.*, **15** : 374-379, 1962.

14. Molinoff, P.B. and J. Axelord. Biochemistry of catecholamines. *Ann. Rev. Biochem.*, **40** : 465-500, 1971.

15. Neill, D.W. and R.A. Neely. Assay of magnesium in biological tissues. *J. Clin. Path.*, **9** : 162-163, 1956.

16. Nelson, N. In : Methods in enzymology. pp. 85-87, 1957 S.P. Colwick and N.P.O. Kaplana Eds, Academic Press Inc., New York.

17. Ramamurthi, B., C.U. Velmurugendran and T.M. Srinivasan. Neurological treatment in psychiatry, pain and epilepsy. William H. Sweet ed. Uni. Park Press, 309-316, 1977.

18. Ruthven, R.J. and M. Sandler. Estimation of HVA in urine. *Biochem. J.*, **83** : 30-32, 1962.

19. Ruthven, R.J. and M. Sandler. Estimation of MHPG in urine. *Clin. Chem. Acta.*, **12** : 318-324, 1965.

20. Sarada Subrahmanyam and S. Narayanan. A quick colorimetric method of estimation of 5-HIAA in urine. *Curr. Med. Pract.*, **17** : 46-47, 1973.

21. Sarada Subrahmanyam. Neurohumoral Correlates of Behaviour. *Ann. Natl. Acad. Med. Sci.* (India), **16(2)** : 73-88, 1980.

22. Sarada Subrahmanyam. Nonvolitional biofeedback in psychiatric disorders - Assessment by biochemical and electrophysiological studies. *J. Biomedicine*, Vol. 2, No. **2**, : 3-11, 1982.

23. Sarada Subrahmanyam, P.V. Sanker Narayan, K.S. Rajeswari and M. Satyanarayana. Preliminary report on the effect of ELF magnetic Pulsations on human subjects *Bioelectrochemistry and Bioenergetics*, Vol. 14, No. I-III : 756-766, 1985.