(manuscript of Journal of Bioelectricity, 3(1&2), 193-221, 1984)

TREATMENT OF DRUG, ALCOHOL AND NICOTINE ADDICTION BY NEUROELECTRIC THERAPY: ANALYSIS OF RESULTS OVER 7 YEARS

Margaret A. Patterson, M.D., Jean Firth, M.D., Richard Gardiner, M.D.
104 Harley St.
London W1N 1AF, England

ABSTRACT

NeuroElectric Therapy (NET) is a 10-day treatment with a transistorized stimulator, which rapidly reduces both acute and chronic withdrawal symptomatology of all chemical substances, without drugs and with no negative side-effects. It is hypothesized that NET acts by specific electrical frequency stimulation of endorphin production that has been decreased due to chronic substance abuse. This has been demonstrated using NET in rat models; corticosterone levels and hepatic enzyme activity were also significantly altered. Of 186 patients, 98.4% were successfully detoxified, with marked feeling of well-being and no craving (in 95%) or anxiety (in 75%). Detailed assessments of abstinence syndrome in NET are given. Of a 50% response to follow-up, 78.5% were addiction-free (80.3% of drug addicts) 1 to 8 years after NET, although average time in rehabilitation was only 16 days. Alcohol, marijuana and cigarette use were decreased in 64%. Diminished substance use was reported in 76% of recidivists.

INTRODUCTION

In November, 1972 in Hong Kong, Dr. Wen, a surgical colleague of Dr. Patterson, while investigating the possible usefulness in neurosurgery of electroacupuncture for analgesia, made a serendipitous discovery of a potential "cure" for drug addiction (1). In the following 9 months, over 100 drug addicts were treated in Hong Kong, with consistent results. Dr. Patterson soon became convinced that the key curative factor lay in the electrical impulse and not in the acupuncture system (2).

Fifteen months' experimentation in London proved acupuncture needles unnecessary for effective treatment; the use of surface electrodes eliminated both needle pain and the risk of infection (3). Empirically, the area above the mastoid process was found to be a more effective site of stimulation than the original site in the concha of the ear. Subsequent laboratory research has shown that differing biochemical effects are produced by stimulation at different sites on the body (4).

Low voltage electrical stimulation is now used in the treatment of several ailments (5). The uniqueness of NeuroElectric Therapy (NET) lies in the precise selectivity of differing forms of current. Laboratory research into NET using animal models has confirmed to a remarkable degree the accuracy of the empirical clinical choice of optimum wave-shape (6), pulse-width and current frequency (7) for treating each group of psychoactive drugs.

This necessary specificity causes problems to practitioners who use NET without adequate experience. However, the latest model of stimulator is fully programmed and automated for different drug-groups, drug-combinations and the longer term abstinence symptoms such as depression and insomnia.

Although NET can be used either in an inpatient or outpatient setting (the stimulator is pocket-sized and the patient is completely mobile throughout the 10-day treatment), the first follow-up of NET patients (8) showed that long-term outcomes (LTO) are considerably better for inpatients. This may be due to the fact that unless the patient has a supportive family or community who are able to give constant supervision, he is likely to use drugs or alcohol during treatment; the clinical evidence is that concomitant drug use slows down the beneficial effects of NET. (It may, in fact, produce severe aversive effects, particularly cocaine use.) Even nicotine addicts find 3 to 4 days of inpatient treatment preferable, because it is easier for them to stop their cigarettes totally when away from the stresses or daily life.

It has been shown that NET produces enhanced hepatic function, and increased plasma β-endorphin levels in the human (unpublished observations); and alterations in corticosterone (7), tryptophan and HIAA levels (9) and hepatic enzyme activity (10) in rat models. Other researchers have demonstrated rapid rises of β-endorphin levels in the CSF of patients given per- or transcutaneous electrical stimulation (11, 12, 13). These findings support the hypothesis that NET produces its effects by biochemical or electrochemical processes (the stimulation of endorphin or enkephalin production, reduced by chronic drug use (14), being one) which are controlled by the type of electrical signal (5); and that the placebo effect plays only a minor part.

METHODS

Patients treated by NET for addictions are described in Table 1. All but 4 in this review were treated in London or at a Clinic in Sussex but came from a variety of countries. The Clinic was operated from January to December, 1980, specifically for a larger-scale clinical trial of NET; it was staffed by qualified nurses who had been trained in NET and in the recording of assessment charts. Patients signed the Informed Consent Form after the treatment had been explained in detail by a doctor, in the presence of the next-of-kin/friend. There was no selection of patients except for the exclusion of any suspected of having an underlying psychosis, since there were no facilities for dealing with such conditions.

Recorded Data. Detailed data on the immediate effects of NET are presented only for one year, 1980, when nursing staff graded and recorded each patient's progress; these findings closely reflect the results of the previous 6 years, although improvements in techniques and instrumentation were constantly being introduced (15). There were no control groups but the majority of patients were their own controls; nearly all had made at least one and usually many attempts to stop their addiction without assistance.

The patients were treated continuously for the first six days and then for progressively shorter times during days 7-10, resulting in six hour' treatment on day 10. An asymmetric rectangular pulse, 0.22 msec, 1 Hz to 2000 Hz, was used to deliver 1.5-3 ma through 1 cm diameter electrodes. The choice of frequency was based on the

particular addiction being treated; details are given elsewhere (3, 24). Generally, lower frequencies were used for narcotic addiction, and higher frequencies for treating addiction involving stimulants. At night, all patients received a 100 kHz sinusoidal signal that was modulated by the patients' day-time signal.

TABLE 1

Description of patients treated by NET from 1973 to December, 1980, categorized by one main drug used.

n = 186		Her	Meth	Syn	Barb	Sed	Tran	C/Am	Hall	Alc	Nic	TOTAL	(%)
Male		59	7	6	4	2	3	5	0	17	11	114	61.3%
Female		31	3	6	1	1	1	0	1	13	15	72	38.7%
Age on receiving NET:	< 18	5	0	0	0	1	0	0	0	0	0	6	3.2%
	18 - 20	10	0	0	0	0	0	0	0	0	0	10	5.4%
	21 - 30	64	7	7	3	1	1	2	0	3	5	93	50.0%
	31 - 40	10	2	4	1	0	1	3	0	8	7	36	19.4%
	41 - 50	1	1	0	1	1	0	0	1	7	5	17	9.1%
	> 50	0	0	1	0	0	2	0	0	12	8	23	12.4%
Number of pre-NET treatments:													
	None	47	2	7	2	1	2	1	1	8	19	90	50.3%
	1	14	1	3	0	1	1	2	0	7	2	31	17.3%
	2 - 4	17	3	2	2	0	0	1	0	9	4	38	21.2%
	5 - 13	8	4	0	1	0	0	1	0	5	1	20	11.2%

	All Drugs	Alc	Nic	TOTAL	(%)
Number treated as Out-patients	17	7	17	41	22.0%
Number treated as In-patients	113	23	9	145	78.0%
Number who went to TC after NET 1973-1979 with an average stay of 11.3 days (n = 72)	14	1	n/a	15	20.8%
Number who remained in Clinic after 10 days NET 1980 with average rehab stay of 19.2 days (n = 88)	58	14	n/a	72	81.8%
Mean, in days, of total stay in clinic for 10 second-admissions in 1980	12.7	4.7	0	10.0	days

TC = Therapeutic Community
n/a = Not Applicable
Her = Heroin
Meth = Methadone syrup or ampoules
Syn = Morphine, opiates and synthetic narcotics
Barb = Barbiturates
Sed = Sedatives
Tran = Tranquilizers and the range of psychotropic or neuroleptic drugs
C/Am = Cocaine, amphetamines, and similar stimulants
Hall = Hallucinogens
Alc = Alcohol
Nic = Nicotine

Patients' self-ratings were recorded with respect to quality of sleep and overall abstinence syndrome (AS). A random selection of urines was tested by a Government laboratory.

The standard AS as described by Himmelsbach (16) was recorded on a 0-4 scale, 4 indicating the worst and 0 absence of each of 19 symptoms or signs, the maximum possible in each assessment being 76 points. Craving and anxiety were recorded separately since these two symptoms are invariably present in any chemical withdrawal.

Records were kept of the time taken to fall asleep, the number of hours of sleep and the overall quality of sleep on a 4-point scale, as estimated both by night-nurse and patient.

Additional symptoms more specific to alcohol than other drugs – such as tremor and DT's – were recorded but not charted. Weight was taken daily; temperature, pulse, respirations and blood pressure were recorded twice daily, but apart from a brief and mild weight loss, the pattern detailed by Kolb and Himmelsbach in their classic description of the physiological signs in "abrupt withdrawal" from opiates, did not occur (16).

Follow-up. Before 1980, any patients who were willing to accept rehabilitation after NET had to be transferred to some Therapeutic Community (TC). Because so few would accept this, from January to December 1980, during the Pharmakon Clinic research period, patients were encouraged to remain in the Clinic for an additional stay of up to 30 days after NET (this is designated as days of rehabilitation in the Tables).

Questionnaires were sent by mail but some patients who did not reply were instead interviewed by staff. The questionnaires consisted mainly of multiple outcome variables. Because of inadequate funding, there was no follow-up of the 95 drug addicts, 32 alcoholics and 15 smokers who came for a single preliminary interview but did not return for treatment, for financial or other reasons.

RESULTS

Extent of Drug Abuse. Every drug addict treated in 1980 checked a list of 41 drugs (excluding alcohol and cigarettes) most commonly abused, to indicate drugs used at any time in their past. The mean per person was 19.8 different drugs. There was a significant correlation between number of drug categories used daily at time of admission and the amount of main drug used (Pearson correlation coefficient was 0.81, $p \leq 0.05$, $n = 85$). This indicates that polydrug use and amount of main drug use were positively associated.

Of interest in the follow-up is the number of drug groups used on admission. The mean number for those who reported being drug-free was 2.45, while the mean for the readdicted was 3.27. The null hypothesis of no mean differences was examined via the t-test. The analysis indicated that the difference between the means was statistically significant ($t = 2.22$, df 80, $p \leq 0.05$).

Other t-tests were computed to test for differences between addiction-free and readdicted on the following variables: age, number of previous treatments, length of rehabilitation, duration of drug or alcohol history, overall indicator of AS, craving, amount of main drug and time on main drug. None of the mean differences were statistically significant.

No one requested assistance in stopping LSD although nearly all had used it and stopped without difficulty within a year. The drugs listed in Table 2 were those being used on a daily basis at the time of admission. Sometimes the amounts listed were being used simultaneously as in heroin/cocaine or methadone/methylphenidate combinations. On the other hand, the total dosage of methadone might not be used if an adequate supply of heroin were available. Daily amounts used ranged from 300 mg prescribed heroin to 9 g of street heroin, ½ to 10 g of cocaine, 40 to 800 mg of methadone and up to 70 tablets daily of various narcotics or psychotropic drugs.

These high dosages may reflect the fact that there was no selection of patients according to motivation or prognosis; and it is partly an indicator of the socioeconomic status of the majority of those treated, charity funding being available for only a small number.

TABLE 2

Analysis of drugs used daily at the time of admission, 1973-1980.

n = 186		Her*	Meth	Syn	Barb	Sed	Tran	C/Am	Hall	Alc	Nic	TOTAL	(%)
Number reporting daily use		110	39	31	28	43	55	53	26	46	26	457	
Years of use:	0.5 - 1	8	6	5	1	5	5	3	0	2	0	35	8.6%
	4-Feb	54	13	5	10	10	9	14	2	4	0	121	29.8%
	10-May	42	13	13	10	9	15	26	15	18	5	166	39.7%
	20-Nov	5	3	3	0	5	6	7	8	15	9	61	15.0%
	21 - 30	1	0	0	1	1	1	1	0	5	7	17	4.2%
	> 30	0	0	0	0	0	0	1	0	2	8	11	2.7%
Mode of use:	Oral	0	16	8	15	38	45	2	2	46	0	172	40.2%
	Snorted or smoked	20	0	1	0	0	0	18	20	0	26	85	19.9%
	Subcutaneous or IM	4	1	3	0	0	1	0	0	0	0	9	2.1%
	Main-lining (IV)	86	19	15	10	0	3	29	0	0	0	162	37.8%
Amount of daily use:	Slight**	14	9	3	8	23	27	9	8	0	1	102	23.2%
	Moderate	55	18	12	9	15	17	9	10	4	12	161	36.7%
	Heavy	35	7	6	3	2	8	19	4	19	10	113	25.7%
	Extremely Heavy	6	4	9	4	0	2	10	2	23	3	63	14.4%

Drug addicts only:
Total in years of abuse of any drug, including marijuana.

Age on Admission	Range in Years	Mean of Years
< 18	3 - 4	3.3
18 - 20	2 - 5	4.0
21 - 30	1 - 16	8.7
31 - 40	5 - 24	14.1
41 - 50	7 - 30	22.2

Drug Source:

Black Market	117
Legal prescriptions provided by doctors for licit/illicit use	72
Registered with a government Drug Dependency Unit	28
Standard prescriptions by doctors	4

* Average purity of street heroin in London in 1980 was around 40%. Only two patients were receiving heroin legally from a Drug Dependency Unit (DDU), but several used pure (DDU) heroin obtained illegally.

** Slight indicates up to the maximum prescribably daily dosage; for street heroin, up to 1/4 g daily.

Abstinence Syndrome. This is analyzed for each different drug group in Table 3 and for all addictions combined in Figure 1. Three factors emerged as influencing withdrawal symptomatology.

(i) A Kruskall-Wallis test for K independent groups was performed to determine if there was a difference between AS by mode of use of main drug. The results indicate that there was a significant difference between the rank sums of the various modes of use of the main drug (chi square = 18.23, df = 4, $p \leq 0.05$). The mean for intravenous use showed the highest AS.

(ii) The few patients treated a second time by NET experienced a considerable decrease in AS on the second treatment as compared to the first (Figure 2); possibly because of confidence gained from their first experience. There may also have been residual long-term effects from the previous NET.

(iii) The other factor is more difficult to explain. The few who insisted that they had absolutely no AS apart from the first few nights of poor sleep (and two even had no insomnia) were those using excessively heavy amounts of drugs. Urines were tested in all these patients, and in every such case the urine was negative for all drugs. A possible explanation is that an unnecessarily large total amount of electricity was being given to the majority but that this amount was required for the heaviest drug users.

TABLE 3

Abstinence Syndrome (AS) during 10-day course of NET (5 days for nicotine), January to December, 1980 (n = 102*)

		Her*	Meth	Syn	Barb	Sed	Tran	C/Am	Alc	Nic	TOTAL	
		n = 57	n = 5	n = 10	n = 2	n = 1	n = 3	n = 2	n = 18	n = 4	mean	
Mean daily AS out of 76: **												
Days	1 - 2	5.01	5.22	8.06	3.56	2.62	1.59	1.87	3.07	0.58	4.61	
	3 - 4	5.07	5.90	4.59	8.12	6.71	1.56	5.50	0.69	0.33	4.10	
	5 - 7	3.79	7.70	4.40	4.25	n/a	2.50	1.50	0.84	n/a	3.31	
	8 - 10	1.23	2.53	1.38	1.17	n/a	1.00	2.08	0.30	n/a	1.10	
Mean AS rating by nurse: †												
Days	1 - 2	2.70	2.79	2.20	2.96	3.75	3.16	3.09	3.20	2.71	2.95	
	3 - 4	2.35	2.49	1.77	2.45	2.47	2.92	2.09	2.89	3.14	2.50	
	5 - 7	2.88	2.62	2.21	2.61	n/a	3.50	2.98	2.98	n/a	2.83	
	8 - 10	3.36	3.14	3.61	4.00	n/a	3.58	3.83	3.61	n/a	3.59	
Mean AS rating by patient: †												
Days	1 - 2	2.68	2.50	2.06	2.96	3.75	2.95	3.09	3.15	2.86	2.88	
	3 - 4	2.33	2.40	1.71	2.15	2.47	2.86	2.06	2.87	3.17	2.45	
	5 - 7	2.86	2.67	2.13	2.61	n/a	3.47	3.10	2.95	n/a	2.83	
	8 - 10	3.30	3.13	3.60	4.00	n/a	3.44	3.87	3.61	n/a	3.56	
Mean Sleep quality rating by nurse: †												
3rd - 5th nights		2.92	2.27	3.02	3.33	2.25	2.75	3.08	3.60	3.67	3.05	
6th - 8th nights		3.44	3.23	3.43	3.50	n/a	3.21	3.75	3.70	n/a	3.48	
9th - 10th nights		3.63	3.40	3.55	3.50	n/a	3.44	3.75	3.83	n/a	3.63	
Mean Sleep quality rating by patient: †												
3rd - 5th nights		2.84	2.13	3.04	3.33	2.50	2.62	3.17	3.77	3.44	3.00	
6th - 8th nights		3.40	3.38	3.35	3.50	n/a	3.12	3.83	3.23	n/a	3.22	
9th - 10th nights		3.60	3.25	3.58	3.50	n/a	3.37	3.75	3.83	n/a	3.59	
Total per day reporting freedom from Anxiety: ††												
Days	2 - 3	13	0	1	0	0	0	1	3	0	18	18%
	4 - 5	15	0	1	1	0	0	1	7	1	26	26%
	6 - 7	29	1	5	1	n/a	1	2	11	n/a	50	53%
	8 - 10	40	3	9	2	n/a	0	2	15	n/a	71	75%
Total per day reporting freedom from Craving: ††												
Days	2 - 3	29	3	3	1	0	3	1	16	1	57	56%
	4 - 5	33	3	6	1	0	2	1	17	1	64	63%
	6 - 7	40	3	4	2	n/a	4	1	16	n/a	70	74%
	8 - 10	52	4	8	3	n/a	4	2	17	n/a	90	95%

* This analysis is based on one main drug per patient for 92 patients (n = 102 includes the charts of 10 readmissions for a second course of NET). The AS means do not accurately reflect th AS of individual drug groups, since, for example, only 21 patients used opiates alone and one, diazepam (100 mg daily).

** Nineteen abstinence signs or symptoms, based on the Himmelsbach categorization (15), were recorded on a 0-4 scale for each symptom (4 being the worst) by qualified nursing staff; the observations were made 4 times daily from Day 1 to Day 5 (total score divided by 4 for each daily score) and twice daily from Day 6 to Day 10 (total score divided by 2 for each daily score).

† Recorded on a 4 point scale, 1 being the worst and 4 the best condition in each case.

†† n = 101 for Days 2-5 and n = 95 for Days 6-10.

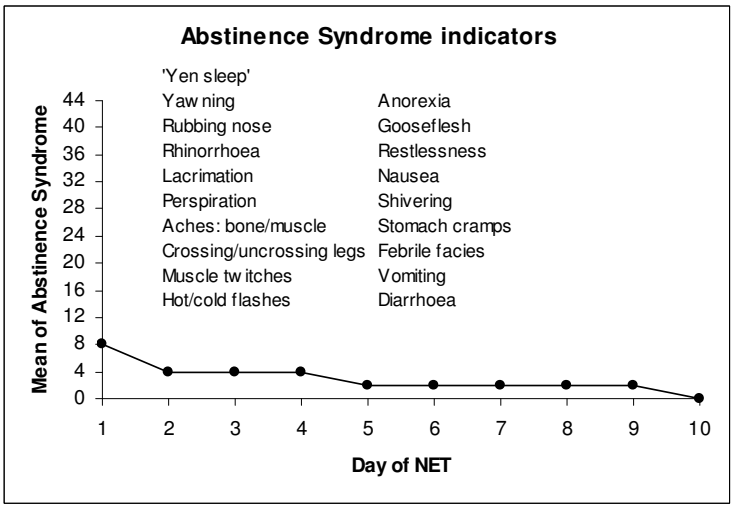

Figure 1

Mean of daily means of the AS for all addictions combined (n = 102), January-December 1980, based on Himmelsbach's categorization (14). Each of the 19 signs and symptoms were recorded on a 0-4 point scale, totaling a possible 76. No patient was graded 4 (the worst) in every indicator simultaneously. The dominant AS indicators varied between patients. The highest mean recorded was 9 points out of 76 because all drugs were totally stopped on admission and NET started immediately; thus withdrawal symptomatology was kept at a minimum from the beginning.

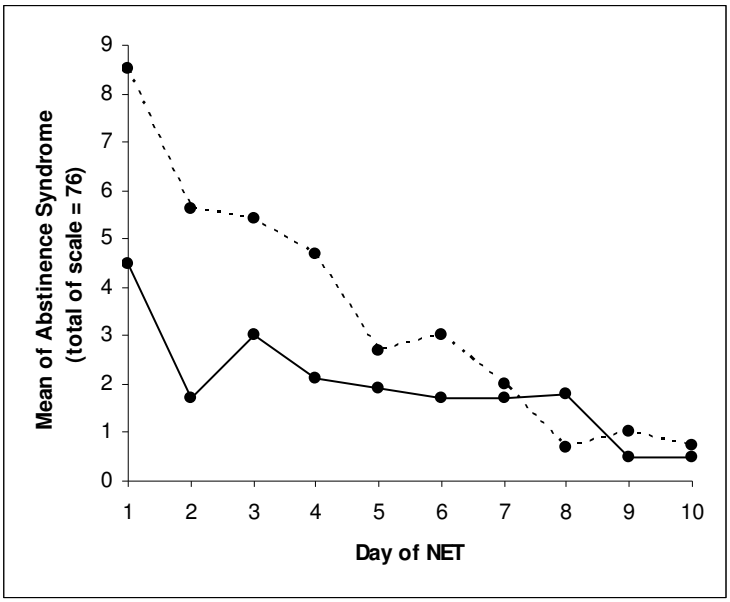

Figure 2

Comparison of the AS for 10 subjects on their first treatment (dashed line) and on admission for a second (solid line) by NET. The vertical axis has been shortened from 76 points to 9 to highlight the differences between reactions to first and second treatments.

Two of the AS have been analyzed separately (Figure 3) because of their significance: (i) craving for the drug because of its importance in recidivism; (ii) anxiety, which is not diminished by drug substitution, including the use of clonidine-like drugs (17, 18, 19, 20), and is increased by gradual drug withdrawal. Ninety-five per cent were free of craving and 75% of anxiety by the 10th day of NET.

The follow-up questionnaires showed that craving tended to recur when patients returned to their former life-situation (Table 4), but for 80% it had finally disappeared within 4 months of NET. There are no known studies concerning the time it takes for drug craving to disappear after "standard" treatments, but methadone addicts in a drug-free TC indicated that it took at least 10 months to diminish and this while still resident in the TC.

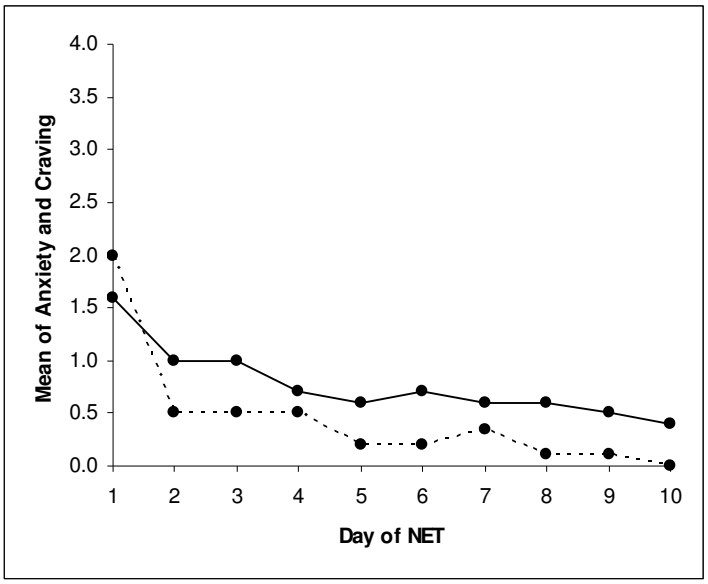

FIGURE 3

Mean of daily means for each subject for craving (dashed line) and anxiety (solid line), n = 102. Recordings were made four times daily Days 1-5 and twice daily Days 6-10. In each condition, 4 represents the maximum of the symptom and 0 the least.

Insomnia. After withdrawal from heroin and amphetamines, it takes two months for a normal sleep pattern to return (21, 22), up to four months after barbiturate withdrawal (23) and probably several weeks after stopping alcohol. The effect of NET, without hypnotics, on the sleep pattern is perhaps the most clear and impressive evidence of rapid physiological recovery, the majority regaining a normal, drug free sleep pattern between the third and ninth nights of NET (24). A specific frequency of current was found to stop persistent nightmares.

Most patients were willing to accept a drug-free program. In only a few cases was sedation considered necessary from the patient's well-being. Only oral paraldehyde was used because it would guarantee a full night's sleep without risk of overdosage; in addition, the foul taste and after-effects insured no repeat requests.

Convulsions. Convulsions occur in withdrawal from a wide range of psychotropic drugs (25), e.g. persistent convulsions were reported in two infants born of mothers under treatment with the tricyclic antidepressant clomipramine (26). Even in withdrawal from diazepam at an average daily dose of only 10 mg or lorazepam at 4 mg, 2.5% of the patients in Tyrer's series of 40 suffered epileptic seizures (27). Few in the NET series used such small dosages (Table 3).

TABLE 4

Follow-up of patients treated by NET for drug, alcohol and nicotine addictions from 1973 to December, 1980.

	Addiction-free					Readdicted				
	Drugs	Alc	Nic	Total	(%)	Drugs	Alc	Nic	Total	(%)
Long-term outcome* n = 93	53**	16***	4	73	78.5%	13	2	5	20	21.5%
Time between NET and report:										
≤ 1 year	22	11	2	35	48%	6	1	0	7	35%
≤ 2 years	19	0	0	19	26%	3	1	0	4	20%
3 - 8 years	12	5	2	19	26%	4	0	5	9	45%
Time between NET and Readdiction:										
< 2 weeks						2	0	2	4	20%
0.5 - 6 months						8	0	1	9	45%
6 - 12 months						0	2	0	2	10%
1 - 4 years						3	0	2	5	25%
Using:										
Much less than before NET						6	1	3	10	56%
Slightly less						3	1	0	4	22%
The same as						2	0	2	4	22%
More than						0	0	0	0	0%
Age when treated by NET:										
≤ 20	3	0	0	3	4%	2	0	0	2	10%
21 - 30	37	3	1	41	56%	8	0	0	8	40%
> 30	13	13	3	29	40%	3	2	5	10	50%
Pre-NET Treatment: None	35	7	2	44	60%	4	0	5	9	45%
1	9	4	1	14	19%	4	2	0	6	30%
2 - 4	6	1	1	8	11%	2	0	0	2	10%
5 - 15	3	4	0	7	10%	3	0	0	3	15%
"Rehab" after NET: None	21	8		29	42%	5	0		5	33%
≤ 2 weeks	13	3	n/a	16	23%	2	0	n/a	2	14%
3 - 8 weeks	18	5		23	33%	6	2		8	53%
2 - 4 months	1	0		1	2%	0	0		0	0%
Relapses after NET: None	12	6	4	22	38%					
1 - 2	17	3	1	21	36%					
≥ 3	10	5	0	15	26%					
Time between NET and first relapse:										
< 2 weeks	9	1	2	12	39%					
0.5 - 6 months	8	2	0	10	32%					
6 - 12 months	5	0	0	5	16%					
1 - 4 years	2	2	0	4	13%					
Duration of Longest Relapse:										
1 - 3 days	5	4		9	27%					
1 - 3 weeks	5	1		6	18%					
1 - 3 months	8	3		11	34%					
6 - 12 months	7	0		7	21%					
Treatments since NET (other than second NET):										
None	24	8	2	34	77%	7	1	4	12	92%
1	6	3	0	9	21%	1	0	0	1	8%
≥ 2	0	1	0	1	2%	1	0	0	0	0%
Second treatment by NET:****	2	2	1	5		1	0	0	1	
Making Alcohol a substitute dependence:										
Never	26			26	76.5%	8			8	
Temporarily	8	n/a	n/a	8	23.5%	0	n/a	n/a	0	
To Date	0			0	0%	0			0	
Drug Addicts who used Alcohol daily, moderately to heavily, before NET, now:										
Alcohol-free	6			6	37.5%	1			1	17%
Much less	3			3	19%	1			1	17%
Slightly less	6	n/a	n/a	6	37.5%	4	n/a	n/a	4	66%
The same	1			1	6%	0			0	0%
More	0			0	0%	0			0	0%

TABLE 4 (continued)

Follow-up of patients treated by NET for drug, alcohol and nicotine addictions from 1973 to December, 1980.

	Addiction-free					Readdicted				
	Drugs	Alc	Nic	Total	(%)	Drugs	Alc	Nic	Total	(%)
Number who still feel Craving:										
Never or rarely	18	5	0	23	68%					
Occasionally	5	0	0	5	15%					
Frequently	6	0	0	6	17%					
Time when Craving finally disappeared:										
During NET	13	5	1	19	62%	4	0	3	7	78%
Within 1 month of NET	1	0	1	2	6%	1	0	0	1	11%
Within 4 months of NET	2	0	0	2	6%	0	1	0	1	11%
> 4 months after NET	7	1	0	8	26%	0	0	0	0	0%
Quality of Sleep since NET:										
Much improved	11	6	0	17	56%	0	0	0	0	0%
Slightly improved	5	1	0	6	19%	0	1	0	1	14%
The same	5	1	0	6	19%	4	0	0	4	57%
Worse	2	0	0	2	6%	2	0	0	2	29%
Quality of Health since NET:										
Much improved	20	8	0	28	62%	2	1	0	3	19%
Slightly improved	8	2	1	11	25%	3	0	1	4	25%
The same	4	0	1	5	11%	2	0	4	6	37%
Worse	1	0	0	1	2%	3	0	0	3	19%
Cigarette use:										
Much decreased	6†	1†		7	28%	0	0		0	0%
Slightly decreased	6	1	n/a	7	28%	3	0	n/a	3	38%
The same	7	2		9	36%	4	0		4	50%
Increased	2	0		2	8%	1	0		1	12%
Marijuana use:										
Much decreased	3†	0		3	19%	1	0		1	14%
Slightly decreased	5	0	n/a	5	31%	3	0	n/a	3	43%
The same	7	0		7	44%	3	0		3	43%
Increased	1	0		1	6%	0	0		0	6%
Relationships with family/spouse:										
Outstanding improvement	20	10		30	67%	3	1		4	37%
Slight improvement	5	2	n/a	7	15%	3	0	n/a	3	27%
The same	7	1		8	18%	3	0		3	27%
Worse	0	0		0	0%	1	0		1	9%
"Are you more able to cope with the problem of living than previously?"										
Much better	28	11		39	68%	2	1		3	30%
Slightly better	11	4	n/a	15	26%	2	0	n/a	2	20%
The same	1	1		2	4%	4	0		4	40%
Worse	1	0		1	2%	1	0		1	10%
"If you were readdicted and wished to come off, would you do so by NET?"										
Yes	27	10	2	39	89%	9	1	5	15	94%
No	4	1	0	5	11%	1	0	0	1	6%

* Total response rate, by questionnaire, letter or interview, was 50% (n = 186); for drug addicts 51% (n = 130), for alcoholics 60% (n = 30) and for smokers 35% (n = 26).

** Another four were reported to be drug-free but these could not be confirmed.

*** 44% of these specified on admission that their aim was "controlled drinking", and achieved this goal.

**** Percentages of addiction-free and readdicted were 6.8% and 5.0% respectively.

† Includes 3 who became nicotine-free and 2 marijuana-free.

Out of 126 patients who admitted to using drugs with the potential for causing withdrawal convulsions, 60 (47.6%) took above maximum therapeutic doses. Seven (5.5%) had seizures. No patient had more than one brief seizure except for one, treated in 1977, who had previously suffered multiple convulsions. He had been taking 1,000 mg pentobarbital, 1,000 mg chlomethiazole and 60 mg flurazepan daily for 3 years, and was

on phenytoin on admission. His phenytoin was continued, the pentobarbital was slowly withdrawn, yet he had multiple seizures, hallucinations and delusions. In contrast, among the patients treated in 1980 who had only one brief convulsion and whose drugs had been totally stopped on admission, was one who had been taking 5,000 mg Tuinal daily for six months, in addition to 26 tablets paracetamol (for excruciating headaches), 2 g heroin and 3 g cocaine; his headaches also disappeared completely with NET.

Only two patients had alcohol withdrawal convulsions, although 69% of alcoholics treated were taking a hypnosedative or tranquilizer regularly; in both cases, the convulsions were hypoglycaemic.

Delirium Tremens. No patient experienced DT's and none had hallucinations or delusions except for the one case described above who was given a gradual withdrawal from barbiturates.

Long-term physical effects. The replies regarding post-NET health, including those referring to non-drug conditions (this review deals only with addictions), reveal no illness which could have resulted from NET, including those receiving long-term treatment for chronic pain. Table 4 shows a 75% overall improvement in health, whether or not there was a relapse in the addiction.

Deaths. There were eight reported deaths (4.3%) over an eight year period, all drug addicts. The average time between NET and death was 22 months, only one being less than one year. None were associated with NET and two were apparently unrelated to drugs. One was a suicide and three were not readdicted but died in their sleep or drowned in their bath after a single episode of heroin and alcohol.

This 6.1% death rate (out of 130 drug addicts treated) is disappointingly high even though it compares favorably with the 15% recorded in a representative sample of 128 patients of London Drug Dependence Clinics over ten years (28) or 21% in New York over 20 years (29).

DISCUSSION

Drop-out rate (DOR). This is probably the most significant indicator both of patient acceptability of any treatment and of clinical effectiveness. In this series, the DOR over 7 years was 1.6%. The 10% who said they would not wish to have NET again did not object to the NET per se but indicated that the treatment they needed was psychotherapeutic.

Other programs report higher rates of DOR, e.g. Simpson (DARP, USA, mostly opioid users) records 71% (i.e. excluding their control group) (30) and Tyrer (low-dosage diazepam or lorazepam) 45% (27). The well-known Haight-Ashbury Drug Clinic in San Francisco use electro-acupuncture, yet there is a 90% DOR from the 21-day treatment; but of those who completed the course, 80% were drug-free at the end of one year (31).

Recidivism. More emphasis has recently been placed on the importance of prolonged dysphoria in the incidence of recidivism. This Chronic Withdrawal Syndrome (CWS) has been aptly described by a leading authority on drug addiction, Dr. Avram Goldstein (32): "It is still not understood why simple detoxification is so ineffective, but the facts are clear and inescapable…As I see it, the reason for the dismal failure of detoxification (the majority of subjects relapse before completing the customary 21 to 30-

day process) is that the newly detoxified addict, still driven by discomfort, physiological imbalances and intense craving, cannot focus attention on the necessary stops towards rehabilitation, but soon succumbs and starts using heroin again." Addicts and physicians alike agree that methadone is a much harder addiction to stop than heroin.

It takes at least six moths for heroin addicts to return to physiological normality (16), probably about 10 months for methadone addicts and up to 18 months for alcoholics (33). Drugs which diminish the AS do not appear to affect this long-term dysphoria (17, 18, 19, 20); the evidence presented in Tables 3 and 4 suggests that NET diminishes it significantly and actually produces a positive mood state.

A low recidivist rate and improved quality of life are the best indicators of diminution of the CWS. Because of insufficient staff and funding, only 50% of patients treated over 7 years could be traced. Despite this low response rate, the NET drug-free rate of 80.3% (for drug addicts only) is encouraging. De Leon reports of Phoenix House in New York that "over 50% of those who had remained a year or longer in residence were successful across five years of follow-up" but his criteria of success included methadone maintenance. He goes on to say that "when effectiveness is defined in terms of heroin or methadone abstinence, less than 10% are judged successful, 10 years after treatment" (34).

Surveys world-wide have shown that "success" is directly related to the "time spent in treatment", usually in some form of TC (35); the majority insist on a "minimum residency of 18-24 months" (36). In contrast, only 42% of NET patients had any such residency and these for an average stay of only 16.06 days. A t-test was performed to determine if there was a mean difference in the days of rehabilitation between addiction-free and readdicted. The mean number of days for addiction-free was 10.92, and for the readdicted, 10.35. The t-test was not significant ($t = 0.16$, $df = 85$, $p \geq 0.05$) indicating that the duration of rehabilitation is unrelated to LTO after NET.

It is realized that many who are treated by NET still need the help of a TC or other support system, but the time required is considerably less if preceded by NET. In addition, there are many drug addicts and alcoholics who refuse hospitalization, let alone long-term residency. Thus the short duration of NET may encourage many who otherwise would make no attempt to discontinue drugs or alcohol.

Of respondents to follow-up, 17% had one treatment after NET (a second NET or other hospital treatment) and 1% had two treatments. In a 1982 US Government survey, 26% to 43% had repeat treatments every year (the number of treatments per year is not stated) after the initial treatment, for up to six years (37).

Of NET drug-free, 23.5% admit to having used alcohol as a substitute for their drug/s, but all of them only temporarily, an unusually low incidence of alcohol substitution. The same US survey reported 60% as drinking moderately or heavily 3 to 6 years after treatment (37). Other data from the NET questionnaires (Table 4) indicate a consistent improvement in quality of life and relationships, and some reductions in alcohol, marijuana and cigarette use. The readdicted also showed some improvements in these areas; in addition, 35% remained addiction-free for more than 6 months after NET and 76% were using less than before NET.

Twenty-eight (21.5%) of drug addicts treated by NET were registered with Drug Dependency Units and 10 of these responded to follow-up. Only 6% of drug-free were registered against 54% of the readdicted. Although not statistically significant, this

would tend to confirm the belief of many drug addicts that if they register, they "will never stop drug abuse because it is so easy to get the drugs".

Sixty-two per cent of the drug-free respondents have occasionally experimented with heroin after NET but discontinued it spontaneously because they found it "unsatisfactory". In contrast, when they had stopped heroin previously by any other method, a single episode was sufficient to readdict them.

Several nicotine addicts have observed that their cravings for cigarettes had been absent for about 6 months to a year after NET and had then returned; a brief "booster" treatment was effective in stopping the cravings again. This suggests a continuing effect of NET after completion of treatment (38).

Several papers have now been published on the profound effects of low intensity electrical currents on the individual nerve cell (39, 40), and this review demonstrates one important clinical application of such laboratory research -- a useful treatment that has no disadvantages or side-effects. The psycho-spiritual problems which make people take refuge in drugs or alcohol will continue to be a major problem in society, but a brief treatment that removes the very real dysphoria of both the acute and chronic withdrawal syndromes is a major step forward in dealing with the multifarious problems of addiction (41).

ACKNOWLEDGMENTS

We thank J. Lebman for the statistical analyses; the Home Office for making their records available; the Marie Curie Memorial Research Laboratories for their work with NET in animal models; the Rank Foundation for their generous support; and most of all, the Staff of Pharmakon Clinic for their dedication and enthusiasm. The follow-up was supported in part by a grant from the British Medical Association (Doris Odlum Award, 1980).

REFERENCES

(1) Wen, H.L., Cheung, S.Y.: Treatment of Drug Addiction by Acupuncture and Electrical Stimulation, Asian J. Med. 9, 138-141, 1973.

(2) Patterson, M.A.: Electro-acupuncture in Alcohol and Drug Addictions, Clin. Med. 81, 9-13, 1974.

(3) Patterson, M.A.: Acupuncture and Neuro-Electric Therapy in the Treatment of Drug and Alcohol Addictions, Aust. J. Alc. Drug Dependence 2, 90-95, 1975.

(4) Capel, I.D., Pinnock, M.H., and Patterson, M.A.: The Influence of Electrostimulation on Hexobarbital Induced Loss of Righting Inflex in Rats, Acupuncture & Electro-Therapeutics Res, Int. J. 7, 17-26, 1982.

(5) Patterson, M.A.: NeuroElectric Therapy, Enkephalin and Drug Addiction, in International Review of Opium Studies, Institute for Study of Human Issues, Philadelphia, PA (in Press).

(6) Capel, I.D., Pinnock, M.H., and Williams, D.C.: The Influence of Differing Forms of Electrostimulation on the Hexobarbital-induced Sleeping Time of Rats, IRCS Med. Sci. 8, 545, 1980.

(7) Capel, I.D., Pinnock, M.H., Withey, N.J., Williams, D.C., and Patterson, M.A.: The Effect of Electrostimulation on Barbiturate-induced Sleeping Time in Rats, Drug Dev. Res. 2, 73-79, 1982.

(8) Patterson, M.A.: The Effect of Neuro-Electric Therapy (NET) in Drug Addiction: Interim Report, U.N. Bull. Narc. 28, 55-62, 1976.

(9) Capel, I.D., Goode, A.G., Smallwood, A.E., and Patterson, M.A.: Tryptophan, Serotonin and Hydroxyindole Acetic Acid Levels in Rat Brain Following Slow or fast Frequency Electrostimulation, IRCS Med. Sci. 10, 427-428, 1982.

(10) Capel, I.D., Williams, D.C., Davey, R.W., and Patterson, M.A.: The Amelioration of Restraint Stress by Electrostimulation, IRCS Med. Sci. 7, 634, 1979.

(11) Sjolund, B., Terenius, L., and Eriksson, M.: Increased Cerebrospinal Fluid Levels of Endorphins after Electro-acupuncture, Acta Physiol. Scand. 100, 382-384, 1977.

(12) Clement-Jones, V., Tomlin, S., Rees, L.H., McLoughlin, L., Besser, G.M., and Wen, H.L.: Increased β-Endorphin but not Met-Enkephalin Levels in Human Cerebrospinal Fluid after Acupuncture for Recurrent Pain, Lancet ii, 946-949, 1980.

(13) Salar, G., Job, I., Mingrino, S., Bosio, A., and Trabucchi, M.: Effect of Transcutaneous Electrotherapy on CSF β-Endorphin Content in Patients Without Pain Problems, Pain 20, 169-172, 1981.

(14) Ho, W.K.K., Wen, H.L. and Ling, N.: Beta-endorphin-like Immuno Activity in the Plasma of Heroin and Normal Subjects, Neuropharmacology 19, 117-120, 1980.

(15) Patterson, M.A.: Addictions can be Cured, in Berkhamsted, Lion Publishing, England, 92-95, 1975.

(16) Kolb, L,. Himmelshach, C.K.: A Critical Review of the Withdrawal Treatments with Methanol of Evaluating Abstinence Syndrome, Am. J. Psychiatry 94, 759-799, 1938.

(17) Anonymous, Clonidine for Opiate Withdrawal (Editorial Comment), Lancet ii 649, 1980.

(18) Gold, M.S., Pottash, A.C., Sweeney, D.R., Kleber, H.D., and Redmond, D.E.: Rapid Opiate Detoxification: Clinical Evidence of Antidepressant and Antipanic Effects of Opiates, Am. J. Psychiatry 136, 982-983, 1981.

(19) Gold, M.S., Pottash, A.C.: Endorphins, Locus Coeruleus, Clonidine and Lofexidine: A Mechanism for Opiate Withdrawal and New Nonopiate Treatments, Advances in Alcohol and Substance Abuse 1, 33-52, 1981.

(20) Charney, D.S., Sterneberg, D.E., Kleer, H.D., Heninger, G.R., and Redmond, D.E.: The Clinical Use of Clonidine in Abrupt Withdrawal from Methadone, Arch. Gen. Psychiatry 38, 1273-1277, 1981.

(21) Lewis, S.A., Oswald, I., Evans, J.I., Akindale, M.O., and Tompsett, S.L.: Heroin and Human Sleep, Electroenceph. Clin. Neurophysiolog. 28, 374-381, 1970.

(22) Oswald, I., Evans, J.L., and Lewis, S.A.: Addictive Drugs Cause Suppression of Paradoxical Sleep with Withdrawal Rebound, in Scientific Basis of Drug Dependence, H. Steinberg, ed., Churchill, London, 1969.

(23) Kalen, A., Malmstrom, E.J., Rickless, W.H., et al: Sleep Patterns of a Pentobarbital Addict: Before and After Withdrawal, Psychophysiology 5, 208, 1968.

(24) Patterson, MM.A.: The Significance of Current Frequency in NeuroElectric Therapy (NET) for Drug and Alcohol Addictions, In Electrotherapeutic Sleep and Electroanaesthesis, F.M. Wageneder and R.H. Germann, eds., R.M. Verlag, Graz, 285-296, 1978.

(25) Cowen, P.J., Mutt, D.J.: Abstinence Symptoms after Withdrawal; of Tranquilizing Drugs: Is there a Common Neurochemical Mechanism?, Lancet ii, 360-362, 1982.

(26) Cowe, L., Lloyd, D.J., and Dawling, S.: Neonatal Convulsions caused by Withdrawal from Maternal Clomipramine, Br. Med. J. 284, 1837-1838, 1982.

(27) Tyrer, P.. Rutherford, D., and Huggett, T.: Benzodiazepine Withdrawal Symptoms and Propanolol, Lancet I, 529-522k 1981.

(28) Willie, R.: Ten-year Follow-up of a Representative Sample of London Heroin Addicts: Clinic Attendance, Abstinence and Mortality, Br. J. Addiction 76, 259-266, 1981.

(29) Vailiant, G.E.: A 20-year Follow-up of New York Narcotic Addicts, Arch. Gen. Psychiatry 29, 237-241, 1973.

(30) Simpson, D.D., and Savage, L.J.: Drug Abuse Treatment Readmissions and Outcomes. Three-year Follow-up of DARP Patients, Arch. Gen. Psychiatry 37, 896-901, 1980.

(31) Inaba, D.: Needle Therapy, in The New York Times, 49, March 14, 1982.

(32) Goldstein, A.: Heroin Addiction. Sequential Treatment Employing Pharmacologic Supports, Arch. Gen. Psychiatry 33, 353-358, 1976.

(33) Troiani, J.: Report in The Journal 10(11), 4, 1981.

(34) De Leon, G.: The Role of Rehabilitation, in Drug Abuse in the Modern World. A Perspective for the Eighties, G.G. Nahas and H.C. Frick, eds., Pergamon Press, New York, 298-307, 1981.

(35) Simpson, D.D.: Treatment for Drug Abuse. Follow-up Outcomes and Length of Time Spent, Arch. Gen. Psychiatry 38, 875-880, 1981.

(36) De Leon, G., Wexler, H.K., and Jainchill, N.: The Therapeutic Community: Success and Improvements Rates 5 Years after Treatment, The Internat. J. Addictions 17(4), 703-747, 1982.

(37) Times, F.M.: Evaluation of Drug Abuse Treatment Effectiveness: Summary of the DARP Follow-up Research, Treatment Research Report for NIDA, DHSS Publication No. (ADH)82-1194, 1982.

(38) Patterson, M.A.: NeuroElectric Therapy: Are Endorphins Involved?, in Mims Magazine, 22-25, September 15, 1981.

(39) Dixey, R., and Rein, G.: H-noradrenaline Release Potentiated in a Clonal Nerve Cell Line by Low-intensity Pulsed Magnetic Fields, Nature 296, 253-256, 1982.

(40) Borgens, R.B., Roederer, E., and Cohen, M.J.: Enhanced Spinal Cord Regeneration in Lamprey by Applied Electrical Fields, Science 213, 611-617, 1981.

(41) Patterson, M.: Getting Off The Hook, Harold Shaw Publishers, Wheaton, Illinois, 77-87, 1983.