

Part II.—Original Articles.

PENTOTHAL SODIUM NARCOANALYSIS.*

By WILLIAM BLYTH, M.D., D.P.M., F.R.F.P.S.G.,

Gartloch Emergency Hospital, Gartcosh, Glasgow.

THE term narcoanalysis may be applied to a technique whereby psychotherapeutic principles are applied and analytical investigations are conducted with the patient under treatment in a mild narcotic state.

The method possesses the advantage of simplicity of utilization, speed in application, and is often as effective as formal analytical psychology, where the latter cannot be applied.

In the earlier methods various narcotics were utilized, but as most of these proved variable in action and often failed to produce the desired effect, this method of analysis has not been employed on a large scale until within recent years. As early as 1917 the use of a light ether hypnotic state in the treatment of various hysterical states was advocated by Starkey (1917). This was followed by the researches of Baernstein (1929), who showed that scopolamine, while having little effect on normal individuals, markedly lowered the threshold of suggestibility in hysterical subjects, and suggested that it might be employed as an adjuvant in the treatment of the psychoneuroses. Later, Newman (1935) stressed the advantages of using intravenous alcohol, and Kauders and Hoff advocated the use of paraldehyde and medinal in the treatment of the neuroses of the hysterical type. With the discovery of sodium amytal in 1929, a definite trend towards the use of the barbiturates in the production of intravenous anaesthesia resulted, and this was reflected in the realm of psychiatry by its employment in selected cases. The appearance of nembutal in 1930, evipan in 1932, pentothal sodium in 1934, eunarcon in 1935, narcominal in 1936 and sodium thio-ethamyl in 1939 established the barbiturates in the field of intravenous anaesthesia and narcosis. Certain of these substances had been previously used in the production of narcoanalysis, since the selective action of the barbiturates on the brain stem makes them eminently suitable for this purpose. Of these, nembutal has perhaps been the most widely employed, while numerous observers have conducted extensive investigations on the action of evipan. More recently the work of Horsley (1936) on the use of pentothal sodium in narcoanalysis has done much to put this method of investigation on a scientific basis and to warrant its more general employment.

Pentothal sodium (sodium ethyl-thio-barbituric acid) is a lemon-coloured powder, bitter in taste and smelling slightly of sulphur. It is closely related to both sodium amytal and nembutal, only differing from the latter in that an O_2 atom is replaced by a S_2 atom on the urea side of the molecule. It is readily soluble in water, strongly alkaline, the pH of a 10 per cent. solution being 10.6, and it forms precipitates with salts of silver and with acids. The presence of the S_2 atom facilitates the rapid solution of pentothal and makes its action more rapid than that of nembutal. In practice, pentothal sodium is supplied in ampoules of 1 gm. together with a separate ampoule containing 10 c.c. of sterile distilled water. On mixing the two, a gaseous solution results with the production of H_2S , which takes a minute or two to clear and is then ready for use. This gives a 10 per cent. solution, which is suitable for general intravenous anaesthesia, but for purposes of narcoanalysis this strength is too high, and the drug should be further diluted with distilled water until a 2½ per cent. solution is formed. The solution strength of 2½–3 per cent. has been found to give the best results, and higher strengths should not be employed for purposes of narcoanalysis, as their prolonged use may be followed by local inflammation and sloughing around the site of injection.

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The 2½ per cent. solution is aspirated into a 20 c.c. syringe, with an eccentric tip, to which a short bevel 20 gauge, 1½ in. needle is attached. The patient is placed in a recumbent position and the room is darkened. Certain observers have advocated the use of a dark blue bulb in addition, but in practice satisfactory results are usually obtained without its employment. The median basilic or median cephalic vein is selected, and the injection is carried out slowly and regularly at a rate not exceeding 1 c.c. per 4 minutes. The amount required varies with the individual patient and the only guide is the response obtained. The relationship between dosage and body weight is of little value, while the amount required cannot be accurately gauged in relation to sex, age, metabolic rate, etc., and should be rather adjusted to the individual requirements of each case. It is of value to carry out all investigations with the patient in a side ward, isolated from all noise and from other patients. A trained nurse should be in attendance throughout, and absolute quiet and rest are insisted upon. In certain cases, especially those of the anxiety type, preliminary medication is to be recommended as an adjuvant, thereby reducing the amount of drug required and assisting in the rapid induction of the hypnotic state. Opinion is divided as to whether the technique of Adams (1938), who advocates the preliminary use of nembutal gr. 1½, morphine gr. ¼, and atropine gr. 1⁄100, or that of Jarman (1938), who prefers omnopon gr. ⅜ and scopolamine gr. 1⁄100, as a preoperative measure is the more efficacious if given 12 hours previously. In this investigation morphine gr. ¼-gr. ½ has been administered as a routine measure 4-6 hours before commencing analytical treatment in all cases where preliminary medication was considered advisable.

The effect of the drug is practically instantaneous. Within a period of 2-3 minutes the patient either feels tired and almost falls asleep or else feels a subjective sensation of being "buoyed up." After the injection of 2-3 c.c., certain patients become garrulous and talk "spontaneously" of their inhibitions and anxieties, while others only give replies to questions and show a progressive desire for sleep. As there is no method of forecasting the behaviour of an individual patient under narcosis, the importance of obtaining as full a history as possible before narcoanalysis is employed is stressed, so that if the patient remains reticent, some idea of the lines along which information is desired may be prepared beforehand. The amount of the drug administered* and the rate of injection should be adjusted according to the behaviour of each patient so that the maximum benefit results.

It is essential to produce a basal anaesthesia resulting in a state of drowsy restfulness during which the patient will be co-operative and receptive to suggestion. Pentothal sodium is admirably suitable for this purpose and possesses the advantage of being reliable in action, with a wide margin of safety, and being the most speedily eliminated of the barbiturates.

The amount of the drug necessary for the employment of narcoanalysis varies considerably both with regard to the type of patient under investigation and with the skill and experience of the physician. It has been seen previously that premedicative measures will considerably reduce the quantity required; it has also been found that the rate of injection has a direct effect on the amount required, and if administered too rapidly more than is necessary is usually required, and is followed in turn by a deeper narcosis than is suitable. With a skilled operator, having minute to minute controllability, the requisite degree of narcosis can usually be attained with 3-5 c.c. of a 2½ per cent. solution. Within a period of 5-8 minutes the patient becomes drowsy and is in a state of passive receptivity—the necessary depth being gauged by questioning the patient while injecting and stopping the administration when the replies are given in a low regular monotone or when spontaneity of speech ensues. It has also been found advantageous to leave the needle in position at this stage, so that a further quantity can be readily administered if the state of light narcosis passes off too readily. As would be expected, the amount necessary varies according to the co-operation of the patient or otherwise—in unco-operative patients quantities as high as 12-15 c.c. of a 2½ per cent. solution have been required, while in susceptible cases a satisfactory state of light narcosis has been attained with as low as 1.5 c.c. of a 2½ per cent. solution. In the present investigation, comprising 187 patients, the average amount required was found to be 3 c.c. of a 2½ per cent. solution. Throughout the course of injection the operator arrests the attention of the patients and establishes hypnotic rapport with them. Certain observers have claimed that this can

be established in every case, but in the present series failure to obtain the requisite degree of narcosis resulted in 5 cases or 2.67 per cent. of the total series, while in 11 cases, or 5.88 per cent., the desired result was only produced on the second or third attempt.

The results obtained subsequent to injection can be roughly subdivided into two main groups. The majority of cases (in this series 109, or 58.3 per cent.) passed into a drowsy state and volunteered no information spontaneously. When questioned they either gave replies to the questions asked and thereafter dropped into the dreamy state, or in certain cases the act of questioning awoke a chord on which they talked animatedly for some time. In the lesser group (in this series 73, or 39 per cent.) the patients ramble on spontaneously without any preliminary questioning and pass rapidly from one subject to another, revealing their anxieties and fears. In both groups the most marked effect is perhaps the hypermnesia which results in all cases, incidents being gone over which the patient had no memory of in his waking state.

The subsequent analysis of the patient depends upon the material which emerges during the first investigation. In a few cases the complete analysis was attained with one prolonged administration, but in most cases the procedure had to be repeated on subsequent occasions. The average number of investigations over a series was found to be 5, while in one case 14 investigations were necessary before a complete analysis could be effected. The time involved in these investigations shows a considerable degree of variation, since certain patients became too drowsy after a period of 15–20 minutes, and the investigation in these cases had to be terminated until the following day. The average session was found to be 1.25 hours, while one case was able to be investigated for periods of 3.75 hours at a time. The hypermnesia which results is considered to be due to a removal of the ordinary inhibitions, enabling any conflict to come to the surface, and this has been found to be especially so in cases where some sexual problem proved to be the dominant factor. In practice the subject matter which emerges during the light narcotic phase is discussed with the patient in the waking state subsequent to the narcoanalysis, and an attempt is made further to amplify the material so obtained. On subsequent occasions an attempt is made to elucidate the subject-matter still further, paying special attention to any periods of life for which there is a marked amnesia. The advantage of this method of investigation is that the amount of relative information obtained in a period of 5–6 hours on an average is equivalent to that obtained by methods of ordinary investigation in a period of weeks, and in many cases the employment of a single investigation enables appropriate treatment to be instituted at an earlier stage than would otherwise be possible. This is especially so in unco-operative cases and where the feeling of shame is predominant.

Throughout the investigation it must be constantly borne in mind that the aim is the reintegration of the dissociated personality, and unless this can be accomplished subsequently the procedure of narcoanalysis may prove to be more harmful than beneficial in character, since the patient's failure of adaptation may be aggravated. This is especially so in the immediate post-hypnotic state, when psychic tension exists, and when the patient is in need of help probably more so than at any other period. The investigation should therefore be followed by a prolonged discussion with the patient in a waking state, during which the facts which have emerged are freely discussed, and this is followed by explanation and suggestions by the physician with the aid of persuasion and re-education. On this account it is advisable to allow the patients to remain in the side ward for a few hours before they return to the main ward. An intelligent nurse is usually found to be of value in anticipating any emotional reaction which may result, immediately following the investigation. In a considerable proportion of cases the investigation is followed by sleep, from which the patient awakes refreshed and able to discuss the material which has emerged. In another group a state of mild mental perturbation ensues, which usually passes off in a period of $\frac{1}{2}$ –1 hour and is not followed by any untoward effects. In only one case in the present series did any adverse reaction follow, and in this case the investigation was followed by a hypermaniacal phase requiring sedative therapy.

In the present investigation 187 cases were submitted to the process of narcoanalysis. Of these 83 were males and 104 were females, the average age being 37 years—males 33.2 years and females 39.9 years, with a range from 16–52 years

in both groups. The following table demonstrates the types of cases constituting the group.

<i>Classification of cases :</i>		<i>Alcoholism :</i>	
Anxiety neurosis	43	a. Chronic	1
Psychoneurotic anxiety state	13	b. Alcoholic hallucinosis	1
Hysteria	40	c. Korsakow's polyneuritic psychosis	2
<i>Schizophrenia :</i>			
a. Simple	7		4
b. Hebephrenic	4		
c. Paranoid	2	Puerperal psychosis	11
d. Catatonic	2	Obsessive compulsive psychoneurosis	2
	—	Psychopathic personality	8
	15	Paranoid state	2
<i>Epilepsy :</i>		Paraphrenia	1
a. Depression	2	Involutional melancholia	5
b. Excitement	1	Traumatic mental enfeeblement	5
c. Automatism	1	Presenile dementia	2
d. Dementia	1	Arteriopathic dementia	3
e. Cysticercosis	1	General paralysis	2
	—	Sexual perversion	1
	6		
<i>Depression :</i>		<i>Psychosis with organic brain disease :</i>	
a. Agitated	2	A. Thrombosis	2
b. Simple retardation	7	B. Embolism	1
c. Acute	7		
d. Hypochondriacal	5		
	—		
	21		

. The following table demonstrates the salient features in the series of cases :

Number of cases investigated.	Number of times narcoanalysis carried out.	Average number.	Average duration in hours.	Shortest duration in hours.	Longest duration in hours.
187	943	5	1.25	.8	3.75

While the above table shows the results obtained over the whole series, certain well-marked differences were found in the individual groups which are considered worthy of further discussion. These may be shortly summarized as follows :

Individual Groups.

A. Anxiety Neurosis.

This group, 43 in number, proved very suitable for this method of investigation. The average number of investigations required in this group was 6.25, or 1.25 above the series average. The average period of investigation was again above the mean for the series, requiring 2.25 hours as against 1.25 hours. A subsequent successful analysis of the underlying causative factors was possible in 41 or 95.4 per cent. of the cases, while the resultant synthesis produced a satisfactory adjustment of these in 37, or 86 per cent. of the group. In the remaining 14 per cent. adjustment was not possible, and although the technique of narcoanalysis enabled an explanation of the mental mechanisms involved to be given to the patient, environmental factors beyond their control prevented the desired adjustment from taking place.

B. Hysteria.

In this group the method gave the most striking results. As might be expected, this group, 40 in number, proved most co-operative and most readily suggestible. The average period required was 1.55 hours as against 1.25 hours. In two cases the requisite degree of light narcosis was produced with as low a dosage as 1.5 c.c. of a 2½ per cent. solution, while the average dose required was considerably below the average, being 2.02 c.c. as against the mean of 3 c.c. for the group. Synthesis

was not so successful in this group as in the previous group. Satisfactory subsequent adjustment following synthesis resulted in 25, or 60.25 per cent., of cases. Against this must be stated that the duration of the illness in this group was more prolonged than in the previous group, the average period before coming under investigation being 7 years, with a range from 3-18 years, while in the previous group the average period was 14 months, with a range from 6 weeks to 2 years 3 months.

C. Psychoneurotic Anxiety State.

In this group of 13 cases the most gratifying results were obtained. The number of investigations required, the dosage of narcotic and the period required were all within the mean limits of the series. The group comprised 5 cases to which clinically the term "effort syndrome" could be applied, but in view of the facts which emerged under narcoanalytical procedure and the subsequent history of the cases, these were considered to be more suitably included in this group. Synthesis resulted in a satisfactory adjustment and resolution of underlying difficulties taking place in 12, or 92.3 per cent. of these cases.

D. Puerperal Psychosis.

A selected group of 11 cases were investigated, in all of which the psychotic reaction was associated with the act of childbirth, and in which there was no history of previous mental instability. The group was necessarily limited in number on account of the numerous contra-indications to the employment of this method of investigation which are found in this type of reaction. Of these 11 cases synthesis produced a satisfactory adjustment in 6, or 54.5 per cent. of cases. Of the remaining 5 cases, 4 of these were further complicated by factors beyond the patient's control in connection with the husband's absence on service, financial difficulties, etc., and the resultant anxiety was considered to be partly responsible for the lack of adequate response.

E. Depression.

In this group 21 cases were investigated, 7 of these being of the simple retardation type, 7 suffering from acute depression, 5 from hypochondrial depression, and 2 being of the agitated depression type. Of these 21, 14, or 66.6 per cent., were benefited by the narcoanalysis and subsequent synthesis. The results obtained in the different types are interesting, and may be shortly summarized as follows:

In the simple retardation group all 7 cases were benefited and able to make a satisfactory adjustment subsequent to treatment; 4 of the 7 cases in the acute depression group benefited; in the hypochondrial group the underlying inhibitions were removed in 3 out of 5 cases, while in the agitated depression group no appreciable benefit resulted in any of the cases.

F. Schizophrenia.

Of the 15 cases in this group, 7 were grouped in the simple type, 4 were in the hebephrenic type and 2 each in the katatonic and paranoid groups. Of these a satisfactory subsequent adjustment resulted in 2 cases of the simple group, while the others remained unaffected. The most striking result in this group was the spontaneity of response in most cases, the patients, who had previously been monosyllabic, introverted and reticent for weeks, becoming garrulous immediately the requisite degree of light narcosis had been attained.

G. Other Groups.

In the other groups the number of cases under review were not sufficiently large in each individual group to allow of any definite conclusions being arrived at. Of these 44 cases which were investigated in private practice, in hospital and at psychiatric clinics, the underlying psychological factors were elucidated in 32, or 72.7 per cent. of cases. As might be expected from the clinical types comprising the group, the degree of adjustment attained subsequently was poor, and was often adversely affected by environmental factors over which the patient had little control. The results in the various groups may be summarized in the following table:

Type.	Number of cases.	Average age and range.	Duration of symptoms.	Number of treatments.	Average duration in hours.	Pentothal required.	Percentage of adjustment.
Anxiety neurosis	43	36 years (18-56)	14 months	6.25	2.25	3.2 c.c.	86
Hysteria	40	32 years (17-38)	7 years	5.025	1.55	2.02 "	60.25
Psychoneurotic anxiety state	13	28 years (18-35)	10 months	5.0	1.8	3.02 "	92.3
Puerperal psychosis	11	27 years (18-32)	12 "	6.25	2.05	3.5 "	54.5
Depression	21	39 years (25-52)	3.25 years	7.2	2.3	3.6 "	66.6
Chizophrenia	15	22 years (16-27)	2.15 "	5.5	2.25	3.8 "	13.3

Before considering the utilization of pentothal sodium in narcoanalysis, every patient should be thoroughly investigated from a physical point of view and special attention should be paid to the following conditions :

1. *Age of the Patient.*

It is inadvisable to employ the method of narcoanalysis in young children below the age of 14 years, or in elderly persons above the age of 60 years. In both these groups prolonged administration may lead to the onset of respiratory difficulties, while in the former group the fear which accompanies the use of the method, as well as the diminished calibre of the veins, makes this technique difficult and unsuitable.

2. *Liver Disease.*

The use of pentothal sodium should be avoided in cases of hepatic insufficiency, hepatic disease, jaundice or biliary tract disease, on account of the diminished capacity to detoxicate the drug.

3. Since pentothal sodium is a respiratory depressant, its use should be avoided in respiratory and cardiac cases. These include such cases as those of cardiac insufficiency, advanced pulmonary tuberculosis, bronchiectasis, asthma and chronic bronchitis. To a lesser extent its use is inadvisable in those suffering from laryngitis, tonsillitis and any cervical infection.

4. In toxæmia its use is definitely contraindicated.

5. General feebleness or any existing hypotension render its use inadvisable on account of its tendency to lower the blood pressure.

6. It should not be employed in conjunction with other barbiturates, and cases which have been receiving previous sedative treatment should have a period of observation to allow elimination of the drug before narcoanalysis is instituted.

7. The administration should always be carried out with the patient in a recumbent position, owing to the fall in blood pressure which ensues, and the erect or sitting position should be avoided.

In 22 cases, or 11.8 per cent. of the series, an investigation was carried out on the blood urea before, during and subsequent to the administration of the pentothal sodium. In none of these were any appreciable results found to suggest that there was any effect as the result of the prolonged administration of the drug.

Investigations were carried out on 10 cases, or 5.9 per cent. of the series with reference to the blood sugar. By means of the Folin-Wu method it was found that subsequent to injection in 6 cases, the blood-sugar curve rose 10 mg. per cent. but had fallen to normal within a period of 15 minutes. In 3 cases there was an initial fall of 20 mg. per cent. with a slow rise to normal over a period of 30 minutes, while one case failed to show any appreciable alteration in the curve. The small number of cases dealt with renders it unwise to draw any conclusions from these results beyond that the blood-sugar changes which do occur originate in functional rather than physical or endocrine changes.

An objection to this method of approach to psychotherapeutic problems might conceivably be raised on the grounds that the results obtained are similar to those obtained by hypnotism and hypnotic suggestion. This has been found not to be so, since in narcoanalysis the connection between physician and patient is purely impersonal in character and does not influence the course of further psychological treatment, as is so often the case where hypnotic methods have been utilized. A further differentiation can be found in the fact that the method does not wholly

depend upon a depressing of the cortical centres with a resultant removal of inhibition as was originally advanced by Hermann. The researches of Lindemann and more recently those of Reitmann have shown that the effects are not interrupted by introducing a cortical stimulant such as cardiazol during the investigation which would serve to neutralize the depressant effect if this was the sole action of pentothal sodium. Further, in this investigation, the dosage employed in certain cases has been sufficiently small to rule out the possibility of any cortical depressant action.

SUMMARY.

The technique of narcoanalysis by means of pentothal sodium in a group of 187 patients whose ages ranged from 16 to 52 years has been described. The method appears to constitute a new advance in psychotherapeutic procedure and to possess the advantages of ease of induction with small amounts of barbiturate, the certainty of production of a suitable degree of narcosis for analytical purposes and the rapidity of recovery following its use. The method can be employed either as a psychotherapeutic adjuvant, as a diagnostic procedure or as a rapid method of approach. These qualities make this form of investigation eminently suitable for use in psychiatric practice in hospitals, clinics, nursing homes and in the patient's own residence. Control experiments failed to reveal any resultant changes in the blood, blood urea or blood sugar as a result of the method. The differences between narcoanalysis and hypnosis have been noted, and evidence has been advanced to show that the effect of pentothal sodium is not merely that of a cortical depressant. While it is not suggested that the method should take the place of formal analytical investigation, the technique is considered to be of value in certain cases where psychoanalytical treatment cannot be obtained, and has a definite place in the routine investigation of doubtful psychiatric cases, especially in those cases where the question of malingering has been raised.

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