HYPNOTIC PHENOMENA, INCLUDING HYPNOTICALLY ACTIVATED SEIZURES, STUDIED WITH THE ELECTROENCEPHALOGRAM¹

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In 1776, the Austrian physician, Franz Anton Mesmer, began his work with animal magnetism, or hypnotism. The same convulsive phenomena, spectacular surgical anesthesias, bizarre hallucinations, regressed behavior and telepathic communications that Mesmer and his many successors obtained have never failed to stir controversy as to what was genuine and what was simulated, and what changes actually occurred in the body. With the advent of new measuring technics, the trance state again was intensively studied. In some subjects profound and striking psychosomatic changes were noted. An excellent modern review of this subject can be found in Wolberg's two volumes (13).

Our purpose was to repeat some of the previous hypnotic experiments (5), using the electroencephalogram, and also to make special studies with the more recently discovered technics of lambda waves, wicket waves and the photic response. Accordingly, we then studied hypnotically-produced visual hallucinations, blindness, anesthesia, phantom hand movements, sleep and regression. We wondered if seizures could be activated by an hypnotic technic, and if so, what changes might occur in the electroencephalogram.

PROCEDURE

The trance was induced by an eye-fixation and levitation technic while the subject was connected to an eight-channel Grass ink-writing electroencephalographic machine. The same general prevailing conditions of illumination and distracting external stimuli, such as telephones, typewriters or epileptic outcries, held for both the control and hypnotic states in our

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11 physician-subjects and 35 patients. Although any grading system for depth of trance has its drawbacks because of the unequal distribution of phenomena, for the purposes of this study we graded the trance as follows:

- Grade 1. Physical relaxation and catalepsy of eyelids and limbs.
- Grade 2. Grade 1, but in addition, anesthesia.
- Grade 3. Grades 1 and 2, but in addition, greater extension of anesthesia, blindness and hallucinations.
- Grade 4. Three previous grades, but in addition, regression and more striking psychosomatic phenomena.

At the conclusion of every trance the subject received suggestions that oriented him to his pre-hypnotic state.

VISUAL PHENOMENA

Eleven subjects, mostly physicians, were studied for visual phenomena in the presence of medium to deep hypnotic trances, by means of the electroencephalogram. The results are summarized in table 1. In addition to the requirement of a deep trance, with visual hallucinations and blindness, there was the problem of obtaining good control visual phenomena when the subject was not in a trance. For instance, if the subject had inhibition of alpha rhythm in the presence of visual hallucinations, as reported earlier by Barker and Burgwin (1), it was important to know what the reaction would be in the normal conscious state, with only imagination of a vision. The same would hold for lambda waves; for instance, their response to the "look-atthe-picture" test, whether they occurred during conscious conjuring of a vision with the eyes closed, or finally, whether they occurred spontaneously when the subject was looking about the room. Special interest was devoted to lambda waves in the presence of hypnotic hallucinations since Gastaut (4) has noted the appearance of these waves in the electroencephalograms of some psychotic patients having visual hallucinations. Our experience confirms this observation.

In none of the 11 subjects were the alpha

Hypnotic Phenomena Studied with the Electroencephalogram

TABLE 1VISUAL H	HENOMENA OF	11 Physicians	DURING DEED	P HYPNOTIC	TRANCES	STUDIED
	Elect	ROENCEPHALC	GRAPHICALLY			

Sub- ject	Control Lambda Response to 'Took at the Picture'' (Eyes Open), Grade*	Lambda Response to Hyp- notic Visual Hallucinations (Eyes Closed), Grade*	Alpha Response to Hypnotic Visual Hallucinations (Eyes Closed)	Control Alpha with Eyes Open	Alpha with Eyes Open during Hypnotic Blindness	Lambda Response to "Look at the Picture" during Hypnotic Blindness : (Eyes Open), Grade*	Photic-Drive Changes during Hypnotic Blindness (Eyes Open)	Clinical and Miscellaneous
1	1-2	1–2	Inhi- bi- tion	0	Occa- sional	1	Graphically absent response as compared with control; strong alpha probably masks drive	Grade 4 trance. No lambda with mescaline visions; could not be hypnotized at height of mescaline psychosis
2	0	0	Inhi- bi- tion	0	Occa- sional; Eyes taped open	0	Minimal flattening or de- crease	Grade 3 trance, Marked increase in alpha during blindness and deafness with eyes open
3	3	0	Inhi- bi- tion	Occa- sional	0	1	Increased low-amplitude drive with many harmonics	Grade 3 trance. No lambda with hypnotic reinforcement of LSD-25 visual hallu- cinations. LSD-25 visions abolished in hypnotic trance without change in elec- troencephalogram
4	1	0	Inhi- bi- tion	0	Occa- sional	0	-	Grade 3 trance
5	1	1	Inhi- bi- tion	0	Occa- sional	0	No change	Grade 3 trance
6	1	0	Inhi- bi- tion	0		-	_	Grade 3 trance. Could not abolish LSD-25 visual hallucinations in the trance: no electroencephalographic change
7	1		_	0	0 Eyes taped open		Higher amplitude response	Grade 3 trance. Pupils markedly dilated with suggestion of darkness; disappear- ance of alpha with suggestion of bright light
8	2	1	Inhi- bi- tion	Occa- sional	More fre- quent; Eyes taped open	-	Higher amplitude response	Grade 4 trance. Markedly dilated pupils with blindness; sluggish reflex to light. Reaction reverts to normal on suggestion of vision
9	2	<u>1</u> 2	Inhi- bi- tion	Occa- sional	Occa- sional	1/2	Increased response of lower amplitude with more har- monics	Grade 3 trance
10	2	1/2	Inhi- bi- tion	0	0	-	No change	Grade 3 trance
11	0	_		0	Occa- sional	_	Increased response of low- amplitude harmonics dur- ing suggestion of continu- ous bright light	Grade 3 trance. Immediate sustained bursts of alpha activity with eyes open when in trance and told room is dark

* Grade 1 = minimal; Grade 2 = moderate; Grade 3 = marked.

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waves suppressed, and in none did lambda activity appear when the subject's eyes were closed in the attempt to imagine a scene, without hypnosis. In nine subjects with hypnotic visions alpha activity was concomitantly suppressed with the eyes closed. Of the nine, five had some lambda waves at this point. In general, the lambda response with hypnotic hallucinations was minimal, in comparison with the controls. A factor that might account for this reaction is that the eyes are closed during the vision, in contrast to the fact that the eyes are open and moving about a real picture during the control observations. Groethuysen and Bickford (6) have found lambda waves to be associated with eye movements. Clear-cut, concrete visions in the subjects with the best lambda response to hypnotic hallucinations would suggest greater eve movements than in those patients whose visions consisted of abstractions and fantasies.

For instance, subject 1, a fisherman, engendered good lambda waves when he had a vivid vision of a great northern pike, whereas subject 8 engendered poor lambda waves while he was describing a vision of Ernest Hemingway fishing. The lambda waves, however, could not be produced in the fisherman by mescaline-induced visions, which consisted of multiple abstractions and fantasies. He could not be hypnotized at this time.

In an attempt to potentiate any lambda response to visual hallucinations, two subjects, while at the height of the d-lysergic acid diethylamide (LSD-25) psychosis with visions but no lambda activity, were hypnotized. Although clinically the visions were alternately augmented and abolished in one subject and impossible to influence in the other, no concurrent electroencephalographic changes were noted.

Absence or marked suppression of lambda

Looking at picture Lambda response	Looking at same picture Hypnotic blindness
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6-8 Mahammahan	man and a state of the state of
7-9 Mr. M. M. Marken M.	-
8-10 MAMMAMAN	Mary Mary Mary Mary
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FIG. 1. Change in lambda response during hypnotic blindness.



FIG. 2. Driving response at photic stimulation of 11 flashes per second in the control state and during hypnotic blindness.

waves occurred in five of six subjects with hypnotic blindness when they looked at the control picture (fig. 1). In spite of encouragement to gaze around the picture which they held in their hands, it was probable that their eyes did not move about as in the unhypnotized state. In two other patients with lack of lambda response during hypnotic blindness, no eye movements were discerned by means of eye leads. Even so, why there should be such uniform restriction of eye movement in the presence of hypnotic blindness is a question in itself. Possibly it is an attempt to shut out all alerting stimuli that might interfere with the successful accomplishment of the suggestion.

Of 11 subjects, three manifested occasional alpha waves in the control with their eyes open; one of these had no alpha waves with the eyes open when hypnotically blinded. Seven subjects exhibited some sporadic alpha waves when hypnotically blinded with the eyes open and under the same conditions of illumination as in the control. In no instance were we able to repeat Loomis, Harvey and Hobart's observation (9, 10) of alpha activity occurring during 15 seconds of hypnotic blindness and suppression of the alpha rhythm during alternate 15-second periods of suggested vision. The eyes of three subjects in deep trances and blindness were taped open, as were the eyes of the above-mentioned subject, but none had any particular change in alpha activity. Despite no striking change in the



FIG. 3. Driving response at photic stimulation of 8 flashes per second in the control state and during hypnotic blindness.

electroencephalogram, in two of these three subjects who received the suggestion of blindness "that would be like total darkness", pupils developed that were much more dilated and sluggish in their reaction to light. This pupillary response reverted to normal with the suggestion of normal vision.

An interesting electroencephalographic response was noted on photic drive in seven of nine subjects with hypnotic blindness. Subject 1 (fig. 2), with a control driving response at 11 flashes per second, had no graphic evidence of driving during hypnotic blindness. Rather than true suppression of the driving response, it is more likely that with the combination of blindness and flashing light a strong alpha rhythm developed that masked the driving response. Subject 2 had minimal flattening and less apparent driving response when hypnotically blind. Subject 3, when hypnotically blind, showed an increased driving response of low amplitude with many harmonics (fig. 3). Subject 7 showed an increased drive of higher amplitude in the blind state as compared with his control. Of the remaining three subjects in this group of seven

who had hypnotic blindness, all had better driving responses in the trance; one of higher amplitude and the other two of lower amplitude and many harmonics. There does not seem to be any consistent clinical correlation with these data. In two subjects who received the suggestion of continued light flash after the light actually was turned off, there was no response different from the control. Because of the conflicting types of photic response with blindness, it would seem that the state of alertness or relaxation might be relevant. This in turn would depend on the neurophysiologic changes associated with the meaning of blindness to the subject. The response is, of course, in no way like a totally absent response that would be anticipated in the presence of total blindness to perception of light, as in complete optic atrophy.

ANESTHESIA

Ten subjects, of whom six were physicians and four were patients, were studied as controls and while under hypnotic anesthesia. The technic used consisted of a short volley of pinpricks to the dorsum of each hand while the eves were closed. Earlier, in a good subject, Loomis and associates (9) reported suppression of alpha activity as a result of pinpricks during hypnotic anesthesia. No control measure was employed. Seven of our subjects had excellent subjective anesthesia and three only fair. Because of the normal spindling of the alpha rhythm, it was hard to discern any change in several cases. However, there was no difference in the alpha response between the control and the trance state. In five subjects there was no constant alpha inhibition. In the remaining five there was a variable degree of alpha suppression. In three subjects with regression to early childhood there was no change in response, despite maintenance of good anesthesia. In one subject, the additional factor of an LSD-25-induced psychosis while the subject was hypnotized, and with suggested anesthesia, showed no response different from the control and plain hypnotic anesthesia. The experiment was repeated with one subject who had no scalp electroencephalographic changes and in whom good control hypnotic anesthesia was achieved, and in the repetition depth electrography coincidental to other studies was used. Although this subject had considerable pain after a recent craniotomy, and despite the fact that his pain was completely relieved during the trance so that he could fall asleep without the necessity of drugs, there was no discernible change in the depth waves on pinprick stimulation. The areas measured were deep in the frontal, occipital and temporal lobes. This does not rule out electroencephalographic changes in other areas deep in the brain.

These studies throw no light on the mechanism of hypnotic anesthesia unless it be that they indicate an altered state of attention where pain is perceived but not appreciated in its emotional aspects. Although some have compared hypnotic anesthesia to psychologic lobotomy, the comparison does not explain the mediating mechanism. However, the clinical fact remains that in good subjects, major surgical procedures can be undertaken solely with the aid of hypnotic anesthesia.

WICKET RHYTHM (ARCEAU RHYTHM)

Because of Gastaut and Bert's studies (3) of wicket waves and their inhibition by the

effects of movement or imagined movement, such as while watching a prize fight, together with the unusual observation of Klass and Bickford (7), who studied a patient who had undergone high amputation of the left arm and who had inhibition of wicket waves while opening and closing his phantom fist, we investigated five subjects with good control wicket rhythm. While in a deep trance they were asked to open and close a phantom hand after they had become seemingly unaware of their somatic hand by hypnotic spatial disorganization. Even though the desired subjective effect was attained, there was no change in the wicket activity, unless it became slightly more frequent.

SLEEP

Natural sleep and the hypnotic trance were believed to be parts of the same fundamental phenomenon until 1947, when Dynes (2) reviewed the pertinent literature and showed the two conditions to be really quite different. The relationship between the two states was narrowed down, however, by the production of true electroencephalographic sleep with specific suggestions. In Barker and Burgwin's four subjects with illustrative recordings only flattening was demonstrated. Among our seven subjects in whom sleep was induced hypnotically, flattening showed in three, spindles and V waves were noted in three, and 120-microvolt, 1-to-2-per-second slow waves were recorded with depth leads from one subject. In the latter case some increased activation of a spike-wave temporal focus was noted. In no cases were K complexes obtained. Two subjects with V waves would remember nonsense syllables only when these were associated with the alerting of alpha activity by the stimulus word during sleep. One subject whose record showed the flattening effect of light sleep failed to recall the word, "tiger", spontaneously, but chose it from a list of several words.

Although these observations are too few in number to permit the formation of any valid opinion concerning the relationship of memory, recall, amnesia and symbology to the level of sleep as revealed by the electroencephalogram, the sum total of cases shows that sleep induced by the trance can, like natural sleep, proceed to the stage at which V waves are produced. It would be of interest to determine if the type of dream material occurring during hypnotically induced sleep could be correlated with the level of sleep as indicated by the electroencephalogram. For example, a dream topic could be suggested to a subject while he is at a certain level of sleep. After the subject is awakened, the dream material which he reported could be studied in an attempt to correlate the different mechanisms of dream work (displacement, condensation, dissociation, repression and the like) with the various levels of sleep.

Automatic Frequency Analysis

Two subjects were studied with the Ediswan automatic-frequency analyzer. In the first subject only the left parieto-occipital area was analyzed. In the other subject the sylvian, frontal, parietal and occipital areas were analyzed. Clinically, both subjects showed the hypnotic phenomena of catalepsy, automatic movements and anesthesia. In no instance did the analysis reveal any difference between the control state and the hypnotic trance. This was also true with reference to hypnotic blindness, which was studied in the second subject and checked with photic stimulation. However, when the mental age of this second subject was regressed to three





years, at which point he chattered like a 3-year-old child, the record on gross inspection resembled that produced by drowsiness or light sleep. This was substantiated by frequency analysis, which revealed a shift to the delta and theta bands, in contrast to the usual alpha predominance (fig. 4). This result was not constant and reproducible.

Regression

Deep regression was carried out in five subjects. In no case was there any notable electroencephalographic change. In two cases clinical regression was advanced, with the assumption of infantile facies, inability to talk and withdrawal phenomena on plantar stimulation. In one case a fronto-occipital muscle artifact constantly appeared when regression had reached the 1-year level. In another subject, an inveterate stutterer, speech was normal during the trance and regressed state; yet the electroencephalogram was unchanged.

In the next section of this paper are mentioned many cases in which regression and appropriate suggestions failed to precipitate seizures in patients with striking electroencephalographic abnormalities and histories of convulsive disorder triggered by nervousness.

SEIZURES WITH PROBABLE ORGANIC CAUSE

Kupper's hypnotic activation (8) of a seizure in a sailor in whom regression was carried to a traumatic period of his life, with the concomitant electroencephalographic dysrhythmic changes and their subsequent normalization when regression was carried further, suggested our hypnotic studies on a series of 16 patients with convulsions. The patients were selected according to the indication of convulsions on the referral card, and were hypnotized after the control recording had been completed.

With the same technic as used previously, moderate-to-deep trances usually were obtained within several minutes. Many of the patients gave nervous tension, fatigue or menstrual periods as the precipitating factors in their seizures (table 2). When in a deep trance the patient was then instructed that at the count of five he would have an overpower-

TABLE 2.—Hypnotic	Reproduction	OF SEIZURES:	16 PATIENTS	SUBJECT	то	Convulsive	SEIZURES,
	WIT	H PROBABLE	Organic Cau	SE			

Patient		Diagnosis, Duration of Disorder	Clinical History	Electroencephalogram	Hypnotic Trance	
1	38 M	M Convulsive disorder, 5 years		Minimal dysrhythmia, bi-tem- poral, maximal left. Metrazol test; no clinical or electroen- cephalographic activation	Grade 2, nothing obtained; no memory of déjà vu, seizure. No response to suggestion of pre- cipitating factors of "tension and fatigue"	
2	33 M	Convulsive disorder, 11 years	Head injury 11 years ago; first at- tack followed Normandy land- ing. Nervousness precipitates tonic-clonic convulsions with tongue biting	Marked dysrhythmia; generalized spike wave. Metrazol-electro- encephalographic activation of myoclonic type of petit mal with clinical seizure	Grade 3, despite good clinical re gression to time of Normandy beach; no seizure or spike wave	
3	46 M	Convulsive disorder, 11 years	Head injury 12 years ago. Aura of odor in left nostril followed by petit mal	Minimal delta, left sylvian; marked dysrhythmia focal sharp-wave, left temporal. At- tack during hyperventilation: confusion, refused to obey com- mands, groping hands (1 min- ute) associated with 5 per sec- ond slow wave, left sylvian dis- charge with spread to the left frontal region and hemisphere	Grade 3; nothing obtained	
4	36 F	Convulsive disorder, 14 years	Temporal-lobe fit: aura of sounds seem distant, feels as if some- one is trying to break into the house followed by petit and/or grand mal	Marked dysrhythmia, sharp- wave focus, maximal right temporal	Grade 3; no aura, seizure, memo- ries	
5	43 F	Convulsive disorder, 1 year	Paroxysmal vague feeling, tight- ness in chest, stares	Marked dysrhythmia, general- ized, maximal right hemi- sphere, mixed spike-and-slow wave. Metrazol: activation of right frontosylvian discharge; confusion and disorientation	Grade 3; nothing obtained	
6	28 F	Convulsive disorder, 20 years	After pertussis as a child, grand- mal seizures with aura of seeing objects down a long passage	Minimal dysrhythmia, general- ized, maximal bitemporal	Grade 3; no aura or seizures	
7	17 F	Convulsive disorder, 9 years	Vague visual aura of "mom and dad", followed by petit mal. Usually precipitated by excite- ment or menstruation	Moderate dysrhythmia, focal sharp-wave discharge, left syl- vian. Metrazol: induction of petit mal with spike wave by concomitant photic stimulation	Grade 4; no aura, no seizure, no activation with LSD-25 or hyp- nosis and LSD-25, in addition to photic stimulation	
8	36 F	Convulsive disorder, 2 years	Temporal-lobe fits: aura of light- headedness, silly dreams and, rarely, tonic-clonic convulsions with tongue biting	Moderate dysrhythmia, general- ized, maximal bi-temporal	Grade 3; no aura, no seizure	
9	31 F	Convulsive disorder, 4 years	Temporal-lobe fits: sucking of lips, stares, stops talking, feel- ing of looking at things from a distance	Moderate dysrhythmia, focal sharp-wave, right temporosyl- vian	Grade 3; no seizure	
10	37 F	Convulsive disorder, 6 years	Spells of floating away, hesitant speech, peculiar facial expres- sion, feeling of tremulousness; one episode of syncope	Minimal delta, right sylvian- frontal; moderate dysrhthmia generalized; maximal right syl- vian	Grade 3; no seizure, no memory	
11	27 F	Convulsive disorder, 3 years	Jerky spells with two episodes of unconsciousness and tongue biting. Precipitated by tension	Marked dysrhythmia, atypical spike and wave, moderate light sensitivity	Grade 3; no seizure or spike wave with suggestion of bright light	

Patient		Diagnosis, Duration of Disorder	Clinical History	Electroencephalogram	Hypnotic Trance		
12	40 M	Convulsive disorder, 7 years	Grand-mal seizures that come on only when completely relaxed	Marked dysrhythmia general- ized, multiple spike episodes bisylvian. Metrazol activation: grand-mal seizure	Grade 3; complete relaxation, no seizures		
13	21 M	Convulsive disorder	Temporal-lobe automatism: aura of strong memory, bad smell or thought	Marked dysrhythmia, spike wave, generalized. Metrazol: focal right frontosylvian acti- vation; with automatism lead- ing to generalized seizure	Grade 3; no recall, nothing ob- tained. No change in scalp or depth electroencephalogram in frontal, occipital and temporal lobes		
14	10 F	Convulsive disorder, 8 months	Episodes of gazing with loss of contact, blinking and jerk. Precipitated by entering a bright room or scolding by older sister	Marked dysrhythmia, spike and wave, generalized; light sensi- tive higher frequencies	Grade 3; no seizure on suggestion of sister's nagging; however, in- creased muscle artifact. With calming suggestions less spike- wave activity on photic drive. Not significant, however, due to spontaneous variation of re- sponse and recognized inhibition of spike wave during mental ac- tivity in other patients		
15	19 F	Convulsive disorder, 6 years	Encephalitis, age 3. Attacks of peculiar feeling, swallowing, purposeless movements. Nerv- ousness and menstrual periods precipitate	Marked dysrhythmia, left tem- poral sharp-wave focus	Grade 2; no aura or seizure		
16	33 M	Convulsive disorder, 6 years	Chiefly nocturnal tonic convul- sions; tongue biting	Minimal dysrhythmia, bi-tem- poral, maximal left	Grade 3; no seizure; just "blank- ness"		

TABLE 2.—(Continued)

ing feeling. If nothing happened at that point, he was told that he would next have a strong feeling such as he had had before in his life; finally he was told that at the count of three he would have a spell. If all these factors failed, specific suggestions were made that pertained to the history. For instance, if a patient said fatigue or an argument with his spouse precipitated a seizure, an appropriate suggestion was made. In many cases regression was carried to the time of the patient's first or last seizure, yet clinical or electroencephalographic changes could not be produced. In one subject with an 11-year history of seizures which he spontaneously attributed to nervousness as the triggering factor, regression was carried to the time of an incident on a Normandy beach, where he had his first seizure under the tension of battle. Nothing happened in the laboratory. In a light-sensitive, myoclonic epileptic patient no spike-wave discharges were elicited during the trance with the suggestion of bright light. In none of the cases of temporal-lobe seizures were any of the characteristic auras activated.

Peterson (11) found that when his patients with organic epilepsy were hypnotized, there was complete amnesia for the seizures, whereas those whose epilepsy was psychogenic could recall their seizures. In our studies, when the patient was connected to the electroencephalogram while in a trance, no spontaneous material (ideational, affective or motor) was produced that could be linked with the dream states, peculiar feelings or behavior found in the seizures. If organic epilepsy is a symptom of an etiologically broadspectrum disease, it is surprising that no such material was obtained during hypnosis. Should not something have been activated, if such material was important enough to the patient to determine the seizure pattern? The failure of hypnotic activation by the technic herein described does not imply that seizures of this type cannot be precipitated by emotional factors. Emotional factors often

Presenting		Presenting Symptoms on Referral to	Electroencephalographic	Humpotia Tranco		
Fatient		Electroencephalographic Laboratory	Diagnosis	Hypnotic Trance		
1	18 M	History of head trauma. Seizures of 2 months' duration, aura of tightness in epigastrium followed by tonic-clonic con- vulsions, can't talk during attack	Minimal dysrhythmia gen- eralized	Grade 3; identical spell as in history, patient confirms hitsory, spell ended by suggestion. No electroencephalographic change in spell		
2	39 F	Convulsive disorder for 6 years, sharp ster- nal pain, cries out, clutches chest, stares, does not talk, jerks right arm, bites tongue, foams at mouth, unconscious for several minutes	Essentially normal	Grade 3; identical spell precipitated and ended by suggestion. No electroenceph- alographic change in spell		
3	33 F	? Space-occupying lesion, 1½-year history of acute attacks of dizziness, tightness in chest, hoarseness, fullness in head, chok- ing followed by nausea, headache, gen- eralized weakness. Past exploratory laparotomy for (?) abdominal disease; ad- vised to have thyroidectomy	Minimal dysrhythmia, bi- temporal	Grade 3; identical spell precipitated and ended by suggestion. No electroencepha- lographic change		
4	27 F	? Convulsive disorder of 1 year's duration, acute changes in visual and auditory per- ception followed by loss of consciousness after ingestion of alcohol, rocking sensa- tion in head, feels ready to float away and faint	Minimal dysrhythmia, bi- occipital, maximal left	Grade 3; no attack with "overpowering feel- ing", typical seizure and recall of previous ones when given glass of water and told it had equivalent of alcohol of 2 glasses of beer. No change in electroencephalogram. No attack or electroencephalographic change with 700 cc. of 5 per cent alcohol, given intravenously		
5	17 F	Convulsive disorder for 3 years after auto accident; episodic chewing movements, left side of face twitches, total collapse, clawing of face and throat, whimpering and flushing	Moderate dysrhythmia, generalized, maximal right temporoparietal	Grade 3; identical spell precipitated and ended with suggestion. Face bled with scratching. No change in electroencepha- logram during spell. No clinical or electro- encephalographic activation with photic stimulation and 950 mg. of metrazol		
6	19 M	Eight grand-mal seizures for past year. Diz- ziness, blackness of vision, falling to ground, tonic-clonic convulsion with drooling from left side of mouth	Essentially normal	Grade 3; typical attack precipitated and ended with suggestion. No change in elec- troencephalogram during seizure		
7	51 F	Paroxysmal atypical right facial pain for 10 years; fine twitching facial muscles on right with unilateral tearing for 80 sec- onds. Past delirium due to overdose of tri- chlorethylene	Minimal dysrhythmia bi- sylvian, maximal left; photic-drive precipitated clinical seizure without change in electroen- cephalogram	Grade 3; attack produced and ended by sug- gestion on three occasions. No electro- encephalographic changes. Photic drive carried out in trance without precipitation of seizure		
8	18 M	Two fainting spells past month, progres- sively severe headaches for 3 years	Minimal dysrhythmia; fo- cal right sylvian	Grade 3; attack produced and ended by sug- gestion. Moaning, twitching, grimacing right face, flushing, clenched fists, muscle artifact with fainting. No change in elec- troencephalogram		
9	23 M	Epilepsy for 4½ years; aura: a premonition followed by paroxysmal twitching of right eye and face. Occasional tongue bit- ing, one episode of unconsciousness	Minimal dysrhythmia, bi- sylvian, maximal right	Grade 3; attack produced and ended by sug- gestion twice. Minimal tongue biting. No change in electroencephalogram		
10	33 M	Post-traumatic convulsive disorder for 10 years after crash in B-29. History of grand-mal seizures with tongue biting fre- quently followed by vivid hallucinations	Moderate dysrhythmia, fo- cal left temporal sharp- wave discharge	Grade 3; attack produced and ended by sug- gestion. Jerking of right hand, fluttering of eyelids, jerking of head and whole body, opens eyes widely and searches but no blink or withdrawal on visual stimulation. Has hallucinations of Rhett Butler and little Bonnie falling from a horse; face flushes, slumps forward in simulated faint. No change in electroencephalogram. Discusses previous seizures during trance. Amnesia for seizure afterward		

TABLE 3.—Seizures Hypnotically Activated: 10 Patients Referred for Electroencephalography Because of Presumed True Seizures

are subtle, and would require a carefully taken psychiatric history for evaluation. Nor does failure of the hypnotic activation in this respect imply that epileptic patients do not have emotional problems and do not need psychotherapy. However, in these cases the hypnotic trance frequently afforded a more relaxed state and consequently a better technical recording with minimal artifact.

SEIZURES HYPNOTICALLY ACTIVATED

In table 3 the data concerning 10 patients are summarized. These 10 patients were referred to the electroencephalographic laboratory for what the clinicians had felt were true seizures. All but two of these patients had normal electroencephalographic tracings or minimal dysrhythmias. Patient 5 had moderate dysrhythmia, generalized, maximal in the right temporoparietal area; and patient 10 had moderate dysrhythmia, and focal, left temporal, sharp-wave discharge. By use of the same hypnotic method and non-specific suggestions, seizures developed in all these patients during which the historically identical attack was reproduced and was then ended by appropriate suggestion. During the actual seizure in the laboratory no changes were noted in the electroencephalogram. It was of significant value for the physician to witness the attack. During the seizures some of the patients were seen by trained observers, who felt that the seizures were similar to those occurring in episodes of focal epilepsy and with concurrent electroencephalographic abnormalities.

In this day of medical sophistication on the part of many patients, it is understandable how formerly useful diagnostic points in the history can be incorporated and reproduced by the patients, such as the biting of the tongue and the frothing of patient 2. Patient 5, with the temporoparietal focus, had a typical seizure with hypnotic activation that included clawing of the face and bleeding. There were no electroencephalographic changes, however, and the attack was ended with suggestion. When out of the trance the patient received 950 mg. of pentylenetetrazol (metrazol) intravenously, without the production of a seizure or activation of the electroencephalogram. During their seizures when in

the trance, all the patients could be questioned, and from their response and behavior it became quite apparent that their convulsive seizures were defenses or symbolic expressions of psychic conflicts. Beyond the establishment of a diagnosis of psychogenic seizure, no further exploration was undertaken. Many were later seen in the Section of Psychiatry, where a definitive diagnosis was established.

Comment

The non-specific suggestion of the patient's getting an "overpowering feeling" was used rather than the phrase, "getting a spell", because in the latter instance, depending on the meaning of "spell" to the subject, seizures could be induced in normal subjects when in a trance or in hysterical patients without previous fits. If the symptoms of convulsion are determined or precipitated by psychodynamic forces, the suggestion of an "overpowering feeling" in a deep trance should be sufficient to activate the first line of defense; in these cases, the somatic expression of the conflict or the convulsion. As long as the patient has his seizures, the underlying anxiety, propensities toward acting-out or other phenomena are held in check. A causal relationship is indicated by the specific response of spells to the non-specific suggestion of having an "overpowering feeling". Unless the physician is prepared further to investigate the seizure while the patient is still in the trance, it is better that the attack be terminated and that the patient's defenses remain intact, pending careful psychiatric examination. Otherwise, there is always real danger of shifting defenses and unleashing strong suicidal tendencies (12).

SUMMARY AND CONCLUSIONS

1. Among 11 subjects tested for electroencephalographic changes with visual phenomena when in a deep hypnotic trance, alpha activity in nine was suppressed during the occurrence of visual hallucinations with the eyes closed. Lambda waves were recorded from five subjects in the presence of visions, whereas no lambda waves were produced while they were in a conscious control state with imagination. In five of six subjects, during hypnotic blindness or negative hallucinations, lambda waves were absent or minimal. The additional factor

of the hallucinogenic drug, d-lysergic acid diethylamide, had no modifying influence on electroencephalographic activity when two subjects were in a deep trance with visual phenomena. Seven of nine subjects had minimal changes in the harmonic content of photic response while in the trance state, as compared with the control state.

2. No consistent electroencephalographic change was noted in six physicians and four patients with subjective anesthesia induced by hypnosis.

3. Movement of hypnotically induced phantom hands produced no change in the wicket rhythm in five subjects.

4. Sleep was produced in seven subjects in the trance. In three, the electroencephalographic evidence was a flattening effect; in three, spindles and V waves were noted; and in one, high-amplitude 1-to-2-per-second waves were recorded from depth leads in the frontal, occipital and temporal lobes.

5. Automatic frequency analysis revealed no significant change in two subjects during hypnotically induced catalepsy, automatic movements and anesthesia. However, in one subject, when regression to 3 years of age was done hypnotically, a shift to the delta and theta bands similar to that which takes place during light sleep occurred.

6. Hypnotic regression was carried out in five subjects, with no profound change in the electroencephalogram.

7. In 16 patients with convulsive disorder and concomitant electroencephalographic findings, hypnotic activation technics failed to precipitate seizures and produced no changes in the electroencephalogram or recall of pertinent material in connection with their seizures. However, the trance often yielded a more relaxed state and consequently a better technical record.

8. In 10 patients referred for electroencephalographic examination because of

seizures, hypnotic activation technics both induced and ended their spells without any change in the electroencephalogram.

9. Hypnosis during electroencephalography is useful in attempting to distinguish between psychogenic and organic convulsive disorders.

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