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OBSERVATIONS ON THE MOTOR PHENOMENA OF HYSTERIA

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I. INTRODUCTION

POSITIVE evidence is necessary for the diagnosis of hysteria and hysterical manifestations; and, whether a superficial exploration of the psychological

background of the patient is made an essential part of the clinical examination or not, observation and appreciation of the physical phenomena of the disease cannot be omitted. That there are such physical phenomena is well known, but with two exceptions there have been no adequate investigations into the details of these phenomena and no attempt to determine their value as positive evidence, the method by which they are produced and the possible sources of confusion between them and physical findings which are regarded as evidence of structural damage in the nervous system. To be complete such an investigation must include examination by both physical and psychological methods, and the observation of the physical phenomena from time to time during the course of recovery under treatment by psychological methods.

The present communication deals with physical expressions of hysteria as they affect the motor system. An attempt is made to define and describe these physical expressions of the disease, to determine whether any general rules or laws are expressed by these phenomena and to decide whether there is any correlation between them or the general rules underlying them and the psychological issues involved in the conscious and unconscious personal problems of the patient. The phenomena described are readily accessible to examination and sufficient of them have been examined to ensure that any exceptions to or variations from general rules are evident.

II. METHOD OF INVESTIGATION

The investigation and the subsequent descriptions and conclusions are based on the examination of a series of 59 patients showing hysterical manifestations who have come under observation in hospital and consulting practice. In all of the patients a complete history of the illness has been taken and a complete physical examination has been made. The family history and the previous medical history, by symptoms as well as by names of diseases, have been recorded. The life history of the individual patient has been investigated in detail and, whenever it was decided that the condition was hysterical in origin, the patient has been explored psychologically to an extent necessary to remove symptoms and physical signs. From time to time during the course of recovery detailed observations were made on the motor phenomena.

In the early cases difficulty was experienced in observing the motor phenomena in detail. In some cases changes and variations occurred so rapidly that it was impossible to observe with any approximation to accuracy the changes which appeared and the sequence of events. Later it was found necessary to study a few cases under light hypnosis. In these cases it was found that a 'slow motion' effect could be produced with some of the motor phenomena and the opportunity was taken of observing them under conditions suitable for the appreciation of detail and for the more accurate examination of the sequence of events. Later it became possible to observe these phenomena in the more rapid motion of the waking state. Hence the descriptions

and conclusions which follow are based on the observation of the motor phenomena in a few cases under light hypnosis and in the majority of cases in the waking state. Sensory, convulsive and other phenomena have been recorded as they arose and await further investigation, but are excluded from the present communication except in so far as they form part of the case histories quoted.

III. THE ESSENTIAL FEATURES OF THE MOTOR PHENOMENA

In this chapter the essential features of the motor phenomena are recorded, and the observations upon which their identification was based are summarised.

1. THE RESPONSE OF THE MUSCLES TO VOLUNTARY EFFORT AT COMMAND.—

The response of the muscles to voluntary effort at command was studied by directing the patient to perform a definite movement involving the limb in which hysterical manifestations were present and then observing by sight and touch the effects produced. The following observations were made.

When the command was given to carry out a definite movement the patient made a conscious effort to perform the movement directed. No contraction or increase in tone occurred in the muscles which perform that movement. An increase of tone did, however, appear, and contraction occurred in the muscles opposed to that movement. That is, the agonists related to the movement directed failed to respond to the conscious stimulus and the antagonists responded completely and fully. As a result a strong movement was produced in the direction opposite to that directed.

Further detailed observations showed that the sequence of events was as follows. In response to command there were the intention and the conscious effort to perform the movement directed. The agonists became more atonic and failed to respond. The antagonists increased in tone and contracted, thus producing a strong movement as if the voluntary stimulus and the command had been directed towards the performance of that movement. The sequence of events was the opposite of that of the phenomenon of reciprocal innervation, though the essential features of contraction of one group of muscles and inhibition of the opposing group were still present.

The grosser features of contraction of antagonists and performance of the movement opposite to that directed were observed readily in the waking state; but the details of the inhibition of agonists followed by contraction of antagonists were observed with ease only in the slow motion effect of the light hypnotic state. Nevertheless, with practice in observation of the phenomena in the hypnotic state it became possible to observe the details in some parts of the body in the more rapid motion of the waking state.

For example, a patient in the waking state was directed to dorsiflex the foot (Case III). He made a conscious effort to do so. Tone diminished and no contraction occurred in the dorsiflexors of the foot. Tone increased and contraction occurred in the plantar-flexors of the foot, observations being

made in both cases by both sight and touch. This sequence of events was observed in slow motion under light hypnosis as well as in a more rapid form in the waking state.

The phenomenon of inhibition of agonists and contraction of antagonists in response to voluntary effort at command was the most common motor effect observed.

In other cases when the command was given to perform a definite movement the patient made a conscious effort to carry out that movement. No contraction occurred in either the simple agonists or antagonists related to that particular movement. A strong contraction did, however, occur in the muscles which fixed the limb in position for the performance of the movement.

When examined in more detail and more slowly it was found that on making a voluntary effort to carry out the movement at command there was a definite lowering of muscle tone in the agonists and antagonists related to that movement. At the same time or immediately afterwards muscle tone increased and contraction occurred in the muscles which fixed the limb in position for the performance of the movement directed. This phenomenon was regarded as an extension and more complex form of that characterised by inhibition of agonists and contraction of antagonists in response to voluntary effort at command.

For example, the patient was directed to flex the elbow. He made a conscious effort to carry out the movement. Diminution of muscle tone occurred in the flexors and extensors of the elbow, and an increase of muscle tone and strong contraction occurred in the fixing muscles at and about the shoulder joint.

In Case VI the patient was directed to close the hand and make a fist. He tried to do so, strong contraction occurred in all the muscles fixing and supporting the elbow and wrist, but no movement of grasping occurred. In this case it was very difficult on account of the grouping of the muscles to make any accurate observations on the long flexors of the fingers.

Considerable extension of this effect was observed. In the second example given above contraction occurred in the fixing muscles of the elbow as well as in those of the wrist. In another case, at one stage of recovery a patient suffering from hysterical paraplegia was directed to dorsiflex the right foot. There was diminution of muscle tone in the dorsiflexors and plantarflexors of the right foot, and strong contraction occurred in all the muscles which fixed the parts above the waist.

In some cases a more pronounced degree of inhibition of the motor impulse was observed. When the command was given to perform a movement and a conscious effort was made to obey the command, there was either absence of muscle tone in the agonists and antagonists from the beginning of the attempt or a sudden cessation of effort with atonicity of these muscles and sometimes of all the skeletal muscles.

A patient who was suffering from hysterical paraplegia was directed to

dorsiflex the right foot. An attempt was made to perform the movement; there was diminution of muscle tone in the dorsiflexors and plantar-flexors of the right foot, and contraction occurred in the fixing muscles of the trunk, upper limbs and neck. There was then a sudden cessation of effort and a loss of muscle tone not only in the right lower limb, but also in the left lower limb and of the muscles of the trunk, upper limbs and neck so that the patient fell back helpless on the bed.

This appeared to be a wide extension of the effect observed in the first motor phenomenon in the agonists only and in the second in the agonists and antagonists related to the movement directed.

That the degrees of development of these motor phenomena were variations of a single underlying method was indicated by the following observations made on a patient recovering from hysterical paraplegia. At the time they were made the hysterical motor phenomena remained only in relation to the movements of the left foot at the ankle. On the command to dorsiflex the left foot and conscious effort to do so, there was diminution of muscle tone and no contraction in either the dorsiflexors or plantar-flexors of the left foot. At the same time, strong contraction occurred in the muscles of the trunk, upper limbs and neck. At a later stage the same command and the effort to obey it resulted in diminution of muscle tone and absence of contraction in the dorsiflexors of the left foot followed by increase of muscle tone and contraction in the plantar-flexors of the foot. At a later stage still the same command resulted in increase of muscle tone and contraction of the dorsiflexors of the left foot and diminution of muscle tone in the plantar-flexors.

These observations confirmed the three motor phenomena described by Kinnier Wilson, namely: (1) Contraction of antagonists in place of agonists; (2) contraction of fixation muscles and absence of contraction in simple agonists and antagonists; and (3) complete absence of muscular response. They showed that the primary effect was inhibition of the motor impulse to the muscles required for the movement directed, and that with it or consequent to it there was transmission of the motor impulse to the opposing muscles. According to the relative preponderance of inhibition of agonists and contraction of antagonists the three motor phenomena described above were produced.

2. THE RESPONSE OF THE MUSCLES TO SPONTANEOUS VOLUNTARY EFFORT.

—The direct investigation of the response of the muscles to spontaneous voluntary effort was more difficult as the opportunity had to be taken of making independent and scattered observations at times when the patient tried of his own accord to perform movements. Nevertheless, by piecing together individual observations on different patients, it was confirmed that the grosser manifestations of the motor phenomena occurred in exactly the same way as they did when conscious effort was made to carry out the movement at command.

These features were studied particularly in a patient with hysterical drop-foot of 14 years' duration (Case I). On examination of the muscular response to voluntary effort at command it was found that in response to the command to dorsiflex the right foot the dorsiflexors of the foot showed a diminution of muscle tone and failed to contract, the plantar-flexors showed an increase of muscle tone and contracted, and a strong movement of plantar-flexion resulted. Thus far the findings were in keeping with the first motor phenomenon described above. When the patient began to walk up and down the room there was at first a slight degree of drop-foot on the right side. As he proceeded, however, the drop-foot became more pronounced and walking became more difficult. Examination at this stage showed relaxation of the dorsiflexors of the foot and strong contraction of the plantar-flexors with elevation of the heel. Later both dorsiflexors and plantar-flexors were contracted and the foot was maintained in a position of full plantar-flexion. These observations agreed with the history of the disability on different occasions. The patient stated that when he began to walk he moved his right foot without great difficulty though it was a little awkward. As he walked farther the drop-foot became more obvious, and finally it was necessary for him to seek help to return home. In this case it was accepted that in walking with a slight degree of drop-foot there was conscious effort to keep the toes of the right foot clear of the ground on taking each step. With each effort to do so there was produced a greater degree of drop-foot as a result of inhibition of the motor impulse to the dorsiflexors and contraction of the plantar-flexors; and as a final result the drop-foot became so pronounced that the patient was unable to walk farther in comfort.

Similar observations were made in relation to the second motor phenomenon. A patient who was suffering from hysterical drop-wrist (Case V) made an effort to place the left hand on the table at a time when the right hand was not free to lift it. There was no response whatever in either the flexors or extensors of the wrist, but strong contraction occurred in the fixing muscles at the elbow and shoulder, and an attempt was made by rotating the body to swing the left hand into position on the table. Similarly, a patient who was suffering from hysterical paraplegia (Case II) was observed at a time when it was necessary for him to change his position in bed. No contraction occurred in the muscles of the lower limbs, but strong contraction occurred in the muscles of the trunk, upper limbs and neck. With these muscles fixing the upper part of the body as a more or less rigid whole the lower limbs were dragged like dead weights from one part of the bed to another.

The third motor phenomenon was seen frequently in response to spontaneous effort in those patients in whom the inhibitory factor was most pronounced. The patient tried to perform a movement such as raising the right hand to the head; some contraction of muscles occurred and some movement took place; there was then a sudden cessation of effort, the right

upper limb fell helpless at the side and on immediate examination the muscles of all parts of the limb were found to be extremely hypotonic.

Though it was impossible from the nature of the observations to confirm every point in detail, there was sufficient evidence to show that the motor phenomena produced in response to voluntary effort at command were the exact counterparts of those produced as a result of spontaneous effort. It followed also that the bizarre effects and contrary responses were produced entirely as a result of factors within the patient and not as a reaction to the observer or the authority issuing the command. The study of the motor phenomena of hysteria, therefore, resolved itself into the study of the territory between the conscious and unconscious levels of the personality as represented in the cerebral cortex and the muscles involved in the production of the motor response.

3. THE NEUROPSYCHOLOGICAL LEVEL OF THE DISABILITY.—It was necessary at this stage to examine the evidence which determined the neuropsychological level at which the disability was produced in the cases which formed the basis of the investigation.

In the patient referred to above in whom there had been hysterical drop-foot for 14 years the following observations were made. In response to the command to dorsiflex the right foot and the conscious effort to do so there was diminution of muscle tone and absence of contraction in the dorsiflexors of the foot. There followed increase of muscle tone and contraction in the plantar-flexors of the foot with a strong movement of plantar-flexion. On the further command to invert the foot and the conscious effort to do so there was increase of muscle tone and contraction in tibialis anticus and decrease of muscle tone in the peroneal muscles. A strong movement of inversion of the foot resulted. That is, in response to the command to perform one movement a muscle was inhibited and in response to the command to perform another movement the same muscle contracted. In each case a motor impulse was transmitted without interruption from the motor level of the cortex to a muscle, though in one case the destination of the impulse varied from that intended. There could be no abnormality of neural function at or below the level of the motor cortex.

Further, the command to perform the movement was heard normally and transmitted to the higher cortical level. The patient heard the command, understood it, and was able to express in words what he intended to do. It followed then that the disability was either at the higher cortical level or somewhere on the path between it and the level of the motor cortex. This path was, however, excluded by the normal response of inversion of the foot at command in the example given above.

On further examination of what occurred when a hysterical motor phenomenon was produced in response to the command to perform a definite movement the following observations were pertinent. In a particular case the command was heard and appreciated as a command to dorsiflex the right

foot. The patient made an effort to dorsiflex the right foot. Strong plantar-flexion of the foot resulted. The patient expressed surprise that the foot was moving down when he was told or shown what was occurring. Also, when he was prevented from seeing the foot concerned, he was often unaware that any movement plantar-wise was occurring and even protested that he was unable to obey the command after he had tried to do so. Immediately, however, he became aware that the foot was in a position of plantar-flexion and expressed surprise that it was so. Appreciation of changes in the position of the toes was normal when they were produced by passive movement. It seemed that the abnormal motor response was produced at the unconscious level and was not under conscious control by the patient. It consisted primarily in inhibition of the impulse transmitted from the conscious level and, secondarily, in the substitution for it of an impulse which had an opposite effect in terms of movement. Furthermore, with the exposure and conscious resolution of conflicts previously hidden at the unconscious level or the uncovering of factors in the personality previously repressed to the unconscious level, the condition passed through a phase of complete inhibition of the conscious motor impulse with the substitution of an impulse to fixation muscles, inhibition of the motor impulse with the substitution of an opposite effect in terms of movement, and finally full transmission of the conscious motor impulse.

4. THE RESPONSE OF THE MUSCLES TO CUTANEOUS STIMULI AS OBSERVED IN CUTANEOUS REFLEXES.—The two groups of cutaneous reflexes which offered themselves for study were the abdominal reflexes and the plantar reflexes, of which the latter were more suitable and convenient for initial study. It was necessary for the study of these reflexes in relation to the motor phenomena of hysteria that the patient should be conscious of the stimulus in the sense that the sensory stimulus which initiated the reflex response should be conveyed to the cortical level and be appreciated consciously by the patient. Hence, for convenience in observation, patients in whom there was hysterical anæsthesia or analgesia in the area of stimulation were unsuitable subjects for study. Since the admissibility of evidence elicited in light hypnosis might be questioned the description and conclusions were based entirely upon observations made in the waking state.

In the first case studied (Case II) only the plantar reflexes were observed. The right lower limb was the subject of study throughout. Examination in the waking state was made both before and after an examination in light hypnosis, the character of the responses and the sequence of events being confirmed by an independent observer who had no knowledge of the possible results. In the waking state it was difficult to secure full relaxation of the hamstrings and of extensor longus hallucis, though relaxation of extensor longus digitorum was secured with comparative ease. In this condition the application of a stimulus by stroking forwards along the outer side of the sole of the foot resulted in further contraction of extensor longus hallucis, an

upward movement of the great toe, contraction of the hamstrings and to a lesser extent upward movement of the small toes, and especially of the second and third toes. Increase of tone and tension was both visible and palpable in the tendons of extensor longus digitorum. With a less obvious degree of the same condition—hamstrings and extensor longus digitorum relaxed, but some tension still present in the tendon of extensor longus hallucis—the application of a stimulus in the same way resulted in upward movement of the great toe and to a lesser extent upward movement of the small toes. It was possible, though difficult to observe accurately on account of the rapidity of the response, that contraction of the hamstrings preceded or was simultaneous with that of the extensor of the great toe. With adequate relaxation of all the muscles of the lower limb, and especially of those named above, the application of the stimulus produced no response whatever.

The more detailed examination of the response of flexors and extensors to a plantar stimulus was difficult to secure under conditions which permitted adequate comparison of the responses in a hysterical limb with those in a normal limb. Eventually, however, there came under observation a young man who had developed right hysterical hemiparesis in response to an emotional situation (Case III). In the right upper limb there were found the characteristic motor phenomena described above, including transmission of motor impulse to antagonists in place of agonists and transmission of motor impulse to fixation muscles in place of simple agonists and antagonists. Similar characteristic motor phenomena were seen in the right lower limb. Observations were made on the two lower limbs. By palpation and manipulation of the great toe and of the small toes the tendons of flexor longus hallucis and of flexor longus digitorum were identified on the outer and inner sides respectively of the tendo Achillis. On application of the stimulus to the outer aspect of the sole of the left foot these tendons contracted at once with flexion of the great toe and of the small toes. On the right side there was some contraction of the tendon of extensor longus hallucis which was difficult to overcome. This was reduced as far as possible. Then, on application of the stimulus to the outer side of the sole of the right foot, relaxation of the flexors of the toes occurred at once and was followed by contraction of the extensors with a movement of extension, at first of the great toe and later of the small toes. The upward movement of the great toe was at first rapid and then proceeded more slowly. The contrast in the behaviour of the two flexor tendons in the healthy limb and in the hysterical limb was readily appreciated.

The findings in response to the stimulus were contrasted with those in the normal subject, those in a subject in whom there was interruption of the motor path involving the upper motor neurone, and those in a subject in whom a lower motor neurone lesion affected the flexor muscles of the toes and spared the extensors. In the normal subject the stimulus to the sole of the foot resulted in strong flexion of the great toe and of the small toes. With a stronger or more prolonged stimulus there was associated with this

response dorsiflexion at the ankle and flexion of the knee and hip. In the subject with interruption of the motor path in the upper motor neurone the stimulus to the sole of the foot when the limb was flexed and relaxed resulted in slow extension of the great toe, contraction of tensor fasciæ femoris and fanning of the small toes; and in addition dorsiflexion at the ankle and flexion of the knee when the stimulus was strong or prolonged. In the subject with a lower motor neurone lesion affecting the flexors of the toes and sparing the extensors the stimulus resulted in extension of the great toe and of the small toes.

In the hysterical state, with full communication between the area of stimulus and the cortex, the stimulus resulted in inhibition of the flexors of the toes and absence of the normal flexion response in all the toes. Further development of this effect was seen especially when tension or contraction was maintained in the extensors of the toes. Under such conditions not only did the stimulus to the sole of the foot result in inhibition of the flexors of the toes and absence of flexion of the toes, but increase of muscle tone and contraction followed in the extensors of the toes with extension of the great toe to a greater extent than that of the small toes. Thus there was produced a result similar to that with the lower motor lesion mentioned above and resembling superficially that produced as the result of a lesion of the upper motor neurone.

It was confirmed that, with full sensory communication between the area of stimulus and the cortex, the phenomenon of inhibition of agonists and contraction of antagonists came into operation in response to the cutaneous stimulus in the same way as in response to spontaneous conscious effort and to conscious effort at command.

5. THE RESPONSE OF THE MUSCLES TO STRETCH.—The response of the muscles to stretch in the hysterical limb was studied by putting individual groups of muscles and when possible individual muscles under tension by means of passive movement and in eliciting individual tendon reflexes. Observations were made also on the response of groups of muscles to the contraction of opposing muscles in limbs or portions of limbs which showed the motor effects of hysteria.

The normal response has been summarized as follows. 'If the tendon of a healthy muscle is drawn upon by an antagonistic muscle or by the manipulation of the observer or by the movement of a joint in response to gravity, the muscle actively resists the extending force. A muscle which has been paralysed by section of its motor nerve or of the ventral or dorsal roots supplying it does not actually resist and behaves like a piece of non-contractile tissue such as the skin. The muscle is flaccid. The resistance, however, from a muscle in full connexion with the nervous system is a reflex contraction, "the stretch reflex"' (R. S. Creed et al., 1932).

In the hysterical subject the following observations were made. In muscles which had normal muscle tone stretch resulted in the appearance of

normal and increasing resistance which depended upon the degree of tension. When muscles which showed an increase of tone were put under tension there was in addition to the original resistance a further gradually increasing resistance which soon made further movement impossible. When the muscles were flaccid or appeared to be so, as in some cases of hysterical paralysis, there appeared to be little or no resistance to the first few movements which put the muscle on stretch, but later definite resistance of the muscles under tension appeared and increased as the tension increased. It appeared that, with hysterical paralysis of this type, it was necessary to bring the stretch above a certain threshold by repeated movements of stretch to elicit the normal stretch reflex. When a limb or a part of a limb was exposed to the action of gravity—such as the forearm, the foot or the toes—the muscles which counteracted the effect of gravity were maintained in a condition of increased tone and any hysterical motor effect in the form of tonic paralysis was usually more pronounced in that group of muscles than in any other group. Finally, in a portion of a limb in which the phenomenon of shunting of the motor impulse into antagonists could be demonstrated, the command to perform a movement or the spontaneous attempt to perform a movement resulted in inhibition of agonists, contraction of antagonists, and then in gradually increasing resistance and increase of muscle tone in the agonists. The same sequence of events was observed in response to a cutaneous stimulus as in eliciting the plantar reflex.

The observations showed that with hysterical motor involvement of the limb the essential and gross features of the stretch reflex as seen in the clinical subject differed in no respect from the normal. The response of the tendon jerk depended upon the balance of muscle tone originally existing between the muscles subjected to stretch and those which opposed their action. The final response in a reflex such as the plantar reflex depended upon the same balance of muscle tone existing between those muscles which normally contracted in response to the stimulus and those which opposed their action. Under favourable conditions, when increased tone existed in both groups of opposing muscles, stretch to one group by tapping the tendon or passive movement resulted in alternating contraction and inhibition of the two groups of muscles and a condition of clonus. Such an effect was observed also following a voluntary movement in one direction by the patient and at times in a tonic limb which appeared otherwise to be at rest.

6. SUMMARY OF THE MOTOR EFFECTS OF HYSTERIA.—In a limb which showed motor effects of hysteria it was established that in response to conscious effort at command, spontaneous conscious effort or cutaneous stimulation as in the eliciting of the plantar reflex there was inhibition of the motor impulse to the agonists related to the movement intended or that which occurred normally in response to the cutaneous stimulus. In extreme examples this was the only effect. In less severe cases the motor impulse to the agonists was replaced by a motor impulse to the fixing muscles; and in

still less severe cases to the antagonists. The final result in terms of movement depended upon the original balance between agonists and antagonists, and the relative preponderance of inhibition of the impulse to agonists and transmission of the impulse to antagonists. Further effects depended upon the presence of the normal stretch reflex in opposing groups of muscles. It was indicated further that the inhibition of the normal motor impulse to agonists and the replacement of it by a motor impulse to antagonists were the result of factors operating at the unconscious level of higher cortical functions.

IV. CERTAIN CLINICAL MANIFESTATIONS OF THE MOTOR PHENOMENA OF HYSTERIA

In this chapter certain of the more clinical manifestations of the motor phenomena of hysteria are described and discussed, and attention is directed to variations in common physical signs.

1. **TONIC PARALYSIS.**—The term 'tonic paralysis' is used to indicate the condition of increased muscle tone with limitation of active movement in response to conscious effort, which may exist with hysteria, to distinguish it from the spastic condition of the limb affected as the result of a lesion of the upper motor path and from the rigidity associated with extrapyramidal lesions.

Simultaneous tonic contraction has been observed in opposing groups of muscles with immobility of the limb to conscious effort, either voluntary or at command. The position of the limb in this condition is neither characteristic nor uniform, and may vary from the extreme position produced by contraction of one group of muscles to that produced by contraction of the opposing group. The position is often one of balance between the two groups. When, however, a local protective effect results from the tonic paralysis or the limb or a portion of the limb is subjected to the action of gravity, the balance of contraction may be in favour of the protection in one case or against the action of gravity in the other.

In the lower limb tonic monoplegia or paraplegia results. In a mean position the knee is extended, the foot slightly plantar-flexed, the small toes in a natural position and the great toe slightly extended. The foot may be maintained in a position of dorsiflexion or of full or partial plantar-flexion. The toes may be slightly extended and often the great toe is extended more than the small toes. The knee may be fully extended, slightly flexed or flexed beyond 90 degrees.

In the face a more or less rigid mask-like condition results, resembling superficially the fixed facies of extrapyramidal rigidity. This has been the clinical feature most often observed in the patients under review. The increased tone of the facial muscles is also evident on palpation and increases on palpation. Since the condition is rarely complete in the face the immobility of the musculature is relative rather than complete. In response to voluntary

effort at command, as in showing the upper teeth, the movement begins slowly, proceeds slowly, and is limited in extent. The same features are observed when the patient smiles, the result being a slow, rigid and limited movement which can be accepted as a smile only because the circumstances seem to warrant such a response. The movement in response to voluntary effort is often more extensive than that in response to emotion. In some cases this relative immobility of the face is more pronounced on one side, and, indeed, may appear to be confined to one side. Attention has been drawn to this unilateral effect in a study of dissociation of voluntary and emotional movements of the face, when it was observed as dissociation of the two types of movement in some patients suffering from conditions of a psychological nature. In addition, with initiation of the voluntary movement of the face, as in showing the teeth at command, on the slightest attempt to perform such a movement spontaneously and when speaking, an alternation of up and down movements appears and produces the effect of a series of clonic movements in the rigid facial musculature. Usually this tremor is observed more readily clinically than the actual rigidity of the facial musculature, for the latter may be mistaken for the normal facies of the patient. In some cases there may be relative freedom of the facial movements in response to emotion and when speaking, a condition which adds in some degree to the appearance of euphoria of the hysterical subject with an organic symptom. These variations from the normal in the facial musculature and the movements of the face are very common in the hysterical subject, and in many patients suffering from hysterical effects other than the motor may be the only motor and objective phenomena observed.

Often there is moderate increase in tone of the intercostal muscles which becomes more rigid on palpation. When observed superficially the limitation of thoracic movement with respiration may suggest paralysis of the intercostal muscles.

The muscles of the abdominal wall are often rigid, either alone, with rigidity of the facial muscles, or with more widespread motor phenomena. The rigidity increases on palpation and is little affected by raising the knees or engaging the attention of the patient. The abdominal reflexes are much diminished or fail to respond, and the respiratory movements are limited or absent. With the eyes closed, the knees raised and regular breathing established, it is sometimes possible to elicit a response to the first stimulus. In that case the movement is abrupt, terminates abruptly, and is followed by an abrupt return to the original position. In most cases, however, the stimulus is followed by what appears to be a more rigid maintenance of the position at the middle line. When such hysterical motor abnormalities of the abdominal musculature are associated with pain in the abdomen, the probability of unnecessary surgical exploration is much increased. Such a case was Case VII.

2. TONIC PARALYSIS WITH CONTRACTURE.—Tonic paralysis with contrac--

ture has been indicated above as a balance of contraction of two opposing groups of muscles against a force such as gravity, or in favour of a protection which is still necessary or no longer exists. That against gravity is of particular importance when it affects, as it commonly does, the extensor longus hallucis and the extensor longus digitorum muscles; for under such conditions the examination and interpretation of the plantar reflex become very difficult. Balance of contracture in favour of protection is illustrated by two cases. In one case there was balance of contracture in favour of the flexors of the left elbow when the skin in front of the elbow had been injured and healed some months before. Detailed examination revealed inhibition of agonists and contraction of antagonists in response to effort both spontaneous and at command whether flexion or extension of the elbow was attempted. The second case was that of a girl who became excited when in the company of a man. Spasm of the adductors of the thighs appeared, and there developed gradually tonic contraction of the abductors and adductors with the balance of contraction in favour of the adductors. In the course of one year the thighs became rigidly adducted and tenotomy was necessary before undertaking treatment of the underlying conflict.

3. TONIC PARALYSIS WITH TREMOR.—Tonic paralysis with tremor has been observed in the limbs, the tongue, the larynx and the facial muscles. Instead of the opposing groups of muscles remaining at rest in a condition of increased tone, as in the form of tonic paralysis described above, there is an alternation of movement in favour of the two groups in turn with consequent tremor on a basis of muscular rigidity. The tremor is regular, the movement is backwards and forwards along the same path, and on palpation the alternating contraction of the opposing groups of muscles can be felt easily by the observer. Examined in detail, it appears that this 'tonic tremor' is an incomplete form of tonic paralysis and develops in the following way. The original volition results in inhibition of agonists and contraction of antagonists, agonists are put on stretch and contract, and there appears a basis of tonic paralysis which varies in degree in the individual patient. With incomplete tonic paralysis the alternation continues in the form of readily appreciated contraction of agonists and antagonists with the appearance of tonic tremor. It may be present at rest, but most often it is initiated by voluntary effort to perform a movement involving the use of the limb affected or by the application of a local stimulus which produces stretch of one group. With the former the effort to perform the movement directed results in contraction of the antagonists, the agonists are at once put on stretch and contract, the agonists and antagonists then contract alternately, and the resultant movement then continues for a varying period. In a limb in a condition of tonic paralysis putting one group of muscles on stretch by tapping a tendon or passive movement may initiate a series of such contractions and cause tonic tremor to persist for as long as half an hour after the stimulus is removed, or in the case of passive movement as long as the limb

is held in the new position. In this way patellar clonus and ankle clonus may be produced.

4. **MINIMUM TONIC PARALYSIS WITH MAXIMUM TREMOR.**—In some cases and in individual groups of muscles the tonic paralysis is slight or absent, and, under suitable conditions, the tremor is freer and more pronounced. When the patient extends the upper limbs and fingers before him at command a slight up and down tremor appears in the extended fingers and increases as long as the fingers are maintained in that position. On examination this is found to be due to contraction of the flexors and extensors of the fingers alternately from the time the attempt is made to maintain them in position. The primary impulse is to contract the extensors to obtain the position directed, and then from the operation of the agonist-antagonist motor phenomenon and the stretch reflex the tremor develops and becomes more pronounced as further voluntary efforts are made to maintain the position. A similar effect is observed in the upper eyelids on closing them gently at command. In either case a pronounced voluntary movement in one or the other direction causes the tremor to cease. The tremor thus produced is a loose, regular tremor whose movement passes backwards and forwards through the same path, and differs from the tonic type of tremor only in the greater freedom of excursion and the absence or slight degree of the tonic element.

5. **THE EFFECT OF THE MOTOR PHENOMENA ON THE TENDON REFLEXES.**—To a great extent the effects of hysterical motor disabilities upon the tendon reflexes are evident. The effects are due entirely to local muscular conditions, though, as indicated above, the factors which produce these conditions are operating at the highest level of the nervous system. When there is a minimum tonic condition the tendon reflexes are exaggerated—the latent period is reduced, the rise is abrupt and more extensive than usual, the cessation of the movement is abrupt and the return to the original position is abrupt. When there is tonic paralysis with tonic tremor the same features are apparent, but the excursion is very slight. When a position of tonic rigidity is maintained or the limb is flaccid the tendon reflexes cannot be elicited. When there is tonic paralysis with the balance of contraction in one direction, there is an abrupt and either small or extensive response with the tendon reflex which operates normally in the direction of the balance of contraction, and an absent or minimal response with a reflex operating in the direction of lesser contraction.

6. **THE EFFECT OF THE MOTOR PHENOMENA ON THE PLANTAR REFLEX.**—Difficulties in the examination and interpretation of the plantar reflex are common and doubt has been expressed as to the simplicity of the observation and interpretation of the phenomena upon which the identification of the extensor response associated with structural damage is based. That there are such difficulties is illustrated by the following case reported by Fox in 1922, and by Cases II and III.

'From the time this sign was first described by Babinski we have been taught and have reverently bowed the knee to its organic significance. From time to time some diffident suggestions have appeared that possibly it might be liable to variation but I have never seen any definite statement impugning its reliability. . . . I have under my care a marine. . . . He was first admitted in December 1919 with a provisional diagnosis of spinal tumour. . . . He had over eighteen years' continuous service, with no history of any previous illness. . . . He complained chiefly of intense pain in the back, with extreme rigidity of the legs which quite prevented him from walking. At night he frequently had "war dreams" in which he cried out and disturbed the ward. The rigidity was very marked and I could only flex his knees with the greatest difficulty. The patellar reflexes were very active; ankle clonus was present on both sides; the plantar response was always readily obtained, and was consistently extensor in type. He had anaesthesia extending equally and completely over both legs, but above that sensation was normal. It seemed to me to correspond fairly well with the cases of astasia one met with during the war. He gradually recovered and was discharged in June 1920. . . . One day he had a fall, when all his old symptoms reappeared, and in March 1921 he was readmitted. . . . His condition then was by no means so severe as when first seen. The rigidity, however, was still extreme, ankle clonus just as readily obtained and the extensor response the same as before. His recovery this time was very slow. . . . The extensor response for a long time never varied, then as the rigidity of the legs decreased it also became less marked; then it would be present on one side and not on the other; then it would be absent on both sides in the morning, returning if he was tired in the evening. . . . His war history was not beset with any startling incidents; the only event which has possibly some bearing on his disorder was that once while coaling at sea a friend of his had both legs badly crushed.'

The effects of hysterical motor phenomena on the plantar reflex are of great practical importance because of the attention paid to the abnormal plantar reflex and even to individual aspects of it to the exclusion of other features as evidence of motor path damage. These effects depend upon the balance of tone in the hysterical lower limb often being in favour of the extensors of the toes, and particularly of the great toe, as against gravity and the sequence of inhibition of agonists, contraction of antagonists and stretch with contraction of agonists being produced by the recognized sensory stimulus in exactly the same manner as by voluntary effort, either spontaneous or at command.

With tonic paralysis of the lower limb and the balance of tone against the action of gravity extensor longus hallucis is contracted either alone or to a greater extent than extensor longus digitorum. In this condition the application of a nocuous stimulus to the outer side of the sole of the foot results in inhibition of the flexors of the toes and contraction of extensor longus hallucis with a movement of extension of the great toe. When the stimulus to the sole of the foot is more prolonged or more acute the small toes also extend, but to a lesser extent than the great toe. In some cases the hamstrings may contract too. In each case the movement of extension of the great toe is at first rapid and becomes slow only when the previously inhibited flexors are put on stretch and begin to contract. Superficial observation of the response when the great toe extends and the small toes fail to move

may lead to the interpretation of the changes as those of the extensor plantar reflex associated with a lesion of the upper motor path.

When, in a lower limb affected by tonic paralysis, there is a normal position of balance between the flexors and extensors of the toes produced either as part of the tonic paralysis or by securing relaxation of the extensors, a nocuous stimulus to the sole of the foot produces inhibition of the flexors and contraction of the extensors, but the normal balance is disturbed only enough to prevent flexion of the toes. No movement of the great toe or of the small toes results. This is the absence of the plantar response in some cases of hysteria described by Buzzard. It may be observed as a manifestation of hysteria in patients in whom there is no evidence of gross motor disturbance in the lower limbs or elsewhere, but in whom detailed examination may reveal minor motor changes of the type described in the facial muscles and elsewhere.

When the lower limb is flaccid in the course of hysteria a stimulus to the sole of the foot produces no response. Repeated stimuli may, however, produce the condition of a balance of tone between the flexors and extensors described above, and in a favourable case the response goes through phases from absence of response with flaccidity of muscles, absence of response with balance of tone between flexors and extensors, and a slight movement of extension of the great toe to extension of the great toe to a greater extent than of the small toes. When the motor phenomena are disappearing in the course of treatment the sequence is from extension of all the toes to extension of the great toe without movement of the small toes, balance of tone with no plantar response, and normal contraction of the flexors and inhibition of the extensors in response to the stimulus.

The sources of error in the examination and interpretation of the plantar reflex in the hysterical subject are evident. The responses observed depend entirely on the motor phenomena described as characteristic of hysteria and are in no way dependent upon diminution or absence of sensation at the site of application of the stimulus. Cases in which sensation was absent or diminished have been excluded from the material upon which these conclusions are based. Diminution or absence of sensation on the sole of the foot does, however, introduce an additional factor when present, but only to the extent of reducing or interrupting the afferent stimulus.

V. SUMMARY AND CONCLUSIONS

1. Observations have been made over a period of five years on patients who were the subjects of hysteria with particular reference to the disturbances of motor function.

2. A series of 59 such patients has been investigated by clinical methods and psychological exploration; and detailed examination of disturbances of motor function has been made both at the time the patient came under

observation and at intervals during the stages of recovery associated with psychological exploration.

3. The essential and primary effect in the motor system is inhibition of the motor impulse to the muscle or group of muscles which in the normal subject would contract in response to that impulse.

4. Inhibition of the motor impulse arises at the unconscious level of higher cortical functions and is produced by either a conflict in the personality, both sides of which are excluded from consciousness, or by that factor in a conflict which is excluded from consciousness to allow the other factor to control the conscious life of the personality.

5. The immediate motor effect is inhibition of agonists, and is followed by contraction of antagonists or of fixation muscles. According to the degree of inhibition the clinical effects, in order of lessening severity, are flaccidity of muscles in the part concerned, flaccidity of muscles with contraction of fixation muscles, and failure of agonists to contract followed by contraction of antagonists. The last-named is the most common motor phenomenon.

6. These effects are produced in the same way whether the original motor impulse arises as a result of voluntary effort, voluntary effort at command, or in response to a sensory stimulus as in eliciting the plantar reflex.

7. The stretch reflex acts normally in the muscles of the hysterical limb, though, when the muscle is flaccid, tone is usually below the threshold at which the reflex comes into action and repeated or prolonged stretch is needed to bring it above that threshold.

8. Local motor phenomena arise as a result of inhibition of agonists, contraction of antagonists, the application of stretch to agonists and contraction of agonists in that order.

9. Hysterical tonic paralysis, tonic paralysis with contracture, tonic paralysis with tremor, tremor with minimal tonic paralysis and tremor are described as they occur in the hysterical subject, and their development shown to depend upon the sequence of effects indicated under (8).

10. Attention is drawn particularly to the clinical effects of these phenomena in the face, abdominal muscles and the lower limb.

11. The effect of hysterical motor phenomena on tendon reflexes and the plantar reflex is described; and attention is drawn to the need for attention to every detail in the examination and interpretation of the plantar reflex.

APPENDIX

Illustrative Cases

The following cases have been chosen from those on which the investigations were made to illustrate the physical and psychological accompaniments of the motor features detailed above. The physical features are described in full; the psychological situations are summarised.

Case I.—W.R., male, age 45 years, was referred by the War Pensions Appeal Board on August 14, 1934, when he complained of partial drop-foot on the right side.

In 1918 he received a wound above and behind the right knee and thereafter for two years suffered from drop-foot due to partial interruption of the external popliteal nerve. He wore a support until 1925. When he began to walk his right foot 'flopped' a little, but after walking about one mile it dropped completely and became difficult to control. Until two years ago he was able to continue his work as a builder with his disability as he could employ men to do his labouring work. Since then he had been unable to have assistance and his disability became worse. For one year sleep had been interrupted and he had been worried by adverse financial circumstances.

On examination the functions of the central nervous system were normal with the exceptions to be described; and no abnormalities other than well-healed scars and a congenital abnormality in the left side of the neck were found in the rest of the examination. A slight tremor appeared in the fingers on extension. At the right hip and knee joints all voluntary and passive movements were normal. Movements at the right ankle and of the toes were affected in the following way. When told to bend the right foot down an attempt was made to do so. There was decrease of tone in the muscles of the anterior compartment of the leg following increase of tone in the muscles of the posterior compartment. These muscles contracted and a strong movement of plantar-flexion resulted. When told to bend the right foot up there was relaxation of the muscles of the anterior compartment followed by contraction of those of the posterior compartment and less pronounced plantar-flexion resulted. Passive movement of the foot resulted in contraction of the muscles of the posterior compartment and finally cessation of the movement of dorsiflexion. At command the toes flexed normally but extension was limited. When told to turn the foot in there was strong contraction of tibialis anticus and good inversion resulted. Eversion was normal. At rest the foot was held partly plantar-flexed with some contraction of the muscles of the posterior compartment. On the outer side of the leg in its upper two-thirds there was an extensive area of loss of sensation to pinprick. This extended upwards to immediately below the knee. The left ankle jerk was normal and the right limited. The left plantar reflex was flexor and the right gave no response.

Examination of the personal history showed that he re-entered civil life with uncertainty as to his capacity to meet it on account of the wound of the right knee. He had been obliged to pass from commissioned rank to his ordinary occupation. Adverse personal and financial circumstances aggravated the situation. The hysterical disability probably represented the terms upon which it was possible for him to re-enter civil life.

Case II.—A male, age 23 years, was admitted on March 3, 1934, complaining of weakness of the legs of four weeks' duration. Four weeks before his legs became suddenly weak, improved for a few days and then became slightly worse. There was numbness of the legs from the hips. He had pleurisy with effusion two years before. On admission he walked in a clumsy manner, all movements of the lower limbs were clumsy in the recumbent position, and the tendon reflexes were exaggerated in both upper and lower limbs. When seen personally the next day there was a tonic to-and-fro tremor in the facial muscles, and limitation of both voluntary and emotional movements of the face. There was a similar to-and-fro movement of contraction and relaxation in the left quadriceps muscle. It was difficult to secure relaxation of the abdominal wall; but with slight relaxation the first abdominal reflex elicited immediately after was normal. In all other respects the physical examination was negative. Following this examination the physical disabilities disappeared, and the patient was discharged at the end of two weeks with tremor of the facial muscles as the only physical sign.

He was readmitted two weeks later. For two days after his return home he had been normal. Then weakness of the legs and numbness of the lower limbs and trunk supervened rapidly. On readmission the house physician's examination revealed

diminution of sensation for pinprick and cottonwool below the second rib, weakness of the abdominal muscles, slight weakness of the legs in the recumbent position, a shuffling and drunken gait, and plantar reflexes recorded as doubtful extensor. After being threatened with laminectomy for spinal tumour, he was seen personally one week later. The finding of many contradictory physical signs rendered that position untenable. Meanwhile, the disability had become much worse. The cranial nerves and upper limbs were normal. The intercostal and abdominal muscles were held rigid, but slight movement occurred with respiration. Below a horizontal level corresponding to the second rib in front and the spines of the scapulæ behind sensation for pinprick was lost with the exception of a small area on the dorsum of each foot. Sensation for cottonwool was normal throughout; heat and cold were appreciated above the level of the iliac crests, changes in the position of the toes were recognized and vibration was felt over the malleoli. In spite of inability to move the lower limbs at command, individual groups of muscles when tested separately acted normally. Flexion and extension of the toes on both sides were possible, there was no movement at the ankles and some flexion occurred at the knees. The knee and ankle jerks were exaggerated. It was impossible to obtain accurate readings of the plantar reflexes. Plantar stimulation resulted at times in extension of the great toe, which was, however, held in a position of partial extension owing to contraction of extensor longus hallucis.

Subsequently with direct encouragement the movements of the lower limbs improved considerably, and it was observed repeatedly that command to perform a movement resulted in contraction of both agonists and antagonists with consequent failure to perform the movement. Also to-and-fro movements occurred in the facial muscles; and tremor associated with alternating contraction of agonists and antagonists appeared in the lower limbs. Because of these findings the patient was examined under light hypnosis on July 8, 1934. At the command to perform a movement involving the lower limbs the antagonists contracted and showed excellent power. Each of the muscle groups of the lower limbs was examined in this way and found to have normal power of contraction. When he was awake extensor longus hallucis was contracted on both sides and accurate reading of the plantar reflexes was impossible. They relaxed under light hypnosis, and plantar stimulation then produced no response. Under deep hypnosis full relaxation of the muscles of the lower limbs was secured; and at command movements at the hip, knee and ankle were performed correctly.

Meanwhile a psychological conflict between the claims of childlike dependence on a family group and fear in facing independent life away from it was being uncovered. The former part of the conflict had been repressed. The crisis which initiated symptoms was the need to leave home and work in another part of the country to secure advancement in his occupation. With psychological exploration the physical condition of the patient was improving.

On August 16 detailed examination was made before, during and after light hypnosis. Before hypnosis there was a to-and-fro tremor in the facial muscles at rest and on movement. Voluntary and emotional movements of the face were restricted. The intercostal and abdominal muscles were held firm and very slight movement occurred with respiration. Examination of the abdominal reflexes revealed slight outward movement only towards the left upper abdominal quadrant. At command the patient flexed the right knee to 90 degrees and the left knee to beyond 90 degrees. There was normal transmission of the motor impulse to agonists. On the command to dorsiflex the right foot the muscles of the anterior compartment of the leg contracted and those of the posterior compartment relaxed. On the command to dorsiflex the left foot the muscles of the anterior compartment relaxed and those of the posterior compartment contracted. On both sides there was some contracture of extensor

longus hallucis. With this condition and slight contraction of the hamstrings, stimulation of the sole of the foot produced contraction of extensor longus hallucis and extensor longus digitorum with extension of the great toe and to a lesser extent of the other toes. When relaxation of all the muscles was secured, stimulation of the sole of the foot produced no response.

Under light hypnosis the following observations were made. On the command to bend the right knee there followed a full extension thrust of the left lower limb, contraction of the flexors of the right knee, relaxation of the extensors and a movement of flexion at the knee. The same effect was observed on the command to bend the left knee. On the command to bend up the right foot the dorsiflexors contracted and the plantar-flexors relaxed. On the command to bend up the left foot the dorsiflexors relaxed, the plantar-flexors contracted and no movement occurred. This was a lesser degree of the condition seen in the waking state. All the thoracic and abdominal muscles moved freely, whereas in the waking state they were held rigid. With slight contraction of the hamstrings and extensor longus hallucis stimulation of the sole of the foot produced extension of the great toe and of the small toes; whereas with full relaxation no response occurred.

On subsequent examinations in the waking state, to-and-fro tremor of the face was absent. Sitting up with effort was associated with a downward thrust of both feet on the bed. The command to bend either knee produced contraction of the flexors and relaxation of the extensors. Command to bend up the right foot produced contraction of the dorsiflexors and relaxation of the plantar-flexors. Command to bend up the left foot produced at first relaxation of the dorsiflexors and plantar-flexors together with contraction and fixation of the muscles above the waist. Later it produced relaxation of the dorsiflexors followed by contraction of the plantar-flexors. Later still it produced contraction of the dorsiflexors and relaxation of the plantar-flexors. On both sides, with adequate relaxation, stimulation of the sole of the foot produced no response. In the usual condition, with slight contraction of extensor longus hallucis, it produced extension of the great toe with contraction of the hamstrings and extension of the small toes. The extensor plantar reflex was closely simulated.

With uncovering and adjustment of the patient's psychological problems, together with training in voluntary movements, the physical disabilities disappeared completely.

Case III.—W.N., male, age 30 years, was admitted on August 17, 1934, in a condition of collapse. His limbs were flaccid, he was sweating freely, and his breathing was rapid and shallow. When lifted and released his upper and lower limbs fell helpless. When directed to do so he could lift his arms a few inches two or three times; their movements were tremulous and uncertain and each attempt ended with sudden cessation of effort and the limbs falling flaccid on the bed. He tried to speak, but was unable to do so. Two days later there was flaccid paralysis of the right upper and lower limbs. A few words were ejaculated in an explosive manner with long pauses between them. With encouragement he could move the fingers and the forearm a little; the movements were jerky, slow and incoordinated, and each attempt was accompanied by shallow breathing at the rate of 40 respirations a minute. Both plantar reflexes were flexor. A detailed physical examination was otherwise negative.

When seen personally six days after admission the following history was elicited. He was an only child and until the death of his mother when he was eight years old he was extremely dependent on her. From eight to 12 he was in a boarding school, failed to adjust himself to the school and to other boys, and was bullied. At another school from 12 to 14 he was happier. His father remarried when the patient was 14. From 14 to 17 the patient remained at home and resented what he regarded as interference by his stepmother's relatives. When he was 17 his father died. From

17 to 20 the patient was at sea, and was seasick most of the time. At 23 he married and left for Fiji immediately without his wife. He lived with her only during the last four months of his stay of two years in Fiji; became suspicious of her getting into debt and being friendly with other men; became very ill and was invalided home. He then separated from his wife. Thereafter he spent two years as a teacher with indifferent success, a further two years on relief works, and for the last six months had acted as agent for an insurance company. During this time he quarrelled constantly with his immediate chief. For three months he had been sleeping badly, his memory and concentration were poor, and he was irritable. The day he was admitted he had quarrelled and argued with his chief for some hours, and then suddenly lost his voice and became helpless. He claimed that three weeks before admission he had been robbed of some money he was holding for his company. During 10 years he had had five abdominal operations following indefinite abdominal discomfort.

On examination the following positive findings were recorded, all other features of the examination being negative. When told to put out his tongue he protruded it to the teeth and then retracted it suddenly. Further attempts resulted in alternating protrusion and retraction of the tongue, producing the effect of a gross antero-posterior or trombone tremor. Speech was spaced and jerky; two or three words were thrown out with obvious effort, there was a long pause, and more words were thrown out. The right upper limb lay helpless, and when lifted and released it at once fell on the bed in a flaccid condition. When told to grasp the observer's hand, contraction occurred in the muscles fixing the shoulder, elbow and wrist, but no grasp resulted. The attempt was associated with a rhythmic tremor of the limb with alternating contractions of the flexors and extensors which could be seen and felt. On cessation of effort the limb dropped at once and was found to be flaccid. When eliciting the right abdominal reflexes the midline moved abruptly, suddenly stopped and as suddenly recoiled. On stimulating the left side immediately after there was no response. The right lower limb lay helpless. When told to lift the right knee, the muscles about the hip, knee and ankle contracted, but there was no movement other than a rhythmic clonic tremor which was found on inspection to be associated with alternating contraction of opposing groups of muscles. When told to bend the right foot up there was decrease of tone in the muscles of the anterior compartment of the leg, then increase of tone and contraction of the muscles of the posterior compartment, slight plantar-flexion, and then increase of tone and contraction of muscles of the anterior group. The right plantar reflex gave no response and the left was flexor. On stimulation of the sole of the right foot there followed decrease of tone in the flexors of the toes, then some contraction and increase of tone of the extensors, but no movement of the toes occurred. The right foot was held slightly plantar-flexed with slight extension of the great toe and tension in the tendon of the extensor longus hallucis.

On September 18 there was a to-and-fro tremor in the facial muscles on beginning to speak, to smile or to show the teeth at command. In all attempts to perform movements at command in the right upper and lower limbs, there was alternating contraction of the flexors and extensors with partial fixation of the limb. The tendon of extensor longus hallucis was tense. In this condition, stimulation of the sole of the foot resulted in rapid extension of the great toe and of the small toes. Subsequent observations on this feature revealed the following. Stimulation of the sole of the left foot resulted in increase of tone and contraction of flexor longus hallucis and digitorum with flexion of all the toes. Stimulation of the sole of the right foot produced relaxation of these tendons, then increase of tone and contraction of the extensor muscles and extension of the great toe to a greater extent than of the small toes.

On October 18 there was a to-and-fro tremor in the facial muscles. On command to perform an individual movement of the right upper or lower limb there were decrease

of tone and relaxation of the agonists followed by increase of tone and contraction of the antagonists, a movement in the direction opposite to that commanded, stretch of the agonists and increase of tone and resistance of the agonists. Early in December the motor phenomena had disappeared with the exception of a tremor in the facial muscles.

Case IV.—G.S., male, age 31 years, was referred on June 23, 1934, complaining of inability to straighten the left arm at the elbow. Four months before boiling tar had splashed on the front of the left elbow. When he returned to work one week after the accident with the skin healing, he found that he could not straighten the left arm at the elbow. This disability had become worse during local treatment to the arm.

He was apprehensive and showed tremor of the eyelids. The left arm was held with the elbow flexed at 135 degrees. With encouragement he could extend the forearm a little further, but when he did so the flexors contracted and further extension became impossible. At command and with passive movements the flexors relaxed somewhat; then the flexors contracted again and there followed a to-and-fro tremor associated with alternating contraction of the flexors and extensors. The remainder of the physical examination was negative. Until the age of five years he had been at home. His father was often cruel to his mother. The patient was afraid of his father and sought his mother's protection. At four he was separated from both father and mother and sent to an orphanage, where he remained until he was sixteen. From 16 to 31 he had wandered from one occupation to another. Throughout life his approach to every situation and problem had been characterized by a struggle between his urge to deal with it and fear.

Case V.—N.S., female, age 32 years, was referred on June 16, 1934, with the complaint that she was unable to use the left hand. Six days before she had been sitting in a cinema with the left leg crossed over the right knee and her left hand in her lap. She felt pins and needles in the left upper and lower limbs. When she got up to leave her left lower limb moved normally, but the left hand hung loosely at the wrist. For six months she had fatigued easily. There had been no previous illnesses. She had been married 18 years, had one child 11 years old, and thereafter had practised c. interruptus. Apart from inability to extend the left hand at the wrist there were no physical signs.

Subsequent examination showed the following. When the left hand was held on the same level as the forearm some extension occurred at the wrist. On the command to extend the left wrist the extensors relaxed and became helpless, the flexors then contracted firmly and became rigid.

She was fourth of a family of five and was strongly dependent on her mother until the death of the latter when the patient was 17. She married at 19 and had a child 18 months later. Three years before she was seen her husband had an accident in which he lost much of his vision. Thereafter he had been employed regularly on light work at smaller wages and the fear of pregnancy which the patient had had since the birth of her child became more acute. With the loss of his employment four months before the patient worried a great deal, was still more afraid of pregnancy and became frigid. With the onset of the drop-wrist her worries ceased. The personal situation was explored, a superficial adjustment obtained, and on May 25, 1934, the left upper limb was normal.

Case VI.—F.G., male, age 55 years, was seen on August 10, 1934, when he complained of being unable to grip with the left hand and of numbness and pins and needles in the left hand of three months' duration. Three months before he was shovelling coal from a railway truck with his left hand on the handle of the shovel and his right hand at the end of the shaft. The shovel struck a bolt in the floor of the truck. Pain was felt in the left hand and forearm. He tried to use the shovel

again immediately and found the left hand fall helpless at the side. The left hand swelled and became congested, but these effects soon subsided. His domestic life was unhappy and he was ruled constantly by an overbearing wife.

On examination the left hand and forearm were held rigid. On the command to flex the left elbow both freely and against resistance the extensors of the elbow contracted. On the command to extend the left elbow the flexors contracted. On the command to flex or extend the left wrist there was contraction of the flexors and extensors at the elbow and in the forearm, with a to-and-fro tremor of the whole limb characterized by alternating contraction of flexors and extensors. In neither case did any movement occur at the wrist. With the command to flex or extend the fingers there was the same result and no movement of the fingers occurred. Sensation for cottonwool and pinprick was lost to a horizontal level 3 inches above the elbow, the vibration of a tuning fork at the wrist was described as 'something there,' changes in position of the fingers were not recognized, and objects placed in the palm of the hand were not recognized. In all other respects physical examination was negative. Examination on August 24, 1934, showed the following. On the command to grip with the left hand the flexors and extensors of the fingers became atonic and contraction of the flexors and extensors of the elbow and wrist occurred. On the command to grip both right and left hands, the right hand gripped normally and flexion of the left fingers and thumb occurred to about 15 degrees. On the command to grip with the left hand the flexors and extensors of the fingers became atonic. Then with the wrist supported the flexors and extensors of the fingers were stretched alternately. At first there was no resistance in these muscles, then tone and resistance gradually increased, and finally definite contraction with resistance to passive movements occurred.

Case VII.—A man, age 28 years, was seized with acute pain in the right side of the abdomen and admitted to hospital the same evening. On admission he complained of severe pain in the right lower abdomen from above the iliac crest to the right groin. Notes made at the time recorded a rapid pulse rate, limitation of respiratory movements of the abdomen and rigidity of the abdominal muscles on palpation. Laparotomy that night failed to reveal any abnormality in the abdomen. The rigidity subsided, but the pain persisted in a less acute form. The urine was normal and a cystoscopic examination was negative. He was seen and examined personally three weeks later. He still complained of pain in the right side of the abdomen and of burning at the end of the penis. Examination showed apprehension, some proptosis of the eyeballs with lagging of the upper eyelids on downward deviation of the eyeballs, fullness of the thyroid gland, exaggeration of tendon reflexes in upper and lower limbs, an excessive response to sensory stimuli, tenderness on palpation of the right side of the abdomen and right loin, and a to-and-fro movement of tremor in the facial muscles. Exploration of his personal history showed excessive mother dependence persisting into adult life. His first experience associated with abnormal fear was at 10 years of age. He was sitting in a car by his father when the latter collided with and killed a man. When he himself began to drive a car he found that when an awkward situation arose he 'became paralyzed with fear' and was unable to take rapid action to avoid a collision. He had many accidents. Two years before admission he collided with and killed a man, and underwent trial for manslaughter. The same 'paralysis with fear' had occurred at the time of the accident. At the same time he was subjected to uncomfortable pressure above the right iliac crest by the edge of the front seat of the car. He had to leave home, and after being away for three months began to have discomfort above the right iliac crest and in the right side of the abdomen. This pain persisted, and twelve months later his appendix was removed. It was normal. Before his admission to hospital he had been living with a sister and her husband, and had found some comfort in the attention the former gave him.

On the day of admission criticism of his helplessness and attitude of dependence by his brother-in-law and the suggestion that he should leave and fend for himself was followed after a short interval by acute pain in the abdomen.

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