THE PROBLEM OF THE THERAPEUTIC CONVULSION

BY

THOMAS D. POWER, M.D., M.R.C.P.

Consultant Psychiatrist, Brentwood Mental Hospital

The points of interest about a general convulsion differ according to whether it is viewed from the neurological or the psychiatric angle. The neurologist is concerned with the nature of the pathogenic agent, its possible site of action in the brain, its frequency of operation, and the remedies with which to combat it. The psychiatrist, on the other hand, is faced with the additional problem: How is it that a general convulsion can benefit mental illness? He knows that by inducing a number of convulsions in a patient suffering from mania, melancholia, or acute schizophrenia he can remove, as if by magic, the symptoms of these vastly different syndromes. Nor does it detract from his scientific interest if in many cases the clinical improvement is only temporary. He is still left with the question: How can an insane person be rendered sane by such means?

It seems to me that before a solution to this problem can be found closer attention must be paid to the neurophysiological mechanism underlying a convulsion. What is a convulsion? Hughlings Jackson (1931), among his many brilliant contributions to the subject of epilepsy, makes the following points. He says: "It is to be insisted on that a convulsion, in any case, is nothing whatever else than a sudden, excessive, and rapid development of the *normal* movements which the centre suddenly and excessively discharging represents." And again: "A severe epileptic convulsion, to take that case for illustration, is nothing whatever else than a sudden, excessive, rapid, and consequently a nearly contemporaneous development of many of the patient's commonplace daily movements. . . . Speaking figuratively, we may say that the epileptic discharge is trying to develop all the functions of the body excessively, and all at once; a severe fit is a fairly successful attempt. Let me give a very simple illustration. If there be a centre for locomotion, then during slight sequent discharges of its elements in health there is walking or running; but if very many of these elements were to discharge suddenly, rapidly, and excessively, the man walking or running would not go faster; on the contrary, he would be stopped, would be stiffened up into a tetanus-like attitude by the *contemporaneous* development of many locomotor movements."

According to Jackson, therefore, during a convulsion many movements are taking place at once and in this way lose their individuality, the resulting tetanic posture being the algebraical sum of the pulls exerted by agonists and antagonists. There is, in fact, a condensation of movement, or, as he himself expresses it, "a clotted mass of movement."

Prominent among Hughlings Jackson's teachings was the doctrine of dissolution. His hypothesis was that nervous dissolution proceeded in the reverse order to that of evolution, and that many of the symptoms of nervous disease, including post-convulsive phenomena, could be explained in this way. There was, he claimed, a reduction from the least organized, most complex, and most voluntary behaviour towards that which was most organized, most simple, and most automatic. Strangely enough, Jackson never applied this theory to the convulsion itself, but only to the manifestations which followed the fit. Nevertheless, his suggestion that during a convulsion there is a fusing of many highly evolved movements into one gross move-

ment deserves consideration from the standpoint of the doctrine of dissolution, because evidence accruing from the embryological method of approach to the study of behaviour suggests that differentiated movement is evolved from mass movement.

"Total Pattern" Theory of Development

There are two schools of thought regarding the development of behaviour in the individual. According to one, it is evolved by the integration of simple reflexes into complex formations. This is the view ordinarily held in this country. According to the second school, with which the name of Coghill is associated, behaviour is integrated as a whole from the beginning, and from this "total pattern" local reflexes become segregated off as development proceeds. It is with this second view alone that we are here concerned, not because the first does not merit an equal hearing, but because it is already the accepted teaching in England. The reader is, however, referred to a critical review of the "total pattern" theory by Windle (1944), a distinguished protagonist of the opposing school.

Coghill (1929a) showed how in the embryo of the amphibian *Amblystoma* movements destined to become local first formed part of a generalized movement. For instance, movements of the fore-limbs, hind-limbs, and gills could not at first occur independently of trunk movements. As development proceeded, however, the limbs and gills were enabled to act by themselves by the dropping out of the trunk component. Coghill did most of his work on *Amblystoma*, but he considered his findings applied equally well to the human foetus. He says (Coghill, 1929b): "I am convinced by a study of all available records of movements in human foetuses of the first six months that behaviour develops in man as it does in *Amblystoma*, by the expansion of a total pattern that is integrated as a whole from the beginning and by individuation of partial patterns (reflexes) within the unitary whole."

Barcroft and Barron (1939), studying the sheep foetus, found a certain amount of evidence which supported Coghill's theory. Their investigations showed that at an early stage of development extensive bodily reactions were initiated by stimulating the foetal head, and that as time went on independent patterns of behaviour—for example, respiration—became segregated out from the initial total response. While admitting the validity of some of the arguments of the opposing school, they conclude that, "so far, therefore, as local and mass responses are concerned in the sheep, local mechanisms do appear to become segregated out from the total response in the sense implied by G. Coghill in his account of the development of behaviour in *Amblystoma*."

Observations on the human foetus have necessarily been scanty. Minkowski, a prominent worker in this field, although he did not subscribe to Coghill's views, is reported by Irwin (1932) as having found in human foetuses considerable irradiation of nervous impulse. There were no isolated reflexes which were localized in the segments stimulated; on the contrary, reactions from local stimulation tended to irradiate over the whole body. This finding of Minkowski's would seem to imply mass activity. Hooker (1936), another authority on behaviour in the human foetus, says in an interim report: "Every bit of evidence from the work of Minkowski and from the other unfinished study [his own] of which I have been speaking indicates that the responses of human foetuses to tactile stimulation follow a Coghillian sequence: first the expanding total pattern; then the rather rapid process of individuation of specific reflexes from the total pattern."

Apart from these findings in the foetus, numerous observers of infant behaviour have testified to the predominance of total reactions in the early days of post-natal life. Gilmer (quoted by Dewey, 1935), who studied the spontaneous responses of four infants from 1 to 10 days old, claims that the newborn's behaviour organization is body-wide; his responses are total bodily responses. Irwin (1932), reviewing his own findings in conjunction with those of Coghill and Minkowski, says: "Differentiation and specificity of behaviour in infants, therefore, probably develop out of an original matrix of mass activity; mass activity probably is the earliest activity of the uterine organism." Langworthy (1932), another authority, says: "Even the newborn infant responds to stimuli with widespread motor responses which spread and increase in intensity with the strength of the stimulus. It is only later as a differentiation from the response of the organism as a whole that refinement and delicacy of activity evolve."

Application of "Total Pattern" Theory to Therapeutic Fit

Let us now return to the therapeutic convulsion and see how far we can apply the above-mentioned findings to it. Do the motor phenomena of the fit reflect a reversal of nervous evolution to the level of the foetus, where mass activity is said to dominate behaviour? There is certainly in the tonic stage of the fit an exaggerated sustained movement, or tetanic posture, of universal distribution. The body and limbs become a rigid mass which can be rolled about in one piece like a log of wood. This rigid mass of muscle is not, however, quite bereft of nervous organization, for "plasticity" can be demonstrated in it in the following way. If during the tonic phase the patient's arm be forcibly flexed or extended at the elbow the limb will tend to remain in the position in which it is placed. We have therefore a widespread sustained movement which retains a degree of nervous organization, and which, according to Hughlings Jackson, consists of a variety of normal movements merged into one. Is it too far-fetched a speculation to regard the normal movements as having retraced their evolutionary pathway and lost their identity in a mass movement similar to the one from which they were originally evolved?

A tonic decerebrate posture similar to the one so often assumed by patients during the tonic phase of the fit has also been demonstrated in the sheep foetus. Describing this manifestation in the sheep foetus, Barcroft (1941) says: "By the sixtieth day, if the foetus be delivered, it exhibits a different picture: the fore-legs are tensely stretched out side by side, the head and tail are extended, and the foetus presents the appearance of an animal suffering from what is known as 'decerebrate rigidity.'" While it is easy to attribute the decerebrate attitude in the human fit, as in the case of the sheep foetus, to the absence of the controlling influence of higher centres, this hardly fits in with Jackson's teaching that in the convulsion there is a sudden, excessive, and nearly contemporaneous development of many normal movements. Jackson certainly had in mind movements of a much higher order than any that could be initiated after decerebration. On the other hand, the application of the "total pattern" theory of development to the tonic phase of the fit appears to be consistent with Jackson's view. Arguing from it, the universal tonic spasm with its attendant decerebrate posture could be explained as a reversion of the higher brain mechanism to the pattern of functioning exhibited in the foetus in the face of a grave threat to the functional integrity of the organism brought about by the action of the convulsant. In the resulting widespread discharge the more highly evolved nervous elements would *participate*, but in a more primitive way than was their wont.

If we assume that the tonic stage of the fit reflects a return to an early pattern of nervous activity, then we can regard the clonic stage as representing the first step towards re-evolution. Coghill, as already indicated, considered that behaviour developed in the embryo by a gradual suppression of the "total pattern," so that local movements were permitted to occur apart from it. Something rather like this seems to be taking place during the clonic phase of the fit. The hitherto continuous motor spasm gives place to intermittent spasms which become spaced at progressively increasing intervals until finally they die out altogether. As the fit proceeds slight movements at the hip, shoulder, knee, and elbow begin to appear, the movements at the proximal joints preceding those at joints more distally placed. The limbs cease to be stiff rods so rigidly attached to the trunk that when they are passively moved the whole body moves, and become segmented appendages as is normally the case. This dawn of independence on the part of the limbs is further enhanced by the gradual establishment of ascendancy of certain groups of muscles over their antagonists so that the range of movement at the implicated joints is progressively extended. There is, in other words, a breaking up of the total pattern, or a commencing crude differentiation of movement.

With the progress of the clonic phase another thing is seen to happen: minute respiratory gasps accompany some of the clonic spasms. Hitherto, apart from one long expiration (or occasionally an inspiration) at the beginning of the fit, respiration has been in abeyance, but it now begins to function, first in conjunction with the widespread clonic spasms, and then, after the termination of the fit, in complete independence. This compares with the way in which Barcroft and Barron (1936) tell us respiratory movements are established in the sheep foetus. These authors say: "They are derived from a general mass movement of an extensor type by the dropping out of the movements of the head and limbs."

The above interpretation of the clonic phase of the fit implies that the convulsion is terminated by inhibition rather than by exhaustion, which is the more usual explanation. There are several clinical facts which seem to support such a hypothesis. In the first place, the terminal jactitations of the fit are quite as strong as those which precede them, and there is no tapering of intensity such as one would expect if the nerve cells were becoming exhausted. Secondly, the knee-jerks, although often abolished immediately after a fit, may be exaggerated from the moment the fit ceases, which is not consistent with exhaustion of spinal neurones. Thirdly, if a chemical convulsant such as triazol be used a second fit may follow a few minutes after the first, and in this event the second fit will be quite as strong as its predecessor. This again is difficult to reconcile with an exhausted nervous system.

But, apart from these arguments, there is the undoubted fact that therapeutic convulsions are associated with so little danger to life. Anyone who, like myself, has been inducing them almost daily for over a decade without a single fatality must have been struck and puzzled by this. In view of the frail condition of some of the patients treated it is questionable whether such a happy result could have been achieved if exhaustion of nerve cells had been the operative factor in ending the fits. Indeed, the more one studies the manifestations of the therapeutic fits the stronger is the impression given that one is here dealing with a physiological rather than with a pathological mechanism.

In making this comparison between the movements displayed during an adult convulsion and those manifested in foetal life it is not, of course, claimed that the foetus when

subjected to a local stimulus reacts with the equivalent of an epileptic fit, for it is quite obvious from the literature and from cinematograph studies of foetal behaviour that this is not the case. All that is argued is that during a therapeutic fit there is a state of mass motor activity involving widespread irradiation of nervous impulse, which corresponds in principle to the type of activity displayed in the foetus in response to local stimulation; furthermore, that this is followed by an apparent segregating out from the original mass movement of certain independent movements, which again roughly corresponds to the pattern of development in the foetus. It is perhaps worth mentioning as an additional point that Barcroft (1941) refers to movements elicited in the sheep foetus as "spasms," and when widespread as amounting to "a trifling convulsion of most of the body."

Psychophysical Relationships

The theory that the convulsion represents a return to the foetal level of nervous functioning does not explain its beneficial therapeutic effect, but it promises a more fruitful line of approach to the problem than do current views about the nature of a fit. It has the merit of enabling one to investigate the psychic phenomena which follow a fit—namely, the post-convulsive confusional state—with certain possibilities in mind. For instance, if there has taken place during the fit a reversal of nervous evolution there may well have been a parallel reversal of psychic evolution, in which case one might find in the post-convulsive state a partial reliving of past experiences. The well-known retrograde amnesia associated with such fits would harmonize with this.

Again, the fusing of normally discrete movements during the fit might be correlated with a tendency to fuse psychic material after it. Indeed, this may be the reason why the term "confusion" is applied. The establishment of psychophysical relationships such as these—and they are not the only ones suggested by the theory outlined above—would be likely to throw light upon the problem of how multiple fits can benefit mental illness. The post-convulsive confusion represents the first demonstrable effect of the fit upon the mind, and it is reasonable to assume that some relationship exists between this and its later therapeutic influence. The frequent persistence of amnesic symptoms after recovery from the original mental symptoms supports such an assumption. Glandular and metabolic effects doubtless also occur, but the core of the matter seems to lie in an alteration of cerebral functioning and, by concomitance, of mental functioning, brought about by the direct action of the convulsive process.

Summary

Attention has been called to some of Hughlings Jackson's teachings regarding the nature of a convulsion. Reference follows to the physiological theory that local movements are evolved from mass movement, and authorities are quoted who support the theory. On the basis of this assumption an attempt has been made to explain the therapeutic convulsion as a reversion of behaviour to the level of the foetus.

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TREATMENT OF INTERTROCHANTERIC FRACTURES OF THE FEMUR BY INTERNAL FIXATION

BY

G. P. ARDEN, M.B., F.R.C.S.

AND

G. J. WALLEY, B.M., F.R.C.S.

(From the Accident Service of the Windsor Group of Hospitals)

Only of recent years have surgeons been stimulated to treat intertrochanteric femoral fractures by internal fixation as a means of obviating the long inactivity and bed-stay of the aged patient. Previously Brittain (1942) had used a flanged pin alone, but in the most urgent group (the comminuted) the pin had tended to cut out. Extending the principle of a firm hold on the shaft cortex, the Capener-Neufeld and McKee type blade-plates were evolved. Reports on several American series of such cases have appeared, but only one in the United Kingdom.

Operative treatment has been advocated for the following reasons: (i) early ambulation; (ii) a more accurate and stable reduction of the fracture; (iii) improved final function; (iv) fewer general complications (chest, pressure sores, thrombosis, nerve lesions, incontinence); (v) shorter hospital stay and quicker turn-over; (vi) lower mortality.

Reports in the Literature

Cleveland *et al.* (1947) reported on 95 cases out of a total of 133 treated by internal fixation with a Neufeld-Capener nail. Their operative mortality was 12.6% and the average hospital stay 57 days. Complications reported by them were overdriving of the nail and breaking of the nail in three cases following early weight-bearing. They claimed a lower mortality and a lower incidence of all complications compared with cases treated conservatively. Hammond (1948) reported a series of cases treated by operative means, with a mortality of 21%. His patients were up on crutches in two to three weeks after operation and began weight-bearing at the end of four months. He also claimed a lowered mortality and complication rate compared with cases treated conservatively.

Evans (1949) reported on 22 unselected cases treated by operation with a Neufeld-Capener nail and claimed the same advantages of early ambulation, greater comfort for the patient, and quicker turn-over and lowered mortality. Murray and Frew (1949) have reported on 100 cases of trochanteric fractures of the femur treated conservatively, and claimed a low mortality, good function, and a low incidence of general complications (except for drop-foot). They stated that the operative complications of shock, infection, and haemorrhage more than outweighed any advantages.

Present Series

Our series comprises 43 consecutive fractures of the intertrochanteric area treated by us at five local hospitals in the last two years. Thirty-seven cases (90%) were treated by operation; these cases were selected. The remaining six were treated conservatively for the following reasons: (a) three patients were considered unfit (one died); (b) two were cases of crack fracture with no displacement; (c) one was a child aged 5.