PREFRONTAL LEUCOTOMY IN CHRONIC PSYCHOSIS.

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INTRODUCTION.

Purpose:

This paper aims at an analysis of the results of the operation of prefrontal leucotomy in a series of cases still resident in a mental hospital.

Historical Review of Frontal Lobe Function:

The function of the extensive cortical field in front of the motor area has for long been the subject of speculation and debate. From ancient times anatomists and physiologists, and even sculptors and poets, have considered the frontal part of the brain to be the seat of intellect. This view was restated and elaborated in the eighteenth century by GALL and SPURZHEIN who reached the conclusion quoted by SOURY : "Man is the more intelligent, the more the anterior superior brain is developed." In contrast, FLEURENS maintained that there was functional equality of the tissues in the cerebral hemispheres, and this view prevailed during the first half of the ninteenth century. In 1870 HITZIG placed the question of cerebral localisation on an experimental basis. In regard to motor function HITZIG was able to disprove FLEURENS' dictum. There followed his famous controversy with MUNK and GOLTZ who retained the view that, as far as intellectual function was concerned, the whole surface of the hemispheres was of equal significance. HITZIG stated, "I hold that abstract thought must of necessity require particular organs and these I find in the frontal brain". The argument continued for many years and need not be followed further in this paper. It served to stimulate further research into frontal lobe function. There followed increased animal experimentation and the study of the symptoms of frontal tumours and frontal trauma in man. Investigation into PICK'S atrophic brain disease and, in modern times, research into the results of partial cerebral excisions yielded further information concerning the frontal areas. It is proposed to give a brief survey of the more important work done in these various fields.

1. Animal Experimentation.

From the time of HITZIG'S first experiment until the end of World War I much work was done, but reports are contradictory and led BRODMAN to say in 1912 that nothing certain was known concerning the functions of the anterior parts of the frontal lobes.

In 1921 BIANCHI published the results of a long series of experiments on dogs and monkeys. He came to the conclusion that destruction of the frontal association area on one side was not followed by noteworthy symptoms, but that destruction of the areas on both sides led to disturbance of the higher emotions. This disturbance was quantitative. The sentiments affected were those of friendship, gratitude, self-esteem and,

above all, that of sociality. The author stated, "... what was found to be suppressed was, without exception, that sentimentality or feeling for others which we designate 'sociality'. A similar condition exists in human beings who have suffered severe injury to both frontal lobes...." He concluded further that the function of the frontal areas was "associating and combining the mental products of the perceptive areas and recomposing them into psychic complexes of a higher order."

JACOBSEN (1931) showed that when apes were deprived of their frontal lobes they lost the ability to solve combined mechanical functions. This "failure in synthesis" was accompanied by a defect in the temporal patterning of behaviour. Both deficits were held to be due to a defect in immediate memory and both were dependent on the amount of frontal tissues removed.

RICHTER and HINES (1938) working on apes found that bilateral excision of area 9 (BRODMAN) produced a great increase in the animal's frequency of movement and in its distractibility. They draw the conclusions that area 9 exerts an inhibiting influence on movement, and that when inhibitory centres are removed external stimuli pass freely to lower reflex centres centres and evoke motor restlessness.

2. Tumours of the Frontal Lobes.

Much work has been done on the subject of mental phenomena associated with tumours of the frontal lobes. Short-comings inherent in this material include the effects of progressive growth, the usual limitation to only one hemisphere, and the production of general and focal symptoms apart from frontal lobe ones.

STARR in 1884 stated that the typical symptoms of frontal lesions were loss of self-control, change of personality, deterioration of attention and disturbances of the synthetical thought-processes. JASTROWITZ in 1888 described several cases of frontal lobe tumours with emotional disturbances which amounted to euphoria. OPPENHEIM also found euphoric symptoms and he coined the term 'Witzelsucht' for the tendency these patients showed to joke, pun and make light of everything. Other observers among whom was E MULLER (1902) stated that from the study of many cases it was clear that frontal lobe tumours were not associated with greater mental disturbances than were tumours in other parts of the brain. SCHUSTER in 1902 published a series of cases confirming the findings of JASTROWITZ and OPPENHEIM. Research into the functions of the frontal lobes concentrated on investigation of traumatic cases during the period of the first Great War, and only returned to the field of frontal lobe tumours with the

advanced development of brain surgery which followed that conflict.

Among later workers in this field BARUK (1926), NONNE (1927) and BOSTROM (1931) confirmed the presence of those changes in the emotional sphere which had already been described and concluded that they were specifically frontal in origin. As late as 1928, however, WEISENBURG and KUBITSCHEK doubted whether frontal tumours gave rise to any specific symptoms and whether the frontal lobes had any more significance than other parts of the brain in mental life. COROSCHKO in 1931 drew attention to pathological appetite and increase in weight as frontal lobe signs. There were many other publications on the subject of tumours of the frontal lobe areas following the Great War. These came from the many neurosurgical units set up about that period. It may be said that no particularly new findings were made. The growing experience gave support to the opinion that frontal area tumours caused special mental symptoms and that the frontal lobes played a significant role in the normal functioning of mental life.

3. Injuries to the Frontal Lobes.

The frontal lobes are particularly susceptible to trauma, whether by direct violence or by contre-coup. An early example of injury to this part of the brain was the famous American crow-bar case reported by HARLOW in 1884. A tamping-iron was driven upwards and backwards from the lower angle of the jaw to emerge in the median line near the coronal suture. Both frontal lobes were involved. Follow-up of the p tient showed a striking change in temperament. Vaccilation, lack of drive, irritability and emotional incontinence replaced his former poise and efficiency. "The equilibrium of balance, so to speak, between his intellectual faculties and his animal propensities seemed to have been destroyed."

During and after the 1914 - 18 war special attention was paid in Germany to frontal lobe injury, and the syndrome was further clarified by the main workers in this field. GOLDSTEIN'S conception of frontal lobe symptoms included hypokinesia, lack of endurance, disturbed attention, distractibility and a difficulty in grasping the whole of a complicated state of affairs. Emotional abnormalities, he said, were also common and consisted of euphoria, Witzelsucht and tactlessness. He later developed the theory of a basic change, and in 1935 stated that the root of all symptoms was a deterioration in behaviour from a more abstract attitude to a primitive, concrete attitude.

In I926 FEUCHTWANGER published the results of a study of 200 patients wounded in the frontal lobes in comparison with 200 wounded elsewhere in the brain. The author stated, "The most common symptoms that occur following frontal injuries are disturbances in attention, euphoria and depressed moods, slowness and apathy, over hastiness, Witzelsucht and to a slight extent, disturbances of equilibration". He agreed that the frontal lobes were concerned with emotion and volition, but considered their task to be one of a regulating synthesis, i.e. when the frontal lobes are uninjured there is a normal co-operation of emotional and volitional impulses in the construction of the personality peculiar to each individual.

KLEIST'S contribution, published in I934, covered over 300 cases of brain injury, in I05 of which the frontal areas were involved. The author reported the sequelae of frontal lobe injury to be lack of initiative, disturbances in attention and emotional anomalies. He came to the conclusion that the convex bilateral surfaces of the frontal lobes were associated with psychomotor and intellectual activities while the orbital surface was concerned with the emotions.

Studies of traumatic brain lesions give further strong support to the contention that lesions of the frontal areas occasion specific mental changes. But nothing definite has been learned of the precise role these areas play in the harmony of mental life. Endeavours to find a common factor for variegated symptoms, and to correlate different functions with certain areas in the lobes have not been wholly accepted.

4. Frontal Lobe Atrophies.

The frontal lobe atrophies first described by PICK and ALZHEIMER are associated with mental symptoms which have drawn the attention of psychiatrists on the Continent since I9I8. SCHWAB summed up the observations in PICK'S disease as follows: " The patients lose their emotional balance: they grow childish and euphoric, show a tendency to Witzelsucht and immoral behaviour: they lose their initiative and at the same time show signs of motor unrest."

More recently these presenile dementias have been studied in Britain and America. STENGEL (I943) has compared the clinical pictures in ALZHEIMER'S and PICK'S diseases and stated that probably the most important single difference in symptomatology is the partial or general over-activity in the former, and the lack of initiative resulting in loss of activity in the latter. STENGEL suggested that the difference in behaviour might be based on the anatomical differences found in the two conditions. He drew attention to the massive destruction of the white matter of the frontal lobes.

found in PICK'S disease, and conjectured that a leucotomy carried out in a typical case of ALZHEIMER'S disease would result in the clinical picture of a typical case of PICK'S. Agitation, distress and restlessness would be replaced by euphoria and loss of activity.

5. Frontal Lobectomy.

Advances in neurosurgical technique have made partial or total excisions of one or both frontal lobes feasible propositions in the treatment of frontal tumours or chronic cerebral abscesses. Neurosurgeons have described cases in which no mental symptoms appeared after operation but these patients were not submitted to examination by a psychiatrist. In general it has been established that the more carefully studied the case the more symptoms have been found, and the larger the excision the more defect has been apparent. Unilateral excision caused much less disturbance than bilateral.

Of the few cases of bifrontal lobectomy which have been published BRICKNER'S report (1936) of a single case is unique in its thoroughness. To the many defects found, which differed little from those already described, BRICKNER applied the theory of associationism. The fundamental defect, he stated, is in the assembling of groups of perceptions to complexes of a higher order. This recalls the "failure in synthesis" postulated by JACOBSEN.

RYLANDER'S impressive monograph published in 1939 gave the results of unilateral excision in 32 cases. In summing up his results RYLANDER stated :"Marked changes occur in allthe domains of the higher mental life, without any one type of symptoms really taking a dominant position." He thought that his findings partly confirmed and partly denied the assumptions of BARUK, KLEIST and GOLDSTEIN. Changes in emotions, in volition, in higher intellectual functions were found, as was difficulty in grasping the essentials in complicated situations and in abstract thinking. He made no attempt to find a common denominator for the various symptoms, or a basic factor to explain all the changes occurring. He put forward no theory of frontal lobe function but considered that the symptoms described must be considered as frontal lobe deficiency symptoms. RYLANDER found evidence supporting the theory relating euphoria to the basal parts of the frontal lobes.

6. Comment.

Some of the findings noted above are controversial, and obvious criticisms can be made of others. In animal experimentation different mammals and different tenhniques were used, and it is doubtful if conclusions derived from lower animals can be transferred to the more complex behaviour of the

human individual. In regard to study of the symptoms of frontal tumours it can be said that the progressive expansion of the lesion is likely to bring in extraneous factors. In PICK'S disease the possibility of vicarious functioning of the remainder of the cerebrum must be borne in mind, as the frontal cortex is not entirely cut off from other parts of the brain. The shattering effect of high-speed projectiles upon the brain, with resulting distant haemorrhages and scars, constitutes an objection to the use of war injuries in studying frontal lobe deficit symptoms. From the study of all the fields dealt with above, including lobectomy, it might be said that more has been learned about the functioning of the brain without the frontal lobes than about the lobes themselves. As RYLANDER has pointed out, one cannot form definite conclusions on the nature of the normal functions, which when damaged, give rise to the pathological features described. "Nor can we conclude that these functions are localised in the frontal brain just because they appear injured in cases of frontal lobe lesions." Nevertheless a definite syndrome of frontal deficiency has been established, and it has been demonstrated that this becomes prominent only when both lobes have been injured.

While many writers seem to be describing the same qualities in different terms and from different view-points, FREEMAN and WATTS (1942) state that the paramount frontal lobe function is concerned with the elaboration of ideas concerning the self, and the relation of the self to the future. Imagination, ambition, foresight and self-consciousness are included in this function. These authors postulate further that all the deficiency symptoms and their underlying common factors (failure in synthesis, turning to the concrete defect in sociality) can be explained by the divorce of this imaginative faculty from the affect which usually accompanies it. And this divorce, they say, occurs in frontal lobe lesions. This theory is elaborated in a later section.

Considering the frontal lobes anatomically it is established that their development is associated only with the more intellectual types of human individual; that they are larger than any two other lobes of the brain; that to two-thirds of their area can be assigned the function of association, and that this large anterior development is connected to the dorsal medial nucleus of the thalamus. The frontal lobes in their cytoarchitecture lie midway between the motor and sensory types of cortex. It seems likely that they possess a power of compensation by one part for another, including a linkage of the two sides through the corpus callosum.

The Surgical Treatment of Mental Disorders:

Surgery of the brain was practiced in ancient times

and in many countries, both for the treatment of wounds and to let out devils. Hundreds of trephined skulls have been unearthed in many lands. Since those far-off days the surgical treatment of mental disorders has taken a devious route through the different regions of the body. The sex glands, and later the thyroid, were the commonest organs to sustain attack, with limited and generally unsatisfactory results. The theory of the etiological importance of focal infection in the neuroses and psychoses opened up many fields to the surgeon. Teeth, tonsils, sinuses, the appendix, the uterine cervix and even the colon received surgical attention in the hope of alleviating mental symptoms. The latter were relieved in some cases, but now a days surgical interference with these organs is undertaken only when warranted by the physical condition of the patient.

The pioneer of modern 'psychosurgery' was BURCKHARDT who operated on 6 chronic mental patients about 50 years ago. He removed portions of the sensory cortex in the temporal parietal and frontal areas. There was one fatality but the remaining 5 were somewhat benefited. BUCKHARDT frankly stated that his purpose in operating could not be otherwise than to transform a dangerous sick person into a harmless one. In this attitude he was at variance with public sentiment and his work was not followed up. Meantime the allied field of neurosurgery made great progress in its range and technique.

Prefrontal Leucotomy:

In August 1935 EGAS MONIZ of Lisbon attended a symposium on the function of the frontal lobes at the Second International Neurological Congress in London. At this meeting the knowledge of this subject was brought up to date. This summing-up stimulated MONIZ to put into practice ideas which he had been developing for 2 years for the treatment of psychotic patients by severance of the frontal association pathways. In November, 1935 MONIZ and LIMA carried out their first operation through a trephine opening over the prefrontal region. In the original technique minute quantities of alcohol were injected into the subcortical white matter. Later an instrument called the leucotome was devised. This carried a flexible wire loop by which, when the instrument was rotated in situ, cores of white matter 1 cm. in diameter could be cut. The cores were not removed but were left to undergo autolysis. From 4 to 6 cores were cut in each prefrontal area, and in some cases this was later supplemented by the injection of alcohol. Reviewing his first 20 cases the author reported 7 patients recovered, 7 improved and 6 unimproved.

This lead was followed at an early date in Italy, Hungary and America. Some workers followed MONIZ' technique; others

experimented with injections of various substances and with different types of leucotome. First reports of the operation did not appear in England until July, 1941. The pioneer workers in America were FREEMAN and WATTS who in 1942 published their monograph "Psychosurgery". In this they reviewed the work already done, described their own technique, and gave detailed descriptions of the results obtained in 74 cases of psychosis and psychoneurosis. The employment of leucotomy has steadily become more widespread and recently the Board of Control published a pamphlet tabulating the results in 1,000 cases in Britain operated on up to the end of 1944.

Theories of the Operation:

Various theories concerning the rationale of the operation in its relief of mental symptoms have been put forward. MONIZ held that in certain mental disorders the functional grouping of cortical cells became fixed instead of interchangeable and that this led to the persistence of fixed ideas. Destruction of these cell-groupings should therefore dissipate the morbid thought-systems.

FREEMAN and WATTS postulate that in the frontal areas are elaborated ideas concerned with the self as a whole and with the future. The frontal lobes give us the capacity "to see what ought to be done." This faculty includes imagination, ambition, self-consciousness and foresight. The thalamus is considered to be the centre for emotion, and according to these authors division of the thalamo-cortical radiation dissociates the emotional and intellectual components of morbid thought processes. The personality is thereby liberated from crippling preoccupations. In support of this theory they point to changes found in leucotomised brains in autopsy; integrity of the frontal cortex but selective degeneration of the dorsal medial nucleus of the thalamus.

It has been suggested by COBB that improvement results from the reduction in association pathways following operation. This limits the spread of stimuli to different areas of the cortex and so prevents the integration of present stimuli with past memories and habitual responses.

Technique of the Operation:

The method of performing prefrontal leucotomy at this hospital follows the technique developed by FREEMAN and WATTS at the George Washington University Hospital, Washington. Some of the early cases were operated on by Mr. G.L. ALEXANDER of the neurosurgical department of the Royal Infirmary, Edinburgh. The majority of operations were performed by Mr. R.L. BEVERIDGE, F.R.C.S.E., consultant surgeon to the Crichton Royal.

Premedication consisted of morphia gr. ¼. hyoscine 1/100 and atropine 1/100 given an hour before operation. After preliminary induction with/ thiopentone anaesthesia was maintained by nitrous oxide, oxygen and ether administered through a nasal intratracheal catheter. Upon the shaved scalp the approximate location of the coronal suture was marked with gentian violet. This line crosses the midline 13 cm. behind the glabella and comes down on either side 3 cm. posterior to the external margin of the orbit. On this line another mark was made 6 cm. above the zygomatic process. At this intersection a vertical skin incision was made and the coronal suture identified. A burr-hole was thencut, enlarged by small bites above and below, and a cruciform incision made in the dura. The brain diameter was measured by callipers in each trephine-hole and served as a guide for the depth of incision. A brain cannula was inserted into the frontal lobe with the point directed at the burr-hole on the opposite side. Usually the instrument passed just anterior to the tip of the lateral ventricle. If the latter was tapped the cannula was withdrawn and directed slightly anteriorly. The sphenoidal ridge was then found by directing the cannula at an angle of 45 degrees toward the base of the skull at the same time keeping it in the coronal plane. The cut was then made using a nasal septal elevator as leucotome. In the present series 2 different cuts were employed. In the majority of cases the white matter was cut by swinging the instrument upward and downward in the coronal plane. In the remainder this cut of FREEMAN and WATTS was modified. The white matter was cut downward towards the base of the brain as usual but the incision was not continued upward towards the convexity. Instead the leucotome was turned horizontally and guided forwards cutting the white matter towards the tip of the frontal lobes. In this way the orbital areas were isolated without severing the fibres leading to the upper parts of the lobes. Whichever cut was used the procedure was a standard one. Surgical technique was not modified according to the age of the patient, the duration or severity of the psychosis.

Post-operative Care:

After operation patients were nursed on an air-bed in a modified FOWLER'S position. The temperature was recorded 2-hourly for the first 24 hours and thereafter 4-hourly. Pyrexia up to 102 degrees F. on the night of operation was not uncommon, and the temperature often remained above normal for several days. The pulse and respiratory rates were charted hourly for the first 6 hours, then 2-hourly until the end of the first 24 hours. Blood pressure was measured 4-hourly during the first day. Small quantities of fluid were given following the operation and the teeth, mouth and bowels received attention. Patients were allowed up in a chair on

the 5th post-operative day. They usually walked to the bathroom and about the ward at the end of a week.

MATERIAL.

The main material of this paper consists of 68 psychotic patients who have been leucotomised for periods ranging from 1 year to over 4 years. At the time when the survey was made there was a total of 90 patients in hospital who had undergone the operation of prefrontal leucotomy. 22 of these had post-operative periods ranging from 2 months to just under one year. They are not discussed here except in so far as they furnish information as to the early effects of the operation. The tables, with one exception, and the bulk of the text are concerned with the 68 patients, 36 of whom are male and 32 female. Of these the age at operation varied from 22 to 59, the average being 37 years.

The paramount indication in the selection of cases for operation was the presence of "mental tension". This feature has been described in a previous communication from this hospital as "a persistent emotional change sustaining and to some extent determining the clinical picture. Such a charge is always of an unpleasant quality, invariably distressing, and sometimes intolerable to the patient". It accompanies many hallucinations and delusions. Despondency fear and anxiety are among its manifestations. It can, and often does, influence each aspect of the patient's behaviour.

The material includes 2 cases of involutional melancholia of many years' duration, 3 cases of epilepsy subject to frequent equivalents with violence and one case each of manic-depressive psychosis, post-encephalitic parkinsonism and general paresis. The remaining 60 cases suffer from schizophrenia, 27 being of the paranoid, 18 of the hebephrenic and 15 of the catatonic type. Of this diagnostic classification it may be said that under "paranoid schizophrenia" are found cases sometimes called paraphrenia. The term "hebephrenic" is used as described in the Text-book of Psychiatry of D.K. HENDERSON AND R.D. GILLESPIE, i.e. "The most prominent symptoms are the incoherence of the train of thought, the strange impulsive, senseless conduct and the vivid hallucinations". The narrower sense of the term, used by some psychiatrists, is not intended here. The designation "catatonic" follows the generally accepted use of that diagnostic term. As indicated above all these cases showed mental tension to a definite degree. Vivid auditory hallucinations and distressing delusions of persecution: noisy, violent, destructive and assaultive behaviour were commom pre-operative findings.

The chronicity of these cases is shown by the following figures. Duration of illness varied from 1 to 28 years, the average duration being 8.4 years. The present attack had lasted from 7 months to 20 years, giving an average figure of 7.8 years. In only 5 cases had the present attack lasted less than 2 years. The length of time spent in hospital before operation varied from 6 months to 18 years. 5.8 years was the average duration of hospitalisation.

In the majority of cases the well-established but less drastic methods of physical treatment had been tried. Of 60 schizophrenic patients 25 had received pharmacological shock treatment with single or (more usually) repeated courses of convulsions, induced by the intravenous injection of leptazol (metrazol, cardiazol, phrenazol) or triazol (azoman). 20 of these were reported as being improved. 48 of the same number of patients were given electrical convulsive therapy according to the technique first introduced by CERLETTI and BINI in 1937 in which therapuetic fits are produced by passing an electrical current through 2 electrodes placed on the forehead. 36 of the patients improved with this treatment. Improvement was reported as amounting to remission in 4 cases, as being considerable in 2 and partial in the remainder. In all cases it was transient. Generally, repeated courses showed the effect of electroplexy to diminish although some patients gave a continued response over several years to "maintenance treatment". In this procedure, described by MOORE (1943) patients were given convulsions at intervals over an indefinite period with the object of keeping them at their best level of behaviour and mentation. The maximum number of monthly fits found necessary was 4 in regular cases. Usually the convulsions were given in groups at two or three-day intervals, though in some cases a weekly fit was most beneficial.

27 of the 60 schizophrenics received insulin coma treatment, first used by SAKEL in 1933. By injection of insulin in increasing doses hypoglycaemic states are produced daily until coma occurs. The daily dose of insulin is adjusted with the aim of producing coma on 6 days of the week for 8 to 12 weeks. Coma is terminated after a set period by the intra-nasal or intravenous administration of glucose. 17 patients improved with insulin coma treatment and 10 were unchanged. Here too, improvement was transient and varied from a good remission to the more common brief partial amelioration. Several patients were given two or more courses. Diminishing effect was not so obvious as with convulsive therapy. Each case treated by SAKEL'S method also received convulsive treatment. Where insulin was not given the duration of the illness was too long to offer any hope of improvement by this means.

Only 5 cases of schizophrenia received no physical

treatment. In one case this was precluded by auricular fibrillation. The others had been hospitalised for long periods before the shock therapies were in common use. Of the 5 schizophrenic patients the duration of whose present attack was less than 2 years, 3 had failed to respond to electroconvulsive therapy and insulin coma treatment and were deteriorating. The other 2 had shown little response to electroplexy; one of them was considered too old for insulin (51), the other had a history of previous attacks over many years.

The 3 patients with a depressive illness had been given repeated convulsive treatment. The 3 cases of epilepsy had received anticonvulsant drugs (e.g. gardenal gr. 2 b.id.) for many years, and in 2 of them the effect of therapeutic electrically-induced convulsions had been tried in an effort to influence their epileptic equivalents. The post-encephalitic patient was given optimum doses of stramonium for years, and in her case pharmacological shock treatment was unsuccessful in modifying the outbursts of violent behaviour. The general paretic had received 2 courses of malarial therapy, 3 courses of arsenicals and a course of pyrexial treatment by inductotherm. Following his last course of fever treatment he developed a chronic hallucinosis.

METHOD OF STUDY.

The fact that these patients have remained in hospital upwards for a year after operation indicates that they represent its less successful results. A follow-up study of patients operated on during the same period, and since discharged from hospital, has been made by colleagues, Drs. FRANKL and MAYER-GROSS. They, too, are 68 in number. Although the results in the present series are less striking the cases are of special interest as a counterpart to the discharged group. In some respects they permit of a closer follow-up than do the latter. The patients considered here have, for the most part, been under constant observation since operation and significant changes regarding them have been recorded. In an attempt to re-assess their condition their case-records were studied, the patients were interviewed, and the observations of members of the staff who had known them before and after operation were solicited. Information was sought under the following headings:

1. Notes on the pre-psychotic personality

2. The duration (a) of the illness (b) of the present attack (c) of hospitalisation, before leucotomy.

3. The diagnosis.

4. Details of previous treatment and the response thereto.

5. The pre-operative state.

6. The date of the operation and the cut employed

7. Complications at or following operation.

8. The post-operative state as indicated by progress notes at approximately one month, six months, one year, two years, etc. after operation.

9. The patient's present condition.

10. Special features following operation, particularly frontal lobe deficiency symptoms.

11. The residue of the psychosis.

12. The result as assessed by standard criteria.

13. Post-operative treatment, particularly the methods of rehabilitation employed.

From a study of the literature on prefrontal leucotomy it appears that no follow-up analysis on these lines, on similar scale and dealing only with hospitalised patients has yet been published.

GENERAL RESULTS.

The criterion of improvement is the standard of the patient's post-operative behaviour.

6 patients are regarded as being "much improved". They can now have parole, do useful work under supervision and enjoy recreational facilities of the hospital. They are potential discharges. Some of them would have left hospital before the present date had their home environment been more suitable.

10 patients have improved. Most of them before the operation were serious nursing problems. They can now take part in occupational and recreational therapy, or do useful work in the hospital, on the farm or in the gardens.

28 patients have improved slightly. They have lost certain troublesome features of their illness such as violent or destructive behaviour while their psychosis remains basically intact.

20 patients are regarded as unchanged, some of them after an early transient improvement.

4 patients are classified as "worse". They will be described in detail below.

The main results for the series as a whole are set out in Table I

Table I - MAIN RESULTS.

Much Improved	6
Improved	10
Slightly Improved	28
Unchanged	20
Worse	4
	68

Table II serves the purpose of giving the total results in the majority of cases, the schizophrenics, and contrasting them with the remainder of the series. It shows 4 cases of schizophrenia to be "much improved", 10 to have improved and 25 to be "slightly improved". 39 schizophrenics have improved to some extent after leucotomy out of a total of 60 cases undergoing operation. 17 cases of schizophrenia are "unchanged". The 4 "Worse" patients also come under this diagnostic heading.

Table II - RESULTS IN SCHIZOPHRENIA CONTRASTED WITH OTHERS.

	Schizophrenia	Others
Much Improved	4	2
Improved	10	-
Slightly Improved	25	3
Unchanged	17	3
Worse	4	-
Total	60	8

In Table III the results are set out according to the diagnosis, with subdivisions in schizophrenia. When the latter are considered it is seen that the highest proportion of improved cases occurs in the catatonic p atients. The paranoid group follows closely and there is a considerably lower ratio of improvement in the hebephrenic subdivision.

No hebephrenic patient of the present series can be classified as "much improved"; 2 of them are among the 4 "worse" cases. 2 of the 3 patients with an affective psychosis are "much improved". 2 of the 3 epileptics have improved slightly, as has the single example of general paresis.

TABLE III RESULTS ACCORDING TO DIAGNOSIS:

	Paranoid Schizophrenia	Hebephrenic	Catatonic	Involutional Melancholia	Manic Depressive	Epilepsy	Post-Encph Parkinson-ism	GPI
M.I.	2	-	2	1	1	-	-	-
I.	3	4	3	-	-	-	-	-
S.I.	14	5	6	-	-	2	-	1
U.	7	7	3	4	-	4	1	-
W.	1	2	1	-	-	-	-	-
Total	27	18	15	2	1	3	1	1

Key to Table:

M.I. = Much Improved
I. = Improved
S.I. = Slightly Improved
U. = Unchanged
W. = Worse

Table IV shows the results according to the duration of the illness. This factor and post-operative improvement are seen to be in inverse ratio. The longer the illnes has lasted before the operation the smaller proportion of cases are in any degree improved.

TABLE IV RESULTS ACCORDING TO DURATION OF ILLNESS.

Duration of present attack up to leucotomy	Number of patients treated	Improved	Unimproved
Under 2 years	5	4	1
2 - 4 years	17	13	4
5 - 9 years	26	16	10
10 - 20 years	20	11	9

The average age at operation of those patients showing improvement was slightly higher than that of the unimproved patients, 37.9 years as opposed to 35.8 years. When the sex distribution of improvement is reviewed a marked difference between the sexes is apparent. 29 men are to some extent improved out of a total of 36 undergoing operation. The corresponding figures for women are 15 patients improved out of 32 leucotomised.

As noted in the introduction 2 operative techniques have been employed in this hospital. A comparative study of all the patients operated on by the "Horizontal Cut" will be the subject of a separate paper. In the present series this technique was used in the treatment of 16 patients, 8 of each sex. In the remaining 52 patients the cut was made in the coronal plane. Of the 16 cases treated by the horizontal cut 5 have improved, 4 have improved slightly and 7 are regarded as unchanged. The numbers of patients in the 2 groups (16 and 52) are too unequal to admit of satisfactory comparison but it appears that where the horizontal cut has been used the number of both "improved" and "unchanged" patients are proportionately high, while that of the "slightly improved" category is definitely low. Distribution of improvement between the sexes shows an even more marked variation than does the series as a whole. Of the 9 patients showing some degree of improvement 7 were men, of the 7 "unchanged" patients 6 were women.

CLINICAL RESULTS.

In considering the results in greater detail it is proposed to study the cases first of all in diagnostic groups.

The Schizophrenic Group:

It is obviously impracticable to describe in detail here the progress of each of these 60 patients. But in this group are found incoherence, retardation and thought blocking; hallucinations and delusions; gross abnormalities of behaviour. The effect of the operation on these features can be studied.

39 cases are reported as being to some extent improved. They are, in varying degree, less distressed than before operation and to that extent life is easier for them and they are easier to live with. The majority of patients in this group show no distress at all. In one half of the patients in whom hallucinations and delusions were prominent before operation these features are still present but in attenuated form. In a quarter they have disappeared and in a like proportion they remain as marked as before operation. Whether they are modified or intact the patients tend to act on their delusions no longer and to take the view that it does not matter what their "voices" say. In the field of behaviour persistent aggression has been lost; violent impulsive outbursts no longer appear or do so very infrequently and in modified form. In 3 catatonic cases the periodicity of either excitement or stupor has been absent since leucotomy. The effect of the operation on disorders of thought is less apparent. They were not reported as prominent features before operation in all these patients. They cleared up after leucotomy in half the cases in which they had been present but were little changed in the remainder.

An example from each grade of the group of schizophrenic patients who have improved is given below.

(1) Case 36 Paranoid Schizophrenia. Male Duration 15 years.

Before operation: He had well-systematised delusions of persecution for many years and at times appeared to be hallucinated. A most difficult nursing problem he was a window-smasher and successful escapist and had made many assaults on the staff and patients. He was unoccupied except for attending mass, going for walks, keeping a scrap-book and writing scurrilous letters.

After operation (1½) years: He is on full parole of which he makes good use. His behaviour is excellent. He does.

not complain spontaneously about being in hospital but when questioned protests quietly without emotion. He has been advised to remain until home conditions are more suitable. No psychotic features are now apparent.

Result: Much Improved.

(2) Case 33. Schizophrenia, catatonic. Male. Duration $4\frac{1}{2}$ years.

Before Operation: After a transient improvement following insulin coma therapy he relapsed into a condition in which auditory hallucinations, grimacing, silly laughter and fatuous irrelevant remarks were prominent features. He had frequent aggressive and impulsive outbursts and was unoccupied.

After operation (1 year, 5 months): He is calm with a degree of emotional flatness. Hallucinations have faded and he is no longer impulsive. Thought-content is barren and there is some lack of initiative. He works well at carpentery under supervision.

Result: Improved.

(3) Case 54 Schizophrenia, catatonic. Male. Duration 15 years.

Before operation: Every few weeks he went into a stupor in which he was confused, restless and inaccessible. This state lasted for many weeks unless cut short by electroplexy. Between attacks he was vague, lacking in insight and with considerable thought-disorder but was able to work in the ward.

After operation (1 year, 4 months): He is quiet in manner and has little spontaneity of speech and little initiative He has not regained insight and has no plans for the future. There has been no recurrence of his periodic stuperose states.

Result: Slightly Improved.

Of the 17 schizophrenic patients now classified as "unchanged" 11 improved from the date of operation for periods ranging from 2 to 12 months, the average duration of improvement being 7 months. During this time delusions and hallucinations lost their emotional charge, behaviour improved and in one instance periodicity disappeared. The remaining 6 patients showed no definite change following operation. A few of them had an amelioration at a later date following shock therapy only to relapse quickly to their preoperative level. Two examples of cases with transient improvement are given here.

(I) Case 23. Paranoid Schizophrenia. Female. Duration 7 years.

Before Operation: She was sullen and unco-operative, refusing to eat as she thought her food was poisoned. She complained of being persecuted by electricity and of hearing unpleasant voices. She became aggressive when spoken to: was untidy and destructive of clothing.

After Operation: At the end of the first month she was serene and calm, neither deluded nor hallucinated, occupied with reading. She remained well until 5½ months after operation when she again became untidy and destructive, stubborn and delusional. She denies hallucinations but her behaviour belies this. Now, almost 2 years after operation, she requires 2 electrically induced convulsions most weeks to keep her at a fair level.

(2) Case 28. Schizophrenic,hebephrenic. Female . Duration 7 years.

Before Operation: At her best level she was facile and inert although well-behaved. There was emotional blunting and intellectual deterioration. At times she was hallucinated, unco-operative, aggressive and destructive. These difficult phases were becoming more frequent and were not modified by convulsive treatment.

After Operation: At the end of the first month she was hallucinated and preoccupied but responded to stimulation and was no longer destructive or aggressive. She remained quiet and could attend occupational and recreational therapy until 7 months after operation when idleness and destructive habits returned. Deterioration followed until at present, almost 2 years after operation, she remains idle and self-absorbed with frequent noisy and aggressive outbursts in which she is hallucinated. There is no response to shock therapy and she requires sedation.

The 4 patients who are considered to be worse after operation are briefly described below.

(I) Case 26. Schizophrenia, hebephrenic. Female. Duration. 9 years.

Before Operation: She was idle, withdrawn and inconsequential. There were occasional impulsive outbursts and supervision at meals and toilet was required.

After Operation: (2½ years). There was a steady improvement in behaviour and habits for a year. The patient acquired superficial interests and was able to live contentedly at home for I4 months. When re-admitted she was restless, idle, manneristic and hallucinated. Emotional tension was greater than before operation and repeated courses of

electro-convulsive therapy have been required to keep her at a level which still falls short of her usual state before operation. She remains more tense in spite of active treatment.

(2) Case 44. Paranoid Schizophrenia. Male. Duration II years.

Before Operation: He was hallucinated with ideas of reference, control and guilt, thought blocking and retardation were present. The patient was solitary but did good work at accupational therapy.

After Operation (2 years): He is reticent, manneristic, retains his delusions but denies hallucinations. He has gradually shown less initiative and now refuses to do work of any kind.

(3) Case 55. Schizophrenic, Catatonic. Male. Duration I3 years.

Before Operation: Grimacing and posturing were prominent. His thought-content was barren and at times he was hallucinated and deluded. He was untidy in appearance and faulty in habits. He worked at occupational therapy and attended gym.

After Operation (3 years, 4 months): He has deteriorated further. He is less aggressive than before operation but the other features remain. He has become completely idle and has developed post-operative epilepsy, having had 6 fits in the last 9 months.

(4) Case 65. Schizophrenic, Hebephrenic. Male. Duration I3½ years.

Before Operation: Every few months for a week or so he appeared less demented than at other times. He then played games, listened to music, did jig-saw puzzles and attended classes. Otherwise he was self-absorbed, apathetic, idle and faulty in habits.

After Operation (2½ years): Since operation he has remained at his previous worse level. The brief periods of relative remission have disappeared.

The non-schizophrenic group:

In one epileptic, 3½ years after operation, equivalents are still present but are less violent and less frequent. The second patient is also less violent although he can still be aggressive when crossed. Grandiose delusions and excessive religious zeal, previously prominent features, are now in the background. The third epileptic is unchanged: her furorescontinue after a brief period of betterment following operation.

One involutional melancholic has lost his depression, hypochondriasis and suicidal ideas. Discharged 5 months after operation he failed to adapt to his home environment and was readmitted to hospital. Now, 2 years after leucotomy, with more successful rehabilitation, discharge is again contemplated. The other patient with this diagnosis is classified as unchanged 4 years after operation. She is still depressed with alternating apathy and agitation. As before, maintenance convulsive treatment brings about a fleeting improvement. In this case amelioration after operation lasted 11 months before relapse.

The single case of manic-depressive psychosis showed true cyclothymic swing, sometimes with brief interludes of normality After operation the periodicity vanished and there was a gradual improvement in adaptation up to 2 years when manic phases reappeared. Now, 3 years after operation, the patient has been at her best level for the past 4 months.

The patient suffering from post-encephalitic parkinsonism is quite unchanged. Her abusive and violent outbursts remain as before. She is being considered for re-operation.

3½ years after operation the general paretic is only occasionally hallucinated, and then with much less affect. His grandiose ideas are more in the background.

It is apparent that improvement has meant a decrease of emotional tension with its facets of anxiety, agitation, depression, fear and guilt. This has been permanent in those cases classified as improved, but has occurred in a transient fashion in the majority of those now deemed unchanged, and even in some of the cases which must be now labelled "worse". With this change psychotic features may exist but they have lost their important influence on behaviour.

Complications of the operation:

Complications in this series were few. Respiratory distress after operation occurred in several cases but yielded to the administration of oxygen plus 5 per cent carbon dioxide. Post-operative vomiting was more frequent but seldom persisted. Where it showed a tendency to do so it was readily controlled by a few doses of atropine gr. $\frac{1}{100}$ at hourly intervals.

Signs of meningeal irritation occurred in 2 cases which are described below.

(1) Case 23.

There was an unusually late onset. Not until the sixteenth post-operative day did clinical signs appear. Examination of the cerebro-spinal fluid revealed a marked polymorph leucocytosis, increased protein, positive Nonne-Apelt reaction. No organisms were seen or cultured. The patient made an uneventful recovery with the 4-hourly administration of Thiazamide to a total of 26 gm.

(2) Case 41.

On the third post-operative day there was pyrexia to 100 degrees Fahrenheit, and distinct nuchal rigidity and a positive Kernig's sign were elicited. Lumbar puncture was not performed. The meningitic signs had disappeared 3 days later and the temperature returned to normal on the ninth day after operation. Cibazol (17½ gm) was given in this case.

Post-operative Signs:

The occurrence of specific mental changes following damage to the frontal lobes of the brain has been discussed in the introduction to this paper. It is not easy to classify all the c hanges which occur: some of them could be interpreted in different ways, some appear to merge into one another. Of these the first 5 are early and transient, the remainder tend to occur a little later and in some instances to be permanent. Temporary symptoms such as disorientation, somnolence, restlessness are probably due to the immediate effect of the operation on brain function. There is no evidence to show that these features are specifically frontal in origin. In order to study post-operative signs as fully as possible findings from all the 90 leucotomised patients in hospital are included in the table which follows. The present writer believes that while the more important and more lasting post-operative signs have been accurately recorded, note has not always been made of early and transient ones and that the latter occur more frequently than the following table shows.

TABLE V POST-OPERATIVE SIGNS IN 90 CASES.

EARLY	1. Confusion	21
	2. Restlessness	29
	3. Over-polite reticence	11
	4. Disinhibition phenomena.. ..	14
	5. Incontinence	9

LATER	6. Irritability	13
	7. Euphoria	18
	8. A lesser elevation of mood..	67
	9. Inertia	37
	10. Changes in higher emotional functions	15

Post-operative confusion included disorientation, lack of appreciation of the passage of time, drowsiness. Its duration seldom went beyond several days.

Restlessness also occurred in the immediate post-operative phase. It generally took the form of purposeless picking at the bed-clothes or bandages, although in a few cases it went so far as to make the control of the patient in the bed difficult. Restlessness tended to last longer than confusion.

Lack of facial expression, monotonous voice, disinclination to sustain a conversation and exaggerated politeness are included in the third feature. These signs may still be detected several months after operation . In 3 of the cases there was a rapid transition from this state to one in which features of disinhibition were prominent. The latter phase more usually occurred after one or two weeks had elapsed and then in cases which had not shown reticence. Its characteristics were a cheerful familiarity, witzelsucht, shouting, singing; occasionally obscene language appearing for the first time, in one case sexual advances also for the first time. These features were of short duration.

Incontinence of urine was present in many cases for the first few days. The patients noted in the table were incontinent for several weeks. One patient whose toilet habits before operation had been faulty was incontinent occasionally for 2 years when this tendency faded out.

Irritability most often appeared towards the end of the first post-operative month and reached its maximum in the second or third month. Thereafter in most instances it gradually became less noticeable. In 2 cases its duration was longer than usual and was a factor militating against social adaptation.

Euphoria may be defined as an exaggerated feeling of well-being. Where it occured post-operatively it did so at an early date, and in most cases persisted. In a few patients euphoria faded after several weeks or months but the feeling tone still remained at a higher level than before operation. In one case euphoria gave way completely before a return of psychotic symptoms 2½ years after operation.

An elevation of mood, varying in degree, not amounting to euphoria but resulting in a freedom from tension was the

commonest post-operative finding. This feature made an early appearance and in the majority of cases persisted.

Apathy, indolence, lack of initiative and drive are included under the heading inertia. Such findings are common in chronic cases of schizophrenia and it requires special care to demonstrate them as sequelae of the operation. Only when they made their first appearance after leucotomy, or were then present to a definitely greater degree are they taken into account here. In this series inertia showed a tendency to persist, in some cases to increase.

Changes in the higher differentiated feelings concerned with ethical and social conduct have been described. They are of the nature of a slight but definite blunting. A few such changes could be detected in those patient who had improved since operation. Tactlessness was a failing in 3 cases. In 4 cases there was a lack of emotional appreciation of the future. Diminished self-consciousness was present in 2 patients, both of whom showed a tendency to flirtation with the opposite sex. This trait was quite foreign to their pre-operative state and also their schizoid pre-psychotic personality. A decrease of the self-critical faculty was evident in 6 patients who manifested moral changes which included lying, petty pilfering (2), extravagance of money (2), and homosexual behaviour. The majority of these features appeared in phases, a few seem to be permanent personality changes.

Other early results of the operation:

The 90 cases have been used for the demonstration of post-operative signs. It is proposed to make one further reference to them before returning to the study of the 68 patients comprising the main material of the paper. Among the 90 cases in hospital when the survey was made were 2 patients with the diagnosis of obsessional neurosis. As they had been operated on only $2\frac{1}{2}$ months previously they were not included in the table of results. Improvement in this brief period had been so striking as to be worthy of record. It serves as a contrast to the slow progress made by even the best of the schizophrenics who form the bulk of the 68 cases.

(1) Case. A Female. Duration 5 years. 3 periods of hospital isation.

Before operation: Normal home life had been impossible for 3 years. Fear of contamination and a washing compulsion "immobilised" the patient and those around her. There was no lasting response to psychotherapy or to electro-convulsive therapy, but there was some improvement in the sheltered hospital atmosphere.

After operation: There was complete lack of emotional tension and obsessional thoughts were but dim shadows of their former selves. The patient was euphoric, out spoken, content with her day-to-day existence. She was

active but rather careless in her work.

(2) Case B Female Duration 17 years, hospitalised 2½ months.

Before operation: This woman had a typical obsessional personality. She had been incapacitated from work for several years. She was full of doubts and ruminations and her compulsive washing and other rituals occupied hours each day. There was no response to psychotherapy or to convulsive treatment.

After operation: She was free of her washing compulsions. She still had vague fears of contamination but these could be banished. 3 weeks after operation she developed an acute visual hallucinosis (rodents) which went on to a Korsakow-like state. This cleared up in 2 weeks leaving her euphoric but showing aggression and irritability and a lack of initiative.

Since their condition was reviewed above both patients have left hospital, earlier than usual, before rehabilitation had advanced very far, one for financial reasons the other at the insistence of the parents.

The main post-operative signs:

On returning to consider the post-operative findings in the 68 patients it is evident that the most important frontal lobe symptoms are those concerned with affect and volition. In the emotional sphere 2 findings fall to be considered, euphoria and the elevation of mood to a lesser degree. Inertia is the volitional change which merits attention These 3 main findings are extracted and their distribution in all categories of improvement is set out in Table VI.

TABLE VI MAIN POST-OPERATIVE SIGNS IN 68 CASES.

Category	No. of patients treated	EUPHORIA		LESSER ELEVATION OF MOOD		INERTIA	
		Transient	Persistent	Transient	Persistent	Transient	Persistent.
M.I.	6	1	3	-	3	1	2
I.	10	-	3	-	7	1	4
S.I.	28	1	4	-	24	2	14
U.	20	-	-	13	-	1	-
W.	4	1	-	-	2	-	3
Total	68	3	10	13	36	5	23

Where a patient has improved tension has been lost and the mood is raised, in some instances to euphoria. In the improved cases the emotional tone has remained elevated. In the majority of the "unchanged" cases it has risen transiently although in some patients under this heading no such change could be detected. The other main post-operative sign, inertia, serves as a counterbalancing factor. Where permanent,, inertia, may,even in the presence of raised mood, cause a case to fall into the category of only "slightly improved". Where it is marked and persistent the patient may even require to be labelled "worse". The result in any one case depends onthe proportions of 3 factors, raised mood, inertia and the residue of the psychosis.

In 13 out of 20 "unchanged" patients a transient elevation of mood has brought about a transient improvement. In 7 patients in this category this post-operative finding was absent. It is interesting to note that 5 of the 7 were women operated on by the horizontal cut. In the 16 patients in which this technique was employed the incidence of the main post-operative signs were as follows. Euphoria appeared in one case and proved to be persistent. An elevation of mood not amounting to euphoria was a temproary feature of 8 cases and a permanent one of 4. 4 patient after operation showed both a raised mood and an inertia which persisted.

After treatment:

All writers on leucotomy have stressed the importance of the continued care of patients after operation, although they have done so from different stand-points. Some American psychiatrists favour readaptation in home surroundings with discharge from hospital at the end of a fortnight and early re-operation in cases which show no initial success. The policy in this hospital is to prolong the period of convalescence in the institution. Six months is about the average minimum time advised for the rehabilitation of successful cases. During this time special attention is paid to post-leucotomy patients. They arethen considered to be malleable and efforts are made to deal with remaining psychotic features and also with the new frontal symptoms which have been acquired. Re-education is directed to preventing the renewal of schizophrenic habits and to dealing with lessened initiative and reduced self-criticism and self-evaluation. Practical measures towards these ends begin with getting patients up towards the end of the first post-operative week. They are then in a different ward from that in which their pre-operative illness was spent and rehabilitation continues in this new environment. Efforts are made to combat inertia which often extends to rising, toilet, washing, dressing and coiffure. If left to themselves patients too easily drift into a routine in which minimum care is devoted to their personal appearance. Inertia in regard to food often changes to greediness, and re-education in table manners may be required. Special care is given to these patients at occupational therapy. They are given specific

tasks and encouraged to persist in them, their aptitudes and interests being studied. Organised games and exercises are a feature of their routine. The social side of rehabilitation includes walks, dances, visits to the shops and cinema with special nurses. Parole is given whenever possible and trial holidays at home are useful gauges of the progress of re-education. Liason is maintained with relatives before and after discharge, and advice is given regarding the patient's attitude, capabilities and possible employment.

Occasional lapses into impulsiveness and outbursts of irritability may interfere with rehabilitation but need not be considered as signs of permanent relapse. It goes without saying that the best results of rehabilitation will not be seen in the patients of this series, all of whom have had to remain in hospital upwards of a year. In a few cases the clinical picture after operation had altered so little that no re-educative measures were possible. In the majority the programme outlined above was initiated and continued until it was clearly seen that further improvement by this means was not to be expected. A few patients followed the routine successfully up to discharge only to return to hospital at a later date. Study of the great majority of discharged patients leaves no doubt of the value, indeed necessity, of the measures and time spent in their readaptation. At the same time it is equally apparent that no amount of rehabilitation will do much to help a patient whose psychosis has not lost its emotional charge, or one in whom tension has been relieved but who has developed a marked and persistent lack of initiative. The less successful cases of this series fall into one or other of these categories.

Other methods were employed to meet the different needs of the post-leucotomy patients. For those who showed a lingering degree of nervous tension mild sedation was given for short periods, e.g. luminal gr. $\frac{1}{2}$ to 1 twice or thrice daily. Electro-convulsive therapy was given post-operatively to 46 of the 68 patients either to deal with a definite relapse, to control an occasional impulsive outburst, or in the hope of adding to a partial improvement or of helping a patient who had shown little change since operation. Its effect was to cut short impulsive outbursts and in 12 cases to alter favourably the clinical picture in a relapse. Convulsive treatment had little effect in increasing improvement or in initiating it. In the majority of cases its effect proved to be no more permanent after operation than before. In a few instances an occasional 2 or 3 convulsions at intervals over several years sufficed to maintain a standard of behaviour and mentation appreciably higher than before leucotomy.

No case among the 68 was thought to be suitable for insulin coma therapy after operation. 2 were submitted for re-operation and are described below.

(1) Case 29. Paranoid Schizophrenia Female Duration 3½ years.

She was grandiose and suspicious, thought that her food was poisoned, had a superior and unco-operative manner. She gave vent to occasional bursts of fatuous laughter. A course of insulin coma therapy brought about a good remission and the patient was discharged. She was readmitted a year later having relapsed several months previously. A second course of insulin was followed by improvement but psychotic features returned within a month accompanied by violent behaviour. This was controlled to some extent by electrically-induced fits fortnightly.

1st Leucotomy. 21.2.43. Coronal Cut.

After operation: She was placid for a month when she again became hallucinated, deluded and violent. Convulsive treatment was required as before. Latterly it failed to control her.

Re-leucotomy, 19.6.45. Horizontal Cut commencing in the same line of section and then continued anteriorly as described in the introduction. The surgeon reported that resistance to the leucotome was much less than usual.

After operation: Little change was apparent in the first month but during the first year her outbursts became gradually less frequent and less violent and short courses of electroplexy controlled them. Convulsive treatment has not been required since August, 1946. Now she has occasional outbursts, more of irritability than impulsiveness. She works in the departmental kitchen or in the ward. Her hallucinations remain but she pays less attention to the voices. Her delusions of poisoning have faded.

Result: Improved.

(2) Case 68 Schizophrenic, catatonic. Male Duration 5 years.

Pharmacological shock treatment in the early stages of his illness had resulted in a brief amelioration. Insulin coma therapy and electroplexy in 1942 - 43 failed to modify the psychosis. Before operation he lacked any insight. He was manneristic and posturing. Generally pleasant in a childish way he was periodically hallucinated, aggressive and impulsive. He was able to do a little work at occupational therapy.

Leucotomy, 25.7.43. Coronal Cut.

After operation: At the end of the first month he was reported as being quiet, pleasant and idle after earlier ndsy and uninhibited behaviour. A month later he began to be gradually more aggressive and restless and then developed periodic states of excitement. At his best he was fatuous and cheerful, vague and deluded.

Re-leucotomy, 30.7.45. A coronal cut was made from a

point of entry 1 cm. below and in front of the original point. On each side this incision passed through a cystic space. Exploration by cannula showed these cysts to be filled with cerebro-spinal fluid and apparently to be in connection with the lateral ventricle. It was estimated that on the left side the cyst had a diameter of $\frac{3}{4}$ inch, on the right the dimensions were 1 inch antero-posteriorly and $1\frac{1}{2}$ inches vertically. Note is made of resistance encountered by the leucotome. This may have been caused by the walls of the cyst.

After operation: There was a gradual improvement in behaviour from the 3rd month. He still has periodic phases but is mildly aggressive only in speech, he does not strike out as before. He remains fatuous, idle, and hallucinated.

Result: Slightly improved.

Cyst-formation at the site of incision has been found at re-operation in other cases not in the present series and has been described as a post-mortem finding. It is a probable explanation of the decreased resistance to the leucotome described in the first of these 2 cases. Neither of these patients showed signs of more frontal lobe damage than the rest of the series.

Relapse:

This question involves more than consideration of the "unchanged" patients who have failed to maintain a temporary improvement. Relapse occurred in all categories of improvement and is taken to mean a sustained approximation to the pre-operative state. Minor fluctuations of behaviour were common and are not considered here. The number of patients discharged unsuccessfully was 9 and 7 of these fulfilled the criteria of relapse. The condition of the other 2 patients on readmission was different from their pre-operative state: in their case there was a failure of adaptation due to the influence of post-operative features. Examples of both types follow.

(1) Case 43. Paranoid Schizophrenia. Male Duration 3 years.

Before operation: There had been 2 previous admissions to hospital with improvement and discharge following convulsive therapy. This treatment led to no betterment on the third occasion. He was sullen and unco-operative. He had strong delusions of a persecutory nature and was very aggressive.

Leucotomy, 8.2.45.

After operation: He was still unco-operative but was more friendly towards his wife. Euphoria with only fleeting irritability became noticeable later and his delusions disappeared. From being idle he became a good worker and in his wife's opinion was perfectly normal.

Discharged. 17.5.45.

Re-admitted 12.9.46. having gradually relapsed over several

months. He was sullen and withdrawn, with paranoid delusions and auditory hallucinations. He had threatened his wife and was aggressive towards the staff. He has gradually become quieter, more idle and apathetic. He gives little trouble but lacks the initiative to co-operate readily in the ward routine.
Result: Slightly improved.

(2) Case 56. Melancholia with hypochondriasis. Male Duration 10 years.

Before operation: Since 1939 he had lived mainly in mental hospitals. He had made several suicidal attempts and had many hypochondriacal and inhilistic delusions. His attitude was querulous and self-centred.
Leucotomy, 29.5.45.
After operation: He complained of various symptoms but without any anxiety. There was a marked improvement in his behaviour and personal habits. He became interested in his business affairs.
Discharged. 12.10.45.
Re-admitted 16.8.46. complaining of irritability over trifles and recounting quarrels with strangers who had annoyed him in buses, trams etc. He had been outspoken and generally inconsiderate of others. In hospital he became more contented in his own routine. His hypochondriasis has disappeared.
Result: Much improved.

The first example illustrates a return of marked psychotic symptoms after an improvement amounting to remission. In the second case irritability and inertia militated against social adaptation.

The 9 patients remained at home for periods ranging from 2½ to 20 months, the average period being 11 months. When re-admitted they had been relapsing for several weeks, in one or two instances for several months. In 3 cases the home environment was clearly a major factor in precipitating a relapse, in the others it may have played some part.

Relapse occurring in the different categories may be set out as follows.

Much Improved: 3 of the 6 patients now in this group relapsed after gradual improvement over 1 to 2 years. One of them relapsed while at home.

Improved. 3 patients under this heading returned to their pre-operative state after periods of from 3 to 10 months. 2 of them relapsed while at home.

Slightly Improved: 10 patients in this category relapsed 2 to 16 months after operation, 2 of them while at home.

Unchanged: 11 patients failed to maintain an initial amelioration of their pre-operative condition after periods varying from 2 to 12 months. One of these patients had been able to go home.

Worse: 1 patient relapsed while at home over 2 years following leucotomy.

To summarise, 28 patients relapsed to a condition resembling their pre-operative state after an average period of 9 months. In addition 2 patients could not be considered to have relapsed but owed their return to hospital to the presence of marked frontal lobe symptoms. Where true relapse took place the returning psychosis largely blotted out the new personality features which the patient had acquired since operation. The elevated mood was lost although inertia showed a tendency to remain in some cases and so modified the clinical picture. In 16 cases the relapse was temporary. In the majority of these the period which passed before the patients overcame the set-back was not more than a few months. In a few instances major fluctuations followed one another for over a year before the patient became stabilised at his best level. Electroplexy was given to 12 of the 16 patients. In half of this number a single course of treatment was followed by a better level of behaviour. The other 6 required repeated courses or maintenance convulsions before the beneficial effect of the operation was given permanence. The remaining 4 of the 16 cases subsequently regaining a better level, and the 2 showing marked frontal symptoms, required no more active treatment than continued rehabilitation in the sheltered environment of the hospital.

Post-operative Epilepsy:

Epileptiform fits occurred for the first time in 6 leucotomised patients of this series. All of them had received electro-convulsive treatment before leucotomy. In 3 cases there were single major convulsions taking place 9,10 and 16 months respectively after operation. Only the second case had been given electroplexy post-operatively and this treatment had consisted of several short courses which were terminated 6 months before the appearance of the spontaneous convulsion. 2 patients had 2 major fits, in one instance on the same day, in the other with an 11-day interval. These appeared 9 months, and 2 years and 10 months respectively after operation. In both cases convulsive therapy had been given on a maintenance basis following leucotomy, but had not been administered for several months before the spontaneous seizures occurred. In the only case where epilepsy has shown a tendency

to persist it first developed 2 years and 6 months after operation. In all 6 major convulsions have occurred to date, at approximately monthly intervals for the first 4 fits, latterly with intervals of several months. Post-operative electro-convulsive therapy was a feature of this case but 17 months separated its termination and the onset of epilepsy. This last patient received thrice-daily doses of a bromide and chloral mixture, 2 of the others were given luminal - gr. ½ t.d.s. and gr. 1 b.i.d. The remaining 3 patients received no anticonvulsive treatment. No deductions could be drawn as to the effects of the usual anti-convulsive drugs on post-operative epilepsy. RIZATTI has stated that leucotomised patients later developing epilepsy continue to improve mentally. Of the 6 patients described here one is classified as "improved" 2 as "slightly improved", 2 as "unchanged" and 1 as "worse".

4 cases of epilepsy, one of them also a schizophrenic, were among the 68 patients undergoing operation. In one of them fits have been less frequent since operation the others have shown no significant change in the rhythm or frequency of their seizures.

Changes in Body Weight:

Increase in weight may be counted as the most striking vegetative manifestation of frontal lobe deficiency. It is associated with a voracious appetite. The latter has been accounted for by the lack of visceral distress which these patients show; they fail to recognise the fullness of the stomach after an adequate meal. Decreased self-consciousness and self-criticism, with no fear of fatness, may play a part. FREEMAN and WATTS have stated that post-operative increase in weight is more marked in women than in men. LYERLY is reported by these authors as finding a high correlation between gain in weight and improvement in mental state.

In this series adequate weight records were available for 62 patients, half of whom were male and half female. 24 of each sex gained weight post-operatively, and the average gain in the first few months was approximately the same, 20 lbs. for men and 19 lbs. for women. In some cases there was a gradual increase over many months, but the commonest finding was an initial increase reaching its peak from the 5th to the 8th month. Thereafter in most cases the weight decreased but still remained above the pre-operative level. The maximum gain reported was 47 lbs. This occurred in a " much improved" patient after 3 months, but an equal increase was made over 21 months in a patient classified as "worse". No relationship could be traced between improvement and increased body weight. The different categories of improvement are distributed among those who gained weight, permanently or transiently, and the 14 whose weight either decreased or showed no significant change after operation. 8 of the latter group are classified as being in some degree improved.

Weight records over 4 years are available for a few cases. One patient (slightly improved) with a gain of 7lbs. in the first 3 months had increased by an additional 10 lbs. after 4 years. Another (improved) who had gained 19 lbs. in the first 5 months had returned to his pre-operative weight at the end of 4 years.

Changes in Intelligence:

Little can be said here regarding changes in intellectual functions following leucotomy. The cases of the series were generally unsuitable for intensive psychological testing both before and after operation. From clinical observation there was no intellectual deterioration following operation.

Changes in Personality:

Under this heading, too, the material of the series does not permit of any large contribution to the question. The pamphlet published in 1947 by the Board of Control admitted failure to determine (1) if leucotomy restored the pre-psychotic personality (2) if it impaired the personality, and (3) the nature and duration of any change which did occur. The difficulty of answering these questions in cases of chronic psychosis was recognised in this study. Obviously where psychotic features remain, as they do in practically every case of this series, the resulting clinical picture is a complex one. In contrast, where improvement is so great as to permit of discharge, post-operative personality changes are so clearly defined that FRANKL and MAYER-GROSS made this heading the title of their follow-up study. These authors appear to have answered the questions posed by the Board of Control. They suggest as a theory of the operation that, if successful, it provides the patient with a new framework of personality caused by the isolation of his prefrontal areas. It follows as a corollary to this hypothesis that the prepsychotic personality should not have a decisive influence on the final result. Study of the present series lends some support to this view. Where the operation is not successful, or only partially so, the findings are again frontal lobe deficiency signs but this time accompanied by a larger proportion of signs remaining from the illness. Euphoria, freedom from tension and lack of initiative may exist side by side with delusions, hallucinations and thought disorder. An entirely new and "composite" personality has come into being after the operation. Less prominent frontal manifestations concerned with ethical and social conduct, e.g. tactlessness, lying, pilfering, have also been found. Few of these were permanent and none could be found to have their roots in the premorbid personality. They appeared for the first time after leucotomy.

In a recent article HUTTON concludes that an undesirable post-operative personality is much more definitely allied to the character of the patient prior to illness than to the

form of the illness itself. The premorbid, morbid and post-operative personalities of those patients in this series who were most and least improved by operation have been examined. In a few cases information about the premorbid personality is lacking. In some it is scanty, although fuller than is given in the appended case-summaries where only brief notes are made on this point. Of the 16 "improved" and "much improved" patients the premorbid personalities of 9 showed schizoid traits. In 2 there was emotional instability and in 4 apparent normality. No information is available regarding the remaining case. A schizoid premorbid personality was found in 2 of the 4 "worse" cases, who also had among them one normal personality and one of which nothing is known. Egoism and lack of social adjustment are the personality features which HUTTON found present before illness and exaggerated after operation. These are features of any character which qualifies for the term "schizoid". They are certainly exaggerated during the illness, but not, as far as the cases under consideration go, after leucotomy.

Factors influencing Prognosis:

In Table VII an attempt has been made to assess two of the factors considered by FREEMAN and WATTS to influence the prognosis. They are compared in the 2 groups, one of 44 patients who have improved in any degree, the other of 24 patients unimproved. The factors are the pre-operative degree of mental tension and degree of break with reality. These do not lend themselves readily to mathematical assessment, but with behaviour as a guide, different degrees of tension and reality-break can be made out. The somewhat arbitrary method of measuring individual tension against unity has been adopted. The total amount of tension therefore cannot be a greater figure than the number in the group, and in this way it is hoped to avoid errors arising from artificially multiplying the size of the sample.

TABLE VII FACTORS INFLUENCING PROGNOSIS.

	IMPROVED (44 patients)	UNIMPROVED (24 patients)	DIFFERENCE
Degree of tension (percentage)	83(±5.5)	61(±10)	22(± 11)
Degree of reality-break. (percentage)	71(± 7)	80(±8)	9(±10.5)

Maximal tension is equated with unity and minimal with $\frac{1}{3}$, an intermediate degree being recorded as 2/3. Examples of the different degrees of tension follow.

(1) Scoring 1. Case 5 .... "for long periods she was continuously noisy, violent and destructive with homicidal and suicidal tendencies".

(2) Scoring 2/3. Case 33 ...."with fairly frequent aggressive and impulsive outbursts which were cut short by electro-convulsive therapy".

(3) Scoring $\frac{1}{3}$ Case 49....."He is friendly and cheerful. Generally unproductive he admits to hallucinations without giving any detail. His intellectual functions are impaired".

In the improved group of 44 patients under the heading pre-operative degree of tension 24 patients scored 1, 18 scored 2/3 and 2, $\frac{1}{3}$. The total for this group is 36 2/3 and this is expressed as a percentage (83 per cent) of the total possible tension which is 44. The total score for the unimproved group is 14 2/3 which is 61 per cent of the total possible tension (24). The difference between the proportions of this factor in the 2 groups is therefore 22.

The degree of break with reality is dealt with in the same way, the patient's behaviour again being the guide in making the individual assessments. Examples of scoring for this factor follow.

(1) Scoring 1. Case 39....."He is not readily accessible. Thought-blocking, incoherence, disorientation and mis-identification are included in the clinical picture".

(2) Scoring 2/3. Case 34....."He alternates every few weeks between catatonic excitement and a state in which he is courteous and formal, autistic but able to work well at classes".

(3) Scoring $\frac{1}{3}$. Case 38....."although showing thought-disorder and being subject to hypochondriacal delusions and auditory hallucinations he retains some insight and is willing to co-operate. He attends all classes and amusements".

The total score for the improved group is 31 and for the unimproved 19, giving percentage figures of 71 and 80 of the total possible reality-break for their respective groups (44 and 24). In the table each percentage is followed by its Standard Error, and each difference by the Standard Error of Difference. When the factor of mental tension is considered the difference between the 2 groups is found to be twice the Standard Error of Difference. This figure can be considered

to be statistically significant. If the premise that such a factor can be measured in different degrees is granted, and if the scoring is accurate, it follows that pre-operative mental tension is greater in cases which improve after leucotomy than in those which do not. The presence in great degree of tension can therefore be said to have a favourable bearing on the prognosis. The attempt to assess the degree of break with reality leads to no such conclusion regarding its prognostic significance. The percentage figure is greater in the unimproved group than in the improved but the difference is less than the Standard Error of Difference and is therefore not statistically significant. It was found to be more difficult to make individual assessments of this pre-operative factor. In chronic schizophrenia, which is the diagnosis covering the great majority of the cases under consideration, there is always some withdrawal from reality. Different degrees of this cannot always be easily assessed.

DISCUSSION.

The Results applied to Theories of the Operation:

Several theories have been put forward to explain the results of prefrontal leucotomy in terms of cerebral physiology. Those of MONIZ, FREEMAN and WATTS and COBB have been mentioned in the introduction to this paper, and that postulated by FRANKL and MAYER-GROSS has been referred to under the heading Changes in Personality. It is proposed to examine some of these hypotheses in the light of recent work, and to apply where relevant the results in the present series of cases.

Few adherents can still be found for the original view of MONIZ that in certain mental disorders there is a pathologic stabilisation of synaptic connections and that leucotomy acts by destroying these fixed arrangements. This theory would appear to be disproved by the fact that severing the axones in the cortical white matter does not cause an immediate disappearance of morbid ideas. In some of the cases under discussion hallucinations and delusions eventually disappeared. But when they were still present the patient was less distressed by them. The emotional reaction to the ideas was suppressed. This phenomenon is explained by FREEMAN and WATTS by the contention that ideation is divorced from affect by the resection of the anterior thalamic radiation. These authors contend that the emotional charge mediated by the thalamus is the essential element in maintaining the affective charge attached to ideas of the self and the future. As support for their theory they have demonstrated at autopsy in leucotomised brains selective degeneration of the dorsal medial nucleus of the thalamus. This hypothesis provides a logical account of the rationale of the operation and is the theory that has been most widely accepted. The function ascribed to the thalamus explains the importance of mental tension as a prognostic factor. In the present series of cases, as in most others, improvement after operation has meant release from tension with subsequent modification of other psychotic features. But doubt appears to have been cast on the validity of the specific thalamic role by the researches of MEYER and BECK (1945). In their study of leucotomised brains these workers drew attention to the considerable variation in the plane of incisions even though the surgeon thought he was carrying out the operation in standard fashion. In 4 cases considered to have recovered from their mental symptoms there was incomplete severance of the thalamo-frontal fibres. In one of these there was only a unilateral and incomplete section of the tract and in another it had been entirely spared. In this last case the dorsal medial nucleus of the thalamus was preserved, in the others cell-degeneration in the nucleus was not considerable. This indicates that severance of a particular tract is not the only factor contributing to the success of the operation. In

spite of this MEYER and BECK say, "...it would be difficult to conceive of a theoretically and practically more rational place for the operation than MONIZ has suggested." Here, then in the plane of the coronal suture the frontal lobes may best be isolated.

FRANKL and MAYER-GROSS have suggested that the operation succeeds by giving the patient a new framework of personality caused by the isolation of his prefrontal areas. In other words a modified frontal lobe deficiency syndrome is superimposed on the existing psychosis. The features of the syndrome are less marked following leucotomy than those which appear after lobectomy or other gross cerebral injuries but the difference appears to be only one of degree. HEBB (1945) in throwing doubt on any of the theories of frontal lobe function that have been advanced in the past, stresses the point that the personality changes following leucotomy are signs of frontal lobe dysfunction. The incidence of these signs in this series has been discussed in the body of the paper. Those appearing to have most influence on the psychosis have been extracted and their incidence in relation to improvement has been charted in Table VI. Of all post-operative signs the commonest is an elevation of mood not amounting to euphoria. This change was described by RYLANDER (1939) as occurring after lobectomy and the present writer is impressed by the frequency of its appearance in the cases of this series. The sign would appear to be a definite clinical entity when the pre and post-operative conditions are compared. In the more successful cases tension is lost. Inertia may accompany the change but it cannot account for it: one post-operative sign is in the emotional sphere, the other in the volitional. It is suggested here that "freedom from tension" be equated with "elevation of mood"; that the presence of this frontal lobe deficit sign is the main factor in improvement, and that it can appear without a special role being assigned to the thalamus.

It seems likely, but it has not yet been proved, that the prominence of the desired post-operative signs is in direct proportion to the amount of frontal lobe isolated. If future anatomical and clinical studies demonstrate a clear correlation in this respect the problem of the operation becomes a quantitative one. Too small an area isolated would have little effect on the psychosis, too great might precipitate a syndrome as troublesome and crippling as the original illness. Consideration of this approach forces one to the conclusion that an open operation through an osteoplastic flap may be the method of choice. MEYER and BECK have shown that with the present "closed" procedure the cut varies in plane and depth from case to case.

Various workers, notably KLEIST(1934), have associated the orbital areas of the frontal lobes with emotional functions. DAX and RADLEY-SMITH (1946) suggested that aggression could be

alleviated by a dorsal, paranoid symptoms by a middle cut, and depression and tension by a cut nearer the orbital region. In using the Horizontal Cut, described in the introduction, an attempt has been made to isolate the orbital areas. Of the 50 patients treated by this method 16 are to be found in the present series. The results in these cases have already been described. The incidence of post-operative changes in the emotional sphere in the 16 patients deserves comment. Only one patient showed euphoria out of 10 with this sign in the whole series. A lesser elevation of mood appeared transiently in 2 cases and permanently in 8. The corresponding figures for the 68 patients are 13 and 36. Of the whole series only 7 patients had no change in the emotional sphere after operation and 5 of these were women operated on by the Horizontal Cut. There is therefore, as far as this sample goes, less post-operative emotional change after the horizontal cut than after the vertical cut. In these cases there is no correlation between orbital area isolation and an emotional change which would relieve tension and distress. According to REITMAN (1946) extroversion and increased motor activity are also associated with orbital area isolation. Such post-operative findings were absent in the cases under discussion.

Examination and Comparison of the Results:

HOFSTATTER ET AL. (1945) have reported 4 stages in the recovery of patients following operation: "The patient's psychotic behaviour persisted to some extent: then inertia became more prominent, and the patient frequently complained of inability to overcome his dullness. The period of relative listlessness was followed by one of overactivity. It is at this time that the patient is in most need of assistance and direction toward a more normal adjustment. With anxiety diminished and the expression of the inherent trend reduced, a better integration of the personality can be established". This outline of progress is too dogmatic; post-operative reactions vary from case to case. It is more accurate to say that some post-operative signs tend to appear early and some later, but once the immediate post-operative phase is over, there is no hard and fast sequence. What is certain is that improvement is gradual and may require a considerable period of time for its development. It should, of course, be stressed that the results in this series cannot be considered as final at the time of reporting. The shortest post-operative period is one year, but some patients will continue to improve, others may relapse.

As presentation of the results of the hospitalised patients alone gives an incomplete picture of the effects of the operation it is proposed to add to them the results of the discharged patients before attempting a brief survey of the success of leucotomy in this hospital. Of 68 patients discharged FRANKL and MAYER-GROSS found 7 whom they considered to require

readmission to hospital. The remaining 61 were usefully employed and more than half of them were earning their own living. For the total of 136 patient the results are therefore, 61 socially recovered, 6 much improved, 10 improved, 28 slightly improved, 27 unchanged and 4 worse. The 7 patients who were idle and thought to require further hospitalisation have been added to the "unchanged" group. This is putting their post-operative status at probably its lowest estimate. Percentage figures for the total series are 45% recoverd, 32% improved, 20% unchanged and 3% worse. These results compare favourably with others when the preponderance of schizophrenia and the long duration and hospitalisation are borne in mind.

The results of the survey of 1,000 cases by the Board of Control (1947) are 24.8% recovered, 42.8% improved, 25% unchanged and 1% worse. The material of this large series is similar to the present one. Cases of schizophrenia were again in the majority although to a less extent than among the 136 patients.

In 1943 ZIEGLER surveyed the results of 618 leucotomised patients from Americanand Canadian hospitals and gave the following figures: marked improvement to social recovery = 66.2%; slight to better improvement = 83.8%; unchanged = 10% and less favourable results (including deaths) = 6.2%. Similar evaluation of the 136 patients under consideration gives the percentage figures of 48.5, 76.6, 20 and 3 for the respective categories. In the series collected by ZIEGLER there is no mention of the diagnosis,and HALSTEAD ET AL. report that only superficial attempts have beem made to standardize the criteria for the pre- and post-operative clinical status of the patient.

FREEMAN and WATTS (1946) for 331 cases report results to be good in 52%, fair in 32% and poor in 13%. Almost two thirds of these patients suffered from involutional psychoses, obsessive states or psychoneuroses. The same authors, also in 1946, for a series of 65 schizophrenics of more than 2 years' duration quote the following figures: good result in 31%, fair in 27%, poor in 41%.

It is felt that more should be said here of those patients of the present series considered to be worse after operation. 4 may seem to be a high proportion of a small series. The term itself may be to some extent misleading. The patient's post-operative behaviour is the criterion of improvement. As slight improvements in behaviour have been noted so also have all deteriorations. In case 44 no more is meant by "worse" than that a patient previously able to work at occupational therapy is now idle. Case 55 is similar, but with the addition of post-operative epilepsy. This is the only patient of the series in whom this sequela is persistent. In case 65 the

brief periods of relative remission have disappeared after leucotomy. It is perhaps tempting to assume that in these 3 male patients, all schizophrenics of long duration, the operation has failed to check a progressive illness. But from the presence of other frontal deficiency signs it is more likely that post-operative inertia is responsible for their present state. In the single female patient in this category the diagnosis is also schizophrenia and the duration is similar to that of the others. Her present state is thrown into stronger relief by the fact that following operation she was able to live outside hospital for over a year. This is the only case in which post-operative tension appears to be greater than pre-operative. She is kept at a fair level by a weekly convulsion but this maintenance therapy was not required before leucotomy. Among the 11 cases described as "worse" in the Board of Control's Pamphlet there were deteriorations more dramatic and more drastic than those shown by these 4 patients.

Examination of the results entails comparison between the 44 improved and the 24 unimproved patients of the series of 68, and comparison between the whole series of hospitalised. patients and the equal number of those who have been discharged. The results of the operation are stated by FREEMAN and WATTS (1946) to be better in elderly patients than in the young on the grounds that the personality breaking down the earlier is the more fragile. The age at operation would hardly seem to be an important prognostic factor in chronic psychotic patients hospitalised for many years, and there was little difference in the average age of those improved and unimproved, remaining in hospital or being discharged.

Duration of the illness may have more bearing on the prognosis. In Table VI this factor is seen to be in inverse proportion to post-operative improvement as far as the present series is concerned. When the 2 groups of 68 are compared the differences are less striking. When theduration of the present attack is less than 2 years 5 patients are found to be in hospital and 8 discharged. When it is from 2 to 4 years 17 are hospitalised against 18 discharged. With a present attack lasting from 5 to 9 years 26 patients of each group are found; from 10 to 20 years 20 remain in hospital and 16 are discharged. The average duration of illness of discharged patients was 6.4 years, of improved patients remaining in hospital 7.5 years and of unimproved 9.2 years.

The sex-distribution of improvement shows interesting if somewhat inexplicable results. In the hospitalised series patients showing improvement numbered 29 men and

15 women, those regarded as unimproved 7 men and 17 women. The series of 68 discharged patients consisted of 28 men and 49 women. Totals for the two sexes are 64 men and 72 women. Female patients show a marked preponderance in the best and poorest categories of improvement. FRANKL and MAYER-GROSS have explained the greater number of female discharges by pointing out that one would expect women to be taken out of hospital more easily than men after a long illness. If this reasonable assumption is granted there follows a levelling-up of the sexes among those patients responding favourably to operation. Some of the group of 29 men who have improved have probably reached the standard attained by the women who have been discharged. Because of the greater responsibilities which await them in the outside world they are not yet considered fit to leave hospital. It is less easy to explain why there should be a female preponderance amongst those who have failed to improve after leucotomy. The pamphlet published by the Board of Control found that results are better in males but pointed out that it did not seem reasonable to assume a sex differentiation in the results of the operation.

Findings are more definite when the diagnostic classification is considered. Nine-tenths of the hospitalised group are schizophrenics as against three quarters of the discharged. There is no obsessional illness among the hospitalised and only 3 examples of affective psychosis, while the number of non-schizophrenics of these two categories among the discharged is 17. Table III shows the best results in schizophrenia to be obtained in the catatonic subdivision. This is closely followed by the paranoid group and there is considerably less improvement in the hebephrenics. The patients remaining in hospital include 15 catatonic, 27 paranoid and 18 hebephrenic patients. The figures for the discharged group are 24 catatonic, 19 paranoid and 7 hebephrenic and simplex cases of schizophrenia.

The importance of mental tension as a prognostic factor has been sufficiently stressed. In the series of 68 a mathematical assessment shows the group with greater tension to have reacted better to the operation. This bears out the well-established clinical impression. A break with, or withdrawal from, reality which had also been considered to be of prognostic significance was found to be harder to assess, and the impression in regard to this factor was not susceptible of proof.

It must be stated here that no definite and satisfactory answer has been found to be problem of why 68 patients whould remain in hospital while an equal number can be discharged. There is no ready explanation for the partially successful or completely unsuccessful results among these 68 patients. It has been seen that among those reacting favourably to leucotomy

are more cases of affective and obsessional illness, and of the catatonic and paranoid types of schizophrenia. Among those reacting unfavourably are more examples of schizophrenia itself and of the hebephrenic type in particular. Duration tends to be less and tension to be greater where the response is good. The pre-psychotic personality has little bearing on the post-operative state of those patients remaining in hospital however it may modify the behaviour of those who have been discharged. There is, in fact, no common factor running consistently through the groups of discharged and hospitalised, improved and unimproved. Indeed, several cases with very different results have the same diagnosis, a similar duration and a comparable degree of mental tension. FRANK(1946) considers leucotomy to be indicated and successful in patients whose psychosis is sudden in onset, precipitated by psychological or physical trauma and characterised by plasticity of symptoms and a cyclic tendency. It has been pointed out by LEWIS (1946) that these factors have for many years been emphasised as favouring a good prognosis regardless of the type of therapy employed. The present writer finds himself in agreement with FREEMAN and WATTS who state: "In schizophrenia the percentage of patients in whom there will be good results may be predicted, but which individual patient will be improved cannot be determined". It is suggested that what may be called the accident of the operation has more to do with the result than has been admitted so far in reports on leucotomised patients. There are certainly grounds for believing that with the present "blind" procedure no 2 patients will have an exactly similar amount of frontal lobe isolated. It may be that where the psychosis continues to dominate behaviour the operation has not been sufficiently extensive.

The Problem of Relapse:-

The literature of prefrontal leucotomy makes only brief mention of those patients who relapse after operation. FREEMAN and WATTS (1942) considered that the immediate post-operative state had a bearing on this question. They held that patients who were alert, well-orientated and euphoric during the few days after operation would relapse later. In contrast those who were drowsy and confused at this stage reacted well in the weeks and months that followed. These findings were not substantiated by later work and they find no confirmation here.

Among the 68 patients 28 are considered to have relapsed at some stage but in 16 this was a temporary regression and they later reached a state which showed a definite improvement over their pre-operative level. The remaining 12 relapsed permanently and this took place between 2 and 12 months after operation. The question of relapse is closely linked to that of after-

treatment. A number of authors have reported that electro-convulsive therapy was helpful in clearing up the remains of psychotic activity and in dispelling post-operative lethargy, and that patients were much more responsive to a small series of shocks after leucotomy. The findings in this study are not in full agreement with these statements. Electroplexy controlled occasional outbursts of psychotic behaviour. By means of single or repeated courses, or maintenance treatment, 12 patients were helped over a relapse. In most cases its effect was no more permanent than before operation, and this therapy had little effect on post-operative inertia. In putting forward a theory of the effect of electro-convulsive treatment in relapsed leucotomised patients FREEMAN and WATTS say"....there appears to be a disorganising effect upon total cerebral function as the result of epileptic discharge, with elimination of recently developed psychotic activity. Then, if the incisions are satisfactorily placed, the abnormal behaviour may not return". To follow this hypothesis further would be to deal with the vexed question of the rationale of electroplexy rather than to consider relapse after leucotomy.

The other major physical treatment used in this connection was a repetition of the operation itself. Formerly FREEMAN and WATTS (1942) carried this out during the first post-operative week in patients not showing the immediate signs by which they judged success. In later writings (1946 and 1947) these authors no longer insist on the prognostic significance of post-operative confusion and somnolence and no longer advocate early re-operation. The gradual improvement in chronic psychotic patients has been emphasised and re-operation would only appear to be justifiable when there is no reasonable hope of further betterment and when the possibility of temporary fluctuation has been ruled out. In the 2 cases reported here 2 years separated their first and second operations. In both some improvement has followed the second attempt. In the female case described more than a year elapsed after the second leucotomy before electro-convulsive therapy could be discontinued. It seems likely that this patient will make further adaptation. Re-operation might be more frequently considered in patients remaining consistently distressed by their illness following leucotomy.

So far no theories have been advanced to explain the mechanism of relapse following leucotomy. The obvious assumption is that the operation has not been sufficiently extensive in such cases. It may be noted that COBB (1943) holds that improvement after leucotomy is due to the reduction in the number of possible circuits for association. The spread of stimuli to different cortical areas is thereby limited and the integration of present stimuli with past memories and habitual responses prevented. With a limited operative procedure the disintegration may be minimal and

the environment may assume great importance. In 3 of the 9 cases discharged unsuccessfully home circumstances appeared to precipitate a relapse, and in some others the same factor could have played a part.

The infinite lability of the nervous system has been emphasised by GOLLA (1942). New pathways may take over the functions of the cut fibres. If this process in some cases leads to satisfactory social adaptation, it is equally possible that in others it may lead to relapse. But these are mere speculations on a question which will not be answered until the rationale of the operation itself is better understood.

The Role of Leucotomy in Chronic Psychoses:

From the results of the operation in this series of chronic psychotic patients some conclusions can be reached concerning the role of the operation in the different illnesses from which these patients suffer. MONIZ' procedure, unlike the shock therapies, does not have a specific action on the diseases as such but acts primarily on their symptoms. The number of cases in the non-schizophrenic group are small but the results tend to confirm pervious findings. It is generally accepted that there will always be a few cases of affective psychosis who prove refractory to convulsive treatment, and that these cases do well with leucotomy. It is interesting to note that the case of involutional melancholia which improved greatly after operation had a strong element of hypochondriasis, a feature which with electroplexy usually indicates a poor prognosis. Although the operation may be followed by epileptic convulsions it appears to have little effect on the rhythm or frequency of the seizures of established epilepsy. HOFSTATTER ET AL. (1945) noted that the behaviour disturbances in epilepsy may sometimes be modified and this has been achieved in 2 of the 3 cases considered here. THORPE (1946) has reported improvement in the disordered behaviour which follows encephalitis. The single case of post-encephalitic illness in this series is quite unchanged. It must be seldom that patients suffering from general paresis are submitted to operation. Here, as in schizophrenia, relief from tormenting hallucinations has been obtained.

The great majority of patients in this series, and in mental hospitals generally are chronic schizophrenics. The role of prefrontal leucotomy in this illness may be considered at greater length. PARKER (1946) stated that "in schizophrenia, paranoia, and paraphrenia it is doubtful whether leucotomy is more efficacious than other methods of treatment". The point must be made, on the basis of the results quoted here, that where other methods have been tried and repeated without success leucotomy still offers hope of improvement. This may range from freedom from distress to social recovery and will include the majority of those brought to operation. It is not considered that all cases

of schizophrenia should undergo leucotomy. The results of those who operate at an early date are not significantly better than those in this group of chronic patients. Where the shock therapies fail, and there is no reasonable chance of a spontaneous remission, leucotomy should be considered. This would appear to be the optimum time for operation. Where the disease has been present for years and has progressed to deterioration the patient may still be susceptible to improvement as long as he is still distressed by his illness. Schizophrenic deterioration is a common clinical concept and is generally taken to mean a progressive disintegration of the total personality with gross defect in volition, emotionand the thought-processes. FREEMAN and WATTS (1946) state that: "A deteriorated schizophrenic looks and acts about the same with or without his frontal lobes". This dogmatic statement merits examination. While holding that only a lobectomised individual can truly be said to be without his frontal lobes, one turns to consider what these writers mean by 'deteriorated'. As a rule of thumb they "employ 3 criteria in judging the emotional responses of the patient, severity of complaints, disturbing behaviour and autonomic imbalance. When none of these is present the patient is too deteriorated to warrant operation". Deterioration in the emotional field is therefore the contra-indication to leucotomy found by these authors. They would appear to be describing the flat, "burned-out" schizophrenic, the hebephrenic or catatonic patient who has progressed to a state which may rightly be called dementia praecox. Most psychiatrists would agree that such a patient is an unsuitable subject for operation. But many of the hebephrenic and catatonic patients of the present series before operation were deteriorated in the sense in which that term is commonly used. Many were withdrawn and barely accessible, dissociated and incoherent in thought. Some had faulty personal habits. Some, for part of the time showed a flattened or incongruous affect but all were subject to frequent bouts of violent and disturbed behaviour. Of these patients some improved in varying degree while others remained unchanged.

Prefrontal leucotomy is in some respects the most drastic method yet devised for the treatment of mental disorders. FLEMING (1942) has called it a less drastic procedure than insulin or convulsive therapy on the grounds that with these the patient is near enough the line which separates life and death. Other early observers in this country have stressed the comparatively simple operative technique and would consider leucotomy to be a minor operation. There is, however, no escape from the fact that it leads to permenent change in the personality. In spite of what has been said regarding partial reintegration of the ne vous system after operation it is clear that in the great majority of cases irreversible personality changes ensue. This quality distinguishes leucotomy from any other form of physical treatment.

Physical methods of treatment in psychiatry have always been viewed with doubt and suspicion by those who practice psychotherapy alone. Prefrontal leucotomy more than any other procedure has aroused a strong emotional reaction and has brought into the light of controversy prejudices hitherto partly veiled. From December 1945 to May 1946 an acriminious correspondence was conducted in the columns of the British Medical Journal. In its course the opponents of leucotomy made much of the facts that the treatment was empirical and achieved its results by mutilation. WINNICOTT called "...the worst honest error in the history of medicine", and said,"enough is already known of mental disorder for it to be said that no mentally ill person can ever be made well by operation on a normal brain...". Another correspondent talked of "....the protection of patients in mental hospitals, which are no longer asylums, from violence". It was suggested that the patient be allowed to "enjoy his aggressions, even if this appears 'nasty' to us". Judgement of the value of a method of treatment must, of course, rest on appraisal of its results. Unbiased consideration of these can leave no doubt that the benefits following the operation by far out-weigh undesirable effects. This paper is concerned with cases of chronic mental illness. They are a representative sample of those patients who, without hope of amelioration, spend their lives in the disturbed wards of mental hospitals. Far from enjoying their aggression they were tormented and distressed by their psychoses. The limited nature of the successful results in these patients is considered to be worthwhile when the character and duration of their illness before operation is taken into account. It has been rightly said that statistics are a poor medium to convey the changes that occur in patients following leucotomy. 68 patients may be failures in that they have not attained recovery, but almost two-thirds of them have been freed from anxiety, despondency and fear. They are no longer noisy or violent. They do not attempt to injure themselves or others. They are not tormented by their "voices" and no longer struggle unavailingly with delusional phantasies. They have lost their degraded habits. Many of them are able to work usefully and contentedly. The benefit to the patients themselves, to their fellows in the wards and to the hospital atmosphere generally constitutes a therapeutic achievement of major importance, little less gratifying than the return home of those who responded more dramatically to prefrontal leucotomy.

SUMMARY AND CONCLUSIONS.

(1) The results of prefrontal leucotomy are reported in 68 cases of chronic mental illness which had failed to respond to all other methods of treatment. The patients are still resident in a mental hospital after a post-operative period ranging from one to 4 years. 44 patients improved in varying degree and 24 are considered to be unimproved.

(2) The results are analysed in terms of age, sex, duration of the illness, diagnostic classification and the operative technique employed. The form taken by amelioration in the various illnesses is described and examples of the post-operative state are given.

(3) Post-operative signs occurring in all leucotomised patients in hospital at the time of the survey are listed. Other early effects of leucotomy include favourable results in 2 cases of obsessional neurosis outwith the present series. The main post-operative signs are euphoria, an elevation of mood to a lesser degree and inertia. These are signs of frontal lobe deficit and their recurrence in relation to improvement in the 68 patients is charted, and their effect in modifying the psychosis described. No relationship is found between premorbid and post-operative personality traits.

(4) After-treatmentis described and the value of post-operative electroplexy and of re-operation is discussed.

(5) Relapse occurred transiently in 16 and permanently in 12 patients. Its theoretical aspects are discussed.

(6) Changes in body-weight following leucotomy are described. No correlation is found between increased weight and improvement of mental symptoms.

(7) Two factors in the pre-operative state thought to infleuce the prognosis are examined in relation to post-operative improvement. Those cases which improved after leucotomy had in aggregate a greater degree of mental tension than those not improving. No such prognostic significance could be attached to the other factor, the degree of break with reality.

(8) Theories of the operation are examined in the light of the results. It seems most likely that the operation acts by superimposing a modified frontal lobe syndrome on the psychosis. The importance of the position of the cut is suggested. No relationship is found between orbital area isolation and post-operative changes in the emotional sphere.

(9) The lack of finality in the reported results is mentioned. They are compared with the results published by others. The

significance of the result "worse" is discussed.

It is concluded that affective and obsessional illnesses respond well to leucotomy. The results in schizophrenia are less satisfactory, but in this illness the greatest response is found in the catatonic and paranoid types, the least in the hebephrenic variety. Leucotomy acts by the removal of mental tension and where this is marked there is still hope of improvement. even if the patient is considered 'deteriorated'.

It is further concluded, that while duration is less and tension greater where the response to the operation is good, there is no common factor in those patients who improve or fail to improve after leucotomy. The results in individual cases of chronic mental illness are unpredictable before operation, but the value of this method of treatment in such cases is fully confirmed.

APPENDIX.

CASE- SUMMARIES.

There follow brief extracts from notes made on the 68 cases of the main series and the 2 cases of obsessional neurosis described in the text. Duration is given under 3 headings, (a) of illness, (b) of present attack, (c) of hospitalisation. The heading Present Condition refers to that obtaining at the time of the survey, March to May 1947.

CASE I. Miss A.A. Age 40. Household Duties.

Premorbid Personality: No information.

Duration: a. Unknown. b. unknown. c. 6 years.

Diagnosis: Epilepsy.

Treatment: Gardenal gr. 2 b.i.d. Prominal gr. 3 b.i.d. Sedation as required. E.C.T. 6, I942, with improvement.

Pre-Operative State: She had infrequent fits but many equivalents, which took the form of violent and aggressive bouts. A good worker in the laundry, but selfish and easily upset.

Operation: 30.9.43. Coronal Cut.

Complications: Vomiting. 2 major convulsions on first post-operative day.

Progress: 22.I0.43. - She has been confused and restless, is now mischievous and noisy, unable to occupy herself.

27.4.44. - Still incontinent. At times impulsive and assaultive. Receiving maintenance E.C.T. Working as before operation.

20.9.44. - Little change.

30.9.45. - As above, but is less inclined to work.

Present Condition: She remains childish and petulant, has few seizures. Her equivalents continue but are less frequent and lessviolent. She will rarely do ward-work, but is a less serious nursing problem.

Post-Operative Signs: Restlessness. Confusion. A decrease in tension. Decreased initiative.

Rehabilitation. Anti-convulsive drugs. Maintenance E.C.T. Trial at various jobs.

Result. Slightly improved.

CASE 2. Miss N.B. Age 40. Domestic Servant.

Premorbid Personality: Little information available but but there appears to have been a degree of mental defect since infancy, although her attack of encephalitis occurred at 20. She has an illegitimate child. Home conditions were very poor.

Duration: a. I5-20 years. b. I2 years. c. I2 years.

Diagnosis: Post- encephalitic Parkinsonism.

Treatment: Stramonium. Cardiazol,7, I939, without effect.

Pre-Operative State: She had been subject to fits of rage and violence since I934. These were noisy, destructive and assaultive outbursts occurring at intervals of a few days. At her best she was simple and childish, emotionally and intellectually. At times she admitted to ideas of influence. Physical findings included slurred speech and tremor of the left arm and leg.

Operation: 9.5.46. Horizontal Cut.

Complications: Nil.

Progress: She was cheerful and co-operative and fully orientated, for I0 days,when her violent outbursts recommenced and continued exactly as before operation.

Present Condition: No change in the character, frequency or periodicity of her outbursts. She assaults the staff and patients, smashes windows and abuses all who come near her. Between attacks her conduct is also as before leucotomy. The tremor is more pronounced.

Post-Operative Signs: Restlessness.

Rehabilitation: Change of environment. Simple ward-work. E.C.T. later with no effect.

Result: Unimproved.

CASE 3. Miss E.B. Age 36. Saleswoman.

Premorbid Personality: She was backward in her early years. A difficult and super-sensitive child, she did well at school but was not popular. Her home-life was sheltered. She was a successful saleswoman but was described as obstinate, quick-tempered and asocial.

Duration: a. since December I942. b. since June I944. c. intermittently since I943.

Diagnosis: Paranoid Schizophrenia.

Treatment: E.C.T. several courses, I943, with improvement. Insulin, 37 comas, I945, with improvement.

Pre-Operative State: She had recently relapsed once more following discharge after insulin treatment. She had persecutory ideas and was constantly distressed by numerous 'voices'. She lacked any insight into her illness and constantly demanded to go home. Her personality was well preserved.

Operation: I2.6.45. Coronal Cut.

Complications: Nil.

Progress: I4.7.45. Idle and quiet, she avoids classes and resents coaxing. She is careless of her appearance. Denies hallucinations.

I2.I2.45. She is now hallucinated but less so than before leucotomy. She admits lying about not hearing voices in order to get home. Has little initiative and requires supervision in dress.

5.2.46. Discharged. She is occasionally rude but generally co-operative. Her hallucinations are fainter and can be ignored. She can concentrate and has more initiative.

I4.6.46. Re-admitted. She is irritable, hallucinated, lacking initiative.

Present Condition: Still hallucinated but with much less affect. She is facile, lacking initiative, distractable, expressing no delusional ideas. E.C.T. has not changed the clinical picture. She attends classes and is able to have parole.

Post-Operative Signs: Polite reticence followed by "cheekiness" in a few weeks. Marked inertia. Elevation of mood.

Rehabilitation: Occupational therapy. Social activities. Trial at home. E.C.T.

Result: Improved.

CASE 4. Miss M.B. Age 26. At Home.

Premorbid Personality: She was late in learning to walk and talk and later showed further evidence of mental defect. Always backward at school she made few friends and had no social interests. She subsequently helped with the housework but became more withdrawn and solitary till her psychosis became apparent.

Duration: a. 8 years. b. 8 years. 5 years.

Diagnosis: Schizophrenia, hebephrenic.

Treatment: E.C.T. 85, I942-45, slight transient improvement with repeated courses.

Pre-Operative State: She admitted to auditory hallucinations and thought her mother was trying to poison her. She giggled frequently and had an incongruous affect. Thought-blocking could be made out over and above the intellectual impairment. She was incontinent of urine and had frequent aggressive and impulsive outbursts.

Operation: I2.I2.45. Horizontal Cut.

Complications: Nil.

Progress: I0.I.46 - behaviour has been quiet. She is still manneristic, idle and incontinent, and whispers back to the voices.

I2.6.46.- improvement in behaviour maintained until March when she again became impulsive and aggressive. This phase responded to E.C.T. and she is now amenable. She lacks concentration at occupational therapy but tries to help in the ward.

I2.I2.46.- as above. Toilet habits still faulty.

Present Condition: Her behaviour has been good for the past few months. She works in the ward. She is still hallucinated, manneristic and withdrawn but some contact can be made. Still incontinent.

Post-Operative Signs: Decrease in tension.
Epileptiform Seizure, 8.I0.46.

Rehabilitation: Occupational Therapy. Ward-work. E.C.T.

Result: Slightly Improved.

CASE 5. Miss B.B. Age 35. At home.

Premorbid Personality: An only child, her early days were spent abroad, in charge of an ayah. At school she was an average scholar, good at games, even-tempered and sociable.

Duration: a. 20 years. b. I5 years. c. I5 years.

Diagnosis: Schizophrenia, catatonic.

Treatment: Triazol,II, I939. Insulin, 49 comas, I940. E.C.T. 65, I940-43, with transient improvement in each case.

Pre-Operative State: Periodicity occurred. In her quiet phase she was facile and placid, idle, with barren thought-content, visually hallucinated. For long periods she was continuously noisy, violent and destructive and had suicidal and homicidal tendencies. There was only a fleeting response to E.C.T.

Operation: I8.9.43. Coronal Cut.

Progress: 25.II.43. - pleasant and polite. Beginning to show initiative. Occasionally incontinent.
II.6.44. - friendly and childish. Restless and lacking in concentration but easy to manage.
20.9.44. - placid but at times bullies other patients. Working better.
23.9.45. - Condition unchanged.

Present Condition: Outwardly placid but still tends to bully weaker patients. She is not obviously hallucinated. Thought content barren. She has not regained full initiative, but is occupied with rug making and reading and has parole.

Post-Operative Signs: Confusion. Incontinence. Early inertia which later decreased. Euphoria. Diminished self-criticism (greediness, inconsideration, pilfering.)

Rehabilitation: Occupational and recreational therapy. Social Activities. Parole.

Result: Improved.

CASE 6. Miss H.C. Age 58. At Home.

Premorbid Personality: Little information available but no history of instability or mood-swings before her first break-down in I938.

Duration: a. 9 years. b. 9 years. c. Intermittent since I939.

Diagnosis: Involutional Melancholia.

Treatment: E.C.T. 42. I942-43, with transient improvement.

Pre-Operative State: Her depression was characterised by apathy, dullness and retardation, with marked but brief improvement after E.C.T. Relapse followed each course then maintenance treatment of 2-3 fits fortnightly kept patient at a fair level. Latterly electroplexy was losing its effect.

Operation: I6.5.43. Coronal Cut.

Complications: Nil.

Progress: I5.6.43.- rather irritable. Childish in demeanour, shouting and singing on occasion, at other times mildly depressed.

I6.II.43.- lacking spontaneity and without much interest in her environment. She is working well and has parole.

23.3.44.- Discharged. Still retarded and lacking initiative. This state continued at home and she was unable to cope with housework, neglected her appearance and was silent in company. Re-admitted I4.9.44.

I6.5.45.- dull, apathetic and almost mute becoming cheerful and active after 2 or 3 convulsions.

I6.6.46.- no change except that effect of E.C.T. lasts only one week instead of two.

Present Condition: At interview she was depressed and mildly agitated. Her attitude was pessimistic and querulous. At classes she requires constant stimulation. There is still some response to an occasional therapeutic convulsion.

Post-Operative Signs: Affective incontinence. Disinhibited behaviour. Transient elevation of mood. Persistent inertia. 2 epileptiform seizures I5.2.44.

Rehabilitation: Occupational and recreational therapy. Social activities. E.C.T.

Result: Unchanged.

CASE 7. Mrs. A.C. Age 59. Housewife.

Premorbid Personality: No information.

Duration: a. intermittent since 1915. b. 10 years.
c. from 1936.

Diagnosis: Paranoid Schizophrenia.

Treatment: E.C.T. 1941, with transient improvement.

Pre-Operative State: Beginning as acute mania her condition in 1938 was diagnosed as mild chronic mania. Thereafter a suspicious attitude became more pronounced and delusions of persecution appeared. She was probably hallucinated. Her personality was well preserved. Aggressive and violent episodes became more frequent.

Operation: 21.10.43. Coronal Cut.

Complications: Nil.

Progress: She was quiet, cheerful and facile, retaining her paranoid delusions but not being distressed by them till 31.1.44. when she became noisy, abusive and uncooperative. Given E.C.T., she became confused and incontinent and was unable to concentrate on her work for several months when this phase passed.

Present Condition: Mildly euphoric, over-active and garrulous. At intervals she is quarrelsome and abusive but less so than before operation. Her delusions remain in the background. She does a little ward-work with coaxing and supervision.

Post-Operative Signs: Euphoria. Inertia.

Rehabilitation: Change of environment. Knitting. Ward-work. E.C.T.

Result: Slightly Improved.

CASE 8. Miss G.D. Age 49. Comptometer Operator.

Premorbid Personality: No early neurotic traits. She was a good scholar but not a good mixer. She developed a tic and nervousness at I4 and left school. Later she was an able clerical worker. Described as reserved and diffident, but not unsociable.

Duration: a. 6½ years. b. 6½ years. c. I8.2.4I to I7.I2.4I. 24.5.45 to present.

Diagnosis: Paranoid Schizophrenia.

Treatment: Active treatment precluded by auricular fibrillation.

Pre-Operative State: She was discharged in I94I improved, having regained partial insight. She gradually lost control till re-admitted. Her thought content was then taken up with bizarre persecutory delusions about which she talked fluently and coherently. She became more constantly aggressive and noisy in response to auditory hallucinations.

Operation: 2I.3.46. Horizontal Cut.

Complications: Nil.

Progress: 22.4.46.- She was placid for one week during which the hallucinations faded. Now shouting and swearing in response to the voices.
23.9.46. - No sustained improvement. She is extremely difficult to manage. Having prolonged baths.

Present Condition: She is now very often at her worst level. She is hallucinated and deluded, noisy and aggressive, requires sedation. As far as can be judged her personality and intellect are unaltered.

Post-Operative Signs: Confusion.

Rehabilitation: Occupational therapy. Ward Work. Prolonged baths. Sedation.

Result: Unchanged.

CASE 9. Miss E.D. Age 39. Dispenser and Nurse.

Premorbid Personality: Although her work-record was good hysterical traits could be made out.

Duration: a. 5 years. b. 5 years. c. 5 years.

Diagnosis: Schizophrenia , hebephrenic.

Treatment: E.C.T. 6, I942. Insulin, 39 comas, I942, condition unchanged.

Pre-Operative State: She was auditorily hallucinated and incoherent and inconsequential in her talk. Her mood was depressed. Her behaviour showed a histrionic element and she made several suicidal attempts, one of which was serious. At times she was uncooperative and aggressive.

Operation: I6.5.43. Coronal Cut.

Complications: Respiratory distress during and after operation.

Progress: I6.6.43.- She was amenable, euphoric and facetious, still hallucinated. Lacking in initiative.

I2.I.44.- Giggling fatuously. Aggressive in a childish way. She escaped and reached home where she remained for 3 months.

I6.5.45.- mildly euphoric, occasionally impulsive, but generally amenable and able to do a little work.

Present Condition: She is euphoric and facile, at times irritable. She talks rationally but with inadequate thought content. She takes little interest in her appearance, but is doing good work at occupational therapy. Her impulsive behaviour is much less marked and less frequent. She is no longer a serious nursing problem.

Post-Operative Signs: Restlessness. Confusion. Disinhibited behaviour. Euphoria. Lack of initiative. Lying at one stage.

Rehabilitation: Ward-work. Occupational and recreational therapy. Social activities. Prolonged baths. E.C.T.

Result: Improved.

CASEIO. Miss S.F. Age 38. At home.

Premorbid Personality: A nervous infant she became a healthy and active child although backward at school. Later she was solitary and introverted, had no occupation but liked gardening.

Duration: a. II½ years. b. II½ years. c. from I935 with several short breaks.

Diagnosis: Schizophrenia, hebephrenic.

Treatment: E.C.T. 75, I943-44, with transient improvement in behaviour.

Pre-Operative State: At her best she was withdrawn and manneristic lacking in spontaneity and drive and in depth of affect. She was subject to frequent violent and excited bouts in which she was deluded and hallucinated. Less frequently she was depressed, mute and barely accessable.

Operation: 5.IO.44. Coronal Cut.

Complications: Prolonged post-operative vomiting.

Progress: 7.II.44 - alternately restless and lethargic, unrestrained in speech, incontinent of urine.
20.I.45 - in bed for three weeks shouting and swearing at her voices!
II.5.45.- simple,clumsy, loud-voiced. Her mood is even and she is not hallucinated. Able to have parole.
24.II.45.- little change. She is working well but is unreliable and has abused parole.

Present Condition: She lacks spontaneity. Her answers are relevant but inadequate. She admits to hallucinations. These are less consistent and less annoying but she still has frequent spells of noisy and aggressive behaviour. These are controlled temporarily by convulsive therapy.

Post-Operative Signs: Confusion. Disinhibited behaviour. Incontinence. Transient elevation of mood. Decreased self-criticism- pilfering.

Rehabilitation: Occupational and recreational therapy. Social activities. Cardiazol and E.C.T.

Result: Unchanged.

CASE II. Miss A.F. Age 50. At home.

Premorbid Personality: An only child her early days showed no abnormality. She was pleasant, sociable and active at school. Later she remained at home dominated by her mother. Her psychosis was of sudden onset following an unhappy love-affair.

Duration: a. 8 years. b.8 years. c. I939 to present.

Diagnosis: Paranoid Schizophrenia.

Treatment: Insulin, 50 comas, with transient improvement in behaviour. E.C.T. I7, I94I, little change. Prolonged baths, I942-43.

Pre-Operative State: For years she was hallucinated and with delusions of poisoning directed mainly against her mother. An incongruous affect was noted at times. She was subject to aggressive and assaultive outbursts which became more frequent and less easy to manage.

Operation: 2.I2.43. Coronal Cut.

Complications: Nil.

Progress: 2.I.44.- not confused now, she is euphoric and lethargic.

2.6.44 - the same features are present. She is friendly towards her mother and only occasionally hallucinated. Attendingclasses.

2.I2.44.- on I4.I0.44. she became solitary, aggressive and abusive improving only temporarily after E.C.T.

2.I2.45.- incoherent and hallucinated, with noisy and aggressive outbursts. She showed no response when informed of mother's death.

Present Condition: She is still incoherent and fatuous, and is obviously hallucinated. Her delusions have faded and she is generally well-behaved. Unable to occupy herself beyond doing a little ward-work.

Post-Operative Signs: Restlessness. Confusion. Disinhibited behaviour. Euphoria. Lack of initiative.

Rehabilitation: Occupational and recreational therapy. Social activities. E.C.T.

Result: Slightly improved.

CASE I2. Miss R.H. Age 26. Student.

Premorbid Personality: She showed a jealous tendency from an early age. Regarded as egocentric, asocial, uncertain in her contact with her parents, hypersensitive. Intellectually she was above average.

Duration: a. 8 years. b. 8 years. c. from I94I.

Diagnosis: Schizophrenia, catatonic.

Treatment: Insulin 53 comas, I942 with transient improvement. E.C.T. I2, I943, fleeting improvement.

Pre-Operative State: She was very hallucinated and obeyed 'voices' which told her not to eat etc. She believed that her food was poisoned, her bowels completely stopped. She was resistive and impulsive and had to be forcibly fed. She was manneristic, secretive, solitary and petulant. Relapsed quickly after E.C.T. Able, at her best, to do some work at occupational therapy.

Operation: I6.5.43. Coronal Cut.

Complications: Post-operative vomiting.

Progress: I6.6.43. - her delusions have faded but hypochondriacal trends remain. She denies hallucinations. She is asocial and slow but fully occupied.
I6.II.43. - at times disinhibited. She recently received a message through the wall. Still occupied.
I6.5.44. - she has smashed windows and attacked other patients in obedience to the 'voices'.
I6.5.45. - recently improved but remains introverted and asocial.
I6.5.46. - still hallucinated and hypochondriacal but her behaviour is better.

Present Condition: She is antistic, manneristic and preoccupied with bowel-function. Still hallucinated but ' what they say does not matter'. There have been no impulsive outbursts since Sept.I946 and she behaved well during a short holiday. She has town parole.

Post-Operative Signs: Irritability. Transient inertia
Elevation of mood.

Rehabilitation: Occupational and recreational therapy. Social activities. Parole. Holiday. E.C.T.

Result: Much improved.

CASE I3. Miss M.H. Age 26. Childrens' Nurse.

Premorbid Personality: Little information available but she was described as a good scholar and her work record was excellent.

Duration: a. from I938. b. same period. c. intermittently since I938.

Diagnosis: Schizophrenia, catatonic.

Treatment: Cardiazol, II, I94I. E.C.T. 67, I942-46, with transient improvement.

Pre-Operative State: She was auditorily hallucinated in I94I but this feature had not been prominent for several years. Her condition alternated and a strong affective element was present. In one phase she was cheerful and facile, mildly hypomanic, taking part in all activities. This changed rapidly to a depressed state in which she wept, was mute and inaccessable. She was restored to a good level by a few convulsions but maintained it for no more than 4 weeks.

Operation: 7.2.46. Horizontal Cut.

Complications: Nil.

Progress: 8.3.46. - very quiet and mildly depressed after confusion had cleared up. Now becoming brighter and more active.

8.8.46. - 2 depressed phases since last note. She recovered from the first spontaneously but required E.C.T. for the second.

Present Condition: No change from pre-operative state. For the past 4 months there has been a 4 weeks' periodicity of the depressed phase, clearing up as before with electroplexy.

Post-Operative Signs: Confusion . Restlessness.

Rehabilitation: Occupational and recreational therapy. Social activities. E.C.T.

Result: Unchanged.

CASE I4. Mrs Z.I. Age 36. Housewife.

Premorbid Personality: Little information available. She was brought up in an orphanage and her early life was difficult. At the time of her marriage in I930 she was morose and unreliable.

Duration: a. about I5 years. b. same period. c. since I942.

Diagnosis: Paranoid Schizophrenia.

Treatment: E.C.T. 20, I942-43, with no improvement.

Pre-Operative State: She was auditorily hallucinated and her delusions were always fantastic grandiose. Her behaviour varied. At times she was euphoric with strong erotic and exhibitionistic tendencies. At times she was restless, almost incoherent, noisy and aggressive, and this phase became more prominent.

Operation: 26.7.45. Coronal Cut.

Complications: Nil.

Progress: I2.8.45. - her delusions are unchanged. She is elated and over-active.

26.I.46. - deluded and hallucinated. She is restless and distractable.

26.7.46. - there was a brief improvement in behaviour after E.C.T. earlier in the year. She has been more aggressive recently and has been confined to bed for several months.

Present Condition: She admits to hallucinations and her delusions are still grandiose. She shows a rapid change from a fatuous pleasantness to aggression but has been quieter of late. She is incontinent at night.

Post-Operative Signs: Nil.

Rehabilitation: Occupational and recreational therapy. Ward -work. E.C.T.

Result: Unchanged.

CASE I5. Miss M.J. Age 32. Shop Assistant.

Premorbid Personality: No early neurotic traits or social misadaptations. She was a good scholar and had a good work record being manageress of a shop. She had many social activities but was indifferent to the opposite sex.

Duration: a. 9½ years. b. 9½ years. c.6 years.

Diagnosis: Schizophrenia, hebephrenic.

Treatment: Cardiazol, 22, I939. E.C.T. 60, I943-44, with little improvement.

Pre-Operative State: Following pharmacological shock treatment she spent 3 years at home. When re-admitted she was negativistic and apathetic, almost inaccessible and with degraded habits. E.C.T. did little to alter this state and she became increasingly difficult with many impulsive outbursts.

Operation: I2.I0.44. Coronal Cut.

Complications: Nil.

Progress: She was pleasant but vague and hard to contact. Her aggressive episodes were less frequent. Her habits improved. Discharged.

I2.7.45. - she was re-admitted 2 months later in a state resembling her pre-operative condition. E.C.T. led to a temporary improvement but she quickly slipped back.

Present Condition: Barely accessible, idle and apathetic. Her behaviour is still violent at times and her toilet habits still faulty.

Post-Operative Signs: A transient elevation of mood.

Rehabilitation: Occupational therapy. Holidays at home. E.C.T.

Result: Unchanged.

CASE I6. Miss F.K-W. Age 54. Nurse.

Premorbid Personality: She was a bright and friendly child until I3 years old when she suffered from concussion. Thereafter she had 'hysterical attacks'. She trained as a nurse and served as a V.A.D. An able worker, she was easily fatigued and later became moody and emotional.

Duration: a. 28 years. b. 20 years. c. I9I9, I920 and from I927 onwards.

Diagnosis: Paranoid Schizophrenia.

Treatment: Cardiazol 2I, I938-39. E.C.T. 7, I94I with no improvement.

Pre-Operative State: She was hallucinated and full of delusions of persecution. Noisy and violent. She frequently attacked the staff and patients and was controlled only by heavy sedation.

Operation: I6.2.44. Coronal Cut.

Complications: Nil.

Progress: I0.3.44. - her delusions persist but her behaviour has been good. She is unoccupied except for reading.

I.5.44. - she is talking more now. Is pleasant and co-operative and working well at occupational therapy.

I6.3.45.- still hallucinated and deluded. Calm and placid but working less satisfactorily.

I6.3.46.- she has infrequent aggressive phases of short duration. Working well in the ward.

Present Condition: She is generally placid with an incongruous mood but has occasional fleeting outbursts of aggression. She does not admit to hallucinations but has delusions about food and health. She does some work in the wards.

Post-Operative Signs: Restless. Confusion. Reticence. Euphoria. Inertia.

Rehabilitation: Occupational and recreational therapy. Ward work.

Result: Slightly improved.

CASE I7. Miss J.K. Age 3I years. At home.

Premorbid Personality: She was an intelligent and normal child till the age of I0 when epilepsy followed a head-injury. Since then she has been dull and backward and later became jealous, quarrelsome and religiose.

Duration: a. 2I years. b. 6 years. c. 5 years.

Diagnosis: Epilepsy.

Treatment: Gardenal gr. 2, b.i.d. E.C.T. I0, I942-43, with fleeting improvement.

Pre-Operative State: She had many furores which lasted for hours or days and could be aborted by electroplexy. In them she was excited, violent and incoherent and obeyed hallucinatory voices. She had typical major fits and was intellectually defective. She was able to work in the ward when well.

Operation: 4.8.43. Coronal Cut.

Complications: Nil.

Progress: She was placid and amenable until October I943 when furores returned. Their quality and frequency were unaltered thereafter. The quiet intervals and the major fits continued as before.

Present Condition: Described under 'Progress'.

Post-Operative Signs.: A transient elevation of mood.

Rehabilitation: Anticonvulsive drugs. Ward -work. Maintenance E.C.T.

Result: Unchanged.

CASE I8. Miss J.L. Age 45. Clerkess.

Premorbid Personality: Little information available. For about 3 years prior to admission she had been moody, apathetic and asocial. Her psychosis then gradually developed.

Duration: a. I3 years. b. I3 years. c. I.I2.34 to 23.7.35. I6.9.36 to present.

Diagnosis: Paranoid Schizophrenia.

Treatment: Triazol, 28,I938. E.C.T. maintenance, I942-43 with transient effect.

Pre-Operative State: At her best she was pleasant and co-operative although suspicious and with ideas of reference and control. She was subject to frequent exacerbations of her paranoid state in which she became distressed, insomniac and aggressive. Convulsive treatment controlled these phases temporarily.

Operation: 4.8.43. Coronal Cut.

Complications: Nil.

Progress: I0.9.43. - after initial confusion she is pleasant but apathetic. She attends classes.
4.4. 44.- she remained pleasant although still suspicious until October I943 when she had a typical exacerbation and these have continued as before.
5.8.45. - she has slightly more initiative. The other features are unchanged.
4.8.46. - no change.

Present Condition: She still has periods in which she is grandiose, irritable and quarrelsome and she is always suspicious. She attends amusements and works in the sewing-room but has little initiative.

Post-Operative Signs: Confusion. Incontinence. A transient release from tension. Inertia.

Rehabilitation: Occupational therapy . Office-work. Kitchen-work. Needlework. Holidays at home.

Result: Unchanged.

CASE I9. Miss F.M. Age 53 years. At home.

Premorbid Personality: She was educated at home and was described as intelligent, sociable and kindly. She had a nervous illness after an unhappy love-affair but recovered satisfactorily. Her psychosis was apparently precipitated by her father's death.

Duration: a. 2I years. b. 2I years. c. from I0.9.36 to present.

Diagnosis: Paranoid Schizophrenia.

Treatment: Triazol 9, I939. E.C.T. I6, I94I-42. Modified Insulin I94I, with no sustained improvement.

Pre-Operative State: She heard the 'voices' of her father and other relatives, and thought the former had been resurrected and was nearby. This belief persisted for years and her behaviour was almost constantly difficult and resistive, noisy and restless. Her personal habits were faulty. She was controlled only by wet packs.

Operation: II.5.44. Coronal Cut.

Complications: Nil.

Progress: II.6.44. - she is cheerful, talkative and polite. Her time is spent in reading and in helping in the ward.
23.I2.44.- her delusions and hallucinations have returned with the same emotional charge and disturbance of behaviour.
II.5.45. - condition unchanged.
II.5.46. - she is still resistive and restless at times and still tries to act on her delusions.

Present Condition: Her delusions and hallucinations are unchanged and at times they lead to difficult behaviour but much less frequently than before operation. Her toilet habits have improved.

Post-Operative State: A decrease in tension.

Rehabilitation: Occupational therapy. Ward-work. E.C.T.

Result: Slightly Improved.

CASE 20. Mrs D.M. Age 37. years. Housewife.

Premorbid Personality: She was a shy nervous child, easy to manage and good-tempered. She was educated abroad, and her marriage was happy, until the birth of her second child I94I.

Duration: a. 5½ years. b. 4½ years. c. from July I942 to present.

Diagnosis: Paranoid Schizophrenia.

Treatment: E.C.T. ,Modified Insulin, Continuous Narcosis, Cardiazol, I942-45 ,with no material improvement.

Pre-Operative State: She had delusions of grandeur and ideas of reference and influence. Her mood was incongruous and her talk incoherent. Her behaviour was impulsive and unco-operative and her toilet habits were faulty.

Operation: I4.2.46. Horizontal Cut.

Complications: Nil.

Progress: I4.3.46. - her delusions are unchanged but she is mainly polite and co-operative. She has mended her clothes and written letters.

I4.8.46. - she relapsed early in March becoming more incoherent, resistive, aggressive and idle. Now hallucinated and assaultive.

20.I0.46.- she continues as above.

Present Condition: Her delusions remain as before. She has had only one violent episode during the past three months and is generally quiet with occasional periods of irritability. This improvement is too recent to allow classification as improved. She is still idle and retains her degraded habits.

Post-Operative Signs: Reticence. Elevation of mood.

Rehabilitation: Needlework. Ward-work. E.C.T. Cardiazol.

Result: Unchanged.

CASE 21 Miss B.M. Age 33 At home.

Premorbid Personality: She suffered from epileptiform seizures in infancy and was a difficult child who slept badly, was careless of her clothes and continually asked questions. She did not play games or mix easily. Later she became still more asocial and introverted.

Duration: a. 14 years.
b. 14 years.
c. 15.6.33 to present.

Diagnosis: Schizophrenia, hebephrenic.

Treatment: Prolonged Narcosis, 1937. Cardiazol, 19, 1938 with a brief improvement on each occasion.

Pre-operative State: She hardly ever spoke but was obviously hallucinated. She was self-absorbed and idle. Her behaviour was occasionally impulsive. She was untidy and required much supervision.

Operation: 14.2.46. Horizontal Cut.

Complications: Nil.

Progress: 14.3.46. Quiet and withdrawn. Attending occupational therapy but requiring much help.
24.6.46. Began shouting in response to hallucinations on 21.3.46. Recently given E.C.T. which produced a violent and excited state.
14.8.46. Hallucinated but quieter than before.

Present Condition: She is a pale untidy girl with the praecox grin who answers simple questions briefly but is mainly inaccessible. She sits awkwardly and shows flexibilitas cerea. She is still idle, self-absorbed and hallucinated, but is rather quieter and less impulsive than before operation.

Post-operative Signs: None reported.

Rehabilitation: Occupational and recreational therapy. E.C.T.

Result: Unchanged.

CASE 22. Mrs. M.M. Age 58. Housewife.

Premorbid Personality: Little information about early days. Later she was described as shy and gentle and with few friends. At first happily married she underwent considerable domestic stress later.

Duration: a. 9 years.
b. 9 years.
c. Intermittent since 1938.

Diagnosis: Paranoid Schizophrenia.

Treatment: E.C.T., 16, 1944, with slight improvement.

Pre-operative State: She was quiet and self-absorbed. Her attitude was suspicious and she entertained paranoid delusions and auditory hallucinations. From time to time, she shouted, swore and threatened violence.

Operation: 15.2.45.

Complications: Nil.

Progress: 17.3.45. Still solitary and quiet. She admits to no delusions or hallucinations. Attends classes.
15.8.45. She is improving. Her behaviour is quiet, her work good, and her appearance tidy.

3.1.46. Escaped and went home. She was well-behaved there but disregarded the normal routine of life.

Present Condition: She voices persecutory ideas usually without the appropriate affect. She remains hallucinated and at times shouts. Generally well-behaved she is occasionally quarrelsome.

Post-operative Signs: A transient elevation of mood.

Rehabilitation: Occupational and recreational therapy. Social activities.

Result: Unchanged.

CASE 23. Miss V.M. Age 28. Artist.

Premorbid Personality: Always a moody and difficult child. She was unhappy at school. She attempted suicide after an unfortunate love-affair and later was morbidly pre-occupied with religion.

Duration: a. at least 7 years.
b. 3 years.
c. on 4 occasions since 1940.

Diagnosis: Paranoid Schizophrenia.

Treatment: E.C.T., 1940 with transient improvement.
Insulin, 32 comas 1940 - 41 with considerable improvement.
E.C.T., 10 1944. No improvement.

Pre-operative State: She was catatonic on admission, but later developed more paranoid features. She complained of electricity and poisoning and was hallucinated. She was sullen and unco-operative but actively aggressive only when receiving attention. She was untidy and destructive of clothing.

Operation: 29.6.44. Coronal Cut.

Complications: Meningeal irritation.

Progress: 29.7.44. She is serene and calm, neither deluded nor hallucinated, occupied with reading.
28.3.45. Very well until a fortnight ago when she became stubborn, destructive and untidy. Now better again after E.C.T.
29.6.45. Requires 2 to 3 convulsions weekly to maintain a fair level of behaviour.
29.6.46. No change.

Present Condition: She is solitary and manneristic. She denies hallucinations but is still religiose. She becames brighter and more co-operative after electroplexy but 2 fits per week are required. Without treatment she becomes noisy and destructive and refuses food.

Post-operative Signs: Confusion. A transient elevation of mood.

Rehabilitation: Occupational and recreational therapy. E.C.T.

Result: Unchanged.

CASE 24. Miss E.R. Age 45. At home.

Premorbid Personality: She was not a good mixer at school and not good at games. Her outlook was pessimistic and she was easily discouraged. She had not attempted to find an occupation.

Duration: a $8\frac{1}{2}$ years.
b. $8\frac{1}{2}$ years.
c. from 1938.

Diagnosis: Schizophrenia, hebephrenic.

Treatment: Insulin Coma Therapy and Cardiazol, 1939, with very brief improvement.

Pre-operative State: She was a deteriorated schizophrenic with meagre thought-content, bizarre delusions, and auditory hallucinations. Her mood varied from apathy to depression. Her behaviour was characterized by silly, impulsive and aggressive actions. Her personal habits were degraded.

Operation: 27.7.44. Coronal Cut.

Complications: Nil.

Progress: 27.8.44 More cheerful and amenable with no impulsive actions.
27.1.45. Still pleasant, with little spontaneity she is sometimes rational but her delusions persist. Only one impulsive outburst since operation.

27.7.45. She is childish and facile, lacking initiative but well-behaved.
27.7.46. Generally pleasant, occasionally aggressive. Her toilet habits have improved.

Present Condition: She is emotionally blunted and unaffected by her mother's death. She admits to auditory hallucinations. The delusions have faded. She is solitary but pleasant with only occasional, fleating aggression.

Post-operative Signs: Elevation of mood. Increased inertia.

Rehabilitation: Occupational therapy. Needlework. Social activities.

Result: Slightly Improved.

CASE 25. Miss L.S. Age 40. Domestic Science Student.

Premorbid Personality: She was backward at school but did better at college. She was lazy, self-centred and extravagant.

Duration: a. 14 years.
b. 14 years.
c. 14 years.

Diagnosis: Schizophrenia, catatonic.

Treatment: Cardiazol, 29, 1938. Triazol, 23, 1939 - 40. E.C.T., 99, 1940 - 43 with brief improvement.

Pre-operative State: She was manneristic, withdrawn and hallucinated. For the most part she was mute, any utterance was stereotyped. She was very destructive of clothing and resisted strongly any examination or treatment.

Operation: 6.8.43. Coronal Cut.

Complications: Nil.

Progress: 6.7.43. Still withdrawn and manneristic, but is not destructive and now dresses herself.
1.12.43 She is well-behaved but obstinate at times. Attending classes.
20.6.44. More aggressive, negatavistic and slovenly
6.12.45. Aggressive and striking out unless she has a weekly convulsion.

Present condition: She remains hallucinated, deluded, solitary and idle. She is still manneristic, untidy; less destructive than before. Her aggression is controlled by E.C.T.

Post-operative Signs: Confusion. A transient elevation of mood. More inertia.

Rehabilitation Occupational and recreational therapy. Social activities. E.C.T.

Result: Unchanged.

CASE 26 Miss B. S. Age 36 At home.

Premorbid Personality: No information available.

Duration: a 12 years.
b 12 years.
c from 1935 with two short breaks.

Diagnosis: Schizophrenia, hebephrenic.

Treatment: Triazol, 1939 with improvement. Insulin 1940 and 1942 with improvement. E. C. T.; 7, 1942 no change.

Pre-operative State: She was idle and self-centred, lacking in spontaneity and irrelevant in her answers. Mainly amenable she had occasional impulsive phases. She required supervision at meals and toilet.

Operation: 7.10.43. Coronal Cut.

Complications: Nil.

Progress: 7.11.43. Improvement in appearance and habits.
7.4.44. Lacks spontaneity and has only superficial interests but is fully occupied and behaves well.
7.10.44. She lives contentedly from day to day, only occasionally aggressive
21.2.45. Left hospital on probation.
22.3.46. Readmitted - euphoric, lethargic, at times hallucinated.

Present condition: In August, 1946 she became restless, manneristic and more constantly hallucinated. She improved after E. C. T. but has required maintenance treatment since. Tension is greater than before operation.

Rehabilitation: Occupational and recreational therapy. Social activities. Holidays and probation. E. C. T.

Result: Worse.

CASE 27. Mrs. N.S. Age 30. Housewife.

Premorbid Personality: Little information is available. She was a stable and intelligent child, a good housewife. She first showed abnormality after child-birth.

Duration: a. about 6 years. b. same period. c. from 25.7.42. onwards.

Diagnosis: Schizophrenia, hebephrenic.

Treatment: Nil.

Pre-Operative State: The salient features were auditory hallucinations, marked thought disorder, withdrawal from reality, blunting of mood and deterioration of personal habits. She was at times impulsive and destructive.

Operation: 7.2.46. Horizontal Cut.

Complications: Nil.

Progress: IO.3.46. - rambling and incoherent, hallucinated, faulty in habits.
3.6.46. - improvement in behaviour after E.C.T. last month but this has not been maintained.
3.8.46. - she is incoherent, delusional and hallucinated. At times violent without provocation.

Present Condition: She is rambling and incoherent, hallucinated and deluded. Her mood is blunted and occasional impulsive actions still appear. She is idle and slovenly and still destructive.

Post-Operative Signs: None reported.

Rehabilitation: Occupational and recreational therapy. Social activities. E.C.T.

Result: Unchanged.

Case 28 Miss M.T. Age 28 Nurse.

Premorbid Personality: She was a bright and active child who did well at school. She trained in domestic science and then became assistant matron at a college. Later she began her training as a nurse and then showed undue anxiety and an over-conscientious attitude. She was reserved but popular with her fellows.

Duration: a. 7 years.
b. 7 years.
c. From 1940

Diagnosis: Schizophrenia, hebephrenic.

Treatment: Insulin, 27 comas, 1940 with considerable improvement.
Cardiazol and E.C.T., 1941 with slight improvement.

Pre-operative State: At her best she was facile and amenable, self-absorbed, lacking initiative, with emotional blunting and apparent intellectual deterioration. At times she was aggressive and assaultive. The latter phase had a close relation to menstruation. It was becoming more frequent and was unaltered by E.C.T.

Operation: 29.6.44. Coronal Cut.

Complications: Nil.

Progress: 29.7.44. Hallucinated and preoccupied but no longer destructive or aggressive.
29.12.44. Little change, now attending classes.
29.6.45. Again des ructive and at times aggressive, but less so than before.
29.6.46. There has been a steady deterioration. She is at times violent and requires heavy sedation. She is idle and hallucinated.

Present Condition: She is solitary, self-absorbed and idle. Her mood is generally incongruous. She is frequently noisy and hallucinated, especially when menstruating.

Post-operative Signs: Confusion. Restlessness. A transient elevation of mood.

Rehabilitation: Occupational and recreational therapy. E.C.T.

Result: Unchanged.

CASE 29 Miss J.T. Age 37 Cashier.

Premorbid Personality: Little information available. She had a normal childhood and was a good scholar. Later she was reticent and self-centred. Although good at her work she had frequent changes of job.

Duration: a. $7\frac{1}{2}$ years.
b. 6 years.
c. 2.3.40. to 27.7.40.
14.7.41 to present.

Diagnosis: Paranoid Schizophrenia.

Treatment: Insulin, 27 comas, 1940 with remission. Insulin 22 comas, 1941, with slight improvement. E.C.T. 1941 to 43.
Prefrontal Leucotomy, 21.2.43. coronal cut with no improvement.

Pre-operative State: She remained as before leucotomy, hallucinated and deluded with a strong fear of poisoning. At times she was very violent and E.C.T. had little effect.

Operation: 19.6.45. Horizontal Cut.

Complications: Nil.

Progress: 20.7.45. She was hallucinated but quiet early in the month, she is now deluded, violent and aggressive.
23.12.45. She remains hallucinated but is only occasionally noisy and disturbed and is then helped by electroplexy.

20.6.46. As above but with longer spells of good behaviour.

Present Condition: She is probably still hallucinated but with much less emotional contact. Her delusions have disappeared. She is still aloof and to some extent suspicious She has been working well in the kitchens with only occasional fleeting aggression. E.C.T. has been discontinued since August, 1946.

Post-operative Signs: An elevation of mood.

Rehabilitation: Occupational therapy. Kitchen-work. Ward-work E.C.T.

Result: Improved.

CASE 30 Miss A.W. Age 52. At home

Premorbid Personality: It was noted that she had been excitable and unstable all her life. She was not on good terms with her family.

Duration: a. 11 years.
b. 11 years.
c. From 1935 with one short break.

Diagnosis: Manic-depressive Psychosis.

Treatment: Cardiazol, 13, 1938. E.C.T., 8, 1940, with transient improvement. Prolonged Baths, 1944.

Pre-operative State: She showed cyclothymic swing from a manic to a depressed phase, sometimes with brief interludes of comparative normality. In one phase she was talkative, distractable, with flight of ideas and aggression. In the other she was despondent, retarded and suicidal. The duration of these varied greatly. Latterly excited phases predominated and lasted longer.

Operation: 5.5.44. Coronal Cut.

Complications: Nil.

Progress: 5.6.44. Only occasionally noisy and abusive when receiving attention.
9.11.46. There has been a gradual improvement till she is now cheerful, active and stable. Parole granted.
5.5.45. She lives a care-free day-to-day existence.
2.6.46. Recently she has become hypomanic, rude and aggressive.

Present Condition: The manic phase noted above responded to E.C.T. She has now been fairly well for 4 months. She is pleasant and co-operative, exhibits a facile euphoria, lives from day to day and lacks inability to plan. She has Town Parole and attends all classes and amusements.

Post-operative Signs: Euphoria. Transient Inertia. Lack of emotional appreciation of the future.

Rehabilitation: Occupational and recreational therapy. Social activities. Parole. E.C.T.

Result: Much improved.

CASE 31. Miss J.W. Age 46 Civil Servant.

Premorbid Personality: She was over-particular and conscientious, asocial and sexually immature. Her work record was good and her intelligence above average.

Duration: a. 16 years.
b. 10 years.
c. 6 years.

Diagnosis: Paranoid Schizophrenia.

Treatment: Cardiazol, 5, 1941. E.C.T., 32, 1942 - 43 with brief improvement.

Pre-operative State: She had vague unsystematised delusions of persecution and auditory hallucinations. She showed considerable aggression and was frequently violent. Her intellect was well-preserved.

Operation: 6.6.43. Coronal Cut.

Complications: Post-operative vomiting.

Progress: 18.6.43. Placid and co-operative. Occasionally hallucinated. Attending occupational therapy.
20.12.43. Pleasant and amenable with infrequent aggressive outbursts.
22.12.44. At home on pass for 4 months she became more quarrelsome and her delusions returned.
7.6.45. Has regained the improvement which followed operation.

Present Condition: She is garrulous and euphoric, making good contact but refusing to help in the ward. She does some knitting. Although she denies hearing 'voices' she obviously does so. Her delusions are in the background. She is infrequently aggressive and abusive.

Post-operative Signs: Euphoria. Inertia.

Rehabilitation: Occupational and recreational therapy. Social activities. E.C.T.

Result: Slightly improved.

CASE 32. Miss A.W. Age 55 Dispenser.

Premorbid Personality. No information.

Duration: a. 20 years.
b. 15 years.
c. From 1928 with one short break.

Diagnosis: Paranoid Schizophrenia.

Treatment: Cardiazol, 9, 1941. E.C.T., 9, 1941 - 42, with transient improvement.

Pre-operative State: She was full of bizarre delusions that her family had been burned to death, and her affect was generally incongruous. She was visually and auditorily hallucinated. She was at times restless and distressed, had tried to escape and to commit suicide.

Operation: 21.10.43. Coronal Cut.

Complications: Nil.

Progress: 5.11.43. Quiet and pleasant, still deluded and hallucinated.
13.8.44. More settled now, working well in the ward and at classes.
12.10.45. As above, occasionally noisy and impulsive.

Present Condition: She retains her delusions and hallucinations but these have largely lost their emotional content. Her periods of tension have been modified and her behaviour has consequently improved. She attends classes and amusements.

Post-operative Signs: Restlessness. An elevation of mood.

Rehabilitation: Occupational and recreational therapy. Social activities and ward-work

Result: Slightly Improved.

CASE 33. Mr. D.A. Age 26. Forestry Worker.

Premorbid Personality: Not a good scholar he worked well at his job. He had few other interests and was regarded as 'conceited' and asocial.

Duration: a. 4½ years.
b. 4½ years.
c. 5.10.44 to present.

Diagnosis: Schizophrenia, catatonic.

Treatment: E.C.T., 39, 1944 - 45. Insulin 44 comas, 1944 - 45, with slight improvement in both cases.

Pre-operative State: His behaviour improved for several months after insulin coma therapy and he was able to work in the gardens. He manifested grimacing, fatuous laughter and silly irrelevant remarks. He had fairly frequent aggressive and impulsive phases modified only transiently by E.C.T.

Operation: 29.11.45. Horizontal Cut.

Complications: Nil.

Progress: 29.12.45. Hallucinations were marked after operation, they are less prominent now. He has had several impulsive outbursts, between these he is reticent and apathetic.
29.5.46. Less hallucinated. He has had no disturbed behaviour since December. He is talking more freely and works in the carpenter's shop.
29.11.46. As above.

Present Condition: He is calm but emotionally blunted and with poverty of thought. Still mildly hallucinated his behaviour is good. He lacks initiative but works fairly well at classes.

Post-operative Signs: Restlessness. Disinhibited behaviour - sexual advances. Elevation of mood. Inertia. Major epileptiform convulsion 7.4.47.

Rehabilitation: Ward-work. Carpentry. Occupational therapy.

Result: Improved.

CASE 34. Mr. N.B. Age 32. Architect.

Premorbid Personality: He was quiet and studious at school with no close friends. These he acquired later but still remained shy and asocial. He was over-conscientious at College: took an Honours degree. Latterly he was preoccupied with religious and sexual problems.

Duration: a. 9 years. b. 6 years. c. periodically since onset from 6.9.43. onwards.

Diagnosis: Schizophrenia, catatonic.

Treatment: Insulin, I940 and I942 with remission on each occasion. E.C.T. I94I - 45 with transient effect.

Pre-Operative State: He had severe catatonic attacks since I942, lasting for several weeks and at intervals of one to three weeks. These could be cut short by 2 convulsions. In his disturbed phase he was inaccessible, impulsive and destructive. At his best he was pleasant, formal and autistic.

Operation: I5.6.44. Coronal Cut.

Complications: Nil.

Progress: I5.7.44. - he is quiet and asocial, moody and with a tendency towards aggression.
I5.I2.44. - he is aloof and suspicious and has ideas of reference. He has about one week of irritability per month, but works well at classes.
3.7.45. - he has had catatonic phases in February, March and April each being aborted by sedation. Now working well and has parole.
3.7.46. - having 2 convulsions every 3 weeks at the first signs of a relapse.

Present Condition: With E.C.T. monthly which keeps him at a fair level, he is quiet, introverted and asocial although doing well at classes and games.

Post-Operative Signs: A transient elevation of mood and altered periodicity.

Rehabilitation: Occupational and recreational therapy. Office-work. Parole. E.C.T. Intensive thyroid medication.

Result: Unchanged.

CASE 35. Mr. F.B. Age 41. Retired Army Officer.

Premorbid Personality: Little information available. He was fond of school-life, was intelligent, athletic and sociable. He joined the Regular Army before the war.

Duration: a. since 1942.
b. same period
c. from 1942 to present.

Diagnosis: Paranoid Schizophrenia.

Treatment: E.C.T., 23, 1944 with little change.

Pre-operative State: He was vividly hallucinated. He had many delusions of persecution of which he constantly complained and he was frequently irritable and abusive. He spent hours writing about his "case" but could attend classes and take part in games.

Operation: 8.11.45. Coronal Cut.

Complications: Nil.

Progress: 8.12.45. More sociable and less aggressive and self-centred. He plays games but only occasionally goes to occupational therapy.
15.5.46. After two months as above he became aloof an asocial.. Still suspicious and unfriendly but less actively so than before. Refuses to attend classes.
8.11.46. More amenable and now goes to classes.

Present Condition: He is as deluded and hallucinated as before operation and is vague and inconsequential. His behaviour is quieter and more co-operative and he has parole.

Post-operative Signs: Somnolence. Inertia for several months. Elevation of mood.

Rehabilitation: Occupational and recreational therapy. Social activities. Parole.

Result: Slightly Improved.

CASE 36 Capt. F. B-T. Age 59. Retired Army Officer.

Premorbid Personality: Little information available. A Guards Officer, he was considered to be rather effeminate and he did not get on well with his brother-officers. He did well during World War I but was retired when the army strength was reduced.

Duration: a. about 15 years.
b. Same period
c. 28.9.35 to present.

Diagnosis: Paranoid Schizophrenia.

Treatment: No physical therapy.

Pre-operative State: He had well-systematised delusions of persecution for many years and was possibly hallucinated. He was a most difficult nursing problem, a window-smasher, and successful escapist. He made many attacks on the staff and patients. He was unoccupied except for going for walks, keeping a scrap-book and writing scurrilous letters.

Operation: 11.10.45. Coronal Cut.

Complications: Nil.

Progress: 12.11.45. He has ideas of victimisation and illegal detention but displays less emotional tension. He is sociable and cheerful and attends classes.
11.4.46. Continued improvement, he writes and talks less about his dentention.
10.10.46. He is active and sociable, friendly towards his wife and the staff. Has full parole.

Present Condition: He makes good use of parole. He does not complain spontaneously about being here but when questioned he protests quietly without emotion. He accepts advice to remain here until home conditions are more suitable.

Post-operative Signs.: Somnolence. An elevation of mood.

Rehabilitation: Occupational therapy. Social activities. Parole.

Result: Much Improved.

CASE 37 Mr. E.C. Age 36 Salesman.

Premorbid Personality: Little information available. As a youth he suffered from emotional instability.for which he received analytical treatment.

Duration: a. from 1941
b. same period.
c. same period.

Diagnosis: Schizophrenia, hebephrenic.

Treatment: E.C.T., 1941 with improvement. Insulin, 28 comas, 1943 with no improvement. E.C.T., 23, 1945 with slight improvement.

Pre-operative State: In spite of auditory hallucinations and ideas of reference his mood was for the most part flat: occasionally his behaviour was violent and destructive. He was brought to a good level prior to operation by E.C.T. and was then able to attend classes.

Operation: 30.7.45. Coronal Cut.

Complications: Nil.

Progress: 30.8.45. At first very restless, then quieter but elated and at times irritable. At present he shouts back to the 'voices'.

30.1.46. Behaviour improved until 2 weeks ago when he again became tense and destructive. E.C.T. started.

30.7.46. He is idle and uncooperative, at times irritable and impulsive, not obviously hallucinated.

Present Condition: Little change since above notes. He is probably hallucinated and is still fatuous. The violent outbursts have been replaced by transient irritability. He swims and walks but is otherwise idle. He requires supervision for personal cleanliness.

Post-operative Signs: Restlessness. Noisiness. Elation. Irritability. An elevation of mood. More inertia than before operation.

Rehabilitation: Occupational and recreational therapy. Social activities. Holiday. E.C.T.

Result: Slightly Improved.

CASE 38. Major J.C. Age 32. Army Officer.

Premorbid Personality: He was a shy, timid and solitary youth. Above average scholastically he acquired some competence at games but made few friends. His service record was good.

Duration: a. since I942. b. same period. c. from I943.

Diagnosis: Schizophrenia, hebephrenic.

Treatment: E.C.T., I943, with improvement. Insulin, 50 comas, I945 - 46, no change.

Pre-Operative State: Thought disorder was apparent, and hypochondriacal delusions and auditory hallucinations were marked. He retained some insight and was willing to co-operate. He occasionally went to classes.

Operation: 28.3.46. Horizontal Cut.

Complications: Nil.

Progress: 28.4.46. - he is quiet, asocial, irritable at times. He is less restless and his hypochondriasis is less marked.
28.9.46. - little change. He is doing farm-work.

Present Condition: He hears both male and female 'voices' but is not interested in them. He is less concerned about his 'tummy'. He is still mannerestic and withdrawn although co-operative and amenable.

Post-Operative Signs: Irritability. An elevation of mood.

Rehabilitation: Occupational and recreational therapy. Farm-work. Parole.

Result: Improved.

CASE 39 Mr. W.C. Age 39. Labourer.

Premorbid Personality: No information.

Duration: a. from 1935.
b. same period.
c. in 1935. from 1937 to present.

Diagnosis: Schizophrenia, catatonic.

Treatment; E.C.T., 13, 1942, with no improvement.

Pre-operative State: He was almost inaccessible, with thought-blocking, incoherence and incongruous affect. He mis-identified those around him. He had a long history of impulsive outbursts when he smashed windows in obedience to the voices. Latterly he required heavy sedation.

Operation: 8.9.43. Coronal Cut.

Complications: Nil.

Progress: 3.10.43. He is pleasant and quiet, and pays little attention to 'voices' which still talk about windows.
4.3.44. He is working in the gardens under supervision.
8.9.44. Working in the ward. There has been no window-smashing or other impulsive behaviour.
8.9.45. Continues as above.
8.9.46. No change.

Present Condition: He remains hallucinated but without distress or impulsive behaviour. He is more coherent and accessible than before operation. Generally pleasant and co-operative he can be irritable when crossed.

Post-operative Signs: Elevation of mood.

Rehabilitation: Ward-work. Gardening.

Result: Improved.

CASE 40. Mr. F.H.C. Age 54. Company Director.

Premorbid Personality: An able and energetic business man he was a director of an engineering firm for many years. Primary lesion in 1916 with inadequate treatment. There was a sudden onset of mental symptoms just prior to admission.

Duration: a. since 1941
b. same period
c. since 1941 with 2 short breaks.

Diagnosis: General Paresis.

Treatment: Malaria, 1941 and 1944. Arsenicals, 1942 and 1943. Inductotherm, 1942.

Pre-operative State: He was well-groomed, pleasant and sociable. but was frequently tormented by vivid hallucinations and at such times became aggressive and noisy. He had grandiose delusions.

Operation: ;4.9.44. Coronal Cut.

Complications: Nil.

Progress: 12.10.44. Quiet and pleasant, no hallucinations, some inertia.
14.3.45. Still placid, more active now. His delusions persist.
14.9.45. Hallucinations recurred in May, the patient was at times mildly agitated.
14.9.46. No material change.

Present Condition: He is only occasionally hallucinated and then with much less affect. His grandiose ideas remain in the background. He is disinclined to work but attends amusements. Recently a deterioration in toilet habits responded to electroplexy.

Post-operative Signs: Restlessness. An elevation of mood.

Rehabilitation: Occupational and recreational therapy. Social activities. E.C.T.

Result: Slightly Improved.

CASE 41. Mr. W. S. C. Age 43. Sugar Planter.

Premorbid Personality: He was a good scholar and cheerful and sociable. In Jamaica at 19 he appears to have had little stability. He wasted chances, led a fast life and contracted venereal disease. The latter appears to have precipitated his psychosis.

Duration: a. 16 years.
b. 16 years.
c. 27.4.33 to 31.7.33.
16.4.36 to present.

Diagnosis: Schizophrenia, hebephrenic.

Treatment: E.C.T., 26, 1941 - 43, with transient improvement.

Pre-operative State: He was untidy and slovenly, hoarding rubbish and occasionally faulty in toilet habits. He occasionally referred to the past in an incoherent and disconnected way. He was hallucinated at times. Usually quiet and self-absorbed he was subject to excited and noisy spells of behaviour.

Operation: 20.1.44. Coronal Cut.

Complications: Meningeal irritation.

Progress: 20.2.44. He is tidy in appearance; conversation is more coherent.
20.7.44. After a period of irritability he is now more settled, is well-behaved and working well.
24.1.45. Irritable and aggressive behaviour cleared up with E.C.T. Still occasionally incontinent
2.41.46. Occasional disturbed behaviour.

Present Condition: He is emotionally blunted and his thought-content is barren. At times mildly hallucinated he is less impulsive now. He lacks application and does only an occasional day's work.

Post-operative Signs. Confusion. Restlessness. Irritability. Elevation of mood. Inertia.

Rehabilitation: Occupational therapy. Carpentry. Gardening E.C.T.

Result: Slightly Improved.

CASE 42. Mr. F.C. Age 43. Clerk.

Premorbid Personality: He showed promise at chool but was never normally affectionate. At 20 he had a nervous breakdown for which he was analysed. At his university he drank heavily, gambled and did no work. He was a failure in the City.

Duration: a. probably 23 years
b. same period
c. 4.6.33 to present.

Diagnosis: Schizophrenia, hebephrenic.

Treatment: E.C.T., 4, 1941 followed by acute excitement.

Pre-operative State: He was graudally deteriorating. Always under tension he muttered and gesticulated in response to auditory hallucinations and was at times noisy. Formerly a good sportsman he was unable to concentrate on any activity for more than a few minutes.

Operation: 25.5.44.

Complications: Respiratory distress following operation.

Progress: 25.6.44. Less distressed but still restless and hallucinated.
25.11.44. Hallucinations are not so vivid. No other change.
25.5.45. No change.
25.5.46. No change, except that he is able to occupy himself a little.

Present Condition: He remains as hallucinated as before operation. He is distressed and at times impulsive and is unable to occupy himself in any way.

Post-operative Signs: Restlessness. Confusion. A transient elevation of mood.

Rehabilitation: Ward-work. Carpentry. Games. E.C.T.

Result: Unchanged.

CASE 43. Mr. R.C. Age 52. Labourer.

Premorbid Personality: An average scholar he later had many jobs but did not persevere with any. He was sociable and with normal interests. He had a quick temper but controlled it.

Duration: a. 3 years.
b. 7 months.
c. Intermittent since 29.6.44.

Diagnosis: Paranoid Schizophrenia.

Treatment: E.C.T., 1944 on 2 occasions with remission, in 1945 without improvement.

Pre-operative State: He was sullen and unco-operative, often very aggressive, restless and suspicious. Delusions of a persecutory nature were very prominent.

Operation: 8.2.45. Coronal Cut.

Complications: Nil.

Progress: 15.3.45. No longer suspicious or deluded. He is euphoric, friendly towards his wife, with only transient irritability. He refuses to occupy himself.
17.5.45. Not irritable now, and has attended classes. He is friendly and co-operative. His wife considers him to be normal. Discharged.
30.5.46. Seen at out-patient clinic. He has been relapsing for the past few months into his previous aggressive and deluded state.
12.9.46. Re-admitted, suspicious, sullen with paranoid delusions and auditory hallucinations.

Present Condition: He has lost his aggression, shows no signs of hallucinations and denies ideas of reference or persecution. He is idle and unco-operative.

Post-operative Signs: Confusion. Restlessness. Irritability. Transient Euphoria. A more lasting elevation of mood and inertia.

Rehabilitation: Occupational therapy. Discharge.

Result: Slightly Improved.

CASE 44. Mr. E.D. Age 40. Chartered Accountant.

Premorbid Personality: He was said to have "retired into himself" in childhood. He was very quiet, never made friends but had a sense of humour. He was intelligent, painstaking, lacking in confidence.

Duration: a. about 13 years.
b. same period.
c. intermittent since 1934.

Diagnosis: Paranoid Schizophrenia.

Treatment: Cardiazol, 20, 1938, with brief improvement. Insulin on 3 occasions, 1940 - 41 with little change. E.C.T., 1[illegible], 1940 - 45, transient improvement.

Pre-operative State: He was auditorilly hallucinated and had ideas of reference, control and guilt. Thought-disorder was apparent. He was slow, solitary and uncooperative, but did good work at occupational therapy.

Operation: 15.3.45. Coronal Cut.

Complications: Nil.

Progress: 15.4.45. His thought content is unaltered. He shows complete lack of initiative.
15.9.45. Little change. He works at occupational therapy but refuses to do clerical work as before.
15.3.46. As above.

Present Condition: He had an impulsive outburst in October. He retains the delusion about his eyesight and admits to self-reproach. Hallucinations are denied. He is reticent and monosyllabic, manneristic and asocial. He refuses to do any work.

Post-operative Signs: Polite reticence. Disinhibited behaviour. Incontinence. Elevation of mood. Persistent inertia.

Rehabilitation: Occupational therapy. Office-work. Social activities. E.C.T.

Result: Worse.

CASE 45. Mr. W.D. Age 34. Motor Engineer.

Premorbid Personality: An only child he was spoiled by an emotional and unstable mother. He was difficult as a schoolboy and ran away at 15. An average scholar he had few outside interests and never played games.

Duration: a. 13 years.
b. same period.
c. Intermittent since 1940.

Diagnosis: Paranoid Schizophrenia.

Treatment: No physical therapy.

Pre-operative State: He was continually tormented by hallucinations and shouted back to the 'voices'. He was terrified of people whom he thought were watching him. He had been idle for many months and had refused sedation, active treatment and classes.

Operation: 10.1.46. Horizontal Cut.

Complications: Nil.

Progress: 10.2.46. His hallucinations do not annoy him as they used to do. The content of thought remains much the same.
10.7.46. He began to pay more attention to hallucinations in March and became more paranoid.
10.1.47. Solitary but occupied in the ward.

Present Condition: He is reclusive but more co-operative. His behaviour is liable to be influenced by hallucinations and delusions but tension is much less and is not constant. He is still occupied.

Post-operative Signs: An elevation of mood.

Rehabilitation: Garage-work. Occupational therapy.

Result: Slightly Improved.

CASE 46. Mr. P.G. Age 28 years. Clerk.

Premorbid Personality: He was a spoiled child but showed no marked neurotic traits. He worked well and was good at games at his public school and university. He took an Honours degree. In his last year at college he became moody and argumentative. He later joined the army and was commissioned.

Duration: a. since I94I. b. same period. c. from I944 to present.

Diagnosis: Paranoid Schizophrenia.

Treatment: E.C.T. I944. E.C.T. and Insulin, I945 with no improvement.

Pre-Operative State: He was hallucinated and deluded and exhibited thought disorder. He refused food and had to be forcibly fed. He was very violently aggressive and impulsive with few intervals of good behaviour.

Operation: 22.5.45. - Coronal Cut.

Complications: Nil.

Progress: 22.6.45. - he is vague perplexed and paralogical. He has not been aggressive. Co-operates well and is attending classes.

25.7.45. - he relapsed today becoming negativistic, refusing food and refusing to go to classes.

22.II.45.- although mildly paranoid he is behaving well. An occasional lapse into negativism, during which he is probably hallucinated, responds well to E.C.T.

22.5.46. - requires E.C.T. more frequently.

Present Condition: There has been no return of aggression but he is paranoid and hypochondriacal. He is less co-operative now and works poorly. He requires E.C.T. more frequently than he did last year and this brings him to a poorer level than then.

Post-Operative Signs: Confusion. Reticence. An elevation of mood.

Rehabilitation: Occupational and recreational therapy. Social activities. E.C.T.

Result: Slightly improved.

CASE 47. Dr. T.G. Age 32 years. Medical Practitioner.

Premorbid Personality: No information.

Duration: a. 9 years. b. 9 years. c. since I939.

Diagnosis: Paranoid Schizophrenia.

Treatment: Triazol,35, I940 with slight improvement.
Insulin, incomplete, I942, no improvement.

Pre-Operative State: He was idle,self-absorbed and suspicious. His auditory hallucinations led to noisy behaviour. He thought his food was poisoned and ate poorly. He picked his face constantly.

Operation: 20.I.44. Coronal Cut.

Complications: Nil.

Progress: 20.2.44. - he is polite, well-behaved and active. He does not appear to be deluded or hallucinated.
20.7.44. - as above but lacks initiative and is now idle.
20.I.45. - in August I944 he again became withdrawn, hostile and hallucinated. He refused food and E.C.T. was started.
20.I.46. - requires 2 or 3 convulsions monthly, otherwise he goes off his food and loses weight.

Present Condition: He requires 2 convulsions at intervals of 2 to 3 weeks. He is then co-operative and able to enjoy amusement. Always idle and asocial. He plays patience and reads papers. At his worst he refuses food, has mild persecutory ideas, is incoherent and hallucinated.

Post-Operative Signs: Confusion. Elevation of mood.

Rehabilitation: Occupational and recreational therapy. Medical work. E.C.T.

Result: Slightly improved.

CASE 48. Mr. G.H. Age 36 years. Journalist.

Premorbid Personality: Little information available. He spent a normal, happy childhood. There appears to have been a lack of drive and purpose later. He gave up law studies for journalism. After several years in the latter occupation he gave this up too.

Duration: a. at least I0 years. b. same period. c. I2.6.37 to present.

Diagnosis: Schizophrenia, catatonic.

Treatment: Prolonged narcosis, I937, brief improvement. Cardiazol, I0, I937 - 38, no change. I939-40 no change.

Pre-Operative State: For years he had required a special nurse. He made many suicidal attempts, impulsive attacks and constantly tried to escape. He had ideas of reference, paranoid delusions and auditory hallucinations. He became quieter in April I942 and was only occasionally impulsive. The following month he became mute and answered only by gestures.

Operation: I0.2.43.

Complications: Nil.

Progress: I7.3.43. - he speaks now but still tends to be mute. There have been one or two impulsive episodes but on the whole he is friendly.

I0.8.43. - He improved after 6 E.C.T. for a brief period but is now mute, manneristic and probably hallucinated.

I0.2.44. - after 2 disturbed periods he is again mute and negativistic.

I8.2.45. - silent, with occasional noisiness. He does crude work at occupational therapy.

I0.2.46. - little change.

Present Condition: He is silent most of the time with occasional episodes of shouting and excitability. He is unoccupied but goes for walks and attends amusements. He sleeps without sedation and is generally less of a nursing problem.

Post-Operative Signs: Restlessness. Decrease of tension. Increased inertia.

Rehabilitation: Occupational therapy. Social activities. Ward-work. Benzedrine. E.C.T.

Result: Slightly improved.

CASE 49. Mr. B.T. Age 38 years. Pioneer Corps.

Premorbid Personality: He was below average intelligence but did fairly well at school and in various labouring jobs thereafter. He played games, had many friends but was not interested in the opposite sex. He served happily in a Pioneer Company overseas.

Duration: a. since June I944. b. same period. c. from July I944.

Diagnosis: Schizophrenia, hebephrenic.

Treatment: E.C.T. I944 with slight improvement, I945 with no change. Insulin, 46 comas, I945, no change.

Pre-Operative State: He was friendly and amenable, empty and unproductive. Stereotypy of answers and grimacing were prominent. He admitted to hallucinations and these were becoming more marked.

Operation: 2I.II.45. Horizontal Cut.

Complications: Nil.

Progress: I6.I2.45. - he is facile and cheerful. Hallucinations are not apparent. He works in the ward.
20.5.46. - his 'voices' reappeared in February and he is occasionally angry and was more aggressive because of them. He made little progress at occupational therapy, now working in the ward.

2I.II.46. - he is working well out-of-doors. Still hallucinated.

Present Condition: He is fatuous, cheerful and well-behaved. There is no evidence of hallucinations now. He works well in the gardens, attends all amusements and has recently been at home on pass.

Post-Operative Signs: Euphoria.

Rehabilitation: Occupational therapy. Ward-work. Gardening, Holiday.

Result: Improved.

CASE 51 Mr. K.K. Age 34. Student.

Premorbid Personality: He was brought up by his grand-parents who were over-indulgent. He did well at prep. school but was unhappy and out of his element at his public school. He lost confidence and became depressed. He broke down after a year at college.

Duration: a. 16 years.
b. 16 years.
c. intermittently since 1932.

Diagnosis: Paranoid Schizophrenia.

Treatment: No physical treatment.

Pre-operative State: He was auditorilly hallucinated and had ideas of reference. He frequently talked of suicide and and complained of incestuous dreams and vague aches and pains. He was antagonistic towards his family. At times he worked on the farm but lacked application.

Operation: 28.2.46. Horizontal Cut.

Complications; Nil.

Progress: 12.3.46. He is happy and contented. The 'voices' are not so troublesome and he has had no distressing dreams.
15.4.46. Calm and composed, working well.
30.5.46. Discharged, active, sociable and optimistic about the future.
25.9.46. Readmitted. At home he had shown little initiative and been aggressive towards his parents.

Present Condition: At times he is depressed and agitated, but is more generally placid even when occasionally hallucinated. He complains of suicidal thoughts and a pain the knee with an equal amount of affect. He was not upset by news of his brother's suicide. He takes part in all activities with little drive and talks vaguely of farming in the future.

Post-operative Signs: A decrease of tension. Increased inertia.

Rehabilitation: Occupational and recreational therapy. Farm-work. Social activities. A period at home.

Result: Improved.

CASE 50. Col. T.J. Age 4I. Army Officer.

Premorbid Personality: He manifested no early neurotic traits. He joined the Army in the ranks, obtained a commission and rose to a senior staff post. He saw a considerable amount of action. He was subjected to overwork and domestic stress before his breakdown. He was described as keen, conscientious and ambitious.

Duration: a. since October I944. b. since May I945. from I944 onwards.

Diagnosis: Paranoid Schizophrenia.

Treatment: Prolonged narcosis. E.C.T. I944, with a good remission. Insulin (2 courses) and E.C.T. I945 with little improvement.

Pre-Operative State: Superficially he was well-preserved but considerable thought-disorder was present. He was liable to impulsive outbursts in response to auditory hallucinations. E.C.T. had a very fleeting effect. 2 weeks before operation he jumped through a window in an attempt to escape.

Operation: 7.3.46. Horizontal Cut.

Complications: Nil.

Progress: 7.4.46. - well-behaved, rational in conversation, facile and simple in manner. At occupational therapy.
7.7.46. - he is relapsing,and is now tense, hallucinated and suspicious.
3.9.46. - he is pleasant and amenable with maintenance E.C.T., but writes bizarre letters and shows a loss of self-criticism.

Present Condition: As above. He requires a short course of electroplexy every 2 months. He has rather grandiose ideas. His memory is faulty and his appearance untidy. He works well at classes and enjoys amusements. Periodically he is tense, hallucinated and disturbed.

Post-Operative Signs: An elevation of mood. Diminished self-criticism.

Rehabilitation: Occupational and recreational therapy. Social activities. Parole. E.C.T.

Result: Unchanged.

CASE 52 Mr. J.K. Age 25. Commercial Student.

Premorbid Personality: He was above average as a scholar and had a good work-record. He was reserved and diffident: liked company but had few friends. He had "nervous breakdowns" at $13\frac{1}{2}$ and $16\frac{1}{2}$.

Duration: a. since 1935.
b. 3 years.
c. intermittently since 1935.

Diagnosis: Schizophrenia, catatonic.

Treatment: E.C.T., 1942 - 43, with good remission; 1944 with improvement.

Pre-operative State: After improving almost to normality he relapsed completely into a state of catatonic excitement. He had marked thought-blocking and incoherence, was vividly hallucinated, and made many violent attacks on those around him.

Operation: 19.10.44. Coronal Cut.

Complications: Nil.

Progress: 19.11.44. Behaving practically normally and taking part in all activities.
19.2.45. Discharged. Quiet and pleasant, with little initiative but responding to encouragement. Retains some masturbation-guilt.
24.10.46. Readmitted with a relapse of 6 weeks' duration. In this he became suspicious and hallucinated.

Present Condition: He improved after electroplexy and now denies ideas of reference and auditory hallucinations. He is cheerful but lacks initiative. His appearance is slovenly and he does little at classes except pay attention to female patients.

Post-operative Signs: Restlessness. Uninhibited speech. Euphoria Diminished self-consciousness and self-criticism.

Rehabilitation: Occupational and recreational therapy. Carpentry. Social Activities. Period at home E.C.T.

Result: Much Improved.

CASE 53 Mr. J.L. Age 38. Student.

Premorbid Personality: Not much is known of his early days. He was quiet, reserved and over-sensitive. He was thought to have studied too hard for his examinations and after failing he became tense, irritable and moody.

Duration: a. 12 years.
b. 12 years.
c. 25.9.35. to present.

Diagnosis: Schizophrenia, hebephrenic.

Treatment: Cardiazol, 1938. E.C.T., 1942 with no improvement.

Pre-operative State: He was hallucinated, incoherent and inaccessible. Fatuous giggling, grimacing and echolalia were prominent. He was unco-operative and destructive.

Operation: 9.12.43. Coronal Cut.

Complications: Nil.

Progress: 9.1.44. Very little change.
10.6.44. He began tearing clothes again in February and his restless behaviour was not improved by E.C.T.
9.12.44. Unchanged.
9.12.45. Sedation continues. He is hallucinated and at times noisy.

Present Condition: Exactly as before operation.

Post-operative Signs: Major epileptiform fits, 6.10.46 and 17.10.46.

Rehabilitation: E.C.T.

Result: Unchanged.

CASE 54 Mr. T.M. Age 43. Butcher.

Premorbid Personality: He showed no early neurotic traits. He did well at school and was a conscientious worker thereafter. He was quiet, kindly, reserved, with few friends and no interest in women.

Duration: a. since 1931.
b. same period.
c. intermittently from 1932.

Diagnosis: Schizophrenia, catatonic.

Treatment: E.C.T., 90, 1942 - 45 with transient improvement.

Pre-operative State: He was a period catatonic. Every few weeks he became stuporose, confused, restless and inaccessible. Unless cut short by E.C.T. this state lasted for many weeks. Between attacks he was vague and lacking in insight and with considerable thought-disorder. He was able to work in the ward and go for walks.

Operation: 6.12.45. Horizontal Cut.

Complications: Post-operative vomiting.

Progress: 6.1.46. He talks rationally but superficially. He mentioned going home - the first reference to this subject.
6.4.46. The periodicity has disappeared. For a few months he was unco-operative and refused to work or go for walks. He does both now and is amenable.
6.12.46. He is friendly and co-operative and has parole.

Present Condition: He is quiet and pleasant. There is no spontaneity of speech and little initiative. He is content to wander about the ward.

Post-operative Signs: Irritability. Increase of inertia. Disappearance of periodicity.

Result: Slightly improved.

CASE 55 Mr. J.M. Age 37. Clerk.

Premorbid personality: He was a happy child who passed the early milestones with some precocity. He was an average scholar, not athletic, fond of music and drama, and had a cheerful easy-going disposition.

Duration: a. since 1930.
b. since 1932.
c. since 1932 with one break of a year.

Diagnosis: Schizophrenia, catatonic.

Treatment: Prolonged Narcosis, 1938, no change. Cardiazol, 1938 with transient improvement. E.C.T., 24, 1941 with transient improvement; 25, 1943, no change.

Pre-operative State: He was slovenly and faulty in habits. His thought content was barren and his speech monosyllabic. He grimaced and postured. At times he was hallucinated and his behaviour was then impulsive. He attended occupational and recreational therapy.

Operation: 6.1.44. Coronal Cut.

Complications: Nil.

Progress: 6.2.44. The same features are present; he attends classes.
6.7.44. He is apathetic, deluded and still faulty in habits.
5.1.45. His noisy and impulsive phases respond to E.C.T.
6.1.46. He is not aggressive but remains hallucinated and is now idle.

Present Condition: He is less aggressive than before and is now idle. He has developed post-operative epilepsy. There is no other change.

Post-operative Signs: Confusion. An elevation of mood. Increase in inertia. Epileptiform convulsions, 18.7.46. 10.8.46. 11.9.46. 22.9.46. 5.10.46. 6.1.47.

Rehabilitation: Occupation and recreational therapy. E.C.T.

Result: Worse.

CASE 56 Mr. W.N. Age 54. Tobacco Manufacturer.

Premorbid Personality: He was described as pleasant, lively easy-going and sociable. He had a good war and work record.

Duration: a. 10 years.
b. 10 years.
c. intermittently since 1939.

Diagnosis: Involutional Melamcholia.

Treatment: Modified insulin, 1940, with little change. Convulsive treatment, 1940 discontinued because of fractured femur.

Pre-operative State: He had previously made several suicidal attempts. He was completely self-centred and constantly grumbled about many bodily sensations. Nihilistic delusions were prominent. He was abusive and argumentative and generally unco-operative. His personal habits were faulty.

Operation: 29.5.45. Coronal Cut.

Complications: Nil.

Progress: 16.6.45. He is quiet, idle has lost the sensations which troubled him and his habits have improved.
12.10.45. Discharged. He has mentioned various paraesthesiae without any anxiety. He is sociable and active.
16.8.46. Readmitted. At home he was outspoken and inconsiderate, neglected his business and showed a tendency to hypochondriasis. He mentioned irritability overy trifles and quarrels with strangers who annoyed him.

Present Condition: He is pleasant as long as he gets his own way; contented in his own routine, grumbles if stimulated. He tends to miss classes. He is meticulously tidy. Extravagant in small things. Critical and inconsiderate of his sister. He makes no move towards returning home.

Post-operative Signs: Restlessness. Irritability. Tactlessness. An elevation of mood. Lack of initiative. Decreased self-consciousness.

Rehabilitation: Occupational therapy. Social activities. Period at home.

Result: Much Improved.

CASE 57 Mr. A.P. Age 34. Solicitor.

Premorbid Personality: He was a nervous and delicate child who developed late. His scholastic record was excellent but he was moody and did not fit in to public-school life. At university he did well until his final law examination which he failed several times. Introverted and asocial traits became more pronounced.

Duration: a. from 1934.
b. same period
c. from 1937 to present.

Diagnosis: Schizophrenia, catatonic.

Treatment: Insulin, 1937, 1938, 1939 and 1941 with improvement on each occasion. E.C.T., 1942, no change.

Pre-operative State: For years he was subject to violent outbursts and he had made several escapes. Latterly he was generally cheerful and co-operative but could be sullen and aggressive and at times noisy and violent. His 'voices' were usually pleasant ones. Delusions were less marked than previously.

Operation: 12.7.45. Coronal Cut.

Complications: Post-operative vomiting.

Progress: 12.8.45. He thinks things seem "more natural". He is behaving well and is less inclined to be moody
12.1.46. Less aggressive now, he is fully occupied.
12.7.46. He broke parole twice recently and is now in a closed ward.

Present Condition: His condition is fluctuating. At times he is aggressive and refuses food. After a few E.C.T. he attends classes and amusements and can have parole. The good phase has lasted for several weeks. He denies hallucinations.

Post-operative Signs: Restlessness. Irritability. Transient inertia. An elevation of mood. Epileptiform convulsions, April, 1946.

Rehabilitation: Occupational and recreational therapy. Carpentry Parole. Holidays, E.C.T.

Result: Slightly Improved.

CASE 58 Mr. J.P. Age 31. Cashier.

Premorbid Personality: No early neurotic traits are reported. He was popular at school, good at games, not a very good scholar. He joined the Territorial Army, was at Dunkirk, and became an officer cadet. a/He was said to be generous, open and frank and to have keen sense of humour. He had little interest in the opposite sex; did not smoke or drink.

Duration: a. Since 1941
b. same period
c. Since 1941.

Diagnosis: Paranoid Schizophrenia.

Treatment: E.C.T., 1944, with improvement; 1945 no change.

Pre-operative State: He was hallucinated and had bizarre delusions of victimisation and ideas of reference. His mood was at times mildly elated, at times agitated. He repeatedly refused treatment and insulin coma therapy could not be given because of his noisy and resistive behaviour. He worked at occupational therapy from time to time.

Operation: 19.7.45. Coronal Cut.

Complications: Nil.

Progress: 15.8.45. Behaving quietly but still hallucinated and persecuted.
19.1.46. He is less vividly hallucinated and less paranoid. Although asocial he is tidy, active and well-behaved.
5.4.46. Extremely hallucinated. His 'voices' say he is to be crucified, and the female patients at classes slander him.

Present Condition: His hallucinations and delusions have been attenuated and their emotional component is modified. He is polite, pleasant and mildly euphoric as before operation. His personality is still fairly well-integrated. He attends amusements but refuses to occupy himself.

Post-operative Signs: A phase of homosexual behaviour. A decrease of tension. Increase of inertia.

Rehabilitation: Occupational and recreational therapy. Social activities.

Result: Slightly improved.

CASE 59 Mr. N.R. Age 37. Clerk.

Premorbid Personality: He was a good mixer at school, good at games and organising although below average scholastically. He did poorly at university and after trying various jobs unsuccessfully hejoined the R.A.F. He was in action in the Middle East; later broke down at OCTU.

Duration: a. since early 1942
b. same period
c. intermittently since 1942.

Diagnosis: Paranoid Schizophrenia (with epilepsy)

Treatment: Insulin, 1944 with improvement. Anti-convulsive drugs since 1944.

Pre-operative State: He was hallucinated and had many grandiose delusions. His mood was at times flat and incongruous, but latterly a hostile attitude with aggressive behaviour and violent episodes became more frequent.

Operation: 8.11.45. Coronal Cut.

Complications: Nil.

Progress: 8.12.45. Since a violent outburst on 11.1145. he has been elated, friendly, not hallucinated, attending classes.
5.5.46. He is amenable but readily provoked. He is less hallucinated. The delusions persist. Parole granted.
25.10.46. Discharged after a successful holiday at home. There have been no epileptic seizures since operation.
7.1.47. Readmitted. He is reported as being irritable, difficult and argumentative at home.

Present Condition: He is amenable and socialble although still hallucinated and grandiose. He is garrulous and circumstantial in speech, complacent in mood. He states that he feels more incisive, more sure of himself, since the operation. He has parole and works well at carpentry.

Post-operative Signs: Transient euphoria. A lesser elevation of mood. Irritability

Rehabilitation: Occupational and recreational therapy. Social activities. Period at home. Parole. Carpentry.

Result: Much improved.

CASE 60 Mr. J.R. Age 60. Gardener.

Premorbid Personality: No information.

Duration: a. 24 years.
b. 9½ years.
c. for 4 periods since 1923.

Diagnosis: Paranoid Schizophrenia.

Treatment: E.C.T. I942, transient improvement.

Pre-operative State: He had delusions of his wife's infidelity for many years and for the past 2 years he was hallucinated. He was tense, suspicious and distressed by his detention. He refused to occupy himself.

Operation: 28.10.43. Coronal Cut.

Complications: Nil.

Progress: 28.11.43. He is less aggressive and is not obviously hallucinated. He seldom demands to go home.
27.4.44. His hallucinations, delusions and aggression returned in January. He improved after E.C.T. and was tried out at home, unsuccessfully.
28.12.44. He is hallucinated, deluded and idle. At times he is aggressive, at times cheerful.
3.12.45. No change.
28.12.46. Less aggressive, otherwise unchanged.

Present Condition: He remains hallucinated and his delusional system is intact. He is less aggressive than formerly but still refuses to work.

Post-operative Signs: Disinhibited behaviour. An elevation of mood.

Rehabilitation: Gardening. Holiday E.C.T.

Result: Slightly Improved.

CASE 61. Dr. E.R. Age 60. Medical Practitioner.

Premorbid Personality: He was the youngest of the family and his father's pet. A brilliant scholar he was studious and persevering and did well at university. He was a successful and popular general practitioner.

Duration: a. since 1942.
b. same period
c. 6.4.45 to present.

Diagnosis: Epilepsy.

Treatment: Anticonvulsant drugs for many years.

Pre-operative State: He had no real insight into his illness, and entertained grandiose delusions and excessive religious zeal. He was at times euphoric but more often agitated. He was petulant and aggressive and sometimes so violent as to be difficult to control. His memory and intellect were impaired.

Operation: 19.7.45. Coronal Cut.

Complications: Nil.

Progress: 18.8.45. Confusion lasted longer than is usual, he is still partially disorientated. He is amenable and polite.

10.1.46. He became resistive and violent on 27.10.45. He constantly asks to go home and is religiose and generally unco-operative. He has several seizures most months.

19.7.46. He is quiet and well-behaved and is easily dissuaded from leaving.

Present Condition: He is now more settled after 3 violent outbursts during which he attacked the staff and patients. He exhibits no grandiose ideas and his interest in religion is less. He reads and plays patience and has parole when fit.

Post-operative Signs: Restlessness. Confusion. Incontinence. An elevation of mood.

Rehabilitation: Occupational therapy. Social activities. Parole

Result: Slightly Improved.

CASE 62. Mr. R.S. Age 31. Law Student.

Premorbid Personality: An Honours graduate he had a rigid, ambitious and perfectionist personality. He was always serious and well-behaved, had few friends and no emotional strong attachments.

Duration: a. 9 years.
b. 5 years.
c. intermittently since origin.

Diagnosis: Schizophrenia, catatonic.

Treatment: Cardiazol, 15, 1940, with considerable improvement.
E.C.T., 20, 1942 with brief improvement.
Modified insulin and E.C.T., 1946 no change.

Pre-operative State: For years his condition had varied between excitement and stupor. He was noisy and violent during the course of modified insulin treatment. Prior to operation he was restless, voluble and incoherent. His mood was elated but with no infectious gaiety.

Operation: 25.4.46. Horizontal Cut.

Complications: Nil.

Progress: 22.5.46. He was restless, confused and uncooperative, earlier in the month. He is now quieter although occasionally restless and negativistic.
1.11.46. Incoherence and thought-blocking are marked. He requires supervision and stimulation for every activity.

Present Condition: He is still fatuous, dissociated and incoherent. There has been a change in behaviour. He is quieter, less restless and less talkative, and no longer accosts everyone within reach. He is slovenly and unable to take part in any sustained activity.

Post-operative Signs: Restlessness. Confusion. A decrease of tension. Increase of inertia.

Rehabilitation: Occupational and recreational therapy. Benzedrine. E.C.T.

Result: Slightly Improved.

CASE 63. Mr. A.T. Age 27. Art Student.

Premorbid Personality: He was a dreamy, romantic child who became something of an 'infant prodigy' as an artist. He was a good scholar, had a kindly nature but did not mix easily with his fellows. At about 15 he became more detached and self-absorbed. He lost his zest and appeared to be unhappy.

Duration: a. at least 9 years.
b. same period
c. 15.7.40 to present.

Diagnosis: Schizophrenia, hebephrenic.

Treatment: E.C.T., 10, with little change. Insulin, 56 comas 1940 - 41 with improvement in behaviour. E.C.T. 6, 1942 little change.

Pre-operative State: He was hallucinated, autistic, irrational and incoherent. He had changing delusions which at different periods were paranoid and then hypochondriacal His mood was incongruous. Just before operation he was idle and negativistic and had frequent spells of violence. He masturbated openly.

Operation: 25.7.43. Coronal Cut.

Complications: Nil.

Progress: 24.8.43. He is slightly more alert, more rational in speech and less erratic in behaviour
25.1.44. He is quiet, asocial and shallow. Working well at classes.
25.7.44. Still impulsive but less so than before operation.
25.7.45. Becoming less active.
25.7.46. He is idle and apathetic. At times hallucinated but less aggressive. Occupational therapy was stopped to-day as he continually wandered among the women patients.

Present Condition: As reported above. He lounges about without interest in anything, and only with much coaxing will he do work in the ward. He has become more slovenly in habits and still masturbates.

Post-operative Signs: A decrease in tension. Decreased initiative.

Rehabilitation: Occupational and recreational therapy. Social activities. Parole. E.C.T.

Result: Slightly improved.

CASE 64. Mr. E.V. Age 28 years. Medical Student.

Premorbid Personality: He was described as a normal, healthy and intelligent boy of fine character, steady nerves and equable temper.

Duration: a. since I938. b. since I940. c. intermittently since I938.

Diagnosis: Schizophrenia, catatonic.

Treatment: Insulin, I938 with remission; I94I with improvement. Cardiazol, I94I, no change. E.C.T. I942, no change.

Pre-Operative State: He was hallucinated and at times inaccessible. He stood about in catatonic postures. He was becoming increasingly negativistic and more frequently violent, striking out and smashing.

Operation: 2I.2.43. Coronal Cut.

Complications: Respiratory embarrassment after operation.

Progress: 22.3.43. - his behaviour and mental state are unchanged. He attends classes.
22.8.44. - after a brief improvement he became manneristic and impulsive on I4.5.43. He is better after E.C.T. but still apathetic and withdrawn.
22.2.44. - as above after a short violent phase in October.
26.2.45. - pleasant and co-operative, resting quietly in bed because of suspected tuberculosis.
I7.2.46. - he is solitary, mute and idle.

Present Condition: There has been no violent episode since I944. He lacks spontaneity in speech. His replies to questions are rational although limited in scope. He is untidy, does no work and dislikes taking exercise.

Post-Operative Signs: Restlessness. An elevation of mood. Increased inertia.

Rehabilitation: Occupational and recreational therapy. Gardening. Carpentry. Benzedrine. E.C.T.

Result: Slightly improved.

CASE 65. Mr. H.W. Age 34 years. Unoccupied.

Premorbid Personality: He was a normal, healthy child till he suffered an injury to an eye. He then became backward and developed inferiority feelings. He later became preoccupied with religious matters.

Duration: a. since March I93I. b. same period. c. 5.I.32. to present.

Diagnosis: Schizophrenia, hebephrenic.

Treatment: Cardiazol, I4, I938, with temporary improvement.

Pre-Operative State: Every 2 or 3 months for about a week he appeared to be less deteriorated than at other times. He then played games, attended classes, played the gramophone and did jig-saw puzzles. Otherwise he was apparently hallucinated, self-absorbed, incoherent, idle and faulty in habits. He was never aggressive.

Operation: I4.9.44. Coronal Cut.

Complications: Nil.

Progress: I9.I0.44. - he mutters incoherently, smiles inanely, requires supervision.
I2.3.45. - after I0 E.C.T. he remains inaccessible, slovenly and idle.
I4.9.45. - there is little change. He is hallucinated at times.
I0.9.46. - he is inaccessible and idle, occasionally incontinent.

Present Condition: There is little change from the condition noted above. He is abviously hallucinated and is unable to occupy himself in any way. The periodicity has disappeared and with it the brief phases of relative remission.

Post-Operative Signs: Restlessness. Increased inertia.

Rehabilitation: Occupational therapy. Carpentry. E.C.T.

Result: Worse.

CASE 66. Mr. E.W. Age 36 years. Law Student.

Premorbid Personality: He was an only child, healthy, athletic and a good scholar. He did well at his school and university.

Duration: a. since I932. b. same period. c. from I939 intermittently.

Diagnosis: Paranoid Schizophrenia.

Treatment: Insulin, I939, with remission; I942, no change.
E.C.T. IO, I945, with slight improvement.

Pre-Operative State: He had many grandiose delusions and ideas of reference. He was rambling in speech and his mood was generally flat. Occasionally when receiving attention he was violent and resistive.

Operation: 25.IO.45. Coronal Cut.

Complications: Nil.

Progress: 20.II.45. - his delusions are not mentioned spontaneously but they appear on questioning.
28.4.46. - he is consistently quiet and well-behaved, otherwise unchanged.
IO.IO.46. - he is more sociable and active. He voices his delusions less than before.

Present Condition: He is well- behaved and co-operative. He asked to be allowed to do wood-work. His delusions have faded into the background.

Post-Operative Signs: Disinhibited behaviour. An elevation of mood.

Rehabilitation: Occupational and recreational therapy. Carpentry. Social activities.

Result: Slightly improved.

CASE 67. Mr. T.W. Age 33. Draughtsman.

Premorbid Personality: Little is known but he was said to have lacked initiative and self-confidence all his life.

Duration: a. at least I2 years. b. same period. c. 3.5.35 to present.

Diagnosis: Schizophrenia, hebephrenic.

Treatment: Cardiazol, I7. I938, with slight improvement. Insulin, I940, no change. E.C.T. I6, I942, with slight improvement.

Pre-Operative State: He was manneristic, inaccessible, destructive and dirty in habits. After electroplexy he became brighter and more co-operative; his habits improved and he was able to do simple work. Prior to operation he had begun to relapse.

Operation: I0.2.43. Coronal Cut.

Complications: Post-operative vomiting.

Progress: I0.3.43. - he shows more spontaneity and is occupied with reading, classes and games.
7.8.43. - he is now clean and tidy, more accessible.
I0.2.44. - he says little but is in touch with his environment. At times irritable. Occasionally incontinent. He has been destructive since October.
3.I.45. - no change.
I0.2.46. - after a spell of idleness he is now at occupational therapy regularly.

Present Condition: He continues to work but not very well. He reads the paper and attends gym. His speech is rational although lacking in spontaneity and limited in ideation. He is still destructive of clothing although less so than before. Irritability is still present.

Post-Operative Signs: Restlessness. Irritability. An elevation of mood.

Rehabilitation: Occupational and recreational therapy. Ward-work. Gardening. Benzedrine. E.C.T.

Result: Improved.

CASE 68. Capt. A.W. Age 36. Army Officer.

Premorbid Personality: He was an active and social boy who became a bookish and extravagent youth. He did well in the army for 4 years and then got into debt.

Duration: a. since I938. b. same period. c. since I940.

Diagnosis: Schizophrenia, catatonic.

Treatment: Cardiazol, I3, with transient improvement. Insulin, 58 comas, I942, no change. E.C.T. I9, I943, no change. Prefrontal leucotomy, 25.7.43, Coronal Cut, with no improvement.

Pre-Operative State: At his best he was vague, inconsequential, hallucinated and deluded. He was cheerfully restless and fatuous. Periodically he became manneristic, aggressive and assaultive.

Operation: 30.7. 45. Coronal Cut repeated.

Complications: Nil.

Progress: 30.8.45. - he remains idle and hallucinated, occasionally unco-operative.
30.2.46. - he improved in October and is now more sociable and co-operative. Periodically he is aggressive but only in speech.
30.7.46. - in the ward he is fatuous, manneristic and idle. His mother finds him more considerate and interested in others.

Present Condition: He still talks and laughs to himself and is idle. He does not strike out now.

Post-Operative Signs: Confusion. A decrease of tension.

Rehabilitation: Occupational and recreational therapy.

Result: Slightly improved.

CASE A. Mrs. K.B. Age 32. Housewife.

Premorbid Personality: She was carefree, sociable and capable; had a satisfactory work-record and was a good wife and mother. She had always been particular about personal cleanliness.

Duration: a. 5 years. b. 5 years. c. 3 periods since I946.

Diagnosis: Obsessional Neurosis.

Treatment: Narco-analysis, I945, no change. E.C.T. I4, I946, with transient improvement. Psychotherapy, I946, with transient improvement.

Pre-Operative State: Normal home-life had been impossible for about 3 years on account of her fear of contammination and washing compulsion. She had full insight. Much anxiety accompanied her rituals and depression followed their accomplishment. In hospital she was slightly less tense and the compulsions were not so marked.

Operation: 23.I.47. Coronal Cut.

Complications: Meningitis.

Progress: 23.2.47. - she is slightly euphoric. Obsessive thoughts have lost their emotional charge and can be pushed aside.

Present Condition: Still euphoric and completely lacking in tension. She is content with a day-to-day existence. She is active but slow and inaccurate in her work. Her obsessive thoughts are further in the background.

Post-Operative Signs: Euphoria. Slight inertia. Tactlessness. Lack of emotional appreciation of the future.

Rehabilitation: Occupational and recreational therapy. Social activities. Relaxation classes. Parole.

CASE B. Miss J.M. Age 35. Artist.

Premorbid Personality: She was an only child. At school she was good at art but neglected other subjects. She was particular in her choice of friends but quite a good mixer. She was over-conscientious in most things, obstinate and self-willed, keenly interested in religion.

Duration: a.I7 years. b. same period. c. from I5.II.46.

Diagnosis: Obsessional Neurosis.

Treatment: E.C.T. I6, I946-49, with no improvement.

Pre-Operative State: She was afraid of germs and of contamination generally, and was full of obsessional doubts and ruminations. Compulsive washing and other rituals occupied hours each day. Great distress was shown at times.

Operation: 23.I.47. Horizontal Cut.

Complications: Respiratory distress.

Progress: 30.I.47. - she washes normally and is free of any compulsion. She still has vague fears of contamination but can deal with them.

24.2.47. - she developed an acute hallucinosis in which she saw rodents of various types. She became increasingly distressed and as sedation had no effect a few convulsions were given.She is now disorientated and confabulating.

Present Condition: She is mildly euphoric, at times irritable and lacking in initiative. She tends to be outspoken. The obsessional features and the hallucinosis have both disappeared.

Post-Operative Signs: Reticence. Euphoria. Lack of initiative. Irritability. Tactlessness.

Rehabilitation: Occupational therapy. Social activities. E.C.T. Prolonged Baths.

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