A CONTROLLED STUDY OF THE EFFECTS OF LEUCOTOMY

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Previous Studies

Although the operation of leucotomy is now over 20 years old only a few attempts at a controlled assessment of its therapeutic effect have been made (Penrose, 1944; Mettler, 1949, 1952; Friedman, Moore, Ranger, and Russman, 1951; Livingston, 1953; Jenkins and Holsopple, 1953; Freeman, Davis, East, Tait, Johnson, and Rogers, 1954; Jenkins, Holsopple, and Lorr, 1954; Medina, Pearson, and Buchstein, 1954; Powell, 1955; Crandell, Zubin, Mettler, and Kugelmass, 1956). Of these, moreover, a number have suffered from either (a) a poor matching of control and treatment groups (*e.g.*, Mettler, 1949; Friedman *et al.*, 1951; Freeman *et al.*, 1954; Powell, 1955) or (b) too short a period of follow-up (*e.g.*, Penrose, 1944; Mettler, 1949; Jenkins and Holsopple, 1953; Livingston, 1953; Freeman *et al.*, 1954; Jenkins *et al.*, 1954) so that their validity is suspect. Finally, the conclusions of these studies are conflicting. While intramural improvement is generally reported (Mettler, 1949; Friedman *et al.*, 1951; Jenkins and Holsopple, 1953; Jenkins *et al.*, 1954; Medina *et al.*, 1954) discharge rates are reported as improved by some (Penrose, 1944; Freeman *et al.*, 1954; Friedman *et al.*, 1951), as unchanged (Mettler, 1949; Jenkins and Holsopple, 1953; Medina *et al.*, 1954; Crandell *et al.*, 1956), or even as worse by others (Powell, 1955).

General Principles

A number of possible sources of error must be considered when an attempt is made to assess the therapeutic results of leucotomy. In brief these are as follows:

(1) "Spontaneous remission" has been reported in 30% to 50% of cases in a number of studies of large groups of psychotics (Bond and Braceland, 1937; Hunt, Feldman, and Fiero, 1938; Whitehead, 1938; Guttman, Mayer-Gross, and Slater, 1939; Stalker, 1939). Where the therapeutic result is not universal and immediate but where, as in leucotomy, a "delayed operative response" is claimed, "spontaneous remission" must be excluded.

(2) Indications for operation may be derived by reviewing improved cases after the treatment. The indications thus derived may in fact be merely general indications of good prognosis, *i.e.*, of "spontaneous remission". Later cases selected for treatment on the basis of such indications, *e.g.*, a short period of illness, acute onset of symptoms, good premorbid personality, etc., will naturally have a good prognosis and serve to perpetuate the myth of the treatment's success.

(3) It is possible that the severity and outcome of the functional psychoses have changed in the last few decades (Harris and Norris, 1954; Hoenig, Leiberman, and Auerbach, 1956). Comparisons, therefore, of results obtained in the thirties with those after leucotomy obtained in the forties or fifties may not be valid as the cases may not be comparable.

(4) Shorter periods of time may alter the nature of a population to be treated. For example, where the most chronic cases in a hospital are operated upon first, all subsequent series contain more acute material (Scoville, Wilk, and Pepe, 1951) with a naturally better outlook. Later results will improve commensurately.

(5) There are social aspects to "recovery". The act of treatment may alter a community's attitude and willingness to receive a patient. Many patients have been removed, objectively unimproved, because they "have had the treatment".

(6) Active treatment may also bias the psychiatrist towards a favourable reassessment of a patient's condition, *e.g.*, increased dementia may be classified as "improvement" because of quieter behaviour.

(7) Finally, a specific treatment, like leucotomy, may be associated with rehabilitative measures which are continued long after the treatment and may be of equal or even greater importance than the treatment itself.

To avoid these sources of error it is necessary:

(a) To employ a control group which has the same outlook as the treatment group, contains the same quantities of positive prognostic indicators, and has the same tendency to "spontaneous remission" (see 1 and 2 above).

(b) That the treatment and control groups should be treated at the same period of time and as far as possible under the same conditions (see 3, 4, and 7 above).

(c) That a long period of follow-up should be undertaken to allow for "flash in the pan" effects due to the enthusiasm of relatives, "total push" measures, mistaken assessments, etc. (see 5, 6, and 7 above).

Arguments for the Proposed Design

Facilities for a forward-looking study of the type proposed by Guttman *et al.* (1939) and recently undertaken by Ackner, Harris, and Oldham (1957), to examine the efficacy of insulin coma therapy were not available. It was, therefore, necessary to use material already operated upon in a retrospective study, still, however, employing non-leucotomized patients for comparison. It is fundamental, as has been said, that the groups compared should have been treated at the same time and have been of like outlook, so that it could be said at the onset that under similar conditions it would be expected that equal numbers of both groups would recover or improve. The methodological problem resolved itself, therefore, into (1) noting the factors known to affect prognosis, (2) selecting the most important and workable of these, and (3) matching the groups accordingly. It was important that all the data should be as objective as possible as it is difficult to avoid the information that a patient has, or has not, had an operation when working with patients known to the enquirer and with case records available. Data which needed interpretation might become biased in the light of this knowledge. There are three items of completely objective information which are, however, important to prognosis. These are: (1) length of stay in hospital, (2) age on admission, and (3) sex.

(1) **Length of Stay in Hospital.**—The importance of chronicity is shown in Table I which has been constructed from two tables in the Registrar General's (1953) Statistical Review of England and Wales (Mental Health Supplement). The longer a patient stays in hospital the less are his chances of

discharge. These, in fact, drop from 1 in 14 after two years to around 1 in 200 after 25 years.

(2) **Age on Admission.**—The effect of age on admission is shown by Penrose (1947). It is clear that the earlier the age of admission the larger the percentage of patients still in hospital at one, five, and 25 years. Even in the young and middle-age groups, where loss of patients through death would not be an important factor, this effect is still apparent and it may be said that the earlier the onset of the illness the worse the prognosis.

(3) **Sex.**—The overall effect of sex on prognosis is not great. There is, however, some unevenness in the chances of discharge in the different sexes after different periods in hospital (Registrar General, 1953).

The Design

The actual method of matching was as follows: Each leucotomy patient was matched with a patient of the same sex, of the same age on admission (in five-year blocks), admitted nearest to the date of admission of the leucotomized patient (in three-month blocks) and still in hospital at the time when the leucotomized patient had the operation. Matching for sex was exact. Matching for age was maintained as closely as possible working backwards in the admission register to obtain patients of the same age but of greater chronicity in the first place, if patients of the same chronicity were not available. Where there was no patient of the same age and the same or greater chronicity, a patient from the next age block was taken, first on the younger side and only if this was not possible from the older side. It will be seen that wherever perfect pairs were not possible the disadvantages have been allocated to the controls if possible. The complete material comprises 396 patients, 198 subjected to leucotomies and 198 controls. This series comprises all patients subjected to leucotomy whose date of admission preceded December 31, 1950. The follow-up continued until December 31, 1955. Twenty of these patients had more than one operation. These are dealt with separately as "multiple leucotomies". The vast majority of the patients treated had a

TABLE I

CHANCES OF DISCHARGE IN 1949 FROM MENTAL HOSPITAL IN ENGLAND AND WALES BY LENGTH OF ADMISSION IN SURVIVORS*

Period in hospital in years	..	..	..	2—3	3—5	5—10	10—15	15—20	20—25	25—30	+ 30
Number discharged in 1949	..	..	..	582	482	482	252	120	82	42	66
Number resident on December 31, 1949	..	..	..	7,472	11,745	22,524	21,391	15,697	11,302	9,262	11,799
Number at risk during 1949	..	..	..	8,054	12,227	23,006	21,643	15,817	11,384	9,304	11,865
Chance of discharge—1 in	..	..	..	14	25	48	86	132	139	221	180

*Constructed from M.22, M.29, Registrar General's Statistical Review for 1949, Mental Health Supplement (1953)

FIG. 1.—Number of leucotomy and control patients in hospital, discharged and traced, out of hospital but untraced, committed suicide or dead, one to 10 years after operation date in groups matched for age, sex, and chronicity.

“standard” leucotomy operation; six patients had orbital undercutting, one a medial undercutting, and one patient transorbital leucotomy.

It will be seen that each patient had a minimum total of five years’ observation, taking the periods before and after operation date (range five to 19 years). The period of follow-up after the operation date extended up to 13 years and is illustrated in Fig. 1 which shows the numbers available for different periods of follow-up from one to 10+ years.

It will be seen that the design provides for groups of similar outlook, simultaneous admission to hospital, and prolonged follow-up. The patients subjected to leucotomy will unavoidably have had special conditions for a few months after operation, but apart from this have had no separate programme of treatment.

Statistical Considerations

By and large, inspection is the only statistical method which need be employed, as the results in the two groups, leucotomy and control, resemble each other so closely. Almost all the results presented are, however, amenable to treatment with the χ^2 test and this has been employed with Yates’ correction (Fisher, 1936) throughout. Probabilities are shown where there may be some doubt as to the significance of differences on inspection.

Controlled Study of 198 Cases of Leucotomy Matched for Sex, Age on Admission, and Length of Admission

The material studied here comprises all patients subjected to leucotomy (including multiple leucotomies) on admissions up to December 31, 1950,

inclusive and their matched controls. One hundred and ninety-eight pairs have been considered. In each group there were 155 women and 43 men. Each control subject was allocated the operation date of the operated subject with which it was matched in order that the periods before and after operation might be compared. In all the tables where periods of admission to hospital are shown, the length of admission is divided into two periods—less than two years in hospital and more than two years in hospital. It will be seen in the Registrar General's Mental Health Supplement (1953) that 90% of patients discharged from hospital had admission of less than two years' duration. Crandell, Zubin, Mettler, and Logan (1954) found periods in hospital of more than 600 days to be a critical factor in prognosis. This arbitrary division was made roughly to separate the "chronic" from the "acute" patient and to make the tables more readily appreciated on inspection.

Although not matched, it will be seen that the groups compare closely in (1) the number of previous admissions to Runwell Hospital (Table II), and (2) the total period of previous admissions to Runwell Hospital (Table II).

The groups also compare as far as the distribution of diagnoses is concerned, except in two minor categories (Table II). There is a larger number of neurotics and psychopaths in the leucotomy group and only one organic disorder. The position is reversed as far as the controls are concerned where there are more organic disorders than neurotic ailments.

It can be shown that these two diagnostic groups, "organic" and "neurotic and psychopathic", are drawn from the same area in the pool of cases in this series. The totals of neurotic and organic cases in both leucotomy and control groups are identical (Table II) and the cluster of cases also compares closely in their distribution of ages on admission and in their period from admission to operation date. It was necessary to determine, however, at this stage to what extent the exchange of diagnoses affected outcome in the leucotomy and control groups as a whole. It was conceivable, for example, that all the neurotic subjects would do well and the leucotomy group benefit relatively, or that all the organically ill might die and the control group appear at a disadvantage. In fact, this end of the diagnostic table behaved very similarly in both leucotomy and control groups and the exchange of diagnosis does not have any significant effect on the outcome of the full groups.

The results (Table II) in the 198 pairs may now be considered. It will be seen that leucotomy does not significantly improve the chances of discharge or

TABLE II
PREVIOUS ADMISSIONS, READMISSIONS, DIAGNOSIS, AND RESULTS IN 198 CASES OF LEUCOTOMY AND MATCHED CONTROLS

	Leucotomies	Controls
<i>No. of Previous Admissions to Runwell Hospital</i>		
1	30	29
2	14	14
3	8	7
4	2	3
Total number previously admitted	54	53
Total not previously admitted	144	145
Total cases	198	198
<i>Total Time Spent in All Admissions</i>		
1 mth.	4	10
— 3 mth.	10	5
— 6 mth.	15	7
— 1 yr.	10	11
— 2 yr.	12	12
— 3 yr.	2	6
— 4 yr.	1	0
— 5 yr.	0	0
— 10 yr.	0	0
+ 10 yr.	0	0
Total previously admitted	54	53
Total not previously admitted	144	144
Total cases	198	198
<i>Diagnosis</i>		
Schizophrenia	91	97
Paraphrenia (paranoid psychosis)	22 (2)	17 (2)
Melancholia (Hypochondriasis)	39 (2)	30 (1)
Mania	9	5
Manic depressive psychosis	4	13
Congenital mental defect	2	6
Epilepsy	14	13
Neurosis (psychopathic personalities)	16 (3)	7 (4)
Organic disorders	1	10
Total	198	198
(For $n = 5$, $\chi^2 = 13.2$, $P = < 0.05$) (Excluding "organic disorders": for $n = 4$, $\chi^2 = 4.7$, $P = 0.5$)		
<i>Results</i>		
Never discharged*	102	113
Transferred to other hospitals	12	5
Total discharged from Runwell Hospital	84	80
Discharged and readmitted to Runwell Hospital†	31	33
Discharged and not readmitted to Runwell Hospital	53	47
Discharged and readmitted to other mental hospitals	11	9
Not readmitted to mental hospitals since discharge	42	38
*Died—same admission	20	19
†Died—subsequent admission	2	4
	22	23
<i>Period from Operation to Discharge (+ transfers)</i>		
1 mth.	10 (3)	19
— 3 mth.	18 (3)	22 (1)
— 6 mth.	11 (1)	13
— 1 yr.	14 (2)	9 (1)
— 2 yr.	12	6
— 3 yr.	7 (1)	3
— 4 yr.	1 (2)	1 (1)
— 5 yr.	2	3
— 10 yr.	8	3 (2)
+ 10 yr.	1	1
Total discharged	84 (12)	80 (5)
(For $n = 1$, $\chi^2 = 2.75$, $P = 0.1$)		

Table II continued overleaf

TABLE II—*continued*

	Leucotomies	Controls
<i>Period between Discharge and Readmission</i>		
Up to 1 mth.	3	4
— 3 mth.	4	4
— 6 mth.	4	4
— 1 yr.	2	4
— 2 yr.	7	5
— 3 yr.	1	5
— 4 yr.	2	3
— 5 yr.	4	1
— 10 yr.	4	3
+ 10 yr.	0	0
Total readmitted	31	33
<i>No. of Readmissions to December 31, 1955</i>		
1	19	16
2	6	9
3	5	3
4	1	2
5	0	0
6	0	3
Total readmitted	31	33
<i>Total Period of Readmission to December 31, 1955</i>		
1 mth.	2	2
— 3 mth.	3	5
— 6 mth.	3	3
— 1 yr.	4	6
— 2 yr.	5	5
— 3 yr.	2	0
— 4 yr.	2	0
— 5 yr.	1	0
— 10 yr.	8	7
+ 10 yr.	1	1
Total readmitted	31	33

reduce the number of patients readmitted. Finally, the numbers of deaths in hospital in both groups are comparable. Leucotomy does not accelerate discharge in those patients who leave hospital, neither does it delay readmission in those who return. The number of readmissions and the total period of the readmission to Runwell Hospital are comparable in the leucotomy subjects and controls.

Leucotomy, it is often claimed, improves patients in hospital. Indeed, close perusal of many of the "improved" columns in leucotomy statistics shows most of these patients to be in hospital. This claim has been examined here by assuming that the type of ward in which a patient is resident reflects his behaviour level. The wards were readily classified into three groups: (1) An "open" ward has free access to the grounds, and, whether or not there is a night nurse, caters for patients with the highest level of hospital behaviour. (2) A "non-observation" ward is a locked ward, without a night nurse, however, and is of an intermediate behaviour level. (3) An "observation" ward is a locked ward with day and night staff and caters for patients with the lowest behaviour level.

The normal ward of each patient who was never discharged was noted at the date of operation and again at the date of survey. By "normal ward" is

TABLE III
CHANGES IN WARD ADJUSTMENT OF PATIENTS NEVER DISCHARGED FROM RUNWELL HOSPITAL

Type of Ward	Leucotomies		Controls	
	Ward at Date of Operation	Ward at Date of Survey	Ward at Date of Operation	Ward at Date of Survey
Open	1	7	11	21*
Non-observation	8	17	38	32†
Observation	73	58	45	41‡
Total	82	82	94	94

* ($n = 1$, $\chi^2 = 0.6$, $P = 0.5$)

† ($n = 1$, $\chi^2 = 1.47$, $P = 0.3$)

‡ ($n = 1$, $\chi^2 = 0.12$, $P = 0.7$)

mean the ward on which the patient was normally resident before operation, and not the actual ward at the operation date which would, naturally, have been in all leucotomy cases the hospital's surgical ward. The numbers of patients on each type of ward is thus shown (Table III) for leucotomy subjects and controls before and after operation. The period after operation varies as the survey date was fixed (December 31, 1955) while the operations were spread over a long period. The initial distribution of wards is significantly different in the two groups, but it must be remembered that matched pairs are no longer being considered, merely two subgroups of non-leucotomized patients in the fully matched groups. In both leucotomy subjects and controls there is a general trend towards improvement. Patients in observation wards become fewer and those in open wards increase in number. The rate of improvement does not differ significantly between the two groups. A more detailed study of ward adjustment was made in undischarged patients subjected to a single leucotomy and their controls. Table III shows the general position of the two groups (leucotomized and non-leucotomized) at two dates, before and after operation. Individual patients within the groups may have remained the same, deteriorated, or improved, and it was possible that significant movements in opposite directions had cancelled themselves out in the final table. As far as the patients on closed wards before operation were concerned, there was a sufficient number of cases to determine what in fact did happen to make the final result. These patients might remain in closed wards, improve one step (to non-observation wards) or, finally, two steps (to open wards). The proportion of patients improving in the leucotomy and control groups is the same (Table IV). In patients resident in non-observation wards before operation the figures are smaller (Table IV), and while it may appear that the controls do better than the patients subjected to leucotomy this result must be treated with caution. In general, however, the previous

TABLE IV

WARD AT TIME OF SURVEY OF PATIENTS NOT DISCHARGED IN (A) CLOSED AND (B) NON-OBSERVATION WARD AT DATE OF OPERATION

Type of Ward	Leucotomy	Controls	Total
A Open	4 (6.5%)	5 (12.5%)	9
Non-observation	14 (22.5%)	6 (14.5%)	20
Observation	45 (71%)	30 (73%)	75
Total	63	41	—
(n = 2, $\chi^2 = 1.7$, P = not significant)			
B Open	2 (25%)	8 (25%)	10
Non-observation	2 (25%)	22 (66%)	24
Observation	4 (50%)	3 (9%)	7
Total	8	33	—
(n = 2, $\chi^2 = 8.2$, P = <0.05)			

finding that leucotomy does not improve ward level is fully borne out.

Finally, the death roll has been considered in more detail and it is shown that the diagnostic distribution of the dead is comparable in the leucotomized patients and controls as is the age distribution of the dead (Table V). The number of leucotomized patients dying within six months of operation is not significantly greater than the number of controls, but it must be added that the number of "delayed operation deaths" (McLardy, 1950) which might be expected from 200 patients would be small (about four to six).

A histogram (Fig. 1) has been constructed to show the position of patients one to 10+ years after the operation date. The patients are shown as (1) resident in a mental hospital, (2) discharged and contacted, (3) discharged and not contacted but not resident in the same name in a mental hospital,

TABLE V

DEATHS AND AGE AT DEATH OF PATIENTS DYING IN RUNWELL HOSPITAL

Diagnosis	Leuco- tomies	No. at Risk	Controls	No. at Risk
<i>Deaths</i>				
Schizophrenia	4	91	7	97
Manic depressive psychosis	10	52	6	48
Paraphrenia	4	22	2	17
Congenital mental defect	0	3	1	5
Epilepsy	1	14	5	13
Neurosis (psychopathic personalities)	2	16	0	7
Organic disorders	1	1	2	11
Died within 6 mth. of operation date	9	—	3	—
Deaths in patients never discharged from hospital	20	—	19	—
<i>Age at Death</i>				
21-30	3	—	4	—
40	4	—	3	—
50	8	—	6	—
60	5	—	7	—
+60	2	—	3	—

and (4) dead. The similarity in the two groups is self evident.

To summarize, therefore, 198 patients treated by leucotomy when compared with a matched series of non-leucotomized patients do not have (1) improved chances of discharge from hospital, (2) an accelerated discharge, (3) reduced chances of re-admission, (4) a delayed readmission, (5) a reduced number of readmissions, (6) a reduced total period of readmission, (7) improved hospital behaviour as judged by ward level, or (8) a significantly increased death rate.

Controlled Study of 20 Cases of Multiple Leucotomy Matched for Sex, Age on Admission, and Length of Admission

Patients treated with more than one leucotomy, or "multiple leucotomy", have been included in the group of 198 cases described above.

The patients undergoing multiple leucotomies and their controls have been treated in exactly the same way as has already been described for all leucotomies. It so happens that only female patients were concerned. The control patient was matched in each case, as far as operation date is concerned, with the first operation. Detailed tabular results are not given. When examined separately, the results in all respects are similar to the results already reported. It can now be added that having more than one leucotomy does not improve the patient's prospects in comparison with untreated controls.

Controlled Studies of 43 Male and 135 Female Cases of Single Leucotomy Matched for Sex, Ages on Admission, and Length of Admission

Detailed tabular results are not given. The method, results, and conclusions are as previously found. Sex appears to have no influence on the results of leucotomy.

A Comparison of "Recovered" Patients

It will be seen that 80 patients—42 leucotomized, 38 controls—having been discharged from hospital have not since been readmitted to Runwell or any other mental hospital in England and Wales under the same name. These have been designated "recovered" patients, and one control, who was not readmitted, having committed suicide, had to be excluded. Comparisons between the leucotomy and control "recoveries" have been made (Table VI *et seq.*).

The level of recovery is compared, but the comparison is marred by the larger number of untraced cases in the control series. Experience has shown that untraced patients later traced (between

TABLE VI
WORK AND SYMPTOM STATUS OF PATIENTS
DISCHARGED AFTER OPERATION AND NOT
SUBSEQUENTLY READMITTED
("RECOVERED PATIENTS")

	Leucotomies	Controls
<i>Work Status</i>		
As competent as before illness	14	18
Coping	20	4
Incompetent or idle	5	0
Not contacted	3	15
Total	42	37
<i>Symptom Status</i>		
No symptoms	15	18
Symptoms better	18	2
Symptoms same	6	2
Symptoms worse	0	0
Not contacted	3	15
Total	42	37

January, 1956, and July, 1957) tended to be doing well as far as work and symptoms were concerned. Indeed, they had lost contact with the hospital as support was no longer needed. On the other hand, it is possible that the untraced patients may be dead or, in the case of the younger single women, married and admitted to a mental hospital in another name. The death rates in the two groups are so comparable as far as the patients traced are concerned that it is difficult to believe that a large number of the untraced controls can be dead. The number of eligible women is small and, as it were, three disasters have to be assumed for patients to be lost in this second way. First, marriage; second, readmission; and finally, insufficient interest by the psychiatrist in the patient's previous illness treated in Runwell for a request to be made for her case record or for a report. A record is kept of such enquiries and some patients were traced in this way.

It can be seen, however, that both as far as work status and symptoms (Table VI) are concerned (even excluding the untraced patients) the level of the controls already matches that of the leucotomized patients in the best adjusted categories. As, therefore, similar numbers recover to roughly the same extent, it is of great interest to know whether similar patients are involved in the recoveries. The distribution of diagnosis is very similar indeed (Table VII), as is the age distribution and the length of stay before the operation date (Table VIII).

Finally, of the 42 "recovered" leucotomy patients, 13 were discharged more than two years after operation, some of these five to 10 years after operation. Six controls were discharged more than two years after the operation date (for $n = 1$, $\chi^2 = 0.7$, $P = 0.3$). To sum up, similar patients recover after leucotomy in similar numbers to those

TABLE VII
DIAGNOSIS OF ALL PATIENTS DISCHARGED AFTER
OPERATION AND NOT SUBSEQUENTLY READMITTED
TO MENTAL HOSPITAL ("RECOVERED PATIENTS")

Diagnosis	Leucotomies		Controls	
	Recovered	No. at Risk	Recovered	No. at Risk
Schizophrenia	14	91	10	97
Affective disorders	15	52	14	48
Paraphrenia	5	22	3	17
Epilepsy: mental defect	3	16	1	19
Psychoneurosis:				
Psychopathy	5	16	5	7
Organic brain disorders	0	1	4	10
Total	42	198	37	198

TABLE VIII
AGE ON ADMISSION AND LENGTH OF ADMISSION TO
OPERATION OF ALL PATIENTS DISCHARGED AFTER
OPERATION AND NOT SUBSEQUENTLY
READMITTED ("RECOVERED PATIENTS")

	Leucotomies	Controls
<i>Age on Admission</i>		
—20	3	1
—30	8	10
—40	10	11
—50	12	4
—60	7	10
+60	2	1
Total.. .. .	42	37

(For $n = 2$, $\chi^2 = 3.9$, $P = 0.2$)

Length of Admission to Operation Date		Leucotomies	Controls
— 1 mth.	12	23	8
— 3 mth.	2		6
— 6 mth.	2		6
— 1 yr.	4	19	7
— 2 yr.	3		4
— 3 yr.	6		2
— 4 yr.	4		1
— 5 yr.	4		0
—10 yr.	5	0	3
+10 yr.	0		0
Total		42	37

(For $n = 1$, $\chi^2 = 1.5$, $P = 0.2$)

who recover in a matched control group not so treated. The number of controls who make delayed responses is not significantly different from the number of patients subjected to leucotomy and there is thus no evidence for a delayed operative response. In fact, these responses seem likely to be spontaneous remissions.

Summary

The results in 198 cases treated by leucotomy were compared with those in 198 controls matched for chronicity, age on admission, sex, and under treatment at the same time.

Leucotomy did not appear to (a) improve the chances of discharge from hospital; (b) accelerate

discharge; (c) reduce the chances of readmission; (d) delay readmission; (e) reduce the number of readmissions; (f) reduce the total period of readmission; (g) improve hospital behaviour as judged by ward level; (h) significantly increase the death rate.

A second leucotomy did not significantly improve the patients' prospects of discharge in relation to the controls.

The sex of the patients did not influence the results of leucotomy.

"Recovered" patients had at least the same level of adjustment in the control group as in the leucotomy group and seemed similar in that they showed the same distribution of diagnoses, ages, and lengths of stay.

No evidence was found for a delayed operative response after leucotomy.

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REFERENCES

- Ackner, B., Harris, A., and Oldham, A. J. (1957). *Lancet*, **1**, 607.
- Bond, E. D., and Braceland, F. J. (1937). *Amer. J. Psychiat.*, **94**, 263.
- Crandell, A., Zubin, J., Mettler, F. A., and Logan, N. D. (1954). *Psychiat. Quart.*, **28**, 185.
- , and Kugelmass, N. (1956). *Ibid.*, **30**, 96.
- Fisher, R. A. (1936). *Statistical Methods for Research Workers*. 6th ed. Oliver & Boyd, Edinburgh.
- Freeman, W., Davis, H. W., East, I. C., Tait, H. S., Johnson, S. O., and Rogers, W. B. (1954). *J. Amer. med. Ass.*, **156**, 939.
- Friedman, S., Moore, B. E., Ranger, C. O., and Russman, C. (1951). *Amer. J. Psychiat.*, **108**, 10.
- Guttmann, E., Mayer-Gross, W., and Slater, E. T. O. (1939). *J. Neurol. Psychiat.*, **2**, 25.
- Harris, A., and Norris, V. (1954). *J. ment. Sci.*, **100**, 241.
- Hoenig, J., Leiberman, D. M., and Auerbach, I. (1956). *J. Neurol. Neurosurg. Psychiat.*, **19**, 130.
- Hunt, R. C., Feldman, H., and Fiero, R. P. (1938). *Psychiat. Quart.*, **12**, 414.
- Jenkins, R. L., and Holsopple, J. Q. (1953). *Ass. Res. nerv. Dis. Proc.*, **31**, 319.
- , and Lorr, M. (1954). *Amer. J. Psychiat.*, **111**, 84.
- Livingston, K. E. (1953). *Ass. Res. nerv. Dis. Proc.*, **31**, 374.
- McLardy, T. (1950). *J. Neurol. Neurosurg. Psychiat.*, **13**, 106.
- Medina, R. F., Pearson, J. S., and Buchstein, H. F. (1954). *J. nerv. ment. Dis.*, **119**, 23.
- Mettler, F. A. (1949). *Selective Partial Ablation of the Frontal Cortex*. Hoeber, New York.
- (1952). *Psychosurgical Problems*. Blakiston, New York.
- Penrose, L. S. (1944). Results of Special Therapies in the Ontario Hospitals. Coma, Convulsions and Leucotomy up to November, 1944. Ontario Department of Health, Canada.
- (1947). *Proc. roy. Soc. Med.*, **40**, 863.
- Powell, C. W. (1955). *W. Va. med. J.*, **51**, 287.
- Registrar General (1953). Statistical Review of England and Wales for the Year 1949. Supplement on General Morbidity, Cancer and Mental Health. H.M.S.O., London.
- Scoville, W. B., Wilk, E. K., and Pepe, A. J. (1951). *Amer. J. Psychiat.*, **107**, 730.
- Stalker, H. (1939). *J. ment. Sci.*, **85**, 1224.
- Whitehead, D. (1938). *Psychiat. Quart.*, **12**, 409.