A CONTROLLED STUDY OF THE EFFECTS OF LEUCOTOMY

BY

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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 Kugelmas, 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; Guttmann, 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 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).
CONTROLLED STUDY OF EFFECTS OF LEUCOTOMY

(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 outset 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>
<thead>
<tr>
<th>Period in hospital in years</th>
<th>2—3</th>
<th>3—5</th>
<th>5—10</th>
<th>10—15</th>
<th>15—20</th>
<th>20—25</th>
<th>25—30</th>
<th>+30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number discharged in 1949</td>
<td>582</td>
<td>482</td>
<td>482</td>
<td>252</td>
<td>120</td>
<td>82</td>
<td>42</td>
<td>66</td>
</tr>
<tr>
<td>Number resident on December 31, 1949</td>
<td>7,472</td>
<td>11,745</td>
<td>22,524</td>
<td>21,391</td>
<td>15,697</td>
<td>11,302</td>
<td>9,262</td>
<td>11,799</td>
</tr>
<tr>
<td>Number at risk during 1949</td>
<td>8,054</td>
<td>12,227</td>
<td>23,006</td>
<td>21,643</td>
<td>15,817</td>
<td>11,384</td>
<td>9,304</td>
<td>11,865</td>
</tr>
</tbody>
</table>

*Constructed from M.22, M.29, Registrar General's Statistical Review for 1949, Mental Health Supplement (1953)
"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 $\chi^2$ 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,
CONTROLLED STUDY OF EFFECTS OF LEUCOTOMY

The groups were also compared 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
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 meant 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
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, 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
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 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 re-
admission; (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 leuco-
tomy 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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