ROSTRAL LEUCOTOMY: A REPORT ON 240 CASES PERSONALLY FOLLOWED UP AFTER 1½ TO 5 YEARS

By

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CORTICAL undercutting, as an alternative to standard leucotomy and to the major operation of topectomy, was devised by three surgeons independently. Scoville (1949) published his preliminary results soon after McKissock had begun to do rostral leucotomies. Both have continued to use this type of operation (Scoville *et al.*, 1951; Scoville, 1954) but Ferey (1950), the third to develop a similar technique, was disappointed with the results and soon abandoned it (Ferey, 1953). McKissock (1951) reported the initial impressions of the results in 100 cases and by the end of 1952 had operated on 240 cases. During 1953–54, 1½ to 5 years after operation, I followed up these patients, visiting 175 of them in their homes, and 35 in hospital. Personal follow up was refused or for some reason impracticable in 17 cases, including 4 whose case notes had been destroyed; 13 others had died before the survey was made.

Partridge (1950) reported a follow up study of 300 cases operated on by the same surgeon by his "standard" technique (McKissock, 1943); he had the advantage, which I had not, of being able to see his patients before operation. I have had to work retrospectively, and the case notes available, whilst often excellent, had usually not been made with the idea that they would be needed for follow-up purposes. I have not, therefore, thought it right to draw more than broad conclusions from this study.

I considered using standardized psychological tests but it was clear, from the lack of adequate testing before operation in all but a minority and the slightness of the personality changes in the majority, that none of the relatively crude psychometric techniques at present available could have measured such changes as were present. The investigation has, therefore, been a clinical one with emphasis on "questions as to how the patient feels, what he can do and what do others think of him?" (Curran, 1952); long informal interviews were held with the patients, their relatives and friends, along lines which Partridge used so successfully, and case records were obtained from all hospitals to which patients had been admitted. Most patients were seen only once, but the interview was continued as long as useful information was forthcoming, usually about 2 hours but sometimes much longer; more than one visit was made when necessary. Only 3 brains have reached a neuropathologist and since all of these came from patients who died as a direct result of operation, no information exists as to the extent of the lesion in patients who have recovered.

Most large series of patients reported in the literature contain a majority of schizophrenics; less than 10 per cent. of leucotomies have been done on psychoneurotic patients, mostly obsessional; another 25 per cent. had affective disorders, 60 per cent. were schizophrenic (Kolb, 1953). The corresponding figures in this series are, obsessional and other neuroses and psychopathies 43 per cent., affective disorders 32 per cent., schizophrenia 15 per cent.

The original open rostral operation (McKissock, 1951), here called O, was done in 63 cases: an incision 1 to 2 cm. wide was made below the superior frontal cortex, isolating part of Brodmann's areas 8, 9 and 10. In the next 116 cases a blind incision was made in the same plane or a little posterior to it, using a brain needle; this operation is referred to as B. The plane of operation in the last 60 cases is somewhat different and McKissock (1954) has given this account of the operation he calls G, after Grantham (1950) who introduced a technique for coagulating the inferior medial quadrants of the frontal lobes:

For the original rostral leucotomy burrholes were made just in front of the coronal suture, whereas in this modification the burrholes are made some 5–6 cm. forward of the coronal suture, 2 cm. lateral to the sagittal suture. When the dura has been opened a brain needle is inserted downwards to strike the orbital plate at the junction of its middle and posterior thirds, considerably further back than in the original rostral operation.

The line of section thus runs from above downwards and possibly somewhat backwards in comparison with the original rostral cut which ran from above, downwards and forwards to the junction of the middle and anterior thirds of the orbital plate.

The width of the section of white matter is the same in the two operations, about 2 cm. broad at the lower end of the plane of section, diminishing as it nears the site of insertion of the brain needle superiorly.

It was hoped that by concentrating on the inferior medial quadrants, which Fulton (1951) regarded as so important on experimental and theoretical grounds, and the importance of which has recently been stressed by Sargant (1953), the operation could be made even more effective than O and B; in fact the incidence of the lesion in all three operations should be greatest in the inferior medial quadrant, where the G cut is more posterior than B which in turn is usually more posterior than O.

There has been no agreed way of recording the results of leucotomy. Part of the difficulty arises because the object of therapy differs in different series of cases. Many leucotomies are done to bring about "administrative improvement" (Hoch, 1953), but in the patients considered here the operation was usually done with the hope of restoring to something like normal health. Ström-Olsen and Tow (1949) considered their cases under 5 headings: the result of operation on illness, social status, work adjustment and capacity for pleasure and the presence of adverse personality changes. Wherever possible I have rated patients on a 5-point scale under each of 6 headings, 3 of which show the effect of operation on illness and himself and 3 reflect social adjustment. The rating is given after considering carefully the pre- and post-operative history, taking into account what the patient was before illness and the extent to which his illness incapacitated him.

A patient who is quite unchanged by operation will, therefore, rate SPEWCH 424444, the arithmetical sum of which is 22; one who is slightly improved all round and has no personality deficits will rate 323333, totalling 17; one who is much improved all round and has only slight personality deficits rates 232222, totalling 13; complete restoration to previous normal rates 121111. I have regarded as a good result a total of 13 or less, however derived, as a fair result a total of 14–17 and as a poor result anything more than 17. This has meant that most patients who remain in hospital rate as poor results even when there are real gains from operation; for example, a 69-year-old man, brought after 24 years of unchanging depression to a state of cheerful hypomania,

TABLE I

The Rating Scales

Scale		1	2	3	4	5
S	Symptoms	Free	Much improved	Improved	Not improved	Worse
P	Personality deficit	On balance resulting in improvement	None or indefinite	Slight	Marked	Severe
E	Enjoyment	Fully restored	Much improved	Improved	No change	Less
W	Work adjustment	Up to best previous level or better	Much improved but less skilled or lighter than best previous	Working but efficiency still impaired	No change	Worse
C	Community liability	"contributes" as much or costs as little as before illness	Society much better off	Society better off	No change	Society worse off
H	Home adjustment	As good as best previous	Much better	Improved	No change	Worse

rates 242434. This method of rating has proved useful in assessing results and each case record in this paper includes the SPEWCH ratings.

COMPLICATIONS OF OPERATION

1. *Death.* Three patients died within 12 days; 2 were hypertensive and death was due to cerebral haemorrhage and venous thrombosis; the other died of paralytic ileus and acute haemorrhagic pancreatitis; a good deal of bleeding had taken place in the line of section, which was considered, however, insufficient in itself to have caused death. Two of these patients had had open operations, suggesting that the securing of haemostasis under direct vision is by no means so certain as its advocates believe. There is thus 1 death in 177 consecutive blind rostral operations (0·6 per cent.). Ten other patients had died before the time of follow up, mostly of conditions unrelated to their psychiatric illness, but 3 who were suffering from tension states committed suicide between 1 and 2½ years after unsuccessful open operation.

2. *Cerebral haemorrhage* sufficient to produce focal neurological signs occurred in 4 cases and 2 of these have severe personality deficits. There was less serious haemorrhage in 3 others. In 20 other cases there was confusion sufficient to be noted, or unusual post-operative inertia. Urinary incontinence in the early post-operative period, so common after standard leucotomy, was noted in 22 cases, including 3 of the 4 known to have had major intracerebral haemorrhage and 10 of those who showed undue confusion or inertia. Of the other 9 cases, 2 were incontinent only once, 2 had been incontinent for a long while before leucotomy, 1 was an epileptic who had been occasionally incontinent ever since childhood, 1 was over 70 and hypertensive; 1 had more striking personality changes, which may be taken to indicate a more extensive lesion than usual. Post-operative urinary incontinence, confusion or inertia, in the absence of obvious contributory causes, strongly suggests that the operative lesion has been unduly extensive or has been increased by haemor-

rhage or venous thrombosis. In no case did incontinence persist longer than about 6 weeks without obvious reason. Increased frequency of micturition, usually with slight urgency, persisted at the time of follow up in 14 cases, only 2 of whom had been incontinent. In none was it more than slightly inconvenient.

It has already been noted that 2 of the patients who died were hypertensive. Fifteen others were known to have been hypertensive and the operation had no lasting effect on the blood pressure. Two of the 15 cases probably suffered some unplanned increase in the lesion as the result of bleeding but the clinical results were good in about half the cases. Hypertension should not, therefore, be regarded as necessarily contraindicating leucotomy, a conclusion in general agreement with that of Le Beau (1953) who does, however, regard hypertension and advanced age, above all in combination, as the main contraindications for psychosurgery.

3. *Osteomyelitis* necessitated the removal of bone discs, which had been replaced after open operation, in 2 cases. In one other case a frontal lobe abscess responded to aspiration and penicillin treatment.

4. *Epilepsy*. Two hundred and twenty patients were alive more than 18 months after rostral leucotomy, of whom 4 had previously had standard leucotomy as a result of which 1 was already epileptic. Six were known to have had epileptic fits at some time in their lives; only 2 of these had any fits after operation. Of 15 patients who certainly or probably had intracerebral complications, 3 had fits; one was in status epilepticus on the third post-operative day, but had no fits thereafter. The other 2 had many major convulsions. During the follow up period of the remaining 196 patients, 10 had one or more epileptic fits: 2 had a single fit within the first 5 days; 4 had single fits between 12 and 26 months after operation, one of whom was, by that time, in a state of advanced arteriosclerotic dementia. Two patients had attacks of status epilepticus 14 months after operation.

Twenty-three patients later had a second operation, 2 of whom had already had fits after the rostral operation. Of the remaining 21, 5 subsequently became epileptic. Thus the incidence of epilepsy after uncomplicated rostral leucotomy is 4·6 per cent., a lower figure than after any leucotomy except transorbital, when the incidence is about 1 per cent. (Freeman, 1953). Intracranial complications or more than one operation raise the incidence to about 22 per cent. Freeman, too, has reported greatly increased incidence of epilepsy under similar circumstances (53 per cent. of 54 cases submitted to more than one standard operation). There is no evidence in this series that the incidence is higher among men (as Stengel, 1950; Partridge, 1950; Freeman, 1953, found), or in schizophrenics (as Stengel and Partridge but not Freeman found).

Few patients took the phenobarbitone recommended as a prophylactic against epilepsy: the incidence is so small and severe epilepsy so rare that there seems no need to prescribe phenobarbitone unless intracranial complications or more than one operation make the risk of epilepsy more considerable.

5. Apart from post-operative mania, discussed below, the only notable psychiatric complication of operation is marked disinhibition which may necessitate heavy sedation and a side room; this was noted in 6 patients, 4 of whom were obsessionals. It is likely that others were similarly, though less markedly, disinhibited. The noisy phase lasted up to several weeks and appears to correspond to the post-operative syndrome which Le Beau (1952) and Klein (1952) referred to as hypomanic, and which the former relates to damage to Brodmann's area 9.

In the absence of obvious causes, such as operative haemorrhage resulting

in a larger lesion than usual, personality changes following rostral leucotomy are slight. I am dealing with them in a separate paper and it suffices to say here that they are similar in kind to those observed after standard leucotomy and to those described by Tow and Whitty (1953) after cingulectomy, but are much less than after standard leucotomy and negligible in all but about 5 per cent. of cases symptomatically improved. A comparable figure after standard leucotomy is 56 per cent. (derived from Partridge, 1950).

Apparently distinct from post-operative disinhibition which diminished within a few weeks of leucotomy, is a phenomenon which Partridge observed but which has appeared much more frequently in this series; 10 patients operated on for depressive illnesses have had attacks of hypomania only since operation. Seven cases occurred in 18 patients regarded as suffering from recurrent endogenous depression who had had their first breakdown before the age of 40.

In one case it did not happen until over a year after an apparently ineffective leucotomy and it seems unlikely that operation had anything to do with the mild hypomanic state which then occurred. In 2 cases, men of 54 and 62, the change followed directly on operation and has persisted despite subsequent standard leucotomy, which has increased the personality deterioration and merely damped down the hypomanic manifestations. In another the 9 months of elation made home life enjoyable for her family as well as herself and only subsequent progression of arteriosclerotic dementia made hospital care necessary. A woman of 65 had suffered from cyclothymic mood swings all her life and in the 21 years before leucotomy had had 7 severe depressive breakdowns. E.C.T. at these times produced an irritable, shortlived elation but for 2 years had been ineffective. After leucotomy her mood swings occurred from a higher basic level, so that the depressions, which still occurred regularly, were less deep and alternated with a "champagne mood", in which she was interfering, quarrelsome and given to abusing her husband. On the whole, however, this was preferable to her pre-operative state. In yet another case, a man of 48, who for many years had been mildly depressed for a few weeks in each year, became more steadily depressed, ruminative, irritable and indecisive. After leucotomy the periodicity gradually changed and 18 months later his mood varied between depression and elation at intervals of a few days, with no intervening normal periods.

One of 21 patients operated on for involutional depression was described as paranoid and hypomanic for about 2 months after operation and then recovered; it seems possible that this was more like the "disinhibition" described above.

Two of 5 non-involutional patients operated on during their only depressive illnesses became hypomanic and another became hypomanic for several months, more than a year after standard leucotomy had been done as a second operation.

One had always been a forceful, dominating personality and for the 18 months his hypomania lasted became impossibly overbearing; the other was a morose, inhibited, unsociable leptosomatic individual of 44; he had always wanted, so it was noted before operation, to be a hypomanic business man, achieved this ambition some 4 months after leucotomy, and during the 5 months it lasted got into difficulties from which he has not extricated himself a year later, for he put up virtually the whole of the capital in an unsuccessful business venture with a convicted embezzler, though in fairness it must be said that the failure was not the fault of the latter. The characteristic hypomanic press of activity was well shown in his efforts to pack for the summer holiday; he broke off repeatedly to do unimportant repairs to all the door knobs in the house and when, 48 hours late, the family eventually reached the seaside, he was found to have packed an immense quantity of unnecessary things into the car, even including the telephone directory. Whilst on holiday he organized a large midnight fishing expedition, but omitted to arrange for a boat to be available. When he returned home he gave considerable financial support, which he could ill afford, to a new theatrical company, and bought most of the seats for their first performance. This meant that many people were unable to get in, and since he omitted to find anyone to use his tickets the first house was almost empty.

No case of hypomania occurred in any other diagnostic group and it seems clear that the risk is only considerable in cases of affective disorder which belong with the manic-depressives, or at any rate cannot strictly be regarded as suffering from involutional or neurotic depression. In such cases there has been an incidence of 8 in 23, and in the end, though the result has been worthwhile in 4, it has been good in none of the 8.

Rostral leucotomy should, therefore, be used cautiously in cases of recurrent endogenous and non-involutional single depressions; hypomania has not been conspicuous in reports of orbital undercutting for depression (Rylander, 1952; Scoville, 1954) and it may be that this operation will be found preferable for such cases; it is important to take note of anything pointing to a manic-depressive basis for an involutional melancholia, particularly a history of a tendency to depression or a positive family history, e.g.:

A 62 year old irritable, extraverted merchant had no breakdown until he was 60 except for 2 brief and minor depressions after influenza. He was a conscientious man, on good terms with everyone and "a born wit"; his father had been a well known local public figure; 1 brother had committed suicide, another had been in a mental hospital and a third, the black sheep, had been exported in youth. In a severe agitated depression at 60 he believed his business had gone to ruin and made several suicidal attempts. E.C.T. brought only temporary relief. After leucotomy he became elated, boastful, arrogant, extravagant, sexually demanding, and drank to excess. After 9 months of persistent hypomania a standard leucotomy was done with resulting severe frontal lobe deficit but no change in mood. Fifteen months later he was deteriorating physically and mentally, but was still hypomanic.

Results

Consideration of the results of the 3 types of rostral leucotomy, O, B and G, is inevitably complicated by the difficulty of comparing one case with another. The criteria for selecting patients differed somewhat for each group; since the O operation could only be done at a neurosurgical centre a majority of the patients were admitted from general hospital out-patient departments or from private practice. The B and G operations, which could be done almost anywhere, were carried out in many hospitals, mainly in Southern England and Wales. Few schizophrenics were accepted until G was introduced and it was thought, partly because of the success of bimedial leucotomy (Greenblatt *et al.*, 1952) that it might prove an adequate cut. The initial impressions (McKissock, 1951) have been confirmed: in no diagnostic category does the O operation give as good results as the others; there is little to choose between B and G (see Table II).

TABLE II

Psychoneurotic and Psychopathic States and Affective Disorders (Excluding Manic-depressive Psychosis with Manic Episodes). Results in 160 Cases Surviving Operation, Whose First Operation was Rostral Leucotomy

Type of Operation	Number of Cases	Good	Per cent.	Fair	Per cent.	Poor	Per cent.
O ..	39	8	(21)	6	(15)	25	(64)
B ..	84	41	(49)	16	(19)	27	(32)
G ..	37	16	(43)	8	(22)	13	(35)
Total ..	160	65	(41)	30	(18)	65	(41)

In other words B and G have given good results in nearly 1/2 the cases selected in these categories and fair results in another 1/5, or 2/3 altogether, whilst O gave good results in 1/5 and worthwhile results in only 1/3 altogether.

There is some evidence that intellectual damage is likely to be more marked after G than after B, perhaps because any unplanned extension of the more posterior G lesion may be expected to isolate more frontal lobe than a similar extension in the plane of B. The B operation is therefore recommended as the most satisfactory of the three rostral operations.

It is now generally accepted that the most noticeable effect of a successful leucotomy is the relief of emotional distress. Not all tense patients are relieved of illness but patients who are not tense are rarely helped. Sargant (1953) stated that symptoms which are secondary to emotional tension are likely to be relieved and in this series this general conclusion is confirmed, whether the symptoms are hysterical, obsessional, aggressive, etc. Depression is often relieved at once, but patients who had been several years in hospital responded less quickly and the behaviour of 2 continued almost unchanged until something happened to jolt them out of their ruts; both had been more than 5 years in hospital for involutional melancholia and seemed to settle back again into their customary patterns of behaviour; in one case the illness of her husband provided sufficient stimulus for her to leave hospital and to resume the management of her household.

The results in the different diagnostic categories are shown in Table III. (Figures in parentheses, other than percentages, exclude those who had open operation.)

TABLE III

	Good	Fair	Poor	Total	Operative Deaths
Affective disorders ..	35 (49%)	14 (20%)	22 (31%)	71 (61)	
(*a*) Cases with both manic and depressive attacks		1 (1)	3 (2)	4 (3)	
(*b*) Recurrent, mainly endogenous, depression ..	10 (10)	5 (3)	7 (4)	22 (17)	
—with dementia ..		2 (1)	2 (2)	4 (3)	
(*c*) Recurrent, more reactive depression	10 (9)	2 (2)	3 (2)	15 (13)	
(*d*) Single depressions:					
(i) Involutional ..	14 (13)	2 (2)	4 (4)	20 (19)	
—with dementia ..		1 (1)		1 (1)	
(ii) Non-involutional ..	1 (1)	1 (1)	3 (3)	5 (5)	
Psychoneuroses and Psychopathy	31 (34%)	17 (18%)	47 (49%)	95 (65)	
Tension states	11 (8)	10 (8)	12 (6)	33 (22)	
Obsessional states	12 (10)	4 (4)	10 (6)	26 (20)	
Hypochondriasis	3 (2)	1 (1)	9 (5)	13 (8)	1
Psychopathic personality ..	5 (5)	2 (1)	16 (9)	23 (15)	
Schizophrenia and paranoid illness	4 (13%)	5 (16%)	22 (71%)	31	1
Mental illness in reaction to or in association with organic disease	9 (45%)	2 (10%)	9 (45%)	20	1
Unilateral		1	6	7	
Untraced				13	
				240	

Affective Disorders

The results (see Table III) compare favourably with those obtained by more extensive operations.

(*a*) Only 4 patients had both manic and depressive attacks before leucotomy and the only one to derive any benefit was relieved of a depression which had lasted a year, but, to quote her employer, "she went into hospital like a lamb and came out as a dragon". Three years later, having passed through a post-

operative hypomania, she was drifting from one casual ward to the next (particularly favouring one which gave her a Chelsea address), verminous and cheerful and occasionally bothering her family when short of money; psychopathic traits, previously present, had been exaggerated. On the whole rostral leucotomy is not advised for this category of patient.

(*b*) The particular risk of hypomania in cases of recurrent endogenous depression has already been emphasized; nevertheless good results were obtained in nearly half of these cases, and fair results in another quarter (excluding those who were already showing signs of organic dementia). Depression was relieved in 5 dementing patients but good results were marred by unpleasant personality changes accompanying the dementia; it is important to warn relatives of this since otherwise they may reproach themselves with having sanctioned the operation.

(*c*) The group called "recurrent, more reactive depression" consists of 15 vulnerable personalities readily cast down by minor setbacks and retaining some symptoms between more serious breakdowns which in nearly every case necessitated repeated admissions to hospital, e.g.:

A timid, obsessionally slow and fussy spinster of 49 had had, fortunately for her, no need to earn her living, but spent most of her time looking after her foster father. For 3 years from 35 she was receptionist to a doctor, to whom she grew greatly attached, and when it was no longer possible to continue working for him she became worried and depressed; for 11 years she was repeatedly in this state in reaction to even slight stress, each time recovering with E.C.T. or cessation of the stress. Leucotomy was done to interrupt this pattern and was successful: there had been no recurrence in 2½ years after operation, but her irritable, abrupt and outspoken manner earned her the reputation of being aggressive and she lost a job because of it. Sensorial testing suggested slight intellectual impairment, but few demands are made on her as companion to an older woman and this is not evident in her daily life. (131312)

Ten of the 15 were good results. The 2 poor results had such inadequate personalities and (for them) such overwhelming and unalterable problems that it must be doubted whether the decision to operate was wise.

One 37 year old man was quite unfitted for the responsibility of earning for his wife and 4 children and for the burden of a heavy mortgage on his home: as his wife said, he would have made an ideal lodger, but he was a hopeless father. (334344)

The 3 fair results were less than good because of personality inadequacies, and in one case because a tendency to depressive mood swings persisted.

(*d*) The best results were in the group of involutional melancholics, with 70 per cent. good and another 10 per cent. fair. They had been ill for between 6 months and 9 years; length of illness only seemed of importance in that recovery was slower in those who had been more than 5 years in hospital. Of the 4 poor results, one was almost symptom free for 6 weeks but relapsed and was then allowed to become institutionalized; one failed to derive any benefit from a later standard leucotomy; one recovered after a series of spontaneous epileptic fits a year after operation. The fourth relapsed within a few months. These results are similar to the half–three-quarter good results generally reported after standard or lower quadrant operations in affective disorders, and in view of the lesser personality changes after rostral leucotomy suggest that this operation might well replace the others, especially in cases of involutional melancholia and reactive depression.

Tension States

Curran and Partridge (1952) referred to a group of "undifferentiated tension states"; try as I will, I cannot usefully subdivide this group into more diagnostic categories. Most but not all are vulnerable personalities, retiring,

unassertive people, who have remained immature and dependent. The home background in many cases is grim; they have found little security with their quarrelsome parents, overpowering, neurotic, physically incapacitated or otherwise unsatisfactory mothers and intense sibling rivalries; at best their adjustments are precarious and their psychoneurotic reactions to any stress are diverse; along with tense anxiety and its somatic expression in headaches, sweating, flushing and a host of other symptoms, they are often depressed, hypochondriacal, ruminate obsessively, or exploit symptoms for gain in an hysterical way. Phobias are frequent and in a few dominate the clinical picture. Symptoms tend to alter from time to time in response to treatment or changes in environmental circumstances. Many were treated by physical methods and psychotherapy, with temporary restitution of the unstable adjustment. Not all patients were as inadequate as this description would imply, and the more adequate personalities seemed on the whole to do rather better than the inadequate.

A particularly good result was a 33 year old sociable, extraverted woman, a hairdresser, who had separated from her psychopathic husband just as her mother before her had separated from her drunken father; she became tensely depressed and derealized, with obscene obsessive rumination, when deeply attached to a man with whom her rigid, convent-derived moral principles would allow her no intimacy. Though E.C.T. lightened her depression her life continued to be intolerable because of her ruminations; open rostral leucotomy was done after an illness lasting only 8 months. Tension was immediately relieved and she gradually stopped ruminating during the next 6 months. Three years later she was well and leading a full and happy life. Beyond a greater readiness to relax, in her case a good thing, and a slight increase in outspokenness, not in the least offensive, no personality changes had been noticed. (131111)

Another good result was a 47 year old builder, with a background of poverty and drunken, quarrelling parents. He was a compulsive worker, whose stability had depended on his devoting every scrap of energy to his work, and had been described as a human dynamo. He had, in fact, been tremendously productive, but when short of work readily became hypochondriacal. The death of his wife imposed a severe strain on him and when, a few years later, he had a colonic resection for carcinoma a severe tension state developed, in which he became obsessed with religion and had several ecstatic experiences; at one time he was considered paraphrenic. Leucotomy relieved tension but with it went much of his abnormal drive, so that he is now a shadow of his old dynamic self and no longer minds having lost his zest for work. The scale of his building operations can now be measured in tens of thousands of pounds instead of in millions. (232222)

The result was fair in the case of a 45 year old clergyman, an indulged only child, whose reaction to stress had always been to develop somatic symptoms and hypochondriacal concern over them. His leucotomy was done after increasingly severe tension in the face of real parochial troubles had made it difficult for him to carry on during 4 years. Some relief of tension was obtained and he returned to his parish within 10 days of operation, where he has since carried on although his symptoms have been exacerbated as fresh problems have faced him. (323123)

The next case is an example of the effect of leucotomy in a less adequate personality:

A married woman of 25, two of whose sisters were similarly shy and sensitive, had always been upset by quarrels between her parents. Easily embarrassed and acutely conscious of blushing excessively she had, on this account, to leave the Land Army in which she was working happily. After some conflict and indecision she married and was obsessionally houseproud, fearful of going out and of meeting strangers. Despite out-patient psychotherapy she continued to be intensely self-conscious and variably depressed and after 3 years was leucotomized. For a year she was better, but the attempted suicide of a neighbour threw her into a panic and she has needed regular sedation since to control recurrent attacks of panicky and guilt-ridden depression which are, however, becoming less frequent. Two and a half years after operation her husband says "for the last 6 months I have known what it is like to have a normal wife"; but she still has some symptoms and has suffered some intellectual loss of which she is well aware but does not regret. She is more irritable and has less endurance, but her lessened concern with appearances makes her easier to live with and the reduction in emotional tension makes her more stable. (232211)

This case illustrates well the way in which personality deficits common to many patients after leucotomy can, in a particular personality setting, lead to both undesirable and desirable effects. There is a worthwhile relief of tension but less than one might expect from a standard leucotomy: on the other hand personality deficits are only slight and satisfactory relief has been achieved without undue "simplification" of the personality.

In the group of 33 patients with tension states, 11 rate good results, 10 fair and 12 poor. The reason for failure was not always clear, but one hysteric, comfortably resident in a mental hospital seems to have been mistakenly regarded as tense. Six patients later had more psychosurgery and 4 were symptomatically helped, but in all but one, who had a unilateral standard operation, the personality deficits were such as to make them in many ways unsatisfactory people. I am discussing the question of second operations in another paper.

Obsessional States

Ten of the 26 cases resembled those discussed under the heading of Tension States but the obsessional features were more marked. Four rate as good results, 3 as fair and 3 as poor. Two of the poor results were in markedly immature and insecure young women, with overwhelming dependent needs, features which seem to make it impossible for patients to take advantage of the general reduction in tension brought about by operation. Both these patients had to cope with unaltered environmental conditions which were full of conflict for them:

A woman of 34, terrified in childhood by constant quarrels between her overbearing and aggressive mother and her cyclothymic father, felt herself inferior to her more favoured older sister and was a cowed, enuretic, much punished child, who early developed obsessional rituals against her fears. She was further handicapped by recurrent attacks of acute rheumatism and was dyspnoeic from mitral stenosis. Her mother and sister interfered in her marriage and her husband demanded fellatio. Though partly relieved by leucotomy of the depression which had totally incapacitated her for a year she remained immature, insecure and still had obsessional ruminations and compulsions. (324423)

In 5 cases entrenched ritualistic behaviour was the most striking feature and the only one who was even a fair result has frontal lobe deficit symptoms more marked than in any other patient in the series, except some of those who had extensive cerebral haemorrhage.

One woman, the daughter of an obsessional, neurotic mother, had compulsive symptoms for 16 years, but these had only become crippling for 3 years, during which she used them in a never-ending hysterical vendetta against her husband for his supposed infidelity. All that leucotomy did was, to her annoyance, to diminish her energy; she was liable to drop off to sleep in the midst of her compulsive cleaning, so that she could achieve less in the time. Three years later the disaster she had both feared and courted came about, for her husband left her. (434444)

In 4 men of markedly obsessional personality and with predominantly ruminative symptoms from childhood, the essential pattern was unchanged by leucotomy but reduction in intensity of symptoms, whilst accompanied by no striking change in the way of life, was such that 2 rate as good results and one, though he remained in the grip of a tyrannical routine, has lost the somatic symptoms of anxiety which previously accompanied frequently recurring depressive phases.

In 5 cases in which the onset was more definitely related to specific external events the result was good.

A 32 year old woman of low average intelligence grew up in a broken home with a mother who was "always on about germs". She had no obsessional symptoms herself until at 24, 3 days after her marriage, a former boy friend turned up and she was involved in regrets and doubts, which found expression in fears of contamination and elaborate protective behaviour, particularly against contamination by anything which came into the house by post and which seemed to symbolize the desired but rejected suitor. During the next 8 years the spread of obsessional behaviour progressively crippled the whole family. After rostral B leucotomy it gradually died away and when, a year later, her husband became incapacitated for work, she found it possible to work as a bus conductress. In the past, because of her fear of contamination by money, this would have been impossible. Those few symptoms which remain are easily tolerated and she and her family are delighted. (232111)

The 2 remaining cases present marked psychopathic features:

A 27 year old typist had indulged in sadistic masturbatory phantasy from the age of 3, and her childhood was marked by ritualistic confessions, prayers and expiatory rituals. She was immature, and though superficially kind and considerate this was a cover for much hostility. She "liked to think up all the naughty things and make someone else do them", and later tried many times to bring about her mother's death by making her go up and down stairs unnecessarily, hoping her heart would fail, or by screening her from approaching traffic, only to step back suddenly leaving her mother as a target. She was preoccupied with thoughts of food, and as a result of compulsive prohibitions and phobias came to resemble a case of anorexia nervosa. Leucotomy made her euphoric and 3 years later she clearly got immense fun from her life. Release from compulsive restraint enables her to indulge a perversion of eating reminiscent of the orgies of the Roman decadence, but since this is carried out late at night and in private and her behaviour otherwise is entirely satisfactory the result cannot be regarded as other than good. (231111)

The other case was referred to by Maclay (1953) as the third of 3 people who have committed murder after leucotomy and are now in Broadmoor.

She had an operative haemorrhage and her obsessional symptoms were greatly relieved for 9 months thereafter. It is debatable whether leucotomy can be held in any way responsible for the "suicide pact" with her young daughter, which resulted in the latter's but not her own death. Her personality was such that had anything like this occurred apart from leucotomy, it would not, perhaps, have been really surprising.

The cases of obsessional illness in this series were probably rather less severely incapacitated on the whole than in Partridge's (1950) series. Table IV compares the results in obsessional states with Partridge's, using his terms to describe the improvement.

TABLE IV

	Partridge (1950) (24 cases)	Rostral Series (26 cases)	
Operative death	1	–	
Non-fatal haemorrhage, final result worse	–	1	
Unimproved	1	3	"Poor"
Slightly improved	1	6	
Distinctly improved	1	4	"Fair"
Substantially improved	9	9	"Good"
Relieved of obsessional symptoms altogether	11	3	

Evidently rostral leucotomy is less effective in relieving symptoms, but the results are satisfactory, particularly in those cases with marked tension who resemble the patients discussed under "Tension States", and those whose illness has been related to specific environmental stress, especially if they were not previously grossly obsessional. The worst results, as with all psychosurgery, were in those with entrenched ritualistic behaviour and those whose obsessional behaviour was hysterically motivated. The more a compulsive act comes to resemble a conditioned response, carried out automatically, the more likely is it

to persist, just as delusional beliefs and phobias may persist; it may be, as some of these cases suggest, that fear which has become conditioned to a situation, such as travel, which provides a real and continuing stimulus, is less likely to be relieved than a phobia which arises more directly on a basis of emotional conflict. Thus, for example, a young obsessional had two main fears:

(*a*) that he had somehow infected girls with syphilis (this did not apply to any particular girl, and seemed based on masturbatory guilt).

(*b*) that he had left engines, on which he worked, in a dangerous condition.

The first fear was relieved by rostral B leucotomy, the second, the conditioned stimulus for which was ever present, was not.

Often the intensity of experienced fear was much reduced in the feared situation (e.g. travelling) if patients could be induced to face it, but in several cases the phobia continued to be just as incapacitating because patients would not put themselves to the test.

Hypochondriasis

As a symptom this is common enough in depressive, schizophrenic and psychoneurotic states in general. Here are considered 14 cases in which preoccupation with supposed physical ailments or excessive concern with real physical illness dominated the clinical picture. Apart from one case in which hypertension, abnormal EEG, dilated ventricular system and psychological tests suggested an organic basis for involutional hypochondriasis, all were suffering from hysterical illness in that their symptoms, however unsatisfactorily, provided some solution for life problems of which they were more or less aware but did not connect, at any rate fully, with their complaints. One died of operative haemorrhage; in two, depressive features were evident but had become obscured by marked hysterical features; both of these did well:

A dull and envious woman of 41 had haunted her doctor for 17 years with hypochondriacal complaints, mostly about her bowels. An epileptic and mentally defective daughter was part of the life problem behind her symptoms. At 40 the departure of her son overseas on national service precipitated a depressive illness with early waking, weight loss and diurnal variation of mood, in which her hypochondriacal complaints were magnified. In the course of a year the depressive features faded and it was for the persistent intense hypochondriasis and despite 'belle indifférence' that leucotomy was done. She is not symptom free but much less concerned over her health and no longer broods so jealously. Nearly 4 years after operation she was again depressed for a few weeks when her son's good fortune in being given a new house made her envious, but this passed with the help of a bottle of medicine. (232221)

Amongst the 11 other cases there is only 1 good result:

A 65 year old woman whose miserable preoccupation for many years with facial pain seemed related to a not entirely satisfactory relationship with her husband. Despite this she had a good home and after operation seemed more able to accept the comparative emptiness of a life in which "so long as I take my dog out my day is full". (232112)

An important distinction between this case, which did well, and those who did badly, seems to be the degree to which a life problem is overwhelming a particular personality. In the case of a 52 year old man who had also complained bitterly for years about facial pain, which had begun as trigeminal neuralgia, the life problem was a squalid home with a wife who was an outspoken slut. Relief of his symptoms would necessitate making him insensitive to his surroundings and to the pride and insecurity which made it impossible for him to get rid of his wife. I do not think that standard leucotomy would do any better in this case, but rostral leucotomy certainly had no obvious effect. In the other cases, too, symptoms seem necessary in the sense that life has set problems which these personalities cannot tackle in any other way. There is, for example, a woman

of 58 left with tinnitus by a labyrinthine haemorrhage, who after receiving an unhopeful prognosis said, "I am not going to be a deaf old woman. This means another breakdown for me." Since her hypochondriasis brought her a great deal of loving care from her husband it was not surprising that leucotomy failed. Rostral leucotomy has, in fact, been conspicuously unsuccessful in cases of hypochondriasis. This contrasts with the common opinion that cases of hypochondriasis do well with leucotomy and the reason lies, I think, not in rostral leucotomy being an inadequate operation, but that many cases were wrongly selected, who had adopted hypochondriasis as a way of life with which they could not dispense. Where hypochondriasis is symptomatic of depression, where there are personality assets and a possibility of altering an unsatisfactory environment then much better results can be anticipated. One patient illustrates very clearly the relief of emotional illness but with persistence of a hypochondriacal way of life.

An actress of 50 had never really achieved anything so satisfying in her life as playing in Maeterlinck's *Blue Bird* at the age of 8. A lifetime of hypochondriasis, with frequent visits to hospitals in two continents, had given her life some meaning and provided excuses for not having done better in her career. When her mother died she became agitated and depressed and her hypochondriasis assumed tremendous proportions. With the relief of depression by open rostral leucotomy a year later she reverted to her normal level but was perhaps more difficult to live with because of an accentuation of her shrewishness and an increase in absentmindedness. (132322)

As judged by these results *the indication for leucotomy is not hypochondriasis, but tense, anxious hypochondriasis.*

Psychopathic Personalities

There is no sharp distinction between the many vulnerable personalities considered under other headings and the 23 patients discussed here. There is, however, in these a more marked lack of restraint in behaviour, a greater impulsiveness, egocentricity and lack of thought for others; many could be called sociopathic. Some were unrestrainedly aggressive and in 7 the operation was done largely because of this; only one of these was even a fair result and there is reason, from the marked personality deficits, to suspect an unusually extensive lesion in her case. Of 5 inadequate psychopaths only one rates even fair and this because he was relieved of compulsive behaviour based upon obsessional rumination.

An alcoholic with a consumption of 30 pints of beer daily had always been intolerant of discipline and several times in the hands of the police for aggressive behaviour; since operation he drinks as much, is even less restrained and on the whole worse. (434445)

A young rag and bone man, from a squalid East End home, had for 3 years been incapacitated by a severe tension state following a motor smash when on unauthorized absence from his unit in the army. Rostral B leucotomy only relieved tension for a few weeks. Within 2 months of operation he had become actively homosexual and one must assume that leucotomy had some effect on bringing this about though even without it would not have been an unexpected development. (424444)

Two schizoid psychopaths became more stable and rate as good results; these and the 3 good results in cases of psychopathy with marked hysterical features are clearly related to relief of tension; in each case antisocial behaviour was dependent on intense suffering; in the 6 cases of hysterical psychopaths who did poorly it was much more evident that they had never learnt to discipline feelings or restrain their impulses; in 4 there was a purposive use of symptoms which was less evident in the others considered in this section. None of 4 patients who had a second operation was any better for it and one was very much worse.

Twenty-one patients were operated on for *mental illness as a reaction to or in association with organic illness*. Seven had intractable pain and the findings here were in agreement with the many authors who have written on the subject: leucotomy often relieved emotional distress so that less attention was paid to pain; in one case of postherpetic pain in a recurrently depressed and anxious man, whose pain showed diurnal variation, the depression was mitigated in the way that Stengel (1950) described and in the course of 6 months his pain gradually disappeared. In one case of severe pain following ophthalmic herpes zoster, rostral O leucotomy was ineffective and later standard leucotomy reduced the patient's emotional over-reaction but only at the expense of serious personality deficit. Where pain was an "old friend" (Penman, 1954) and apparently a necessary part of the patient's adaptation to life, leucotomy had little effect e.g. a plump and contented man who for 15 years had done no work because of facial pain, collapses and a host of other hysterical symptoms, and had become comfortably dependent on pethidine and phenobarbitone.

Tinnitus was a prominent symptom in 7 patients and in 5 the operation was done mainly for its relief; 4 of these were included in the group of 17 discussed by Elithorn (1953) and there is nothing to add to his conclusions. Three hypertensive patients, who became depressed in association with strokes, the result of cerebral vascular disease, all did well.

There remain 6 patients suffering from miscellaneous conditions and no useful conclusions can be drawn from the study of them as a group.

Schizophrenic and Paranoid Illnesses

Thirty-two cases, one of whom died as the result of operation. In 2 the rostral operation was done some years after a standard leucotomy had failed to give relief and in one of these, though the final result was poor, the "administrative" improvement was worthwhile. Ten patients derived no help in any way from rostral leucotomy and later standard leucotomy in 4 of them only led to worthwhile improvement in one, a young man regarded, probably wrongly, as a simple schizophrenic, who had had recurrent depressions for 9 years. Eighteen patients were symptomatically improved by the reduction of suffering; 2 relapsed quickly and in most of the others there was no striking change in the clinical picture. In 3 cases, however, there was complete and lasting remission and in a fourth sufficient relief to allow resumption of a comparatively normal life, these 4 patients rating as good results. Two were suffering from paraphrenia which developed in the sixth decade in patients who had not previously been ill.

A methodical, fussy schoolmaster of 65 had for 5 years increasingly bizarre hallucinatory experiences and primary delusions to which he reacted at first with interest and annoyance and later with despair. E.C.T. brought about a complete remission for 10 months. With further recurrence of his unpleasant experiences, which included the removal of his ghost body to a well known teaching hospital at night for experimental purposes, he became depressed and made a determined suicidal attempt. Two and a half years after leucotomy he has remained well and has given no indication to his wife of remembering anything of his illness. He has resumed teaching and the only change in personality is that he is a "little toned down" and less inclined to worry over trifles, minor changes which but for his having had an operation would have been put down to advancing years. (111111)

Complete remission was obtained in a 23 year old girl who had broken down suddenly 18 months before without any obvious external stress. She was agitated, depressed and perplexed, with vivid aural and visual hallucinations and incontinence. E.C.T. always had a temporary good effect in recurrent phases of more intense suicidal depression. Eighteen months after operation she had been working well for a year and was making sensible plans for her marriage. (131112)

The results were regarded as fair in 5 cases, in 2 of whom it is doubtful whether leucotomy played much part. It appears from this small series that rostral leucotomy is only likely to be useful in schizophrenia where there is a good prepsychotic personality; where the affective response is strong and appropriate, tension and depression being especially likely to yield; where aggressive acts and phantasies, if present, are directed against the self rather than outwards; where illness is of less than 4 years duration or episodic or fluctuating markedly in response to environmental influences. Late paranoid and atypical illnesses on the whole do better than other types. In fact, no patient readily classifiable as hebephrenic, simple or catatonic did well, though several had some symptomatic relief.

Discussion

So far I have explicitly mentioned the prognostic importance of emotional tension; this is so in all diagnostic categories (Greenblatt *et al.*, 1953, found it the only clinical factor of definite predictive value in their series of 116 mostly schizophrenic patients).

To have confidence in prognostic criteria derived from a study such as this it is desirable that patients should have been assessed before and after operation by the same observer. In this series it was not possible for me to see patients beforehand and conclusions are therefore put forward tentatively. It has seemed clear that besides the presence of emotional tension and a quantitatively adequate incision (O is rarely adequate) the quality of the result depends upon the personality of the patient and on the sort of environmental difficulties with which he has to cope after operation; it is not easy to judge to what extent environmental difficulties are truly insurmountable for a particular patient; only the history can give some guide and in some cases which have been cited the failure of leucotomy to make these inadequate people more adequate is not surprising. Golla (1946) observed that the operation was to be "considered only as a step in the reintegration of personality". Often too little attention is paid to environmental factors, and leucotomies seem to be done as a last resort without adequate investigation of the problems which will continue to face the leucotomized patient. The results in many cases of affective disorder tend to make one forgetful of the amount of social work and psychotherapy which may be needed before a neurotic patient is in his stride again: many middle aged depressives have good personalities, established homes and loving relatives and, if they have not been ill for many years, little or no rehabilitation is needed after the rostral leucotomy. The situation is very different for psychoneurotic and psychopathic persons whose long partial incapacity has often created problems which may indeed be insoluble. I cite one case at length to indicate the sort of case work which may be needed, and without which it is useless to leucotomize:

A 45 year old housewife, the fourth of the nine children of an improvident drunkard, was brought up in an industrial slum. She was described by her mother as "the worst-tempered child" but got on well outside the home. Obsessional symptoms appeared at 14 and her left hand became, as it were, sacred, so that it could only be used for "good" things. Many rituals developed and lasted for 9 years but were not seriously incapacitating. Recovery was sudden and followed a determination to stop it all; apart from minor obsessional traits she was well until 36 when she had a breast abscess after the birth of her only child. Obsessional rituals increased and she was many times in hospital, depressed, irritable, tense and apprehensive. Finally she was totally incapacitated and she and her home were filthy. No amount of social work had been able to prevent this. Leucotomy made little obvious difference at first and she spent most of the next year in a convalescent hospital where she found she could carry out some actions, such as knitting, which previously had been impossible. Meanwhile an energetic

social worker badgered the local authority into cleaning up the home, so that when she returned she did not have to face tasks which almost certainly would have precipitated a relapse. Social work and support have continued and she has made steady progress. Comparatively minor obsessional symptoms remain but the final result is good. (212122)

Sometimes the changes necessary occur by chance, and the fact that such things can happen should keep us alert to the possibility of engineering helpful changes:

A 23 year old dressmaker had been ill for 4 years with a severe tension state precipitated by fears that her parents were going to separate. She had become emaciated and no treatment (including narcosis, E.C.T., 20 insulin comas and a year of psychoanalysis in hospital) made any real difference. After leucotomy there was little obvious change, but she herself thought she was calmer. She did not leave hospital until 7 months later and then, living with her mother, found herself rapidly reverting to her previous state. At this point she chanced to meet a kindly man, ten years older than herself, who took her around, giving her interests outside her home, and eventually in the face of maternal opposition, married her. Five years after operation she was, with his support, coping well with housing difficulties and had had a baby. The rating 222211, indicating a good result, probably owes as much to the change in her circumstances as to the leucotomy.

The patient who has been long in hospital must not be allowed to settle back into his old ways after operation: the tendency to persist in old habits is shown not only by schizophrenics, but by depressives, phobic and obsessional patients as well.

A 62 year old printer, a prim, fussy little man who had been more than 40 years with his firm, felt himself ridiculed when a question he had suggested to a friend was derided at a political meeting; 2 sons had been killed in the same year; he developed an agitated depression for which he spent 5½ years in hospital before rostral B leucotomy was done. There was little apparent change for over a year until his third son, who had been away on national service, came to see him. This seemed to provide enough of a stimulus to alter his outlook; within a few months he had recovered and went home where his wife, having made a life of her own in the 7 years he had been away, could not abide him and soon left. He is working well at his old job and his associates find little difference in him. (121112)

Several patients improved strikingly as soon as they were discharged from hospital. In general there is no need for prolonged rehabilitation in hospital after rostral leucotomy, provided that the patient has a satisfactory home, and work to go to. Even without this, early discharge may well be the best policy; after leucotomy one certified paranoid patient made repeated attempts to escape from hospital and though he was greatly improved and no longer driven distracted by his "tormentors", his escapes were countered by keeping him in a refractory ward. Ultimately he managed to escape and had not been readmitted during the next 6 months.

As regards the personality factors, rostral leucotomy is too limited an operation to have much effect on established personality traits. Sargant (1953) has repeatedly stressed that the more worried one is about doing a leucotomy because the personality remains good, the better will be the result. Ström-Olsen and Tow (1949) disagreed on the basis of their experience with standard leucotomy, but it is true of the present series that the better results have been in the more adequate personalities who have shown in the past a capacity for friendly relationships, adaptability, the capacity to work steadily, etc. Unfavourable features have been marked feelings of insecurity and passive dependent needs, secondary gain from illness, "necessary" symptoms, firmly established unsatisfactory behaviour patterns of whatever kind, and hysterical exploitation of illness. Greenblatt *et al.* (1953) from their study of schizophrenics conclude that "the greater the emotional maturity, the better the interpersonal relationships, the less personality disorganization and the higher the anxiety and tension, the better the outcome"; my conclusions from a study of markedly

different case material, are therefore similar. In any potential candidate for leucotomy we must ask:

(1) Would he be any better if his emotional tension were reduced, his depression lifted, his ruminative worry diminished?

(2) Has he personality "assets" which will enable him to reorganize his life to get some satisfaction for his needs.

(3) Is his environment satisfactory or can it be made sufficiently so?

(4) How extensive a lesion is likely to be needed and where should it be?

The answer to the last question is slowly becoming clearer; we now know that quite limited topectomies (Pool, 1951; Le Beau, 1953; Tow and Whitty, 1953), or cortical undercutting (Rylander, 1952; Scoville, 1954) may be adequate in patients with well preserved personalities. The results of rostral leucotomy confirm this; it is an adequate operation in most cases of affective disorder, and should certainly be considered in all other cases with well preserved personalities before submitting them to the often mutilating standard cut.

Summary

The results of rostral leucotomy in the first 240 cases operated on by Mr. Wylie McKissock are described. A personal follow up was carried out 1½ to 5 years after operation. The 3 rather different operative approaches, and the rating scales used in classifying the results are described.

There were 3 deaths attributable to the operation; only 1 death occurred in 177 consecutive blind rostral operations (0·6 per cent.); major non-fatal intracerebral haemorrhage in 1·7 per cent.; less severe bleeding in perhaps 5 per cent.; a frontal lobe abscess in 1 case. There is therefore an operative morbidity of about 7 per cent. but lastingly serious effects in only 1 per cent. Urinary incontinence in the early post-operative period occurred in less than 10 per cent. of cases and was rare after uncomplicated operation except where there were contributory causes. The morbidity is higher in hypertensive patients but not sufficiently high to make hypertension a serious risk.

Epilepsy occurred post-operatively in 4·6 per cent. of 196 cases whose operation was uncomplicated and who had no previous history of fits; in 24 per cent. of 21 cases after a second leucotomy; in 20 per cent. of 15 cases with probable undue operative haemorrhage, etc. Three patients had attacks of status epilepticus.

Six patients, 4 of whom were obsessional, were strikingly disinhibited during the early post-operative period; this condition appears to be distinct from post-operative attacks of hypomania observed in 10 cases of affective disorder of endogenous type, especially in recurrent depressive illness. Caution is advised in recommending this last type of patient for rostral leucotomy.

The Open O, Blind B and Blind G operations are compared. The open operation gives much inferior results and is no longer in use. There is little to choose between B and G, both of which give worthwhile results in two-thirds of the cases of affective disorder and psychoneuroses. There is a suggestion that intellectual deficits are likely to be more marked after G, and B is therefore recommended as the most satisfactory of the three operations. The therapeutic results are comparable to those obtained by standard or lower quadrant operations and in view of the slight personality deficits after rostral leucotomy it is suggested that this should replace the other operations in suitable types of case.

The importance of social, environmental factors is discussed. These may well determine the success or failure of the operation and should be carefully assessed in each case, with the idea that modifications may be brought about which will enable a patient to cope when his tension has been partially relieved by operation.

Success or failure depends largely upon three main factors:

(1) The extent to which symptoms, of whatever kind, depend upon distress, whether of tension, depression or ruminative thinking.

(2) The quality of the personality.

(3) The possibility of helping the patient to surmount environmental difficulties.

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