ELECTROCOAGULATION OF THE CEREBRAL ORBITAL PROJECTION IN THE PERSISTENT DEPRESSIVE PSYCHOSES OF THE ELDERLY

By

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THE tranquillizing drugs are used so extensively in the control of psychotic states that the wave of enthusiasm threatens to swamp the entire therapeutic field. Yet, until the scope and limitations of these drugs have been established it would be unwise to neglect advances in other methods of treatment. Prefrontal leucotomy has long since passed the crest of its wave, and in recent years conservative operative techniques and a more selective field of clinical application have rendered it a valuable treatment for certain groups of patients.

The earlier standard operation with its blind surgical approach and uncertain side-effects has rightly been discarded, as also the use of brain surgery in schizophrenia, since the best that can be achieved is a one-third discharge rate, and Robin (1958) has shown in a follow-up study of 91 cases with controls that no advantage could be found for the standard leucotomy operation.

Yet it is recognized that leucotomy achieves its best results in the disorders of affect (Pool, 1957) particularly when intractable emotional excesses such as tension, anxiety, agitation and depression dominate the patient. On the other hand, manic states, hypochondriasis and the manic-depressive psychoses show results from leucotomy little better than those for schizophrenia and it is doubtful if the operation has any place in their treatment (Robin, 1958).

The most gratifying results from leucotomy have been found in the severe and intractable depressions of the elderly and senile patient (Scoville and Ryan, 1955; Thorpe, 1958, 1959) and it is in this group of cases that a modified leucotomy procedure with its reduced risk of adverse personality change offers the patient the best chance of recovery.

With the development in recent years of the restrictive leucotomy techniques, encouraging reports have been received on a number of modifications under trial, although more statistical evidence is required to assess their relative efficiency. The recent reviews of Pool (1957), Freeman (1958) and Falconer and Schurr (1959) indicate the variety of procedure (topectomy, cortical undercutting, bimedial and orbital leucotomy) designed to isolate the orbital cortex of the frontal lobes with consequent alleviation of disorders of the affect and minimal personality defect.

A modified leucotomy procedure which seems to have been little explored is the electrocoagulative method introduced by Grantham (1951), and, as we have been unable to find any other reference to its trial in Great Britain, we decided to record our satisfactory experience of this method in the treatment of intractable melancholic states. This operation produces destructions of the ventro-medial fibre tracts by the insertion under X-ray control of an insulated needle through ventral burr holes, and passing a coagulative current. A small

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discrete tissue lesion is produced at the tip of each needle, and the advantages claimed for the method are more precise localization with minimal damage to the cortex, absence of post-operative convulsions, little or no intellectual impairment, less personality change, and no urinary incontinence.

In the present study we have assessed the results of a Grantham operation on 100 cases of persistent depressive psychosis treated at the Middlewood Hospital. The criterion of operation in the series was intractable or repeated relapsing severe depressions in patients showing no sustained improvement from other acceptable forms of treatment including electroplexy. After excluding 3 schizophrenics, the remaining 100 were consecutive operations performed during the 5-year period 1952 to 1957 by Mr. James Hardman in the Neurosurgical Department of the Sheffield Royal Infirmary. There were 71 females and 29 men in the group, and all (except 8 with retardation) had severe agitated depressions with involutional melancholia predominating, 73 patients being over the age of 50. A diagnostic classification is shown in Table I.

Operative Procedure

After shaving the head and premedicating with "Omnopon" and scopolamine, a vertical incision 7 cm. above the gabella is made under local analgesia

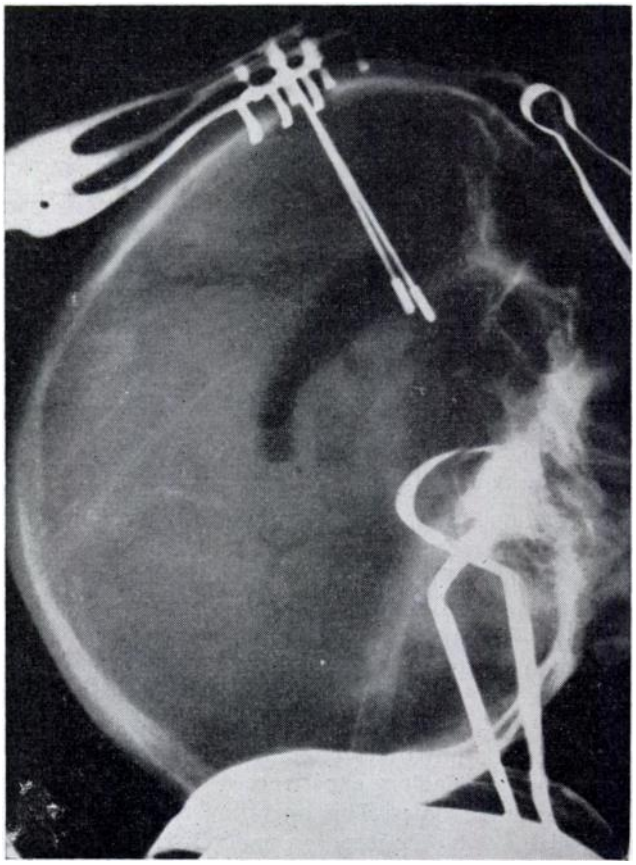

Fig. 1.—Lateral X-ray of skull showing electrodes in correct position.

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TABLE I

Diagnostic Categories

Diagnosis	No. of Cases	Improvement			Readmitted
		Marked	Mod.	None	
Chronic Depressive	46	23	20	3	4
Recurrent „	37	21	16	–	5
Hypochondriacal „	10	3	6	1	3
Obsessional	7	5	2	–	–
	100	52	44	4	12

2½ cm. on either side of the midline, just behind the hair line. Burr holes are made, the dura mater incised, and with the head accurately positioned, a canula is inserted into the anterior horn of each ventricle and about 20 c.c. of fluid removed and replaced by air.

The electrodes are thin steel rods insulated with polythene except for 9 mm. at the tip, and are inserted vertically into the brain, directed slightly backward to a depth of 5·5 cm. placing their tips just in front and below the anterior horns of the ventricles. The patient is carefully, and without head movement, wheeled on the operating table into the adjoining X-ray room.

Lateral and antero-posterior films are taken (Figs. 1 and 2) and if the

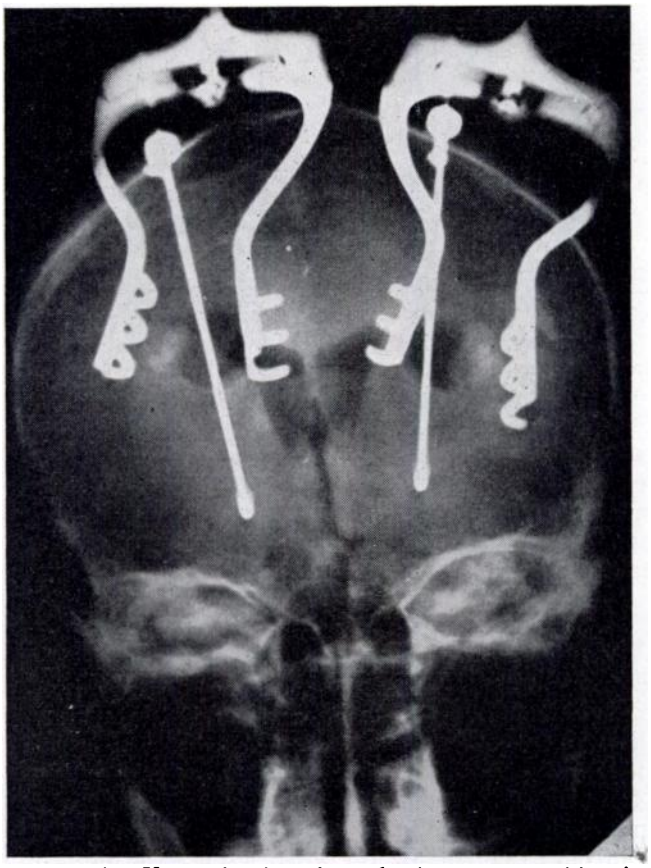

FIG. 2.—Antero-posterior X-ray showing electrodes in correct position just lateral to the anterior horns of the lateral ventricles.

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electrodes are seen to be in a satisfactory position, or after changing their position if necessary, the diathermy (Davis-Bovie Automatic-gap Electrosurgical Apparatus) is attached to each in turn and with a power setting of 20 on the coagulation device, the current is passed for 30 sec. and repeated after withdrawal of the electrodes by 1 cm. The optimum current strength is determined by trial in cases of terminal carcinoma with the object of producing an electrocoagulative lesion about $1\frac{1}{2}$ cm. diameter in the inferior medial quadrant of the frontal lobe, just above the medial orbital gyrus (Fig. 3). Such a lesion will interrupt the orbital fibres of the thalamo-frontal bundle at the site of maximal concentration near the anterior limb of the internal capsule.

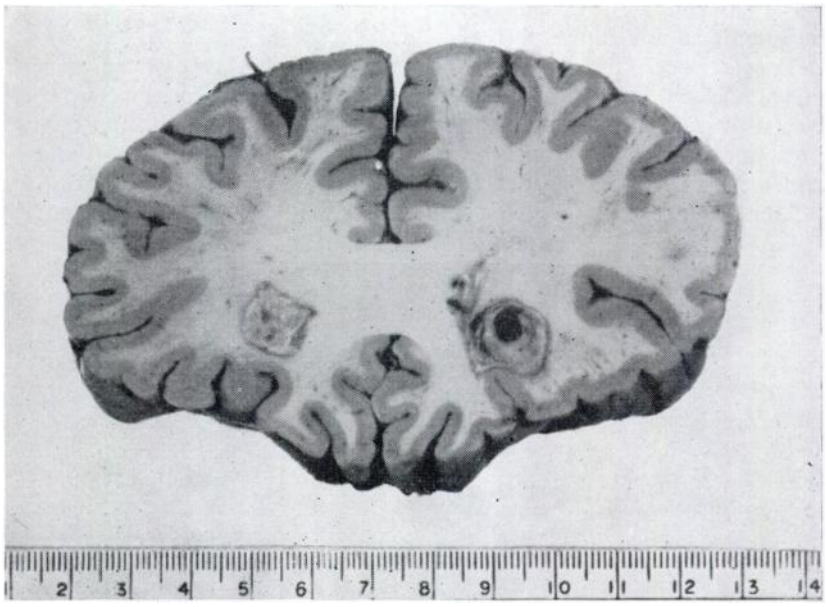

FIG. 3.—Coronal section of the frontal lobes of the brain to show position of electrocoagulative lesions in the orbital segments.

The patient is conscious throughout the operation which, because of the X-ray procedure, takes about 45 min. to complete. During most of the time the anaesthetist maintains a reassuring conversation with the patient, encouraging him to keep his head still. Immediately after the operation there is a noticeable relaxation, and he rests quietly with eyes closed, responding to simple questions, and may exhibit some disorientation.

Post-operative Course

The patient arrives back in the ward in a calm and tranquil state of mind and with little recollection of the operation except in some cases when the feel and sound of the drill is remembered. A few patients express denial of the operation for the first 24 hours. A rise of temperature up to 100° to 101° develops in about 8 hours, and may persist for 2 or 3 days, and seems to be in proportion to the extent of the operative lesion. The observation made by Ayd (1956) that absence of temperature forecasts a poor therapeutic result

might be due to minimal lesions, but we have been unable to confirm this in our series.

It is customary to give prophylactic cover of penicillin for the first 3 or 4 days, but there is usually no marked alteration in pulse or blood-pressure, and ordinary soft diet can be taken. The patient can sit up on the second day, get out of bed on the third day when the sutures are removed, and then allowed to be up in the ward. Mental improvement becomes apparent on the first day, agitation disappears, a placid demeanour, a ready smile, and occasionally a short phase of euphoria supervenes. Mental improvement quickly becomes stabilized, and it has been our practice to discharge patients home after three weeks, believing with Freeman that it is the function of the family to rehabilitate him and shape his convalescence. The operation scar is just behind the hair line, and has little adverse cosmetic effect. Many patients develop a moderate increase in weight.

General Results

The 100 cases have been reviewed and results assessed at the end of 1958, two to seven years following operation. Contact was made in the clinics, in the homes, and when personal interview was impossible, a report by letter was obtained. Only 4 patients could not be traced, having left their previous address, and assessment was based on their last home report (all recovered). Table II shows a summary of the results arranged according to age groups.

Table II

Results in 100 Cases of Grantham Leucotomy 1952—1956

Age Groups	No. of Cases	Progress: Improvement Marked	Mod.	None	Discharged No.	Readm.	1958 Review: Deaths Operative	Other	In Hospital	At Home
20-29	2	1	1	–	1	–	–	–	1	1
30-39	8	4	4	–	8	1	–	1	–	7
40-49	17	10	6	1	14	–	–	1	3	13
50-59	26	14	11	1	24	3	1	5	3	17
60-69	32	17	14	1	28	6	1	5	3	23
70-79	15	6	8	1	12	2	1	7	3	4
Total	100	52	44	4	87	12	3	19	13	65

The improvement rate was 96 per cent., including 52 recoveries and 44 moderate improvements. There were 87 patients discharged home. The term "moderate improvement" is used when tension and depression is mitigated, social improvement maintained, with less dependence on others though still retaining traces of the pre-operative symptoms, hypochondriasis especially. Of the 44 moderately improved patients, 32 were discharged home. The only unimproved patient was a female aged 63, who had persistent cephalgia uninfluenced by two Grantham procedures, though her depression was minimal.

Readmissions in relapse occurred in 12 per cent., 3 cases being subsequently discharged and of the 9 remaining one is dead, 7 are moderately improved and 1 (mentioned above) is unimproved. All the readmissions occurred in the moderately improved group, and 8 of them had experienced recurrent depressions before operation. Late depressive relapses occurred in 2 patients following discharge, one committing suicide and the other recovering without readmission.

The operative deaths were 3 in number, 2 from cerebral haemorrhage in hypertensive patients, aged 58 and 70, their deaths occurring on the 9th and 7th post-operative days respectively. A third patient, age 67, died on the 11th day with a purulent basal meningitis.

In a long-term study it is to be expected that many elderly patients will have died from non-operative causes, and at the time of assessment 19 such deaths had occurred, 17 from cardiac or cerebral vascular causes, 1 from cancer and 1 from suicide. Table II shows the deaths to be in the upper age groups, and of the 17 deaths 4 occurred within 1 year, increasing to 10 in 2 years, 12 in 3 years, 14 in 4 years, 16 in 5 years and one more in the sixth year.

Post-operative Complications

There were no instances of urinary incontinence. Epileptic fits occurred in 2 patients, a male aged 60 having one fit on the 6th day and none during the ensuing 2½ years of mental improvement, and the other, a female aged 66, developing late epilepsy after discharge home and reported to have occasional fits.

Some patients complained of tiredness and lack of energy, but nevertheless seemed to do a reasonable amount of work. Outspokenness and free use of criticism is not infrequently noticed by relatives, who should be warned of its possible occurrence. "I can stand up for myself now" a wife said, and the husband of another patient said his wife had never called him a b— before but he didn't mind as she was so much better. If marital incompatibility has been an adverse environmental factor, the post-leucotomy patient may be better equipped to endure the stress, but lack of restraint may cause trouble. One such woman with an unhappy marriage recovered from a chronic depressive suicidal state following leucotomy, but 3 years after discharge was convicted of attempting to poison her husband.

It is doubtful, however, if any serious adverse personality changes can arise from the limited operative lesion produced by the Grantham procedure, and such has been our general impression from the study of this series of cases.

Anatomical Study

We were able to make a macroscopic examination of the brain in 4 cases of this series. In the 2 deaths from cerebral haemorrhage the brain showed a large unilateral operative intracerebral haematoma in each case, situated at the site of the coagulative lesion and rupturing into the lateral ventricle. The cerebral arteries showed atherosclerosis. In the third case the post-operative infection had progressed to a purulent basal meningitis though the operative lesions were satisfactory.

The fourth brain available for study came from a female aged 72 who died in hospital 2 months after a successful orbital leucothermy. Although relieved of her chronic depressive psychosis, she died of coronary thrombosis. Examination of the brain in coronal slices showed what we would regard as a typical Grantham electrolytic lesion situated in the optimum position in the orbital white matter (Fig. 3).

The following is an abstract of the report from the neuro-pathologist. The illustration shows the post-mortem coronal section of the brain at a plane 4 cm. behind the tip of the frontal poles. The two small areas of coagulation necrosis are situated in the lower medial quadrants of the white matter. They are roughly 1 cm. in diameter on the left side and 1·2 cm. in diameter on the

right side. The area on the right side extends into the deeper layers of the cortex in the depths of a sulcus. On this side the lesion is situated just below and lateral to the tip of the anterior horn of the right lateral ventricle. A further coronal section 1 cm. posterior to the first cut at the tip of the temporal pole shows the area of coagulation necrosis in the lower medial quadrant at the ventral extremity of the anterior limb of the internal capsule. The area involved extends into the ventro-lateral part of the head of the caudate nucleus. At this level the lesions are again 1 cm. in diameter.

The lesion on the right side is slightly larger than that on the left and extends into the anterior part of the lenticular nucleus. Its ventral extremity extends into the cortex of the medial and central inferior frontal convolutions, and the middle cerebral artery can be seen in the sylvian fissure less than ½ cm. away from the limit of the area of coagulation.

Discussion

Many neurosurgical procedures at present under trial are directed at the frontal lobes with the object of relieving intractable disorders of the affect by interruption of the thalamo-frontal fibres. Most surgeons now appear to have as their anatomical target the isolation of the orbital cortex which MacLean (1949) and Fulton (1951) regarded as the cortical representation of the so-called "visceral brain", under which is comprehended the posterior orbital cortex, the cingulate gyrus, temporal pole, hippocampus, amygdaloid nucleus and their connections with each other, and with the hypothalamus and thalamus (Meyer and Beck, 1954).

The problem for the surgeon is to combine maximal therapeutic effect with minimal operative risk, and avoidance of unnecessary destruction of brain tissue with its resultant adverse personality changes. There has been a high measure of achievement in this direction, and the overall results of the different procedures compare well with each other although the published reports are too few to give a clear result.

Each neurosurgeon develops the technique of his choice, there being a choice between the open operation such as topectomy by Pool (1955), orbital undercutting by Scoville (1953), Tow and Lewin (1953), Strom-Olsen and Northfield (1955), Knight and Tredgold (1955), Hirose (1958) or bimedial leucotomy by Greenblatt and Solomon (1952), Falconer and Schurr (1959), and the closed operational approach as in the transorbital leucotomy of Freeman (1952), the blind rostral leucotomy of McKissok (1958) the former lower quadrant leucotomy of Thorpe and Hardman (1952) and the electro-coagulative method of Grantham (1951).

The Grantham operation was originally used for the relief of intractable pain and only later extended into the field of psychiatry. Few publications of any magnitude have so far appeared, but favourable reports have come from Grantham (1953, 1956), McIntyre (1954), Soupault (1955), and Ayd (1956, 1957). The advantages of the Grantham technique as a closed operation are the anatomical accuracy obtained by X-ray visualization of the electrodes during operation, the wide measure of control in the position and size of the lesion produced, the easy repetition of the operation at the same or a different level and the absence of any need for a general anaesthetic. It is particularly suitable for older or debilitated patients.

We adopted the operation for routine use in 1952 and have not found any reason to change. The operative risks are minimal though a 2 per cent. cerebral haemorrhage is not unexpected in view of the many elderly patients

with cerebral atherosclerosis. Post-traumatic epilepsy was negligible since the only one persistent case could be due to cerebral vascular disease. Personality defects have been few, outspokenness being a prominent feature in some 20 patients of the series.

Some comments on the Grantham operation have been made by other investigators, including Pool (1957), who states that in his experience the results are somewhat unpredictable unless the effects of cauterization are tested during the operation. Freeman (1958) considers the procedure too recent to permit adequate clinical or anatomal studies that would establish its superiority over other methods with a larger period of performance behind them. Ferey et al (1956) found a variability in the position of the lesions in their two brain specimens. None of these comments is serious, and much depends upon the skill and experience of the operator.

The therapeutic results obtained in this series of mainly elderly patients suffering from persistent depressions compares more than favourably with the recorded results of other operative procedures in the same type of case. Freeman (1950) noted that involutional depressions offer a promising field for leucotomy, taking up where convulsion therapy leaves off, and he noted that 60 per cent. of 144 patients had a good result. Pool (1957) finds 85 per cent. of depressive patients improve after brain surgery.

In the present series of 100 patients a 95 per cent. total improvement rate may be regarded as the best one could hope to obtain with any neurosurgical procedure on institutionalized cases, and fully confirms previous reports on the therapeutic efficacy of the Grantham electrocoagulative ventromedial (orbital) leucotomy.

Summary

A study has been made of the therapeutic effects of an orbital leucothermy operation using the Grantham technique and placing an electrolytic lesion in the ventro-medial quadrants of the frontal lobes of 100 patients with persistent depressive psychoses. Assessment of results was made 2 to 7 years after operation, at which time 65 patients were at home, 13 in hospital and 22 dead (3 operative deaths). Most patients were over 50 years old.

The total improvement rate was 96 per cent., 52 patients showing complete recovery. Only one patient showed no clinical improvement, and 87 patients were discharged after operation. There were 12 patients readmitted in temporary relapse. There were no serious post-operative personality defects and only one case of established epilepsy.

An anatomical study was made of the brain of an improved patient dying after 3 months with coronary thrombosis. It is concluded that the Grantham electrocoagulative procedure is an accurate though closed leucotomy technique with a wide range of modification and capable of producing maximal therapeutic results with minimal adverse physical or personality defects. It is particularly suitable for the old and debilitated patients.

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