Psychosurgery: stereotactic subcaudate tractomy. An indispensable treatment

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Psychosurgery: Stereotactic Subcaudate Tractotomy
An Indispensable Treatment


Background. Stereotactic subcaudate tractotomy (SST) is the only type of psychosurgery performed at the Geoffrey Knight Unit, London, where nearly 1300 operations have been done since 1961. Statistically reliable data are not available to prove the effectiveness of SST. A detailed statement about contemporary psychosurgery is given.

Method. Relevant publications from the Unit and via Medline are discussed. The outcome figures are reviewed. The outcome is assessed at the Unit in global and clinical terms, associated with results of self-completed questionnaires.

Results. SST allows 40–60% of patients to live normal or near-normal lives, perhaps with continuation of medication. A reduction in suicide rate to 1% post-operatively, from 15% in cases of uncontrolled affective disorders is seen.

Conclusion. As a treatment of last resort, no controlled trial against a comparable treatment is possible. It appears reasonable to offer SST to patients with suicidal and deluded depression or with frequently swinging moods, not responding to other treatments.

After years of controversy and hostility, psychosurgery in Britain has become re-established on rational clinical principles, after the original operation of prefrontal leucotomy became obsolete in the 1950s. A review of recent literature suggests that there are or recently have been units carrying out regular operations only in Boston, Stockholm and London. The general, although not invariable, favour now accorded to psychosurgery in the UK is illustrated by the regular approval by the Mental Health Act Commission (see below) of cases accepted for psychosurgery; by the continuing referrals for assessment for possible surgery (Table 1); and by a questionnaire survey showing that 78% of 144 general adult and old age psychiatrists in the National Health Service regions of Yorkshire and Trent reported that they have referred or may wish to refer patients for psychosurgery (Snaith et al., 1984).

Such attitudes in the UK may be due to three factors. First, the operation of stereotactic subcaudate tractotomy (SST) has proved to be a highly refined, safe and effective operation. It involves modern stereotactic techniques allowing accurate siting of the lesion to within 1–2 mm. Second, the use of the operation is supervised by an appropriately experienced psychiatrist and neurosurgeon working closely together. Third, psychosurgery has in recent years been practised only in a very few appropriately staffed and specialised centres.

The Geoffrey Knight National Unit for Affective Disorders, set up in 1970, has experience of nearly 1300 operations. It has a multi-professional team, along with two part-time consultants, that includes a junior doctor of lecturer status, a secretary, a half-time senior social worker and occupational therapist, and the services of a psychologist when needed.

British practice involves a referral from a local psychiatrist to the psychosurgical team and not to a neurosurgeon alone, as was the tradition. While neurologists and neurosurgeons developed psychosurgery their close collaboration with psychiatrists has been required to subsequently clarify its clinical significance and validity.

Misunderstandings

‘Psychosurgery’, as the treatment of appropriate psychiatric disorders by means of cerebral neurosurgery, involves routine neurosurgical techniques. It appears that, more commonly in the past, ‘psychosurgery’ is not acceptable but ‘neurosurgery’ is entirely approved of. The word does provide a potential for confusion. For example, are temporal lobe operations always to be regarded as neurosurgical or could some indications, such as pathological aggression or schizophreniform disorders (Taylor & Falconer, 1968), suggest that they are psychosurgical?

There are those who insist that surgery is inappropriate for psychiatric disorders because they lack an organic basis (Bridges, 1984a). The absence of awareness of possible metabolic origins of the
Table 1

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<tr>
<th>Year</th>
<th>Brook hospital</th>
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<tr>
<td>Referrals</td>
<td>Operations</td>
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</tr>
<tr>
<td>1979</td>
<td>74</td>
<td>69</td>
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<td>1980</td>
<td>47</td>
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<td>1981</td>
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<td>73%</td>
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<td>1982</td>
<td>51</td>
<td>62</td>
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<tr>
<td>1983</td>
<td>31%</td>
<td>18%</td>
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<td>1984</td>
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<td>1993</td>
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Remarkable misconceptions are revealed with great clarity. In any case, too much reliance on simplistic explanations is to be avoided. However intense the social stress an element of predisposition must be involved because resulting psychiatric incapacity is not invariable.

There is now much evidence that affective disorders in some way involve neurotransmitter abnormalities (Delgado et al., 1992). In the recent past neurosurgery on the basal ganglia was a treatment for the neurotransmitter abnormality of Parkinsonism; this largely gave way to levodopa when this drug became available. Similarly, SST is a neurosurgical treatment on the frontal lobes, involving the limbic system and presumably having effects on neurotransmitters. This operation may now be giving way to the more effective use of psychotropic medication, as will be described.

With the possible and rare exception of the use of amygdalotomy for abnormal aggression (Kiloh et al., 1974), psychosurgery is not carried out primarily to alter behaviour, as once quite incorrectly defined by the World Health Organization (1976).

Neither is psychosurgery a "bizarre treatment for bizarre illnesses" as Valenstein (1986) attempts to establish in Great and Desperate Cures. He mentions some of the disastrous 'cures' of the distant past, and links them with insulin coma therapy in the more recent past, and with electroconvulsive therapy (ECT) and prefrontal leucotomy. The issues become clouded so that all these treatments are seen as a series of completely misguided assaults on patients which inexplicably keep recurring in psychiatry. ECT is still an essential treatment for certain severe illnesses, as is psychosurgery when both medication and ECT prove ineffective.

Historical background


Moniz (Damasio, 1975) first suggested frontal lesions for some psychiatric disorders and he devised the first psychosurgical operation, carried out in 1935. This was followed one year later by the standard prefrontal leucotomy operation (lobotomy — lesion in a lobe — in the USA; leucotomy — lesion in white matter — in the UK) of Freeman & Watts (1950). The question continues to be asked: how was it possible that over 10,000 prefrontal leucotomy operations were carried out in Britain alone in the
10 years from around 1940, despite the significant risks of personality destruction and death (Tooth & Newton, 1961)? Distorted perceptions of the past and subsequent prejudice now obscure the extreme clinical value of this operation in its time. It was largely a treatment for schizophrenia when there were no other specific treatments of any type for this disorder, which could result in a lifetime in hospital with persistently disturbed behaviour. The potential adverse effects of the operation no doubt seemed reasonable risks to take in the circumstances.

In a detailed study of over 10,000 cases, Tooth & Newton (1961) showed that the operation allowed as many as 18% of the patients with schizophrenia to be discharged from hospital. Prefrontal leucotomy must have appeared to be a remarkable therapeutic advance at the time. In 1949, Moniz received a Nobel prize for initiating psychosurgery. This indicates that it was a highly respected treatment soon before it ceased to be used.

Prefrontal leucotomy became obsolete in the 1950s, because of the introduction of chlorpromazine, a more effective treatment for schizophrenia and with little chance of serious side-effects. The controversy then began, with hostility generated towards psychosurgery which was undoubtedly associated with untenable and transient pseudo-psychodynamic theories of the nature of schizophrenia (Szasz, 1960; Laing, 1965). Tooth & Newton (1961) showed that depression did even better with prefrontal leucotomy so that as many as 50% with this diagnosis could leave hospital. Therefore, following the disuse of prefrontal leucotomy subsequent operations were increasingly refined and affective disorders became the main indications. Uncomplicated schizophrenia has not been an indication for these increasingly modified operations, including SST.

**An indispensable treatment**

In contemporary psychiatric practice SST must not be viewed as an isolated treatment. Its place is at the end of a progression of treatments beginning with antidepressant medication, going on to ECT, then high-dose and combined antidepressants are prescribed if necessary. When all these become ineffective psychosurgery is likely to be indicated. It is necessary to be sure that the appropriate routine physical treatments have failed to help after adequate trials. SST will produce recovery or considerable improvement in 50–60% of selected cases for whom there is no other treatment option available. The alternative is continuing suffering for the patient. A society without psychosurgery available is rendering untreatable some of its most severely ill and desperate people.

Many clinicians, inevitably having little experience of the uncommon, extraordinarily distressed patients that need to be considered for the operation, assume that surgery cannot be a reasonable option for any psychiatric disorder. While nobody contemplates the possibility of cerebral surgery with equanimity, nearly everyone, given enough desperation, will ultimately accept a dreaded treatment which offers hope of recovery or at least amelioration. In the event, SST is not really a disturbing experience except for understandable anxious anticipation, and pain is not a prominent complaint post-operatively.

There are still clinicians with rigid conscientious objections to psychosurgery who leave potentially treatable but chronically incapacitated cases indefinitely on long-stay wards or hostels, or who discontinue out-patient support because nothing can be offered.

**Selection of patients**

**Referral**

Referral for assessment requires a patient's willingness to discuss the possibility of psychosurgery. An attempt is made to give patients a review of the likelihood of success and the possible complications in relation to their particular illnesses.

The following aspects need consideration:

(a) Appropriate diagnoses
(b) An illness which is incapacitating because of its severity, persistent recurrences or chronicity
(c) Absence of contraindications
(d) Failure of all reasonable alternative treatments
(e) Capacity for informed consent (see ‘Ethical Considerations’).

The management of difficult affective disorders before psychosurgery is considered is of crucial importance. The strategy uses relatively few drugs in high doses. Referral letters almost invariably list a large number of drugs which have been tried, with little information about doses. In many cases, low doses have been maintained for long periods, despite a lack of response; then a change is made to another compound, similarly at a low dose (Bridges, 1983).

The full hospital notes are always needed. A close relative should accompany the patient and is interviewed both by the social worker and usually by the medical staff with the patient at the conclusion of the assessment.
Geography

In one study only 21% of referrals came from the South East Thames National Health Service Region where the unit is situated (Poynton, 1990). Being a national service the referring district now pays for the admission. If patients live a long way from London, they are admitted for a week or two for the assessment.

Although SST being available only in London may cause inconvenience, experience of the treatment and the associated research are desirably accumulated in this way. However, a unit could usefully be developed in the north of England or in Scotland. Up to four new patients are seen each week. Among a group of 300 recent referrals, only 3% failed to attend. The figure for non-attenders at a nearby routine catchment area psychiatric out-patient clinic was 35% (Bridges, unpublished data).

Age and ethnic origin

The median age found in a study involving 268 patients referred for SST was 53 years, with 67% aged between 40 and 69 years (Poynton, 1990). Among another group of 117 women who later came to have an SST operation, 38% had experienced a puerperal psychiatric illness. A very few patients have had the operation in their 20s. There is no upper age limit. General physical complications post-operatively are more likely in older patients and may detract considerably from any psychiatric improvement. Significant dementia, associated with atrophy or atherosclerotic patches, tends to contraindicate surgery. A CT scan is now an essential part of the assessment investigations.

Poynton (1990) found that only four patients (1.5%) referred in the UK were not white; they were Asian and two were accepted for SST. Two non-white patients who were operated on lived outside the UK.

Diagnosis

Psychosurgery requires a fairly rigid use of diagnoses and not formulations or its clinical role is nearly impossible to clarify. Even then, confusion is quite easily generated, as in the report by Hansen et al. (1982) who gave, for 63 patients who had psychosurgical operations involving three different cerebral sites, numerous and unrelated diagnoses including 'hysterical character neurosis', 'pre-senile dementia' and 'unclassifiable'. The issue is best dealt with using the concepts of clinical psychiatry correlated as far as possible with neurophysiological function, especially that of the limbic system.

Early research in this unit involved a factor analysis of various clinical data which gave the features most often associated with a good outcome, as in Table 2.

These factors point directly to an episodic unipolar affective disorder. It is now clear that SST is also suitable for bipolar illness (Lovett & Shaw, 1987; Poynton et al., 1988b; Lovett et al., 1989). In general terms, the cases selected have severe, incapacitating, persistent and treatment-resistant non-schizophrenic illnesses presenting with one or more of the following: anxiety states, phobic anxiety, obsessional symptoms, tension, persistent suicidal behaviour or self-mutilation, as well as depression (Bartlett et al., 1981).

Other assessment aspects

The factors which limit a good outcome post-operatively to only 50–60% of cases are not known. What may be needed is a biological marker for the appropriate psychopathology which would render the clinical assessment less important. At first the dexamethasone suppression test (DST) showed promise (Gitlin & Gerner, 1986) but the results were not stable. Despite early promise (Hale et al., 1989) the tyramine load test has not proved useful (Malizia et al., 1990).

An essential observation is the previous response to antidepressant medication and electroconvulsive therapy. In cases where the treatments gradually become less effective and then totally fail, a few require regularly repeated 'maintenance' ECT. Psychosurgery is likely to be a better therapy for these cases because the progressively deteriorating memory and perhaps increasing confusion caused by regular ECT are avoided, while the positive response to ECT suggests a good post-operative outcome. If a patient has never responded to medication and ECT, there is the possibility that all physical treatments, including surgery, are inappropriate for the illness. With these cases a careful assessment is

<table>
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<th>Features indicating a good outcome after psychosurgery</th>
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<tr>
<td>Prominent depression</td>
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<td>Sudden onset</td>
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<td>Onset in second half of life</td>
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<td>Onset in pregnancy</td>
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<tr>
<td>Good response to ECT at some time during the illness</td>
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<tr>
<td>Recurrent illness with largely undisturbed personality function between episodes</td>
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<td>Marital status - married or widowed</td>
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needed. A positive family history for affective disorders will favour the appropriateness of SST. A history of bouts of illness with normal social and personality function between them, would show that the personality remains largely intact, although not necessarily robust (Bridges & Bartlett, 1985). This tends to preclude chronic symptoms based on personality abnormalities, which are unsuitable.

Severity, chronicity and incapacity

For neurosurgery to be justified the illness must be severe, but rigidity in defining severity is to be avoided. One textbook of psychiatry (Gelder et al, 1989) observes that an "operation should never be carried out until the effects of several years of vigorous treatment have been observed". But psychosurgery is often discussed without adequate consideration of patients' extreme clinical needs (Bridges, 1989b). The psychosurgical team do not offer SST unless they judge that the level of distress makes surgery necessary. As SST has proved to be a satisfactory treatment, there need be no undue delay before it is offered. Goktepe et al (1975) reported that 56.7% of the patients studied had been ill, off and on, for over 10 years and only 3.7% for less than 2 years.

In the days of prefrontal leucotomy, both the chronic untreatable schizophrenia and the adverse effects from the operation could cause personality destruction. Nowadays chronic affective disorders can, in the long term, still result in personality deterioration (e.g. lack of confidence, social withdrawal), if many attacks occur or episodes persist, but SST does not have this effect. Unduly delayed psychosurgery may cause the patient irreversible social disintegration.

Treatment resistance

This has been considered in more detail elsewhere (Bridges, 1983; Quitkin, 1985; Barker et al, 1987). In the 1970s almost complete reliance was placed on the clinical management of the referring consultant. The present policy concerning treatment resistance is more definite. In brief:

(a) For bipolar illnesses:
Lithium and carbamazepine should be unsuccessful after being given together for about two months. Tri-iodothyronine might be added for augmentation. Sometimes an antidepressant or a neuroleptic might be used as well

(b) For most other disorders, and if appropriate:
(i) Two, full courses of ECT, separated by several months, should have been unsuccessful
(ii) Antidepressants should be prescribed at increasing doses but there must finally be a failed response to a combination consisting of clomipramine (or dothiepin or amitriptyline) given up to about 400 mg daily, or even more, with lithium for about 2 months (Hale et al, 1987)
(iii) It may also be appropriate to take the patient off the tricyclic and give phenerazine up to 90 mg daily, if tolerated, with lithium (Barker et al, 1987)
(iv) The failure of an adequate course of behaviour therapy is essential for obsessional illnesses being considered for possible psychosurgery (although intensive behaviour therapy is often not readily available).

The development of treatment resistance usually develops gradually over a number of years. Insisting on the use of high-dose combinations of antidepressants has led to recovery in patients referred for SST; the annual number of operations has halved over the last 10 years (Table 1). Medication and ECT may become more effective postoperatively, when SST is not successful.

Contraindications

Established Alzheimer's disease, multi-infarct dementia, obvious atrophy and other significant cerebral disorders are absolute contraindications. Localised lesions such as a stroke do not necessarily preclude psychosurgery, and neither does a previous psychosurgical operation. Pre-existing epilepsy does not necessarily contraindicate SST but the risk of fits would be higher than usual and anticonvulsants would probably be needed postoperatively. Decisions about such cases depend on individual specialised neurosurgical assessments. Active medical disorders require careful investigations. SST is to be avoided in those with anti-social traits or who are prone to addictions (Knight, 1973). Important psychiatric conditions that will not be helped include personality disorders, primary neuroses and uncomplicated schizophrenia. However, sometimes chronic, less severe, and intractable symptoms of major depression, which would be appropriate for SST, are erroneously considered to be personality disorders mainly because of the chronicity. Anorexia nervosa is not helped by any form of psychosurgery.
Stereotactic subcaudate tractotomy

The surgical procedure is stereotactically controlled and the lesion is partly sited beneath the caudate nucleus. Although major neurosurgery it is not a particularly debilitating experience for the patient. The hair is not shaved and a general anaesthetic is always used. It lasts about one-and-a-half hours, with most of this time needed for taking X-rays to monitor the placement of the radioactive rods. Two forehead incisions are made, within a skin crease if possible.

The incisions allow two burr-holes to be made into the frontal bone above the air sinuses. Into each circular opening the McCaul stereotactic instrument is firmly screwed and then any part of the frontal lobe can be targeted with an accuracy of 1–2 mm by locking the carrier tube of the frame in relation to X-ray films showing the desired track of the cannula which introduces the radioactive yttrium rods. These produce the lesion by beta-radiation, lethal to living tissue up to 2 mm from the surface of the rod. The isotope yttrium 90 has a half-life of 68 hours. With direction predetermined before the rod enters the brain, only depth then needs to be allowed for and the frame accommodates this. At this point the sitting of the rod is entirely fixed and mechanical, so there is no possibility of error due to a faltering hand movement, which was a characteristic of the previous free-hand techniques.

The operation was devised and described by Knight (1969a,b); the lesion has been discussed by Newcombe (1975). The radioactive decay of the rods is carefully monitored from their source to the unit so that they have a radiation strength of 500 grays (50 000 rads) at the time of the operation. The rods become inert, decaying to zirconium, and remain in place indefinitely. This essentially simple technique has in practice been shown to be remarkably effective and safe.

Lesion site

In order to produce a lesion having length and breadth but little depth, which would be equivalent to a simple surgical incision and avoid damage to the corpus striatum, Knight (1969b) was advised by the Department of Radiology and Physics at the Royal Post-Graduate Medical School, London, to employ two rows of four radioactive yttrium rods, placed in the orbital white matter beneath the head of the caudate nucleus and for a short distance anterior and lateral. The results of this were satisfactory but in order to produce an even smaller lesion it was decided to omit the lateral row of two rods on each side. There was no significant falling off in response and therefore a number of cases were treated with two rows of three radioactive rods. Knight (1965) had always emphasised the need for the lesion to be placed deep under the head of the caudate nucleus for the best results. Following years of experience and on clinical grounds, our standard lesion progressively increased and now consists of 2 rows of 5 rods bilaterally.

Short-term side-effects

Patients sit out of bed on the second and are mobile on the third day after the operation. Headaches are rarely severe (usually responsive to analgesics) and can last up to one week, rarely longer. Somnolence occasionally occurs for up to a few days.

A more troublesome side effect is confusion, characterised by muddled thinking, disorientation of place in particular, with reduplicative paramnesias and auditory hallucinations involving familiar voices. This occurs in about 10% of patients of 50 years or over, and is less common in younger cases. It usually lasts up to one month. One 56-year-old woman suffered severe confusion lasting about three months, but she was entirely well and had recovered from her intractable affective disorder when reviewed one year post-operatively. CT scanning shows that confusion is associated with frontal oedema and recent investigations show that this has a strong association with high dose medication (see Post-operative course, below).

A serious degree of confusion occurred in the case of one patient (S1128). A young man of 30 years with an intractable bipolar disorder, he went into coma a few days after the operation and required three days in the intensive care unit. His CT scan showed unusually severe frontal oedema, with the disappearance of sulci due to intracranial pressure. He was transferred back to the referring hospital, psychiatrically well, six weeks after the operation, but he needed regular anti-diuretic hormone for 4 months probably because of damage to the pituitary stalk during the period of oedema.

It appears that the radiation damage to the microcirculation round the yttrium rods causes damage to the blood–brain barrier with tissue necrosis and leaking of proteins and fluid. The oedema spreads selectively along white matter and it gives a characteristic scalloped appearance on CT scans which resembles bats wings. In a small pilot series using MRI scans confusion seemed to be usually associated with the oedema spreading to the basal nuclei. Steroids given after the operation do not help.
Major complications
SST in practice is virtually free of major complications. The
commonest is the occurrence of one or more fits. Fits have occurred with 16 patients in a series of 1000
cases (1.6%). This could be an underestimate, the
figures depending on feedback from referring psychiatrists. Some of these cases had one or more
fits before the operation and so were more vulnerable
to further episodes. Anticonvulsants are prescribed
only if more than one fit has occurred. Patients
should not drive for six months post-operatively.
Patients are warned of the possibility of a cerebral
haemorrhage which could produce demented states,
paralyses resembling strokes or perhaps a fatality.
We have experienced only one case of post-operative
bleeding – in an elderly woman with a cerebrovascular
pathology, who was warned but insisted on having
surgery. The haemorrhage was successfully treated
at a second, emergency operation. Similar effects
could result from an infection but this has not
occurred so far.
In our experience of nearly 1300 cases, there have
been no significant adverse effects on the personality
attributable to the operation.
Yet the two early reviews by Strom-Olsen &
Carlisle (1971) and Goktepe et al (1975) both mention
some personality changes, although mild; the first
reports that in only 3 of 150 cases were there
spontaneous complaints, the second that the relatives
considered that there were undesirable changes in 9
cases.

Fatal outcome and suicides
There has been one death resulting from the
operation itself. It occurred in the early part of the
series, and was due to an yttrium rod being badly
mis-sited (Knight, 1973).
Reports stress (Guze & Robbins, 1970) that of
patients who have uncontrolled depressive illnesses,
as many as 15% will ultimately die by suicide. As
SST does not succeed with all patients, some post-
operative suicides may happen with a few patients
in the year after the operation. Our research includes
active reviewing of various cohorts of patients. A review
by the Unit (unpublished) revealed that of 303 SST
patients followed up 3–13 years after the operation,
1% died by suicide. This may be compared with 5%
up to 20 months after limbic leucotomy (Mitchell-
Heggs et al, 1976; Kelly, 1980) and 9% with 198
patients and a mean follow-up period of 8.6 years,
after stereotactic cingulotomy (Ballantine et al, 1987).
Figures have been given for attempted suicide by
Goktepe et al (1975). The numbers of attempts
were counted for each patient for the same period
pre-operatively as the period after the operation up
to the review (3–4.5 years). For those who did well
(outcome I and II) at one year, there were 33
attempts among 78 patients before the operation and
5 afterwards. For those who did not show significant
recovery (III and IV) there were 31 attempts among
56 patients pre-operatively and 32 afterwards.
Our clinical experience is that high suicidal drive
frequently fades rapidly post-operatively, usually
within a week or two despite the general slow
resolution of other symptoms. As well as high
suicidal drive, severe depressive anorexia may
improve rapidly after the operation.

Post-operative course
In the majority of cases there is a slow improvement,
sometimes involving relapses, over a period of several
weeks, sometimes 3–6 months or even more. When
SST is used for bipolar disorders the full recovery
may take 2 years (Lovett et al, 1987). In association
with Dr Paul Sepping we have attempted some sort
of measurement of this delayed response but not very
successfully. Our attempt to measure this delayed
response suggested that, for those of good outcome
at one year, the improvement began on average 16
weeks after SST. (Details from authors.)
The delay indicates specificity of action, rather
than a placebo response. Retrograde neuronal
degeneration to the thalamus could be involved, and
it was often observed with the earlier psychosurgical
operations (Freeman & Watts, 1947).
It was our policy to stop as much medication as
possible, often all of it, before SST and it was only
recommenced if it seemed clearly to be needed. Our
recent investigations have shown that post-operative
confusion relates to high dose medication and so a
reduction in medication before the operation seems
to be desirable.
If there are relapses soon after the operation there
is no contraindication to the use of other routine
treatments again, such as combined antidepressants,
or ECT. Sometimes the addition of carbamazepine,
with its mood-stabilising and anticonvulsant
properties, is useful.

Post-operative rehabilitation and family support
Rehabilitation is of particular importance after SST.
Illnesses may have resulted in a major impairment
of confidence, institutionalisation, and considerable
limitation of social function.
Marriages may fail at two points in the process.
When the patient is accepted for SST, a seemingly
loyal spouse may reveal total intolerance of the chronic illness and end the relationship. Guilt about doing this is relieved because the patient is to receive a potent treatment. The second point is with recovery. The spouse may have to relate to an unacceptable pre-morbid personality, perhaps aggressive and uncaring, and refuses to tolerate its emergence. Thus some patients remain almost irremediably damaged socially for want of adequate post-operative family support.

Rehabilitation must be gradual because recovery is a slow process but usually not as gradual as assessed by the patients' complaints, because these are likely to be unnecessarily pessimistic. This distorted perception of improvement can be difficult to overcome. Despite apparent improvements in sociability and activity, the patients' themselves may feel there is little incentive for renewed effort, although this is particularly necessary. The best management is to actively encourage the patient, at an appropriate time after the operation, to carry out new activities. This might be something as simple as venturing out of the hospital into the street, or onto a bus, or entering a shop. The patient often protests that the new activity is impossible but, with sufficient support and encouragement it may be achieved for the first time for a long period. Even recovery may not fully dispel the pessimism. One young man was transformed from being chronically and totally socially isolated because of phobic anxieties, to someone living independently, with a girl friend and a job, all within a year of the operation. At the one-year assessment he said that he was feeling no better. On questioning, he seemed to be viewing his improved, emancipated state with the pessimism and depression of the past.

Assessments of outcome

Patients are seen routinely at six months, and the final outcome is assessed one year after the operation. A longer period of follow-up would be desirable but demands more time and resources than are available. However, longer term research reviews are carried out from time to time.

Attitudes to psychosurgery depend fundamentally on the clinical results. These must be assessed as accurately and objectively as possible. The outcome has always been assessed using global clinical categories as follows:

I Recovered, no symptoms and no treatment required. Normal social function.

II Well: mild residual symptoms, little or no interference with daily life. Medication may still be needed.

III Improved, but significant symptoms remain which interfere with the patient's life.

IV Unchanged.

V Worse.

These categories have attracted criticism. They appear rather impressionistic at first glance and it might be thought preferable to offer symptom ratings (for example, Hamilton depression scale scores) before and after surgery. However, such an approach would not allow comparison of outcome across diagnostic categories, nor would it be sensitive to any adverse effects on the personality and would only offer a cross-sectional 'snapshot' of what is generally a gradual process of recovery. Our outcome categories have the advantages of combining symptomatic and social outcome and do allow comparison with earlier work from this Unit. These clinical assessments at one year correlate highly significantly with self-report symptom inventories using the Wakefield Depression scores (Snaith et al, 1971) and the Taylor Manifest Anxiety scale (Taylor, 1955). The significant correlations between the assessments and the clinical outcome (Fig. 1) are given in Goktepe et al (1975).

A senior consultant at a neighbouring hospital (the late Dr Alan Norton) reviewed 74 cases one year after SST entirely independently of the Unit's consultants, who also assessed them. All raters assigned outcome using the categories I–V. The correlation with our own ratings was high (unweighted kappa = 0.72), with never more than a difference of one category.

![Fig. 1 Correlation between global outcome and two self-report symptom questionnaires.](image-url)
There have been three substantial reviews of outcome. The first was carried out by Strom-Olsen and Carlisle (1971). Goktepe et al. (1975) reported the outcome of operations performed up to 1973 and a recent one by Hodgkiss et al. (1994) included all the operations performed in the period 1979–1991. The results from the latter two studies are summarised in Table 3.

Comparing these studies, recent results seem to be less good. It is likely that, due to the present policy of insisting on the use of high dose and combined medication before psychosurgery is offered, we are now operating on cases that are more treatment resistant. Also, in the case of the Goktepe et al. (1975) paper the follow-up period was a minimum of 30 months while the Hodgkiss et al. (1994) study involved a follow up period of just 12 months. There are many more non-operative deaths after surgery in the earlier data. Once again the explanation may lie in the longer period of follow-up.

Several other approaches to the study of outcome after SST have been employed. Curson et al. (1983) studied a sample of 34 patients accepted for SST using the Present State Examination (PSE; Wing et al., 1974). PSE profiles immediately pre-operatively were compared to those at the 12 month review. The most significant changes after surgery were on ‘nervous tension’, ‘psychic anxiety’, ‘depressed mood’ and ‘free floating anxiety with autonomic component’ (somatic anxiety). These authors found improvements on these items in both the good and poor outcome groups. They suggested that, because the categories I–V emphasise social function, patients whose symptoms diminish without improved function are not assessed as improved.

In another investigation, 64 patients were asked to express their attitudes about the desirability of their SST operation at the 1 year review visit. Complete anonymity was guaranteed and the opinions were related to outcome. Fifty-nine were either ‘very glad’ or ‘quite pleased’ that they had decided to have the operation; 26 of these satisfied individuals fell into outcome groups III and IV. Presumably they felt that they had at least tried to find effective treatment even if it was of limited success. Only 3 (all in category IV) of the 64 patients regretted the decision (Poynton et al., 1988a).

**Indirect evidence of effectiveness**

Lasting placebo responses to SST are unlikely because of the long illnesses and the adequacy of previous treatments insisted on. In addition, placebo responses would be unlikely to occur gradually over a period of 3–6 months or more.

Evans et al. (1981) studied EEGs in relation to SST. Recordings were carried out on 35 patients the day before the operation and then two weeks and six months afterwards. The pre-operative recordings were essentially normal, as were those taken six months later. But at two weeks the traces of only three patients were unchanged. All the other traces showed varying degrees of slow activity over the frontal regions with about half the patients showing a change in background activity with an accentuation of alpha rhythm. The degree of disturbance at two weeks was significantly and positively correlated with the assessments of outcome at one year. The more the disturbance, the better the outcome.

**Psychological aspects**

There is a strong expectation that SST is likely to cause localised damage to the brain which, especially as the lesion is in the frontal lobes, should be detectable using psychological testing. This has not been supported by research. A relatively crude test such as the Wechsler Adult Intelligence Scale shows progressive improvement post-operatively, no doubt due to improving function as the incapacitating illness is brought under control. In a study on 15 patients having SST the full scale IQ was 96.5 before surgery, 97.7 one month later and 100 at one year (Bridges, 1972). Observations on 122 patients having limbic

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**Table 3**

Outcome of SST performed to 1973, and from 1979–1991

<table>
<thead>
<tr>
<th>Outcome category</th>
<th>SST to 1973 (n=140)</th>
<th>SST from 1979–1991 (n=202)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Depression</td>
<td>OCD</td>
</tr>
<tr>
<td>I+II</td>
<td>53 (55%)</td>
<td>9 (45%)</td>
</tr>
<tr>
<td>III</td>
<td>16 (17%)</td>
<td>6 (30%)</td>
</tr>
<tr>
<td>IV+V</td>
<td>9 (9%)</td>
<td>3 (15%)</td>
</tr>
<tr>
<td>Deaths</td>
<td>18 (19%)</td>
<td>2 (10%)</td>
</tr>
<tr>
<td>Total</td>
<td>96 (100%)</td>
<td>20 (100%)</td>
</tr>
</tbody>
</table>

1. Assessments as described in text.
2. Goktepe et al., 1975.
leucotomies (Kelly et al., 1973), (similar to SST but not now often used) the pre-operative full scale IQ was 106.7 and 108.7 six weeks later (Kelly, 1980).

More detailed and sophisticated tests would perhaps detect more subtle deficiencies. Kartsounis et al. (1991) carried out a comprehensive prospective neuropsychological study of SST with assessments before surgery and then two weeks and six months afterwards \((n = 23)\). The tests were known to be sensitive to frontal lobe dysfunction. There were also tests of general intelligence, memory, language, visuospatial analysis and attention. The mental state was examined at the same intervals using well recognised instruments including the Hamilton Rating Scale for depression. The results indicate that there is no significant long-term adverse cognitive effect of SST. However, some temporary deterioration in performance on tests of recognition and memory, both verbal and visual, were observed two weeks after SST, but these had disappeared by six months. Similarly, there was a temporary decrement in the patients' performance on tests thought to be sensitive to frontal lobe dysfunction. There was no relation between these changes and any affective change.

The results of these tests suggest that there is a minor, temporary decrease in some aspects of cognitive functioning following SST. This is probably related to the presence of post-operative oedema affecting frontal lobe function, rather than to the disruption of subcaudate pathways. The results concur with views of some authors who have suggested that lesions of the medial and inferior orbital aspects of the frontal lobes give rise to affective rather than cognitive changes (Damasio, 1985). Hence, they would support the notion that the operation affects pathways which play a role in the genesis of pathological affective states. It is remarkable that such a large lesion in the lower part of the frontal lobes produces neither cognitive impairment nor emotional disruption. The only effect seems to be the control of pathological affective symptoms.

The Mental Health Act

The Mental Health Act (1983) introduced legislation specifically to supervise psychosurgery. Section 57 applies to:

1. (a) "any surgical operation for destroying brain tissue or for destroying the functioning of brain tissue: and
2. (b) such other forms of treatment as may be specified for the purposes of this section by regulations made by the Secretary of State"

At present the only other treatment specified under (b) is the surgical implantation of hormones.

The requirement is for a doctor and two other persons appointed by the MHAC (not being doctors):

Section 57(2)a to "have certified in writing that the patient is capable of understanding the nature, purpose and likely effects of the treatment in question and has consented to it" and Section 57(2)b the doctor "has certified in writing that, having regard to the likelihood of the treatment alleviating or preventing a deterioration of the patient's condition, the treatment should be given".

The appointed persons, in practice, require fully informed consent.

An amendment was added, that Section 57 should apply to all patients being considered for psychosurgery, whether compulsorily detained or informal (Rawnsley, 1982). Hence a paradox: legislation to protect the rights of detained patients, also removes the rights of informal patients who, if they agree to psychosurgery, must be interviewed compulsorily by a doctor and two other appointed individuals. Their decision is final and without the possibility of a second opinion or appeal except to the High Court (Dyer, 1988; Bridges, 1989a).

Section 57 is proving controversial. One patient died by suicide when commissioners would not agree to an operation (Bridges, 1984a,b,c, 1985; Colville, 1985). A woman who had been in depressive stupor for about a year could not give informed consent, so the Commission declined to arrange for her to be seen. She died with a chest infection (Bridges, 1992). It appears that the medical ethic of preserving life may have given way to the primacy of the preservation of human rights.

There has never been any suggestion that SST should be carried out as a compulsory treatment. The Mental Health Act Commission should be involved with patients being considered for SST while subject to detention. Patients are only occasionally admitted for SST who are detained under the Act. The detention is usually suspended before transfer to the Unit. There are a few patients who must remain detained but only because of a high suicidal risk.

Ethical considerations

The possible use of psychosurgical techniques for antisocial, usually aggressive behaviour, is unacceptable to most people. There is popular doubt as to whether the surgery, in these circumstances,
is a treatment for an illness or whether the aim is to produce more docile behaviour in order to suit society better, or is some kind of punishment.

As well as undesirable indications there are also undesirable operations. Multiple lesions, for example, a pair in the temporal lobe, the orbito-frontal cortex and the cingulum were carried out by Cox & Brown (1975) but this trend did not continue for long. Another doubtful and transient technique was described by Heath (1977). This required the chronic implantation of a receiver that could be activated by an external power source to stimulate specific brain sites. The instrument was implanted and was used on eleven patients, who either showed violent or neurotic behaviour, or were schizophrenic—surely incompatible indications. The operations of thalamotomy and hypothalatomy were reported in the 1970s (Roeder et al, 1972; Quaade, 1974) but no psychiatric indications were suggested which justified the much greater risks of lesions in these sites. The treatment of sexual violence by hypothalatomy (Diekmann & Hassler, 1977), is an example where both the operation and the diagnosis are unacceptable. These problems may have arisen because neurosurgeons and psychiatrists were not working closely together so surgical techniques were devised which were inadequately related to psychiatric needs.

Stereotactic subcaudate tractotomy has not been subjected to a scientifically acceptable controlled trial. As a treatment of last resort when all has failed, convincing trial is impossible in the absence of a comparable treatment. It may be that surgery will give way to medication in the future because high dose and combined antidepressant medication in some cases makes SST unnecessary. However, we do not yet know which is the safer treatment in the long term.

Considering ethical issues in psychosurgery, Kleinig (1985) observed:

"Those who argue for a total ban on psychosurgery or on psychosurgical experimention tend to arrogant to themselves a wisdom that they have no right to claim. They pose as a voice for the voiceless, 'protecting' them by means of their paternalistically imposed assessments... unless it can be argued that the use of psychosurgery is explicable solely in political terms, taking it completely out of the hands of those whose professional concern it is would be as illegitimate as leaving it completely in their hands."

The political dimension presumably refers to the potential for 'personality engineering', on the lines of 'social engineering', by influencing allegedly unacceptable social attitudes by means of psychosurgery. Any intention to modify socially unacceptable sexual interests, or excessive appetite or antisocial behaviour, cannot be appropriate for surgical treatments. Kleinig (1985) goes on to advocate "some kind of sensitive interplay between the interested parties – doctor, patient and society...", which seems a justification for the British Mental Health Act Commission.

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