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Editorial

Behaviour changes following temporal lobectomy, with special reference to psychosis

The severe behaviour consequences of bilateral extirpation of the temporal lobes were realised in the earliest reports of temporal lobe resection, and several case studies or series were published in the early 1950s.¹ The operations, which included amygdalotomy, uncotomy, and medial temporal lobotomy were initially carried out for the relief of psychosis, mainly in schizophrenic patients, but some patients with epilepsy were included. The severe memory deficits which resulted were not seen with unilateral operations, which became the accepted approach.

In contrast to the recognised need for proper psychometric evaluation before surgery for epilepsy, the necessity for adequate psychiatric assessment was not (and has not been) realised in many centres. The importance of such evaluations emerged early in the history of these operations. Thus the number of patients with pre-operative psychiatric abnormalities was far greater in the Falconer Guy's-Maudsley series than in that from Penfield at Montreal. Although this largely reflected referral patterns, at some stage the Montreal group specifically excluded from the operation patients with gross mental changes.²

In the early studies, it was agreed that some patterns of behaviour could change after temporal lobectomy, especially aggressive problems, while others were not influenced or deteriorated. Improvements were not immediate, and could occur slowly over a period of 12 months or longer.³ Green *et al*⁴ were more explicit, noting that patients with constant hostility benefitted from the operation, while those with psychotic behaviour did not.

The early experiences of Falconer *et al* were written up in 1957.² The post-operative follow up was two to five years, and included information from rating scales, home visits and relatives. Post-operative scores were improved in eighteen cases, unchanged in three and declined in five. All five of the latter continued to have seizures. There was a reduction in outwardly expressed aggressiveness and an increase of depressive mood swings (eleven cases), the latter sometimes so severe that readmission to hospital was necessary; ECT was given to five patients. These depressive states tended to recur for up to 18 months and were not related to post-operative seizures.

Another early series was that of Simmel and Counts⁵ from Illinois. Forty patients were followed up after five years, and eleven were seizure free. Most patients had some personality disturbance or psychoses before surgery, although this was not well documented. They state "patients reported to talk about receiving messages from God, about their food being poisoned, etc, were classified as psychotic". Post-operative assessment was based on

interviews with patients and their families, and patients were rated as "good", "marginal", or "psychotic".

Pre-surgery, 21 were "marginal", and 11 "psychotic". At the time of follow up, 19 were "marginal" and 14 "psychotic". In terms of change, two were improved, 22 were about the same while 16 deteriorated. Of the 14 "psychotic" patients, 10 were definitely psychotic before the operation, while six had "gone further downhill since surgery." Four new cases emerged post-operatively.

Falconer, in discussing the paper of Simmel and Counts said: "... the idea might get abroad that you cannot relieve such symptoms by temporal lobectomy ... seven (of my psychiatric patients) had frank psychotic episodes, and three of them are now better ... I feel at times psychiatric disturbances can be relieved in association with temporal lobectomies."⁶

The Maudsley series

Falconer, Taylor and their colleagues⁷⁻¹¹ reviewed in a series of papers the consequences of temporal lobectomy on behaviour in an extended series of over 200 patients having unilateral temporal lobectomy; follow up was from six to twenty years. Nearly 50% of the cases had mesial temporal sclerosis, hamartomas accounted for one fifth to one quarter, one tenth had miscellaneous lesions such as scars or infarcts, while no specific lesion was found in the rest. In the first series of 100 cases,⁸ there were twelve with confusional states, two with sudden religious conversions, six were diagnosed as paranoid, while three were schizophrenic. There were two suicides post-operatively. Those with paranoid or affective conditions pre-operatively had less prominent delusions post-operatively, while the schizophrenic group did poorly. Patients in a third group, with intermittent symptoms, often ictally linked, did rather better.

In the second better documented series of 100 cases⁹ sixteen were psychotic pre-operatively. Eight had schizophreniform psychoses, five paranoid hallucinatory psychoses, one simple schizophrenia and one catatonia. One was referred to as "organic psychosis". Post-operatively there were nineteen psychotics. Four patients had lost their psychoses, while seven developed psychoses. Of the whole sample, only thirteen had been considered psychiatrically normal before operation. On a social adjustment scale, 61% were reported as improved, 28% worse and 11% the same when pre- and post-operative scores were compared. The main improvements concerned family and extra familial relationships and work status. Those patients with "good" post-operative adjustment showed an excess of normal or

neurotic personalities before surgery, while those who fared worst had an excess of psychopathic disorder or psychoses. The latter also had a lower incidence of mesial temporal sclerosis, and an increase in non-specific lesions on pathological examination of the resected specimen. Complete relief of seizures was not essential for good adjustment, and only 60% of those who moved from "bad" to "good" social adjustment with the operation became seizure free. They also reported on aggressive behaviour.⁷ Pre-operatively, aggressive behaviour was as common with mesial temporal sclerosis as with hamartomas, but post-operatively, patients with mesial temporal sclerosis improved the most. In this series there were five suicides.

Seven of Falconer's psychotic cases were in a series of eleven cases of schizophrenia-like psychoses that had been operated on and reported by Glithero and Slater.¹² Schizophrenic symptoms receded in only three, but in another five they were reported as improved post-operatively.

In an extended follow up study, (five to 24 years) Taylor and March¹³ examined post-operative deaths in 193 temporal lobectomy patients who had a potential survival of at least five years. Four patients died from tumours, seven from natural causes, eight in status, and three in accidents. There were nine suicides (4.6%) and six deaths in "unclear" circumstances. The interval between operation and death was shorter in those who committed suicide or whose mode of death was unclear, compared with the rest. Interestingly, the mortality in the first two years post-operatively was double that in any subsequent two year period.

The Maudsley series has recently been the subject of another follow up investigation reported by Bruon *et al.*^{14,15} They examined the notes and pathological specimens from 249 cases operated on from 1950. They assessed fit frequency and social adjustment, both graded into four categories ranging from greatly improved to worse. The former included only those fit-free for five years, and the social adjustment was based on items, such as, return to work, subsequent marriage, living away from institutional care; special attention was given to depression, aggression, and schizophrenia.

Of 27 deaths, they reported six suicides (2.4%) which occurred at an average time of 5.6 years after the operation. The results of surgery on personality and social adjustment in 234 cases revealed 59 (25%) to be greatly improved, 53 (22.6%) improved, 73 (31.2%) unaltered and 49 (20.9%) were worse. Again it was found that the Ammon's horn sclerosis group had the best chance of improvement, while those with no abnormality were made significantly worse by the operation.

There was a substantial increase in depression post-operatively. While only one case was rated depressed pre-operatively, 24 (10%) had post operative affective disorder. This was more common in those with Ammon's horn sclerosis, double pathology and no apparent pathology. All six suicides were in this series of 24, but not associated with any special pathology. Aggression improved, being assessed as present in 22% pre-operatively and 16% post-operatively. This was best in both those with "alien tissue" (lesions with abnormal or "alien" tissue elements associated with them), and the Ammon's horn sclerosis groups.

In the total series, 25 patients had either a pre- or a post-operative case note diagnosis of schizophrenia. Of sixteen with a pre-operative diagnosis of schizophrenia eleven had a left and five a right sided focus. Post-operatively the figures were five and four respectively. The number of cases with gangliogliomas (4) who developed psychosis was unexpectedly large (44%). Further, there were four patients who lost their psychosis after the operation, three

with Ammon's horn sclerosis, and one with alien tissue, all being left sided lobectomies.

There are several important conclusions that emerge from these data. First it seems that schizophrenia-like states do not emerge at random in temporal lobe epilepsy. They are associated with medial temporal pathology, often but not exclusively with alien tissue lesions as Taylor¹¹ suggested. Secondly, there is an over-representation of left sided pathology, as noted by Taylor, but the relationship holds only for assessment pre-operatively. In post-operative status there is bias towards right sided lesions increasing the vulnerability to develop a psychosis, left sided lesions favouring amelioration. Thirdly, gangliogliomas may have a special relationship to psychosis.

Finally, the data Burton analysed reveal the dissociation between the effect of temporal lobectomy on seizures, and on behavioural adaptation. It is often assumed that a decrease of seizures is automatically associated with improved behaviour, but this is not the case. Patients with Ammon's horn sclerosis did well with both frequency of fits and social adjustment. In contrast, however, the removal of mixed glial and neuronogial lesions helped seizures but not social adjustment. Patients with trauma or indefinite pathology tended to have seizures unaffected, and their social adjustment often became worse.

Other series

The state of the art in 1975 was noted in a review by Jensen¹⁶ of follow up psychiatric status from five centres, including the Maudsley. She noted a marked divergence of results, especially regarding the unchanged/deteriorated category. This may reflect on selection, or on the adequacy of the evaluations. On summing the different series, Jensen noted that 23.5% were considered mentally normal at the time of follow up, compared with 6.2% before operation. In contrast, 35.6% were unchanged or deteriorated and 40.9% were improved.

Further data on psychosis from the Danish series were given by Jensen *et al.*^{17,18} They surveyed 74 patients who had received unilateral temporal lobectomy, 45 (61%) of whom were seizure free post-operatively. There were twenty psychotic patients, either pre- or post-operatively. Seventeen had partial seizures with secondary generalisation. Eleven were psychotic pre-operatively. Eight improved and one recovered after surgery. Nine patients became psychotic post-operatively, and in six there was complete relief of seizures. Curiously the important issue of laterality is glossed over by the statement that "operations on the right or on the non-dominant sides were more frequent in the psychotic patients . . .", but no figures were given.

Relief of seizures was the most important factor in determining rehabilitation to work, but there was no obvious relationship between post-operative seizure frequency and psychiatric status. Behavioural disturbances were the most improved by operation, and this finding agrees with other series. All suicide attempts occurred within the first post-operative month.

This series is of importance in confirming that psychosis can arise de novo post-operatively, and that this is seen in spite of or because of seizure relief. One speculation which emerges is that at least in some of these cases a mechanism similar to that of forced normalisation is operative.

Other groups have provided limited information on the behavioural changes of patients having temporal lobectomy. In a study of patients with psychosis that had undergone lobectomy, Sherwin¹⁹ noted seven cases rendered seizure free in whom no change in psychosis was observed. Walker and Blumer²⁰ provided data on 50 patients. Irritability, anger and rage, noted in 29 patients

pre-operatively, improved in 22, although six patients developed such behaviours. There were nine patients with psychosis; one was alcohol related. Six cases developed a schizophrenia-like psychosis post-operatively, in three this occurred some time after the operation. No data on pathology or laterality were given, and the general conclusion drawn was that temporal lobectomy had little or no effect on psychosis associated with epilepsy.

Stevens²¹ followed a personal series of fourteen cases for 25–30 years, six of whom were psychiatrically well, nine being seizure free. However, six became psychiatrically worse post-operatively, three of whom were reported as normal before surgery. No less than five developed a paranoid psychosis, four of whom had a right sided operation. The majority were not seizure free.

Polkey²² has given data on a new Maudsley series of forty patients, seventeen of whom had some form of mental disorder pre-operatively. Aggression was the commonest, and there were no psychotic patients. Post-operatively two developed psychosis, and Polkey describes a third not in the series of forty. All had non-dominant resections, and in one who subsequently died in an accident, the opposite temporal lobe was pathologically normal. In another, the psychosis resolved when the patient's seizures returned.

Conclusions

These data on the psychiatric consequences of temporal lobectomy lead to several conclusions. First, most centres, including the Maudsley hospital group, have now stopped operating on floridly psychotic patients. This seems largely based on the observation that psychosis generally does not improve with the operation.^{8 17 18} Whether or not this course of action is justified is not clear. It might still be considered better to be psychotic without seizures than to be psychotic with them. This policy, however, has not been taken to its logical conclusion, namely that of a comprehensive psychiatric evaluation being carried out as a routine pre-operatively. This is in marked contrast to the insistence, correctly, on good psychological assessment.

It appears that the psychosocial adjustment of patients post-operatively is by no means as good as the results on seizures, and in some series as many patients deteriorate as improve. The improvements in behaviour generally recorded are those of diminished aggression, irritability and disturbed conduct, and these seem more likely to improve with improvement of seizures and a pathological diagnosis of mesial temporal sclerosis. In contrast, post-operative depression, and both early and late suicide are reported from several groups, which may be seen as a complication of the surgery. Some authors suggest this may be no more than a reflection of the high frequency of depression in non-operated epileptic patients. The figure of 10% of patients developing depression,¹³ and suicide rates of up to 5% emphasise the need for continuing psychiatric observation of patients that have had operations. This is not done in most centres. Indeed, the number of good follow up series of psychiatric data is abysmal, considering the number of centres now doing such procedures.

Psychoses, paranoid or schizophrenia-like in nature, develop de novo post-operatively in 3.8 to 35.7% (mean 7.6%).^{5 14 17 18 20–22} This emphasises the importance of post-operative behavioural assessments, and continuing supervision of patients. There are no clear predictors of the patients that will develop the psychoses, and neither is there agreement on the relationship to the seizure control. There is nonetheless the suggestion that the phenomenon of forced normalisation may be operative in at least some cases. It could be argued that the patients would have

developed psychosis in any case, supported by a high genetic loading for psychiatric illness in the series by Jensen and Larsen.¹⁹ This aspect not been commented on by other authors.

An interesting finding, which emerges from the new cases of psychosis post-operatively, is that where laterality has been established, it is right sided in over 60% of cases in the later series. Bruton even suggested a link to a specific pathology, namely gangliogliomas. That there may be an association with right sided operations is supported further by reports of Mace and Trimble,²³ in which six consecutive patients are described who developed a psychosis following temporal lobectomy; all had right sided operations.

In summary, it is suggested that psychoses do emerge de novo post operatively, and there is some evidence of an increase in depression. However, the phenomenology of these states has yet to be well established. Suicide may be one complication of the procedure. Since psychosis does not develop at random in patients suffering from temporal lobe epilepsy and probably does not do so in new post-operative cases, closer attention to the psychiatric status of patients before and after temporal lobectomy would be rewarding.

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