

Effects of anterior temporal lobectomy apart from the relief of seizures: a study of 40 patients¹

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Summary: The effect of temporal lobectomy, apart from the relief of seizures, is described in 40 patients undergoing the operation and followed up for between 2 and 6 years. Changes in their intellectual performance and mental state are described, and the possible mechanisms of these changes are discussed.

Introduction

Anterior temporal lobectomy is a successful operation for intractable epilepsy so long as the patients are carefully selected. Consistent results have been reported from a number of centres over the last 30 years. In general terms, some 50% of the patients are rendered virtually free of fits and a further 25% have the frequency of their attacks much reduced (Falconer & Taylor 1968, Crandall 1975, Jensen & Klinken 1976, Rasmussen 1980). However, the resection of 30 grams or more of cerebral tissue must have consequences other than the relief of seizures. Our knowledge of temporal lobe function, drawn from a number of sources, creates a complex and fragmentary picture from which a logical prediction of some of the effects of temporal lobectomy can be made. Briefly, the temporal lobes appear to function in three areas: visceral sensation, recent memory acquisition and emotional experience and control.

The precise role of this visceral sensation is obscure and it is chiefly of interest to neurosurgeons in the aura experience of temporal lobe epilepsy. A wide range of auras are described in psychomotor attacks and, in a description of 666 patients, Currie *et al.* (1971) noted a visceral component to the attacks in 40% of the patients. In the early days of epilepsy surgery, in operations under local anaesthesia, stimulation of the temporal lobe produced a number of complex phenomena similar to those usually described as temporal lobe auras (Penfield & Jasper 1954). Compared with stimulation of the sensorimotor cortex, it was also noted that there was considerably more variation in the response obtained, both in the same patient and from one patient to another. This may have been due to variability of stimulus parameters and uncertainty of anatomical localization when structures deep in the temporal lobe were being stimulated. However, recently there has been a report of the results of stimulating with known parameters through chronic indwelling electrodes implanted for other reasons (Halgren *et al.* 1978). It is clear from this report that responses to stimulation were rare (7% of all trials), and were usually accompanied by gross neurophysiological changes, especially when very complex phenomena such as formed hallucinations were involved. Furthermore, the authors felt that the nature of the response obtained was related to the patient's personality rather than the anatomical location of the stimulating electrode or the stimulus parameters. There is evidence from other depth recordings that aura phenomena may accompany subclinical electrical discharges in the depth of the temporal lobe (Babb & Crandall 1976). The fate of such auras after surgery varies but they may persist or disappear slowly, as was found in the group of patients described in this paper (Table 1).

The role of the temporal lobes in memory is well recognized and defects of recent memory in patients with temporal lobe disease have recently been reviewed (Milner 1975). The

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Table 1. Fate of temporal lobe auras after surgery

| | Preoperative | Postoperative | |
|---------|--------------|---------------|-------------|
| | | Good result | Poor result |
| Present | 30 | 8 | 7 |
| Ceased | — | 15 | 0 |
| Absent | 8 | 7 | 1 |
| Unknown | 2 | 2 | 0 |
| Total | 40 | 32 | 8 |

chronic stimulation referred to above (Halgren *et al.* 1978) demonstrated that elements in the medial hippocampal formation must be intact both for input and retrieval of recent information.

Mood change and overt psychiatric illness in relation to temporal lobe disease is more complex. Of patients studied by Currie *et al.* (1971), only 56% were considered normal and 6% had a florid psychiatric disorder. Psychotic illness, both ictal and interictal, is well recognized in epileptics. Certain associations have been proposed between schizophreniform psychosis and left hemisphere lesions (Flor-Henry 1969), and the same psychosis and 'alien tissue' lesions in either hemisphere (Taylor 1975). Certain personality traits have been described in epileptics, but the explanation of these findings is disputed (Bear & Fedio 1977).

Patients and results

A group of 45 patients with epilepsy underwent temporal lobectomy after appropriate investigations which have been described elsewhere (Polkey 1981). From this group, 40 patients are described with a minimum follow-up period of 2 years. There were equal numbers of men and women, 19 having left-sided lobectomies and 21 right-sided lobectomies. The follow-up period varied between 2 and 6 years (mean 3.6 years). The patients' ages ranged from 3 to 48 years, but 14 patients were 15 years or less at the time of operation.

The results of operation are shown in Table 2, where the patients are grouped according to the pathology found in the resected temporal lobe. Although almost all of the patients were in good physical health prior to operation, over half of them presented some intellectual deficit on formal psychometric testing and about half had some mental disorder (Tables 3 and 4). The effect of operation was to produce minor physical disabilities in 6 patients and improve the intellectual performance of 2 patients whilst worsening the

Table 2. Results of operation

| | No. of patients | Pathology | | |
|---------|-----------------|---------------------------|----------|----------------|
| | | Mesial temporal sclerosis | Others | Nonsignificant |
| Group 1 | 21 } 80% | 13 | 16 | 3 |
| Group 2 | | | | |
| Group 3 | 4 } 20% | 5 | 2 | 1 |
| Group 4 | | | | |
| Total | 40 | 18 (45%) | 18 (45%) | 4 (10%) |

- Group 1, less than 1 seizure per year since operation
- Group 2, seizure rate 25% or less of preoperative rate
- Group 3, seizure rate more than 25% of preoperative rate
- Group 4, seizure rate unchanged

Table 3. Preoperative status of patients

| | Normal | Abnormal |
|--------------------------|--------|----------|
| Neurological examination | 39 | 1 |
| Psychometric evaluation | 17 | 23 |
| Mental disorder | 23 | 17 |
| Social situation | 26 | 14 |

Table 4. Mental disorder and social situation preoperatively

| Mental disorder | | Social situation | |
|-------------------------------|----|--------------------------|---|
| Aggressive/difficult | 11 | Isolated/viscous | 7 |
| Obsessional/ritualistic | 3 | Retarded/autistic | 2 |
| Phobia | 1 | Resident in special unit | 2 |
| Depression | 1 | Manipulative | 1 |
| Theft (curious circumstances) | 1 | School problems | 1 |

Table 5. Changes in physical and intellectual state after lobectomy

| | Preoperative | | Postoperative | | | | |
|-------------------------|--------------|----------|---------------|----------|-------|--------|-----------|
| | | | Unchanged | | Worse | Better | Not known |
| | Normal | Abnormal | Normal | Abnormal | | | |
| <i>Groups 1 & 2</i> | | | | | | | |
| Neurological | 32 | 0 | 26 | 0 | 6 | 0 | 0 |
| Intellectual | 13 | 19 | 6 | 12 | 9 | 2 | 3 |
| <i>Groups 3 & 4</i> | | | | | | | |
| Neurological | 7 | 1 | 7 | 1 | 0 | 0 | 0 |
| Intellectual | 4 | 4 | 2 | 3 | 2 | 0 | 1 |
| <i>Overall</i> | | | | | | | |
| Neurological | 39 | 1 | 33 | 1 | 6● | 0 | 0 |
| Intellectual | 17 | 23 | 8 | 15 | 11■ | 2 | 4 |

●Dysphasia 3, homonymous hemianopia 2, diplopia 1

■Of practical importance in only 3 patients

Table 6. Changes in mental state after operation

| | Preoperative | | Postoperative | | | |
|--------------|--------------|----------|---------------|----------|-------|--------|
| | | | Unchanged | | Worse | Better |
| | Normal | Abnormal | Normal | Abnormal | | |
| Groups 1 & 2 | 19 | 13 | 18 | 5 | 3 | 6 |
| Groups 3 & 4 | 4 | 4 | 3 | 2 | 1 | 2 |
| Overall | 23 | 17 | 21 | 7 | 4 | 8 |

performance of 11 patients, although this was only of practical consequence in 3 (Table 5). Among this group there were 11 patients who exhibited some mental disorder postoperatively, but only 3 of these had been normal preoperatively. Of these 3, one developed ruminant obsessions, one had a depression lasting several months, and one having lost her epilepsy developed 'turns' to replace it. Of the remaining 8 patients, 7 were

unchanged and one who had been very difficult before developed frank paranoid psychosis. Among the 8 patients who showed an improvement as a result of operation, 5 lost their difficult and aggressive behaviour (Table 6).

Discussion

Apart from seizures and neurophysiological findings, it is clear that this population undergoing temporal lobectomy was not normal in other respects. Previous reports of surgical series have made the same point. Thus Jensen (1975), in reviewing the world literature, noted that in some series as few as 6% of the patients were mentally normal prior to operation; while other series have suggested that about 50% of patients may be mentally abnormal and 10% to 15% may be frankly psychotic (Taylor & Falconer 1968, Jensen & Larsen 1979, Sherwin 1981).

In attempting to predict the result of operation, one might expect some features to appear as a consequence of 'ablation' whereas others are clearly the result of continuing disordered function. The 'ablation' effects are well known and previously reported. Thus Jensen (1975) described a whole range of neurological deficits from complete hemiplegia to third nerve palsies and visual field defects. Fortunately, the more severe deficits are rare. In the present series, 6 patients suffered such deficits but none were significantly incapacitated by them. Likewise, the worsening psychometric performance, usually measured one month after operation, is in the same category and again mostly of no practical significance. Such worsening occurs because the resected temporal lobe, although not functioning perfectly prior to operation, is presumably making some contribution to useful function in some patients. In some cases one year or more after operation these deficits are seen to have significantly decreased, as was described originally in the case of the verbal learning deficit by Blakemore & Falconer (1967). The 2 patients in the present series whose psychometric scores showed improvement need explanation: in each case one hemisphere was so disabled by subclinical seizure activity as to be unable to perform properly preoperatively.

In the case of mental disorder and psychosis a different mechanism must operate. Again it has been well described that patients with uncontrolled temporal lobe epilepsy may show an aggressive personality disorder which improves if the epilepsy is controlled by lobectomy, and at the same time the patients' social adjustment improves (Taylor & Falconer 1968). However, if patients are victims of longstanding psychosis in association with their epilepsy, then even if the epilepsy improves as a result of surgery the psychosis is likely to remain the same. Thus of 12 patients described by Serafetidines & Falconer (1962), 6 were rendered fit-free but in only 2 was the psychosis described as recovered.

Furthermore, some patients may become psychotic after operation: Falconer & Taylor (1968) reported 3 patients; Jensen & Larsen (1979) 9 patients, of whom 6 were free of fits; and Sherwin (1981) one patient. Up to the present I have observed psychosis in 3 patients, 2 of whom are amongst the group described here. All underwent non-dominant lobectomies and had adverse verbal-performance scores on psychometric testing. In one of them, who died in a road accident, the opposite temporal lobe and its medial structures appeared normal. In another the psychosis was transient and resolved after some months when his seizures reappeared. The third patient, who was difficult prior to operation, has become frankly psychotic but his seizures are now very infrequent.

There is no ready explanation for the resolution of aggressive, difficult behaviour after surgery, nor for the occurrence of psychosis. In several studies of personality traits in patients with epilepsy, Bear and his co-workers appear to have established that certain personality traits are seen more commonly in patients with psychomotor epilepsy (Bear & Fedio 1977, Bear 1979, Bear *et al.* 1982). They believe that this can be explained by fortuitous limbic associations in relation to the epileptic focus, which they term the 'hyperconnection syndrome'. The role of the hippocampal structures in selecting material for storage and retrieval is in many ways ill understood, especially when more complex emotional circumstances are involved. At present the part which disorder of this mechanism plays in

behavioural problems associated with temporal lobe disease can only be the subject of speculation.

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