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Cognitive outcomes of temporal lobe epilepsy surgery in older patients

P.J. Thompson [a,b,*], S.A. Baxendale [a,b], A.W. McEvoy [a,c], J.S. Duncan [a,b]

[a] Department of Clinical and Experimental Epilepsy, UCL Institute of Neurology, Queen Square, London WC1N 3BG, United Kingdom
[b] Epilepsy Society Research Centre, Chesham Lane, Chalfont St Peter, Buckinghamshire SL9 0RJ, United Kingdom
[c] Department of Neurosurgery, National Hospital for Neurology and Neurosurgery, Queen Square, London WC1N 3BG, United Kingdom

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ABSTRACT

Purpose: To examine the cognitive risks of temporal lobe surgery in patients aged 50 years and older.
Methods: We analysed data from 55 patients who underwent temporal lobe surgery (26 left-sided:29 right sided) from 1988 to 2012 at our centre. Pre-surgical and one year post-operative memory and naming capacity were compared to data obtained from two younger cohorts; 185 aged 18–30 and 220 aged 31–49.
Results: Pre-operative memory impairments were most marked for the oldest cohort and were associated with a longer duration of epilepsy. Naming capacity improved with age and better performance was associated with a later age at epilepsy onset. Post-operative declines were largest in older patients, achieving statistical significance for verbal memory, naming and subjective ratings. Left temporal lobe resections carried the greatest risk of memory and naming decline. Cognitive outcomes were unrelated to seizure outcome, VIQ or mood.
Conclusion: Our findings indicate the cognitive risks of TLE surgery are greater for older patients. Cognitive outcomes need to be considered when assessing the efficacy of epilepsy surgery in older cohorts and pre-operative performance levels need to be taken into account.

1. Introduction

Increasingly, surgical treatment for temporal lobe epilepsy (TLE) is being offered to older patients and this trend will continue with improved life expectancies and reports of favourable seizure outcomes [1]. The cognitive impact of TLE surgery on an ageing brain, with likely compromised function remains unclear. The risk of worsening memory is a frequent concern raised by older surgical candidates and their families but the evidence base for counselling is limited.

Few studies have investigated the cognitive outcome of TLE surgery in older cohorts and findings are inconsistent. Sirven et al. [2] failed to find increased cognitive vulnerability in 17 patients undergoing surgery over the age of fifty years. All but four underwent right sided resections, a group known to have lower cognitive risks [3]. Girvas et al. [4] explored cognitive outcomes in 34 patients who underwent TLE surgery at 50 years or older. Post-operative cognitive losses were greater than gains, and lower pre-operative performance levels were associated with poorer cognitive outcomes particularly for verbal memory and surgeries undertaken after 65 years. The memory performance of the older group was already weak pre-operatively and the authors stressed the importance of taking this into account when assessing the cognitive impact of TLE surgery.

Costello et al. [5] reported that 10/42 older patients had adverse cognitive changes post-operatively, nine of whom had undergone temporal lobe resections. Memory test data was only available on 4/9 and only 2/4 were classified on the basis of this as having declined. Patra et al. [6] observed post-operative memory decline in a subset of older patients in a combined group of temporal and extra temporal surgeries. Murphy et al. did not find evidence of memory decline in their older surgical cohort with hippocampal sclerosis [7] while Chapin et al. found decreased susceptibility to memory decline in their older cohort [8].

TLE surgery in the speech dominant hemisphere also carries a risk of language difficulties and declines in confrontational naming have been recorded [9,10]. While language deficits rarely meet the diagnostic criteria of an aphasic disorder they often can affect social functioning and confidence. Word-finding difficulties are the most frequently reported cognitive complaint of people with TLE yet few studies have explored changes in language in older surgical

* Corresponding author at: Epilepsy Society Research Centre, Chesham Lane, Chalfont St Peter, Buckinghamshire SL9 0RJ, United Kingdom.
Tel.: +44 1494 601346; fax: +44 1494 874136.
E-mail addresses: pamela.thompson@ucl.ac.uk, pamela.thompson@uclh.nhs.uk (P.J. Thompson).

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cohorts. Costello noted four patients experienced transient word-finding difficulties lasting less than three weeks with one case receiving speech and language therapy [5]. Murphy et al. reported naming decline in association with left temporal lobe resections but those aged 50 years or older were not at an increased risk [7].

The aim of this study was to examine pre and post-operative memory and language function of people undergoing TL resections at fifty years or older. We aimed to address the following questions:

1. Are pre-operative memory and language difficulties more severe in older patients undergoing TLE surgery and is this related to the chronicity of the epilepsy?
2. Are older patients at greater risk of post-operative cognitive declines?
3. What factors differentiate older patients who experience post-operative cognitive declines from those who do not?

2. Methods

2.1. Participants

The participants were selected from a database of individuals with TLE who had undergone surgery at our centre between 1988 and 2012. Patients undergo neuropsychological assessments pre-operatively and at three months and twelve months as a matter of routine. Patients were included who had cognitive data available preoperatively and at one year post surgery and were assessed to be left hemisphere dominant for language (based on post-ictal dysphasia, Wada test findings to 2002, and latterly fMRI [11]). All patients included had an IQ of >69. Fifty-five patients were identified who were at least 50 at the time of surgery. Patients included represented 93% of the total temporal lobe surgeries undertaken. Demographic and clinical characteristics are presented in Table 1. Most patients underwent standard en bloc resections (LTLE = 22; Right TLE = 24) but seven underwent lesionectomies (3 LTLE; 4 RTLE) and one person had a tailored resection following intracranial recordings. The predominant pathology was hippocampal sclerosis.

Comparable data were available from two younger cohorts aged 18–30 years (N = 185) and 31–49 years (N = 220) at the time of surgery. Age groupings were selected to reflect the age bandings of the memory test norms (see below). There were no significant differences between the groups with respect to gender, side of surgery, hippocampal pathology, seizure freedom rates at one year and intellectual level. The older surgical group had a later seizure onset and had longer seizure histories ($p < 0.001$).

Table 1
Demographic and clinical characteristics of the three TLE age cohorts who underwent cognitive testing pre-operatively and one year post-operatively.

	18–30 years	31–49 years	50 years +
Number/total number of surgeries	185/199	220/248	55/57
Age at surgery Median (range)	25 (18–30)	37 (31–49)	54 (50–69)
Gender Male, *N* (%)	80 (43%)	111 (51%)	24 (44%)
Age of seizure onset Median (range)	8.0 (1–27)	12.0 (1–43)	13.0 (1–58)*
Duration of epilepsy Mean (SD)	16.0 (1–28)	25.0 (3–45)	38.0 (3–62)*
Surgical side Left, *N* (%)	107 (58%)	110 (50%)	26 (47%)
Pathology HS, *N* (%)	143 (77%)	183 (83%)	42 (76%)
Seizure free @ 1 year *N* (%)	116 (62%)	153 (69%)	37 (67%)
VIQ Mean(SD)	91.5 (13.2)	93.9 (13.1)	93.4 (13.5)

* $p < 0.001$.

2.2. Cognitive measures

Pre-operative performance was compared to performance one year following surgery.

2.2.1. Memory

The List Learning and Design Learning subtests from the Adult Memory & Information Processing Battery (AMIPB) and its successor the BIRT Memory and information processing battery (BIMPB) form part of our routine assessments [12].

On the list learning task the subject is read a list of fifteen words and asked to recall as many as possible over five consecutive trials (verbal learning: max = 75 items) and after a second list (delayed recall: max = 15). On the design learning task the person is shown a design comprising nine features on a structured grid for 10 s and then asked to reproduce it on a blank grid. There are five learning trials and delayed recall following a second design leading to a maximum of 45 points for learning and nine for recall. These tests have been previously described and have been reported to be sensitive to temporal lobe pathology and temporal lobe surgery [13].

Patients also rated their memory on a four point scale relating to the degree of impairment experienced in daily life. Ratings ranged from 0 for no nuisance to 3 for a severe nuisance.

For each individual, memory test outcome was classified separately for visual and verbal memory. A change in score was classified as a decline if the learning and/or recall subtest score post-operatively fell more than would be expected from retesting on the basis of the reliable change indices with a confidence interval of 90%. Similarly, a change in score was classified as improved if the test scores increased more than would be expected from retesting. Subjective memory ratings were classified as changed if a category shift occurred (e.g. rating change from 2 a moderate nuisance to 3 a severe nuisance) and rated as improved or declined depending on the direction of that shift.

2.2.2. Naming

The Graded Naming Test was employed to assess naming capacity [14]. This measure consists of thirty line drawings of objects and animals, placed in order of difficulty. The performance indicator is the number of items correctly named. This measure has been found to be sensitive to dominant temporal lobe resections [9]. Naming capacity was classified as deteriorated if the post-operative score decreased more than expected from the effects of retesting [15].

2.2.3. Mood

The Hospital Anxiety and Depression Scale was employed to assess levels of anxiety and depression [16].

3. Results

3.1. Pre-operative cognitive performance

Memory test scores were converted into z scores based on age related norms. All three groups performed well below average for their age with most marked deficits observed for the left TLE group who performed more than two standard deviations below age