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Memory outcomes in mesial temporal lobe epilepsy surgery

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HIGHLIGHTS

- Memory outcome analyses by group mean score differences and Reliable Change Indices (RCI).
- RCI scores derived first time in India in a patient control group.
- Decline and improvements after surgery for both, verbal and visual memory.
- Number of patients that decline in our population less than western study reports.
- Difference may be due to RCI scores and clinical characteristics of our patient sample.

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ABSTRACT

Introduction: Decline in verbal memory after dominant mesial temporal lobe surgery is a concern. Outcomes primarily reported by group data analysis do not address issues of practice effects and measurement errors and also do not provide information about individual meaningful change after surgery. Reliable Change Indices (RCI's) are regarded to be robust statistical methods for reporting individual change and have not been hitherto derived in patient populations in India.
Aim: Report memory outcomes for patients after surgery using group data as well as RCI score analyses using RCI scores derived in a control patient population.
Method: Retrospective data analysis of 106 selected patients who underwent Anterior Temporal Lobectomy (ATL) surgery. RCI scores derived from a control group of 44 non-operated patients. Outcomes based on score shifts on the various measures of two verbal and visual memory tests.
Results: Group mean score analysis revealed no significant shifts in verbal or visual memory scores after left ATL, but significant improvements in verbal memory after right ATL. RCI score analysis revealed decline and improvements in a small percentage of patients for both left and right ATL groups. Percentage of patients showing decline was much less than reported in western literature although percentage improved was comparable.
Discussion: Differences in decline percentage may be due to RCI scores and clinical characteristics of our sample (impaired pre-operative functioning, majority seizure free post surgery, moderate hippocampal sclerosis, early onset, long duration of seizures).
Conclusion: Group analyses mask individual change. Therefore, to report memory outcomes and counsel patients about relative risk-benefits of surgery, RCI scores derived from our patient populations should be used.

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1. Introduction

Mesial Temporal Lobe Epilepsy (mTLE) often presents with disabling, recurrent seizures that tend to be pharmacoresistant. Anterior temporal lobectomy (ATL) surgery is the most common, preferred treatment in a selected group of refractory epilepsy patients. An estimated two-thirds of patients become seizure-free permanently [1–3]. The mesial temporal lobe is the seat for declarative, conscious memory with critical memory networks within the hippocampus and surrounding perirhinal, entorhinal and parahippocampal neocortical regions [4]. The standard ATL procedure that involves resections in this region has raised concerns about memory outcomes after epilepsy surgery [5,6]. A recent systematic review of cognitive outcome studies suggested a trend of verbal memory decline with a pooled estimate of 44% risk to verbal memory after dominant TLE surgery [7]. However, there is considerable variability in the reported memory outcome results across studies in terms of numbers of patients who decline, types of tests used to assess decline, methods for calculating outcomes and extent of resections. Reports of improved memory functioning after surgery and lack of subjective memory complaints in patients after surgery further confound the issue. Seizure freedom is the primary goal of epilepsy surgery but individual patients and families also need to be counseled about risks of memory decline after surgery. In India, only two studies have reported memory outcomes in adult mTLE patients. The first study reported the outcomes [8] based on group mean score differences pre-to-post surgery. However, this method does not provide any information about meaningful shift in scores for an individual patient and also does not account for confounding factors of practice effects, measurement errors or 'regression to the mean' phenomena that affect outcome reports [9]. Reliable Change Index (RCI) method is the more accurate and reliable method of calculating meaningful clinical change in the individual patient and is regarded as the gold standard [10]. The second study from India [11] reported memory outcomes using this method but the RCI scores were from data published in a study by Hermann et al. [10]. Hitherto, no study from India has used Reliable Change Index (RCI) scores derived in our own population to measure memory change in individual patients after surgery. At our center, over the years, we have observed that subjective complaints of decline by patient's and families after ATL are rare and we wanted to evaluate memory outcomes based on objective test score data. Hence, the aim of this study was to evaluate memory outcomes using both, the group mean score differences and RCI methods of analysis with the RCI scores derived from our population.

2. Methods

2.1. Subjects

Patients with unilateral mesial temporal lobe epilepsy who underwent ATL surgery between 2004 and 2014 were selected from the clinical database of our epilepsy surgery series of over 400 patients at the K.E.M hospital, Mumbai, India. Patients included had undergone a non-invasive pre-surgical evaluation that included video telemetry, 1.5 or 3T MR imaging and a comprehensive neuropsychological evaluation at two time points – pre-surgical baseline and a year post surgery. Patients were excluded if there was bilateral MTS on imaging, psychiatric morbidity, left-handedness or IQ < 70. A total of 106 patients were thus identified; 47 had undergone a left and 59 a right ATL. All patients underwent a standard anterior temporal lobectomy with resection of the lateral temporal neocortex including superior, middle and inferior temporal gyrus (5.5 cm from temporal pole on the right side and 4.5 cm on the left side) and amygdalohippocampectomy. The selection flow chart and clinical characteristics of the sample are described in Table 1 and Table 2 respectively.

2.2. Memory tests and measures

The comprehensive epilepsy surgery program, with a multidisciplinary team, at the King Edward Memorial Hospital, in Mumbai, India began in 2001. Every patient undergoes a detailed neuropsychological assessment on a battery of tests that were adapted and normed for the Indian population in 2004 [12,13]. For this study, data of two verbal and visual memory tests was used. (Table 3).

1.*Verbal Memory*: a) Auditory Verbal Memory Test (AVLT) [14], a 15 word list learning, over 5 trials with post interference immediate recall and a delayed recall after 30 min b) Paired Associates Test (PA) from the Wechsler Memory Scale III [15], 8 unrelated word pair learning, over 4 trials with immediate recall and delayed recall after 30 min.

2.*Visual Memory*: Two tests of design/figure recall: a) Visual Reproduction Test (VR) from the Wechsler Memory Scale III, 5 figures, immediate recall and delayed recall after 30 min [15] b) Rey Complex Figure Test (CFT) [16] single complex design copied followed by immediate recall and delayed recall after 30 min.

For all the tests, scores of total learning, immediate and delayed recall were considered for analysis.

2.3. Reliable Change Index (RCI) scores

In this method control group data is used to calculate the RCI scores. To establish the RCI scores we evaluated 44 non-operated refractory temporal lobe epilepsy patients (Table 4) on two occasions, at baseline and after a year (range from 9 months to 18 months) on a battery of neuropsychological tests and calculated the RCI scores for the different memory tests and measures. Score shifts in the surgical series that were greater or less than the RCI score were then identified as significant improvement or decline respectively.

3. Data analysis

3.1. Independent samples T-test

An independent samples T-test using IBM SPSS version 20.0 (IBM Corp, NY) was run to determine if there were significant differences in age, education, seizure duration, seizure onset and intelligence score between individuals in the left ATL group and individuals in the right ATL group.

3.2. Group analyses

A paired samples T-test was conducted using IBM SPSS version 20.0 (IBM Corp, NY) in order to examine changes in memory test scores in a group of individuals that underwent a left ATL (Group 1) and those that underwent a right ATL (Group 2). The dependent variables were the measures of each test (AVLT Total, AVLT IR, AVLT DR, PA IR, PA DR, VR IR, VR DR, CFT IR, CFT DR) and the independent variables were the two time points at which test scores for each patient was collected (Time1 = Pre-operative and Time 2 = 1 Year Post-operative).

3.3. RCI analyses

RCI scores were calculated using the formula modeled by Iverson et al. [17]. This method is a variation of the one proposed by Jacobson and Truax [18]. It allows for the calculation of reliable change indices