Cognitive Rehabilitation in Epilepsy

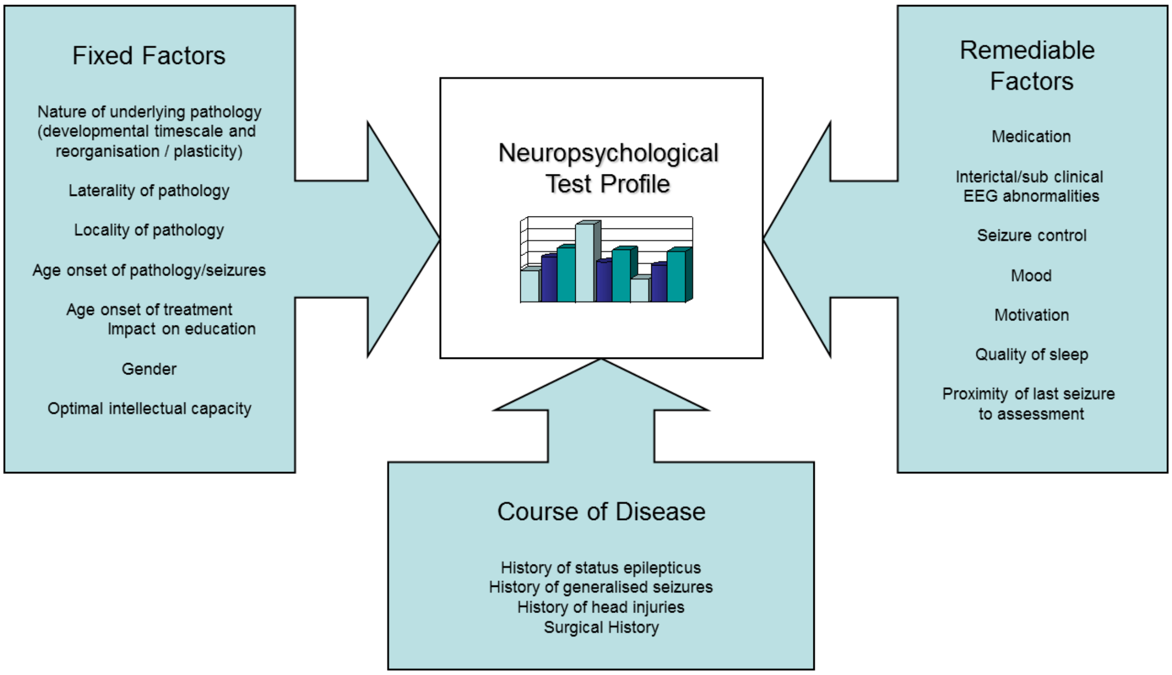
Introduction

Epilepsy is a condition characterised by recurrent, unprovoked seizures, or a high probability (>60%) of seizure recurrence following a single seizure. Most neurological conditions (MS, AD etc.) are unified by a common underlying process within the brain, giving rise to a number of symptoms. Epilepsy is different in that the diagnosis is conferred on the basis of the defining symptom, seizures. The abnormalities and pathologies that can result in seizures are multiple and varied and may be structurally apparent or cryptogenic, genetic or acquired [i]. This makes epilepsy both the most common neurological disorder worldwide and the most common neurological comorbidity of other neurological conditions. It follows that people with epilepsy form an extremely heterogeneous population.

In people with epilepsy, cognitive deficits arise from the complex interplay between the underlying pathology, medical and surgical treatments and common comorbidities associated with the condition. Some of these factors are fixed; others may fluctuate or evolve other time[ii]. See Figure 1.

<<Figure 1 here>>

Figure 1: Factors influencing performance on neuropsychological tests in epilepsy (adapted from Baxendale 2008: copyright ILAE 2008)



Cognitive Rehabilitation in Epilepsy

As with most other neurorehabilitation programmes, the bedrock for cognitive rehabilitation in epilepsy is a thorough neuropsychological assessment. The assessment should be designed to tease out and delineate the relative contributions of each of the factors in the above model to the cognitive disturbance recorded in each individual with epilepsy. This requires a thorough clinical interview in addition to a comprehensive psychometric assessment. Seizure control should be optimised prior to the commencement of any cognitive rehabilitation. This may require exploration of the person with epilepsy's compliance with their prescribed medication regime and discussion of any side effects, including, but not limited to, cognitive effects. Some medications may result in excellent seizure control but this is achieved at the expense of cognitive function. For some, the cognitive price of good seizure control may be too high. Getting the balance right between seizure control and acceptable cognitive compromise is unique for each person with epilepsy and should be a collaborative process between the person with epilepsy, their neurologist and their neuropsychologist. Once an antiepileptic medication regime has been optimised, it is important to optimise the individual's psychological state prior to rehabilitation input. As with many other neurological conditions, depression and anxiety are frequent psychiatric comorbidities in epilepsy. The cognitive rehabilitation can then begin.

Education on how the brain works and how and why memory fails is a fundamental component of most neurorehabilitation programmes. In people with epilepsy, this module is supplemented with education about seizures and the nature of their epilepsy. The important distinction between peri-ictal and inter-ictal cognitive disturbance should be explained. In the example of the memory difficulties often seen in temporal lobe epilepsy, it is important to explain that memory problems are frequently just as much a manifestation of the underlying brain condition as seizures. They are both symptoms of the same problem. Developing an understanding and acceptance that cognitive problems are an integral part of the condition is the first step in the cognitive neurorehabilitation programme in epilepsy, and often contributes to a reduction in anxiety.

Following the development of acceptance, the person with epilepsy can then embark upon the 'SOS' part of a rehabilitation programme using Strategies, Outsourcing and Social Support to reduce the nuisance of cognitive difficulties in everyday life. This part of the programme will be highly individualised and tailored to address specific problems identified by the individual. Training in traditional cognitive strategies (method of loci, visualisation etc.) must take into account the cognitive reserve of the individual. These methods require some commitment to master and may be less effective than outsourcing memory functions to physical media (pen and paper, smart phone apps, white boards etc.) and utilising social support in reducing the nuisance of everyday cognitive failures in people with epilepsy. Social support in cognitive rehabilitation can be utilised in two ways. First, it is very helpful to educate friends, family and work colleagues about the relationship between cognition and epilepsy. Many are sympathetic when someone has a seizure but less tolerant of the cognitive difficulties that are part and parcel of the same condition. Understanding that it is all part of the same condition can reduce friction at home and work. In situations where someone with epilepsy is reluctant to disclose the condition, he or she can still utilise social support covertly, by always asking people to follow up in a text or email any information that may be given in passing and that would otherwise be vulnerable to loss. As with other neurological groups, environmental adaptations can be made at work and at home to ensure optimal conditions for safety in the event of a seizure and efficient encoding and retrieval of new information.

The basic steps in the cognitive rehabilitation of people with epilepsy are illustrated in Table 1.

<<Table 1 here>>

Lifestyle Adaptations

An increasing body of literature indicates that obesity in middle age and beyond may be associated with accelerated cognitive aging in non-neurological populations[iii]. In 2015, we examined the contribution of obesity to cognitive underfunction in people with epilepsy. [iv] Controlling for educational levels and socio-economic status, we found that obesity accounted for a significant proportion of the variance in slowed processing speed in a sample of 81 people with epilepsy. In addition, all measures of memory function in our sample were significantly correlated with BMI, with poorer scores associated with higher BMIs. Although the literature is mixed, some authors have reported that cognitive underfunction associated with a high BMI may be ameliorated following lifestyle changes promoting fitness and weight loss in the general population [v]. Work is currently underway to see if similar beneficial cognitive improvements can be seen in people with epilepsy who implement similar lifestyle changes. If effective, lifestyle advice and guidance may become an integral part of the cognitive rehabilitation process in epilepsy in the near future.

Epilepsy Surgery

Epilepsy surgery patients are exceptional in the neurorehabilitation population as we have access to them before they sustain their surgically induced, cognitive deficits. The recent development of multivariate predictive models means that we can now predict the likely nature and extent of a post-operative cognitive deficit with tailored odds for each individual patient based on their unique clinical characteristics [vi]. These predictions can be used to create bespoke rehabilitative interventions, prior to surgery. This ‘prehab’ approach allows patients to utilise cognitive functions before they are lost, to prepare for post-operative deficits.

Evaluation

Whilst over two thousand studies have been published that describe and quantify the cognitive deficits that are typically seen in various forms of epilepsy, systematic evaluations of cognitive rehabilitation in this group are few and far between. In a recent systematic review, Giovagnoli et al (2015) et al [vii]identified 18 studies of cognitive rehabilitation in epilepsy, only half of which were experimental studies. The conclusions that can be drawn from the published experimental data are limited by the small sample sizes, lack of control groups, lack of randomisation and heterogeneous nature of the participants. As Thompson et al (2016)[viii] point out, the number of reviews advocating the need for such research (n=7) exceeds the number of well-designed outcome studies in the literature. However, whilst sparse, the limited data does suggest that cognitive rehabilitation can have a significant impact on both subjective and objective measures of cognitive function and psychological well-being in epilepsy.

Table 1. Steps in the Cognitive Rehabilitation of People with Epilepsy

Step 1 Optimise seizure control	Requires close liaison between person with epilepsy, the treating neurologist and the neuropsychologist.
Step 2 Optimise psychiatric state	As above. Psychiatry may also be involved. Further cognitive reassessment may be required at this stage if medication changes have been made or there has been a significant change in psychological state.
Step 3 Education	a. General cognition– How the brain works b. General epilepsy – what is a seizure, peri-ictal vs. interictal states c. Individualised – as far as possible: why they have epilepsy, where the seizures are coming from, why cognition is affected, what can and cannot be changed. This will require liaison with other specialties including neurologists, neuroradiologists, psychiatrists or GPs. Never assume that the individual received this information on diagnosis, as some may have, but many more will not.
Step 4 Acceptance	For some, Step 2 may be like receiving the diagnosis all over again. Developing acceptance can be difficult and protracted, and it requires psychological support. Acceptance may involve the relinquishing of work or employment goals and aspirations that cannot be met. This can be very difficult for highly motivated individuals to accept and it takes skilled clinical judgement to determine the line between healthy aspiration and unrealistic expectation.
Step 5 Identify specific nuisance/problem	This will emerge from the formal neuropsychological assessment and clinical interview. Prioritise goals. It is usually best to start with something simple that has a high chance of success to build up a positive cycle of confidence and expectation.
Step 6 S.O.S	Put together an individualised package of strategies from the S.O.S toolbox. Strategies: Internal and external Outsourcing Social Support
Step 7 Evaluate	Monitor and evaluate. Return to Step 5 once a goal has been achieved or if the package devised in Step 6 has not worked. If no solution can be found, a return to Step 4 (Acceptance) may be considered.

[i] Berg AT, Berkovic SF, Brodie MJ, Buchhalter J, Cross JH, van Emde Boas W,Engel J, French J, Glauser TA, Mathern GW, Moshé SL, Nordli D, Plouin P, Scheffer IE. Revised terminology and concepts for organization of seizures and epilepsies:report of the ILAE Commission on Classification and Terminology, 2005-2009. Epilepsia. 2010 Apr;51(4):676-85.

[ii] Baxendale S, Thompson P. Beyond localization: the role of traditional neuropsychological tests in an age of imaging. Epilepsia. 2010 Nov;51(11):2225-30.

[iii] Singh-Manoux A, Czernichow S, Elbaz A, Dugravot A, Sabia S, Hagger-Johnson G, Kaffashian S, Zins M, Brunner EJ, Nabi H, Kivimäki M. Obesity phenotypes in midlife and cognition in early old age: the Whitehall II cohort study. Neurology. 2012 Aug 21;79(8):755-62.

[iv] Baxendale S, McGrath K, Donnachie E, Wintle S, Thompson P, Heaney D. The role of obesity in cognitive dysfunction in people with epilepsy. Epilepsy Behav. 2015:Apr;45:187-90.

[v] Gates N, Fiatarone Singh MA, Sachdev PS, et al. The effect of exercise training on cognitive function in older adults with mild cognitive impairment: a meta-analysis of randomized controlled trials. Am J Geriatr Psychiatry 2013;21:1086–97

[vi] Baxendale S, Thompson P, Harkness W, Duncan J. Predicting memory decline following epilepsy surgery: a multivariate approach. Epilepsia. 2006 Nov;47(11):1887-94.

[vii] Farina E, Raglio A, Giovagnoli AR. Cognitive rehabilitation in epilepsy: An evidence-based review. Epilepsy Res. 2015 Jan;109:210-8.

[viii] Thompson P, Conn H, Baxendale S et al. Optimizing memory function in temporal lobe epilepsy. Seizure: European Journal of Epilepsy: 2016 In Press.