REVIEW

Effectiveness of psychological interventions for people with poorly controlled epilepsy

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People with epilepsy are at increased risk of anxiety and depression, of experiencing low self esteem, and of suffering from the stigma attached to having epilepsy. A recent, large community study (based on responses by 696 adults)¹ showed the importance of frequency of current seizures in determining anxiety, depression, and perceived life fulfilment. Factors other than frequency of seizures may influence ability to cope psychologically.² In addition, psychological factors have become increasingly recognised as playing a part in the occurrence of seizures.³ Psychological interventions might consider, therefore, both the psychological disturbances that accompany poorly controlled seizures, and the occurrence of the seizures themselves.

The present review sets out to consider the status of psychological interventions, both for dealing with psychological disturbances associated with epilepsy, and for the reduction of occurrence of seizures. MedLine and PsychLit searches were undertaken to identify recent literature (1990-6) using the terms epilepsy and self control, group therapy, psychotherapy, psychological treatment, psychological problems, cognitive therapy, behaviour therapy, psychosocial, anxiety, depression, stigma, relaxation, biofeedback. This was supplemented by a manual search and the use of some existing reviews.³⁻⁸ On the basis of this review, indications for further research and for the practical application of such work with patients will be discussed.

Psychological disturbance associated with epilepsy

Little rigorous research has been undertaken to investigate methods of alleviating psychological disturbance in patients with epilepsy.

Psychodynamic psychotherapy has been discussed from purely theoretical aspects, with some case vignettes⁹⁻¹³ which were not systematically controlled. Psychotherapy has, for example, been used to alleviate strong emotional feelings and stigma associated with having epilepsy, and to assist patients in dealing with psychosocial stresses associated with seizure precipitance, emotional conflicts in patients' lives, anxiety, depression, and low self esteem (for example, Mathers⁹ and Miller¹²). Single case reports of patients (often children)

treated from a psychotherapeutic approach suggest that psychotherapy is valuable for the psychological problems associated with epilepsy, but do not permit objective evaluation.¹⁴⁻²¹ Individual counselling provided for 83 patients has been described as worthwhile and a valuable additional service provided by an epilepsy clinic, and although a great majority of these patients (number not specified) were reported to have benefited, this was not objectively or statistically evaluated.²²

Comparing patients randomly assigned to education (n=20) or waiting list control groups (n=18) the Selpuveda epilepsy education programme, a two day group based course providing medical, educational, and "psycho-social therapy", significantly reduced fear of seizures but not self reports of anxiety, depression, or other psychosocial measures.²³ In another study, a self help group approach with group psychotherapy focusing on psychosocial difficulties and encouraging anticonvulsant compliance reduced depression scores.²⁴

Psychological interventions setting out to reduce the frequency of epileptic seizures have also improved patients' psychological state. Thus Rousseau *et al*²⁵ adopted a treatment approach used widely to alleviate tension, that of progressive muscular relaxation, with eight patients with intractable epilepsy. This involved their learning to tense and then increasingly relax groups of body muscles, in specific sequences. The training session was followed by twice daily practice. Four patients had each been randomly allocated either immediately to the active training or first to a sham treatment condition. Relaxation training over a three week period produced improved feelings of wellbeing over and above decreases in seizure frequency.

Gillham²⁶ compared two psychological approaches in a crossover design study to reduce seizure frequency in outpatients; random allocation of patients was not specified. One treatment involved training patients to identify factors that might precipitate seizures, to learn how to avoid these, to try to interrupt seizures in the early stages of their occurrence, or to practice relaxation and breathing exercises. The other intervention dealt with psychological problems affecting the patients such as phobias, mild depression, and family tensions.

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The latter intervention did not include relaxation. Both treatments produced improved self ratings of anxiety and depression.

Cognitive behaviour therapy²⁷ is widely used to treat anxiety and depression. It emphasises the influence of thoughts and their content on emotional state and treatment focuses on changing thought patterns and behaviour. As anxiety and depression are commonly experienced by people with epilepsy, Tan and Bruni²⁸ used cognitive behaviour therapy with a group of patients with intractable epilepsy to try to reduce seizure frequency. They reported an overall improvement in the therapists' rating of patients' global wellbeing after cognitive behaviour therapy but also to some extent after supportive counselling, which had served as one of two control conditions in this random allocation, statistically evaluated study. The value of cognitive therapy for patients with intractable epilepsy has been described elsewhere.²⁹ Patients were given a tailor-made self help manual, the contents of which focused on considering maladaptive coping mechanisms. Emotional and psychosocial wellbeing improved but improved yet more with additional individual therapy sessions.

Various potential areas of psychological intervention seem particularly underdeveloped. Some patients develop seizure phobias³⁰ but there are no studies of its treatment. Psychological disturbance associated with epilepsy seems to be a feasible target for intervention. The lack, however, of formal evaluations of psychodynamic approaches currently makes a comparison between approaches impossible.

Psychological approaches to the management of seizures

A POSSIBLE NEUROPHYSIOLOGICAL BASIS FOR PSYCHOLOGICAL TREATMENTS OF SEIZURES

Fenwick and Brown³¹ adopted a neurophysiological model to underpin psychological reductions of occurrence of seizures. Lockard's³² experimental work with alumina gel induced epilepsy in monkeys led to a model of focal seizure occurrence involving two groups of damaged neurons. Group 1 neurons, central to the seizure focus, were partially damaged and fired in a continuously paroxysmal manner. Surrounding these were group 2 neurons, also partially damaged and able to fire either normally or paroxysmally. They could recruit normal neurons into an epileptic discharge but might also be synaptically suppressed. A localised seizure involves the recruitment of group 2 neurons by group 1 neurons; secondarily generalised seizures occur when group 2 neurons in turn recruit normal neurons.³¹ Fenwick⁴ suggested that as the activity of neurons surrounding an epileptic focus can determine whether a seizure will occur and spread, behaviour which affects neuronal activity may also affect occurrence of seizures.

Fenwick and Brown³¹ also considered the role of conditioning in seizure occurrence and reviewed work showing conditioning of seizures to external stimuli in brain damaged but not in normal animals; Gastaut *et al*³³ showed

conditioning of seizures in a patient with photosensitive epilepsy. Others³⁴ suggested that whereas a seizure is probably not a conditioned reflex, classical and operant conditioning are involved in the pattern of seizure occurrence and maintenance and can therefore be used in its alteration.

Seizures may therefore be hypothesised to occur as a result of changes in the relative activity in group 2 surrounding neurons which may or may not depend on conditioning factors. Despite the attractiveness of such models, studies investigating psychological manipulation of seizure occurrence have rarely considered the possible underlying neurophysiological mechanisms, other than in the case of EEG biofeedback (see below).

Studies of psychological treatments aimed at reducing seizure frequency have been plagued by methodological inadequacies (see reviews⁵⁻⁸). Most studies have included only a few patients with inadequate or no control groups, or inadequately described treatments. This review focuses mainly on studies published since 1985, except for conditioning and biofeedback studies—in which the relevant literature is considerably older. Despite the weaknesses of the study designs results are promising, and systematic reviews^{3-5,6} suggest that psychological treatment can reduce seizure frequency.

OPERANT AND CLASSICAL CONDITIONING

Eleven studies used operant or classical conditioning to reduce seizure frequency.⁸ Operant treatments included positive reinforcement of seizure free periods, extinction (removal of positive reinforcement) when seizures occurred, and punishment of seizure behaviour. Interventions based on classical conditioning included systematic desensitisation, in which hierarchies of anxiety provoking situations associated with seizures were presented to patients under conditions of relaxation. Such approaches have subsequently been studied with greater rigour (see below). Ten of those reviewed⁸ were single case studies and although all used within subject comparisons, none used statistical techniques to evaluate change. Only three used an experimental design which permitted an evaluation of the treatment. The inadequate descriptions of the interventions and observation methods leave the success of these studies in some doubt, although seizure frequency was reduced in 14 of the 15 studies reviewed.

Avoidance strategies²⁹ have been described on an idiosyncratic basis for seizures evoked by specific triggers such as music or particular visual stimuli; whereas it may not be possible to avoid all seizure triggers some reduction in seizure frequency may be achieved by manipulation of the environment.

Powell⁶ reviewed nine papers using classical conditioning paradigms (including habituation and presenting stimuli that were gradual approximations to the critical stimulus) to treat rare reflex epilepsies—that is, seizures triggered by specific sensory stimuli. There have been many reports of successful treatment of single

cases, but no controlled group studies. The mechanism by which such treatments work has, however, been poorly described by the researchers involved. In reviewing this area, Powell⁶ has proposed a model whereby a safe form of an epilepsy provoking sensory stimulus (for example, music, written material) is gradually, by means of subtle alterations in its form, merged with the original seizure precipitant and is thereby associated, by conditioning, to a conditioned response that is any behaviour other than a seizure; this behaviour in turn inhibits seizure activity. Unfortunately the neurophysiological basis of this was not discussed. Overall however, although some studies have been poorly described or designed, behaviour therapy (based on classical conditioning) will probably have a valuable role in the treatment of reflex epilepsies.^{6 35 36}

RELAXATION

The use of relaxation for anxiety is based broadly on classical conditioning procedures. As a widely used clinical intervention it is of interest in its own right. In all of the studies investigating its use for seizure reduction sample size has been disappointingly small.

Snyder³⁷ found that three of four adults trained in relaxation and who practised it for at least 15 days per month experienced an average reduction in seizure frequency.

As noted above, Rousseau *et al*²⁵ randomly allocated a total of eight patients to two groups to compare the effectiveness of progressive muscular relaxation with a sham treatment. Subjects showed a significant decrease in seizure frequency after relaxation training although two patients also showed decreases during sham treatment. Whitman *et al*³⁸ trained 12 patients (having at least six seizures in an eight week baseline period) with an abbreviated form of progressive muscular relaxation, and followed patients up at eight, 16, and 24 weeks post-treatment. Although decrease in seizure frequency from baseline to first follow up was only marginally significant, the reduction in frequency continued, with a significant 54% reduction in median seizure frequency after six months. No control group was included. Puskarich *et al*³⁹ compared seizure frequency in 13 patients trained with progressive muscular relaxation with 11 patients who underwent a control treatment which involved sitting quietly in a darkened room and engaging in non-directive conversation. Patient allocation was random. Eight weeks after treatment, 11 of the relaxation group and seven of the control group reported a decrease in seizure frequency, with the number experiencing reduction only being significant for the treatment group; mean seizure decrease was 29% for the relaxation group, and only 2% for the control group, again only significant for the relaxation group.

Variations in the use of relaxation training have been used in a group study⁴⁰ using an almost random allocation of 18 subjects into three groups, comparing contingent relaxation with an attention control condition or with a waiting list control group. Contingent relaxation involved learning to apply progressive

muscular relaxation (which patients learned to associate with bodily sensations and environmental situations that were incompatible with seizure occurrence) to situations and feelings associated with a high risk of seizure activity. The attention control group underwent non-directive supportive treatment for an equal number of sessions. Relaxation produced a median decrease in seizure frequency of 66% whereas the attention control group experienced a median increase in seizures of 68%. The waiting list control group's seizures increased by 2%; the three groups differed significantly from each other in terms of reduction of seizure frequency.

Long term evaluations of treatment are almost non-existent. However, an eight year follow up of 18 children who had been assigned randomly to a behaviour modification (including analysis of seizure behaviour, reinforcement of seizure control techniques, and healthy behaviour, as well as relaxation), a non-directive semieducational attention control, or a third group using traditional caretaking approaches for children with epilepsy⁴¹ reported maintained reduction of seizure activity (of 90%) in the behaviour modification group when considering a measure combining seizure frequency and duration. In the attention control group, seizure activity had increased by 16% relative to the initial baseline and by 44% in the second control group.⁴² At all time points at which between group comparisons were made, the behaviour modification group showed significantly better degrees of seizure control than the other two groups.

Single cases using relaxation as a component of treatment have also been reported⁴³ although study designs have not always been sufficiently complex to permit the convincing demonstration of a treatment effect.

Often in relaxation training patients are taught diaphragmatic breathing to counteract hyperventilation, which itself may lower seizure thresholds and contribute to occurrence of seizures. Fried,⁴⁴ citing earlier work that showed the role of hyperventilation in seizure genesis, indicated that carbon dioxide loss bears an almost linear relation to decreases in EEG frequency and the onset of seizures, and the mechanism here of seizure genesis has a metabolic as opposed to the neurophysiological basis of Lockard's model. Fried⁴⁴ analysed exhaled gas from a nasal tube inserted while patients were trained with deep diaphragmatic breathing and used a video monitor trace representing gas levels as feedback to patients. This demonstrated the need to provide feedback of % end tidal carbon dioxide values to train patients' breathing for there to be EEG normalisation. His study of 24 subjects, not all of whom completed the training, was controlled but not randomised in design. Normalisation of the EEG was accompanied by a significant seizure reduction for the group of patients completing the training. Other, methodologically simple, single cases of training to reduce hyperventilation have also been reported.⁴⁵

CHANGES IN AROUSAL

In addition to observations that stress may precipitate seizures, it has been suggested that sudden changes in arousal may be associated with precipitation of seizures.⁴⁶ Single cases⁴³ have shown the effective use of cue controlled arousal or relaxation to alter the person's arousal level at the time of possible onset of seizures. In addition, a study of three children with refractory epilepsy incorporated treatment techniques that included the use of countermeasures, contingent relaxation, and positive reinforcement for appropriate seizure control behaviour.⁴⁶ Countermeasures were defined as methods of changing the child's arousal level related to early signals of seizure onset and associated arousal. Thus if early seizure cues were accompanied by drowsiness then a behavioural response designed to increase arousal was taught. Contingent relaxation was applied to seizures and seizure situations that had not responded to the countermeasures. A statistically significant decrease in seizure behaviour and in EEG paroxysmal activity was seen in response to the countermeasures intervention. Countermeasures have elsewhere been considered to affect the level of excitability of epileptogenic and surrounding brain neurons and may include making particular movements or engaging in particular mental activities at signs of onset of seizures.^{3 42} Activities that constitute countermeasures have been described anecdotally.^{3 47} The study of Dahl *et al.*⁴⁶ described above, provides some formal evaluation of these techniques but it is unclear how spontaneous use of such techniques by patients might interact with other methods taught within specific seizure reduction studies. Szupera *et al.*⁴⁸ reported the use of conditioning in hypnosis to modify a subjects' vigilance level (their arousal) and thereby inhibit epileptic seizures. Their technique was, however, described for only two patients.

OTHER MULTICOMPONENT PSYCHOLOGICAL APPROACHES

As described earlier, Gillham²⁶ used a balanced crossover design to compare three sessions of a "seizure prediction and control" approach to three sessions of management of psychological distress in an attempt to reduce seizure frequency in an outpatient sample of adults with refractory seizures and significant psychological disorder. Each group was a respectable size (19–21), although random allocation of patients to group was not explicitly stated. Each treatment significantly reduced seizure frequency, with further significant reduction after whichever of the two interventions was implemented second, although improvement was significantly greater after the second treatment and been given. Improvement was maintained at six months and nearly half the patients had a reduction in seizures of at least 50%. A further group of 19 patients, without concomitant psychological difficulties, showed a reduction in seizure occurrence after exposure only to the self control of seizure intervention. This is perhaps the strongest study indicating the value of a brief psychological

intervention aimed at reducing the frequency of seizures in adult outpatients.

Andrews and Schonfeld⁴⁹ have reviewed a treatment programme for seizure reduction which aims to increase the patients' sense of self control, to help them to identify seizure triggers and signs of seizure onset, to help them deal with emotional distress in an adaptive way, and which also includes relaxation and EEG (α activity) biofeedback. Their retrospective analysis of the records of 83 patients treated between 1980 and 1985 notes that 83% achieved seizure control (not defined) by the end of treatment. In addition, patients with daily seizures at onset of treatment achieved a 67% success rate in achieving seizure control. The authors found that although earlier age at onset of seizures and higher seizure frequency at onset of treatment predicted the need for a greater number of treatment sessions, these factors predicted only weakly whether seizure control was achieved.

As already outlined, Tan and Bruni²⁸ compared group based cognitive behaviour therapy (directed at developing coping skills for stress and seizure control), supportive counselling, and a waiting list control group in terms of seizure reduction. Twenty seven outpatients of an original 30 who were randomly assigned to the groups, completed the study. The cognitive behaviour therapy ($n=8$) and supportive counselling ($n=10$) groups each received eight, two hour long sessions. At the end of the intervention phases and at follow up, no significant between group differences were found in seizure frequency. Cognitive behaviour therapy has, however, been shown to be of use in reducing seizure occurrence in a single case study, although no statistical analysis of data was undertaken.⁴³

Oosterhuis⁵⁰ has described a "psychoeducational" group approach to seizure reduction. This approach focused on seizure symptoms and behaviour, provided information on epilepsy and living with the condition, and taught cognitive-behavioural techniques to reduce seizures. In an uncontrolled study of only five patients with stress induced seizures, a mean reduction in seizures of 50% was reported after eight, two hour long sessions.

Preliminary findings with a group based application of the treatment devised by Reiter *et al.*⁵¹ as evaluated by Andrews and Schonfeld⁴⁹ (but omitting α EEG biofeedback), indicated a reduction of seizures in seven adults with chronic intractable epilepsy as opposed to a waiting list control group.⁵²

EEG BIOFEEDBACK

Approaches to seizure reduction which have involved EEG training using biofeedback to modulate cortical activity with visual display feedback, have shown a reduction in seizure frequency. Such approaches are not specifically linked to the model of seizure genesis described earlier involving group 1 and 2 neurons, but neither are they inconsistent with it. Instead, the model here is that on recognition of pre-seizure signals, the patient generates the anticonvulsant EEG rhythm that has been learned and

so inhibits the imminent seizure.³⁴ Presumably this activity could be that necessary to alter the potential for recruitment of group 2 or normal neurons into the epileptic activity of group 1 neurons.

Many of these studies involve training the patient to enhance activity of 12–15 Hz arising from the sensorimotor cortex, activity otherwise known as the sensorimotor rhythm. Much of this work dates back to the 1970s and 1980s. It is based on the premise that the presence of the sensorimotor rhythm is accompanied by a decrease in neuronal excitability, and there have been attempts to condition the production of the sensorimotor rhythm. This work ranges in quality from uncontrolled single cases (for example, Tansey³³) to crossover study designs.^{54 55}

A selection of sensorimotor rhythm studies, positive and negative, are reviewed by Thompson and Baxendale.²⁹ In general the outcome is positive, although Sterman⁵⁵ suggests that effectiveness of treatment is likely to be greatest for seizure types (both focal and generalised) which have a motor manifestation.

Slow cortical potentials, reflecting depolarisation of cortical pyramidal cell apical dendrites, have been the target of other EEG biofeedback studies (for example, Rockstroh *et al.*⁷). Here the aim is to decrease cortical surface negativity, as positivity has been associated with an anticonvulsant effect. In this study 25 patients with refractory epilepsy had 28 one hour long sessions of feedback and operant conditioning of their slow cortical potentials. Baseline measures of seizure frequency were taken but no control group was included. Data from 18 out of 25 patients were available for a one year follow up. Six patients became seizure free and seven showed a reduction in seizures compared with baseline treatment. Treatment is, however, very intensive and does not help all patients, with patients aged over 35 years being less likely to learn to control slow cortical potentials than younger patients.

Other EEG rhythms have also been used in treatment studies, which again vary in quality. Lubar *et al.*⁸ carried out a relatively well designed, statistically well evaluated study, with baseline and non-contingent feedback (feedback bearing no relation to the subject's EEG activity) baseline phases, as well as sessions in which the presence or absence of specific EEG frequencies were rewarded. This study supported the effectiveness of training a variety of EEG patterns in reducing seizure frequency.

PSYCHIATRIC INTERVENTIONS

Williams *et al.*⁹ reviewed the treatment of 37 patients with epileptic and non-epileptic seizures whose seizure disorder seemed to be exacerbated by stress, and who received at least two sessions of a psychiatric intervention (with a range of two to 70 sessions). Patients and family received an initial assessment, with treatment being designed to consider possible psychological contributions to the patients' seizures. At the end of treatment and at follow up, over half of the patients were improved or were seizure free; patients with partial seizures

were more likely to show a good response to sessions than patients with generalised seizures. Patients with non-epileptic seizures were also likely to show a good response to the intervention. Having an IQ within the average range and being hypnotisable also predicted a favourable outcome.

Overview and suggestions for care

Evaluating the effectiveness of psychological treatments for patients with epilepsy remains difficult. Despite the few randomised controlled treatment trials, psychological techniques may have something to offer to at least some patients with epilepsy, both from the psychological adjustment and seizure control perspectives, and such treatment is worth investigating further. Large scale randomised controlled studies are needed which permit comparison of methods that are predominantly cognitive-behavioural (for example, countermeasures, cognitive behaviour therapy, relaxation) with those that have a more direct neurophysiological rationale (for example, EEG biofeedback) as existing studies have compared within specific types of treatment rather than across broad treatment categories. In addition, EEG recordings before, during, and after relaxation training, taught in its different forms,^{25 38 40} or during the application of countermeasures,^{41 47} would permit greater clarification of the relevance of Lockard's model for seizure genesis and seizure modification in humans, as it would permit investigation of whether these techniques do indeed limit the regions of epileptiform activity. As indicated previously³ studies are still needed that will clarify which treatment approaches will be of greatest value for decreasing specific seizure types, and whether particular psychological and psychosocial factors have prognostic value.

Anecdotally, seizure avoidance or abortion via the use of cue controlled relaxation (or arousal) or the use of countermeasures would seem effective for focal seizures in which there is a well defined aura, and the underlying assumption is that these techniques prevent the recruitment by group 1 neurons of group 2 (for a focal seizure) and then of normal neurons (for a generalised seizure) by group 2 neurons. In a similar vein, cognitive-behavioural strategies may be helpful when the patient's seizures have a clear mood related prodrome^{43 60} or when interpersonal difficulties seem to be consistent seizure triggers. This intuitive approach, however, needs clarification from more extensive studies.

The patients' perceptions of their ability to change their own seizure behaviour may be an important factor and this has not been investigated with a view to predicting success or failure of psychological treatments for epilepsy. Psychological approaches, by contrast with pharmacological and neurosurgical techniques, place particular onus on the patient to bring about change that will result in seizure reduction, rather than simply relying on external agents (drugs) or techniques (neurosurgery). It may be, for example, unwise to investigate a patient's suitability for neurosurgical

treatment of their seizures and to explore psychological interventions at the same time. Psychological interventions imply that seizures can be brought under control by change on the part of the patient. The possible use of neurosurgical interventions implies that the patients would not otherwise achieve control of their seizures.⁶¹ Simultaneous psychological and physical investigations may reduce the motivation of the patient to make sufficient effort for psychological treatments to have a maximum chance of success.

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