

## Seizure-alert dogs — fact or fiction?

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Anecdotal evidence suggests that some dogs may be able to sense the onset of seizures and other medical conditions in humans, although this has never been explored scientifically. There is, however, evidence that dogs can be specially trained to recognize specific changes preceding a seizure and give an overt signal enabling the dog to warn his/her owner. The introduction of the use of dogs to detect and accurately predict the onset of a seizure, giving sufficient time for a person to take control of the situation will have a dramatic impact on quality of life. Support Dogs, a registered charity which trains dogs to assist disabled people, has successfully trained several 'Seizure-alert dogs'. As training progressed, the dogs were able to provide overt signals to their owners within time periods varying from 15 to 45 minutes prior to a seizure occurring. Each dog had an accurate prediction time and, in each case, the owner's seizure frequency was reduced.

*Key words:* epilepsy; seizure-alert dogs; quality of life.

### INTRODUCTION

For a person with epilepsy, unpredictable attacks may result in serious injury. However, this is not necessarily the most serious aspect of the condition<sup>1</sup>. The sizeable social stigma attached to epilepsy and its unpredictability may cause considerable demoralization, frustration and anxiety, not only to the person with seizures, but also to family and friends. People with epilepsy have to cope not only with their attacks, but with problems in almost every sphere of their day-to-day lives. These problems should not be underestimated.

The psychological problems experienced by people with epilepsy relate to the impact of living with a chronic illness, particularly one which is stigmatizing and which a negative social label is attached<sup>2</sup>.

A number of studies have been conducted into the link between anxiety and epilepsy; some patients have been shown to have attacks associated with, or precipitated by, anxiety<sup>3</sup>. Anecdotal evidence would suggest that a reciprocal relationship between anxiety and epilepsy exists. The more anxious the patient is, the more likely they are to have a seizure and the more seizures they have, the more anxious they become.

For many people developing seizures there are important social consequences of becoming labelled 'epileptic', and depression has been found to be more

common among people with epilepsy than normal controls or those people with other neurological conditions<sup>4</sup>.

The occurrence of recurring, unpredictable seizures is undoubtedly a major factor affecting the life of a person with epilepsy<sup>5</sup>. Seizure frequency, fear of seizures and self-perception of epilepsy have been shown to be predictors of well-being in people with epilepsy<sup>6</sup>. Low levels of control and self-esteem will all contribute to a reduced feeling of quality of life<sup>7</sup>.

### The effects of animals on human health

Pets, or companion animals, are said to be good for people<sup>8,9</sup>. Animals have beneficial effects on human health; they are used as 'assistants' for people with disabilities<sup>10</sup>; they provide positive psychological, physiological, developmental and social effects on normal and abnormal individuals<sup>11</sup>; they aid the nature of recovery from illness<sup>12</sup>; and can be an instrument of preventative health care. The vast contribution a dog can make to personal well-being has been well documented<sup>13</sup>.

Dogs have been used in a variety of human health-related programmes<sup>14</sup>. The concept of dogs helping people is not new, guide dogs are a familiar sight, and

other assistance dogs for disabled people have joined the ranks of the guide dog. Physical, psychological and social benefits have all been reported by people having a dog to assist them with their specific disability<sup>15</sup>. Studies have shown that the presence of a ‘service’ dog results in the user’s psychological well-being, self-esteem and community integrations<sup>15</sup>. Service dog users have reported requiring an average of 72% fewer hours of personal assistant time, thus reducing the cost of care<sup>15</sup>.

It has also been shown that a suitably trained dog acts as a social catalyst for a disabled person, increasing social interactions and acknowledgements from the general public<sup>16</sup>. A further benefit may be the ability of an animal to divert attention from the disability and provide a non-disease-orientated focus for the owner and others.

### The potential use of dogs with people with epilepsy

The introduction of the use of dogs to detect and accurately predict the onset of a seizure, giving a person sufficient time to take control of the situation, will no doubt have a dramatic impact on quality of life, psychological well-being, as well as the obvious reduction of injury. Other benefits, such as improved family relationships, increased employment opportunities and reduced cost of health care, may also be seen.

### Hazards of untrained dogs

Anecdotal evidence suggests that some dogs may be able to sense seizures and other medical conditions in humans<sup>17</sup>. However, there are several hazards in allowing a dog to be confronted by the phenomenon of a seizure, by the various instinctive ways the dog may react. The extreme novelty of behaviour associated with a seizure may evoke the defensive or offensive repertoire within a dog’s brain by activating the amygdala, the emotional centre of the brain<sup>18</sup>. A dog will become hypervigilant and aroused in the ‘stop–look–listen’ mode and will then endeavour to assimilate the information relative to its previous experiences. In the absence of specialist training the dog will resort to a survival strategy — flight (run away), fight (attack), freeze or appeasement (submission or flirtatious play). Any of these behaviours will be based on a fearful and basic survival strategy<sup>19</sup>.

Repeated episodes will result in an increase in anxiety in the dog and associated stress responses. It has been demonstrated that stress responses, such as the performance of conflict behaviour or increased corticosteroid plasma levels, can easily be evoked by events

or signals that announce oncoming danger or risk situation<sup>20</sup>. This indicates that there are several serious risks, both to human and canine subjects, if a dog is not properly trained.

Long-term, chronic stressors activate the hypothalamic pituitary adrenal axis — corticotrophin releasing hormone stimulates the anterior pituitary to secrete adrenocorticotropic hormone, which in turn stimulates glucocorticoid secretion by the adrenal cortex. This activity is associated with environments which the dog is unable to control (such as experiencing a seizure in a human without specific training) and can cause ulcers, immunosuppression, changed weight and alterations in basic behaviour.

This is supported by the number of disturbing cases of self-responding dogs which have been reported to Support Dogs.

- (1) Dog exhibiting escape behaviour associated with seizures. Increased corticosteroid plasma levels, immunosuppression and impaired neurological function have been reported.
- (2) Dog exhibiting flight/avoidance behaviour when first witnessing a seizure in a young boy began to show nervous aggression towards similar children.
- (3) Dog responded to owner’s seizure showing nervous aggression towards anyone approaching the owner.
- (4) Dog asphyxiated by the lead when attempting to escape from owner during a seizure.
- (5) Dog exhibiting bizarre behaviour patterns (conflict behaviour) and aggression towards owner’s seizure.

A study investigating the possibility that dogs may be able to anticipate and respond to seizures in their owners indicated that all the dogs which showed activity before a seizure were reported as looking anxious, apprehensive or restless<sup>17</sup>. It has also been reported that certain cats may respond to a seizure by exhibiting a threat response<sup>21</sup>.

This evidence indicates that it is important that only dogs which have been selected for their suitability are trained for seizure-alert work and that it is essential that these dogs have a structured training from a behavioural training specialist to make certain of their reliability and ensure that their health and welfare is not compromised and that the safety of the general public is not jeopardized in any way.

## Basis for study

### Case report

LM, a 28-year-old female who had a 5-year history of epilepsy, learning difficulties and physical disability, originally contacted Support Dogs for help with training her 18-month-old collie cross bitch to assist her with her physical disability. On completion of this initial training, it was decided to pursue the possibility of training the dog to provide an indication to LM that a seizure was imminent. Up to this point the dog had never shown any response (positive or negative) to LM's seizures. Following 3 months of specialist training the dog (using a vocal signal) was able to indicate 20 minutes in advance of a tonic-clonic seizure.

### Preliminary study

Further human subjects subsequently presented themselves to the charity following the publicity surrounding LM.

## MATERIALS AND METHODS

All human subjects had a clinical diagnosis of epilepsy, were experiencing frequent and recurrent seizures and did not have a drug treatment changed during the study. Human subjects had at least 3 months seizure data before training commenced. Canine subjects were healthy and temperamentally sound (ascertained through veterinary and behavioural assessments) and were not exhibiting any responses associated with seizures.

Specific training techniques for each dog were employed in all six cases. Each dog was initially conditioned to the seizure type of the subject through Pavlovian associative techniques to ensure the dog associated the seizure with a pleasurable event. Following this the dog was conditioned to detect and indicate the onset of a seizure through joint Pavlovian and operant conditioning. All subjects were required to attend the Support Dogs training centre for individual training. Extensive video-telemetry was used during training and in the subjects' homes. Seizure frequency was monitored retrospectively prior to, during and after training via the subjects' own seizure diaries.

### Human subjects

*Subject 1 (BS):* A 9-year-old boy with severe behavioural disturbances who had a 6-year history of epilepsy.

*Subject 2 (JS):* A 36-year-old male with a 5-year history of epilepsy, possibly complicated by non-epileptic seizures.

*Subject 3 (VM):* A 52-year-old female with multiple sclerosis who had a 1-year history of epilepsy.

*Subject 4 (TBG):* A 26-year-old female with asthma who had a 6-year history of epilepsy.

*Subject 5 (JE):* A 40-year-old female with a 1-year history of epilepsy, possibly complicated by non-epileptic seizures.

*Subject 6 (AH):* A 14-year-old male with a 9-year history of epilepsy.

## RESULTS

All dogs were successfully trained to detect and indicate imminent seizures, within 6 months. No dog exhibited a fearful or avoidance response. As training progressed each of the dogs was able to provide an accurate prediction of a seizure via an overt signal within time periods varying from 10 minutes up to 45 minutes. Each dog had a specific and reliable prediction time which did not vary once the training was complete. In each human subject seizure frequency was seen to be reduced following completion of the training, since this had not been an original outcome measure, accurate data are not available. However, there is a strong subjective impression from the subjects' reports that seizures had reduced in frequency. Perhaps this should not be too surprising: an increased predictability of seizure may have allowed our subjects to engage in more everyday activities with greater confidence. It has been shown that being occupied can reduce seizure frequency, probably by arousing the EEG<sup>22</sup>.

*Subject 1 (BS):* The dog trained for BS was an 8-month-old labrador retriever bitch. On completion of training the dog was able to indicate (by barking) 15 minutes prior to each seizure.

*Subject 2 (JS):* A 5-year-old jack russell dog, on completion of training, was able to give a 20 minutes warning by jumping up and pawing before each seizure.

*Subject 3 (VM):* A 2-year-old border collie dog was trained to give a 15 minute warning by barking prior to a seizure.

*Subject 4 (TBG):* A 3-year-old border collie dog was trained to give a 5 minute warning to an absence by jumping up and pawing and a 45 minutes warning to a tonic-clonic seizure by barking.

*Subject 5 (JE):* A 2-year-old miniature schnauzer was trained to lay down and not move 15 minutes prior to a seizure.

*Subject 6 (AH):* A 1.5-year-old collie cross bitch was able to give 10 minutes warning of a seizure by barking and jumping up.

## CONCLUSION

Despite the recent introduction of new antiepileptic drugs, it is likely that many people will continue to have uncontrolled seizures or experience adverse drug effects. This preliminary study has shown that specially trained dogs can provide a reliable warning prior to a seizure. The change from experiencing unpredictable seizures to control and predictability in the life of a person with epilepsy, via the use of a reliable 'early warning system', will reduce psychological problems such as anxiety and depression and improve quality of life. The reduction in seizure frequency suggests that these specially trained *seizure-alert dogs* may be considered as a potential and additional treatment for people with epilepsy.

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