Experience of vagus nerve stimulation in children and young people with refractory epilepsy

Introduction

Despite increasing numbers of antiepileptic drugs (AEDs) available, approximately 25% of children and young people will have epilepsy refractory to treatment (Keenan & Appleton 2006). Therapeutic options for children with pharmacoresistant epilepsy and who are not suitable for are the ketogenic diet or vagus nerve stimulation (VNS). The ketogenic diet demands significant co-operation and commitment from children and parents and many families cannot manage this. The first VNS study began in 1988 and since then over 46,000 people in the USA and Europe have had a vagus nerve stimulator implanted for seizure control. Benefits to patients are reported as reduction in seizure frequency, improved alertness and mood, and acute abortive effects on seizures (Patwardhan et al 2000).

Project

• Since 1999 vagus nerve stimulators have been implanted in 24 children and young people from Edinburgh and Glasgow aged between 4 and 18 years.
• All children had failed to respond to multiple AEDs and have been evaluated for epilepsy surgery, or in the case of three have had surgery that had been unsuccessful in improving seizure control over the long term.
• The aim of this project is to combine the experience of both centres to examine the efficacy of VNS as a treatment by reviewing case records and interviewing families.

Methodology

• One child had a vagus nerve stimulator implanted in Sheffield, and another in New York. All others had the stimulator implanted and turned on in Edinburgh, and the ongoing programming and management of this was undertaken by the epilepsy nurses in Edinburgh and Glasgow, in accordance with suggested programming settings (Heck, Helmers & DeGiorgio 2002).
• Children were followed up at a nurse led VNS clinic where the changing parameters of the device were recorded in the child’s case records, along with information on seizure frequency, magnet use, side effects and any other observations noted by parents and school.
• These records were reviewed by the nurse in each centre to obtain the required information for this study, and parents were contacted by telephone where necessary to ensure completeness of information.

Results

• Seizure control: one boy’s daily seizures stopped immediately after the stimulator was turned on. Another teenager had no seizures for nine weeks after implantation: this had never happened before or since, but the improvement was not maintained. A third child is now seizure free, but after changing and stopping medications. 5 (20%) children experienced > 50% seizure reduction without medication changes. 5 (20%) children had < 50% seizure reduction and 10 (42%) no change in seizure frequency.

• Magnet efficacy: 4 children had not used the magnet because seizures were too brief. Of the 20 who did, 14 (70%) found the magnet effective in aborting seizures and ameliorating the post ictal period.
• Increased alertness: 12 (50%) children were found to be more alert and better able to function at home and school. This effect has been reported in other studies and appears to be independent of seizure reduction (Welas & Maggio 2002).
• Side effects: Hoarseness during stimulation was experienced by most children, but discomfort caused by this was only prohibited to increasing output current in four children, temporarily in two of them. One child experienced marked muscle spasm of left arm, shoulder and left side of face which has never been described but this settled on reducing the output current.

Discussion

• This was not a controlled trial and we do not suggest that all the improvements experienced by some of the children are a direct result of VNS. 12 (50%) children in our cohort required medication changes in response to increased seizure activity during the programming period. Our observation was that some of these medication changes appeared to improve seizure frequency – possibly in conjunction with VNS, although it is impossible to determine to what extent this may be the case.
• We have not seen improvements related to underlying pathology in the children who have had most success all had different diagnoses. Our sample size is small, but similar to that of most VNS studies, apart from the major studies EVNS appears to be helpful for some children but it is not possible to predict which children could benefit most at present. Efficacy of VNS is said to evolve over time with continuing improvements even after a year of treatment (Schermann et al 2001). Only two children in our group gained increasing benefit over time – the benefits experienced by the others started immediately and did not alter with increasing output currents.

Further research

• Edinburgh and Glasgow are in the process of participating in the current national E-06 study where there will be stricter control of variables such as medication changes which were the main complicating factor in this study.
• The possibility of synergistic combinations of VNS therapy and AEDs is an area beginning to be explored and requires further research.

References