Phagenyx™ for stroke-induced dysphagia

SUMMARY

Phagenyx™ is a new medical device intended to treat difficulty in swallowing caused by a stroke. It delivers electrical stimulation to certain areas of the throat - a treatment called pharyngeal electrical stimulation (PES). PES is intended to stimulate areas of the brain involved in swallowing. The device is expected to be used in a hospital at a patient’s bedside. A small trial of PES in patients who had had a recent stroke which caused difficulty swallowing reported it reduced the number of abnormal swallows, the need for dietary adaptation and feeding supervision and hospital stay. However, the results of larger trials are needed to confirm these findings and show if improvements are maintained over time. More research is also needed before it is known how PES compares to current treatments.

BACKGROUND

Difficulty in eating, drinking and swallowing, also known as dysphagia, can be caused by damage to the brain when someone has a stroke. Swallowing is a complicated process which involves moving food or drink from the mouth to the stomach. Normally the brain must co-ordinate many muscles in order to do this. There are three main stages involved in swallowing, an oral stage, where food is manipulated in the mouth, a pharyngeal stage, where muscles propel food through the throat, and an oesophageal stage where muscles in the gullet, or oesophagus, contract in sequence forcing food down into the stomach.

Usually the pharyngeal stage of swallowing is triggered automatically by the presence of food in the throat. Signs of difficulties in swallowing caused at the pharyngeal stage (pharyngeal dysphagia) include: slowness or delay in triggering swallowing, reports of a sticking sensation in the throat, throat clearing, coughing or choking, gulping, wet, gurgly, hoarse sounds and breathing difficulties during meals.
Dysphagia can lead to dehydration and malnutrition\(^1\). An expert comments that disordered swallowing can increase the risk of lung infections caused by inhalation of infected oral secretions (aspiration pneumonia). However, they also comment that there are a number of other risk factors for aspiration pneumonia which include poor oral hygiene, decreased immunity, general poor health and immobility and that many pneumonias classified as ‘aspiration’ are more likely to be community acquired. Aspiration pneumonia is associated with increased mortality and poor outcomes\(^2\).

Each year, in England, there are about 110,000 strokes and stroke is estimated to cost the economy around £7 billion with direct costs to the NHS of around £2.8 billion\(^2\).

Dysphagia after stroke is common, affecting 27% to 64% of patients\(^3\). Half of these patients will recover within two weeks; some will die (from a variety of causes) and others will require long-term feeding with significant impairment of function, recovery, and quality of life\(^3\). Dysphagia improves spontaneously in many stroke patients although at one month after stroke 15% of patients still have swallowing problems\(^3\).

**CURRENT PRACTICE**

Therapies to improve swallowing are designed to speed recovery of swallowing function and to reduce the risk of developing pneumonia\(^3\). Treatments for dysphagia are often given to patients by speech and language therapists (SLTs). They include postural techniques, for example tucking the chin or turning to one side to help a person compensate for weakened muscles, swallowing exercises, to strengthen muscles in the tongue or throat, and manual stimulation of oral and pharyngeal structures with, for example, something cold.

The practice of these techniques may vary according to the institution and the availability of trained staff. One expert comments that high frequency of treatment is considered to be most effective, but that this is sometimes only practical if an individual can be supported to carry out the exercises or manual stimulation themselves or with the support of an assistant or health support worker.

If swallowing is unsafe, the consistency of food and drinks can be changed to make them safer to swallow or tube feeding through the nose or stomach may be considered\(^3,4\). Feeding tubes may be required for many reasons post stroke, not just for the prevention of aspiration pneumonia.

There are two types of feeding tubes, nasogastric (NG) tubes, where a plastic tube is inserted through the nose and down into the stomach and percutaneous endoscopic gastrostomy (PEG) tubes where a tube is surgically implanted directly into the stomach. NG tubes are designed for short-term use and need to be replaced and swapped to the other nostril after four to six weeks. PEG tubes are designed for long-term use and last for around two years before they need to be replaced\(^4\).

The National Institute for Health and Clinical Excellence (NICE) recommend that on admission, people with acute stroke should have their swallowing checked before being given food, fluid or medication by mouth. If there are problems with swallowing the person should have a specialist assessment of swallowing preferably within 24 hours of admission. NICE recommend people who have difficulty in swallowing food and fluids should be given them in a form that can be swallowed without aspiration and that people who are unable to take adequate nutrition and fluids orally should receive tube feeding with a NG tube within 24 hours of admission (or a nasal bridle tube or gastrostomy if the person is unable to tolerate a
NG tube). They should also be referred for a detailed nutritional assessment, individualised advice and monitoring².

**NEW TECHNOLOGY**

Phagenyx™ developed by Phagenesis Ltd, is a new medical device designed to treat oropharyngeal dysphagia arising from brain injury caused, for example, by a stroke. The treatment involves the delivery of electrical pulses to specific areas of the throat - a technique known as pharyngeal electrical stimulation (PES). Signals then travel back along nerves to the areas of the brain that control swallowing. PES is intended to increase brain activity in these areas and help undamaged areas of the brain compensate, thus improving swallowing function.

The company state that initially the treatment is intended for people in hospital with dysphagia following a stroke. They estimate that around half of stroke patients with dysphagia would be potentially amenable to treatment with the device (in the UK around 36,000 people per year).

The Phagenyx™ device consists of a battery powered console which is connected to a tube, called a catheter. The catheter is inserted through the nose, into the throat, and down into the stomach and, if required, can function as a feeding tube. On the catheter are two electrodes through which the device delivers electrical pulses to the pharynx. There are guide marks on the catheter to help position the electrodes correctly and software indicates whether good contact has been achieved. The console is operated by a touch screen and controls and monitors the catheter. It can also record and store patient information.

The treatment is intended to be delivered to the patient for 10 minutes a day for three consecutive days. When not being used for treatment, the catheter is left in position but disconnected from the console. The company state patients who are safe to swallow modified texture diets and fluids may do so whilst the catheter is in place. After three days the catheter may be removed if it is not needed for feeding. Treatment on each day is preceded by a process to tailor the electrical stimulation to the patient, which takes approximately 10 minutes. During this process the maximum comfortable stimulation level is found. The company state the treatment may be uncomfortable but will not be painful and some people may not feel any sensation during treatment.

A healthcare professional would need to stay by the patient during treatment, which can be delivered at the patient’s bedside. The company state that the catheter needs to be placed by a healthcare professional trained and competent in the passing of NG tubes and the therapy itself could be delivered by a speech therapist or nurse after training.

The Phagenyx™ device received a CE mark in July 2012 and is now available in the UK. There is a one off cost for the console and recurrent cost for the disposable catheters. The cost of the device and disposable catheters were not available for this briefing. The company state the price of a multi-day treatment for one patient is approximately £1,000.

PES is also being studied for treating dysphagia in people with multiple sclerosis (MS)⁶.
To date, one clinical trial of PES for dysphagia following stroke has been fully published and three further trials are ongoing. Details are given here.

A randomised controlled trial of PES in 31 people with acute dysphagic stroke has been published. Participants were recruited within three weeks of their admission for stroke and scored greater than three on a penetration-aspiration scale on any of six swallows. The penetration-aspiration scale is an eight point scale where a score is determined by the depth to which material passes in the airway and by whether or not material entering the airway is expelled. Videofluoroscopy was used to capture images of the throat as participants attempted to swallow 5ml of liquid barium and penetration-aspiration scale scores were determined later by two speech and language therapists. Participants were randomised to receive either PES or sham treatment once daily for three days. Videofluoroscopy was performed before randomisation and then again two weeks later. The authors report of 67 stroke patients who were screened for eligibility 31 patients were selected for randomisation of whom 28 completed the study. 16 people were allocated to receive PES and 12 to receive sham treatment. The authors report a post-treatment reduction in the number of abnormal swallows (defined as a penetration-aspiration scale score greater than 3) in the PES group compared to the sham group (p=0.049). Secondary outcomes included the degree of dietary adaptation and feeding supervision required by participants and period of hospitalisation, both of which the authors report as statistically significantly improved in the PES group (p=0.04 and p=0.038 respectively).

There are two ongoing randomised controlled trials comparing PES with sham treatment for dysphagia after stroke.

In the first, participants were recruited within six weeks of their admission with stroke. The planned participant number is 46 and the trial is due to complete in February 2013. The results have not been reported, but are expected in the summer of 2013.

In the second study, the current version of the Phagenyx™ device is used. The planned participant number is 140. Participants are people with dysphagia following a stroke that happened not more than 42 days before recruitment. The primary outcome measurement will be change in mean penetration aspiration scores on videofluoroscopy between Phagenyx™ and sham treatment groups. The study will look at outcomes up to three months post intervention. A quality of life measurement, the EQ5D, is also included within the trial. The trial is due to be reported by April 2013.

Preliminary results from another ongoing randomised controlled trial of PES, repetitive transcranial magnetic stimulation and paired associative stimulation in 14 stroke patients with dysphagia persisting for more than six weeks have been reported as a conference abstract. Participants were randomised to real or sham application of one of the three techniques. The authors concluded that real neurostimulation was associated with a reduced aspiration penetration score of -14 +/- 4% compared to sham (p=0.03) and that comparison between the three real interventions showed no specific advantages of one over the others.

A systematic review of treatments for dysphagia and nutritional support in stroke has recently been published. The authors concluded that “There remains insufficient data on the effect of swallowing therapy, feeding, and nutritional and fluid supplementation on functional outcome and death in dysphagic patients with acute or subacute stroke. Behavioural interventions and acupuncture reduced dysphagia, and pharyngeal electrical stimulation reduced pharyngeal transit time”.

CLINICAL STUDIES AND RESEARCH QUESTIONS
In order to determine the potential impact of this new technology on the management of patients with dysphagia after stroke larger randomised controlled trials of treatment with the Phagenyx™ device are needed. These should compare the device not just to sham therapy but also to other treatments. An expert suggests areas of uncertainty which should be addressed are safety, what the mechanism of swallowing improvement is, what functional changes are made to patients swallowing and how long lasting and permanent these changes are. They also suggest it would be helpful to include measures of patient opinion from those who have undergone the process.

A study to assess this treatment in people with chronic dysphagia in the community setting and due to conditions other than stroke is planned.

**POTENTIAL IMPACT**

Improving recovery from stroke is part of the NHS Outcomes Framework. Swallowing problems are common after stroke and can contribute to chest infection and malnutrition. Dysphagic, and malnourished, stroke patients have a poorer clinical outcome.

Treatment with the Phagenyx™ device may reduce complications of dysphagia such as lung infection and reduce the length of hospital stay. It may also reduce the need for current treatments including specialist feeds, implanted PEG tubes and behavioural treatments. This could mean savings for the NHS, but these would need to be balanced against the cost of the device, disposable catheters and staff training to use the device.

More research is necessary to determine how well the treatment works and whether it reduces hospital stay, death rates, institutionalisation and dependency and improves someone’s quality of life.

**Lay summary**

*Phagenyx™* is a new medical device designed to treat people who have difficulty in swallowing after a stroke. It has a special tube which goes through the nose and into the stomach. The tube can stimulate the inside of the throat with electrical pulses. This may turn on areas of the brain which control swallowing and improve how well someone can swallow. The device is meant to be used in hospital patients. People treated with the device might not need other treatments and may be able to go home earlier. However, more research is needed before we know how well the treatment works.

**REFERENCES**