What is the purpose of the study?
Motor neurone disease (ALS) affects approximately 2 people in every 100,000 in the UK. One of the main symptoms of ALS is breathlessness. The muscles that people use to help them breathe (the main muscle being the diaphragm) become weak and so patients cannot breathe as well as they once could. This study will determine if adding a new treatment to the usual treatments for ALS breathing problems are of benefit to patients.

What are we studying?
One of the treatments available is a face mask attached to a machine that helps them to breathe more effectively. This is called non-invasive ventilation or NIV. This is a common treatment for breathing problems in people with ALS. The mask fits over the nose or mouth or both. As you breathe in, the machine gives an extra push of air to support the breathing muscles enabling a bigger deeper breath.
Another possible treatment is Diaphragm Pacing (DP). DP is a new technique to help increase the strength of the diaphragm muscle contraction and consequently improve breathing.
The purpose of this study is to find out if having the DP Device fitted as well as receiving NIV offers added benefits, such as prolonging life and improving quality of life, to treatment just with NIV. We do not know if adding DP treatment to standard NIV will be beneficial and this is why we are asking for your help.

Why have I been chosen?
You will have been advised that NIV is a potential treatment option for you to help with your breathing. We would now like to invite you to participate in this study. You do not need to make a decision immediately as to whether or not you want to take part.

If you participate we would also like to invite your main carer to participate in this study. Their involvement would be limited to questionnaires and interviews. If you do not wish your carer to participate or they do not wish to participate you may still enter the study. We are contacting people in a number of NHS hospitals including Sheffield, Manchester, Oxford, Birmingham and Newcastle to take part.

Do I have to take part?
No. It is up to you to decide if you want to join the study. We will describe the study and go through this information sheet. If you agree to take part, we will then ask you and your carer to sign a consent form. You are free to withdraw at any time, without giving a reason. If you wish to withdraw, you and your carer will both be withdrawn from the study. We will ask you if you are happy for us to use the information that you have already given us. Withdrawal from the study will not affect your ongoing care.

What will happen to me if I take part?
If you decide to take part and give consent to the trial, you will first undergo some screening assessments at X hospital to see if you are suitable to participate in the trial. These will include: a heart tracing (ECG), blood tests and an

ultrasound scan to evaluate the movement of your diaphragm, a check of the strength of your breathing muscles using sniff and blowing tests. If your centre usually assesses breathing muscle strength using overnight monitoring of oxygen and carbon dioxide levels in your blood, this may also be performed. You and your main carer will be asked to complete some baseline questionnaires at that visit.
Once we have determined that you are eligible to take part you will be put into one of two treatment groups at random as below:

Group 1 – Non Invasive Ventilation (NIV); in this group patients will be given NIV alone
Group 2 – Diaphragm Pacing (DP) plus Non Invasive Ventilation (NIV); this group of patients will be given DP alongside NIV.

You will be given NIV regardless of which group you are allocated to. NIV has already been proven to prolong life and improve quality of life in people with ALS. An appointment will be made with your respiratory or neurology consultants to start NIV. If you are allocated to receive DP, you will need to attend hospital for some additional hospital visits both to get the DP device fitted and also 1 week after surgery to check the device. The admission for surgery to insert the DP device may occur at the same time as the NIV admission depending on local arrangements. NIV should be available in the anaesthetic recovery room after the device is fitted. You should expect to be in hospital for approximately 2 days. A representative from the company who make the device may be present during your operation to help guide the Surgeon with putting the system in place and setting it upYou and your carer may be invited to participate in interviews. 12 patients and their carers will be chosen to take part in the interviews at 1 and 6 months after implantation. The purpose of the interviews is to explore in detail the effects that DP is having. If chosen, you will have the option to opt out of the interviews at the time.

Surgical Implantation (DP group)
If you are receiving DP, you will be admitted to X hospital prior to surgery, for a final review by the surgical team to consider any additional assessments as necessary. You will receive general anaesthesia and will not be awake or able to feel anything during the procedure. During the procedure, approximately 6 small cuts of about ½ an inch long are made in the abdomen. This is to allow passage of the key hole surgery camera, lights and surgical instruments through the abdominal wall.

The surgeon will place the wires in each side of the diaphragm muscle. The wires from the diaphragm will travel under the skin a short distance and then will be passed through the skin onto the surface of the abdomen. The wires will be trimmed so that the ends sticking out of your skin are only 2 - 6 inches in length. You will stay in hospital overnight and should be able to return home the next day. An x-ray will be taken following the surgery to check the position of the wires and to make sure no air has travelled above the diaphragm and into the chest.

If damage to the motor nerves to the diaphragm is too severe it may not be possible to stimulate the diaphragm with the diaphragm pacing system. The scan of the diaphragm performed during screening is an attempt to confirm that diaphragm nerve damage is not too severe. However it is only possible to be certain at the time of the operation. If during the operation it is clear that the diaphragm cannot be stimulated then the operation will be stopped and the device will not be inserted.

Trial Procedures
DP group
DP training will occur prior to discharge. Training is the process of teaching you and your caregiver the correct care and use of the stimulator, and how to record information in your study diary.

You will be given a patient diary to take home with you. In this you will be asked to record the amount of time you have spent on DP and/or NIV. There will also be an option to record any problems you might have experienced. 1 week after implantation you will need to return for assessment at the clinic. You will undergo a surgical evaluation and a safety check to see how the DP device is working.
DP use should not be painful. Your study doctor will set the device at a level which causes maximum stimulation of the diaphragm without discomfort. We recommend that patients start using DP pacing for 30 minute sessions through the day. These sessions can then be gradually increased. Patients should also build up to using DP at night whilst asleep. Your study doctor will advise you on the timings of your DP use and will record your target DP use in your diary.
Quality of Life questionnaires will be administered at each subsequent visit – 2, 3, 6, 9 and 12 months into the trial.

NIV group
You will be given a patient diary to take home with you. In this you will be asked to record the amount of time you have spent on NIV. There will also be an option to record any problems you might have experienced. Quality of life questionnaires will be administered at each subsequent visit – 2, 3, 6, 9 and 12 months into the trial. At the end of the trial, patients in the NIV group will not receive DP as DP is not currently a treatment available for patients as part of usual standard care.

What are the benefits?
Research suggests that patients with ALS may benefit from Diaphragm Pacing, in addition to NIV, by slowing the progression of breathing muscle weakness, but also by an improved quality of life. DP may reduce the need for you to have NIV and may also prove to be a less intrusive method of supporting breathing function when compared to NIV.

What treatment may be withheld?
No treatment will be withheld as a result of your involvement in this trial.

Are there any risks or discomforts?
Operation site infection, diaphragm muscle injury and a pneumothorax (see explanation below) are potential complications with the DP implant technique. Infections at the operation site are a possibility, but to date this has not been an issue. If an infection does occur, and it cannot be treated without removal of the electrodes, then the electrodes will be removed.

Air may track from the abdominal cavity to the space around the lungs during the procedure, and this is classified as a pneumothorax. This often occurs during any routine key hole abdominal procedure. If present, it is easily sucked away with a needle and syringe at the completion of the operation.
One of the reasons for undergoing this procedure is that your breathing muscles are weak. A general anaesthetic in patients with weak breathing muscles carries an increased risk of complications including pneumonia. Following the operation there may be an increased risk of requiring additional breathing support with invasive ventilation.

The x-ray to check the placement of the DP wires exposes you to a small amount of radiation. This is equivalent to about 8 days average natural background radiation. The Health Protection Agency describe this level of radiation dose as 'Negligible Risk'. You would not receive this x-ray if you were not taking part in this study.

Will I be able to keep my pacing device at the end of the trial?
Yes. If you want to keep the device at the end of the trial you will be able to.

What happens if I don't want to continue with the study?
You are free to withdraw from the study at any time and this will not affect your clinical care. If you decide to withdraw we can cut the wires at the surface of the skin because they are safe to be left inside your body. However we can remove them completely under local anaesthetic if you chose to.
Will it cost me any money?
No. Any expenses incurred as a result of extra visits over and above usual clinic attendances will be reimbursed.

What happens if something goes wrong?
Any complaints should be addressed to your local doctor in the first instance (contact details are given at the end of this information sheet). If you have any concerns about the study you should ask to speak to the researchers who will do their best to answer your questions [contact number]. If you remain unhappy and wish to complain formally, you can do this via the NHS Complaints Procedure. Details can be obtained from [insert site specific details].

Will my taking part in the study be kept confidential?
All information which is collected about you during the course of the research will be kept strictly confidential, and any information about you which leaves the hospital will have your name and address removed so that you cannot be identified. Some parts of your medical records and the data collected for the

study will be looked at by authorised persons from the University of Sheffield organising the research. They may also be looked at by authorised people to check that the study is being carried out correctly. All will have a duty of confidentiality to you as a research. We will write to your GP to let him or her know that you are participating in this study, as they are involved in the management of your care, and so it is important that they know what is happening.

What will happen to the results of the study?
We will publish the results in a scientific journal and produce a report that is freely available to anyone who wishes to read it. You will not be personally identified in any report or publication we produce. Please contact us using the details below if you would like to see a summary of the results when the trial is completed.

Who is organising and funding the research?
The research is organised by the University of Sheffield and funded by the Department of Health and the Motor Neurone Disease Association.

Who has reviewed the study?
All research in the NHS is looked at by independent group of people, called a Research Ethics Committee, to protect your interests. This study has been reviewed and given favourable opinion by Cambridge Central Research Ethics Committee.

Further information can be obtained from:
<insert local PI name>
<insert local PI address>
<insert local PI telephone number>
Or contact the Chief Investigator:
Dr Christopher McDermott
Chief Investigator
Sheffield Institute for Translational Neuroscience
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