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HeartMate 3 Left Ventricular Assist Device (LVAD) Teaching Guide

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Dear LVAD patient and family,

Welcome to the LVAD programme at the Queen Elizabeth Hospital Birmingham.

Following your pump implant the LVAD team will arrange to see you on a daily (Monday-Friday) basis to commence your LVAD training. It is very important that you and your family fully engage in this teaching in order to learn the following:

- Understand the functions of the system controller
- How to perform daily safety checks
- How to initiate the daily system controller self-test
- Accurately record daily LVAD readings and understand their significance
- Recognise and appropriately respond to battery/power alarms
- Recognise and appropriately respond to advisory alarms
- Recognise and appropriately respond to hazard alarms
- How to use the power unit
- How to use the battery charger and batteries
- How to report alarms or any concerns to the LVAD team
- Know your target INR and your acceptable therapeutic range
- Learn how to self-administer medication including oral warfarin and enoxaparin injections safely
- How to change the abdominal driveline exit site dressing using a sterile technique
- Recognise signs and symptoms of driveline exit site infection
- How to change the system controller in an emergency pump-off situation

Prior to discharge from hospital you will need to demonstrate that you are competent in all of these areas. Please rest assured that the LVAD team will help and guide you through the teaching process. We aim to tailor the teaching sessions to your level of understanding. Although it can seem like an overwhelming amount of information to process and remember, with time and daily repetition you will gain the knowledge you need to keep yourself safe and well at home.

Please note that more detailed instructions on the functions and use of your LVAD are provided in the manufacturer's official HeartMate 3 Patient Handbook you have also been given. You should use this teaching guide in conjunction with the manufacturer's handbook and you will see reference links to the official handbook in each section of this teaching guide.

If you have any comments or suggestions on how we can improve this teaching guide, or any aspect of the face-to-face teaching you receive, please do not hesitate to let us know.

Kind regards

LVAD team
Queen Elizabeth Hospital Birmingham

Contents

1. Initial record chart for LVAD readings and safety checks

The daily safety checks you must perform are detailed in this training guide on pages 10 to 13. It is important that you begin to perform these tasks daily whilst you are in hospital so they become part of your daily routine. This will help reduce anxiety when you go home as you will already be used to looking after your device and will be familiar with your LVAD readings.

Please use this chart as a prompt to record your LVAD readings and log that you have performed the safety checks, usually in the morning when you get up.

Date														
Time														
Speed (RPM)														
Flow (LPM)														
Pulsatility Index														
Power (Watts)														

Driveline Lead Secure ✓														
System Controller Self-Test ✓														
Temperature (°C)														
Weight (Kg)														
INR result														
Warfarin Dose (mg)														
Driveline Dressing Changed ✓														

Prior to discharge we will give you the "Green Book" in which you will record your daily LVAD readings, observations, and medications. Please always remember to bring this green book, and the yellow anti-coagulation book, with you to LVAD out-patient clinic appointments.

2. When to contact the LVAD team

You should immediately telephone the LVAD team for advice in the following circumstances:

- Any advisory alarms (yellow spanner alarms)
- Any hazard alarms (red alarms)
- System controller hardware fault
- Any other alarm where the system controller prompts you to 'Call Hospital'
- Malfunction of any equipment, including battery charger and power module
- Any damage or wear to your driveline lead or power cables
- LVAD readings are not within your parameters
- If you feel unwell, even if LVAD readings are within parameters
- If you have shortness of breath
- If you have swelling of feet, ankles or legs, or significant weight gain over the period of a few days
- If you experience palpitations, dizziness or fainting
- If you have a temperature greater than 37.5°C
- If you have stomach or abdominal pain, or you are passing stools of an unusually dark colour, or you notice blood in your stool
- If your urine becomes dark, red, or brown in colour
- If you experience significant bleeding from anywhere, or significant spontaneous bruising (i.e. not associated with accidental injury)

If you are seriously unwell, or if the LVAD pump has stopped, always telephone for an ambulance before calling the LVAD team.

3. Lifestyle adjustments and restrictions

Given time we hope that the LVAD will alleviate your heart failure symptoms thereby improving your health and quality of life, giving you the ability to do the things you like to do. However, having an LVAD does unfortunately impose a number of restrictions on your lifestyle.

Upon discharge from hospital you may initially need extra help and support with daily activities whilst you recuperate. If you live with your family they may be able to provide this support. If they cannot support you, or if you live alone, you will need to arrange for a relative or friend to stay with you for a few weeks following discharge, or you may need to stay with them.

The skin wound around your abdominal driveline should usually heal within 6 to 8 weeks of surgery. However your sternum (breastbone) will not fully heal for about three months. This is one of the main limitations on when you are able to return to daily activities and hobbies.

In the early post-operative weeks do not undertake any activity that might strain your chest as this may delay the healing process. This applies particularly to exercises that put undue strain on the sternum (breastbone) such as lifting weights.

Do not push, pull or lift anything heavier than one kilogram for at least eight weeks. Care should be taken when bending, stretching or walking a dog on a leash.

Re-introduce activities slowly and build up intensity gradually. When you are exercising be sure to drink plenty of fluid to prevent dehydration. Avoid exercising in excessively hot, humid or cold conditions.

Having an LVAD does unfortunately impose a number of restrictions on your lifestyle. You should **never** participate in any of the following now that you have an LVAD:

- **DO NOT swim, play water sports, take baths or use a hot tub/jacuzzi.** Although the system controller is water-resistant it is not waterproof. You should minimise risk by avoiding any circumstances where the system controller could get wet or be submerged in water as this could create a short-circuit causing your pump to stop

- **DO NOT play contact sports or engage in running or jumping activities.** This could cause bleeding or damage to your pump

- **DO NOT use a rowing machine or perform abdominal muscle exercises or repetitive bending.** This may cause irritation at your driveline lead exit site and cause an infection or put undue strain on the internal driveline lead

- **DO NOT use a vacuum cleaner or engage in activities that may create static electricity.** A strong static electric shock can damage the electrical parts of the system and cause the pump to stop! (Please note this does not apply to defibrillation by an implanted or external defibrillator which can be used safely with an LVAD in an emergency situation)

- **DO NOT have a Magnetic Resonance Imaging (MRI) scan.** The strong magnets used during the scan can affect metal implants like an LVAD

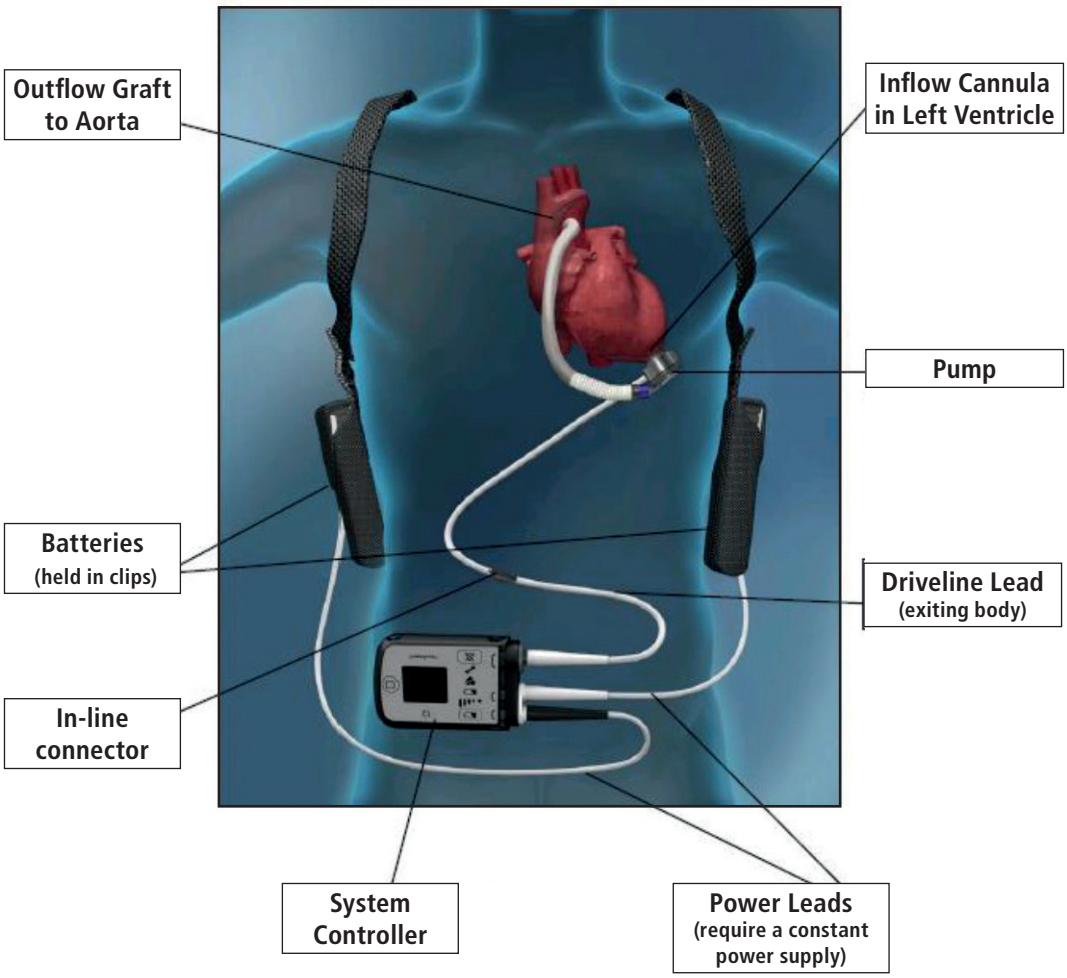
Although you cannot take a bath you will eventually be allowed to have a shower once the LVAD team is happy that your abdominal driveline exit site is dry and healing well. Please refrain from showering until we have agreed that you may do so. You must then use the shower bag and moisture barrier dressing provided to protect your system controller, batteries, and driveline lead exit site from getting wet.

4. Overview of internal and external components of the HeartMate 3

The Left Ventricular Assist Device, or LVAD for short, is a mechanical device that is used to circulate blood around your body as your heart is too weak to pump blood on its own. It restores blood flow to organs throughout the body, enabling you to breathe more easily, feel less tired and relieves other symptoms associated with heart failure. Given time post implant, LVAD patients generally feel more energetic and are able to resume normal activities that they were unable to do before they had the device. The pump draws its power from external batteries or mains power electricity via the system controller.

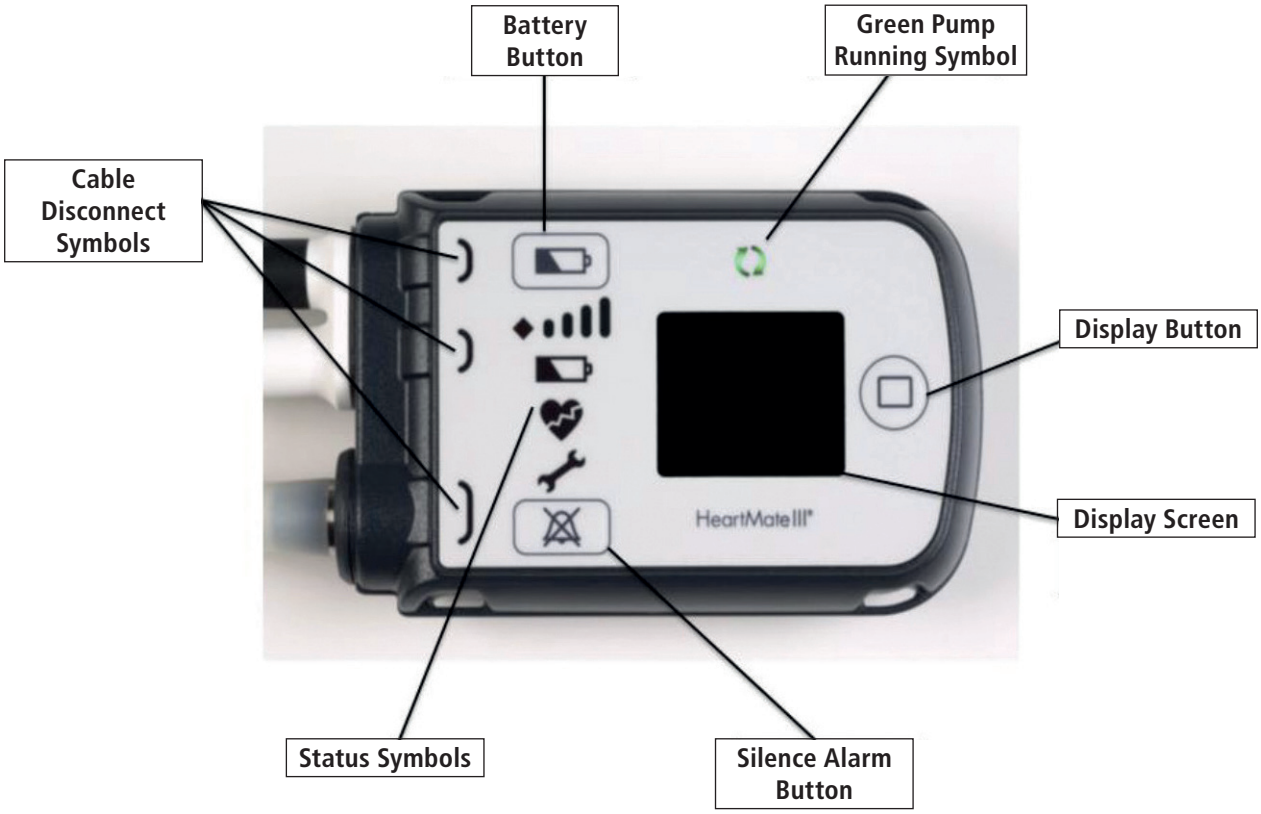
In order to work the pump requires two things:

- The driveline permanently connected to the system controller
- A constant supply of external power (either two batteries or mains power electricity)



5. Overview of the system controller

The system controller is the interface between the implanted pump and users. It allows you to access pump readings and provides audio and visual alarms to alert you to any problems with your pump.



The Pump Running ( ) symbol is always illuminated green when the pump is operating.

There are three buttons on the system controller; the battery button, display button and the silence alarm button. Do not be afraid to press these buttons as doing so will not affect the running of the pump in any way.

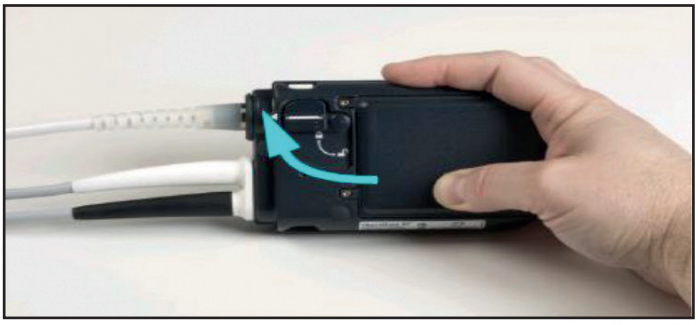
The system controller has a 15-minute emergency internal back-up battery to power the pump should you become disconnected from an external power source. However you should never rely on this back-up battery and must always change the power source when prompted to do so.

6. Daily safety checks and tasks

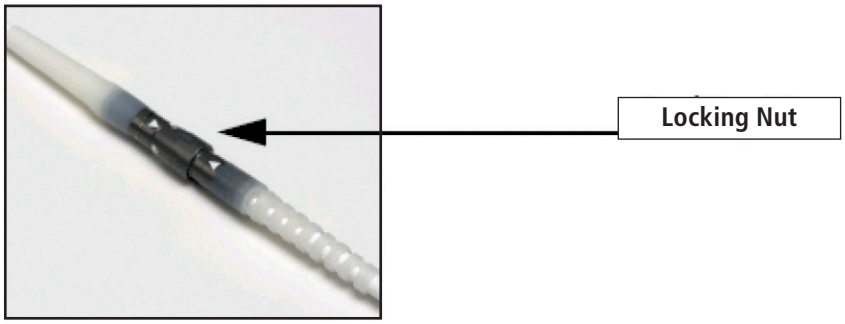
To ensure that your LVAD is functioning correctly you should perform the following safety checks twice a day: when you get up in the morning and before you go to bed at night. Try to perform the safety checks at the same time each day so they become part of your daily routine.

6.1 Check driveline is securely connected

The driveline must be permanently connected to the system controller. Disconnection of the driveline will cause the pump to stop and you could potentially die. To prevent this you should thoroughly examine the driveline connection on the back of the system controller. Ensure that the safety lock is always in the closed position so that the red button beneath cannot be seen.



Also check that the driveline in-line connector locking nut, which is located on the driveline nearest the abdominal exit site, is fully secured. If loose, tighten the nut until the clicking sound stops and ensure that the yellow line is hidden by the locking nut.



Also ensure that your driveline is firmly secured to your skin using a fixation device such as a Hollister clip, to avoid pulling on or moving the driveline at the exit site.

6.2 Perform the system controller self-test

The system controller self-test takes less than a minute. It is brief but very important. During the self-test the system controller checks its lights, symbols, and sounds to determine that they are working correctly. The system controller self-test is loud and bright. All of the lights, symbols, and sounds come on and the words "Self-Test" appear on the display screen. **Please ensure that you inform the nurse looking after you before starting the self-test to avoid any unnecessary concern due to your LVAD alarming.**

To initiate the self test press and hold the **Battery** button  for five seconds. Then release the Battery button.

Check that:

- ☑ Self-Test appears on the screen
- ☑ All symbols and indicators on the system controller illuminate at the same time
- ☑ The system controller is making a loud audio alarm tone

Once all the lights, symbols and sounds have remained on for 15 seconds, turned off automatically and the display screen has gone black, the self-test is complete. The system controller has passed its self-test and you can be assured that it is working correctly.

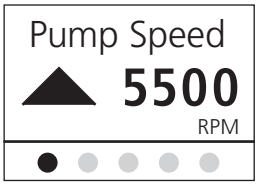
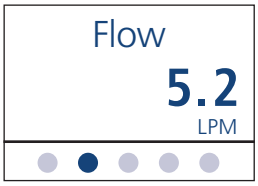
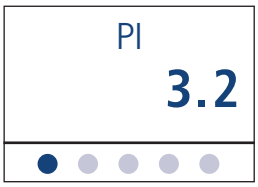
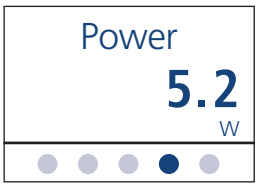
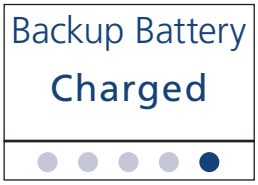
If any of the following occur during the self-test there is a problem with the system controller and you urgently need to telephone the LVAD team for advice:

- ☒ The lights remain off
- ☒ No audible sounds heard
- ☒ The words Self-Test do not appear on the display screen

6.3 Record your LVAD readings

Each morning you should check and record your LVAD readings to ensure they are within the safe parameters given to you by the LVAD team. We encourage you to start recording these values daily whilst you are in hospital to familiarise yourself with your pump readings.

You can access the following information by pressing the Display button on the system controller:

Display Button Actions	Screen Displayed (Example)	Meaning
Press **ONCE**		Pump speed in revolutions per minute
Press **SECOND** time		Pump flow in litres per minute
Press **THIRD** time		Pulsatility index
Press **FOURTH** time		Power in watts
Press **FIFTH** time		The System Controller's backup battery (located inside the System Controller and used to temporarily run the pump during an emergency) has three charge status states: 1. Charged (ready for use) 2. Charging (actively charging) 3. Fault (there is a fault or problem with the backup battery that could affect its reliability)
Press **SIXTH** time		Blank user interface screen indicates the screen is off, which is normal

6.4 What your LVAD readings mean

As well as checking daily that your pump readings are within safe parameters, it is also important that you have an understanding of their significance, as detailed below:

SPEED	• The pump can run at speeds from 3000 - 9000 revolutions per minute (RPM) • The pump is set at a fixed speed, usually 4,500 - 6,200 RPM. The set speed for your pump will reflect your individual need • Intermittent fluctuations of 100 RPM above or below the set speed are acceptable • If the speed is dropping further than 100 RPM below your set speed this could indicate 'suction events', possibly caused by dehydration, arrhythmia, significant internal or external bleeding, or deterioration in right side heart function • Take note of how much fluid you are drinking daily and monitor for any signs of swollen feet and shortness of breath
FLOW	• Flow indicates the volume of blood flowing through the pump in litres per minute (LPM) • Flow is an estimated reading and is directly related to pump speed and pump power, therefore an increase or reduction in either will affect flow • The system controller will alert you with a **'Low Flow'** alarm if flow falls **below 2.5 LPM**, possibly caused by dehydration, arrhythmia, a blood clot in the pump, significant internal or external bleeding, or deterioration in right side heart function • If pump power increases significantly it could be due to problems with a blood clot in the pump and flow readings may be inaccurately high • If the pump is on and running the 'Pump Running Symbol' will be lit green

PULSE INDEX	• Pulsatility Index (PI) indicates the left ventricle's pulsatile contribution to the pump.
	• PI will fluctuate dependent on your haemodynamic status:
	  • Indicative of hydration and how well the right side of your heart is functioning
	  • Indicative of changes to your heart's natural contractility

POWER	• Power is a measurement of pump voltage and current, and will change in relation to speed and blood flow • Power is measured in Watts • Readings greater than 10, or sharp consistent increases of 2 or more above your normal readings could be indicative of a blood clot inside the pump • To reduce the risk of a clot developing you should ensure that your INR is kept within therapeutic range of 2.0-3.0 • If your INR is below therapeutic range you may need to take daily enoxaparin injections, in addition to warfarin, until your INR is back within therapeutic range (please also refer to section 7 on anti-coagulation therapy)

If any of your LVAD readings are consistently outside of the parameters given to you by the LVAD team, or they are within parameters but you feel unwell, you should immediately telephone the LVAD team for advice.

7. Powering your LVAD

Your LVAD relies on a constant supply of power to work. **Before** you are discharged home from hospital you **must** do the following (tick when done):

- Telephone your household electricity provider to inform them that you have a life-sustaining electrically powered heart pump and request priority reinstatement of power following any power outages.

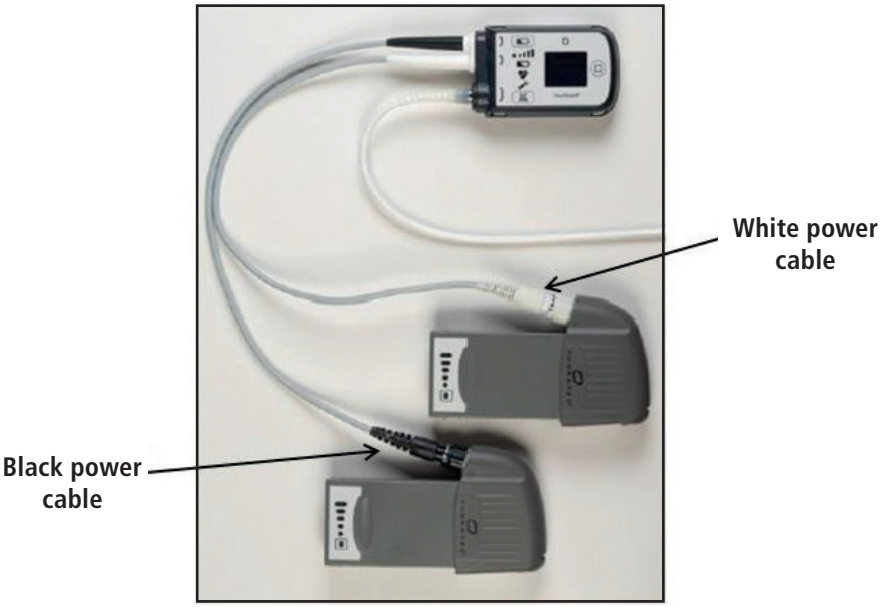
- Your home must have a standard credit electricity meter (whereby you pay electricity bills using direct debit payments direct from your bank account). If you have a pre-payment (pay-as-you-go) electricity meter which uses a top-up card or key it will need to be replaced with a standard credit electricity meter. It is your responsibility to contact your household electricity supplier or landlord to arrange this prior to going home.

- You will need two dedicated wall-mounted non-switched power sockets (usually in the bedroom) to power the LVAD battery charger and power unit. The wall-mounted power sockets should not have switches to avoid the equipment being accidently switched off. You may need an electrician to replace any switched power sockets with non-switched sockets before you go home. Please note that extension leads or multiple plug adaptors must not be used with the LVAD equipment.

The LVAD can be powered from either of two power sources:
- Mains power electricity via the power unit
- Two fully charged batteries

The LVAD team will teach you and your family how to change power sources safely and we encourage you to practice this daily whilst you are in hospital to build your confidence. Until you are competent to change power sources independently you should always ask an LVAD trained nurse to observe you to ensure your safety.

The system controller has two power cables which are colour coded: one black, one white. The pump needs a constant supply of power to work. Therefore, when you are changing power sources it is essential that you only disconnect one power cable at a time!



7.1 Power unit

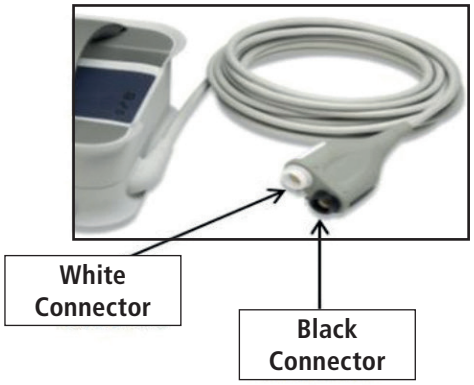
You must always be connected to mains power electricity via the power unit overnight whilst you sleep.

The functions of the power unit are as follows:

- To power the system controller and pump at night whilst you sleep
- To alert you to any problems with your LVAD overnight by amplifying the audible alarms from the system controller
- To re-charge the system controller's internal back-up battery

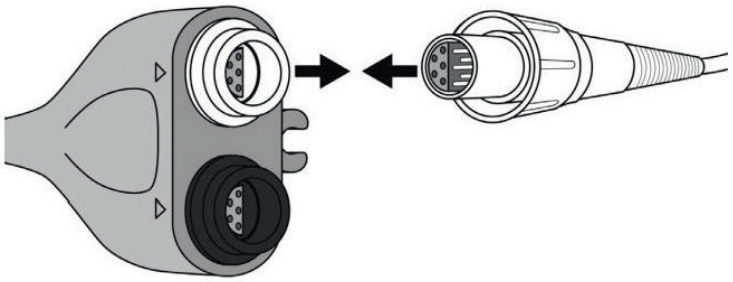
Once the power unit is plugged in at the wall power socket, check that the green power light illuminates. It is then ready for use.

Like the power cables on the system controller, the power unit cables are also colour coded. When changing the power cables from battery power to connect to the power unit, always connect white-to-white and black-to-black. Remember to **only remove one connection at a time:** as you disconnect the white cable, the black cable should still be attached to a battery.



Procedure for moving from batteries to mains power:

- Unscrew and disconnect only the **white** system controller power cable connector from the attached battery clip. This will activate the power cable disconnect alarm on the system controller – this is normal. **Do not remove the black connector**
- Carefully align opposite half circles inside the white system controller power cable connector and the white power unit cable connector
- Firmly push together the two connectors. The alarm will stop



- Tighten the connector nut until secure. Hand-tighten the nut only until resistance is felt. Do not use tools or over tighten as this can break the nut
- Now the white power cable is safely connected to the power unit, repeat the above process with the **black** system controller power cable. Both system controller power cables are now connected to the power unit
- Remove the batteries from the clips and place them into the battery charger to recharge

7.2 Weekly power unit self-test

You should perform a self-test on the power unit once a week. Unplug the power unit from the wall power socket, wait a few minutes for the green power light to go off and then plug back in. The three symbol lights should illuminate and you should hear two bleeps. The power light then remains illuminated green whilst the other two lights go off. The self-test is complete.

7.3 Power unit alarms

If any of the following alarms appear on the power unit you should follow the advice given below.

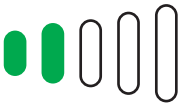
Constant audible alarm with no lit symbols. Constant Alarm	Loss of mains power electricity. Immediately change to fully-charged battery power.
Power indicator lit green and battery light lit amber.  Intermittent beep	The three AA batteries in the base of the power unit have run out. Immediately replace the batteries. You should avoid this alarm by routinely replacing the batteries every six months.
Power indicator lit green and spanner lit amber.  Intermittent beep	There is an internal malfunction within the power unit. Immediately change to fully-charged battery power and call the LVAD team for advice. Remain on battery power and do not use the power unit as it will need to be replaced
Flashing yellow diamond on System Controller with an intermittent alarm and "Replace Power/Low Battery" error message.  Intermittent beep	The white and black power cables have been incorrectly connected: white-to-black and black-to-white. Re-connect one power lead to a battery then move the second power lead to its correct colour coded position. Then move the power lead connected to the battery back onto mains power. The cables should now be correctly placed: White-to-white and black-to-black.

7.4 Battery power

Your LVAD can be powered using two fully-charged HeartMate 14-Volt Lithium-Ion batteries, so that you can move around freely when not connected to mains power electricity. Two fully-charged batteries will last between 15 and 17 hours, but this will vary depending on the speed of your pump and how old the batteries are.

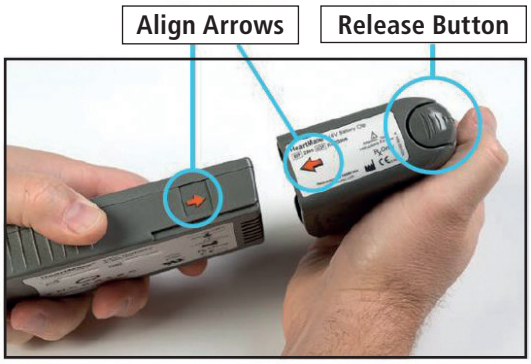
Before using a battery, remove it from the battery charger and check that it is fully charged by pressing the battery button for five seconds:

The number of bars illuminated on the battery gauge indicates the level of charge:

	5 lights	Approximately 80-100% of power remains
	4 lights	Approximately 60-80% of power remains
	3 lights	Approximately 40-60% of power remains
	2 lights	Approximately 20-40% of power remains
	1 light steady	Approximately 10-20% of power remains
	1 light blinking	Approximately 10% or less of power remains. Do not use if battery has on blinking light. HeartMate 3 LVAD System Controller will indicate a power advisory

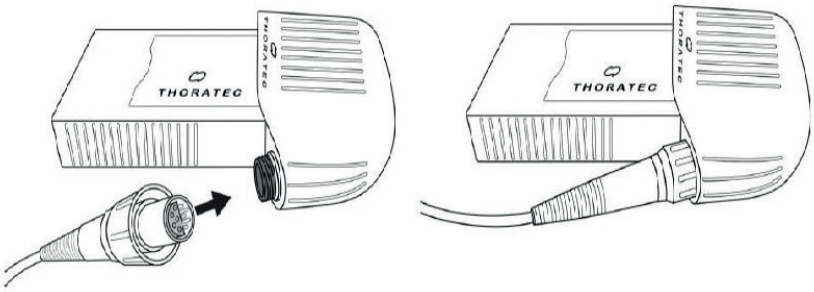
Before you can attach the batteries to the system controller power cables, you need to insert the fully-charged battery into a battery clip. To do this:

- Line up the red arrows on the battery and battery clip
- Push the battery into the clip until the battery clips into place
- Repeat for the second battery



Procedure for moving from mains power to batteries:

- Unscrew and disconnect only the white system controller power cable connector from the power unit. This will activate the power cable disconnect alarm on system controller – this is normal. Do not remove the black connector
- Carefully align opposite half circles inside the white system controller power cable connector and either of the battery clips
- Firmly push together the two connectors. The alarm will stop



- Tighten the connector nut until secure. Hand tighten the nut only until resistance is felt. Do not use tools or over tighten as this can break the nut
- Now the white power cable is safely connected to a battery, repeat the above process with the black system controller power cable. Both system controller power cables are now connected to batteries

7.5 Battery power indicator

The battery power gauge on the system controller shows the approximate charge status of the power source that is connected to the system controller. You can access this information by pressing the system controller battery button once.

- If you check the power gauge whilst attached to mains power electricity via the power unit you will see four green bars and this indicates normal power unit operation

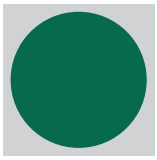
- If you check the power gauge whilst attached to batteries you can establish the remaining battery life:

	4 green bars = 75–100% of battery power remains
	3 green bars = 50–75% of battery power remains
	2 green bars = 25–50% of battery power remains
	1 green bars = 25% of battery power remains

7.6 Battery charger

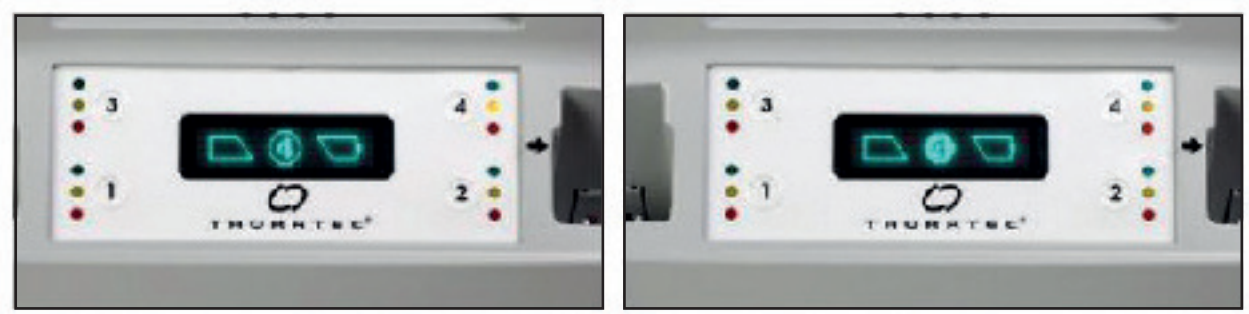
The battery charger can charge up to four batteries simultaneously and it takes up to four hours to fully charge a battery. The battery charger display screen should always show the words 'HeartMate Charger'. If any error messages or a telephone symbol appears please contact the LVAD team for advice.

Each battery pocket on the charger has an associated set of lights: green, yellow and red. The light illuminated next to the battery pocket indicates the charge status of the battery:

a) Green light 	Battery is fully charged and ready for use. For best battery performance, leave charged batteries in the charging pockets until they are needed for use. Once removed from the Battery Charger the battery will hold its charge for approximately three months if not used.
b) Yellow light	The battery is charging or in calibration mode.
c) Flashing yellow light	The battery needs to be calibrated (refer to section 7.7 of this guide).
d) Red light 	The battery is not charging. There is a problem with either the battery or the charging pocket. Initially clean the contact pins on the battery and in the charging pocket to see if that rectifies the problem. If the red light remains, move the battery to another charging pocket. If the red light follows the battery there is a fault with the battery. In this case do not use the battery and call the LVAD team for advice. If the red light does not follow the battery, try another battery in the initial charging pocket. If the red light remains there is a fault with the battery charger. The remaining charging pockets can still be used to charge batteries, but call the LVAD team for advice and possibly a replacement battery charger.

7.7 Battery calibration

Periodically each battery needs to be calibrated. During calibration the battery charger drains the battery of all electrical energy and then recharges it. Battery calibration can take up to twelve hours and only one battery can be calibrated at a time. Whilst calibrating one battery the battery charger can continue to charge three other batteries as usual.



When a battery needs calibrating the above images will alternate on the battery charger display screen (the above example indicates that battery 4 needs calibrating). There will also be a flashing yellow light next to the battery pocket. To calibrate the battery press the corresponding pocket number button within ten seconds of the yellow light starting to flash. The calibration process for that battery will then begin: the yellow pocket light will remain illuminated during calibration and 'HeartMate Charger' will return to the display screen.

If you want to check that calibration is in progress press the corresponding battery pocket number button and the below calibration status screen will appear. This example indicates that battery 4 is calibrating.

When calibration is complete, the yellow light turns off and the green light comes on, indicating that the battery is fully charged and ready for use.

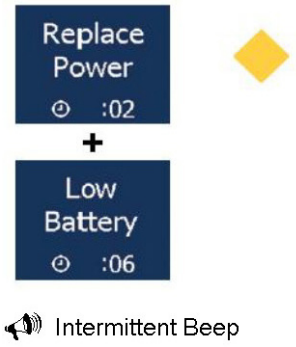
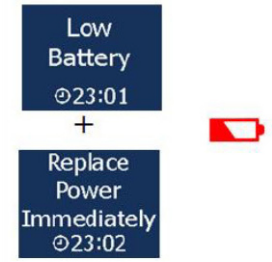
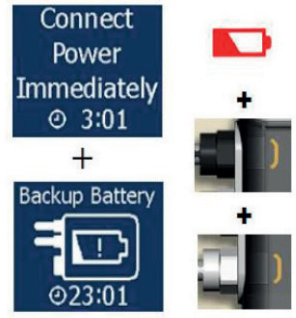
If it is not convenient to calibrate the battery do not press the battery pocket button and the battery will charge in the usual way. However, each subsequent time you place the battery in the battery charger it will prompt you to calibrate the battery. You should not continually ignore the calibration process as over time you may experience "Low Battery" warnings on your system controller as your batteries may hold less charge than they indicate.

8. System controller alarms

If the system controller detects a problem with your LVAD it will provide audio and visual alarms to alert you to the problem. You need to be able to recognise all of these alarms and know what action to take to resolve them. **This is very important as some of the alarms may be alerting you to life-threatening situations.**

8.1 Power alarms

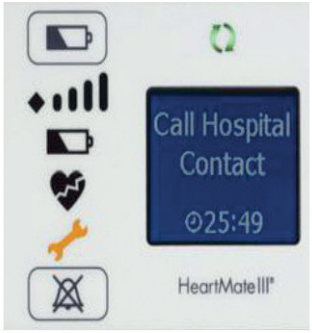
The system controller will prompt you to change your power source using the following alarms:

 Intermittent Beep	**Advisory Alarm – Low Battery** Less than 15-minutes of external battery power remaining. **Action:** Immediately change batteries using two fully-charged batteries, or transfer to mains power electricity via the power unit. If you do not rectify this alarm within ten minutes ↓
 Continuous Alarm	**Hazard Alarm – Low Battery!** Less than 5-minutes of external battery power remaining. **Action:** Immediately change batteries using two fully-charged batteries, or transfer to mains power electricity via the power unit. If you do not rectify this alarm within five minutes ↓
 Continuous Alarm	**Hazard Alarm - No External Power!** If attached to battery power: your external batteries are fully drained of power and you have flipped onto the 15-minute system controller emergency internal back-up battery. **Action:** Immediately change batteries using two fully-charged batteries, or transfer to mains power electricity via the power unit. If attached to mains power electricity via the power unit: there has been a mains power outage. **Action:** Immediately transfer to battery power using two fully-charged batteries. Remain on battery power until mains power electricity is restored. **If you do not rectify this alarm within 15 minutes the pump will eventually stop!**

You must always change the power source when you see the first 15 minute 'Low Battery' advisory alarm. Never ignore it and never get into the habit of relying on the emergency internal back-up battery.

8.2 Advisory alarms

If the spanner symbol is illuminated yellow on the system controller this alerts you to an advisory alarm. There are several potential causes of a spanner advisory alarm and the exact error message will appear on the display screen. It may be due to a mechanical, electrical or software issue with the system. Your response to any spanner advisory alarm should be the same, as detailed below.

<table>
<tr>
<td>



Intermittent Beep
</td>
<td>
This is an advisory alarm notifying you of a malfunction with the system controller.

Look at the system controller display screen to determine the exact error message.

You can temporarily silence the alarm by pressing the silence button but this does not rectify the problem and the alarm will re-occur until the problem is resolved.

Action:

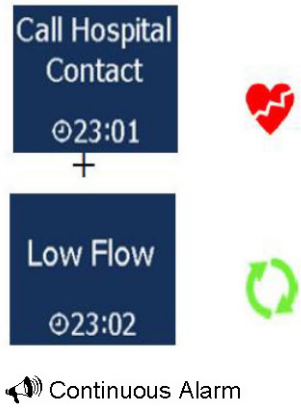
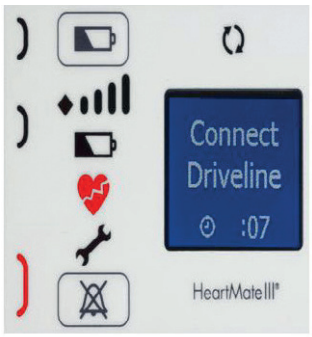
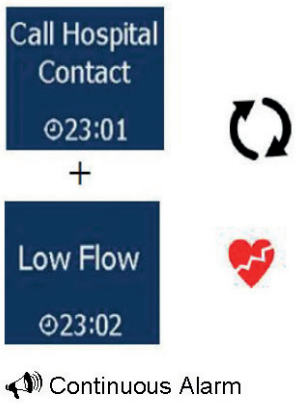
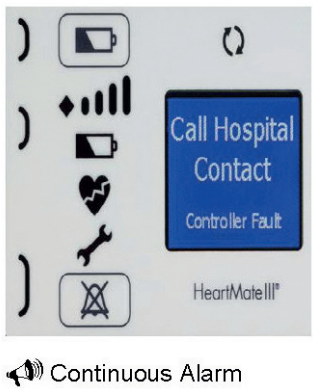
! Check that the pump running symbol is still illuminated green and your LVAD readings are within normal parameters as the pump should still be working correctly !

If you feel ok: immediately call the LVAD team emergency helpline for advice.

If you feel unwell: immediately call 999 to request an ambulance then call the LVAD team emergency helpline for advice.
</td>
</tr>
</table>

8.3 Hazard alarms

These situations are life-threatening. Your pump may have stopped or you may not have enough blood circulating around your body.

	**Hazard Alarm - Low Flow!** The screen will display a 'Low Flow' warning. Although the pump is still running there is less than 2.5 litres per minute of blood circulating through your pump. Press the display button to establish exactly how low the flow is. **Action:** If you feel ok: immediately call the LVAD team emergency helpline for advice. If you fell unwell: immediately call 999 to request an ambulance then call the LVAD team emergency helpline for advice.
	**Hazard Alarm - Driveline Lead Disconnection – The pump has stopped!** The driveline has become disconnected either at the system controller or in-line connector. The green pump running symbol will be black as the pump has stopped. **Action:** Immediately re-connect the driveline! Check the driveline is firmly secured to the system controller and the in-line connector. Once the driveline is re-connected the pump will automatically restart. **Immediately call 999 to request an ambulance then call the LVAD team emergency helpline for advice.**
	**Hazard Alarm - The pump has stopped!** **Action:** Immediately check that you have power, if not change to fully charged batteries or connect to mains electricity via the power unit. Immediately check that the driveline lead is firmly secured to the system controller and the in-line connector. Fix any loose connections. Press all buttons to attempt a pump re-start. Listen to the patient's chest: can the hum of the pump running be heard? Immediately call 999 to request an ambulance then call the LVAD team emergency helpline for advice. **You may need to perform an emergency system controller change if the above measures do not resolve the problem.**
	**Hazard Alarm – System Controller Hardware Fault – The pump may still be running** **Action:** Immediately check that you have power, if not change to fully charged batteries or connect to mains electricity via the power unit. Next check that the driveline lead is firmly secured to the system controller and the in-line connector. Fix any loose connections. Press all buttons to attempt a pump re-start. Listen to the patient's chest: can the hum of the pump running be heard? If you feel ok: immediately call the LVAD team emergency helpline for advice. If you fell unwell: immediately call 999 to request an ambulance then call the LVAD team emergency helpline for advice. **You may need to perform an emergency system controller change if the above measures do not resolve the problem, but only if instructed to do so by the LVAD team.**

8.4 Emergency system controller change

A system controller change should never be performed if the pump running symbol is illuminated green.

If the pump stops the pump running symbol will be black and red heart symbol lit red. This is an emergency situation. Changing to your spare system controller should only be undertaken if you are absolutely certain that the pump is off and you have been unable to re-start the pump by addressing the possible reversible causes of a pump stoppage.

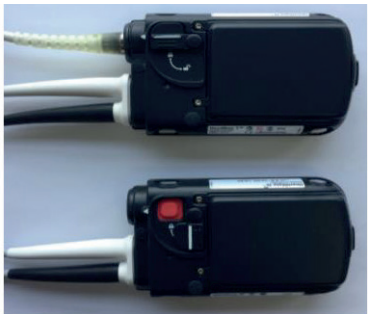
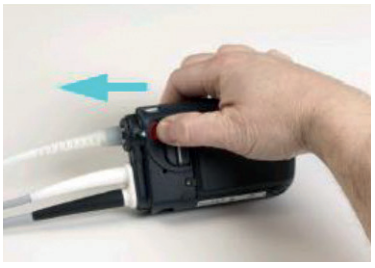
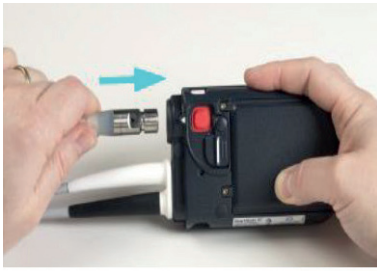
If the pump running symbol is black but you can hear the hum of the pump running when you listen to the patient's chest, immediately call the LVAD team emergency helpline for advice before changing the system controller.

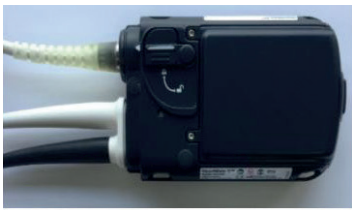
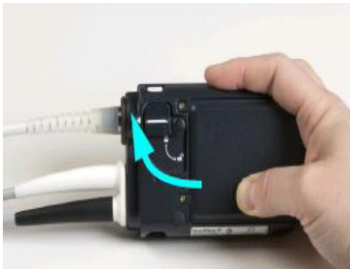
An emergency system controller change should only be performed if the pump-running symbol is black (refer to pump-off alarms in section 6.3). Before changing the system controller in an emergency pump-off situation you must first check the following:

- **Immediately check that you have power: if not change to fully charged batteries or connect to mains electricity via the power unit**
- **Immediately check that the driveline is firmly secured to the system controller and the in-line connector. If not re-connect it**
- **Check for, and fix, any loose cable connections**
- **Individually press the three system controller buttons to attempt a pump re-start**
- **Listen to the patient's chest: can the hum of the pump running be heard**
- **Immediately call 999 to request an ambulance then call the LVAD team emergency helpline for advice**

If you have checked all of the above and the pump-running symbol remains black you should call the LVAD team and prepare for an emergency system controller change. This will be a very stressful situation as the current system controller may be alarming and the LVAD patient may be unwell or unconscious. Try to remain calm, remember what you were taught during LVAD training and stay focussed on the task at hand.

To change the system controller in an emergency pump-off situation:

1.	Get the spare system controller.	
2.	Connect the spare system controller's white power lead to a power source; either mains electricity via the power unit, or disconnect a battery from the faulty system controller and attach this to the spare controller's white power lead (provided the battery has charge). The spare system controller will display "Charging" on the display screen once it has power.	
3.	Align both system controllers side-by-side, face down. Faulty controller ⟶ Spare controller ⟶	
4.	Slide the driveline safety lock down on the back of the faulty system controller to expose the red button. Faulty controller ⟶	
5.	Firmly press the red button on the back of the faulty system controller and pull the driveline out of its socket. Faulty controller ⟶	
6.	Carefully align the BLACK arrow on the driveline connector with the WHITE arrow on the spare system controller driveline lead socket. Spare controller ⟶	

7.	Insert the driveline connector into the socket pressing firmly until it snaps into place. The spare system controller will immediately start operating when the cable is fully and properly inserted in the socket. Spare controller ⟶	
8.	Slide the driveline safety lock up to the locked position, so that it covers the red button. Spare controller ⟶	
9.	Check that the pump running symbol is illuminated green on the spare controller.	
10.	Disconnect the black power cable of the faulty system controller and connect the power source to the spare system controller's black power lead.	

9. Anti-coagulation (warfarin) therapy

A few days after your LVAD implant you will be commenced on an oral anti-coagulation drug called warfarin. Warfarin is an important drug for LVAD patients as it thins your blood to prevent blood clots forming in your pump. You need to take warfarin once daily for as long as you have an LVAD. You should not allow anyone to stop your warfarin without discussion with the LVAD team.

The International Normalised Ratio (INR) test is used to measure how quickly your blood clots and usually only involves taking a finger-prick sample of blood. With an LVAD your **INR target is 2.5,** with an acceptable **INR therapeutic range of 2.0 to 3.0.**

Low INR results indicate that your blood is thicker and will take less time to form a clot. This could result in a blood clot forming in your pump. If your INR is low you will be prescribed a larger dose of warfarin. If your INR is below therapeutic range you will also need to inject a drug called enoxaparin into your abdomen, in addition to taking oral warfarin. The combination of warfarin and enoxaparin will ensure that your INR returns to therapeutic range quicker.

- HeartMate 3 patients with heart arrhythmias or other risk factors should inject enoxaparin twice daily if their INR is **below 2.0**
- HeartMate 3 patients with no previous heart arrhythmias or other risk factors should inject enoxaparin twice daily if their INR is **below 1.5**

The LVAD team will tell you which category you fall into and what dose of enoxaparin you need. You should stop injecting enoxaparin once your INR is back within your therapeutic range so please ensure that you have your INR re-checked more frequently whilst taking enoxaparin. If your INR is below therapeutic range you should not rely on your local anti-coagulation clinic to prompt you to take enoxaparin. Please follow the enoxaparin advice given to you by the LVAD team.

High INR results indicate that your blood is thinner and takes a longer time to clot. This could result in you bleeding heavily if you cut yourself, spontaneous bruising anywhere on your body, risk of severe nose bleeds, internal bleeds in your gut, heavier than normal menstrual bleeding for women, or a bleed on your brain. If your INR is high your Warfarin dose will be reduced or possibly paused for a day or two.

Whilst in hospital we check your INR daily and manage your warfarin dosage. Once discharged home you will be referred to your local anti-coagulation clinic. This is usually at your GP practice or sometimes your local hospital. You should then follow the specific warfarin dosing advice given to you by the anti-coagulation clinic managing your INR. Your INR will also be checked each time you attend LVAD out-patient clinic at QEHB.

Warfarin tablets come in 4 different strengths. The tablets and the boxes they come in are different colours to make it easier for you to take the right dose. The strengths and colours are:

Please note that your dose may be made up of a combination of different coloured tablets.

Upon discharge from hospital you should initially have your INR checked weekly. Once your INR is consistently within therapeutic range and the warfarin dose is stable you can increase the length of time between INR tests. However, with an LVAD we recommend that you have an INR check no less than every 2-3 weeks as being out of therapeutic range for any significant amount of time could potentially have serious consequences. Poor adherence to warfarin therapy or infrequent checking of your INR can result in a blood clot forming in the LVAD pump. This can be life-threatening: you may require further surgery to replace the LVAD pump or you could have a stroke.

In addition to taking warfarin we may also ask you to take aspirin. Although this combination is not often taken together, it is not uncommon for patients with an LVAD to require both medications. Aspirin should be taken after breakfast to reduce any upset to the stomach.

Please do not take diclofenac ('Volterol') or ibuprofen ('Nurofen', 'Brufen') especially whilst taking warfarin and/or aspirin.

If you need any medical or dental treatment, show the yellow anti-coagulant alert card we will give you to the nurse, doctor or dentist. This includes before you have vaccinations and routine sessions with the dental hygienist. Your doctor or dentist may advise you to stop taking warfarin or reduce your dose for a short time before any treatment. If this is the case you must contact the LVAD team for advice.

9.1 Serious bleeding

Occasionally you can have serious bleeding from taking warfarin. This can be dangerous and needs urgent medical attention. Contact the LVAD team and your anti-coagulant clinic, or go to the nearest hospital's emergency department (A&E) straight away if you get:

- Red urine or black stools
- Large bruises or bruises that happen for no reason
- Significant nose bleeds that last longer than 10 minutes
- Blood in your vomit or you cough up blood
- Severe headaches, fits (seizures), acute changes to your eyesight, numbness or tingling in your arms or legs, or feeling very tired, weak or sick (these can all be signs of bleeding in your brain)
- Any significant bleeding from a cut or injury that won't stop or slow down

There are other side effects of warfarin. For a full list see the leaflet that came inside the medicine's packaging.

9.2 Foods, drinks, and medicines that can affect your INR

It is important to keep your diet stable as this means your dose of warfarin is more likely to stay the same. Any big changes in what you eat or drink can change how your body responds to warfarin. Speak to your anti-coagulation clinic nurse before changing what you eat - for example before you go on a diet to lose weight.

Foods containing a lot of Vitamin K can interfere with how warfarin works. These include:

- Green leafy vegetables
- Chickpeas
- Liver
- Egg yolks
- Cereals containing wheat bran and oats
- Mature cheese and blue cheese
- Avocado
- Olive oil

It is important that you eat foods containing vitamin K, so rather than leaving them out of your diet, make sure you eat similar amounts of them regularly. This will mean the level of vitamin K in your blood stays fairly constant, and makes it more likely that your INR level stays stable.

Do not drink cranberry juice while you are taking warfarin as it can increase the blood-thinning effect of warfarin. Similarly it is dangerous to binge drink alcohol whilst taking warfarin.

Some over-the-counter medicines, including alternative 'herbal' remedies, can affect the action of warfarin. You should tell the pharmacist you are taking warfarin and show them your anti-coagulation alert card. They can then advise you on medicines that are safe to take.

10. Managing your abdominal driveline exit site

The most common complication associated with having an LVAD is an infection on the abdominal driveline exit site. It is important to learn the correct way to care for your driveline exit site to minimise the risk of infection.

10.1 Dressing frequency

The abdominal driveline exit site should **always** be covered with a sterile dressing and the dressing should be changed using a strict sterile technique that we will teach you and your family. The frequency of dressing changes is as follows:

- If your exit site is **clean, dry and appears healthy**, you should change the dressing every **three days**
- If the exit site **dressing gets wet** you should **change it immediately** as moist warm conditions are a breeding ground for bacteria
- If the exit site is **infected** you should **change the dressing daily**
- The same **Hollister clip** (driveline lead fixation device) can remain on the skin for **7 to 10 days**, provided it is clean, dry and secure

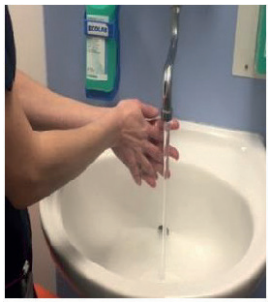
10.2 Importance of sterile technique

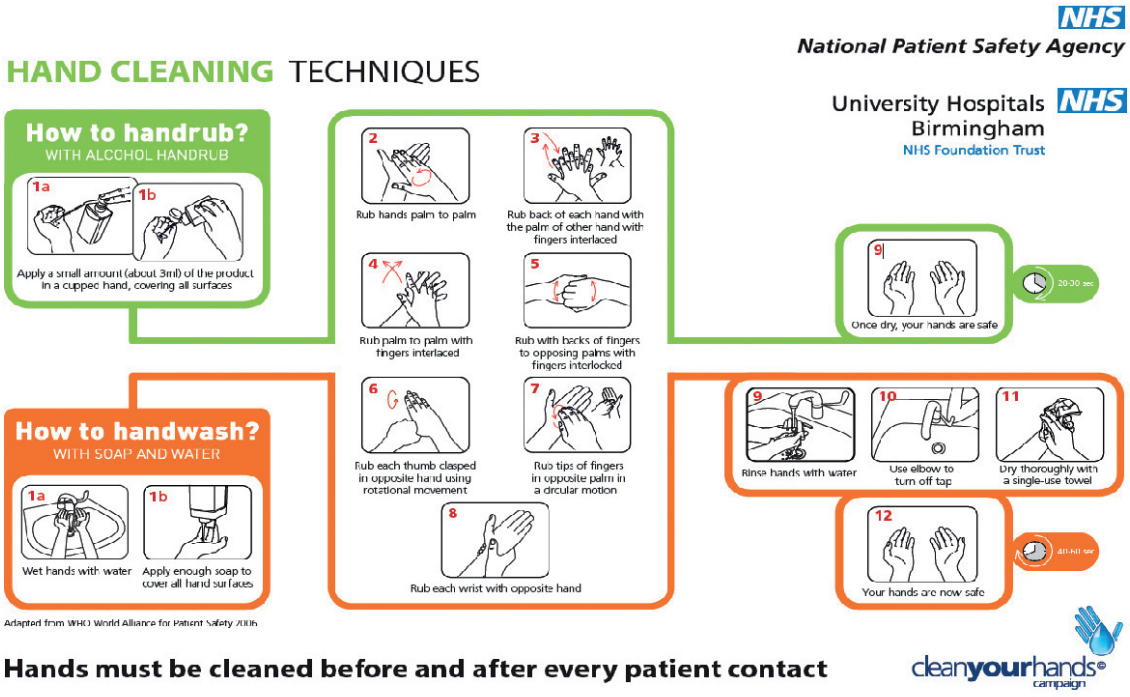
It is important to keep your abdominal driveline exit site clean and dry at all times. Keeping the exit site clean and dry lowers the risk of infection.

Sterile dressing technique is a set of specific practices and steps used under carefully controlled conditions with the goal of minimizing contamination by microbes in the environment or on the hands of the person changing the dressing. The LVAD team will teach you and your care-giver how to undertake the sterile dressing change. You will practice changing the dressing many times to build your confidence and achieve competence in the technique before you go home.

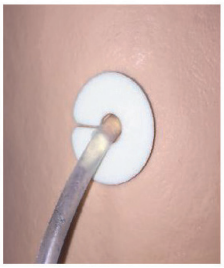
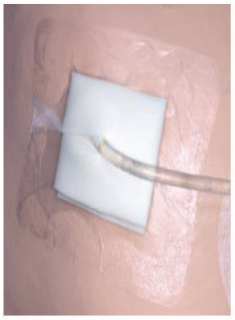
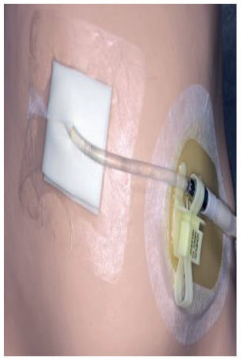
We will give you a list of the dressings you will need. Take this list to your GP who will be able to prescribe the dressings for collection from your local pharmacy. We will send you home with a supply of dressings to see you through until your GP supply is available. Most of the dressings required are available via your GP. QEHB will continue to provide any items your GP cannot prescribe (this is usually just the Hollister clip fixation device).

10.3 Sterile dressing procedure

1.	Gather all of the dressings and equipment you need. Ensure that all outer-packaging is intact with no rips or tears. If damaged, discard and do not use.	
2.	Using an alcohol based cleaning wipe thoroughly clean the flat surface that you intend to place the dressing pack on.	
3.	Remove all jewellery from your fingers and wrists and roll up your sleeves as you need to be bare below the elbow. Now wash your hands using the hospital-approved hand cleaning technique, as detailed below:	



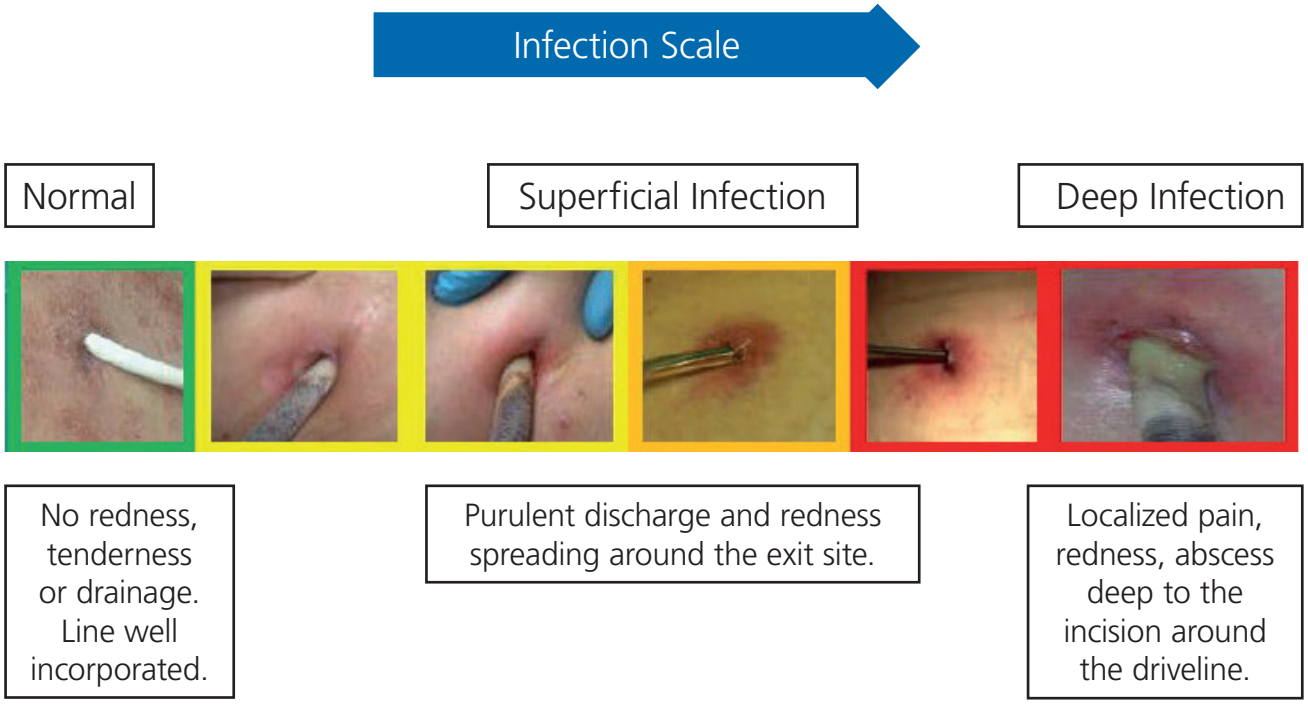
4.	Open the outer packaging of the sterile dressing pack. Let the sterile dressing pack drop onto the clean flat surface ensuring that the outer packaging does not touch the flat surface. Carefully open out the sterile pack to create a sterile field.	
5.	Carefully open all other dressings and equipment letting them drop onto the sterile field, ensuring that the outer packaging does not touch the sterile field.	
6.	Apply non-sterile gloves. Loosen the driveline from the Hollister clip. Carefully remove the old dressing from the abdominal driveline exit site, ensuring that you do not touch beneath the dressing. Only remove the Hollister clip fixation device if it needs changing.	
7.	Dispose of the old dressing into the clinical waste bag provided. Remove and dispose of the non-sterile gloves. Carefully examine the exit site for any signs or symptoms of infection (see section 8.4). If you are concerned that an infection may be present contact the LVAD team for advice after you have completed the dressing change.	
8.	Wash your hands again following the hospital approved hand washing technique. Thoroughly dry your hands using the sterile towel from the dressing pack. Now apply the sterile gloves.	
9.	Prepare the dressings as follows using the sterile scissors: - cut down the middle of two adhesive dressings and stop when you reach the centre. (if using additional dressings such as foam, or silver to treat an infection, you also need to cut down the middle of these dressings and create a small T shape in the centre).	

10.	Holding the Chloraprep mop with the mop head down, break the 'wings' of the mop. This releases the fluid from the shaft to the mop head. Apply gentle pressure and initially use the mop to clean around the driveline site without touching any open wounds, and then gradually work it away to the outside border of where the new dressing will be. Then dispose of the mop into the clinical waste bag provided. Allow a few minutes drying time before applying dressings.	
11.	The antimicrobial foam disc dressing should be applied against the skin around the driveline lead, with the opening pointing towards the belly button.	
12.	Apply the first adhesive dressing: Peel the backing off one dressing to reveal the adhesive surface beneath. Apply to the skin around the driveline lead with the opening pointing towards the Hollister clip. Ensure the open ends are slightly overlapping each other. Then peel off the top label.	
13.	Repeat the above using the second adhesive dressing, but apply it in the opposite direction with opening towards the belly button, again slightly overlapping the ends. This should form a tight seal around the driveline exit site.	
14	If the Hollister clip fixation device needs changing: • Remove a new Hollister clip from its packaging • Peel off the backing which covers the adhesive in the centre • Align the clip so that it is in-line with the driveline, then apply firmly to the skin. Then peel the backing off the outer ring and secure • Place the driveline onto the cable tie. Push the tie into the clamp and pull closed around the driveline. You want it tight enough that the driveline won't move, but not so tight that the driveline is crushed. Also ensure that the driveline is not twisted or pulling on the exit site • Fold back any remaining cable tie into the clip	
14.	Dispose of all equipment and waste safely.	

10.4 Signs and symptoms of infection

You should closely monitor your abdominal driveline exit site for any signs or symptoms that may indicate that it has become infected. This may include:

- Pus, discharge or bleeding
- Foul odour
- The site feels hot, or there is redness or inflammation around the driveline
- Increased tenderness, itching or pain around the driveline
- You have a temperature above 37.5oC



If you think you may have a driveline exit site infection you should contact the LVAD team for advice. We will swab the exit site to check for any bacterial infection, or ask your GP to do so. Superficial skin infections can usually be treated with oral antibiotics and some LVAD patients are on long-term oral antibiotic therapy. More serious deep infections may need to be treated with intravenous antibiotics during an admission to hospital.

The driveline at the exit site is covered with a special material that lets skin cells grow into the cable. This skin growth acts as a barrier that can lower the risk of infection. As the exit site needs to be protected from water do not shower until you have discussed this with a member of the LVAD team at your out-patient clinic appointment. We will allow you to shower once we feel that the exit site is well healed.

Trauma to the driveline exit site can lead to an increased risk of driveline infection. In order to minimise trauma to the exit site be careful with the driveline and ensure it is immobilised at all times using the Hollister clip fixation device. Try not to pull, twist or kink the driveline lead. Take care not to drop the system controller or place unnecessary strain on the system controller's electrical leads.

11. Attending LVAD out-patient clinic at QEHB

Once you have an LVAD your lifelong follow-up care will continue at the Queen Elizabeth Hospital Birmingham. There are only six specialist LVAD centres in the UK so it is not usually possible to transfer your care to a hospital closer to your home. Although we appreciate this means that some patients have to travel long distances for follow-up appointments, the importance of attending out-patient clinics at QEHB cannot be stressed enough.

You will be expected to attend LVAD out-patient clinic in Birmingham within a week of being discharged home. Out-patient clinic appointments are weekly for the first two weeks, then fortnightly for ten weeks. If you are recovering well the appointments are extended to monthly, and then every three months up to your first year post discharge. You will visit every four months during the second year and every six months from year three onwards. This schedule assumes that you are progressing well. If you are unwell or have any complications we will need to review you in clinic more frequently.

It is very important that you attend your out-patient clinic appointments. It allows the LVAD team to see how well you are recovering, to monitor the performance of your LVAD and check on the condition of your driveline exit site. It is also your opportunity to ask questions, to tell the LVAD team if you have any problems or concerns and be reviewed by a consultant cardiologist.

When you are discharged from hospital we will give you a list of your out-patient clinic appointment dates for the year ahead. This list will also indicate what tests and investigations will be performed at each visit. Generally LVAD clinics are on a Friday morning and the more tests that are scheduled the longer the appointment will be. The tests and investigations performed in out-patient clinic can include:

- Blood tests
- Download of LVAD data and alarm history
- Examination and re-dressing of your driveline lead exit site
- Checking your observations: doppler blood pressure, heart rate, oxygen saturations, temperature, weight
- Echocardiogram (Echo)
- Chest X-ray
- Electrocardiogram (ECG)

If you are unable to attend an out-patient clinic appointment you should inform the LVAD team without delay. It is not always possible to re-schedule appointments so you should aim to attend if possible.

If you are unable to drive you will need to make suitable arrangements with relatives or friends to provide transport to attend regular out-patient appointments at QEHB. You can also contact your GP to ascertain if you are eligible for patient transport, although this is not always available.

12. Psychological and emotional issues

Following your LVAD implant surgery you may encounter a range of emotions and feelings that will change over time. Each patient's reaction to LVAD surgery is different and unique to them. For some, the LVAD is seen as a problem. To others, a challenge. To one person it is life-saving, improving their health and quality of life. To another it is a devastating experience. There is no right or wrong way to react. Everyone adapts and adjusts in their own way and in their own time.

12.1 Adapting to your new circumstances

Adapting to living with an LVAD is a complex process and everyone's journey will be different. Those closest to you: your family, loved ones and friends will all be going through their own journeys as well.

Your personal experience of how you came to have an LVAD may also affect how you feel. For example, if you have been living with heart failure for some time and have been experiencing progressively deteriorating health and quality of life, you may feel physically better after your LVAD implant. You may be able to do more and your quality of life may improve as you recover from surgery. Seeing this physical improvement may help with your emotional adjustment. For some patients however, even though they may experience physical improvement, they find adjusting to living with an LVAD difficult. The restrictions it places upon you can lead to understandable psychological and emotional distress.

Some of you may have had very different experiences prior to LVAD implantation. A patient who has been living with deteriorating heart function over a long period of time has, naturally, had longer to adapt. A sudden diagnosis of heart failure leaves little time for adjustment. Receiving this life altering diagnosis and the information that you need an LVAD can therefore be a huge shock: you may not feel like you have had time to adjust to this new reality. Shock and disbelief are commonly experienced emotions for people who have had an LVAD fitted. Those closest to you may also feel the same. It will take time to adjust to this new reality. Sudden onset heart failure and LVAD implantation may result in a perception that although the LVAD has been lifesaving it has not provided you with an improvement to your physical health and quality of life. It can be hard therefore to accept it as part of you. You may also experience a sense of loss and grief for your old life in a way that feels similar to a bereavement.

12.2 Common psychological and emotional difficulties following LVAD surgery

Whilst everyone's experience will be unique, there are some common thoughts and feelings that people often experience following LVAD surgery.

Feelings of loss, grief or bereavement:

Whatever your journey, adjusting to living with an LVAD often involves some element of grief with feelings of loss and sadness for your pre-LVAD life and body. This is very normal and common, especially in the earlier days, post-surgery. Like any major change you need to give yourself time to grieve, time to process and time to start to re-work what your life will look like as you adjust to your 'new normal'. Along with this it is common to experience feelings of low mood or feeling more emotional than normal (feeling sad and tearful).

Depression:

Many people find that the initial feelings of loss, sadness and tearfulness persist over time. It is important to understand that depression is different to feelings of grief and sadness. Depression is often characterised by the following symptoms that persist over time:

- Persistent feelings of low mood
- Loss of interest and pleasure in activities you used to find enjoyable
- Feeling low in energy and motivation
- Sleep and appetite disturbance
- Feelings of worthlessness, and thoughts of self-harm or suicide

While these feelings are not uncommon, it is important that you seek further help and support if you think you are experiencing symptoms of depression. Please refer to section 11.3 on self-help and seeking further support.

Anxiety:

It is common to feel anxious after LVAD surgery. There is a lot to learn about how to operate the device, how to respond to alarms and how to care for your abdominal driveline lead exit site, to name a few. While the LVAD team will support you with this and make sure you feel confident with operating your LVAD, anxiety about getting it wrong and the consequences of this is understandable. You may also experience anxiety about the device malfunctioning as you start to build your trust and confidence in this new equipment.

Further anxiety may be associated with doing day-to-day activities. For example: not feeling confident to go out on your own. The first time you do this may feel like a huge step forward. Anxiety regarding an uncertain future, associated with possible future heart transplantation or LVAD complications, are also common worries that people experience. While these feelings are to be expected, if you feel that your confidence isn't improving over time, or you feel that anxiety is affecting your quality of life (preventing you from doing things you want to do) it is important that you seek further support.

Post-traumatic stress:

Experiencing heart failure and having LVAD surgery are traumatic experiences and there may be aspects of your post-operative recovery that were particularly traumatic and shocking for you. For many people, these experiences occur during the critical care period of their recovery. It is not uncommon for people to experience critical care unit related delirium after LVAD surgery. If you experienced delirium you will have been confused, disorientated, unable to concentrate and found it difficult to make sense of what was going on around you. You may have seen or heard things that were distressing, that you have been told by others did not happen, or were not there, but to you they will have seemed very real. You may also have experienced vivid and distressing dreams that you can clearly recall.

If you are experiencing high levels of anxiety or feelings of vigilance (feeling watchful and on-guard), you may re-experience these disturbing events. Sometimes these events pop into your head during the day as though a video is playing that you don't have control over, or you have bad dreams or nightmares of these experiences when you go to sleep. This may be due to post-traumatic stress and it is important that if you are experiencing these symptoms you seek support. Post-traumatic stress is a treatable psychological condition, so do not feel you need to cope with this alone.

Anger, frustration and irritability:

As you recover from your experience, you may feel that you are more short-tempered, irritable and snappy with your family and friends. You may then find yourself criticising yourself or feeling confused about why you are acting in this way. This in turn can make you feel low in mood, and may encourage you to be more short-tempered: a vicious circle develops.

Try to be patient and kind to yourself rather than critical. Feeling short-tempered is an understandable response to stress and trauma as you adjust to how life is now. Try to explain to your family and friends that you are feeling stressed, it is not personal and you know they are only trying to help. Apologise if you feel you have behaved unkindly towards others, talk it through and explain how you are feeling. Try to forgive yourself too, and try and work on finding ways of reducing stress in your daily life, which may include seeking more support from others. Again, if you feel that these feelings are persisting or are becoming problematic, it is important you speak to those involved in your care.

Feelings of low self-esteem or low self-worth:

Feelings of low self-esteem or low self-worth are common if you are not able to fulfil the roles you used to, or you feel you are not able to contribute in the way you want or are used to.

It can be helpful to try to redefine who you are now, focussing on what you can do rather than on what you can no longer do. It is important to consider the value in what you can still do. For example, you may not be able to provide as much practical support to your family as before, but you can still provide emotional support and a listening ear. This is still of value and will be appreciated by others. What do you think others appreciate about you? If you are not sure, you could always ask them. Often we are helpful to people in ways we have not even considered.

Body image:

Having an LVAD implanted imposes significant changes to your body image, both physically and emotionally. The process of adjustment and acceptance often takes time. After LVAD surgery, give yourself the time you need to adapt. Be patient, be kind to yourself, share your feelings and seek help if you need it.

Coming to terms with your changed body can be overwhelming. Being open and honest with people you care about is one key aspect of dealing with those initial feelings. Try to explain how you feel (about your body with the LVAD) to your partner or a supportive friend. You might have strong negative feelings that could lead to depression or anxiety, affect your sense of identity and may result in reduced participation in social activities and impact on the way you behave towards those around you. Be sure to give your loved ones the best chance to understand and be there for you.

Remember that the LVAD team is available to you and are trained to support you while you adjust and recover. You are not alone. Everyone with an LVAD has had to deal with these emotions: the LVAD team is skilled at listening, understand how you are feeling and can guide you to other professional help if needed.

Relationship concerns:

You may fear that your social role has changed and that others may not accept you as they did in the past. One of your first concerns may be how to tell other people about your surgery, who to tell and when. You should be prepared to explain your surgery with a few brief statements such as "The LVAD is a pump that helps my heart keep me alive". Understand that you do not have to tell everyone about the surgery. Whom you tell, and when, is your choice.

Returning to your work place may present concerns: how you interact with colleagues, feelings of being 'watched'. Employability and insurability are issues for some people. If these issues develop, seek help from healthcare professionals and/or talk with other LVAD patients who have found solutions to any of these issues.

Sexual activity is a common concern for LVAD patients. Linked closely to our sexuality is how we think about ourselves and our body image. It is important to discuss these concerns with your partner. When to discuss your LVAD depends upon the nature of the relationship. As the relationship grows or leads to intimacy, the partner needs to be told about the LVAD prior to a sexual experience. Please also refer to section 17 of this guide on sex and contraception.

Self-care concerns:

The LVAD team will teach you how to care for the LVAD and in time, you will master the daily checks and tasks. You and your family should begin to assist the LVAD team with caring for the device as soon as possible. Becoming involved in this process will build your confidence and help you to regain control of the situation.

12.3 Self-help and seeking further support

If you are experiencing any of the psychological or emotional issues discussed in this guide, please be reassured that they are common difficulties that many people experience living with an LVAD. It is important to give yourself time to adjust and be patient and kind with yourself in the same way that you would if it was a family member or friend going through the same experience.

If you are concerned that negative feelings are persisting longer than you expected, or you feel they are impacting on your quality of life or recovery, it is important to discuss these concerns with a healthcare professional who can advise you further. You can talk to the LVAD team when you attend your clinic appointments. It may also be useful to discuss your concerns with your GP who can make recommendations for any local support that may be available to you. You might also like to consider:

- **Attending VAD Café**
  This is a monthly peer support session where you can come together with other LVAD patients and their families over a cup of coffee to share your experiences, concerns and learn positive ways of coping from each other. Speak to the LVAD team if you would like further information about attending VAD Café.

- **Participate in critical care follow-up**
  Patients who have undergone treatment in critical care for more than seven days are given the opportunity to return to the critical care unit, accompanied and supported by a critical care nurse, to address any negative thoughts or feelings they may have due to this period of their treatment and recovery. You should automatically be invited to participate in critical care follow-up but speak to the LVAD team if you would like further details.

- **Social media**
  There is an "LVAD support group" you can join on Facebook. Please note that this Facebook group is not run or moderated by the Queen Elizabeth Hospital Birmingham. You should not seek advice related to your medical condition, your treatment, or the LVAD equipment from social media. Always seek this advice from the LVAD team or a qualified health professional.

13. Exercise

The HeartMate 3 LVAD is a fixed speed device and the speed of your pump will not increase in response to exercise. However, as you exercise your own heart will naturally pump harder and faster and this is a normal response to increased activity. Consequently the flow of blood through your LVAD will also increase.

It is very important that you take time to warm-up before and cool-down after exercise. Be careful to protect your driveline lead and system controller. You will also need to be careful not to push yourself too hard. If you feel pain, or if you start to feel dizzy or short of breath during any activity, stop.

When you go home it is important that you continue with the walking programme and exercises you started with the physiotherapist in hospital and you may be referred to a local cardiac rehabilitation team. This will help you to return to as full and independent a life as possible. Regular exercise helps to:

- Strengthen your heart
- Improve your circulation and lung function
- Strengthen your muscles and bones
- Optimise your body in preparation for a potential future heart transplant
- Make you feel better by reducing stress and anxiety
- Control your weight by burning up extra calories

13.1 Types of exercise

Your heart will benefit most from exercise that builds stamina. This is your ability to keep going without getting too out of breath. Walking is an excellent stamina building exercise, which should be developed gradually.

13.2 Pace

You should walk at a pace that gets you breathing more deeply and slightly out of breath, but still allows you to keep a conversation going. Start each walking session at a gentle pace gradually increasing towards a brisk walk with a good stride allowing your arms to swing. Slow down towards the end of the walk to enable the heart rate to gradually lower. If you feel you are tiring or becoming uncomfortable during the walk, stop and rest.

13.3 Activity and approximate timescales

Please be aware that the position of your driveline lead may limit your activities. Do not overstretch or perform vigorous or repetitive movements as this may cause movement at your driveline exit site. Excess movement can lead to irritation at the wound site and increases your chances of developing a driveline infection. Whilst everyone is different, you can use the table below as a guide. It contains a variety of activities and specific advice. Build up your activities day-by-day and do things that you enjoy!

Activity	When you can resume after surgery	More details
Back to work	Three months	Depending on the nature of your work and hours/shifts, and with occupational health department's approval
Shower	Once the LVAD team are happy that your driveline exit site has well healed	Seek advice from the LVAD team before showering. Refer to section 19 of this guide
Bowls and golf	Three months	Practice shots/movements can begin
Cooking	When you feel ready	Avoid heavy pans to start with
Cycling / dancing	Two months	Excellent exercise for your heart
Decorating	Get the professionals to do it	
Driving	Do not drive for three months and then only once your LVAD doctor gives you permission to	Tell your insurance company and the DVLA about your LVAD implant. Make sure you can safely steer and use the brakes before you start driving again Whenever travelling in a car, either as the driver or passenger, you must wear a seatbelt. Preferably sit in the front of the car where your chest and LVAD will be best protected Refer to section 22 of this guide
Fishing	Three months	Be careful not to get the system controller or batteries wet, or fall into the water
Gardening	Two months	Weeding, digging, grass mowing
Getting dressed	Straight away	
Having visitors	Any time	Don't be afraid to limit visitors and telephone calls. Protect your rest time
Housework	Light housework after two months	Do not use a vacuum cleaner and avoid any activities that can create static electricity
Lifting/pulling/ pushing	Nothing heavy indefinitely, including shopping trolleys	
Night out	When you feel ready	You may tire quickly at first
Sex	Whenever you feel ready	Make yourself comfortable and be careful of your batteries and lines. Ensure you do not put too much pressure on your sternum for the first 3 months Refer to section 18 of this guide

Holidays and air travel	Leave flying for at least six months after discharge from hospital	Speak to the LVAD team about flying. You should only ideally travel on short haul flights. Be sure to inform your travel insurance company and airline that you have an LVAD Travel insurance may be more expensive. During any long journeys take regular opportunities to walk and stretch your legs. It is advisable to wear compression flight-socks Refer to section 23 of this guide
Shopping	For the newspaper – straight away. Supermarket trolleys and carrying bags – two months	Carry no more than 1kg in weight
Stairs	Straight away	
Swimming / Water Sports / Contact Sports	Swimming, water sports and contact soprts are NOT allowed with an LVAD	All LVAD equipment must be kept dry

If you have any questions about starting or increasing activities speak to the cardiac rehabilitation staff, LVAD team or your LVAD doctor.

13.4 Signs and symptoms of over-exertion

When exercising you should expect to feel warmer, your breathing rate will increase and your heart will beat faster. These are normal and good responses to exercise. You should stop exercising if you experience any of the following:

- Dizziness or light-headedness
- Excessive sweating
- Severe shortness of breath
- Chest pain or palpitations
- Nausea

Upon discharge from hospital your physiotherapist will refer you for cardiac rehabilitation, usually at your local hospital. You will normally be invited to join the cardiac rehabilitation programme six to eight weeks following your discharge. The programme involves attending one to two classes per week. This may be on an individual basis or in a group setting. Classes involve supervised exercise sessions and practical advice on diet, maintaining a healthy lifestyle, medication advice and relaxation techniques. It is important for you to attend cardiac rehabilitation if you are accepted onto the programme as it will help to maximise your recovery, rebuild your confidence and strengthen your body. This is particularly important if you will be going on to have a heart transplant in the future.

It is important that you protect your driveline exit site and LVAD equipment during physical activity. You should always discuss any new form of physical activity with the LVAD team before you start. Please ask if you would like your physiotherapist to give you more advice on specific types of exercise.

14. Diet

Due to your heart failure and subsequent LVAD surgery you may have reduced appetite, be losing weight and/or be underweight. If this is the case you need to ensure your protein and calorie intake is adequate. To achieve this:

- Eat regular meals (three per day) with snacks in between
- Have at least three servings of protein rich foods daily, for example meat, fish, cheese, eggs or beans/pulses
- Aim to have at least one pint of full-fat milk per day in drinks (milky coffee, hot chocolate), or in cereals or puddings
- Have snacks such as biscuits, cake, cheese and crackers, yogurts, chocolate or nuts
- Be mindful of the timing of snacks as it is important to also eat nourishing meals
- If unable to take adequate calories and/or protein, information on food fortification and supplement drinks are available – please ask a dietitian or the LVAD team for advice

You should continue with the above advice until your appetite has recovered and you achieve/ maintain your healthy weight. **Once you are at your target weight**:

- Include at least one portion of starchy food at each meal such as bread, cereals or potatoes
- Eat at least five portions of fruits and vegetables a day
- Have two or three portions of low fat milk and dairy products a day to meet your calcium requirements
- Two portions of meat, fish, eggs or beans per day should provide adequate protein. This can include all lean meats, chicken, white and oily fish and pulses
- Fats include spreads, oils and salad dressings. Choose unsaturated versions. The foods with hidden fats will be high in calories, for example, pastries, pies and crisps
- You should reduce sugar in drinks and limit foods high in sugar, such as chocolate, sweets, biscuits or cake (sugars provide you with energy but no other nutritional value)

You can use the healthy eating plate as a guide to a well-balanced diet:

15. Weight

Whilst unwell it is not uncommon to have a poor appetite. As you begin to recover from your LVAD implant surgery your appetite should improve. As your appetite improves it is easy to overindulge. It is therefore important to eat a healthy well balanced diet and have and maintain a healthy weight. If you are or become overweight you will be advised to lose weight. You should aim for a steady loss of one to two pounds (half to one kilogram) a week. Please ask your GP or the LVAD team if you would like advice from a dietitian.

Please bear in mind that being overweight with a Body Mass Index (BMI) greater than 32 is a is a strong indicator for potentially needing a heart transplant in the future and also increases contraindication to future heart transplantation and increases the risk of a driveline infection.

16. Fluids

Ensure you drink adequate amounts of fluid each day as dehydration can cause LVAD 'low flow' alarms. As a general rule aim to drink two to three litres of fluid per day (although some patients may be advised to drink slightly less). You may also require more fluid if the weather is hot or you are exercising. Try to avoid sugary drinks to help with weight reduction.

17. Alcohol, smoking, and recreational drug use

Alcohol can impair your ability to respond to LVAD alarms, increase your risk of falls and injuries and may be contraindicated with some of your medications. You should ideally refrain from drinking alcohol, or drink a moderate amount sensibly. You should not exceed national guidelines; these are up to three units a day for men and up to two units a day for women. One pint of beer is two units, one pub measure of a spirit (25ml) is one unit and one pub measure of wine (125ml) is one unit. All alcoholic drinks are high in calories so avoid alcohol if you are trying to lose weight or if you have high blood pressure.

Smoking is a big risk factor in heart disease. If you continue to smoke it will double your risk of further serious heart problems. Everyone will advise you to stop smoking, but it can be easier said than done. Stop smoking services can help you as they provide:

- One-to one help
- Group support sessions
- Free nicotine replacement therapy for some people

If you are a smoker or use a vape, please ask your GP for advice on smoking cessation or get advice on-line from www.nhs.uk/smokefree.

Taking recreational drugs can also impair your ability to respond to LVAD alarms and may negatively affect your health and wellbeing. If you take recreational drugs, or need treatment for drug addiction, your GP is also a good place to start. They can discuss your problems with you and get you into treatment.

Please note that excessive alcohol intake, smoking tobacco, vaping, and recreational drug use are all contraindications to future heart transplantation.

18. Sex and contraception

You can continue to enjoy a happy and healthy sex life with an LVAD. However it is common for LVAD patients to feel anxious about resuming a sexual relationship.

After a long illness and/or major surgery, it is not uncommon for people to feel undesirable or to lack sexual drive. This is perfectly natural as limitations on your health can affect your ability to give and to receive sexual pleasure. You may:

- Feel unhappy with your body image, particularly due to the LVAD driveline and equipment attached to you
- Have feelings such as fear, sadness or anger
- Feel more dependent on your partner and this may affect your relationship
- You may still be experiencing some physical pain or discomfort
- You may still be in the process of returning to normal strength and fitness

It is important to continue with normal loving contact such as touching, kissing and cuddling. You should resume your sexual relationship whenever you and your partner feel ready to do so. However, you should initially wait to resume strenuous sexual activity until your sternum (breastbone) is completely healed, which usually takes three months. Then it is best to check with your LVAD doctor if you have any questions or concerns. Once you are ready to resume sex, initially consider adopting more passive sexual positions that do not put pressure or strain on your chest.

Try not to worry about a loss of sex drive or impotence. It is a common problem and usually temporary. The emotional stress of your illness or the medicines you have been prescribed could be the cause of your problems. Having diabetes can also affect your sex drive.

You should not feel embarrassed to talk to your GP or LVAD doctor who will be understanding and can offer you advice and support.

If you are a female patient, please remember that you should not become pregnant when fitted with an LVAD. It is therefore important that appropriate contraception is used. This can be discussed further with your LVAD doctor.

If you are a male patient experiencing erectile dysfunction, you should not start taking, or increase your current dose of sildenafil (Viagra), or other similar medications, without first seeking advice. In heart failure patients, sildenafil is used to reduce pulmonary hypertension. Larger doses of sildenafil can lead to a significant drop in your blood pressure, so always talk to your LVAD doctor before starting or altering your current dose of sildenafil (or similar medications).

If you take sildenafil (Viagra) or similar medications, you should not also take nitrates such as glyceryl trinitrate (GTN) for angina, or amyl nitrate ("poppers"), as the combination of drugs can cause dangerous drops in your blood pressure.

If you have several sexual partners, or have casual sex, you should be vigilant about the risk of sexual transmitted infections and always use a condom. Some sexually transmitted infections are not obvious and you may not be aware that you or your partner has them. If you experience symptoms such as genital discharge, bleeding, itching or if you feel you are at risk of STIs, then you should obtain advice and testing from your GP or local genito-urinary clinic.

19. Washing and showering

NEVER have a bath with an LVAD and avoid getting any LVAD equipment wet. You risk possible electrocution and/or pump stoppage!

As the LVAD needs to be protected from water please do not shower until you have discussed this with a member of the LVAD team at your out-patient clinic appointment.

The driveline at the exit site is covered with a special material that lets skin cells grow into the cable. This skin growth acts as a barrier that can lower the risk of infection. Keeping the skin clean and dry near the cable site also lowers the risk of infection. We will allow you to shower once this site is well healed.

Once your LVAD doctor has agreed that you can shower you will be given a large moisture barrier dressing to apply over the driveline lead exit site dressing and driveline in-line connector. Your batteries and system controller must be placed in the shower bag provided (as shown below).

The moisture barrier dressing and shower bag must be used for every shower. Ensure that the driveline is well secured using the Hollister clip fixation device throughout.

Once out of the shower, dry off and then remove the moisture barrier dressing and your driveline exit site dressing beneath. Once the site is dry, re-dress the exit site using your usual sterile dressing technique.

20. Mouth care and invasive dental procedures

Now you have an LVAD it is important that your teeth and gums are well looked after. This is because bacteria from infected teeth and gums can circulate in the bloodstream and may cause an infection in the lining of the heart called endocarditis. Although this is a rare condition it is serious.

To reduce the risk of infective endocarditis you must ensure that you maintain good oral hygiene and have dental check-ups every six months. You should thoroughly brush your teeth twice a day to remove dental plaque (the white sticky film that builds up on teeth at the gum edge and is laden with bacteria). As well as brushing, you should use an interdental brush or floss to get in between the teeth where the toothbrush does not reach. An antiseptic mouthwash may also help. If your gums bleed when you brush them this is a sign of gum disease and you need to see a dentist for advice about treatment. This may involve having your teeth professionally cleaned and scaled on a regular basis.

20.1 Invasive dental procedures

If you need to have any dental work that requires manipulation of the gums (including extractions and scaling), the root of the teeth (including root canal procedures) or perforation of the oral mucosa, it is recommended that you receive a one-off dose of antibiotics to protect you from infection (as detailed in the below table).

Drug allergy?	Antibiotic	Adult Dose	When to give
No allergy to penicillin	Amoxicillin	3g orally	Single dose 1 hour before procedure
Allergy to penicillin	Clindamycin	600mg orally	Single dose 1 hour before procedure

Antibiotic cover is **not** required for:

- Local anaesthetic injections in non-infected oral tissue
- Treatment of superficial cavities not requiring gum manipulation
- Removal of oral stiches
- Dental X-rays
- Placement, adjustment or removal of removable artificial teeth, dental appliances or braces
- Following trauma to the lips or the mucous membrane lining the inside of the mouth

21. Body piercing and tattoos

LVAD patients are at greater risk of bleeding and infection when getting a body piercing or a tattoo. If you are thinking about getting a piercing or a tattoo please discuss this with your LVAD doctor before you proceed and then only use a licensed studio.

22. Driving

You are not permitted to drive a car for three months following your operation. Whether you can resume driving after this three month period is decided on an individual basis. Please discuss this with your LVAD doctor at your three month out-patient clinic appointment. It is important that you contact the DVLA and your insurance company to explain your situation to them. The DVLA may request a medical report about you from your LVAD doctor.

If you are unable to drive you will need to make suitable arrangements with relatives or friends to provide transport to attend regular out-patient appointments at QEHB. You can also contact your GP to ascertain if you are eligible for patient transport (although this is not always available).

23. Travel and holidays

When preparing for a trip away careful planning is essential to ensure you travel safely. Talk to the LVAD team about your travel plans well in advance, especially if you plan to travel long distances.

Once you are back home and feeling confident with the LVAD you may want to visit friends and family or spend some time away. We do not recommend that you travel abroad initially, but you can take holidays in the UK whenever you feel comfortable spending time away from home. We advise that you do not travel abroad for at least six months after your LVAD implant. It is essential that you take out comprehensive travel and medical insurance before you travel. Remember that your insurance may be more expensive.

Here are some things to consider when planning a trip abroad:

- Check that your LVAD doctor is happy for you to travel abroad before you book
- Only travel to countries that have a reliable electricity supply. It is not advised to travel to countries that experience regular power outages as your life depends on a constant supply of electricity
- The LVAD battery charger and power unit function safely using 100-volts to 240-volts AC power supply. You can use travel adaptor plugs appropriate to the country you are visiting
- Only travel to countries that have a good standard of healthcare
- Notify the LVAD team of the countries and regions you will be travelling to. We will give you the contact details of the nearest hospitals that are familiar with the HeartMate 3 LVAD in case you have an emergency whilst away
- Ensure you have an adequate supply of medication to last you the duration of your trip. If flying, carry your tablets with you as hand luggage in case your hold bags are lost or stolen
- If you are going to be away for a significant length of time you will need to make suitable arrangements to have your INR checked and warfarin dosed at a local clinic or hospital

Here are some things to consider when travelling by aircraft:

- Contact the LVAD team to request a 'fit to fly' letter to present to the airline and airport security
- Complete the airline's Medical Information Form (MEDIF) which confirms that you are fit enough to fly. You need to complete part of the form, then ask your LVAD doctor to complete another part (please allow sufficient time for this process as we cannot always fulfil urgent requests)
- Inform your airline that you have special healthcare needs when you book. Explain that you need to take life-sustaining equipment into the aircraft cabin (the airline should allow you extra baggage allowance for this)
- Inform the departure and arrival airports that you have special healthcare needs so they can arrange for you to have assisted priority boarding and disembarkation
- You must avoid the electronic security equipment as this may interfere with the LVAD. You should be hand screened at security, advising them to take extra care when inspecting around your driveline exit site
- All of your LVAD equipment (battery charger, power module, spare emergency equipment and batteries) must be taken into the aircraft cabin with you and stowed near you. Do not allow your equipment to be separated from you and it should not be placed in the hold of the aircraft
- Wear compression stockings (flight-socks) throughout your journey. Exercise your feet regularly whilst seated and get up from your seat frequently to stretch and exercise your legs to prevent deep vein thrombosis

24. Future heart transplant assessment

The National Health Service only funds LVADs in the UK as a bridge-to-transplantation and this is the intended strategy for your device. Around six months post-discharge from hospital following your LVAD implant surgery we will invite you to undergo the heart transplant assessment process again. This will involve a three-night in-patient stay at QEHB and you will have a series of tests that will include:

- Right heart catheterisation
- Echocardiogram (Echo)
- Computerised tomography scan (CT scan)
- Electrocardiogram (ECG)
- Chest X-ray
- Cardio-pulmonary exercise tolerance test (CPEX)
- Abdominal ultra-sound scan
- Blood tests

We will also arrange a counselling session to explain the heart transplantation process and the potential implications for you and your family. Before going home you will be told the outcome of these tests and the decision of the multi-disciplinary team on your suitability for heart transplantation.

There are three different levels of waiting list for heart transplantation in the UK, each with a different level of urgency. These levels are listed here in ascending order of urgency:

1. **Conventional** (patients waiting at home: treated with oral medication and/or LVAD);
2. **Urgent** (patients waiting in hospital: dependant on intravenous drug therapy or with a serious LVAD complication);
3. **Super-Urgent** (patients being treated in the critical care unit on external mechanical circulatory support).

Having an LVAD does not guarantee that you will become a suitable candidate for heart transplantation, but if you meet the listing criteria you will usually be placed on the national 'conventional' heart transplant waiting list. It is worth noting that due to the lack of donor organs, whilst not impossible, it is unlikely that you would receive a heart transplant from the 'conventional' waiting list whilst you are well and supported by the LVAD. If you were to have a serious complication that could not be rectified by changing the LVAD pump, then you could possibly be considered for listing on the 'Urgent' or 'Super-Urgent' heart transplant waiting list, depending of the severity of your condition.

Unfortunately, the QEHB Heart Transplant team cannot give any guarantee that transplantation will occur and cannot give any indication of how long you may wait for a suitable donor organ to become available.

If you are not sure whether you want a heart transplant it is worth going through the assessment process as it gives you a thorough medical review and plenty of information on which to make an informed decision about heart transplantation. Please be assured that you will not be pressurised into going onto the heart transplant waiting list if you feel that transplantation is not for you.

25. Safety checklists

The below table gives an overview of the minimum routine checks and maintenance required to maintain the safety of your LVAD equipment. It is important that you also refer to the comprehensive safety checklists in the official HeartMate 3 Patient Handbook.

Daily:	Daytime: • Perform system controller self-test • Ensure driveline is securely connected to system controller: the locking gate should be closed so that the red button is not visible • Ensure driveline in-line connector is secure: with locking nut in the locked position and no yellow indicator visible • Inspect all equipment, cables and connector pins for any signs of damage or wear • Inspect the bag you carry your system controller and batteries in for signs of damage or wear • Manage driveline exit site dressing in accordance with hospital instructions Preparing to sleep at night: • Ensure driveline is securely connected at system controller and in-line connector (as above) • Ensure you are connected to mains power electricity via the power unit • Have a working torch, two fully-charged batteries (with battery clips) and the spare system controller by your bedside in case of a power outage or fault during the night
Weekly:	• Perform a self-test on the power unit • Review recognition and appropriate response to all battery, advisory and hazard alarms to refresh your memory • Review instructions on how to replace the system controller in an emergency • Ensure battery charger and power unit are clean and dust free
Monthly:	• Check expiry date on batteries. If a battery was manufactured more than three years ago, the battery has expired and you should request a replacement from LVAD team • Check the number of use/charge cycles for each battery. Insert battery into charger pocket and press corresponding pocket number button twice. Any battery exceeding 360 cycles should be replaced, e.g. 1 = 361 (pocket one, battery 361 charge cycles) • Clean the metal battery contacts on the batteries and battery clips using a cotton swab or lint-free cloth that has moistened (not dripping) with alcohol. Allow to dry before re-use
Six Monthly:	• Charge the spare system controller and perform a self-test (HM3 Handbook, page 2.38 – 2.39) • Replace the three AA batteries in the base of the power unit (HM3 Handbook, pages 3.9 – 3.10)
Yearly:	• Inspection and servicing of the power unit and battery charger by an engineer. The LVAD team will advise you when to bring your equipment in for servicing

Please use the space below to write down any questions you may have and bring this with you to your next appointment.

Images used in this patient information booklet are courtesy @Abbott

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If you require this information in another format, such as a different language, large print, braille or audio version please ask a member of staff or email **patientexperience@uhb.nhs.uk**.

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