Network Guidance

Guidelines for Exercising Ventricular Assist Device (VAD) Patients in Cardiac Rehabilitation Programmes

Introduction

The intention of this guidance is to inform professionals working in cardiac rehabilitation regarding appropriate exercise of VAD patients. The aim is to standardise the approach taken, ensuring equality as well as safe and effective delivery of rehabilitation programmes for VAD patients, across the North of England Cardiovascular Network.

Despite the absence of large scale trials within the literature, several academic articles note the positive impact that cardiac rehabilitation has in providing muscular strength, aerobic capacity, nutrition, weight loss, lipid management and smoking cessation with this group. Support gained from meeting other patients with cardiovascular disease is unquestionable. 1, 2

The Department of Health Cardiac Rehabilitation Commissioning Pack 2010 recognises that key patient populations should have access to Cardiac Rehabilitation, including specialised interventions such as ventricular assist devices. 3

Background

It is estimated that there are 750,000 people with heart failure in the UK today. With life expectancy increasing, the treatment of heart failure becoming more advanced and secondary prevention, the incidence of chronic heart failure (CHF) is increasing. There is a 60% mortality rate 5 years after diagnosis of heart failure. 4

Medical management of heart failure is limited and ultimately heart transplant is curative therapy. With a decline in the number of donor hearts, other treatment options have been identified and researched. The use of ventricular assist devices as a ‘bridge to transplant’ has increased, resulting in a significant improvement in quality of life and survival rates amongst heart failure patients.

The benefits of VADs pre-transplant have been observed post transplant, in comparison to patients managed medically. VAD implantation can improve cardiovascular status and overall muscle strength, dependent upon pump settings, allowing optimisation prior to transplantation.
The REMATCH trial demonstrated an 81% improvement with a VAD in two year survival rate, in comparison to optimum medical management. The clinical evidence for myocardial recovery post VAD implantation is limited. However by offloading the heart, recovery may occur. Research is currently being conducted into pharmacologic management of VAD patients with a view to improving myocardial function.

There are a wide range of devices available including total artificial hearts and right or left ventricular assist devices. Over the last two decades the initial pulsatile volume displacement pumps have evolved into to the second generation rotary blood devices. These rotary continuous flow non-pulsatile pumps are smaller, more reliable and durable, less noisy and only have one moving part within the pump, the impeller or concentric cones.

The use of the HVAD (HeartWare left ventricular assist device) to treat congestive heart failure has significantly increased within Freeman Hospital over the last 2 years. There are currently 47 patients with ventricular assist devices and 35 of them are living at home.

Clinical Considerations

It has been established that various exercise tests including VO2max, modified Bruce, Naughton, modified Naughton and the modified Wassermann ramp protocol have been safely performed. All of these can be used to give an indication of the patient’s anaerobic threshold and therefore their exercise capacity. Patients must be able to walk on a treadmill or cycle an exercise bike in order to complete these tests. It is therefore presumed that the tests cannot be conducted until independent mobility is achieved, which in most cases will be sometime post VAD implantation. At the Freeman Hospital VO2 max testing is conducted 3 months post operatively.

Prior to this, the major obstacle to exercising patients with continuous flow non-pulsatile pumps was the inability to measure accurate heart rate, BP and SaO2 non-invasively. This is not a contraindication to exercise. Prescription of exercise is based upon shortness of breath (SOB), use of the modified BORG scale, symptom reporting and peripheral muscle fatigue. Objectively, VAD flows should be observed and documented prior to, during and post exercise. However the flow is not a direct indicator of exercise capacity. The VAD will have a set rpm (revolutions per minute) and so cardiac output will be limited dependant upon underlying cardiac function. The patients exercise capacity may be restricted by this, if cardiac function is absent, in addition to their physical status prior to VAD implantation.

Assessment

Review of VAD settings involves confirming the patient’s understanding of device settings and where required, verification of these with the implanting service staff. Knowledge of settings are important for informing physical activity and exercise assessment, advice and interventions.

It is recommended that the patient’s carer should be present at the initial assessment where change of controller and battery will be discussed. Next of Kin contact information should be obtained in case of an emergency.
Objective assessment will include:

- Incremental shuttle walk test or 6 minute walk test - this will be limited by RPM set on VAD device. Note: SOB.
- Modified Borg Scale of Exertion CR10
- Waist Circumference / hip to thigh ratio

Please note no alteration to medication is allowed, this can only be done by VAD clinicians at the tertiary centre.

Cardiac rehabilitation staff need to document flows and observe trends. Patients are discharged with a VAD flow log book and should be brought to every Rehabilitation session. Low flow necessitates increasing oral intake of fluids and exercise should not be performed.

If the controller has alarmed or alarms high watts the patient should be referred straight to the Freeman Hospital.

As stated in the Association of Chartered Physiotherapists in Cardiac Rehabilitation (ACPICR) Guidelines (2009), patients should be assessed and exercised on an individual basis.

Contraindications / Cautions to Exercise

The following are based on a single study for patients approximately 4-6 weeks post implantation and therefore clinical judgement is paramount.

- Onset of Angina
- Drop in VAD flow<3L/min or more than 2L below baseline pre-exercise
- 0-10 RPE rating of >4 at sub maximal workloads
- Patient reporting exercise intolerance/dizziness/SOBAR
- Controller alarming
- New onset of neurological changes
- Evidence of bleeding

Complications:

- Infection - primarily observed at the drive line site. Patients with evidence of infection should not be exercised
- Thrombus - usually evidenced by an increase in the number of watts
- Bleeding
- Controller malfunction

It is anticipated that the majority of patients will be independently mobile before discharge from Freeman Hospital. All VAD patients will receive a patient information booklet before going home. A section of this booklet is dedicated to exercise and the continuation of this once discharged from the hospital. A summary of the patient's treatment whilst an inpatient will be documented and goals to be achieved agreed. An exercise diary is included to assist the patient in documenting their levels of activity. It also acts as a guide for other professionals exercising these patients.
At 3 months patients return for VO2 max testing and right heart catheters. This information should be made available to cardiac rehabilitation staff in order to guide exercise prescription. All VAD patients will be referred to cardiac rehabilitation services on discharge.

**Cardiac Rehabilitation Setting and Programme Type**

The setting of the cardiac rehabilitation - community or district general hospital and the programme type - Phase III or Heart Failure are all suitable for the inclusion of VAD patients and there is no preferred model.

It is important that the programme is tailored appropriately and exercise is individualised to meet the patient’s needs.

The following information is to be used as a guide to exercising VAD patients within cardiac rehabilitation programmes.

**How to Exercise**

Patients should have attended gym sessions prior to discharge from Freeman Hospital and have individual exercise programme. This needs to be reviewed and progressed as appropriate.

Gym sessions will generally include a warm up and cool down with conditioning and endurance exercises in between. Examples of suitable exercises include:

- Treadmill (increase incline, not speed)
- Static bike
- Step ups
- Sit to stand
- Mini squats
- Heel raises
- Hamstring curls in standing position
- Leg press
- Quads bench
- Bicep curls
- Core stability

Stopping CV exercise abruptly and standing statically may cause a drop in device flow, and result in the need for lower limb pump.

As stated in the ACPICR Guidelines (2009) VAD patients have been safely and effectively exercised on a treadmill for 20-30 minutes.

**Exercise don’ts include:**

- No running on treadmill
- No trampette
- No rowing machine
- No cross trainer
- No abdominals
- No bilateral arms above head with weights or abduction with weights
- No swimming
All of the above may exert tortion on the drive line increasing the risk of infection.

At each session please ensure that the patient has a spare battery, spare controller and dongle (alarm silencer) with them.

Relaxation and health education can be locally defined.

**Staff Training**

A member of each cardiac rehabilitation team should attend in depth training delivered by the Freeman Hospital. This information should then be cascaded to the relevant professionals within the locality area.

It is also recommended that a member of the rehabilitation team accepting the VAD patient should attend the hand over meeting held with the patient, their GP and the district nurse on discharge from hospital. This is an ideal opportunity to ask questions and seek advice directly from VAD practitioners.

**Further Information**

- Living with your VAD - a New Start Patient Information
- Guidelines for Exercising VAD Patients Post Operatively in Hospital (Hard copies should be available to access within locality teams).

For ventricular assist device advice, please contact VAD Practitioners and Co-ordinators at Freeman Hospital on: 0191 213 7037 or 0191 213 7038

**References**


3. Strategic Commissioning Development Unit, Department of Health, Cardiac Rehabilitation Commissioning Pack, 15 October 2010


5. ACPICR Standards for Physical Activity and Exercise in the Cardiac Population (2009), London: Chartered Society of Physiotherapy
Bibliography

Ventricular Assist Devices - the challenges of outpatient management Wilson SR et al 2009 in the Journal of the American College of Cardiology Vol 54, no. 18 pp 1647

Benefits of physical training on exercise capacity, inspiratory muscle function, and quality of life in patients with ventricular assist devices long-term post implantation S European Journal of Cardiovascular Prevention & Rehabilitation 2011; 18:33

Acknowledgements

The North of England Cardiovascular Network would like to thank the following people for contributing to the development of these Guidelines:

Alex Gatehouse, Senior Physiotherapist in Cardiorespiratory, Freeman Hospital

Dr Christine Baker, Consultant Clinical Psychologist, RVI

Dave Ferguson, Cardiovascular Disease Community Nurse, Darlington PCT

Esther Carr, Deputy Manager / Senior Physiotherapist, James Cook University Hospital

Ian Storer, Cardiology Primary Specialist Nurse Care, SOTW NHS Community Services

Jane Davenport, Senior One Physiotherapist Cardiac Rehab Exercise Programme, Darlington Memorial Hospital

Joy McCulloch, Lead CR / CHD Specialist Nurse, County Durham & Darlington Foundation Trust

Karen Reid, Cardiovascular Clinical Team Lead, County Durham & Darlington Foundation Trust

Lillian Henderson, Cardiac Specialist Nurse, RVI

Linda Llewellyn, Cardiac Rehabilitation Co-ordinator, Freeman Hospital

Liz Flynn, Senior Physiotherapist, RVI

Nicola Robinson, VAD Nurse Practitioner, Freeman Hospital

Peter Linstead, Cardiac Exercise Professional, County Durham PCT - Easington locality

Tim Maguire, Service Improvement Manager (Heart Failure Lead), NECVN

Vicci McGurk, Service Improvement Manager (Cardiac Rehabilitation Lead), NECVN

Copyright

Please acknowledge the North of England Cardiovascular Network as the source of the material if you wish to reproduce this guidance in full or part.

Review Date: April 2012
Flow Chart for Changing Heartware Controller

1. Lie patient down in safe place

2. RED Triangle Alarm, continuous VAD alarm sounding. VAD stopped on controller panel

3. Obtain new controller, battery and dongle

4. Connect a battery to the new controller

5. Pull back grey driveline cover on failed controller

6. Pull metal driveline connector out of failed controller (DO NOT TWIST)

7. Align the red dot on the driveline connector to the red dot on the new controller and push into place

8. Connect a second power source to the new controller, the new controller should show no alarms and work

9. Insert the dongle into the failed controller, THEN remove the battery or mains cable (all power sources)

10. If the patient or relative is on the telephone ask them to send the failed controller back to the VAD team.

   A replacement controller will be sent out by the VAD team
Heartware Resuscitation

Patient NOT responsive to pain AND Capillary refill >3 sec = inadequate perfusion
Patient may not have palpable pulse or measurable blood pressure even when the pump is providing adequate circulation. Pulse oximetry may not be reliable

Is Pump operating?
1. Check controller screens for alarms
2. Auscultate left upper abdomen quadrant: continuous whirring sound indicates pump is operating

No
Controller Alarming
“No pump”
“Pump stopped”

Disconnect pump
Remove pump lead from controller socket
Commence CPR

Yes
ECG
Treat rhythms as standard per procedure

Asystole or non cardiovertable rhythm
VT, VF or Cardiovertable rhythm
Stable rhythm

1. Ensure controller is on battery power only
2. DEFIBRILLATE

1. Disconnect pump
2. Continue defibrillation

1. Give fluid load (up to CVP 11)
2. Treat for cardiogenic shock as per standard procedure

If feasible transport the patient to Freeman Hospital for theatre