# GUIDELINES FOR NOCTURNAL HAEMODIALYSIS

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**Directorate & Speciality**
Cancer and Associated Specialties  
Renal & Transplant

**Date of submission**
March 2014

**Explicit definition of patient group to which it applies (e.g. inclusion and exclusion criteria, diagnosis)**
Home patients under the care of the Nottingham Renal and Transplant Unit undertaking nocturnal (overnight) haemodialysis

**Version**
2

**If this version supersedes another clinical guideline please be explicit about which guideline it replaces including version number.**
Replaces March 2010 version.

**Statement of the evidence base of the guideline – has the guideline been peer reviewed by colleagues?**
Evidence level 5 and 6

**Evidence base: (1-6)**

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<tr>
<td>1</td>
<td>NICE Guidance, Royal College Guideline, SIGN (please state which source).</td>
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<tr>
<td>2a</td>
<td>meta analysis of randomised controlled trials</td>
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<td>2b</td>
<td>at least one randomised controlled trial</td>
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<td>3a</td>
<td>at least one well-designed controlled study without randomisation</td>
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<td>well –designed non-experimental descriptive studies (ie comparative / correlation and case studies)</td>
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**Consultation Process**
These guidelines were developed in conjunction with medical and nursing staff within the renal unit. They have been ratified at the Renal Unit Senior Staff Meeting.

**Ratified by:**
Renal Unit Senior Staff Meeting

**Date:**
August 2014
Renal Guidelines for Nocturnal Haemodialysis

Target audience
These guidelines will be disseminated to all Ward Managers, Nursing and Medical staff within the Renal Unit and will be available on the renal intranet.

Review Date: (to be applied by the Integrated Governance Team) A review date of 5 years will be applied by the Trust. Directorates can choose to apply a shorter review date; however this must be managed through Directorate Governance processes.

September 2019

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This guideline has been registered with the trust. However, clinical guidelines are guidelines only. The interpretation and application of clinical guidelines will remain the responsibility of the individual clinician. If in doubt contact a senior colleague or expert. Caution is advised when using guidelines after the review date.

To be used in conjunction with the following guidelines:

- Guidelines for the Insertion and Removal of Fistula/Graft Needles
- Guidelines for Performing Haemodialysis in Established Renal Failure
- Guidelines for Prevention of Blood Borne Viruses in Dialysis Patients
- Guidelines for Anticoagulation of Extracorporeal circuits

Purpose of guideline
To enable patients to undertake nocturnal home haemodialysis.

Evidence base of policy
These guidelines have been derived following a review of the literature and discussions with other renal units that have successfully implemented a nocturnal home haemodialysis programme both within the UK and internationally.

Audit Plans
Proportion of home haemodialysis patients undertaking nocturnal haemodialysis; patient satisfaction in patients undergoing home haemodialysis; number of patient safety incidents for patient undertaking nocturnal haemodialysis; proportion of patients achieving renal association standards for dialysis.

Renal Guidelines for Nocturnal Haemodialysis
Introduction

Nocturnal Home Haemodialysis (NHHD) is an alternative to conventional three times a week dialysis. It is performed by patients in their own homes during the night whilst they sleep. NICE guidelines (2002) recommend that all suitable patients should be offered the choice between home haemodialysis or haemodialysis in a hospital/ satellite unit. Home haemodialysis generally gives patients an improved quality of life, more flexibility over their dialysis regime and is cost effective compared to satellite unit dialysis. Nocturnal dialysis is a form of home haemodialysis that allows patients to have their day free which may encourage more patients to choose this option. Instead of the usual four hour dialysis session three times per week patients dialyse for approximately 8 hours, four to six nights per week (consider reducing to 4 or 5 nights per week if low body mass – 4 nights <50kg, 5 nights 50-70kg) at a slower pump speed. This allows for more gentle removal of fluid and waste products and much less restriction of fluid and diet. The increased removal of fluid and middle weight molecules results in discontinuation of phosphate binders and antihypertensive treatment is usually reduced or stopped with associated cost savings. Studies report much fewer adverse effects of dialysis and a greatly increased quality of life. Long slow dialysis has cardiovascular benefits with small scale studies indicating improved blood pressure, reduced peripheral resistance and decreased left ventricular mass. Patients also report increased energy levels, improved appetite and daytime cognitive functioning.

Ideally patients should have someone in the home with them whilst they are undergoing nocturnal dialysis but this is not always possible. Patients wishing to have nocturnal dialysis who live alone should be assessed for suitability on an individual basis. Well motivated and carefully selected patients who are able to complete training and competency assessments will be able to carry out nocturnal dialysis if they live alone. There is experience in other UK renal units (e.g. Guys hospital) of “solo” nocturnal dialysis.

The following notes are intended to be a helpful guide for use by nurses and/ or doctors when a patient is being commenced on nightly nocturnal dialysis training.

Aim: The Trust is committed to managing and ensuring effective and safe practice in the care of patients with renal failure. This guide applies to all individuals employed by the Trust including nursing, medical and allied healthcare professionals involved with the delivery of care to renal patients at the Nottingham University Hospitals NHS Trust.

“It is the responsibility of staff at all levels to ensure that they are working to the most up to date and relevant procedural documents. By doing so the quality of services will be maintained and the risk of staff making erroneous decisions which may affect the patient, staff or visitor safety or give rise to complaint or concern will be reduced”.

Identification of patients for home haemodialysis

Pre Dialysis Patients

Patients should receive information and counselling on treatment options prior to reaching established renal failure. This encourages patients to make informed decisions about their own treatment and allows timely creation of access, reducing the infection risks associated with late access creation. This information should include the choices available in the delivery of haemodialysis including the options of home, or satellite unit/hospital dialysis and the possibilities of short daily haemodialysis or long slow nocturnal haemodialysis if home HD is considered. The benefits and disadvantages of each therapy should be discussed to enable the patient to make an informed choice.
Those patients who express an interest in home haemodialysis should then be assessed by the Nephrologist and the Home Therapies Team for their suitability for home haemodialysis prior to the commencement of renal replacement therapy to enable them to commence training in a timely manner. Patient education during this period should include discussions about the benefits of more frequent dialysis and the options available for home HD patients to adapt their dialysis to their lifestyle. Patients should be made aware that the adaptation necessary to their house will be dependent upon whether they choose conventional (or short daily) dialysis or nocturnal dialysis and this cannot easily be altered after the adaptations have been made to accommodate the dialysis machine. If the patient is considering nocturnal dialysis the machine will need to be plumbed into the bedroom. The Renal Technicians will assess the home and make the necessary arrangements and adaptations prior to the patient commencing home haemodialysis.

Patients that have made a clear decision to commence home haemodialysis should receive training from their first dialysis session (where possible). The pre-dialysis team will inform the haemodialysis manager and the home training team that the patient needs to start haemodialysis and requires dialysis slots in the home training bay. All staff caring for the patient once haemodialysis is commenced should be aware of the patient’s therapy choice so that they can support them in home training, for example, early encouragement of self-needling and buttonhole technique and patient involvement in setting up their machine.

Ideally patients will have a dialysis partner (someone else in the home at the time of dialysis to help in case of emergency) but it is recognised that this is not always possible. Patients wishing to dialyse at home alone should not be excluded from the nocturnal home dialysis programme. Patients should be assessed on an individual basis, having demonstrated their competence, motivation and desire to dialyse at home.

**Home Haemodialysis Training**

Home Haemodialysis training will be provided in the home training area of the main dialysis unit. Both the patient and their dialysis partner are trained over a period of approximately 2-4 months. The patient is encouraged to be independent with regards to their dialysis therapy with the partner available for support if they become unwell. If the patient has expressed a preference for nocturnal haemodialysis they should be supplied with a machine with a double pump module to enable single needle dialysis at a later stage. Consideration should be given to training the patient to do button hole needling technique (see Buttonhole guidelines). Patients with a central venous catheter can be considered for home dialysis and nocturnal dialysis. Patients with arteriovenous grafts in the leg are suitable for nocturnal dialysis and home haemodialysis. Patients will be trained in all aspects of dialysis including administration of erythropoiesis stimulating agents and enoxaparin/heparin, and procedure for taking blood. A competency package will be completed and signed off prior to transfer home. IV iron is given by the home therapies nurses once the patient has gone home (to comply with MHRA advice).

**Nocturnal Haemodialysis Training**

Once the patient has been established on home haemodialysis therapy and has dialysed at home successfully for approximately three months they can be considered for nocturnal haemodialysis training. This period allows the patient and the dialysis partner to develop their skills and confidence during the day when they will be more alert and advice is easier to access. The patient will be referred to Nottingham City Hospital for training dates. Training will consist of single needle haemodialysis training if an AV fistula or graft is used for haemodialysis access. Patients with central venous catheters will be trained in the use of safety mechanisms to reduce the risk of disconnection. Training will also include securement of blood lines and needles and the use of a blood leak detector (see appendix 1). Patients will also be trained in the use of a heparin infusion on dialysis.
Prior to issuing training dates the home training team inform with the home therapies team who will liaise with the Renal Technicians and Renal Supplies department to ensure stocks of equipment are ordered (including dressings, connectors and bandages) and to arrange for the patients machine to be adapted for long slow dialysis (this involves reducing the dialysate flow setting to 300mL/min).

The patient (and their partner) will need to attend each of the training sessions. The minimum number of sessions will be 2 long daytime (8 hours) dialysis sessions in hospital followed by 1 long daytime dialysis session at home. Training in single needle dialysis (if required) and heparin administration will take place prior to the long training sessions during standard home dialysis training. This will usually take 1-2 weeks. Patients will need instruction in needling with single needle, securing of the lines and the use of single needle/ double pump dialysis (not for CVC). They will need to know how to deal with common problems and how to obtain advice. The 8 hour dialysis sessions will require with pre dialysis and post dialysis Renal Profile blood tests.

For securement of all types of access used for nocturnal home HD see Appendices1-6

**Needling**

Single needle dialysis is used for nocturnal dialysis in the majority of cases as an added safety measure. Single needles reduce the likelihood of excessive blood loss if the needle becomes dislodged as this will affect the arterial flow into the needle and will trigger machine alarms. Venous needle dislodgement in double needle dialysis will not reliably trigger machine alarms. The patient will be informed of the different types of needling techniques and consideration given to the suitability of the buttonhole needling technique. Instruction in this technique will be given if required. Once the needle tract is formed at buttonhole sites blunt needles can be used as they reduce pain and possible trauma to the site.

In carefully selected patients conventional 2 needle dialysis can be used for nocturnal haemodialysis. The following groups of patients are NOT suitable for 2 needle nocturnal dialysis:

- Patients with arteriovenous grafts in the lower limb
- Patients who live alone and are dialysing without a dialysis partner/carer present

Double needle nocturnal dialysis may be considered in patients dialysing using machines that cannot facilitate single needle dialysis (eg NxStage), patients with well-functioning AV fistulas who would benefit from improved clearance and patients who prefer the option of 2 needle dialysis. The risks and benefits should be discussed with the patients by their home haemodialysis nurse and consultant.

For 2 needle dialysis the machine should be set to allow the limits of the venous pressure alarm window to be asymmetrical so that a relatively small pressure drop is detected without nuisance alarms being set off when the venous pressure rises slightly during patient movement. The lower setting should typically be -20mmHg lower than the actual value and +70mmHg above the upper limit.

The policy for securing the needles must be strictly adhered to on all needling techniques whether single- needle or two needles.

Additional security is provided for all patients (single or double needle) in the form of a Redsense blood loss detector. Patients with central venous catheters will use a Haemodialert. Please refer below to application of blood loss detectors.
Blood pump speed for patients using two needles should be 150-200ml/min and for single needle should be 300-400ml/min. Dialysate flow should be set at 300mls/min for all patients.

**Dialysis prescription**

The patient should initially continue to use the same dialyser as prior to nocturnal dialysis although this should be reviewed regularly following commencement of long slow dialysis. The machine should be adapted to 300ml/min dialysate flows to ensure the 5 litre dialysate container will be sufficient for the whole dialysis and reduce the intensity of the dialysis. (A 5 litre container should be sufficient for 9.5 hours at this flow rate). A standard Biobag should be sufficient but some patients may need a large Biobag. Some patients dialysing using a fistula should have a single needle double pump dialysis; their dialysis machine will require a double pump module to enable this. The blood flow rate should be slowed to reduce the intensity of the dialysis; this should be 150-200mls/hour for 2 needle dialysis or 300-400ml/min for single needle dialysis. The flow rate may need to be higher to prevent venous pressure alarms.

For patients dialysing via a central venous catheter the blood flow should be set at 200ml/min.

The standard prescription should be 8 hours dialysis 5-6 times weekly but this may need to be reduced for very small patients by reducing the frequency of dialysis sessions. (If reduction of dialysis adequacy is required and blood flow cannot be reduced sufficiently consideration can be given to reducing dialyser size or reducing time, although this may disturb the patients sleep).

**Excessive Ultrafiltration rates**

Patients should ensure that the ultrafiltration rate prescribed is doubled checked to ensure that excessive fluid loss is not entered. The machine default will be set to maximum ultrafiltration of 1000ml/hour but this will not prevent excessive ultrafiltration over an 8 hour treatment.

Patients should use standard dialysate concentrate but this may need adjusting with increase in potassium depending on blood monitoring.

The patient should initially use the same heparin dose as previously if on unfractionated heparin. If the patient is receiving low molecular weight heparin consideration should be given to conversion to unfractionated heparin because the LMWH may not give sufficient anticoagulation for an eight hour period. If the patient chooses to stay on low molecular heparin they are likely to need a 2nd dose after 4 hours.

The patient’s dialysis prescription must be prepared by a Consultant Nephrologist from the home training team and reviewed daily during their training. Any alterations must be communicated to renal supplies at NUH to ensure the correct stocks are supplied for the patient.

**Blood Monitoring**

Prior to commencing dialysis the patient should have mineral levels checked for:

- Magnesium, Copper, Zinc, Aluminum, Selenium, Albumin (please inform the renal dietitian and provide the patient with a food diary 1 week prior taking these blood tests).

Following commencement on nocturnal dialysis these should be checked annually.

In addition a full renal profile (Urea & Electrolytes, bicarbonate, bone), LFT’s, FBC, B12, Folate, Ferritin, PTH should be checked.
During the first week a full renal profile should be taken pre dialysis & U&E, serum calcium and phosphate taken post dialysis. Blood sampling post dialysis should ensure no recirculation from the single needle effects the result. Ideally check bloods 1 hour post dialysis to reduce the effect of rebound. After the first week these bloods can be taken weekly for the first month and then reduced to monthly when clinically indicated. The lead consultant for home haemodialysis will review the bloods results promptly and make necessary changes. These will include advising the patient when dietary and fluid restrictions can be relaxed or stopped, changing the dialysate potassium, and when phosphate binders or antihypertensives need reducing or stopping and supplements commenced.

**PHOSPHATE** The post dialysis phosphate should not be below 0.4mmols/L and ideally not below 0.8mmols. If below this the dialysis prescription and patient’s diet will be reviewed.

**POTASSIUM** The post dialysis potassium should be greater than 3mmol/l. Low potassium can be addressed either by relaxing dietary restrictions or using 3mmol/l potassium dialysis concentrate.

**Medication**

Studies indicate that phosphate binders are unlikely to be required by patients having daily dialysis and antihypertensives are often reduced or discontinued. Most patients will require phosphate and potassium supplementation. All patients should receive renal multivitamins (Renavit) and may require the dose increasing. Folic acid supplementation may also be required. The IV iron requirement should be closely monitored as this may increase following conversion to daily nocturnal dialysis.

**Redsense blood loss detector**

**FOR USE WITH ARTERIOVENOUS FISTULAS OR GRAFTS.** The Redsense© monitor should be provided by Nottingham University Hospitals for the patient prior to training. The patient will be shown how to use the Redsense© blood loss detector and how to overcome common problems. The blood loss detector is attached to patients clothing in the most comfortable position and will alarm if any blood is sensed from the needle site. This can be problematic for patients whose fistula often bleeds a small amount on insertion and they must be encouraged to clean all blood from site before applying monitor to prevent false alarms.

**Completion of training**

Patients should be supplied with necessary medication including vitamin supplementation and IV iron if required prior to returning home for dialysis. They should have sufficient dressings, Tubifast and Redsense blood sensors for the first two weeks dialysis and should be provided with their own Redsense© monitor/HEMOdialert blood loss detector, Rotoclix, and Tego needleless connectors. Nurses must check that the correct dialysis supplies have been delivered and that the patient is aware of their dialysis prescription and any changes made. The patient and nurse should complete the training check list and a copy placed in the patient’s notes.

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**Equipment needed to reduce the risk of bloodline disconnection and subsequent exsanguination from blood loss when dialysing via a central venous catheter**

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<th>Equipment</th>
<th>Description</th>
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<tr>
<td>Tegaderm I.V. dressing</td>
<td>changed every 7 days</td>
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<tr>
<td>HEMOdialert blood loss detector and sensor pad</td>
<td>To be provided for each patient on an individual basis. Sensors last up to 6 months (test every use)</td>
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<tr>
<td>Tego connectors</td>
<td>One to be attached to each lumen to be changed after 28 activations or</td>
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Problem solving

Patients should be confident in overcoming common problems during dialysis and know how to obtain advice or support if required once they return home. They should be reassured that they will be sufficiently well dialysed that if problems occur they can discontinue dialysis and discuss problems the next day if there are machine related problems or non urgent medical problems. They should be supplied with contact details for the renal technicians, the main Dialysis Unit, the renal services community team and have access to 24 hour advice from Carrel Ward. An advice sheet is available on the ward to assist nurses who are contacted during the night and they can contact the on call SpR or on call consultant Nephrologist for emergency advice.

Numbers for advice

Carrel Ward City Hospital Campus 0115 9691169 Ext 56301 or 55052 (for 24 hour emergency medical and nursing advice).
Renal technicians via Nottingham City Hospital switchboard 0115 9691169
Renal Service Home Therapies Team 0115 9627705, (8am – 4pm only)

References / Bibliography


Mahadevan, K; Pellicano, R; Reid, A et al, (2006) Comparison of biochemical, haematological and volume parameters in two treatment schedules of nocturnal home haemodialysis. Nephrology. 11(5) pp413-418


Appendix 1.

**Securing technique for a single needle inserted in an arteriovenous fistula arm for nocturnal haemodialysis.**

The patient is instructed how to secure the needle and dialysis lines. The needle should be secured in place using Transpore White tape.

First a long strip of 2.5cm wide tape is placed over the over the needle. This secures the needle in place.

A Redsense© blood loss sensor with fibre optic technology embedded into a sensor patch is attached with the pipette placed as close as possible to the needle exit point on the skin and attached to an alarm unit The Redsense blood loss detector cable is also secured using Transpore white tape.

A piece of tape 1.25cm wide is then wrapped around needle lumen ‘chevron’ style and securely attached to the arm ensuring at all times that the Redsense blood loss sensor patch is not overlapped with tape.

A final piece of tape, 2.5cm wide, is used over the chevron to hold it in place and again with no overlap onto the Redsense sensor.

Once blood lines are connected to the needle lumen, tape will be taped around the leurs lock at blood line and needle lumen connections.

Bloodlines are then looped loosely attached to the arm up to the shoulder and secured using tape at several points on the arm.

Tubifast© (2 way stretch) tubular bandage is used over the bloodlines and needle holding all securely to the fistula arm to retain lines and needle (See appendix 1 for detail pictures of securement).

- If using the HEMOdialert the sensor pad is placed as per instructions (Appendix 3).

- A Park line clip is used to secure the bloodlines in place to the Tubifast.

- The bloodline clamps are left outside the Tubifast for access to the clamps.

Education and competencies to be completed with regard single needle haemodialysis, securing the bloodlines, placement/testing of the Redsense blood loss detector and securement of the blood lines to the patient.
Appendix 2. Securement of a Single arteriovenous fistula needle for Nocturnal Haemodialysis and placement of the Redsense® blood loss detector at needle exit point.

1) Single AVF needle inserted and secure with Transpore white tape®.

2) Pipette of the Redsense® blood loss detector

3) Place Redsense sensor pipette over exit point of AVF single needle and secure

4) Redsense sensor patch and Tape must not overlap at any point.
5) Tape the Redsense blood loss detector cable in place for added securement.

6) After dialysis machine checks completed connect the bloodlines to the single arteriovenous needle. Using tape secure the connections between the needle and the bloodlines.

7) Ensure that the bloodlines are completely secured to the patient’s limb at several points along the fistula arm using Transpore White tape.

8) Cover with Tubigrip ensuring that the Tubigrip is the correct size i.e. not too tight or too loose.

9) The bloodline clamps should be outside the Tubigrip to allow for patient access to the clamps. Redsense blood loss monitor must be turned on and attached to patients clothing before commencing dialysis. Bloodlines to be secured with either a Park line clip or Roto clix to patient’s nightwear.
Appendix 3. Method for securing bloodlines attached to a Central Venous Dialysis perm catheter for Nocturnal Haemodialysis.

- Tegaderm I.V. code 1635 dressing to be applied over exit site of tunneled haemodialysis catheter and changed every 7 days.

- Tego needleless caps should be attached to both lumens of the central venous catheter and changed after every 4th dialysis session or after 28 activations. The Tego should be secured using ‘First aid tape’ at the connection point between the Tego and the catheter lumens.

- Patient should wear a low necked close fitting T shirt or vest (for privacy and dignity) in order that Rotoclix® may be attached to the T shirt and then to the bloodlines and the CVC lumen to reduce the risk of disconnection overnight. (see picture appendix 3)

- The HEMOdialert should be tested as per the manufacturer’s instructions and fastened to the patient’s clothing.

- The patient or carer should commence dialysis according to the guideline for commencement of haemodialysis using a central venous catheter.

- The HEMOdialert sensor should be taped into position underneath the connection point between the haemodialysis catheter and bloodlines. The lines should be placed on top of the sensor and secured in place with tape.

- The Rotoclix® clips should be attached as shown in the photograph (appendix 3) to secure the bloodlines.

At all times the bloodlines should be above the blankets. This is to ensure that should the venous line become disconnected the risk of exsanguination from the failure of the venous pressure guard alarm to activate will be reduced.
Appendix 4. Instructions for safe use of the HEMOdialert.

FOR USE WITH CENTRAL VENOUS HAEMODIALYSIS CATHETERS

The HEMOdialert monitor should be provided by Nottingham University Hospitals for the patient prior to training. The patient will be shown how to use the HEMOdialert blood loss detector and how to overcome common problems.

The HEMOdialert™ with the plastic reusable HEMOsensor™

Indications for Use

The HEMOdialert™ ALARM is to be used as a blood leakage monitor alarm to alert the patient undergoing haemodialysis if blood leakage has occurred because of line disconnect from the fistula site.

Description

The HEMOdialert™ consists of an alarm with a plastic reusable blood detecting HEMOsensor™ connected via a wire lead to the HEMOdialert™ alarm. When the HEMOsensor™ is wet by blood leaking from the fistula site it triggers the alarm. It can be used in a hospital situation, or when the user is undergoing Haemodialysis at home.

HEMOdialert™ alarm lead HEMOsensor™

The HEMOdialert™ has two parts: the HEMOdialert™ alarm and the HEMOsensor™ (with its integral wire connection to the HEMOdialert™ alarm).
1. The HEMOsensor™ is a moulded plastic sensor which triggers the HEMOdialert™ alarm when blood comes into contact with the special sensing elements of the HEMOsensor™. It is supplied with an integral wire lead to plug into the HEMOdialert™ alarm.

2. The HEMOdialert™ alarm is powered by internal batteries (4 X 1.5 volt alkali “button type”). It is supplied with hook fastening fixed on the back of the HEMOdialert™ alarm case. The corresponding loop fastening is also supplied and can be pinned or sewn onto the clothing on the shoulder or chest region of the user. This allows the HEMOdialert™ alarm to be placed on to the loop fastening patch.

3. When not in use always unplug the HEMOsensor™ from the HEMOdialert™ alarm to conserve battery life.

Instructions for use

1. Attach the looped fastening material to the clothing as shown below. The HEMOdialert™ alarm has hooked fastening material on the back to attach to the looped fastening on clothing.

2. Plug the wire lead into the HEMOdialert™ alarm.

3. Battery level indicator signal

When the HEMOsensor™ lead is plugged into the HEMOdialert™ alarm, the HEMOdialert™ alarm will sound a single “beep” which is a signal that the circuit is functioning. If the HEMOdialert™ alarm does not “beep” when the HEMOsensor™ lead is plugged in, then the batteries should be replaced.

When the HEMOsensor™ lead is plugged in and waiting to detect the presence of blood leakage, the HEMOdialert™ alarm will begin to “beep” at 10 second intervals (approximately) when the batteries should be replaced.

4. Disinfecting and testing before use

IMPORTANT: use ONLY isopropyl alcohol or hydrogen peroxide, for disinfecting, other disinfectants (such as Chlorhexidine and bleach based disinfectants) will damage the HEMOsensor so that it will not be able to trigger the alarm.

Before each use carry out this procedure to disinfect the HEMOsensor which at the same time will test that the HEMOdialert alarm and the HEMOsensor are working correctly.

(i) Plug the HEMOsensor™ into the HEMOdialert™ alarm; it will beep once to show that the circuit is functioning;

(ii) with the HEMOsensor™ still plugged in, using a swab soaked in isopropyl alcohol or peroxide disinfectant (or a commercially available pre-soaked swab), clean the HEMOsensor™ which will at the same time trigger the alarm and will show that the alarm circuit is working correctly.
To switch off the HEMOdialert™ alarm, unplug the HEMOSensor™. If the HEMOdialert™ alarm does not trigger during this cleaning procedure then go to Troubleshooting.

5. Place the HEMOdialert™ alarm (with the HEMOSensor™ lead connected) onto the fastening material sewn onto the clothing.

6. Positioning of the HEMOSensor™ over the fistula site.

(i) When the bloodlines are in place and the sterile gauze has been wrapped over the fistula site (Important. Follow the protocol of the clinic or hospital supervising the dialysis), position the HEMOSensor™ over the sterile gauze and over the site of the fistulas.

(ii). Cover the HEMOSensor™ with a wrapping of sterile gauze and, to ensure that the HEMOSensor™ stays in place, apply pieces of sterile tape on either side of the HEMOSensor™ and across the bottom of the HEMOSensor™, as shown here:

7. When the HEMOdialert™ alarm has been triggered by the presence of blood on the HEMOSensor™, the HEMOdialert™ alarm will continue to sound until the HEMOSensor™ is unplugged from the HEMOdialert™ alarm.

8. Cleaning of the HEMOSensor™. Use ONLY Isopropyl alcohol or hydrogen peroxide on a pre-soaked commercial or self-prepared swab. Important. Do not use bleach because this will damage the plastic.
**Troubleshooting**

1. The HEMOdialert™ alarm “beeps” when the HEMOsensor™ is plugged in, but the HEMOsensor™ fails to trigger the HEMOdialert™ alarm when dipped in water.

   (i) Replace the HEMOsensor™.

   (ii) If the new HEMOsensor™ fails to trigger the HEMOdialert alarm, then replace the HEMOdialert alarm unit.

2. Batteries. Battery life is expected to be six months; however this can vary depending on shelf life before use, and the conditions in which the HEMOdialert™ alarm is kept after sale.

   (i) Replace the batteries if the HEMOdialert™ alarm does not beep when the HEMOsensor™ is plugged in or (ii) when the low battery warning (see No 3) sounds.

**Appendix 5.**

**Redsense blood loss detector Please refer to the instruction manual**

**How Redsense works**

Redsense consists of two parts, one alarm unit and one sensor patch. The sensor patch employs fiber optic technology embedded in the patch which is attached to the alarm unit. The alarm unit sends infrared light through the fiber optic cable enabling continuous monitoring of the venous needle. If the venous needle is dislodged the alarm unit is designed to sound the alarm.

**How to use Redsense**

1. Attach the alarm unit comfortably

2. Apply the sensor patch with the absorbent part centered over the needle puncture

3. Ensure the sensor patch is not covering the wings of the needle

4. Connect patch to the alarm unit

5. Activate Redsense to start the monitoring

More than 1.3 million patients worldwide depend on Hemodialysis for their survival. Redsense venous needle monitoring device was developed together with dialysis nurses and dialysis technicians to detect if the venous needle is dislodged during dialysis which will not always be detected by the dialysis machine.
Appendix 6. Securing technique for leg graft or an arm graft

The patient is instructed how to secure the needle and dialysis lines. This involves placing a Redsense © blood loss sensor over the needle exit point.

- Single needle Haemodialysis.
- Redsense blood loss sensor with fiber optic technology embedded into a sensor patch which is placed over the needle exit point of the needle and attached to an alarm unit.
- ‘Fast aid’ tape will be taped around the leur lock at blood line and needle lumen connections.
- Securing single needle lumens and blood lines with Mefix tape to the patient to ensure that the bloodline connection is held secure.
- Tubi grip to be placed over the blood lines and needle site once all connection are checked and secured.
- Bloodlines to be secured using Rotoclix® to the patient’s clothing to minimize the risk of pulling onto the blood lines or needle.
- Patient and carer are to be given education and instruction by Home Dialysis trainer regarding use of the Blood loss detector Redsense placement of sensors and securement of bloodlines.
- Competencies to be completed with regard single needle haemodialysis, securing the bloodlines, placement/testing of the Redsense blood loss detector and securement of the blood lines to the patient.
- Bed frame to be used to ensure bedding is lifted away from leg graft area, blood lines and needle site.
- Technique to be observed by the Home therapies team for 4 consecutive haemodialysis sessions and assessed by the Home Therapies Team as competent.

Please see Appendix 5 for detailed pictures of securing technique.

Patient or carer to be instructed in how to summon help.

Haemodialysis via Single needle Leg graft. Please see this document for step by step guide for securement of the arteriovenous needle and blood lines before commencing dialysis. A bed cradle must be used to lift bed linen away from secured fistula needle and bloodlines.
Place RedSense sensor in position ensuring the Tegaderm and sensor are NOT overlapping.

Ensure Tegaderm and RedSense sensor patch are not overlapping.

Secure both needle lumens and blood lines with First Aid Tape®.

Place gauze underneath clips for comfort.

Straight connection. Secure blood lines with Transpore WHITE tape to leg.

Pull Tubifast over all needle and blood lines after dialysis has been commenced.

Secure blood lines with Rotoclix as demonstrated.

Remember to turn RedSense Monitor ON.