SURVEILLANCE OF VASCULAR ACCESS, INCLUDING GUIDELINE FOR THE USE OF TRANSONIC AND BTM MODULE IN HD PATIENTS

University Hospitals of Leicester NHS
NHS Trust

Renal, Respiratory, Cardiac and Vascular CMG

1 SCOPE

This guideline is written for the use of all staff involved in the care of fistulae or grafts used for haemodialysis. It provides general guidance on the care and maintenance of vascular access and advice on measuring access flow and recirculation using either the Transonic flow-QC, or the Fresenius BTM module on the 4008 and 5008 HD machines (the technique is not limited to the 5008 machine, and was in fact developed using earlier Fresenius machines amongst others with the BTM module). It is for the use of all suitably qualified registered nurses, who have achieved competency in haemodialysis, or for those working under the direct supervision of a haemodialysis competent nurse.

Clinical guidelines are 'guidelines' only. The interpretation and application of clinical guidelines will remain the responsibility of the individual practitioner. If in doubt consult a senior colleague or expert.

2 BACKGROUND

Access to the circulation is necessary for haemodialysis and problems with vascular access are a major cause of morbidity and hospitalisation for chronic haemodialysis patients. There is some evidence that regular monitoring of vascular access flow combined with intervention to deal with anatomical problems can prolong the life of the access device although this is not absolutely certain [1-3]. Monitoring of grafts and fistula may also prevent the need for surgical intervention, reduce thrombosis and prevent the complete failure of the access. This monitoring involves regular inspection by both patients and staff for any obvious infection, aneurysm formation or narrowing.

Monitoring of access includes:

- Access Blood Flow Rate (BFR)(Transonic or BTM module method)
- Recirculation
- Raised venous pressure
- Reduction in HD adequacy (URR)
- Poor arterial flow
- Clotted needles

Of these measurements, access flow can be used as a less subjective measurement (less dependent on the nurses interpretation) of access failure/problems. Serial measurements of vascular access flow are being used increasingly to detect problems developing in AVF/grafts.

The Transonic flow-QC device and the BTM module method provide a method to reliably assess vascular access flow and recirculation at the bedside. The Transonic uses the technique of ultrasound dilution whereby the rate of ultrasound wave transmission through the blood tubing is altered by the introduction of a bolus of sodium chloride 0.9% into the dialysis circuit. The monitor provides an immediate and accurate assessment of access flow and recirculation to monitor haemodialysis

delivery and access patency. The BTM module method uses blood temperature monitoring to measure access recirculation in two line configurations to calculate Access BFR.

Regular monitoring of vascular access BFR using either the Transonic flow-QC device or BTM module method permits:-

- Detection and quantification of access recirculation
- Determination of proper needle placement in relation to arterial and venous side of the access
- Serial monitoring of vascular access flow prompting further investigation and treatment of abnormalities which may cause access failure.

The recent emphasis on quality assurance in the treatment and care of haemodialysis patients has resulted in the formulation of standards of care, the Dialysis Outcome Quality Initiative (DOQI) guidelines, by the US National Kidney Foundation [4]. Access BFR monitoring meets DOQI guidelines by providing quantitative measurements to improve delivery of prescribed treatment and to monitor vascular access.

3 AIMS OF GUIDELINE

This guideline aims to guide staff involved in the care of chronic haemodialysis patients on four areas:-

- General advice on monitoring of vascular access
- Frequency of access flow measurement
- Interpretation of results of access flow measurements
- Practical advice on the use of the Transonic-QC flow monitor and the use of BTM module to measure Access BFR

4 GENERAL ADVICE ON MONITORING AVF AND GRAFTS

Patients should be educated and encouraged to check the patency of the AVF/AVG daily and report problems immediately. Careful clinical assessment of the access device should also be part of quarterly haemodialysis clinic visits. Access should be regularly monitored each dialysis by nurses observing for infection, obvious areas of narrowing or increased aneurysm formation. Venous and arterial pressure and blood pump flow rate are measured and recorded each dialysis session. Recurrent clotting, difficult needle placement, difficulty with haemostasis on needle withdrawal, and a persistently swollen arm are all suggestive that a stenosis may be present. However, these indicators, as well as indicators of under dialysis, are generally very late manifestations of access dysfunction.

The following may also indicate problems with the access:-

Venous Pressure

Venous pressure is routinely measured at the beginning of dialysis. With any given blood flow rate, blood viscosity and venous needle size there is a certain level of venous pressure at the drip chamber. Most of this pressure is due to resistance at the venous needle, and this is primarily determined by the venous needle size used and the blood flow rate [5]. A progressive increase of pressure further down the access from the needle site causes the venous drip chamber pressures during dialysis to rise over a period of time. Venous pressure should not be above 200mmHg without investigation. The venous pressure needs to be raised on three consecutive dialysis treatments to be meaningful. Regular monitoring of dynamic

venous pressure has been shown to be effective in detecting stenosis in AVF/grafts but requires a carefully calibrated set up. Nevertheless rapid changes in venous pressure should prompt further assessment.

Decreased URR

Multiple factors can affect delivered dialysis dose. Therefore although this is a useful indicator that there may be a problem with access it is not very specific.

Inadequate flow rate on the blood pump

May be an indication that there is a poor actual access flow, but may also be related to needle placement and patient condition.

Immediate reporting of these parameters allows further assessment of the AVF/graft by flow measurements and/or venography.

5 ACCESS FLOW/RECIRCULATION STUDIES

5.1 Frequency of access flow measurement

Ideally every haemodialysis patient dialysing through an arteriovenous fistula or graft will have an assessment of their vascular access flow using the Transonic-QC flow monitor or BTM module method every three months.

The following patients should have monthly flow measurements

- Patients with arterio-venous grafts
- Patients who have previously undergone angioplasty or surgical revision who may be at increased risk of recurrent stenosis.
- Patients whose vascular access is otherwise suspected of malfunction (e.g. rising venous pressure, problems with needling, poor blood flow rate on the dialysis machine, or a reduction in URR).

6 INTERPRETATION OF RESULTS OF ACCESS FLOW MEASUREMENT

Access BFR measurements will be reported to a doctor and will be used to prompt further investigation by venography when the following criteria apply

- Access flow below 500ml/min,
- If there has been a 25% drop in access flow to <1000ml/min

7 INTERPRETATION OF RESULTS OF RECIRCULATION MEASUREMENTS

In addition to measures of Access BFR these methods also produce measures of access recirculation. The following are general principles for the interpretation of recirculation measurements with the blood lines in the correct (normal) orientation. [11]

- Recirculation < 10%. Access flow likely greater than HD machine effective BFR. Normal result. No action required
- Recirculation 10-20%. Fistula recirculation may be present. When performing BTM flow measurements reduce the HD machine BFR and repeat measurement. Provided setting an effective BFR > 200ml/min gives a recirculation result <= 10% then proceed with BTM fistula BFR measurements and act according to the calculated fistula BFR (section 6 above). If fistula BFR is adequate by criteria in section 6, and no other

clinical concerns with dialysis access the recirculation can be ignored as spurious. If clinical concerns discuss with senior medical staff and consider early repeat measurement.

- Recirculation >20%. Fistula circulation is very likely. Consider referral for investigation on this basis alone.

8 PROCEDURE FOR USE OF TRANSONIC FLOW-QC MONITOR

8.1 Equipment required:

- Laptop computer with software program
- Transonic monitor
- Set of matched flow/dilution sensors
- 20mls luer lock syringes (3)
- 21g Needles (3)
- 0.9% sodium chloride ampoules 10mls (3)
- Sterile gauze

8.2 Procedure

8.2.1 Explain procedure to patient and maintain patient's privacy.

8.2.2 Gain access to the computer on first prompt for password enter renal2

8.2.3 On second prompt, click the ok key

8.2.4 Clip the red-banded cable onto the arterial line, and the blue to the venous line connecting the cable from the Transonic box to the patient. Link the computer and the transonic box to each other using the specific cable.

8.2.5 Go into the Transonic screen on computer by double clicking onto Transonic Kimal

8.2.6 Once into this screen follow one of two pathways

Pathway one (New patient to the system)

8.2.7 Go into new patient and enter details (First letter of names must be in capitals and the identity number must have the G or U before it)

8.2.8 Put on plastic apron and visor

8.2.9 Clean surface with detergent and water and disinfect with using disposable cloth.

8.2.10 Wash hands with liquid soap and water and dry thoroughly.

8.2.11 Open dressing pack onto clean surface. Using corners of sterile paper open the sterile field.

8.2.12 Open the sterile equipment without contaminating the sterile field: 20ml leur lock syringes (3), 21g needles (3), 0.9% saline ampoules 10mls (3).

8.2.13 Decontaminate hands with alcohol gel and draw up 0.9% sodium chloride into two 20mls syringes.

8.2.14 Wash hands with liquid soap and dry thoroughly.

8.2.15 Enter the recirculation screen (double clicking at top of screen), enter data as requested then click ok

8.2.16 Decontaminate hands with alcohol gel and put on non sterile gloves

8.2.17 Follow the instructions on the screen using the bolus push method of delivering the 0.9% normal saline

8.2.18 Exit this screen by clicking on stop at the top of the screen

8.2.19 It is only necessary to repeat more than once if it is a first ever recording or if the results are very different from the previous results

8.2.20 Enter access screen and follow instructions

8.2.21 When completed exit screen and input data into Access screen on proton

8.2.22 It is imperative to ensure that dialysis lines are returned to normal position and secured to patient properly.

8.2.23 Follow referral as the access flow indicates (see section 6).

Pathway Two

8.2.24 Go straight into recirculation screen and enter patient details

8.2.25 Follow from 6.14 to 6.22

9 PROCEDURE FOR BTM MODULE METHOD

9.1 Equipment required

Fresenius 4008 HD machine with BTM module, or Fresenius 5008 machine.

9.2 Principle

The calculation requires a measurement of access recirculation with the blood lines connected in the conventional configuration (arterial line connected to the arterial needle, venous line connected to the venous needle), and in the "reversed" configuration (arterial line connected to the venous needle, venous line connected to the arterial needle). Two measures of recirculation are made in each configuration and the mean recirculation in each configuration used in the calculation, together with the HD machine effective BFR (one reading from each configuration) and the ultrafiltration rate during the period of the studies. The calculation takes place in proton on the "Access Flow" screen [9,10,11].

9.3 Pre-requisites

The calculation is only valid if the follow criteria are met

9.3.1 HD machine effective blood flow rate >= 200ml/min in both line configurations. Although the Fresenius fact sheet has 250ml/min as the minimum, the published literature confirms the validity of the method for effective HD machine blood flows between 200-350ml/min [9]

9.3.2 Recirculation measured in the conventional configuration <=10% (this reflects cardio-pulmonary recirculation and not access re-circulation and is present in all patients). See notes in section 7 on how to proceed if value is greater than 10%.

9.3.3 A reasonably constant UF rate during the measurements (although this makes little impact on the calculations, it is preferable if the UF rates are with 50% of each other).

9.3.4 Fistula blood flow when calculated is in the range 300-2000ml/min. The accuracy of very high fistula flow measurements (>2000ml/min) is doubtful as there will have been insufficient time for mixing within the fistula. The values

should be recorded in proton, but there will be significant variation if the readings are repeated which should not be over-interpreted [9].

9.4 Procedure

9.4.1 Explain procedure to patient and maintain patient's privacy.

9.4.2 Commence patient on dialysis in line with current UHL policy.

9.4.3 Measurements can be done at any time during the dialysis procedure, but once started completed measurements should follow each other without undue delay to minimise difference in UF rate (which varies through dialysis in many profile settings). It takes approximately 30 minutes to take all the measurements, during which the patient must be attended about every 6 minutes.

9.4.4 If (but only if) practicable change the machine settings to minimise variation in the UF rate during the test (turn off UF, select a constant UF rate, or proceed promptly if using a linear profile). Avoid a "stepped" profile whenever possible as the UF rate varies dramatically during these profiles. If it is not practicable to

have a constant UF rate then note the UF rate at the beginning of each recirculation measurement and take an average of these four values.

9.4.5 Take note of the UF rate.

9.4.6 Pass arterial line through arterial section of the Fresenius BTM module. Ensure that there is the shortest practicable distance between the module and the patient access.

9.4.7 Pass venous line through the venous section of the Fresenius BTM module.

9.4.8 Note down the current HD machine effective BFR (must be >=200ml/min)

9.4.9 Press <rec> on the BTM module and wait approximately 6 minutes for measurement to complete.

9.4.10 Note the recirculation percentage and repeat measurement. Take and average of the two measures which should be similar. If recirculation measure is >10% then see section 7. It is perfectly valid to reduce the HD machine effective BFR and repeat the recirculation measurement. Provided the effective BFR is >200ml/min and the repeat recirculation measurement now <= 10% then the calculations are still valid – proceed with next step. If it is impossible to reduce recirculation <= 10% despite decreasing HD pump speed then stop measurement and discuss with senior medical staff.

9.4.11 Stop the HD machine blood pump.

9.4.12 Using the current sterile technique for connecting and disconnecting HD lines from a fistula needle (see UHL guidance "Commencing and Terminating haemodialysis with an AVF or AVG") switch the connection of the arterial blood line from the arterial to the venous needle, and the venous blood line from the venous to arterial needle.

9.4.13 Recommence haemodialysis. The HD machine effective BFR is often lower in this configuration, but must be >=250ml/min for a valid measurement. Once the venous pressure and HD machine BFR are stable note the HD machine BFR for this configuration.

9.4.14 Press <rec> on the BTM module and wait approximately 6 minutes for measurement to complete.

9.4.15 Note the recirculation percentage and repeat measurement. Take and average of the two measures which should be similar.

9.4.16 Stop the HD machine blood pump.

9.4.17 Using the current sterile technique for connecting and disconnecting HD lines from a fistula needle (see UHL guidance "Commencing and Terminating haemodialysis with an AVF or AVG") switch back the blood line connections to the conventional direction. IT IS IMPORTANT THAT LINES ARE RETURNED TO CORRECT CONFIGURATION.

9.4.18 Recommence haemodialysis and complete the HD session as normal

9.4.19 Take the five values to a computer terminal and enter into proton details of the

Date

Access type

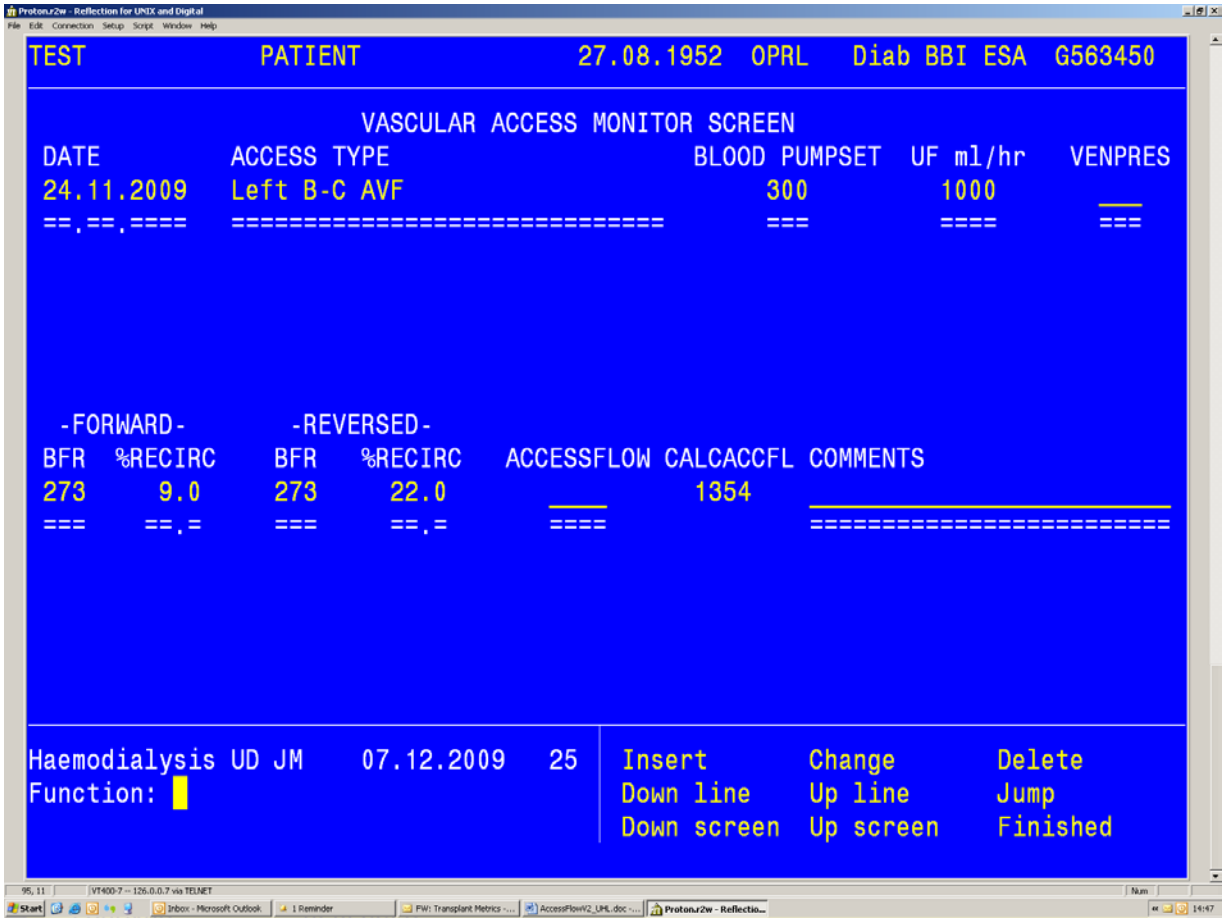
Machine BFR and average recirculation in the conventional configuration

Machine BFR and average recirculation in the reversed configuration

The screen is in <UPDATE>..<HAEMODIALYSIS>..<Ac Flow Mon>

Blood pump speed and venous pressure can be recorded, but are not required for this calculation. “ACCESSFLOW” is not used in this method (it is entered manually for the transonic method).

9.4.20 The access BFR will be calculated automatically (CALCACCFL).



10 MONITORING AND AUDIT INDICATORS

Key Performance Indicator	Method of Assessment	Frequency	Lead

11 LEGAL LIABILITY GUIDELINE STATEMENT

Guidelines issued and approved by the Trust are considered to represent best practice. Staff may only exceptionally depart from any relevant Trust guidelines and always only providing that such departure is confined to the specific needs of individual circumstances. In healthcare delivery such departure shall only be undertaken where, in the judgment of the responsible healthcare professional' it is fully appropriate and justifiable - such decision to be fully recorded in the patient's notes

12 REFERENCES

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13 KEYWORDS (up to six)

Access flow, transonic, fistula, haemodialysis, venous pressure

DEVELOPMENT AND APPROVAL RECORD FOR THIS DOCUMENT			
Author / Lead Officer:	James Medcalf		**Job Title:** Consultant Nephrologist
Reviewed by:	Nephrology Consultants		
Approved by:			**Date Approved:**

REVIEW RECORD			
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