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MANITOBA RENAL PROGRAM

SUBJECT ▪ Arteriovenous Fistula (AVF) /Arteriovenous Graft (AVG) Vascular Access Assessment: o Clinical Assessment o Recirculation Blood work o Fresenius BTM Recirculation Measurement o Dynamic Venous Pressure (DVP) Monitoring	**SECTION** **30.20** Vascular Access **CODE** **30.20.06**
AUTHORIZATION ▪ Professional Advisory Committee, Manitoba Renal Program ▪ Nursing Practice Council, St. Boniface Hospital	**EFFECTIVE DATE** June 2002 **REVISION DATE** October 2009 November 2012 April 2015 October 2018

PURPOSE:

1. To provide instruction in evaluation of vascular hemodialysis access of Arteriovenous Fistula (AVF) and Arteriovenous Graft (AVG) used for hemodialysis therapy.

POLICY:

1. Nurses in Dialysis, who have demonstrated competency to the renal educator or delegate, shall perform vascular access assessment (which includes a review of vascular issues from the chart) and a clinical assessment (which includes inspection, palpation and auscultation of AVF/AVG) each treatment prior to cannulation.

2. Urea based recirculation bloodwork may be used to assess AV fistulae and AV grafts per physician order. If recirculation is greater than 5%, confirm needle position and repeat next hemodialysis treatment. If recirculation is greater than 5% on 2 consecutive measurements notify Nephrologist and/or Vascular Access Nurse.

3. Fresenius BTM recirculation is performed with each treatment and may be repeated during the same treatment. If result greater than 20% notify the Nephrologist and/or Vascular Access Nurse. Complete a review of the overall trend for recirculation and Kt/V each treatment. Any trend showing increasing recirculation with decreasing Kt/V must be reported to the Vascular Access Nurse for further investigation.

4. Dynamic Venous Pressure (DVP) monitoring will be done with each treatment for AVGs. If DVP are >125 mmHg or trending upwards on 3 consecutive treatments, notify Nephrologist and/or Vascular Access Nurse.

5. Prolonged bleeding time post treatment and/or high venous pressures may indicate a stenosis. Notify Nephrologist and/or Vascular Access Nurse.

6. Local Renal Health Centres within Manitoba may connect with the Local Renal Health Centre Community Nurses located at the Health Sciences Centre to assist with further notifications and interventions regarding statements 2 – 5 above.

AVF/AVG Recirculation Bloodwork:

EQUIPMENT:

- 3 Alcohol swabs
- 3 – 10 mL syringes
- 3 – blunt fill needles
- 3 Chemistry tubes
- 3 Chemistry requisitions

PROCEDURE:	**KEY POINT:**
1. Label each chemistry tube with the appropriate patient labels. Mark one of each of the tubes arterial, venous, and systemic.	▪ Each blood tube requires a separate lab requisition for urea level.
2. Obtain blood samples 15-30 minutes after initiation of hemodialysis.	
3. Press the UF Timer light off.	▪ This will stop Ultrafiltration and therefore eliminate convective transport
4. If the patient has Na+ and UF profiles, the 5008 reads: ***Stop Both Profiles*** **or** ***Continue Treatment*****.** • Press Stop Both Profiles.	▪ If the profiles are not stopped, the dialysate flow will stop which will cause the arterial and venous samples to be the same as there will be no diffusion occurring. Pressing ***Continue*** will cause the UF to resume and give inaccurate results.
5. Swab the arterial (red) sampling port using an alcohol swab. Using the 10 mL syringe with a blunt fill needle, collect a minimum of 4.5 mL of blood. Place in chemistry tube labelled "arterial".	
6. Repeat step 5 using the venous port and place in chemistry tube labelled "venous".	
7. Lower the blood flow to 120 mL/minute.	▪ This clears recirculated blood from the access.
8. After 10 seconds, turn the blood pump OFF.	
9. Clamp the arterial bloodline between the sampling port and dialyzer.	▪ To prevent backflow from the dialyzer.
10. Clamp venous blood line.	▪ To prevent introduction of venous blood into the systemic sample.
11. Swab the arterial sampling port. Collect a minimum of 4.5 mL of blood from the arterial port. Place in chemistry tube labelled "systemic".	▪ Systemic sampling must be obtained within 15 seconds of stopping the blood pump.
12. Unclamp the arterial and venous bloodlines and resume original blood flow.	
13. If the patient has Na+ and UF profiles: Press the UF menu and reset the UF profile. Press the Na+ Profile menu and reset the Na+ profile.	▪ If less than 2 hours of treatment remain, will not be able to reprogram the Na+ profile.
14. Press the UF Timer Light ON	

15. The following formula is used to calculate the percentage of recirculation:

$$R(\%) = \frac{S-A}{S-V} \times 100$$

- Elevated levels of access recirculation will be investigated for the presence of vascular access stenosis.

S = Systemic
V = Venous
A = Arterial
R(%) = percentage of recirculation

- See policy statement #2 in regards to follow up with values greater than 5%.

- **Dynamic Venous Pressure Monitoring for AVGs:**

1. Initiate hemodialysis with blood flow of 200 mL/min.

- Ensure priming fluid has cleared from the extracorporeal circuit.

2. Ensure patient's bed/chair is set to the lowest possible level.

- Assess at same level for all measurements for all treatments. DVP will fluctuate at different elevations.

3. Measure the venous pressure from the hemodialysis delivery system during the first 2 – 5 minutes of every hemodialysis treatment.

- Pressure will vary depending on the gauge of the fistula needle. If venous pressure >125 mmHg on 3 consecutive treatments or increasing progressively, notify Nephrologist and Vascular Access Nurse.

4. Document on Hemodialysis Flow Sheet.

5. Increase blood flow (Qb) to desired rate.

- **Fresenius Recirculation Measurement (On-Line Recirculation):**

1. The nurse must document and interpret the results using the following guidelines:

- A recirculation value of less than 10% is likely due to cardiopulmonary recirculation.
- If recirculation is high (> 20 %), there is probably a considerable recirculation in the fistula. First check whether the needles are well positioned and whether the blood lines have not been reversed before being connected. If the fault cannot be ascertained here, the fistula should be further examined for possible stenosis.
- If the recirculation is between 10 and 20 %, the patient might have a very high cardiopulmonary recirculation or additional fistula recirculation might be present. To distinguish between both possibilities, decrease the blood flow by 100 mL/min and repeat recirculation measurement. If there is only a minor recirculation change, this is an indicator for cardiopulmonary recirculation. If there is a considerable change (>10 %), it is more likely a case of fistula recirculation.

- The Fresenius 5008 measures access recirculation using the thermo dilution method of the blood temperature monitor (BTM). The result is displayed on the "treatment" and "BTM" option pages approximately 15 minutes into treatment.
- Recirculation measurement impacts dialysis efficiency (clearance). Monitor clearances (Kt/V) with recirculation values.

- If the patient has a recirculation value that is normally between 10-20%, the repeat test is not required.

2. To repeat the recirculation measurement, touch the Recirculation I/O button

3. Notify Nephrologist and/or Vascular Access Nurse with results greater than 20%.

- Local Renal Health Centres see policy statement # 6 above.
- Any trend showing increasing recirculation with decreasing Kt/V must be reported to the Vascular Access Nurse for further investigation.

<u>Vascular Access Assessment</u>:

AVF/AVG assessment to be performed before every cannulation.

1. INSPECTION

a. Compare arms looking for ecchymosis, erythema, edema, discoloration of skin or any breaks in the skin.
   (i) Assess entire length of the arm/access extremity, chest, neck and face noting any edema or collaterals.
   (ii) Check the following with each dialysis treatment:
      - Redness/discoloration
      - Rash
      - Swelling/edema
      - Pain (steal syndrome)
      - Serous or purulent discharge
      - Temperature: area warm(infection)/cool (steal syndrome)to touch
      - Numbness/Tingling
      - Fever
      - Chills/rigors
      - Ischemic changes
      - Capillary refill <3 seconds is normal
      - Assess vessel length for two needles
      - When palpating the vessel roll your fingers over the vessel to gauge vessel diameter

- Infections are usually related to break in aseptic technique during insertion and or removal of needles. Could also be caused by a hematoma within the fistula or graft that becomes infected.

b. Inspect access arm for aneurysms, hematomae, curves or flattening of the vessel, presence of accessory vessels, signs of steal syndrome, and previous puncture sites.

- The aneurysmal site usually has a diameter 1.5-2 times greater than the regular fistula vein.
- Aneurysms are diagnosed by imaging (fistulogram or ultrasound). Aneurysm (true) and pseudoaneurysm (false) are caused by poor cannulation technique, repeated cannulation of the same area of the vessel, improper/poor compression of the needle exit site post treatment and vessel stenosis.
- If an aneurysm/pseudoaneurysm is identified on the access:

- Do not cannulate access.
- Contact the vascular access nurse.
- Document the details, include measurements.
- Follow instructions provided by the vascular access team for access use.

- **When to seek <u>urgent</u> treatment from vascular team:**
  - Do not cannulate access.
  - If skin overlying the aneurysm/ pseudoaneurysm is compromised
  - Risk of rupture
  - Rapidly expanding
  - Infected
- Treatment of aneurysms may include:
  - Local repair
  - Local excision
  - Inter-positional graft
- Steal syndrome is when the fistula or graft "steals" blood from the distal portion of the limb causing ischemia. It can manifest immediately post operatively or develop later over weeks, months or years as AVF flow increases and or distal arterial disease worsens. Often diagnosed by symptoms alone but definitive diagnosis made by performing:
  1) Arteriography – brachial angiogram with and without compression of fistula. This test will determine arterial stenosis, occlusive arterial disease, and patency of surrounding arteries.
  2) Less invasive techniques- MRI and CT angiography.
- If signs of steal syndrome present notify physician.
- Early signs of steal syndrome include:
  - Cool hand
  - Pallor or blue discoloration
  - Numbness
  - Tingling
  - Pain during HD treatment
  - Hand or arm weakness
  - Delayed capillary refill
  - Radial pulse only palpable with manual compression of fistula (not definitive)
- <u>URGENT</u> notification of the physician and the vascular access team (see Policy Statement #6 for Local Renal Health Units).
- <u>URGENT</u> late signs of steal syndrome:
  - Pain at rest
  - Ischemic ulcers/tissue loss
  - Dry Gangrene
  - Neurlogic deficits-sensorimotor dysfunction

c. Assess for good cannulation site rotation.

- Confirm use of the rope-ladder cannulation technique.
  - Utilize the entire length of the fistula.
  - Avoid old needle areas/scabs; try to needle 0.6cm to 1.2cm from the previous puncture sites.
  - Educate patients on the importance of site rotation.
  - This will allow even maturation of the fistula.
  - Helps to prevent aneurysm formation.

- Decreases peri-fistula or peri-graft bleeding.
- Prolongs the life of the access.

- Avoid “one-site-itis”, make sure the entire length of the vascular access is being utilized.
  - “One-site-itis” refers to using an area for repeated cannulation causing the vessel wall to weaken and contributes to aneurysm formation.
- Avoiding the “NO STICK AREAS” such as the anastomosis and bend area of the vascular access.
- Cannulation sites must be 2.5 cm from the anastomosis.

d. Assess the blood flow direction in the vascular access.

- For new loop grafts it is important to assess the direction of the flow and properly document the direction in the kardex.

2. PALPATION

a. Using fingers feel for the thrill beginning at the anastomosis and following the entire length of the access.

- A “thrill” is a buzzing or vibration felt as the result of turbulence of the blood flow created by the high pressure of the arterial system merging with the low venous pressure system. (Ball 2006)

- Feel for the thrill through the entire length of the fistula starting at the anastamosis. It is typically strongest at the anastomosis and may become weaker moving away from the anastamosis. The fistula should be easily compressible throughout the entire length.

- No thrill may indicate clotted fistula and requires further assessment before cannulating.

3. AUSCULTATION

a. Using a stethoscope listen for the bruit beginning at the anastomosis and following the entire length of the access, including the outflow veins of the upper arm.

- Blood flow in the vessel should be consistent in sound (pitch). It is typically loudest at the anastomosis and may diminish moving away from the anastamosis.
- Pulse like sounds or high-pitched sounds could indicate a stenosis.
- <u>If thrill **AND** bruit are not present do NOT cannulate. Notify Nephrologist and Vascular Access Nurse (or Local Renal Health Centre Community Nurse) immediately.</u>

4. Notification

a. DO **NOT** CANNULATE AVF/AVG IF THERE IS:
- Signs of infection
- Absent thrill or bruit
- Severe swelling or bruising due to infiltrate

- Contact the following immediately:
  - Clinical Resource Nurse/Charge Nurse
  - Nephrologist
  - Local Renal Health Center Nurse (LHRC) (if patient receiving treatment in a Local Renal Health Center).
  - Vascular Access Nurses

b. Notify vascular access nurse (or Local Renal Health Centre Community Nurse) and/or nephrologist of any abnormal findings.

- Photo and measurements of anomalies recorded in chart PRN.

DOCUMENTATION:

- Hemodialysis Treatment Record
- Vascular Access Record
- Integrated Progress Notes
- Hemodialysis Flow Sheet
- Kardex

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