MedicalFrontiers INTERNATIONAL

NEW FRONTIERS IN NEPHROLOGY

Partnering with Patients on Hemodialysis: Nursing Support, Advocacy and Skills

A report from the

Canadian Association of Nephrology Nurses and Technologists (CANNT) 2011

Calgary, Alberta / October 20-22, 2011

Calgary - Patients entering into hemodialysis (HD) are under pressure to make many difficult decisions, including what modality is best for them and what vascular access they will require. Among the many tasks facing HD nurses is the need to coach patients during this decision-making process. Nurses also need to advocate for patients in an effort to preserve veins for current and future dialysis access. When starting dialysis, most HD patients have central venous catheters. Nurses must continuously assess those lines for patency and, if occluded, manage the line to facilitate efficient HD. Nurses also need to be aware of the types of occlusion that can occur and the appropriate treatment response. Prophylactic tissue plasminogen activator (t-PA) has been shown to significantly reduce catheter dysfunction and, very importantly, the incidence of bacteremia compared to heparin. Consideration may now be given to t-PA as a prophylactic locking solution.

Chief Medical Editor: Dr. Léna Coïc, Montréal, Quebec

A major preoccupation for hemodialysis (HD) patients is the many decisions they must make throughout the trajectory of their care. Here at CANNT, HD nurse practitioner Alison Thomas, St. Michael's Hospital, Toronto, Ontario, offered her own experience. "Even though patients are educated during predialysis care, they are still not making decisions in a timely manner, they are confused and they are deferring having to make a decision," she confirmed. One of the hardest decisions they have to make is which modality they are going to choose and consequently, the type of vascular access (VA) they will require.

Choice of Vascular Access

Arteriovenous fistula (AVF) and arteriovenous graft (AVG) are the preferred VA for HD but as speakers concurred, many patients are resistant to the idea of fistulas despite the fact that AVF/AVGs offer more effective dialysis and have fewer complications than central venous catheters (CVCs). Studies indicate that AVFs and AVGs at the time of HD initiation is an important modifier of survival (*J Am Soc Nephrol* 2011;22:1113-21).

Thomas told delegates that part of a nurse's role is to try and understand what is interfering with a patient's ability to reach a decision and coach them along through the decision-making process towards a suitable solution for themselves.

In a small research project, Thomas and colleagues screened 16 HD patients with a CVC for the presence of decisional conflict; if detected, the group would plan to determine the impact of introducing a tailored decision support intervention. Experienced nurses screened patients with questions aimed at identifying those who really could not make up their minds about what access was best for them. As Thomas reported, none of the 16 patients screened positive for the presence of decisional conflict—"meaning that patients were confident that they wanted to keep their lines and that they were not having a fistula no matter what we told them." She and colleagues subsequently determined that patients are fearful about the cannulation required for AVF and AVG access and the prospect of pain and discomfort they felt would accompany it. If this is the case, Thomas wondered if nurses could not better alleviate patients' concerns about pain, perhaps with

the use of a local aesthetic, making a fistula more acceptable.

"My gut feeling is that by the time patients get to HD, it's too late to be having this conversation; patients see and hear others in the waiting room, they hear about bad experiences people have had [with their fistula] and they don't want anything to do with it. We need to have this conversation earlier when we can talk about the different modalities and work through patients' concerns," Thomas stated.

Preserving Vascular Access

According to data presented by clinical nurse specialist Patricia Quinan, Dialysis Access, Humber River Regional Hospital, Weston, Ontario, time from referral until permanent vascular access creation is longer in Canada (61.7 days) than in Europe (29.4 days) or in the US (16 days). An estimated 55% to 60% of fistulas fail to mature and maturation can take up to 5 months or longer. This means that many chronic kidney disease (CKD) patients enter dialysis on an essentially urgent basis with a CVC.

Many peritoneal dialysis (PD) and transplant patients also end up on HD on an equally urgent basis, meaning that they will need a CVC in order to begin HD. Speakers here at CANNT agreed that in anticipation that most patients will need more than 1 fistula in their lifetime, veins must be preserved.

As observed by VA nurse Rick Luscombe, Providence Health Care, Vancouver, British Columbia, the creation of a successful fistula is dependent on having patent peripheral arm veins and a healthy venous circuit back to the heart. "Importantly," he continued, "venipuncture, peripheral intravenous (i.v.) and peripherally inserted central catheter (PICC) lines can all damage veins and jeopardize future fistula creation or function. Preservation of arm and central veins needs to start at the predialysis stage and continue when patients start on HD."

Vein preservation should also be practiced in patients with a functional kidney transplant. Earlier this year, the BC Renal Agency published recommendations on preferred locations for venous access for vein preservation (Table 1).

Luscombe noted that for CVCs, the first choice is the internal jugular veins, the second choice is the external jugular veins and the third choice would be the femoral veins. In all situations, health care professionals should try to avoid the use of PICCs as well as the use of subclavian veins for CVC access to reduce the chance of central vein stenosis. "We also produce wallet cards for patients saying which veins health care professionals should be using/preserving and we put posters up in the hospital as well," Luscombe added.

Assessing CVC Lines for Patency

The majority of patients have a CVC when they start HD. Indeed, data from the Canadian Organ Replacement Register (CORR) indicate that over 80% of patients just starting dialysis have a CVC. This means that nurses have a major responsibility to assess lines for patency to ensure smooth delivery of dialysis and unclot occluded lines.

As discussed by Alana Campbell, RN, MN, Clinical Nurse Specialist Consultant, Roche Canada, the function of a central line is key to delivering adequate dialysis. The position of the catheter is essential to ensure correct placement with the tip of the CVC located at the right atrial caval junction or in the right atrium where 2000 cc of blood flow occurs every minute. Correctly positioned, "this catheter tip position provides excellent blood return, which is essential in HD. The need to remove blood quickly to be dialyzed and return it to the

Table 1. **BC Renal Agency Recommendations for Venous Access for Vein Preservation**

	Access in place	No access is in place
First choice	Use dorsal veins of the hand of the arm without the access	Use dorsal veins of the dominant hand to save non-dominant hand in case of fistula or graft are needed
Second choice	Use dorsal veins of the hand of the arm with the access	Use dorsal veins of the non-dominant hand
Third choice	Use forearm veins of the arm without the access	Use forearm veins of the dominant arm to save the non-dominant arm in case a fistula/graft is needed
Last resort	Use forearm veins of the arm with the access	Use forearm veins of the non-dominant arm

Adapted from BC Renal Agency. Chronic Kidney Disease: Vein Preservation, March 9, 2011. (http://www.bcrenalagency.ca/professionals/VascularAccess/ProvGuide.htm)

patient is paramount." Most HD CVCs have a capacity of running approximately at 400 mL/min or greater; KDOQI defines catheter dysfunction when blood flow falls <300 mL/minute.

An estimated 1 in 4 catheters are at risk to become occluded; when they do, approximately 60% of the occlusions will be thrombotic in nature. A thrombotic occlusion comes in several forms. An intraluminal thrombus results from a backwash of blood, eventually filling the lumen of the catheter, either completely or partially. A fibrin tail (also called a withdrawal occlusion) causes catheter occlusion where the tail occludes the opening of the catheter upon aspiration. A fibrin sheath is a "sock" of clot running the entire length of the line or enclosing the catheter tip. Lastly, a mural thrombus, a true cardiovascular (CV) emergency, occludes the central vein plus or minus the catheter.

As Campbell noted, pain, swelling and discoloration are all symptoms of central vein occlusion (also called the SVC syndrome) and patients must be referred to interventional radiology to confirm the diagnosis. The clot is then directly lysed with tissue plasminogen activator (t-PA).

The initial assessment of a line starts when the nurse opens the line. In the presence of an intraluminal thrombus (either partial or complete), flow will feel sluggish and nurses will be unable to withdraw, infuse or both. The presence of a fibrin tail means they can still infuse but they will be unable to aspirate, while in the presence of a fibrin sheath, withdrawal again will be sluggish and nurses will feel resistance as they try to infuse; often, pressure alarms are activated in the presence of a fibrin sheath as well. A randomized study by Oliver et al. (*Clin J Am Soc Nephrol* 2007;2:1201-6) showed that 70% of patients with refractory catheter dysfunction had a fibrin sheath—suggesting that its effective management is a critical component in CVC management and is likely the most common cause of catheter dysfunction.

Catheter Occlusion Management

A total of 5 randomized clinical trials have been carried out to assess the efficacy of lytic in catheter occlusion management, providing level 1 evidence in dosing for catheter dysfunction: 2 in adults and pediatric patients not involving HD catheters; 1 in a pediatric cohort to assess for safety; and 2 in HD patients. In the COOL-1 study, patients ≥30 kg received alteplase 2 mg (2 mL) per lumen while patients ≥10 kg and <30 kg received enough alteplase to fill 110% of lumen volume. After a 2-hour dwell time, function had been successfully restored in 74% of catheters after the first dose and in 90% after the second vs. 17% for placebo. As Campbell noted, this would indicate level 1 evidence for 2 mg/per lumen as the effective dose for fibrinolysis in catheter dysfunction.

COOL-2 (n=1000) again did not involve HD catheters but rates of restoration of function were 52% after 30 minutes and 76.5% after 120 minutes with the first dose of alteplase. After the second dose, restoration rates were 83.6% after 30 minutes and 87.2% after 120 minutes. Importantly, there were no intracranial hemorrhages (ICH), no embolic events and no major hemorrhages or deaths due to study drug. The same safety results were also seen in the pediatric cohort study as well. The CAPS study involved 310 children, all treated with the t-PA, and the safety results had zero ICHs, major bleeds, embolic events or deaths; "so if it is safe for children and infants, it is safe for adults," Campbell stated.

For optimal efficacy, alteplase must be used in the approved dose of 2 mL per lumen unless nurses are treating a femoral catheter, at which point they will likely require a double dose. (In the 2 clinical trials that did involve HD catheters, a sister molecule, tenecteplase, was found to be equally effective at a dose of 2 mg per lumen, suggesting that alteplase 2 mg is the appropriate dose for HD catheters as well). These 5 trials provide the best evidence for all types of catheters in both adult and pediatric practice.

Nurses must also aim to overfill the catheter in order to bathe the catheter tip and manage the extraluminal clots. The fibrin sheath, fibril tail and mural thrombus are all outside the lumen of the catheter. If nurses just fill the lumen of the catheter, known as exact lumen dosing, the intraluminal clot within the catheter lumen will be managed but the extraluminal thrombus will never be managed.

Nurses must also know that once they lock the lytic in for an overnight or an extended dwell, they have active drug in the line and only the little that escapes into the systemic circulation has a half-life of 5 minutes.

"Time and patience are needed for fibrinolysis or 'clot-busting' to go into effect and it depends on how much clot burden there is," Campbell confirmed. The assumption is that a tiny clot is being lysed vs. a 9-inch sheath.

Nurses do not want to continue with an all-too-common practice of line reversal when they cannot aspirate brisk blood flow from the arterial lumen. Firstly, as Campbell noted, line reversal is supposed

to be a temporary solution when a line has withdrawal occlusion, allowing them to complete dialysis for that session, after which they need to manage the clot at the end of the arterial lumen. "Reversing the line does not treat the thrombus," she reaffirmed.

Moreover, when that thrombus has been sitting in a catheter at body temperature for hours, days, weeks and months, the catheter will be seeded with bacteria. "If you suddenly decide to declot the lumen that has had blood sitting there for some time, patients may go septic and develop fever, rigors, elevated white counts or septic shock," she told delegates. "So if you are dealing with a catheter that has been line-reversed for months, don't try to declot it, patients need a line exchange."

Preventing Catheter Malfunction, Bacteremia

To prevent catheter malfunction from the outset, anticoagulants (primarily heparin, until recently) are routinely used as catheter locking solutions. Studies now indicate that sodium citrate 4% is as effective as heparin 10,000 IU/mL but sodium citrate is associated with a lower bleeding risk than heparin and is cost-saving.

As discussed by Dr. Brenda Hemmelgarn, Associate Professor of Medicine and Community Health Sciences, University of Calgary, CVC-related infections in HD are the most common cause of morbidity and the second most common cause of death.

"Topical antibiotics used at exit sites have been associated with a 75% to 93% reduction in the risk of catheter-related bacteremia," she noted.

In addition, results from the Pre-CLOT (Prevention of dialysis catheter lumen occlusion with rt-PA versus heparin) trial showed that the rate of thrombotic catheter malfunction was only 20% among patients who received prophylactic t-PA at a dose of 1 mg per lumen per week vs. a 34.8% catheter malfunction rate in patients whose catheters were locked with heparin 5000 IU per lumen per week. This trial provides level 1 evidence for the 1 mg /lumen prophylactic dosing.

"More importantly," Dr. Hemmelgarn noted, "the incidence of bacteremia was 3 times higher in the heparin arm than in the t-PA arm (13% vs. 4.5%, respectively)," she added. Minor, clinically important and major bleeds were also higher in the heparin arm and 4 of the major bleeds in the heparin arm were ICH. (It should be noted that patients in the t-PA arm also received heparin twice a week in this study so bleeding events in the lytic arm were really due to heparin, not the t-PA, as speakers here later pointed out.)

"t-PA given once a week as a locking solution was safe, resulting in a significant reduction in thrombotic catheter malfunction and catheter-related bacteremia," Dr. Hemmelgarn concluded.

Summary

Nurses who work in HD develop a very special relationship with patients. Not only do they see patients very frequently relative to other types of nursing, patients really do depend on their skills required to deliver adequate HD and they trust the care they receive is both evidence-based and best practice medicine. Nurses are also best qualified to offer patient-centred care, as they are with patients throughout their care and can anticipate their many needs. It is through their skill and knowledge that nurses can make what can be a challenging journey for patients less so and ensure patients live as well as medicine can offer with the fewest possible complications along the way. □

To view an electronic version of this publication along with related slides, please visit www.mednet.ca/2011/PP12-022 MFe.

Medical Frontiers International Inc.
132 chemin de l'Anse, Suite 100, Vaudreuil, Quebec J7V 8P3