



## 23rd Annual National Canadian Association of Nurses in Oncology Conference

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### Management of Catheter Occlusion and Home Intravenous Chemotherapy: Increasing Patient Safety and Comfort

**Halifax** - It is estimated that 25% of all catheters become occluded, the majority from thrombus formation. Early recognition of a partial or complete occlusion is critical as without prompt initiation of fibrinolytic therapy, patients and health care providers can all be adversely affected. Here in Canada, only one fibrinolytic agent is currently indicated for the treatment of catheter occlusion. Pivotal studies have shown it is highly effective even after a single dose and that safety issues are virtually non-existent. Although challenges remain, a novel pilot project suggests that carefully selected oncology patients may receive intravenous chemotherapy delivered by trained oncology nurses in the comfort of their home.

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Nurses need to recognize the signs and symptoms of partial and complete catheter occlusion and initiate fibrinolytic therapy promptly in order to minimize patient risk of physical and psychological trauma of having to recreate another venous access route and to facilitate timely delivery of the prescribed therapy. Prompt recognition of catheter occlusion will also ensure patients receive chemotherapy treatment as scheduled. "A blocked catheter has significant ramifications for patients, nurses and even the organization," Daphne Broadhurst, RN, clinical specialist, Desjardins Pharmacy, Ottawa, Ontario, told delegates here at CANO.

For patients, a blocked central venous access device (CVAD) means chemotherapy may need to be delayed as nurses start a peripheral intravenous (i.v.) line, at best an uncomfortable procedure that can undermine patient satisfaction with their care. It also means nurses cannot attend to other equally urgent tasks in the same timely fashion and it may necessitate involving the pharmacy, the laboratory and other members of the health care team as well.

#### Occlusion Overview

While prompt detection of an occlusion comes with experience, there are key signs to look for in a partial or complete occlusion. In a partial or "withdrawal" occlusion, fluid can be freely infused but blood cannot be freely withdrawn. When the catheter cannot be flushed and blood withdrawn, the occlusion is complete.

Once a partial or a complete occlusion is suspected, nurses typically check first for mechanical causes of the occlusion. Mechanical blockages are largely due to problems with the catheter itself or the administration set—there may be a kink in the i.v. tubing or the catheter; clamps that should be open are closed; infusion rates are either too fast or too slow; filters

may be clogged; or the i.v. bag is not thoroughly punctured. "You also have to look at your dressing and make sure there are no twists or kinks in the administration set and if there is a suture, you have to make sure it is not pinching the catheter," Broadhurst advised.

Occlusions can also be positional in nature and getting patients to raise their arm and change position can often help unblock the occlusion. A chest X-ray may be needed to rule out pinch-off syndrome or catheter tip malposition.

Chemical occlusions due to drug incompatibility are much less common and are usually caused by inadequate flushing of the lines between drug administrations (a minimum of 20 mL is needed). If drugs end up forming a cement-like precipitate in the catheter, bicarbonate or sodium hydroxide should be used depending on the pH of the precipitate.

By far, the most common cause of catheter occlusion is thrombotic in nature. As CANO speakers noted, cancer causes a hypercoagulable state and cancer patients are primed to form blood clots. Coughing, vomiting and constipation—common symptoms in cancer patients—are also risk factors for catheter occlusion.

Thrombi can block the lumen of a catheter (intraluminal thrombus) or form along the wall of the vein, exterior to the catheter (mural thrombi), partially or completely blocking the catheter, the vein or both. Fibrin deposits can also form a sock-like sheath that covers the exterior of the catheter tip or a larger "stocking" that covers more of the external surface of the catheter.

Often enough clots are not benign. If, for example, fibrin forms a "tail" at the tip of the catheter, whatever is being infused will flow out into the vein but as nurses pull back on the syringe, "the flap closes over the catheter tip like a ball-valve so you won't get blood into the catheter," Broadhurst explained. If the fibrin tail grows into a bigger fibrin sheath, whatever solution that should be emptying out into the

superior vena cava (SVC) gets caught between the outer wall of the catheter and the fibrin sheath and will backtrack along the length of that sheath and dump out into the vein. “If the sheath is short, the medication will still dump in the SVC and you may (or may not) have adequate hemodilution,” she noted.

Conversely, if the sheath is longer, the medication will empty out into a much smaller vein where hemodilution is not the same and the fluid may erode or extravasate through the vein wall; if a full-length fibrin sheath is present, the solution may dump out into the chest wall or the arm, depending on where the CVAD has been inserted, potentially causing tissue damage.

### Thrombotic Occlusion

When a thrombotic occlusion occurs, a fibrinolytic agent is needed to unblock the catheter, Broadhurst stressed. The fibrinolytic agent currently indicated for the restoration of function to CVAD occlusion is alteplase 2 mg dissolved in 2.2 mL of sterile water.

Among several techniques to instill alteplase, the simplest is via the use of a single syringe. “In my practice in Ottawa, we use 2 mg regardless of the catheter fill volume to ensure that any fibrin on the outside of the catheter is bathed in [alteplase]. Some practitioners are using 4 mg for larger catheters, such as implanted ports, to get optimal patency restoration,” Broadhurst told delegates. Others are instilling 2 mg of alteplase initially and then they “chase it” with a bit of saline, given every 10 minutes, to push the fibrinolytic forward so it interfaces with where the clot has formed. A few literature reports also support the effectiveness of dissolving the same fibrinolytic dose in a 50 mL bag of saline and infusing it over 2 to 3 hours.

It is also important for practitioners to treat every blocked lumen even if the patient has a double or triple lumen CVAD. “If bacteria get into the blocked lumen and it’s not treated... your patient could end up septic,” Broadhurst stated. Alteplase 2 mg does not break down established clots well, “so it really is critical that we treat a partial or complete occlusion as soon as we identify it, before the fibrin really establishes itself,” she reminded delegates.

Broadhurst emphasized that safety issues are essentially nominal at the dose used for catheter occlusion. In the pivotal COOL (Cardiovascular Thrombolytic to Open Occluded Lines) studies, there were no episodes of intracranial

hemorrhage, embolic events, major hemorrhage or death related to treatment. Restoration of function in both COOL1 and COOL2 were also high at approximately 75% after the first dose and approximately 90% after the second.

### Home i.v. Chemotherapy

Although challenges regarding CVAD management abound in hospital, they are much greater in the home setting where i.v. oncology treatments are considered for select patients. Acknowledging these challenges, Nicole Crisp, MN, Hematology, University of Alberta Hospital, Edmonton, believes that at least some i.v. chemotherapy can be delivered at home provided lengthy eligibility criteria are met.

In the only pilot project of its kind in Canada, she and colleagues from the Cross Cancer Institute (CCI) in Edmonton recruited a total of 117 medically stable oncology patients who expressed an interest in receiving i.v. chemotherapy at home.

“All chemotherapy was given by trained oncology nurses,” Crisp reported at CANO, “although patients continued to attend the CCI for assistance, follow-up and blood work.” Three oncology nurses were dedicated to the project; the maximum number of patients they could service in a day was 5. Over the course of one year, the only adverse event recorded was a single episode of extravasation which was managed in the home as it would have been in the hospital.

Preliminary analyses of the project are forthcoming but so far, cost-effective data suggest that a home-based i.v. chemotherapy program costs roughly the same as it does to deliver the same chemotherapy in hospital.

There did not appear to be any difference in quality of life between patients receiving chemotherapy at home vs. those who receive it in hospital—a somewhat surprising observation, as Crisp suggested, given that patients who received their chemotherapy at home had very positive comments about their experience, including the more personalized care and the increased convenience for both themselves and their caregivers, as well as greater privacy and comfort.

As cancer is predicted to affect between 40 and 45% of Canadians in the foreseeable future, “We have to find an alternative delivery system for chemotherapy, and home-based chemotherapy—even when it is given i.v.—may be a viable option for select patients,” Crisp suggested. □

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