

REPRINTED

JOURNAL OF VASCULAR ACCESS DEVICES

JVAD

The Official Publication of the National Association of Vascular Access Networks

S U M M E R 2 0 0 1

Preventing Central Venous Access Device Occlusions with Saline Only Flush by Use of an Adapter

Cheryl Lenhart, BSN, HRM

Introduction

During the past four years, problems associated with infusion via central venous access devices (CVADs), especially occlusion of the cannula, have been a primary focus in the medical outpatient center and by the intravenous therapy department at The Western Pennsylvania Hospital in Pittsburgh, Pennsylvania. A nursing research study was conducted in 1999 to determine the effectiveness of utilizing the CLC2000 Adapter (ICU Medical, San Clemente, CA) with established care and maintenance procedures for CVADs, including protocols for flushing the cannula of CVADs with heparin in order to maintain patency. A pilot study found that use of the adapter reduced the incidence of catheter occlusions.¹ Eighteen months after guidelines were established to formalize the use of the adapter, we found that the incidence of occluded CVADs declined to such a level that this problem now seems to be an event of the past.

Management of Occluded Catheters

About the time that the medical outpatient center began its occlusion management study, the intravenous therapy department initiated a venous assessment and access program that included the insertion of peripherally inserted central catheters (PICCs). Each month, the quality assurance data were reviewed on this new program, and the catheter type and follow-up performance of the device were

key factors in the analysis made. Soon it became apparent that the choice of catheter often was determined based upon the physician's desire that heparin not be used to flush the catheter, either because of the patient's medical condition or to permit ease of care following the patient's discharge from the hospital.

According to performance follow-up monitoring, these particular catheters were not always suited for the required therapies, especially for patients requiring frequent blood and/or platelet transfusions. With the hematology and oncology service accounting for thirty-five per cent of the patients needing CVADs and over one hundred blood transfusions occurring per month being given in the medical outpatient center, long-term catheter performance was critical to the new program's success. With this in mind, as well as wanting continued low CVAD occlusion rates, the idea to assess the use of the CLC2000 Adapter without a heparin flush was generated.

Discussion with several clinicians yielded surprising results — they were somewhat reluctant to stop the use of heparin for flushing CVADs. They did not want to return to the problems that are associated with occlusion management. Every opportunity was taken to talk about the study but progress was slow until the chairman of the division of thoracic surgery expressed an interest. The chairman was concerned about the increased return rate of post-open heart surgery

patients to the operating room because of bleeding potential from exposure to heparin. If use of heparin could be eliminated in this particular group of patients, it would be beneficial to patient outcomes. At the same time a nurse clinician from a large oncology practice in town called to voice support for the study. So, within two weeks, staff education and data collection tools were completed and the trial was started.

Trial Initiation

The trial began with four patients recovering from open-heart surgery and two patients receiving chemotherapy treatments. The study's premise was that flushing only with saline would be sufficient to maintain catheter patency as long as a CLC2000 Adapter was placed on the lumen of each intermittent-use catheter. The CLC2000 Adapter creates positive pressure when the syringe containing material used to flush the cannula of a CVAD is detached from the cannula, which forces the flushing solution through the cannula and thus prevents venous blood from being drawn into the cannula. All access attempts were documented as either "YES," indicating the ability to withdraw blood from the catheter lumen or from an accessed implanted port; or "NO," indicating the occlusion of either the catheter's lumen or port. Any attempt to declot the device with an antithrombolytic agent or any subsequent intervention (*e.g.*, initiation of a dye study or

removal of the device) was documented. During the first two weeks of the trial, no occlusions were found. News of the study spread and several more clinicians were interested in adding patients to the trial. By the fourth week, seventeen patients had been enrolled in the assessment.

During the early weeks of the assessment, several clinicians voiced concern about a syndrome called heparin-induced thrombocytopenia (HIT), a complex antigen-antibody-platelet interaction that occurs in approximately 20% of patients who receive an infusion of heparin.² HIT Type I causes a reduction in the platelet count, which increases the patient's chance of bleeding. The majority of patients will not experience any long-term effects from this phenomenon. However, for some patients, this condition develops into a more severe form, HIT Type II, which causes severe platelet reduction and concomitant thrombosis development. This syndrome is life threatening and can result in the loss of limbs due to thrombotic arterial events. HIT has been reported in patients receiving low-dose subcutaneous heparin for prevention of clots, small amounts of heparin from catheter flush solutions, and even from heparin-coated catheters.³ Even though the potential for developing Type II HIT is highest with full doses of unfractionated heparin, it can occur with doses as small as those used for flushing catheters.² Armed with this information, we were determined to increase the scope of the trial; by the end of the second month, over 40 patients and 400 vascular access attempts were documented.

Study Findings

The study was closed in January 2001, and the outcomes were compared to the historical data of catheters that were maintained with a heparin flush (Table I). Not only did the study support our premise that the CLC2000 Adapter would reduce the incidence of CVAD occlusions without the use of heparin, but also the results were better than the prior study in which

	Saline Flushing Solution Used	Heparin Flushing Solution Used
Number of Patients enrolled	71	49
Number of Access Attempts	647	500
Access Attempts by Device Type		
Central Venous Catheter	278	160
PICC	251	160
Implanted Port	118	180
Number of Occlusion Incidences	4 (1/162 attempts)	5 (1/100 attempts)
Number of Dye Studies Required	0	0
Number of Catheter Replacements Required	0	0

heparin was used to maintain the patency of the CVADs¹. Most likely this was due to the clinicians' experience with the Adapter device during the course of this study period. Of the four occlusion events that did occur, three resolved with just one instillation of an antithrombotic agent; the fourth occlusion was in one lumen of a triple lumen catheter and it resolved with one dose of antithrombotic agent as well. The other two lumens were patent during the entire indwelling period.

Benefits Noted

The elimination of heparin from the flushing procedure has a wide range of benefits for the patient, the patient's caregiver, and the institution. Enhanced catheter selection is a tremendous advantage in that every CVAD can be a "no heparin" device. Clinicians do not have to limit their device selection to specific catheters or manage unsatisfactory catheter function because of the need to eliminate heparin. Patients are spared repeated exposure to the effects of heparin, a very potent and potentially harmful drug, during the course of their therapy via a CVAD. In addition, the maintenance of the device is simplified for the caregiver both in the hospital and at home. Finally, the cost associated with

flushing the device is substantially lowered. For example, if one calculates the cost of a 3cc flush of heparin (at \$0.41 each flush), then over the course of one month, the cost for providing 100 flushings of heparin per day runs approximately \$1,230, and the cost over one year is \$14,760. Reducing the number of heparin flushes used can impact the cost of catheter maintenance favorably.

Conclusion

In today's complex, and sometimes troubling, health care environment, it is often difficult to make significant improvements in clinical outcomes. Use of positive pressure devices appears to provide both the patient and the clinician the option for heparin-free flushing without a compromise in catheter performance. When changes in outcomes are recognized, compliance and enthusiasm for such a process comes easily. Everyone who has participated in this study was thrilled with the results and our hope is that your patients and clinicians can likewise benefit from our experiences. ♥

Cheryl Lenhart, BSN, HRM is the Manager of the Medical Outpatient and Intra-venous Therapy Department of the Western Pennsylvania Hospital, Pittsburgh, Pennsylvania.

REFERENCES

1. Lenhart, CL. Prevention vs. treatment of VAD occlusions. *JVAD* 2000; 5(4): 34-35.
2. Brieger DB, Mak KH, Kottke-Marchant K, Topol EJ. Heparin-Induced thrombocytopenia. *Journal of American College of Cardiology* 1998; 31(7): 1449-1459.
3. Kelton JG, Warkentin TE. Heparin-induced thrombocytopenia. Diagnosis,

natural history and treatment options. *Journal of Postgraduate Medicine* 1998; 103(2): 169-171, 175-178.