

# **Continued Studies in Preventing Complications of Central Venous Access Devices (CVAD's)**



**By Cheryl Lenhart, BSN, HRM  
Nurse Manager**

**Intravenous Therapy Department/Medical Outpatient Center/Bone marrow Transplant Unit  
The Western Pennsylvania Hospital  
Pittsburgh, Pennsylvania**

Preventing complications that occur as a result of central venous access device placement has been a topic of serious consideration and a major targeted improvement initiative for infusion therapy at our hospital. As the nurse manager of three nursing units that have the greatest number of patients with CVADs, there is a tremendous need to keep the problems related to these devices at a minimum. Four years ago, patient treatment delays related to CVAD complications: occlusions, infections and device malfunctions were a major source of patient, physician and nurse dissatisfaction. Occlusions were our number one patient problem in the Medical Outpatient Center.

Our procedures at that time focused on managing the complication once it occurred. This management involved the following steps:

- 1. instillation of an antithrombotic**
- 2. repeating the antithrombotic if necessary**
- 3. if no blood return upon aspiration: radiological dye study (venogram)**
- 4. if patency could not be confirmed: removal of device**

This process was time consuming for the nurse, frustrating for the patient and caregivers and very, very costly.

When positive pressure adapters first became available, we conducted a nursing research study on the effects of these adapters in reducing occlusions in CVADs. The results were so dramatic that we instituted a hospital wide policy to utilize them on all intermittent use CVADs. To our surprise, not only did they effectively eliminate occlusions, but they also contributed to significant reductions in other CVAD complications such as infection rates, malfunctions and damage of these devices (**Lenhart, "Prevention vs. Treatment of VAD Occlusions," JVAD, Winter 2000**). The results of this original study prompted a second study that was similar to the first study, but eliminated the use of heparin in the flushing procedure. This study proved that heparin was, indeed, not necessary to prevent CVAD occlusions as the occlusion rate was even lower than in the first study (**Lenhart, "CVAD Occlusions with Saline Only Flush by Use of an Adapter," JVAD, Summer 2001**). The results of the second study led to a hospital wide

preventative strategy for CVAD complications that included the elimination of heparin from our flushing procedures for all central lines.

As technology continues to evolve, additional positive pressure devices have become available to eliminate occlusions in CVADs. From October 2002 through February 2003 we studied a new positive pressure device called the **MaxPlus** adapter on intermittent use CVADs in our Medical Outpatient Center. The design of this adapter is symmetrical with the intravenous administration sets, so it was very easy for the nurses to apply it to the catheter lumens. The **MaxPlus** adapter was changed weekly and remained on all lumens throughout the patient's treatment course.

A total of 32 patients with central catheters were studied. These catheters included Peripherally Inserted Central Catheters (PICCs), triple lumen catheters and accessed implanted ports. The purpose of the study was to determine the patency (ability to obtain a blood return upon aspiration) of the catheter lumen prior to the initiation of any intravenous therapy (medication administration, intravenous solutions, blood administration, etc.). A total of 316 access attempts utilizing the **MaxPlus** positive pressure device (PPD) were documented on a data collection sheet. The study was performed with a saline only flushing regimen. Patients were studied for a period of 4 to 8 weeks of a prescribed medical regimen. The results are shown in the table below and compare the current results with our previous studies.

Pre Positive Pressure Devices	Post Positive Pressure Devices	Post PPD-- No Heparin	MaxPlus PPD-No Heparin
3 Occlusions/100 AA*	1 Occlusion/100 AA	1 Occlusion/162 AA	1 Occlusion/105 AA
1 Venogram/200 AA	0 Venograms	0 Venograms	0 Venograms
1 Cath Replacement/325 AA	0 Cath Replacements	0 Cath Replacements	0 Cath Replacements

**\*Access Attempts**

All three studies demonstrated significant reductions in occlusions. It is important to note that any occlusion event was resolved without venogram (dye study) or catheter replacement so long as there was a positive pressure device in place. The **MaxPlus** product functioned on all types of CVADs and the nursing staff had no difficulty adapting it to their normal infusion and flushing procedures.

There is no question that positive pressure adapters, when used with preventative measures, are the major factor in reducing complications associated with CVADs. The impact on our patient, physician and nurse satisfaction has been enormous. We no longer experience treatment delays or have to verify placement of non-functional CVADs with radiological studies. We have not replaced a catheter due to occlusion-related problems in over 3 years. We have also eliminated the use of heparin in our catheter flushing procedures, further reducing the patient's risk of heparin exposure. Lastly, we have significantly reduced our costs in treating

CVAD complications, which in the Medical Outpatient Center alone equated to over \$40,000/year (based on costs associated with antithrombotic instillations, venogram verification, catheter replacement and heparin flushing solutions).

If you have any questions or would like further information regarding this article, please contact Cheryl Lenhart at [clenhart@wpahs.org](mailto:clenhart@wpahs.org).