

An Evaluation of the Effectiveness of Intravenous Disinfection Caps in the Prevention of CVAD Infections in Parenteral Nutrition Patients and Patients with Multi-lumen CVADs

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Introduction

One of the most serious complications of parenteral nutrition (PN) is a catheter-related blood stream infection (CRBSI). One national infusion company's outcomes have demonstrated infection rates for PN central vascular access devices (CVADs) at more than two times the frequency of those found in non-PN CVADs, specifically 1.01 infections per 1,000 catheter days vs. 0.39 infections per 1,000 catheter days respectively. It has been reported^{1,2} that multi-lumen CVADs are more likely to become infected than their single-lumen counterparts because contamination is more probable due to multiple access sites and a likely increase in manipulation of multiple ports.

One of the most common sources of CVAD contamination is the catheter hub. Catheter maintenance standards and best practices indicate that the best way to prevent a CVAD infection via the hub is to clean it with an antiseptic prior to access. A recent study has shown that a 15 second hub scrub with either isopropyl alcohol (IPA) or chlorhexidine gluconate (CHG) is effective in the prevention of bacterial ingress.³ The same national infusion company adopted the 15 second hub scrub in their policies and procedures more than a year prior to this study; however, not unlike the findings in many publications, it was found that the protocol for hub antisepsis is not always followed. Studies have indicated that hubs accessed without any antisepsis at all subsequently have increased CVAD infections.

Background

One infusion branch of a national home infusion company noted several CVAD infections in the first quarter of 2010, primarily with their PN patient population. They continued to reinforce good antiseptic technique with these patients, but found that the rate of CVAD infections continued.

Home infusion PN patients frequently have concomitant health issues which further complicate their care, and may pose a risk for higher incidence of CVAD infection. Common diagnoses associated with TPN such as Crohn's, enteritis, pancreatitis, short bowel syndrome and malabsorption may also predispose TPN patients for increased risk of CVAD infection due to immunosuppression and cross-contamination of intestinal output. PN patients typically have long dwell times, and long dwell times may extend the

opportunity for the development of a catheter infection. Fifty percent of PN patients have been found to have multi-lumen CVADs, whereas non-PN patients average approximately 30 percent multi-lumen CVADs. Additional lumens also pose more opportunity for bacterial ingress.

After consideration of options for increasing catheter antisepsis, a observation using an intravenous disinfection cap (SwabCap[®]) was initiated. The cap would be provided to all PN and multi-lumen CVAD patients for attachment to their CVAD injection cap when not in use.

The cap screws on to the IV injection cap and acts as a physical barrier in addition to providing sustained application of 70 percent isopropyl alcohol until removal. All PN and multi-lumen CVAD patients were taught to connect this

cap to their IV injection cap after medication administration was completed and until it was time to access the injection cap for flushing or medication administration. Follow-up phone calls were made to each patient to ascertain compliance with product use. Access devices, sites and patients were monitored closely for any signs of catheter infection. The observation was initiated on July 1, 2010 (quarter 3), and catheter infection data from Q1 and Q2 2010 was then compared to catheter infection data for Q3 and Q4 2010.

The process change for CVAD antisepsis was minimal. The presence of the disinfection cap at the start of therapy served to provide antisepsis without remembering an additional step. The steps for each process can be observed below.

At Start of Infusion

| Traditional Antisepsis with PN Infusion | Antisepsis with Disinfection Cap |
|---|----------------------------------|
| Swab injection cap | Remove disinfection cap |
| Flush with saline | Flush with saline |
| Connect PN infusion | Connect PN infusion |

At End of Infusion

| Traditional Antisepsis with PN Infusion | Antisepsis with Disinfection Cap |
|---|-----------------------------------|
| Disconnect PN infusion | Disconnect PN infusion |
| Swab injection cap | Swab injection cap |
| Flush with saline | Flush with saline |
| Swab injection cap | Swab injection cap |
| Flush with Heparin (if indicated) | Flush with Heparin (if indicated) |
| | Attach disinfection cap |

Data

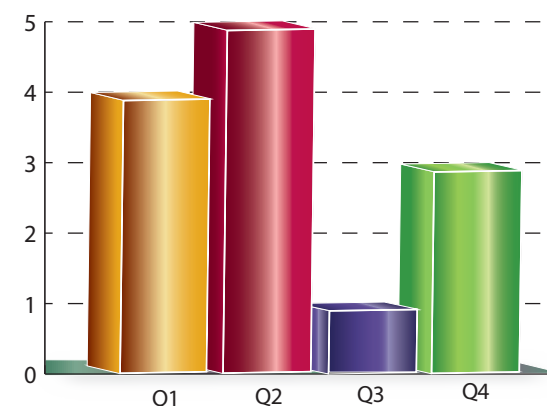
TPN and Multi-lumen Number of Catheter Days

| Quarter | Q1 | Q2 | Q3 | Q4 |
|--|--------------|--------------|--------------|--------------|
| TPN | 1,266 | 1,524 | 1,614 | 1,409 |
| Multi-lumen | 606 | 706 | 869 | 720 |
| Total Catheter Days (TPN + Multi-lumen) | 1,872 | 2,230 | 2,483 | 2,129 |

Catheter Infection Rate

| Quarter | Q1 | Q2 | Q3 | Q4 |
|---|-------------|-------------|-------------|-------------|
| TPN | 2 | 2 | 0 | 2 |
| Multi-lumen | 2 | 3 | 1 | 2 |
| Total | 4 | 5 | 1 | 4 |
| Infection Rate per 1,000 Catheter Days | 2.14 | 2.24 | 0.40 | 1.88 |

Total CVAD Infections



Outcome

PN and multi-lumen CVAD infections decreased from 2.14 and 2.24 per 1,000 catheter days in quarters 1 and 2, 2010 to 0.40 and 1.88 per 1,000 catheter days in quarters 3 and 4, 2010.

Conclusion

Quarters 1 and 2 averaged a catheter infection rate of 2.19 per 1,000 catheter days. Quarters 3 and 4 averaged a catheter infection rate of 1.14 per 1,000 catheter days, with three of the five infections occurring with patients not using the disinfection cap. Even with the infections reported by the non-compliant patients, the catheter infection rate decreased by 48 percent in this branch. $((1.14/2.19) - 1.00)$

Of the five catheter infections reported during the observation, one was clearly a track infection as a result of an infected suture, one patient admitted to stopping use of the disinfection cap (no reason provided), and two double lumen CVAD catheter maintenance patients declined to use the cap because it was "an extra step". One PN patient was using the SwabCap as directed, although when his catheter was partially pulled out during an independent dressing change, he did not notify the company and continued to infuse. A catheter infection developed within one week. A protocol that includes the use of a disinfection cap on all lumens of this CVAD population when the lumens are not in use appears to lower the risk of CVAD infections. Compliance with use of a disinfection cap should be monitored via supply inventory with weekly patient phone calls.

Regular catheter antisepsis with a swab or wipe prior to each access may not be the best way to achieve 100 percent compliance with this procedure. A disinfection cap that applies sustained antiseptic contact with the IV injection cap between uses may be indicated for those catheters that pose higher infection risks, such as PN patients and multi-lumen catheter patients.

References
¹Crit Care Med. 2003 Sep;31(9):2385-90.
²Infection. 2008 Aug;36(4):322-7. Epub 2008 Jul 28.
³JANA. 2007 Vol. 12, No. 3, Wendy Kaler, MT, MPH, CIC and Raymond Chinn, MD, FACP