AVA 2012
Abstract #71

HEALIX

Incidence of Central Venous Catheter (CVC) Infections in Patients Treated with Intravenous Antibiotics (IVAB) in the Physician Office Infusion Center (POIC)

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Abstract (revised)

Purpose/Design: CVC-related blood stream infections are a common cause of hospital-acquired infections, are associated with a high mortality rate and increase healthcare costs. The POIC setting provides a unique environment for the physician-nurse team to continuously maintain and manage problems associated with CVCs while avoiding risks associated with hospitalization. Data is not available on incidence of CVC infections in the POIC setting in the US.
Methods: A retrospective review of clinical catheter forms available from a centralized database was done. Patients were included if they were seen at one of the 3 independent participating sites and had their CVC inserted and removed during a 6 month period. Data was reported using descriptive statistics.
Results: 263 patients met study criteria. The average number of catheter days was 30.7 (range 4-125). All (100%) CVCs were placed outside of the POIC and 200 (76%) patients self-administered IV therapy. The catheter infection rate in our patient population was 0 in 8070 total catheter days (0/1000). Seventeen (6%) patients experienced a catheter dysfunction.
Limitations: Our retrospective analysis is limited by the availability and accuracy of catheter forms.
Conclusions: Compared to national averages, the lack of CVC infections in our patient population is impressive and there is an enormous potential for cost savings. We attribute the low infection rate to extensive nurse and patient education, continuity of care, consistency in product selection and early intervention. As patient services are moved from the hospital to the outpatient setting for patient-centered care and reimbursement issues in addition to clinical outcomes, data from the POIC environment becomes critical.

Introduction

Approximately 250,000 central-line associated blood stream infections occur annually, have been reported as the forth most common cause of hospital-acquired infections (1) and result in an estimated mortality rate of 12 -25% (2). Estimated rates of central-line associated infections in the hospital range from 1.14 per 1000 central line days in the inpatient wards to 3.64 per 1000 central line days in the intensive care unit (3). Outpatient administration of intravenous therapies has been on the rise due to increased acceptance by both patients and caregivers, the development of once daily administration of antimicrobial agents, advances in vascular access and infusion devices, an emphasis on cost containment and the increasing availability of the service (4). Additionally, hospitalization can be avoided by receiving IVAB therapy in the POIC setting. Specific advantages to receiving care in the POIC include rapid and convenient care initiation and consistent care with infectious disease physicians and nurses who specialize in infusion care.
The POIC setting provides a unique opportunity to initiate, maintain and manage problems associated with CVCs. Physicians work closely with nursing staff to continuously monitor for risk factors that may lead to CVC infections. The physician and nursing staff work collaboratively to maintain policies aligned with evidence-based practices as well as to follow our zero tolerance policy for acting immediately on signs and symptoms that may lead to CVC infections.

Methods

- Our study was IRB approved through expedited review by the University of Houston-Victoria.
- We retrospectively reviewed data previously collected on central venous catheter tracking forms over a 6 month period (October 1, 2011 – March 31, 2012) from 3 participating sites. Independent POICs participating in the study were located in Delaware, California and Texas.

Inclusion Criteria:
- Adult patients 18 years or older
- Seen in one of 3 participating POICs during the study period
- A central venous catheter inserted and removed during the study period
- Received intravenous infusion therapy

Clinical Definitions:
- CVC infection was defined as an infection at the catheter site or a catheter-related blood stream infection as diagnosed by the physician

Cost Analysis:
- Hospital costs are reported based on the mean Medicare charges per CVC infection (ICD-9 code 999.31) from the 2010 Healthcare Cost and Utilization Project (HCUP) data base.

Data Analysis
- Descriptive statistics were used to report data.

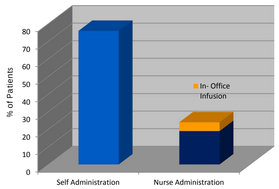
Results

Demographics

Table 1: Demographics

Demographics	n=263
Average age (years)	55
Range	9-88
≥ 65	78
Co-morbidities	
Diabetes mellitus	52
Cancer (history or current)	61

Figure 1: Medication Administration



- The most common treatment indications were osteomyelitis 43 (16%), cellulitis 28 (11%) and bacteremia 19 (7%).
- The IVABs most frequently received by our patient population were vancomycin 62 (24%), ceftriaxone 45 (17%) and cefazolin 41 (16%).

- Elastomerics for self administration were the most common delivery device (76%), followed by ambulatory pumps (19%) and stationary pumps (5%).
- Catheter care was performed solely by nursing staff.

Safety

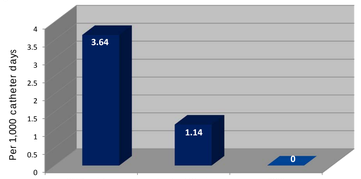
Table 3: Catheter Dysfunctions

- 17 (6%) patients experienced a catheter dysfunction during the study period and all had positive resolution upon intervention
- The estimated cost for treating a catheter occlusion was $192 (medication cost plus professional fees).

Total	Event	Partial / Full	Intervention	Resolved
11	Single lumen occlusion	9 partial, 2 full	activase	10 resolved, 1 improved
4	Dual lumen occlusions	4 partial	activase	yes
1	Severe adhesion reaction	1 partial	catheter sutured in place	yes
1	Chest pain (tunneled IJ)	1 partial	enoxaparin, ruled out PE	IJ retained

Outcomes

Figure 4: CVC Infection Incidence



*National average based on CDC. Vital Signs: Central line—Associated Blood Stream Infections—United States, 2001, 2008, and 2009. MMWR. Morb Mortal Wkly Rep 2011;60(80);243-248.

- The total number of catheter days represented by our population was 8070
- The average number of central catheter days was 30.7 (range 4-125).
- CVC Infection incidence in our patient population was 0/1000 catheter days.

Catheter Specifics

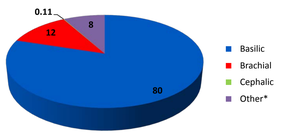
Table 2: Catheter Information

Catheter Specifics	
Type (%)	
PICC	95
PORT	1
Tunneled	0.3
Tunneled central venous dialysis catheter	0.3
n/a	3.4
Lumen Count (%)	
Single	76
Double	23
Triple	1
Manufacturer (%)	
Bard	71
Navylist	22
Other*	7

* Quinton (4), Arrow (1), JCH (1), n/a (12)

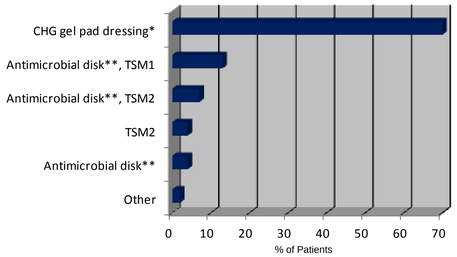
- 100% of CVCs were placed outside of the POIC by either interventional radiology or an RN.
- CVCs were placed an average of 3 days prior to the first visit in the POIC (median, 1 day).

Figure 2: Insertion Vein



* Cephalic (3), tunneled port (chest, 3), IJ (3), subclavian (2), n/a (10)

Figure 3: Dressing Type



- CHG gel pad dressing was applied to the majority of catheters (70%).
- Regardless of dressing type, a securement device was used on all CVCs.
- Site maintenance was performed a minimum of once weekly.

*3M ™ Tegaderm ™ CHG Chlorhexidine Gluconate I.V. Securement Dressing"
**Biopatch ™ protective disk; TSM (Transparent Semipermeable Membrane)1- Opsite 3000 ™ dressing
TSM2 – SorbaView ™ Shield; Other includes: gauze-based (1), plain Tegaderm ™ (3), and n/a (2).

Cost Avoidance

Table 4: Cost Avoidance

Extrapolated ICU Infection Rate	Extrapolated IP Ward Infection Rate	Cost* / Episode	POIC Infection Rate	Actual Cost
29 / 8,070	9 / 8,070	$65,046	0	0

* Hospital costs reported based on the mean Medicare charges per CVC infection (ICD-9 code 999.31) from the 2010 Healthcare Cost and Utilization Project (HCUP) data base

Discussion

- Considering the large portion of patients who self-administered at home, we show a remarkably low incidence of CVC infections.
- While there was no cost associated with treating CVC infections at our study sites, there was a cost associated with rapid intervention on catheter dysfunctions that could possibly lead to CVC infections and associated morbidities and death. We suspect that this could project to substantial cost savings associated with possible hospitalization or emergency room visit avoidance as well as avoidance of diagnostic fees and treatment of the infection including medications and possible catheter replacement.
- A recent study by Barr, et al reported a catheter infection rate of 0.79 per 1000 use days (5) in the outpatient setting, however, this study was performed in the UK and included 3 separate delivery models. We report a 0 infection rate in a novel POIC population.

The success of POICs in preventing CVC infections may be attributed to uniform standards that follow current evidence-based practice at all three study sites.

Nursing Education and Training

Uniform Education and Training
•On-line courses and competency testing
•Standardized patient education methods

Standardized Product Selection

Policies for site maintenance access and patency care

Zero Tolerance
• Product compliance
•Catheter tracking documentation
•Patient education documentation
•Policy adherence
•Immediate action on signs and symptoms of CVC infection

Ongoing Education and Follow-up

Patient Education

Admission to the POIC
• Video
Specific to the POIC environment and treatment
Handouts / Pictograms

Knowledge and feasibility assessment

Patient-specific medication and catheter education
1. Administration technique
2. Aseptic technique
3. Actions for complications
4. Self-monitoring

Handouts / Pictograms

Education with Return Demonstration and Follow-up

Conclusion

- We propose the reason for impressively low incidence of CVC infections in our novel patient population was a result of a commitment to excellence in nursing and patient education combined with product selection and the application of evidence-based practice.
- As patient care moves to the outpatient setting due to cost containment as well as patient preference, data from the POIC is paramount.
- We are currently pursuing a study spanning 12 months with an increased number of subjects and catheter days.

References

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4. Paladino JA and Poretz D. Clinical Infectious Diseases 2010;51(S2):S198-S208.
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A travel grant for meeting attendance to present this poster was provided by 3M
We would like to thank Jere Hammer, RN, PhD, Assistant Professor, University of Houston-Victoria for her consultative advice.