The CentrAl VenouS Catheter Access DocumEntation (CASCADE) Study

Retrospective Chart Review

Principal Investigator

Claudia Douglas, DNP, RN, CNN*e*, APN-C

Sub-Investigator(s)

Mohammed Quadri MD, MBA, SSBB, CPH
Dianne Aroh, RN, MS, NEA- BC, FACHE
Rose Williams BSMT, MSCRA, MBA, CCRP

INTRODUCTION

Central venous catheters (CVCs), peripherally inserted central catheters (PICCs), and hemodialysis (HD) catheters, a necessity in health care, are vital in both inpatient and ambulatory care settings.[1] In the United States, more than five million central venous access are inserted annually,[2] playing a fundamental role within the complex treatment modalities in critical care, total parenteral nutrition (TPN), and renal replacement therapies. The significant role of central lines in critical care and hemodialysis is coupled with impending problems that must be prevented, recognized, and managed as catheter-associated complications considerably increase morbidity, mortality, and healthcare costs.

Central lines account for up to 15 million catheter-days per patient year in intensive care units (ICUs).[3] From 2000 through 2009 there was a 15% increase in ICU beds from 67,579 to 77,809.[4] In hemodialysis there was a 25% increase in the use of CVCs for dialysis access.[5] This increasingly high prevalence is projected to continue its upward trend in the number of intensive care and end-stage renal disease (ESRD) patients. In 2013, newly diagnosed cases were 117,162 above the 662,000 established ESRD population.[6] Clinical documentation within the electronic medical record (EMR) systems is at the core of every patient encounter. EMR offers a vast reservoir of coded data across continuums of care enabling systematically structured evaluation from which meaningful prognostication on the quality and cost of care delivered can be derived. And, as it is a fact that comprehensive care is communicated through the medical record,[7] therefore, the importance of documentation cannot be overstressed. EMRs can be used to identify adherence and variation in practice, inconsistencies in quality of care, and value based clinical decision.[8] Thus EMRs are valuable clinical tools.

Table -1 Catheter Definitions and Indications for Use

Catheter Type	Defintion	Indications for Use
Central Venous Catheter - CVC	A tunneled cuffed inserted via the internal jugular, axillary veins and the tip of the catheter is advanced into the lower one-third of the superior vena cava (SVC) at the level of the cavoatrial junction (CAJ). A nontunneled, noncuffed inserted percutaneously into femoral, subclavian, or internal jugular vein	• Chemotherapy and bone marrow transplant (BMT) • Plasmapheresis and leukapheresis • Intravenous (IV) antibiotic and antifungal therapy • Total parenteral nutrition (TPN) • Pain management (rarely)[9] -Short tem use[10]
Hemodialysis Catheter - HD	A cuffed tunneled central venous catheter dialysis tunneled into the superior vena cava used exclusively for hemodialysis therapy	• Hemodialysis access for acute and chronic renal failure, and end-stage renal disease (ESRD).[11]
Peripherally Inserted Central Venous Catheter - PICC	Peripherally inserted central venous catheter inserted in a large peripheral vein, such as the cephalic or basilic vein, and then advanced until the tip rests in the distal superior vena cava or cavoatrial junction.	• IV therapy lasting several weeks up to 6 months. ▪ TPN ▪ Antibiotics ▪ Analgicics ▪ Repeated Blood Transfusions ▪ Chemotherapy[12]

BACKGROUND AND SIGNIFICANCE

Central lines have no absolute placement contraindications. They afford a readily available vascular pathway for life-sustaining intravenous fluids, nutrition and medications,

repeated laboratory tests, high-flow infusions, hemodialysis, and hemodynamic monitoring that cannot be precisely measured via non-invasive means.[Error! Bookmark not defined.] A major factor in the choice of a central access is the intended need. A non-tunneled catheter is the best option for short-term use (days to weeks), PICCs for intermediate use (weeks to months), and tunneled CVCs for long-term care (months to years).[13] At times when vesicant and vasoactive medications are required to avoid local tissue injury or when needed for extracorporeal therapies,[14] central access becomes the only viable alternative. Central lines are categorized as either inserted centrally or peripherally inserted. PICC has become increasingly popular because they are easy to insert, is considered cost-effective, and has been perceived to be safe in comparison to CVCs.[14] PICCs, however, is not without complications. Some of these complications include catheter fracture, leakage, infection, superficial and deep vein thrombosis (DVT).[15, 16] As with all invasive procedures, catheter-use has high probabilities for complications.[17] With more than five million catheters inserted annually,[15] the vulnerability of CVCs to complications mandates a careful, structured investigation from the time of insertion, during dwell time, and at removal. Central venous catheters, now commonplace in critical care, hemodialysis, and long-term care setting, requires specialized knowledge in care, management, maintenance, and documentation.[16] Practitioners, care providers, manufacturers, and regulatory agencies have long recognized that central lines are problem prone.[17] Mechanical, thrombotic, and infectious complications remain the leading cause of catheter malfunction and failure.[18] The hydrophobic surface of CVCs promotes adsorption of protein and cellular adhesions, making them susceptible to thrombotic occlusion and fibrin sheath formation in as early as twenty-four hours after placement.[19, 20] These building blocks eventually precipitate obstruction, a frequent complication of central lines.[21]

Catheter occlusion occurs within one to two years in approximately 14% to 36%,[22] which can be due to mechanical causes, precipitation of TPN, and low pH medications.[23] Occlusions interrupt and delay patient care,[24] a compromise that often leads to cancellation of life-sustaining therapies, ultimately contributing to mortality and higher overall costs.[25] Occlusions do not just impede critical treatment; they also result in infectious complications due to the formation of complex biofilms of bacteria, viruses, and fungi,[26] an eventuality that situates the supposedly beneficial catheter as the source of problematic bloodstream infections and hospital acquired complications (HAC). Blood stream infections can exacerbate a patients' condition, especially when the patient is immunocompromised, as biofilms are difficult to eradicate due to its high resistance to host defenses and antimicrobials.[27] Catheter-related infection is a serious complication leading to sepsis, septic shock, and a mortality rate as high as 25%.[28] By many analyses, the cost of infectious complications is significant as it increases morbidity, mortality, length of stay, and financial resources.[29] The Centers for Disease Control and Prevention (CDC) approximates the added cost per infection to be at $16,550 therefore independently escalating hospital length of stay and cost.[30] As a result, catheter utility should be measured by the improvement in a patient's condition relative to its use. Identifying variability in catheter function and the inverse proportionality relative to cost is critical in the current value-based purchasing reimbursement environment. Compounding this issue of economics in catheter management, the Centers for Medicare and Medicare Services (CMS) no longer reimburses for hospital-acquired central line-associated blood stream infections (CLABSI), a never event.[31]

The second highest occurring never event in healthcare is central venous catheter infection,[32] a clearly identifiable, measurable, and preventable HAC.[33] Catheter-related complications are not only detrimental to a good prognosis but is also unacceptable to care

providers, payers, and institutions. The importance of vigilant central line management is required because catheter-related complications adds additional financial burden on healthcare institutions. Estimates of per infection attributable never event cost is between $34,508 and $56, 000,[34] with a yearly cost ranging from $296 million to $2.3 billion.[35]

The emergence of the concept of "big data" in the EMR system has revolutionized patient care delivery. A principle standard in electronic documentation is easy access to relevant information and [36]transparency, as information is openly shared.[37] The seminal work of L. L. Weed (1968), titled: "Medical Records That Guide and Teach," stresses the importance of a highly organized medical record; and the significant role in quality care as it puts a system to the multiple problems that directly and indirectly affect a patient.[38] Moreover, data must be analyzed to derive meaningful use and improve quality, safety, efficiency, and cost.[39] A vital clinical information that enables the continuing development and delivery of quality health care; inaccuracies translate to inaccurate reports that can lead to adverse events.[40, 41, 42] Electronic documentation affords data abstraction for the purpose of epidemiological analysis.[43] Furthermore, as the healthcare moves from volume-based to value-based purchasing (VBP),[44] Information Governance Principles for Healthcare (IGPHC) of 2014 provides a sound framework: accountability, transparency, integrity, protection, compliance, availability, retention, and disposition – allowing for a compliance to standards of information and technology in healthcare.[45] A health institution must have a documentation environment that is conducive to both patient and care provider, i.e. ownership and transparency.

STUDY PURPOSE AND RATIONALE

Translating good clinical practice and best evidence into the care and management of central lines poses many challenges.[46] Several experts have identified the existing gap between

policy awareness and adherence among providers and clinicians.[47, 48] A comprehensive review of the literature from 2001 to 2015 found few studies describing and quantifying existing clinician variability in care and management of centrally and peripherally inserted catheters.[49] Therapeutic interventions in 21st century healthcare is assumed to be based on evidence demonstrating a net beneficial effect that is without supporting data. CMS value based purchasing now demands stakeholders (i.e. purchasers, payers, providers, clinicians, patients, and policy makers) to change the measurement of healthcare quality from the historical practice of individual judgement based primarily on clinician credentials to metrics. [50] The high prevalence of central lines mandates a paradigm shift from the standard perception of complications being "inevitable" to "unacceptable" thereby setting elimination as the goal versus the current benchmarking comparisons.[51] Specific outcome metrics for central lines should be identified in individual organizations with specific performance metrics. Hospitals need to monitor clinician adherence to specified outcome metrics for CVCs, PICCs and HD catheters.

The aim of this study is to document clinicians variation in practice in comparison to standard guidelines by the Medical Center's approved Evidence-based Practice (EBP) guidelines, policies, and procedures for CVCs, PICCs and HD catheters by way of a structured retrospective review of the EMR system. This study will assist in future translational research and to design a prospective study on CVCs, PICCs and HD catheters.

RESEARCH QUESTION

1. What are the outcomes associated with management of CVCs, PICCs and HD catheters in adherence with hospital approved EBP guidelines for CVCs, PICCs and HD catheters?

2. What are the mechanical/technical, thrombotic, and other adverse outcomes (Heparin induced coagulopathy) associated with central venous catheters due to variation in insertion and management practices of CVCs, PICCs and HD catheters?

HYPOTHESIS

There is no statistical significant difference between mechanical/technical, thrombotic, and other adverse outcomes associated with CVCs, PICCs and HD catheters due to variation in insertion and management practices and with adherence to hospital approved EBP guidelines for CVCs, PICCs and HD catheters.

PRIMARY OBJECTIVE

1. To explore the association between mechanical/technical, thrombotic, and other adverse outcomes associated with CVCs, PICCs and HD catheters due to variation in insertion and management practices and with adherence to hospital approved EBP guidelines for CVCs, PICCs and HD catheters.

PRIMARY ENDPOINTS

1. To document number of mechanical/technical, thrombotic, and other adverse outcomes associated with CVCs, PICCs and HD catheters in two groups:

   1a. Clinicians interventions and management *in adherence* with hospital approved EBP guidelines for CVCs, PICCs and HD catheters.

   1b. Clinicians interventions and management *not in adherence* with hospital approved EBP guidelines for CVCs, PICCs and HD catheters.

   Catheter Insertion - See Appendix B

   Clinician performing insertion identified

   - Number of attempts documented
   - Radiologic confirmation

- Confirmation of catheter placement and PICC location
- Under Floroscopy

Indication for catheter-need documented

- TPN
- Intravenous fluids
- High flow infusions
  - Type of product infused
- Repeated laboratory tests
- Hemodialysis
- Medications
  - Long-term Antibiotic therapy
  - Infusion of vesicants
- Hemodynamic monitoring

Catheter Management and Care Documented: Appendix

Number and rate of times that the following best practice indicators were documented

- Department/Unit of catheter insertion
  - Operating Room
  - Bed-side
    - Cardiac Intensive Care Unit (CICU), Surgical Intensive Care Unit (SICU), Medical Intensive Care Unit (MICU)
  - Interventional Radiology
- Personnel performing the insertion
- Physician assistance Advance Practice Nurse

- Catheter insertion site
    - Subclavian
    - Internal jugular
    - Femoral
    - Cephalic vein
    - Basilic vein
    - Brachial vein
- Frequency of dressing changes
- Mask was used during dressing change procedure
- Mask was used during access procedure for CVCs, PICCs, HD catheters
- Accessing central line procedure
- Scrub the hub procedure document
- Alcohol impregnated cap
- CUROS cap
- Frequency of line flushing
- Flush with normal saline as per post infusion policy
- Flush with heparin lock as per post infusion policy
- Syringe size used for flushing documented
- Infusion pump high pressure alarm documented
- Type of products infused through line (medications, etc)

SECONDARY OBJECTIVE

1. To explore variation in practices in clinician management of CVCs, PICCs, and HD catheters and non-adherence to hospital approved EBP guidelines and catheter complications.

SECONDARY ENDPOINTS

1. To document number of variation in practices in clinician management of CVCs, PICCs, and HD catheters associated with CVCs, PICCs and HD catheters in two groups:

Catheter Complication –Appendix B

Mechanical Complication

- Pneumothorax
- Air embolism
- Catheter occlusion
- Thrombosis
- Pinch-off syndrome
- Catheter malposition
- Catheter rupture

Infectious Complication

- CLABSI (Central Line Associated Bloodstream Infection)
- Exit Site Infection

Thrombotic Complication

- Thrombotic occlusion
- Catheter patency rate
- Drug precipitates

Catheter Dwell -- Appendix B

- Line insertion date
- Line insertion time
- Line removal date
- Line removal time
- Discharge Order Time for catheter removal
- Line Removal time from discharge order

STUDY DESIGN

This is a single site retrospective (non-experimental) study utilizing the electronic medical record, both descriptive and correlational methods.

METHODOLOGY

Clinician adherence to hospital approved EBP guidelines, policies, and procedures will be obtained by way of a retrospective medical record review to include data abstraction from nursing and physician notes, consultation, admission notes, discharge notes, medical history, laboratory and diagnostic tests, flow sheets, and other relevant clinical documentation. EPIC, the electronic medical record will be the primary source for the retrospective data collection. The hospital approved EBP guidelines, policies and procedures to evaluated clinican variation in the care and management of CVCs, PICCs and HD catheters in the Department of Patient Care (DOPC) and Infection Control (IC) are listed below and summarized in Appendix A.

1. DOPC Clinical Procedures – Apheresis Catheter Maintenance – A-2
2. DOPC Clinical Procedures Central Venous Catheter Maintenance and Removal – C-10A

3. DOPC Clinical Procedures – Adult Dialysis Catheter (Care and Use) D-2
4. DOPC Clinical Procedures – Implantd Venous Acess Devices Maintenance – I-1
5. DOPC Clinical Procedures – PICC (Peripherally Inserted Central Catheters) Maintenance – P-8
6. DOPC Dialysis – Initiation of Dialysis via Central Venous Catheter – R-98
7. IC- Equipment, Supplies – Insertion and Maintenance of Central Cannulas in Large Vessels – 706-2-1
8. IC- Equipment, Supplies – Insertion and Maintenance of Central Venous Catheters for Patenteral Nutrition – 706-8

This method is based on the 1991 seminal work by Brennan et al.,[52] considered to be the gold standard of epidemiological analysis to identify variation in clinical practice, specifically related to treatment plans, morbidity, mortality and cost.[53,54] (Cassidity, Marsh, Holleran, & Ruhll, 2002; Murray et al).

DATA COLLECTION TOOL

The data collection tool is systematically organized to facilitate retrieval of data from the electronic medical record. See Appendix B. The data collection tool includes specified items, values, and descriptions. See Appendix C.

STUDY PERIOD

The one year retrospective study will be implemented immediately after institutional review board approval.

INCLUSION CRITERIA

Adult patients in MICU, CCU, CSICU, SICU and hemodialysis with either CVCs, PICCs, or HD catheters.

EXCLUSION CRITERIA

Pediatric (including neonates), obstetric and gynecology, medical-surgical, and oncology patients.

SAMPLE SIZE

The total number of CVCs and PICCs inserted in MICU, CCU, CSICU, SICU in year 2015 and 2016 is summarized in Table 2 and Table 3 below:

Table 2 – CVCs Inserted in Critical Care Units

CVC	2015	2016
MICU	132	176
CCU	168	160
CSICU	164	80
SICU	204	192

Table 3- PICCs Inserted in Critical Care Units

PICC	2015	2016
MICU	32	10
CCU	60	32
CSICU	56	68
SICU	44	56

A convenience sample of three-hundred medical records will be reviewed for this study, one-hundred and seventy-five CVCs, seventy-five PICCs, and fifty HD catheters representing 25%, 45% and 10% respectively of the total number of catheters inserted in 2016.

INFORMED CONSENT

This research will request the Institutional Review Board to waive documentation of informed consent.

BENEFITS

Data generated from this retrospective study will be used in the design of a prospective study on central venous catheter care and management.

CONFIDENTIALITY

Data will be handled in a confidential manner to meet mandated Information Technology (IT) security standards and prevent loss of privacy. All electronic files will be stored in an encrypted and password-protected database on a secure medical center server. Any research data extracted from participants' medical records will be recorded in REDCap and electronic spreadsheets will be kept on a password protected computer. The information will be de-identified for study analysis. If the results of the trial are published, participants' identities will remain confidential. Publication resulting from this research will not contain any information that could potentially identify participants either directly or indirectly.

DATA ANALYSIS

The summary of the demographic characteristics will be presented. Continuous variables will be summarized using mean (SD) or median (interquartile range) depending on whether or not the data follow the normal distribution. Categorical variables will be summarized by frequency (percentage). Correlational analysis will be performed utilizing Pearson Correlation. Comparison of continuous variables between any independent groups will be examined using two-sided T-test or two-sided Wilcoxon rank sum test, analysis of variance (ANOVA) or Kruskal-Wallis test followed by pairwise tests, as appropriate. Categorical variables will be

examined using Fisher's exact test or Pearson's Chi-square test, as appropriate.

DATA MANAGEMENT

All data in this study will be obtained from multiple sources: EPIC and the Business Intelligence Department and review of clinician notes. REDCap will be utilized to for study data entry. All study data will be exported to Microsoft Excel for data analysis preparation, and imported for SAS version 9.4 (SAS Institute Inc. Cary, NC, USA) for data analysis.

LIMITATIONS

A limitation in use of retrospective data collection from the patients medical record is incomplete and/or missing data related to variability in the quality and completeness of documentation by healthcare team members. In addition, because this is a single site study, the generalizability of the study's findings will be limited to the medical center. Also, the non-experimental design limits correlation between adherence to the guidelines and catheter success rate.

References

[1] Chopra V, O'Horo J, Rogers M, Maki D, Safdar N. The risk of bloodstream infection associated with peripherally inserted central catheters compared with central venous catheters in adults: a systematic review and meta-analysis. Infection Control and Hospital Epidemiology. 2013; 34(9): 908-918.

[2] Kombau C, Lee KC, Hughes GD, Firstenberg MS. Central line complications. Int J Crit Illn Inj Sci. 2015; 5(3): 170–178.

[3] Vincent J.L.: Nosocomial infections in adult intensive-care units. Lancet 361:2068–2077, Jun. 2003.

[4] Wallace DJ1, Angus DC, Seymour CW, Barnato AE, Kahn JM. Critical care bed growth in the United States. A comparison of regional and national trends. Am J Respir Crit Care Med. 2015; 191(4): 410-416.

[5] Napalkov P, Felici D, Chu L, Jacobs J, Begelman S. Incidence of catheter-related complications in patients with central venous or hemodialysis catheters: a health care claims database analysis. BMC Cardiovascular Disorders. 2013; 13(86): 1-10.

[6] Illig K. The high-cost, low quality impact of central venous catheters in dialysis access. Supplement to Endovascular Today. 2016; 15(6): 20-22.

[7] Weed LL. Medical records that guide and teach. New England Journal of Medicine, 1968; 593-600, 652-657.

[8] Beach J, Oates J. Maintaining best practice in record-keeping and documentation. Nursing Standard, 2014; 28(36), 45-50.

[9] Puppala S. Cenral Venous Access via Tunneled Catheter, 2015. http://emedicine.medscape.com/article/1375734-overview. Accessed January 2017.

[10] The Joint Commission. CLABSI Toolkit and Monograph, 2011. https://www.jointcommission.org/assets/1/6/CLABSI_Toolkit_Tool_1-1_Comparison_of_Types_of_CVCs.pdf. Accessed Jaunuary 26, 2017.

[11] ibid

[12] Cheung E, Baerlocher MO, Asch M, Myers A. Venous access A practical review for 2009. Canadian Family Physician. 2009; 55: 494 -497.

[13] Mausner P. Vascular access occlusions: the role of thrombolytic agents in treatment and prevention. Ed. Douglas C, Hilleman D, & Jones G. Postgraduate Institute for Medicine. 2004.

[14] Cardenas-Garcia J, Schaub K, Belchikov Y, Narasimhan M, Koenig S, Mayo P. Safety of peripheral intravenous administration of vasoactive medication. Journal of Hospital Medicine. 2015; 00(00): 1-5

[15] Kombau C, Lee KC, Hughes GD, Firstenberg MS. Central line complications. Int J Crit Illn Inj Sci. 2015; 5(3): 170–178.

[16] Alexandrou E, Spencer T, Frost S, Mifflin N, Davidson P, Hillman K. Central venous catheter placement by advanced practice nurses demonstrates low procedural complication and infection rates – a report from 13 years of service. Critical Care Medicine. 2014; 42(2): 1-8.

[17] Bowdle A. Vascular complications of central venous catheter placement: evidence-based methods for prevention and treatment. Journal of Cardiothracic and Vascular Anesthesia. 2014; 28(2): 358-368.

[18] Napalkov P, Felici D, Chu L, Jacobs J, Begelman S. Incidence of catheter-related complications in patients with central venous or hemodialysis catheters: a health care claims database analysis. BMC Cardiovascular Disorders. 2013; 13(86): 1-10.
[19] Chauhan A, Bernardin A, Mussard W, et al. Preventing biofilm formation and associated occlusion by biomimetic glycocalyxlike polymer in central venous catheters. The Journal of Infectious Diseases. 2014; 210: 1347-1356.
[20] Mohamad Ali AF, Uhwut E, Liew SK. Dialysis catheter fibrin sheath stripping: a useful technique after failed catheter exchange. Biomed Imaging Interv J. 2012; 8(1): 1-3.
[21] Barrier A, Williams D, Connely M, Creech CB. Barrier A, Williams D, Connely M, Creech CB. Frequency of peripherally inserted central catheter complications in children. The Pediatric Infectious Disease Journal. 2012; 35(1): 519-521.
[22] Ernst F, Chen E, Lipkin C, Tayama D, Amin A. Comparison of hospital length of stay, costs, and readmissions of alteplase versus catheter replacement among patients with occluded central venous catheters. Journal of Hospital Medicine 2014; 9(8): 490-496.
[23] Baskin J, Reiss U, Wilimas J, Metzger M, Ribeiro R, Pui CH, Howard S. Thrombolytic therapy for central venous catheter occlusion. Haematologica. 2012; 97(5): 641-650.
[24] Murray J, Precious E, Alikhan R. Catheter-related thrombosis in cancer patients. 2013. DOI: 10.1111/bjh.12474.
[25] Ernst F, Chen E, Lipkin C, Tayama D, Amin A. Comparison of hospital length of stay, costs, and readmissions of alteplase versus catheter replacement among patients with occluded central venous catheters. Journal of Hospital Medicine 2014; 9(8): 490-496.
[26] Napalkov P, Felici D, Chu L, Jacobs J, Begelman S. Incidence of catheter-related complications in patients with central venous or hemodialysis catheters: a health care claims database analysis. BMC Cardiovascular Disorders. 2013; 13(86): 1-10.
[27] Wu H, Moser C, Wang HZ, Hoiby N, Song ZJ. Strategies for combating bacterial biofilm infections. International Journal of Oral Science. 2015; 7: 1–7.
[28] Gahlot R, Nigam C, Kumar V, Yadav G, Anupurba S. Catheter-related bloodstream infections. Int J Crit Illn Inj Sci. 2014; 4(2): 162–167.
[29] O'Grady NP, Alexander M, Burns LA, et al. Summary of recommendations: guidelines for the prevention of intravascular catheter-related infections. Clin Infect Dis. 2011; 52(9): 1087–1099.
[30] Kombau C, Lee KC, Hughes GD, Firstenberg MS. Central line complications. Int J Crit Illn Inj Sci. 2015; 5(3): 170–178.
[31] Peasah S, McKay N, Harman J, Al-Amin M, Cook R. Medicare non-payment of hospital-acquired infections: infection rates three years post implementation. Medicare & Medicaid Research Review. 2013; 3(3): E1-E13.
[32] World Health Organization. Preventing bloodstream infections from central line venous catheters. http://www.who.int/patientsafety/implementation/bsi/en/. Accessed on August 9, 2016.
[33] Agency for Healthcare Research and Quality. Never events. https://psnet.ahrq.gov/primers/primer/3/never-events. Accessed August 15, 2016.
[34] Au A, Rotte M, Grzybowski R, Ku B, Fields J. Decrease in central venous catheter placement and complications due to utilization of ultrasound-guided peripheral intravenous catheters. Am J Emerg Med. 2012; 30(9):1950-1954.
[35] Yousif A, Jamal MA, Raad I. Biofilm-based central line-associated bloodstream infections. Adv Exp Med Biol. 2015; 830:157-79. doi: 10.1007/978-3-319-11038-7_10.
[36] Beach J, Oates J. Maintaining best practice in record-keeping and documentation. Nursing Standard, 2014; 28(36), 45-50.

[37] Lavin MA, Harper E, Barr N. Health information technology, patient safety, and professional nursing care documentation in acute care settings. The Online Journal of Issues in Nursing, 2015; 20(2).
[38] Weed LL. Medical records that guide and teach. New England Journal of Medicine, 1968; 593-600, 652-657.
[39] Nuance Health Solutions. Accuracy & completeness of clinical documentation: understanding the clinician, patient and economic implications in NHS England acute trusts, 2015. https://static1.squarespace.com/static/51c1983de4b0e0c8e6cf758c/t/55a66bc2e4b01657825303de/1436969922565/Accuracy_and_completeness_of_clinical_documentation_2015_FOS.pdf. Accessed August 22, 2016.
[40] Kuhn T, Basch P, Barr M, Yackel T. Clinical documentation in the 21 st century: executive summary of a policy position paper from the American college of physicians. Ann Intern Med. 2015; 162:301-303.
[41] ibid
[42] Lavin MA, Harper E, Barr N. Health information technology, patient safety, and professional nursing care documentation in acute care settings. The Online Journal of Issues in Nursing, 2015; 20(2).
[43] Beach J, Oates J. Maintaining best practice in record-keeping and documentation. Nursing Standard. 2014; 28(36): 45-50.
[44] Silberzweig J, Sacks D, Khorsandi A, Bakal C. Reporting standards for central venous access. Journal of Vascular and Interventional Radiology. 2003; 14(9): 443-452.
[45] American Health Information Management Association. Information governance: principles for healthcare (IGPHC) 2014. file:///C:/Users/gp4699/Downloads/IG_Principles.pdf. Accessed August 22, 2016.
[46] Stone PW, Larson E, Saint S, Wright MO, Slavish S, Murphy C, Granato JE, Pettis AM, Kilpatrick C, Graham D, Warye K, Olmsted R. Moving evidence from the literature to the bedside: Report from the APIC Research Task Force. Am J Infect Control. 2010; 38(10):770–777.
[47] Krein SL, Hofer TP, Kowalski CP, Olmsted RN, Kauffman CA, Forman JH, Banaszak-Holl J, Saint S. Use of central venous catheter-related bloodstream infection prevention practices by US hospitals. Mayo Clin Proc. 2007; 82(6): 672–678.
[48] Warren DK, Yokoe DS, Climo MW, Herwaldt LA, Noskin GA, Zuccotti G, Tokars JI, Perl TM, Fraser VJ. Preventing catheter associated bloodstream infections: A survey of policies for insertion and care of central venous catheters from hospitals in the prevention epicenter program. Infect Control Hosp Epidemiol. 2006; 27(1): 8–13.

[49] Gershengorn HB, Garland MD, Kramer A, Scales DC, Rubenfels MD, Wunsch H. Variation of Arterial and Central Venous Catheter Use in United States Intensive Care Units. Crit Care Med. 2014; 120(3) 650 -661.

[50] Meyer GS, Massagli, MP. The Forgotten Component of the Quality Triad: Can We Still Learn Something from Structure? Journ Quality Improv . 2001; 27(9) 484- 492.

[51] Jarvis WR. The Lowbury Lecture. The United States approach to strategies in the battle against healthcare-associated infections,2006: Transitioning from benchmarking to zero tolerance and clinician accountability. *J Hosp Infect*. 2007 Jun;65 Suppl 2:3–9.

[52] Brennan TA, Leape LL, Laird NM, Hebert L, Localio AR, Lawthers AG, Newhouse JP, Weiler PC, Hiatt HH: Incidence of adverse events and negligence in hospitalized patients. Results of the Harvard Medical Practice Study I. N Engl J Med 1991; 324: 370-376.
[53] Cassidy LD, Marsh GM, Holleran MK, Ruhl LS. Methodology to improve data quality from chartreview in the managed care setting. American Journal of Managed Care. 2002; 8(9): 787–793.

[54] Murray MD, Smith FE, Fox J, Teal EY, Kesterson JG, Stiffler T, et al. Structure, functions, and activities of a research support informatics section. Journal of the American Medical Informatics Association. 2003; 10(4): 389-398.

Appendix A

Current Status: Active PolicyStat ID: 1615811

Origination Date:	08/2010
Approved:	10/2013
Last Revised:	10/2013
Next Review:	09/2016
Owner:	Cheryl Marchal: Manager
Policy Area:	DOPC - Clinical Procedures
Applies To:	

Apheresis Catheter Maintenance, A-2

Purpose

1. To outline the nursing management of patients with apheresis catheters.
2. To provide central access routes for apheresis, fluid and medication administration, blood transfusion/sampling and/or hyperalimentation.

Administration

TABLE OF CONTENTS

Operational Definitions

Apheresis catheters are thick-walled, large lumen (10-18.5 french) catheters that are inserted into a large vein, typically the superior vena cava. The large vessel lumen minimizes the risk of vessel irritation, inflammation or sclerosis. Tunneled and temporary non-tunneled catheters provide long-term access for apheresis.

Policy Statement

Aseptic technique and sterile equipment shall be utilized throughout the maintenance procedures for apheresis catheters.

Key Points

- Apheresis catheter dressings shall be changed every 7 days and when wet or Monday-Wednesday-Friday if non-transparent dressing is applied.
- Change dressing 24 hours after insertion if unable to visualize insertion site.
- Prior to use, an order for use other than for apheresis must be obtained from the physician ordering apheresis.
- Always aspirate prior to use, **never flush the catheter prior to removing heparin.**
- Caps should be changed every week with dressing change or when the following occur: new IV line tubing setup, blood cannot be completely flushed after blood withdrawal, or with signs of cracks, leaks or other defects.
- Prior to insertion of a groin line, the area must be cleansed with chlorhexidine starting 48 hours prior to insertion.

Appendix A (Continued)

Current Status: *Active* PolicyStat ID: *2174594*

Hackensack
UNIVERSITY MEDICAL CENTER

Origination Date:	*03/1983*
Approved:	*06/2015*
Last Revised:	*06/2015*
Next Review:	*05/2018*
Owner:	*Cheryl Marchal: Manager*
Policy Area:	*DOPC - Clinical Procedures*
Applies To:	

Central Venous Catheter Maintenance & Removal, C-10A

CROSS REFERENCES:

Infection Control-Insertion & Maintenance of Central Cannulas in Large Vessels	706-2.1
Infection Control- Insertion, Maintenance and Removal of TPN lines	706-8
PICC (Peripherally Inserted Central Catheter Nursing Clinical Policy Manual	P-8
Implanted Venous Access Devices Maintenance	I-1
Short Peripheral Intravenous Therapy	I-3
Adult Dialysis Catheter (Care And Use)	D-2

Purpose:

To outline the nursing management of patients with central venous access devices (CVAD) including but not limited to triple lumen catheters, pulmonary artery catheters and Port- a caths. **(This protocol does not address management of PICC lines, Implanted Venous Devices or dialysis catheters except for information on Appendix I.)**

TABLE OF CONTENTS

Appendix A (Continued)

Current Status: *Active* PolicyStat ID: *2714228*

Hackensack
UNIVERSITY MEDICAL CENTER

Origination Date:	*03/1996*
Approved:	*08/2016*
Last Revised:	*08/2016*
Next Review:	*08/2019*
Owner:	*Cheryl Marchal: Manager*
Policy Area:	*DOPC - Clinical Procedures*
Applies To:	
Applicability:	*Hackensack University Medical Center*

Adult Dialysis Catheter (Care and Use), D-2

CROSS RFERENCES

Central Venous Catheter Maintenance and Removal DOPC - Clinical Procedures	C-10A
Pediatric Central Line Protocol DOPC - Children's Hospital	C-1A

Purpose

To outline the procedure for the use and care of a dialysis catheter.

Table of Contents

Operational Definitions

Dialysis catheter: A large bore catheter used for removal of waste from blood.

Policy Statement

RNs who are validated for care and maintenance of a central venous catheter can use a dialysis catheter for IV access, and blood draw after an order is placed in the electronic medical record (EMR) by a Nephrologist.

RNs may change dressing without MD order if soiled or non-occlusive.

Appendix A (Continued)

Current Status: *Active* PolicyStat ID: *1652411*

Hackensack
UNIVERSITY MEDICAL CENTER

Origination Date:	*06/1986*
Approved:	*06/2014*
Last Revised:	*06/2014*
Next Review:	*05/2017*
Owner:	*Cheryl Marchal: Manager*
Policy Area:	*DOPC - Clinical Procedures*
Applies To:	
Applicability:	*Hackensack University Medical Center*

Implanted Venous Access Devices Maintenance, I-1

Purpose

Provide central access routes for fluid and medication administration, blood transfusion/sampling and/or hyperalimentation.

TABLE OF CONTENTS

Operational Definitions

Central venous access device: A device used to deliver intravenous medication, TPN or for blood sampling in long term therapy.

Policy Statement

All validated registered nurses may access, de-access and draw blood samples through the implanted venous access devices.

Key Points

- Obtain physician order prior to accessing the port.
- Always use at least 10cc barrel syringe.
- If unable to obtain blood return notify physician.

Current Status: *Active* **PolicyStat ID:** *2291969*

Hackensack
UNIVERSITY MEDICAL CENTER

Origination Date:	*02/1991*
Approved:	*03/2016*
Last Revised:	*03/2016*
Next Review:	*03/2019*
Owner:	*Cheryl Marchal: Manager*
Policy Area:	*DOPC - Clinical Procedures*
Applies To:	

PICC (Peripherally Inserted Central Catheters) Maintenance, P-8

CROSS REFERENCES

Medication Guideline: Alteplase (TPA Cath Clearance)	Medication Guidelines HackensackUMC Intranet Resources
Central Venous Catheter Maintenance & Removal DPOC Clinical Procedures	C-10A
Short Peripheral Intravenous Therapy DOPC Clinical Procedures	I-3

Purpose

Care of a catheter inserted via the peripheral venous network into the superior vena cava, providing access for fluid, medication administration or transfusion therapy.

TABLE OF CONTENTS

Operational Definitions

PICC: A peripherally inserted catheter placed in the central venous circulation for the purpose of administering fluids or medication.

Appendix A (Continued)

Current Status: *Active* PolicyStat ID: *1643046*

Hackensack
UNIVERSITY MEDICAL CENTER

Origination Date:	*05/1985*
Approved:	*06/2015*
Last Revised:	*06/2015*
Next Review:	*06/2018*
Owner:	*Donna Ledingham: RN*
Policy Area:	*DOPC - Dialysis*
Applies To:	

Initiation of Dialysis via Central Venous Catheter, R-98

Purpose

TABLE OF CONTENTS

Operational Definitions

Policy Statement

The appropriate flushing technique will be performed to both the arterial and venous ports of a central catheter to ensure patency. The central venous catheter is a dual lumen, radiopaque catheter with luer lock adapter used for short or long term dialysis depending on which type catheter is placed.

Key Points

Procedure for Pre-Treatment

- Gather Supplies
- Close curtain
- Wash hands using soap and water or hand gel
- Don gloves
- Apply mask to self and patient
- Place 4x4 gauze pads under Tego connector caps. If Tego connector cap is due for change (Weekly) see policy # C-10A.
- Disinfect the arterial cap by scrubbing the hub x 15 vigorous rotations with a Provantics swab. .

Appendix A (Continued)

Current Status: *Active* PolicyStat ID: *2508736*

Hackensack
UNIVERSITY MEDICAL CENTER

Origination Date:	*12/1983*
Approved:	*06/2016*
Last Revised:	*06/2016*
Next Review:	*06/2017*
Owner:	*Gail Morchel: Director Infection Control*
Policy Area:	*IC-Equipment, Supplies*
Applies To:	

Insertion and Maintenance of Central Cannulas in Large Vessels, 706-2-1

POLICY:

Central cannulas inserted into large central vessels **shall be** treated as a minor surgical procedure. Aseptic technique *and* sterile equipment **shall be** utilized throughout the insertion and maintenance procedures. Catheters with multiple lumens **shall be** labeled to designate what fluids are to be delivered through each port. All central cannulas **shall be** removed as soon as they are no longer medically indicated *or* if they are strongly suspected of causing sepsis. Internal Jugular (IJ) lines should not be used in patients with a tracheotomy unless no other intravascular access site is available. (Refer to IC Policy # 706-8 for insertion, maintenance *and* removal of TPN lines). **Refer to Patient Care Policy C-10A; Central Venous Catheter Maintenance and Removal, for complete procedure/protocol.**

INSERTION PROCEDURE:

Nursing checklist for Central Venous Catheter Placement must be completed by nurse assisting with catheter insertion. Completed checklist must be kept in designated area of unit for reference and review.

Handwashing:	• **Person performing catheter insertion and persons assisting with procedure shall perform hand hygiene with soap and water for 15 seconds or utilize alcohol hand gel as an alternative prior to beginning procedure.**
Choice of Site:	• Physician **shall** select, subclavian instead of jugular vein when possible. Femoral vein shall be used only if there is a contraindication to other preferred sites. In pre-pubscent patients, the femoral site may not be a contraindication • Remove hair from insertion site **only** if heavy growth is present. **DO NOT SHAVE**. Surgical clippers must be used.
Site Preparation:	• **Sterile gowns and gloves, masks and caps *are required* for all persons participating in the insertion process.** Insertion site **shall be** scrubbed with Chloraprep for **30 seconds** using up and down and side to side scrub procedure; allow to dry for an additional**30 seconds.**

Current Status: *Active* PolicyStat ID: *2054514*

Hackensack
UNIVERSITY MEDICAL CENTER

Origination Date:	*06/1983*
Approved:	*05/2016*
Last Revised:	*04/2014*
Next Review:	*05/2017*
Owner:	*Gail Morchel: Director Infection Control*
Policy Area:	*IC-Equipment, Supplies*
Applies To:	

Insertion and Maintenance of Central Venous Catheters for Parenteral Nutrition, 706-8

POLICY:

Strict aseptic technique must be adhered to when administering total parenteral nutrition (TPN) by central intravenous catheter. Insertion and follow-up of complications is a medical responsibility. Daily care of insertion site is a nursing responsibility. Preparation, according to physician's orders, of TPN solution is the responsibility of the Pharmacy. TPN shall be prepared in the I.V. room under Laminar flow hood using aseptic technique.

INSERTION PROCEDURE:

Nursing checklist for Central Venous Catheter Placement must be completed by nurse assisting catheter insertion completed checklist must be kept in designated area of unit for reference and review.

Responsibility:

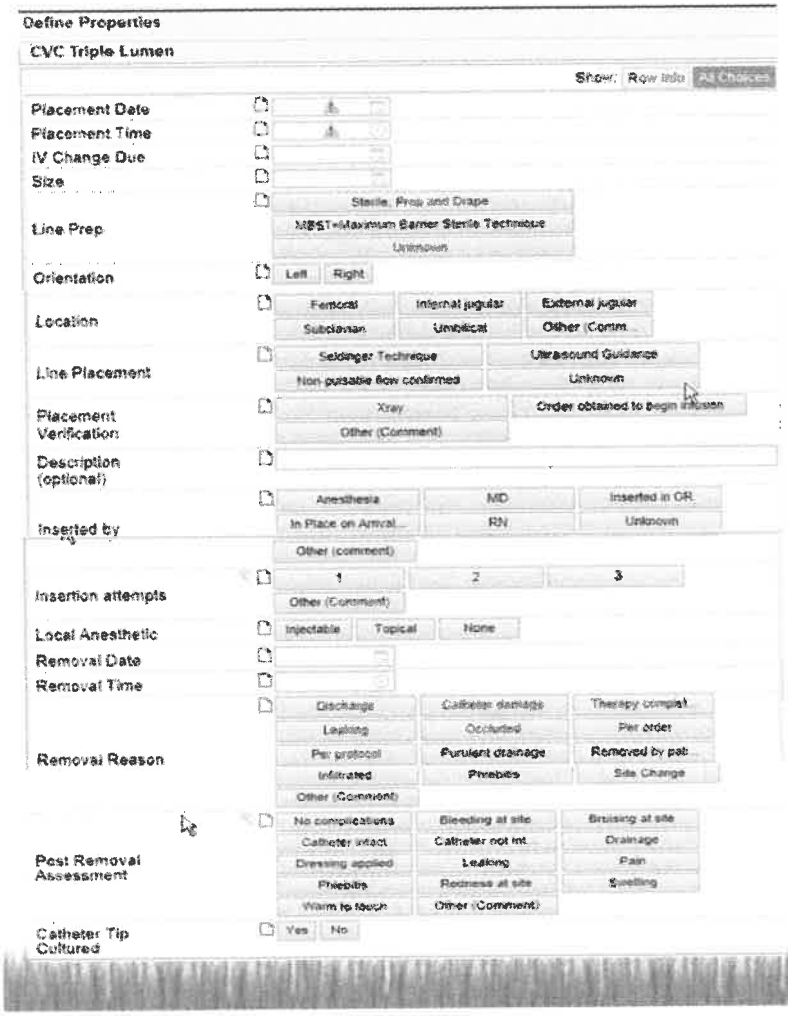
Physician:

- Remove hair from insertion site prior to insertion **ONLY** if heavy growth is present. **Do not shave.** Surgical clippers should be used.
- Maintain strict sterile technique.
- Physician shall select subclavian instead of jugular vein when possible. Femoral vein shall be used only if there is a contraindication to other preferred sites.
- Person performing catheter insertion shall perform hand hygiene with soap and water for 15 seconds or utilize alcohol hand gel as an alternative prior to beginning procedure.
- All personnel assisting in insertion procedure must wear sterile gowns, gloves, mask and caps during insertion procedure.
- Insertion site shall be scrubbed with Chlorhexidine/ alcohol solution 30 seconds using up and down and side to side scrub procedure, allow to dry for an additional 30 seconds.
- Surround insertion site with large sterile drape.
- Record in multi-disciplinary progress note including site of insertion.
- Following catheter insertion, cleanse the insertion site and surrounding skin with Chlorhexidine/alcohol solution 3ml applicator to remove blood from site, allow to air dry and cover site with Semi-Permeable Transparent Dressing (SPTD).

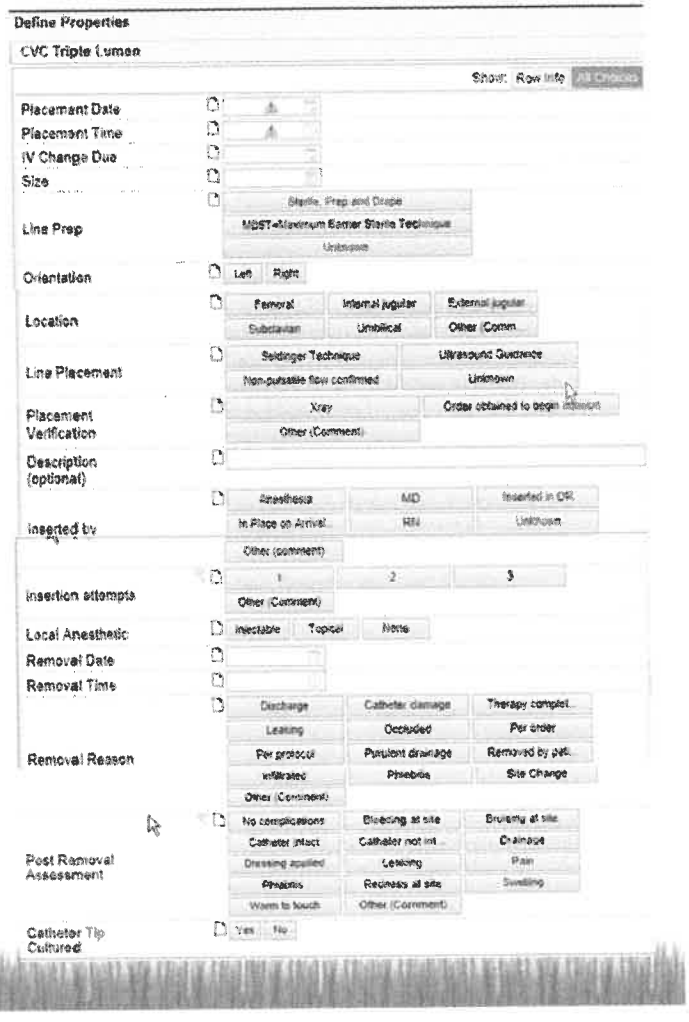
DO NOT apply antimicrobial ointment to CVC insert site.

Appendix B

CVC Placement & Removal Information



CVC Placement & Removal Information



Appendix C

CASCADE STUDY DATA COLLECTION TOOL

Please provide in this format:

MRN	HAR	Medication	...
1234567	2000000001	Albuterol	...
1234567	2000000001	Simvastatin	...

Not in this format:

MRN	HAR	Medication	...
1234567	2000000001	Albuterol Simvastatin	..

Item	Values/examples	Description
MRN	7 or 9 digit number	Patient's MRN
HAR	10 digit number	Patient's HAR
Name	XXX, XXX alphanumeric	Patient full name
Sex	Male/Female	Patient's gender
Age	Number	Patient's age at admission (number)
Line, Drain, Airway, Tubes and Wound (LDAW) of the following types: CVC, PICC and PIV	***Include only the following:*** CVC Double Lumen, CVC Single Lumen, Peripheral IV, PICC Double Lumen, PICC single lumen, PICC Triple Lumen	Specifies the type of LDAW that was placed
Date of LDAW placement	XX/XX/XXXX X:XX:XX AM/PM	The date and time the LDAW was placed
Date of LDAW removal	XX/XX/XXXX X:XX:XX AM/PM	The date and time the LDAW was removed
Calculated field: Duration of LDAW	Number of hours	This can be calculated by subtracting the LDAW placement date from the LDAW removal date. Please present results to hours.
LDAW Removal Reason	Discharge, Catheter damage, therapy complete, leaking, occluded, per order, per protocol, purulent drainage, removed by patient, infiltrated, phlebitis, site change, other (comment)	The reason that the LDAW was removed
Calculated field: Unit in which the LDAW was placed	Any hospital unit name	This unit can be determined based on the following criteria: the time of LDAW placement falls between admission into this unit AND before transferred out of or is discharged from this unit.
Calculated field: Unit in which the LDAW was removed	Any hospital unit name	This unit can be determined based on the following criteria: the time of LDA removal falls between admission into this unit AND before the patient is transferred out of or is discharged from this unit
Calculated field: Was Cathflo (alteplase) administered during the duration of the LDAW?	Yes, No	This can be determined based on the following criteria: Yes if the time that during which Cathflo was administered falls within the timeframe that an LDAW was in place (i.e. after it was placed, but before it was removed) No if the time that during which Cathflo was administered does not fall within the timeframe that an LDAW was in place (i.e. after it was placed, but before it was removed)

Appendix C

The following information will be acquired from Omnicell

Item	Values/examples	Description
MRN	7 or 9 digit number	Patient's MRN
HAR	10 digit number	Patient's HAR
Completed administrations of Irritant/Vesicant Intravenous Medication	Name of IV Medication the patient was ordered: • Acyclovir • Amphotericin B • Ampicillin sodium • Ampicillin sodium/sulbactam sodium Partial parenteral nutrition • Chemotherapeutic agents • Ciprofloxacin • Dextrose 10% or greater • Dopamine • Erythromycin • Fluconazole • Ganciclovir sodium • High-concentration potassium chloride • Iron dextran • Mannitol • Meperidine hydrochloride • Morphine sulfate • Nafcillin sodium • Norepinephrine • Oxacillin sodium • Phenytoin sodium • Promethazine hydrochloride • Sodium bicarbonate • Sodium nitroprusside • Ticarcillin disodium • Tobramycin sulfate • Total parenteral nutrition (TPN) • Vancomycin	A list of all irritant/vesicant medications that the patient was administered via intravenous route