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Case Report

Tunneled Central Venous Catheter Placement in the Emergency Department: Bringing Interventional Radiology Techniques to the Bedside

Matthew D. Ostroff*, Beth Kushner

St. Joseph's University Medical Center, Paterson, New Jersey, USA

***Corresponding author:** Matthew D. Ostroff, St Joseph's University Medical Center, Paterson, New Jersey, USA

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Abstract

Background: Patients with long-term vascular access devices such as a tunneled venous catheter have little recourse for catheter repair or replacement in the emergency department (ED). This often results in a hospital admission awaiting repair or replacement in the interventional radiology suite. This case report describes a patient with congestive heart failure receiving long term inotrope therapy through a right upper extremity peripherally inserted central catheter (PICC), presenting to the emergency department on a Friday night with neck pain, headache, and intermittent chest/clavicular pain. The electrocardiogram demonstrated a prolonged QT interval. The physical exam revealed swelling and pain in the region of the chest and clavicular region. A chest radiograph confirmed the tip of the PICC terminating in the clavicular region at the junction of the subclavian and cephalic veins. A computed tomography (CT) scan of the thorax without contrast revealed diffuse surrounding infiltration or thrombosis in the region of the catheter tip indicating the need for device removal. Replacement of the PICC through a wire exchange was not an option due to the compromised vasculature of the right subclavian vein and placement on the left side was not favorable due to the existence of a left-sided automated implantable cardiac defibrillator. This patient would require placement of a tunneled catheter. Tunneled central line catheters are traditionally placed in interventional radiology which would not re-open for four days (due to a holiday weekend) requiring a five-day patient admission. St Joseph's Health, Paterson, NJ, expanded the point of care services with an innovative ultrasound-guided multidisciplinary nurse practitioner led vascular access department providing hospital wide bedside-tunneled catheter placement. In this unique case, the patient's non-cardiac related chest pain was resolved with PICC removal and same-day bedside placement of a tunneled central venous catheter with subsequent discharge to continue home inotrope infusion therapy.

Keywords: Central catheter; Tunneled catheter; Jugular; Long-term venous access; Emergency department

Introduction

Vascular access in chronically ill patients remains one of the greatest challenges in emergency medicine. The following case report describes an 85-year-old female with congestive heart failure receiving long-term inotrope therapy via a nonfunctioning peripherally inserted central catheter (PICC) requiring a tunneled central venous catheter. The patient complained of chest pain during infusion of milrinone, and swelling was noted in the region of the right clavicle (Figure 1). Further investigation through chest radiograph identified a malposition of the PICC as the cause of the symptoms, requiring removal of the catheter. Patients with complications related to long-term vascular access devices have little recourse for repair or replacement in the emergency department (ED) setting [1]. The expanded point of care services by this hospitals' multidisciplinary vascular access program facilitated bedside placement of a tunneled central venous catheters (CVC), bypassing hospital admission and allowing for same day discharge. The patient was able to resume infusion therapy, at home, without interruption.

Figure 1: Swelling in the region of the right mid clavicle.

Case Report and Procedure

Patient information

An 85-year-old woman with a past medical history of congestive heart failure (CHF) with a 20% ejection fraction on a continuous milrinone infusion via PICC to the right upper extremity and stage 3 chronic kidney disease presenting to the emergency department on a Friday night with chest pain, neck pain, headache, and intermittent chest and clavicular pain.

Diagnostic Assessment

A focused physical exam revealed chest pain and recent onset edema in the right midclavicular region. A 10cm external segment of the PICC line (Figure 2) was noted from the insertion site and radiologic exam revealed the catheter directed cephalad from the subclavian vein into the cephalic vein (Figure 3). An electrocardiogram was performed demonstrating a prolonged QT interval. A chest computed tomography (CT) exam without contrast was performed exhibiting diffuse infiltration surrounding the catheter and extending into the axilla. The duration of tissue infiltration of the milrinone was unknown.

Figure 2: Migrated PICC external length of 10 cm.

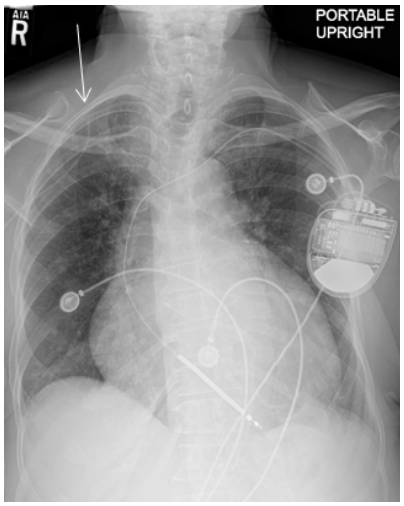

Figure 3: Radiograph demonstrating tip malposition into cephalic vein.

Therapeutic Intervention

A consult was placed to the multidisciplinary vascular access team for PICC replacement. A rapid central vein assessment (RaCeVA) revealed right subclavian stenosis, a patent right internal jugular vein, and a left-sided automated implantable cardioverter defibrillator (AICD) [2]. The infusion therapy guidelines does not recommend ipsilateral PICC placement with an AICD ruling out catheter placement to the upper extremities [3]. The mid-thigh femoral approach was also ruled out due to the patient's ambulatory status [4]. The decision was made to establish long term vascular access with a small bore tunneled catheter with the exit site on the chest promoting patient comfort and reducing infection risk [5]. The patient's right-sided peripherally inserted central catheter was subsequently removed, and insertion of the tunneled catheter was performed at the bedside (Table 1).

Date	Time	Activity and Procedure
8/29	1802	Hospital Emergency Department Arrival
8/29	1815	Chest Radiograph
8/29	1848	Electrocardiogram
8/29	2027	Cardiology Consult
8/29	2038	Observation Status
8/30	1130	Tunneled Catheter Order
8/30	1745	Catheter Placement
8/30	1918	Chest Radiograph Confirmation
8/30	1945	Discharged to Home

Table 1: Hospital Course.

Insertion Procedure

Prior to the insertion procedure the Multidisciplinary Vascular Access Team (MDVAT) performed hand hygiene and established maximal barrier precautions including use of a cap, mask, sterile gown, sterile gloves, and full body drape. The patient's right chest and neck were prepped with 3.15% chlorhexidine gluconate (CHG) (Prevantics™, PDI, Woodcliff Lake, NJ) and allowed to dry. The subcutaneous tissue over the insertion site was infiltrated with 1% lidocaine. Using the modified Seldinger technique, a 21g needle was introduced into the right jugular vein under ultrasound guidance with needle confirmation in the center of the vein. A 0.018-inch guidewire was passed through the needle placement to the jugular vein confirmed with ultrasound imaging.

A subcutaneous tract of 2% lidocaine was administered to the intended tunnel path (10cm) from the right chest to the insertion site. A small dermatotomy was created at both the insertion and exit site. Using an antegrade tunneling technique a 4 french metallic tunneling device (Medcomp, Harleysville, PA) was used to bring the catheter from the exit site to the insertion site [6]. A 4.5 french dilator and sheath was advanced over the guidewire at the insertion site. The dilator was removed, and a single-lumen chlorhexidine-impregnated catheter (Arrow Blue; Teleflex, Morrisville, NC) was placed through the sheath and advanced to 25 cm. The sheath was then peeled away leaving the catheter under the skin of the subcutaneous tunnel. Catheter terminal tip positioning was confirmed at the cavoatrial junction using electrocardiogram and doppler flow imaging.

Following insertion, the two skin entry sites were scrubbed with 2% CHG and 70% isopropyl alcohol (Chlorascrub; PDI, Woodcliff Lake, NJ). Cyanoacrylate skin adhesive (SecurePortIV™, Adhezion Biomedical, Wyomissing, PA) was applied to seal the dermatotomy sites for catheter insertion and exit. The catheter was stabilized with a subcutaneous securement device (SecurAcath™, Interrad Medical, Inc., Plymouth, MA), a chlorhexidine-impregnated sponge (Biopatch™, Ethicon, Cincinnati, OH) applied around the catheter and the site covered with a semipermeable transparent membrane dressing (Figure 4). Ultrasound was used to rule out pneumothorax by verifying a sliding lung sign. Finally, a confirmatory chest radiograph was performed to rule out complications, verify and document the tunneled catheter placement, as per the emergency department protocol for central line catheter placement (Figure 5).

Figure 4: Tunneled right jugular catheter with subcutaneous securement.

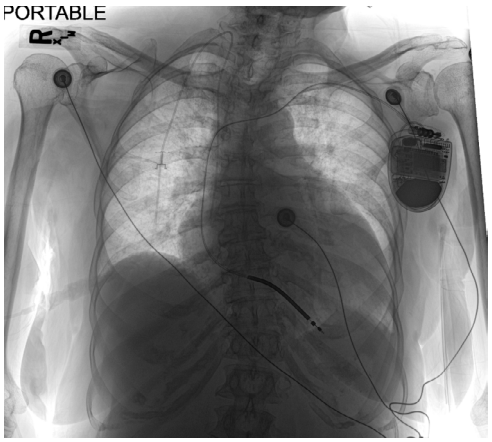

Figure 5: Post-procedure radiograph with tip confirmation.

Follow-up and Outcomes

Immediately following the procedure, the patient was discharged from the hospital. The tunneled jugular catheter remained without complication until the patient was transitioned to hospice care 6 months later.

Discussion

Heart disease was the leading cause of death in the United States in 2020.[7] Chronic heart failure intravenous inotropic therapy provides a "medical bridge" for patients awaiting a left ventricular assist device or heart transplant. Often inotrope therapy is used for palliation in management of patients with acute decompensated heart failure who have reduced cardiac output

and poor end-organ perfusion. Milrinone is a continuous infusion assisting myocardial contractility, and improving cardiac output [8].

Continuous central access via PICC is the current recommendation for home administration of milrinone. In a study by Haglund, et al. 27% of patients receiving therapy for heart failure through a PICC had adverse outcomes such as venous thrombosis, infection, and catheter malfunctions[9]. PICC-associated adverse outcomes may jeopardize heart transplant listings, delay LVAD implantation, and require implantable cardiac defibrillator extractions.

Chronically ill patients with peripheral venous depletion can prove to be challenging when they present to the ED with device complications [10]. There is a growing movement within the vascular access specialty to create multidisciplinary teams facilitating the bedside placement of acute CVCs, tunneled and implantable devices. In a cohort of children, Chau, et al. demonstrated similar success and complication rates with tunneled catheters placed in interventional radiology versus at the bedside [11]. At St. Joseph's University Medical Center, the vascular access team has redefined point of care bedside device placement options and recommendations by implementing a MDVAT composed of advanced practice and registered nurses. Through the MDVAT model, bedside ultrasound guided access devices include: peripheral and central (tunneled and non-tunneled) access devices for all inpatient and outpatient hospital departments. At St Joseph's University Hospital, tunneling catheters at the bedside is within the privileges of the advanced practice nurse on the MDVAT therefore institutional review board approval was not required for the procedure.

The specific complication of infection causing acute systemic inflammation can directly depress myocardial function and alter the delicate balance of oxygen demand and supply. Reducing CVC infections is also paramount because their incidence is included as a quality metric reportable to the National Healthcare Safety Network [12]. The subclavian exit site is listed as a 1b recommendation by the CDC for the least risk of infection [13]. The National Kidney Foundation recommends tunneled catheters for long term patency, reduced infection rates and increased patient comfort [14]. Tunneling the catheter provides greater securement, and potentially lower infection rate than non-tunneled catheters [15]. Given these recommendations and the subclavian vein being compromised, accessing the jugular vein and subcutaneously tunneling to the chest fulfills the ideal exit site.

Another major factor with catheter repair and replacement is cost. In this case, the patient presented to the emergency department on the Friday night of a holiday weekend. For this patient to have the appropriate device placed, she would have been admitted to the hospital from Friday until Tuesday when interventional radiology would be available. An estimated cost of hospital admission is 2-3 thousand dollars per night. Many times, for reasons other than catheter related complications, patients who present on a Friday may not have elective services performed until Monday.

In the United States, tunneled catheters are most performed in the interventional radiology suite. Trerotola and colleagues described successful outcomes with tunneled hemodialysis catheters placed via the right internal jugular vein by interventional radiologists versus traditional placement in the operating room by surgeons [16]. But as early as 1991, Finney and colleagues described bedside placement of a cost-effective peripheral venous port system [17]. Today, through the use of intracavitary ECG and Doppler navigation, tip positioning for central access now can be safely obtained at bedside, eliminating the need for fluoroscopy [18].

Finally, when determining catheter material, Darouiche, et al. compared antimicrobial impregnated catheters to non-impregnated tunneled catheters, demonstrating the impregnated catheters were less likely to become colonized [19]. Therefore, it is the opinion of the authors of this paper that performing the tunneled catheter procedure with a coated catheter should yield greater protection for the long-term treatment patient with ideal infection prevention.

These factors led to St. Joseph's University Hospital implementing the bedside placement of tunneled jugular catheters as a standard-of-care for patients receiving long-term intravenous therapy.

Conclusions

The emergency department is the gateway between outpatient treatment and acute care admission to the hospital. In this chaotic environment, patients with vascular access device related complications could present a challenge when the solution requires interventional radiology. This case study demonstrates the value of a MDVAT, avoiding delays associated with hospital admission for long-term intravenous catheter replacement. The emergency department can facilitate point of care service for patients with long-term vascular access through partnership with the MDVAT.

References

1. McCavery A (2020) A Nurse Practitioner-Led Model to Implement and Deliver Unscheduled Emergency Cancer Care. The Journal for Nurse Practitioners 16: 271-275.
2. Spencer TR, Pittiruti M (2019) Rapid Central Vein Assessment (RaCeVA): A systematic, standardized approach for ultrasound assessment before central venous catheterization. J Vasc Access 20: 239-249.
3. Gorski LA (2021) A Look at 2021 Infusion Therapy Standards of Practice. Home Healthcare Now. 39: 62-71.

4. Brescia F, Pittiruti M, Ostroff M, Biasucci DG (2020) Rapid Femoral Vein Assessment (RaFeVA): A systematic protocol for ultrasound evaluation of the veins of the lower limb, so to optimize the insertion of femorally inserted central catheters. J Vasc Access: 1129729820965063.

5. Bhutani G, Ters ME, Kremers WK, Klunder JL, Taler SJ, et al. (2017) Evaluating safety of tunneled small bore central venous catheters in chronic kidney disease population: A quality improvement initiative. Hemodialysis International 21: 284-293.

6. Giustivi D, Gidaro A, Baroni M, Paglia S (2021) Tunneling technique of PICCs and Midline catheters. The Journal of Vascular Access: p. 11297298211002579.

7. Ahmad FB, Anderson RN (2021) The leading causes of death in the US for 2020. JAMA, 2021 .

8. Mody BP, Khan MH, Zaid S, Ahn C, Lloji A, et al. (2020) Survival With Continuous Outpatient Intravenous Inotrope Therapy in the Modern Era.American Journal of Therapeutics.

9. Haglund NA., Cox ZL, Lee JT, Song Y, Keebler ME, et al. (2014) Are peripherally inserted central catheters associated with increased risk of adverse events in status 1B patients awaiting transplantation on continuous intravenous milrinone? Journal of cardiac faiure 20: 630-637.

10. Bell JA, Spencer TR (2020) Implementing an emergency department vascular access team: A quality review of training, competency, and outcomes. The Journal of Vascular Access: p. 1129729820924554.

11. Chau A, Hernandez JA, Pimpalwar S, Ashton D, Kukreja K (2018) Equivalent success and complication rates of tunneled common femoral venous catheter placed in the interventional suite vs. at patient bedside. Pediatric radiology 48: 889-894.

12. Hsu HE, Wang R, Broadwell C, Horan K, Jin R, Rhee C, et al. (2020) Association between federal value-based incentive programs and health care–associated infection rates in safety-net and non–safety-net hospitals. JAMA network open 3: p. e209700-e209700.

13. O'grady NP, Alexander M, Burns LA, Dellinger EP, Garland J, et al. (2011) Guidelines for the prevention of intravascular catheter-related infections. Clinical infectious diseases 52: e162-e193.

14. Lok CE, et al. (2020) KDOQI clinical practice guideline for vascular access: 2019 update. American Journal of Kidney Diseases 75: S1-S164.

15. Black JR, Coker MA, Li Y, Sung J, Moawad S, et al. (2019) Infection of Small-Bore Tunneled Central Venous Catheters. American Journal of Roentgenology 213: 458-463.

16. Trerotola SO, Johnson MS, Harris VJ, Shah H, Ambrosius WT, et al. (1997) Outcome of tunneled hemodialysis catheters placed via the right internal jugular vein by interventional radiologists. Radiology 203: 489-495.

17. Finney R, Albrink MH, Hart MB, Rosemurgy AS (1992) A cost-effective peripheral venous port system placed at the bedside. Journal of Surgical Research 53: 17-19.

18. Cho S, Lee YJ, Kim SR (2015) The intracavitary ECG method for insertion of a tunneled dialysis catheter without using fluoroscopy. The journal of vascular access 16: 285-288.

19. Darouiche RO, Berger DH, Khardori N, Robertson CS, Wall Jr MJ, et al. (2005) Comparison of antimicrobial impregnation with tunneling of long-term central venous catheters: a randomized controlled trial. Annals of surgery 242: 193.