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Placing Venous Catheters in the Home: Pilot Data from the Mobile VAD Program

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Introduction

Patients requiring vascular access devices (VADs) for home infusion therapy typically receive these as inpatients prior to discharge home. However for years many otherwise-stable outpatients requiring VADs have avoided hospitalizations altogether by having the VADs placed in ambulatory healthcare settings.¹ In the novel Johns Hopkins Home Care

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Group Mobile VAD Program, VAD placement is even removed from ambulatory healthcare facilities such as clinics: trained nurses place VADs in patient homes. The program allows the entire home infusion therapy process (VAD placement, patient and caregiver training, delivery of supplies, infusion therapy, and assessment by home care nurses) to take place in the home, outside healthcare settings. We present preliminary outcomes from a prospective cohort of patients in the program.

Methods

Starting in December 2015, outpatients¹ requiring VADs but not needing hospitalization were referred to the Mobile VAD program. Telephone screenings ensured patients had a location in the home appropriate for VAD placement (i.e., with a clean bed and a clean accessible sink, and where traffic from other household residents and pets can be avoided). A trained nurse placed the VAD [peripherally-inserted central catheter (PICC) or midline catheter], using electrocardiogram (EKG)-based technology to confirm placement (Bard Site Rite 8 Ultrasound System, Bard Access Systems, Salt Lake City, UT). Patients could then be followed by any home infusion agency for medications, infusions, and supplies, and by any home nursing agency for training and support in VAD care.

We expanded a previously-described prospective cohort of home infusion therapy patients² to include Mobile VAD patients. Eligible patients (>18 years of age, with a PICC or midline catheter placed in the home by the Mobile VAD program December 2015-April 2017 for home infusion therapy) consented for a telephone survey and chart abstraction two weeks after VAD placement. Patients were ineligible if they were in hospice care, did not speak English, or could not verbally consent. Consenting patients underwent a ten-minute telephone survey focusing on VAD complications.² The electronic health record (EHR) was abstracted for demographic and clinical information through one month after VAD removal. VAD days were calculated as the number of days between VAD placement and removal.

The primary outcome was any VAD complication/1000 home-VAD days and included any of: central line-associated bloodstream infection (CLABSI), catheter-associated venous thromboembolism (CA-VTE), bloodstream infection (BSI), or VAD occlusion, dislodgement, accidental removal, kinking, coiling, breaking, phlebitis, or linking. CA-VTE was defined as a venous thromboembolism (VTE) on imaging in any location, as PICCs may be risk factors for upper and lower VTEs.⁴ CLABSI were defined based on Association for Professionals in Infection Control (APIC) criteria for CLABSI in home infusion⁵ [adapted from National Healthcare Surveillance Network (NHSN) CLABSI definitions].⁶ BSIs were at least two positive samples of cultured blood within 48 hours of VAD removal that did not meet CLABSI criteria (e.g., in patients with midline catheters).⁶ VAD occlusion was defined as a blockage in at least one VAD lumen necessitating medical treatment or VAD removal.

The study was approved as expedited with oral consent by the Johns Hopkins University School of Medicine Institutional Review Board.

Results

Of 84 eligible patients, 30 could not be reached and 9 refused consent. We enrolled 45 patients (53.6%). Most patients received a PICC (82.2%, N=37, Table) and outpatient parenteral antimicrobial therapy (OPAT, N=40, 88.9%), for indications such as neuroborreliosis (N=8, 20.0%), chronic osteomyelitis (N=16, 40.0%), septic arthritis (N=4, 10.0%) and cystic fibrosis exacerbation (N=10, 25.0%). The most common complication was inadvertent VAD removal (N=4, 8.9%, 2.03/1000 VAD-days). The total rate of complications was 3.05/1000 VAD-days (N=6, 13.3%). Two patients were admitted within 30 days of VAD placement (4.4%) for planned surgical procedures.

Discussion

We present the first report of patients having PICCs and midline catheters placed in the home instead of in a healthcare facility. Overall, patients did well. Six patients had VAD-related complications, primarily inadvertent VAD removal. In other studies, inadvertent VAD removal occurred in 1–2% of OPAT patients.² Rates of other complications were similar to that seen in other studies of home infusion therapy patients. A Scottish OPAT study found an incidence of 4.1% of “other line events” including inadvertent VAD removal, VAD occlusion, VAD leaking or phlebitis.⁷ In a previously-described cohort of home infusion therapy, 23.4% had a VAD-related complication (4.37/1000 home VAD-days).² These studies focused on patients who had their VADs placed as inpatients. Those who have VADs placed in the home may need a period of adjustment to navigating with the VAD prior to going home, or may be more mobile than those with VADs placed in inpatient settings. Future work should compare VAD placement in the hospital, in ambulatory facilities, and in the home.

Our pilot study was not powered to detect differences in potential risk factors and outcomes. We did not have a comparison group, so do not know if the outcomes here differed from outcomes among other home infusion therapy populations.

Ours is the first description of VAD placement in the home versus in a healthcare setting). Patients did well, with no CLABSIs or BSIs and no unplanned readmissions. Home-based VAD placement may be particularly helpful for outpatients unable to access an ambulatory clinic due to transportation or work schedule, and is similar to the cost of placement in an outpatient center. While future work needs to investigate why VADs might be inadvertently removed, the lack of serious complications suggest that this program might be beneficial and piloted in other populations.

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Table:

Demographic and clinical characteristics and outcomes of 45 patients with PICCs and midline catheters placed in the home.

Variable	Total (percentage of N=45)
Age (mean, median, IQR)	52.8, 55 (43–62)
Female Gender	18 (40.0%)
Race/Ethnicity: White Non-Hispanic	34 (75.6%)
African American	6 (13.3%)
Other	5 (11.1%)
Insurance: Private	33 (73.30%)
Medicare	4 (8.9%)
Medicaid	6 (13.3%)
Veteran's or Military Insurance	2 (4.4%)
Charlson Comorbidity Index ⁴ (mean, median, IQR)	2.2, 2.0, (1–3)
Type of Catheter: PICC	37 (82.2%)
Midline	8 (17.8%)
Indication for Home Infusion: OPAT	40 (88.9%)
Chemotherapy	1 (2.2%)
Total Parenteral Nutrition	1 (2.2%)
Venous Access	1 (2.2%)
Other	3 (6.7%)
Admissions within 30 days of VAD placement	2 (4.4%)
Catheter Inadvertently Removed, Rate per 1000 VAD-Days	4 (8.9%), 2.03
Catheter Leakage, Rate per 1000 VAD-Days	1 (2.2%), 0.51
Venous Thromboembolism, Rate per 1000 VAD-Days	2 (4.4%), 1.02
Catheter Occlusion, Rate per 1000 VAD-Days	1 (2.2%), 0.51
Bloodstream Infection	0 (0.0%)
Central Line-Associated Bloodstream Infection	0 (0.0%)
Any Catheter Complication, Rate per 1000 VAD-Days *	6 (13.3%), 3.05

Abbreviations: PICC: peripherally-inserted central catheter; IQR: Interquartile range; OPAT: outpatient parenteral antimicrobial therapy; VAD: vascular access device

* Three patients had two catheter complications.