ORIGINAL RESEARCH

Moving the Line: A Hospitalist-Run Procedure Service Expedites Outpatient Oncology Care Safely

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Background

The advent of internal medicine procedure services within academic medical centers positively impacted patient care, patient safety, and resident training.[1-4] These teams focus on performing invasive bedside procedures, including paracenteses, lumbar punctures, central venous catheter placements, thoracenteses, and ultrasound-guided peripheral intravenous catheter placements. Recently, the procedure service at our large academic medical center expanded to the outpatient setting and began collaborating with the hematology oncology department to secure appropriate vascular access for a wide variety of patients including those undergoing Chimeric Antigen Receptor (CAR) T-cell therapy, stem cell transplantation, and stem cell donation.

CAR T-cell therapy is treatment for leukemias and lymphomas that involves genetic engineering of autologous T cells to target cancer cells.[5] An initial step is the collection of T cells via apheresis, which often requires a central venous catheter. Patients receiving this therapy are typically in poor health after having failed several initial lines of treatment for their malignancy. Given the time-sensitive nature of cancer therapy, it is critical that the CAR T-cell treatment process is as efficient as possible as even small delays may have negative effects. Prior to our intervention, patients were referred to interventional radiology for line placement, which was prone to scheduling constraints and delays from both interventional radiology as well as the availability of the hemapheresis unit to perform the cell collection. The hospital procedure team receiving new inpatient consults via a pager system, which allows for more flexible scheduling. With the expansion of the procedure service to assist outpatients with temporary apheresis catheter placements for CAR T-cell therapy, the goal was to expedite care for patients while also increasing the training and supervision of central venous catheter placements for residents.

The preferred site of placement of central venous catheters was in the femoral position given the short anticipated duration of catheter placement, the ability of the nurses at the hemapheresis unit to remove femoral but not internal jugular central venous catheters, and the lack of need for an X-ray to confirm placement, which streamlined the process. Furthermore, a study of 3,471 patients who were randomized to catheter placement at different sites found no difference in the rate of symptomatic deep venous thrombosis or catheter-associated blood stream infections between the femoral and internal jugular sites.[6] Another study of 108 patients undergoing catheter placement for apheresis in the femoral position, found minimal complication rate and lower cost.[7]

The purpose of this study was to assess the safety and efficiency of femoral apheresis catheter procedures performed by the procedure service in outpatients undergoing apheresis for CAR T-cell therapy or stem cell donation.

Methods

Forty-three consecutive patients age 18 and older were referred to the procedure service from the outpatient oncology department for non-tunneled catheter placement between August 2019 and June 2020 and were included in our analysis. The only exclusion criteria was the inability to tolerate a procedure under a local anesthetic; these patients were referred to interventional radiology. Informed consent was obtained from all patients prior to the procedure. All procedures were performed in a procedure room in the outpatient surgery center utilizing active ultrasound guidance. Decisions regarding the timing of catheter removal were made by the oncologist. Patients were followed for 30 days post-procedure via the electronic medical record to evaluate for complications.

Given that this was a quality improvement study and did not meet criteria for human subjects research, the institution did not require an institutional review board application. Study data were collected and managed using REDCap electronic data capture tools hosted at UCLA Medical Center. REDCap (Research Electronic Data Capture) is a secure, web-based software platform designed to support data capture for research studies.[8,9] Data analysis was carried out with Excel software.[10] A two-sample two-tail t test assuming unequal variances was carried out comparing the wait times for the procedure service and interventional radiology. Wait times were calculated for patients undergoing CAR T-cell therapy using the difference in days from the date of consent to CAR T-cell therapy and the

date of the procedure. Complications were graded according to the Common Terminology Criteria for Adverse Events.[11]

Results

Data was collected and analyzed from a total of 43 patients undergoing a central venous catheter or ultrasound-guided peripheral intravenous line placement procedure by the hospitalist procedure team. Of the 43 patients, 60.5% were female and 39.5% were male with mean age of 47.7 years (Table 1). The majority of patients had active cancer (55.8%) with diagnoses consisting of diffuse large B-cell lymphoma (32.6%), acute lymphoblastic leukemia (7%), primary mediastinal B-cell lymphoma (4.7%), large B-cell lymphoma transformed from follicular lymphoma (9.3%), or other B-cell lymphoma not otherwise specified (2.3%). The remaining cohort of patients were healthy stem cell donors (44.2%). Just over half of the patients (53.5%) underwent pheresis for CAR T-cell therapy, while the remainder required the line for stem cell donation in preparation for allogenic stem cell transplant.

Thirty-nine patients (90.7%) had femoral temporary hemodialysis catheters placed, and 4 (9.3%) had large-bore ultrasound-guided peripheral intravenous lines placed. The duration of catheter or intravenous line placement in all patients was either one calendar day (65.0%) or two calendar days (35.0%). One grade 1 complication was reported involving a small hematoma approximately 6 days after placement of a temporary femoral apheresis catheter. No other complications including deep venous thrombosis, catheter-associated blood-stream infection, or arterial puncture were reported within 30 days post-procedure.

The mean wait time was 7.6 days from signing the consent for CAR T-cell therapy to undergoing pheresis in the procedure service group (Figure 1). One of the 21 patients was excluded from the wait time analysis for the procedure service due to treatment plans intentionally delaying the procedure 146 days. We compared this to 17 patients who were sent to interventional radiology and found that longer mean wait times for interventional radiology (14.8 days versus 7.6 days, p=0.041).

Discussion

The primary aim of our quality improvement study was to examine the safety of placement of temporary non-tunneled apheresis catheters under the supervision of trained hospitalists at a teaching hospital. Apheresis catheters are larger caliber than triple lumen catheters and thus theoretically more prone to complications, although there is limited literature to support this. One meta-analysis that included large bore catheters used for hemodialysis, not apheresis, revealed a higher rate of catheter-associated blood stream infections in non-tunneled hemodialysis catheter group when compared to the non-tunneled non-hemodialysis central line group.[12] Given the possible increased risk for complications with the larger hemodialysis catheter, our medical center recently separated privileging for central line from hemodialysis line privileges for both internal medicine attendings and residents. Our study revealed a minimal complication rate for apheresis line placements by a hospitalist-run procedure team. A limitation of our study is a small sample size, but our initial data is encouraging.

Trainees often participated in central line placement in the outpatient surgery center. A 2006 study reported fewer procedures are being supervised by attendings, and that internal medicine attendings are in turn, becoming less comfortable performing and supervising these procedures.[13] By having an experienced procedural hospitalist and the controlled environment of a procedure room, the residents have a safer setting to increase the number of procedures that they do as well as the quality of instruction. In turn, we anticipate that they will be more proficient at central lines in the future. This is supported by several studies of procedure teams across the nation.[1,2]

The role of the hospitalist continues to grow and evolve. After literature review, we could not find similar publications regarding hospitalists moving into outpatient settings for placement of central venous catheters or being involved in outpatient oncological care. Hospitalists are uniquely positioned to assess health system needs and adapt to them. Our interventional radiology department is robust and busy with complex procedures. As a result, oncology patients or healthy donors for oncology patients had delayed scheduling for a procedure that internists are trained to perform. Given the severity of the oncologic disease, delays in therapy can lead to serious declines in health. The interventional radiology department supported the procedure service in this endeavor as it opened time for scheduling complex procedures. This expedited care for this medically vulnerable population.

Our experience provides a model of how hospitalist-run procedure services can be used to safely bridge the gap in procedural needs throughout the health system. Apheresis catheter placements can be performed with minimal complications by trained hospitalists and provide an important learning opportunity for medical residents. Creating novel processes can expedite comprehensive care for medically-complex patients.

Gender		
	Female	26 (60.5)
	Male	17 (39.5)
	Total	43
Age (years)		
	18-30	9 (20.9)
	31-40	5 (11.6)
	41-50	7 (16.3)
	51-60	12 (27.9)
	61-70	7 (16.3)
	71-80	2 (4.7)
	>80	1 (2.3)
Ethnicity		
	Hispanic or Latino	12 (28.6)
	Not Hispanic or Latino	23 (54.8)
	Unknown/Not Reported	7 (16.7)
Body Mass Index (kg/m^2)		27.1 ± 5.9
Principal Diagnosis		
	Diffuse large B-cell lymphoma	14 (32.6)
	Acute lymphoblastic leukemia	3 (7.0)
	Primary mediastinal large B-cell lymphoma	2 (4.7)
	Large B-cell lymphoma transformed from follicular lymphoma	4 (9.3)
	Other B-cell lymphoma not otherwise specified	1 (2.3)
	Healthy donor	19 (44.2)
Comorbid Conditions		
	Active cancer	24 (55.8)
	Post-organ transplant	1 (2.3)
	Clotting disorder	2 (4.7)
	Bleeding disorder	1 (2.3)
	Autoimmune disorder	2 (4.7)
	Immunodeficiency (e.g. HIV, not chemotherapy)	0 (0)
	Diabetes mellitus	1 (2.3)
	Coronary artery disease	1 (2.3)
	Heart failure	2 (4.7)
	Stroke/transient ischemic attack	1 (2.3)
Medications		
	Long-term antiplatelet therapy	1 (2.3)
	Long-term anticoagulation therapy	3 (7.0)
	Long-term corticosteroid therapy	5 (11.6)
	Chemotherapy/immunotherapy within 1 month prior to procedure	18 (41.9)
	Non-chemotherapy immunosuppressive medication	1 (2.3)
Reason for Catheter		
	CAR T-cell therapy	23 (53.5)
	Healthy donor for allogenic stem cell transplant	19 (44.2)
	Other	1 (2.3)
Labs		
	White blood cell count ($x10^3$)	9.6 ± 12.6
	Absolute neutrophil count ($x10^3$)	6.2 ± 9.5
	Platelet count ($x10^3$)	224.6 ± 105.9
	Hemoglobin (g/dL)	11.8 ± 2.3
	Partial thromboplastin time (seconds)	30.4 ± 7.0
	Creatinine (mg/dL)	0.7 ± 0.2

Table 1: Demographics and clinical characteristics of patients undergoing central venous catheter or ultrasound-guided peripheral intravenous line placement by the hospitalist procedure team. Notes: Continuous variables are presented as mean ± standard deviation. Categorical variables are presented as number (percentage).

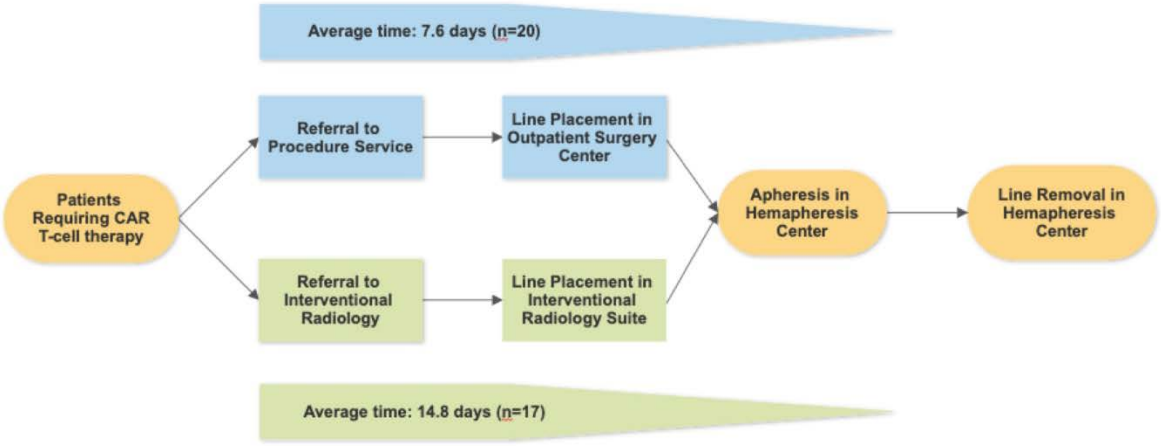

Figure 1. Patient workflow for patients undergoing apheresis catheter placement and removal. Those referred to interventional radiology had longer wait times compared with those referred to the procedure service (7.6 versus 14.8 days, p=0.041).

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