CLINICAL STUDY

Clinical Predictors of Port Infections in Adult Patients with Hematologic Malignancies

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ABSTRACT

Purpose: To identify clinical predictors of port infections in adult patients with hematologic malignancies.

Materials and Methods: A retrospective chart review identified 223 adult patients (age $\geq$ 18 y) with hematologic malignancies, including lymphoma (n = 163), leukemia (n = 49), and others (n = 11), who had a port placed from 2012 to 2015. Early (< 30 d after port placement) and overall port infections (bloodstream and site infections) were recorded. To elucidate clinical predictors for early and overall port infections, proportional subdistribution hazard regression (PSHREG) analyses were conducted with variables including patients' demographics, medications used, laboratory data, and port characteristics.

Results: Total duration of follow-up was 83,722 catheter-days (median per patient, 274 catheter-days). Early and overall port infections were identified in 8 (3.6%) and 26 (11.7%) patients, respectively. Early and overall infection rates were 1.2 and 0.3 infections/1,000 catheter-days, respectively. Backward stepwise multivariate PSHREG analyses identified hypoalbuminemia (< 3.5 mg/dL) at the time of port placement (hazard ratio = 5.03; 95% confidence interval, 1.14–22.16; $P = .03$) and steroid use (> 30 d cumulatively during follow-up period) (hazard ratio = 3.41; 95% confidence interval, 1.55–7.47; $P = .002$) as independent risk factors for early and overall port infections, respectively.

Conclusions: In adult patients with hematologic malignancies, hypoalbuminemia at the time of port placement was a clinical predictor for early port infections, whereas steroid use was a clinical predictor for overall port infections.

ABBREVIATIONS

ANC = absolute neutrophil count, BSI = bloodstream infection, CIF = cumulative incidence function, PSHREG = proportional subdistribution hazard regression

Hematologic malignancies are neoplastic diseases that begin in and affect the hematopoietic and lymphoid tissues. Clinical presentations of hematologic malignancies include various forms of leukemia, lymphoma, and myeloma (1). Although hematologic malignancies constitute a heterogeneous group of cancers with different morphologic, immunophenotypic, genetic, and clinical features, cytotoxic chemotherapy is generally the mainstay of treatment. Patients with hematologic malignancies often require totally implantable venous access systems (ports) as reliable venous access for administration of chemotherapy. Despite progress in antibiotic therapy and infection control procedures, infection remains one of the most common long-term complications associated with ports. It is also the most common cause of premature port removal in adult patients with cancer, followed by mechanical complications and thrombosis (2,3). There are 2 types of port infections—port-site infection and bloodstream infection (BSI). Together, they are reported to occur at a rate of 0.15–0.43 per 1,000 catheter-days (4–6).

Patients with hematologic malignancies have been reported to have a higher risk of port infection compared with patients with solid malignancies, presumably owing to their impaired immune systems secondary to the malignancies and the longer and more intense chemotherapeutic regimens (7,8). The impact of port infections on this immunocompromised patient population can be substantial. Port

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None of the authors have identified a conflict of interest.

J Vasc Interv Radiol 2018; ■:1–8

https://doi.org/10.1016/j.jvir.2018.04.014

Table 1. Patient Demographics, Clinical History, and Relevant Medication Use

Characteristic	All Patients (n = 223)	Early Infection (n = 8)	Overall Infection (n = 26)
Age, y, median ± IQR	55 ± 17	63 ± 12	55 ± 17
Range	19–88	42–75	19–80
Sex			
Male	125 (56.1)	3 (37.5)	16 (61.5)
Female	98 (43.9)	5 (62.5)	10 (38.5)
BMI, mean ± SD	27.8 ± 9.05	32.7 ± 12.7	29.5 ± 14.6
Range	17–62	21–61	20–62
Diabetes mellitus	29 (13.0)	1 (12.5)	4 (15.4)
Prior port placement	10 (4.5)	2 (25.0)	2 (7.7)
Disease status			
Initial diagnosis	202 (90.6)	8 (100.0)	24 (92.3)
Recurrence	21 (9.4)	0 (0.0)	2 (7.7)
Malignancy class			
Lymphoma	163 (73.1)	6 (3.7)	16 (9.8)
Leukemia	49 (22.0)	2 (4.1)	9 (18.4)
Other	11 (4.9)	0 (0.0)	1 (9.1)
Diagnosis			
AML	16 (7.2)	2 (25.0)	4 (15.4)
ALL	18 (8.1)	0 (0.0)	4 (15.4)
CML	4 (1.8)	0 (0.0)	0 (0.0)
CLL	12 (5.4)	0 (0.0)	1 (8.3)
Non-Hodgkin lymphoma	125 (56.1)	3 (37.5)	12 (46.2)
Hodgkin lymphoma	38 (17.0)	3 (37.5)	4 (15.4)
Multiple myeloma	8 (3.6)	0 (0.0)	0 (0.0)
Other	2 (0.9)	1 (12.5)	1 (50.0)
Bone marrow transplantation	18 (8.1)	0 (0.0)	1 (3.8)
Medications			
Steroids	29 (13.0)	1 (12.5)	8 (30.7)
Anticoagulants	13 (5.8)	0 (0.0)	0 (0.0)
Antiplatelets	20 (9.0)	0 (0.0)	1 (3.8)

Note–Values are presented as number (column percent total) except where noted.
ALL = acute lymphocytic leukemia; AML = acute myelogenous leukemia; BMI = body mass index; CLL = chronic lymphocytic leukemia; CML = chronic myelogenous leukemia; IQR = interquartile range.

infections can lead to admission of the patients to the intensive care unit, longer hospital stays, higher medical expenses, and delays in treatment (9,10). To our knowledge, no standard guidelines for screening high-risk patients exist for port infections. The purpose of this study was to identify clinical predictors of port infections in adult patients with hematologic malignancies.

MATERIALS AND METHODS

Patients

This single-center retrospective study was in compliance with the Health Insurance Portability and Accountability Act and was approved by the institutional review board. Through a search of the picture archiving and communication system, 1,116 adult patients (age ≥ 18 y) with cancer who underwent port placement in the Division of Interventional Radiology between January 2012 and December 2015 were identified. During this period, 223 patients (20.0%) with hematologic malignancies underwent port placement and were included in this study. Electronic medical records and imaging studies of patients were reviewed to record baseline information, including patient demographics, clinical history, and relevant medications (Table 1) and port characteristics (Table 2). Relevant medications included for analysis were steroids (prednisone and dexamethasone), anticoagulants (warfarin and enoxaparin), and antiplatelet agents (aspirin and clopidogrel). Steroids were mostly used as part of chemotherapy regimens (prednisone 50–100 mg/d or dexamethasone 20–40 mg/d; n = 22) but were also used for chronic medical diseases, such as autoimmune disease (prednisone 5–35 mg/d; n = 7). Patients with steroid use were included when the duration of use was more than cumulative 30 days during the follow-up period. Patients with use of anticoagulants or antiplatelet agents were included when the duration of use was more than cumulative 6 months during the follow-up period. Relevant