Incidence of Catheter-Related VTE in Acute Leukemia Patients Requiring Peripherally-Inserted Central Catheter

Refaei, M[1]; Fernandes, B.[2]; Brandwein, J.[3]; Wu, C.[3]
1. Dept. of Internal Medicine; 2. Dept. of Nursing; 3. Dept. of Hematology at the University of Alberta

Abstract

Background- Central venous catheters (CVCs) are a leading cause of upper extremity deep vein thrombosis (UE DVT). Long term CVCs are required for chemotherapy in acute leukemia (AL), who can be thrombocytopenic which makes anticoagulation for CVC related thrombosis a challenge. Incidence of UE DVT has been reported to be increased in those with peripherally inserted (PICC) vs centrally inserted lines. ***Aims-*** To identify leukemia inpatients with a PICC line and report the incidence of VTE. ***Methods-*** AL inpatients admitted to Hematology at the University of Alberta Hospital between 2003-2013 and who required PICC insertion were identified, and their charts reviewed retrospectively. Baseline patient characteristics were recorded. All VTE were objectively confirmed on imaging studies. Incidence of catheter associated thrombosis was calculated. ***Results-*** 420 patients with AL were identified. 83 patients were excluded for not undergoing a PICC insertion. The remaining 337 patients had at least one PICC line insertion. Overall, there were 634 PICC line insertions, with the 5FR dual lumen being the most commonly used PICC line (80%). Out of the 634 insertions, there were 65 (10%) new upper extremity DVTs, 54 (83%) of which developed acutely (<1month). ***Conclusions-*** The incidence rate of DVT in our AL patients is higher than predicted for a general cancer patient population.

Introduction

- Venous thromboembolism (VTE) is associated with significant morbidity and mortality.
- Acute leukemia patients are at very high risk of both thrombosis (cancer, chemotherapy, long term CVC use), and bleeding if anticoagulation is required (severe thrombocytopenia).
- Reducing the thrombotic risk in this population will decrease the VTE incidence and minimize subsequent hemorrhagic risk associated with anticoagulation.
- The aim is to determine the incidence of VTE among leukemia inpatients who received a PICC.

Methods

- This project was approved by the University of Alberta Health Research Ethics Board (Pro 00051738).
- Chart review of adult patients (> 17 years old) admitted between January 1, 1993 and December 31, 2013 to the Hematology service at the University of Alberta Hospital (Edmonton, Canada), who have a diagnosis of acute leukemia and received a PICC.
- Data collected:
  - Baseline clinical and demographic data, relevant past medical history, and other VTE risk factors.
  - Characteristics of catheter.
  - Development of catheter-related VTE and timing.
  - Platelet count at time of VTE diagnosis.
  - Other catheter-related complications.
- Diagnosis of any VTE had to be objectively confirmed on imaging studies.

Results

- 420 patients with AL were identified, 83 of whom did not receive a PICC line and were excluded. The remaining 337 had at least one PICC insertion.
- Overall, there were 634 PICC line insertions, with 5FR dual lumen being most commonly used (80%).
- Of the 634 insertions, there were 65 (10%) new UEDVT. If limited to first insertion, UEDVT decreases to 41 (6.5%). There was 44 thrombocytopenic patients (platelets <50) at time of VTE.

Table1: Characteristics of 337 Patients Reviewed

Patient characteristics	Entire cohort N (%)	65 patients with VTE N (%)
Acute myeloid leukemia	305 (90.5)	58 (89.2)
Other active cancer	11 (3.3)	1 (1.5)
BMI >30	44 (13.1)	9 (13.8)
Smoker	144 (42.7)	24 (36.9)
Cardiovascular risk factors*	126 (37.4)	19 (29.2)
Inflammatory bowel disease	3 (0.9)	1 (1.5)
Estrogen	31 (9.2)	11 (16.9)
Pregnancy	3 (0.9)	0 (0)
Previous VTE	14 (4.2)	3 (4.6)

* Cardiovascular risk factors were type 2 diabetes mellitus, congestive heart failure, and hypertension.

Table2: Indications for Insertion and Removal of 634 PICC Insertions

Category	Indication	634 PICC insertions N (%)
Insertion	Chemotherapy	556 (87.7)
	Blood products	352 (55.5)
	Antibiotics	223 (35.2)
Removal	VTE	70 (11.0)
	Infection	144 (22.7)
	Mechanical	81 (12.8)
	Completion of treatment	161 (25.4)
	Transfer to another facility/department	110 (17.4)
	Other	130 (20.5)

Table3: Characteristics of 634 PICC insertions

Category	Subgroup	634 PICC insertions N (%)	65 patients with VTE N (%)
Lumen Number	One	16 (2.5)	1 (1.5)
	Two	600 (94.6)	62 (95.3)
	Three	11 (1.7)	1 (1.5)
	Not Recorded	9 (1.4)	1 (1.5)
Lumen size	4Fr	4 (0.6)	1 (1.5)
	5Fr	511 (80.6)	51 (78.5)
	>6Fr	80 (12.6)	7 (10.8)
	Not Recorded	38 (6.0)	6 (9.2)
Vein of insertion	Basilic	367 (57.9)	40 (61.5)
	Cephalic	13 (2.1)	2 (3.1)
	Brachial	103 (16.2)	4 (6.2)
	Not Recorded	149 (23.5)	19 (29.2)

Table 4: Catheter-Related Complications of 634 PICC Insertions.

Category	Subgroup	65 patients with VTE per 634 PICC insertions N (%)
VTE location	Ipsilateral	64 (10.1)
	Contralateral	1 (0.2)
	Superficial vein* only	23 (3.6)
	Superficial extend into deep vein	40 (6.3)
	Deep vein§ only	2 (0.3)
VTE Timing	Acute (<1month)	54 (8.5)
	Subacute	7 (1.1)
	Chronic (>3 months)	4 (0.8)
VTE Treatment	Therapeutic	32 (5.0)
	Prophylactic	1 (0.2)
	No treatment	32 (5.0)
Recurrent VTE		7 (1.1)
Concurrent VTE		15 (2.4)
Infection	Catheter-related	20 (3.2)
	All-Cause bacteremia	64 (10.1)
Mechanical❖	Any	53 (8.4)

* Superficial vein includes brachial, cephalic, and basilic.
§ Deep vein includes axillary, subclavian, internal jugular, and brachiocephalic.
❖Mechanical complications: non DVT occlusion, leakage, or breakage.

Discussion

- In comparison to other patients receiving PICC lines, AL patients are more likely to develop VTE. In the general, non-hospitalized population VTE rate is 0.01% per year, and less than 10% of these are UEDVT. In non-cancer medical patients, rates are <5%. In solid cancer, rate is 5.9-6.9%. In AL patients rates are 25-40%. This is consistent with trends in our population (10%).
- Our results are consistent with proposed mechanisms of PICC-related thrombosis; 83% of VTE developed within one month of insertion supporting the notion that line insertion causes acute endothelial damage. The presence of the catheter changes dynamic of blood flow leading to mural thrombi. This was reflected in our data where 98% of the VTEs were ipsilateral.
- Anticoagulation is the mainstay of therapy for VTE, with the most common complication being major bleeding. Major complicating factors in AL patients include frequency and degree of thrombocytopenia, as well as frequency of major organ failure (renal, hepatic). Our study highlights the high proportion of concomitant severe thrombocytopenia at the time of VTE diagnosis.
- The importance of our study is to highlight the increased rates of VTE associated with PICC insertion in the acute leukemia population. It would be prudent for harm reduction to investigate if alternative, safer CVC exist.
- As any retrospective study, ours is subject to missing or incomplete data, as well as subjective bias in inability to account for all required information. Similarly, authors were unable to identify why certain treatments where used either for chemotherapy or anticoagulation. We are unable to verify any previous CVC insertions.

Conclusions

- The incidence rate of DVT in our acute leukemia (AL) patients is higher than other cancer population.
- Centrally-inserted CVC have been shown to have lower risk of VTE in other cancer populations. Next step involves reviewing charts of AL patients, who predominantly receive centrally inserted CVC, and compare incidence of VTE to our PICC group.

References

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