To heparin lock or not?

That is the question.

Experiences of a Home Infusion Pharmacy.

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Background

Patients receiving intravenous therapies at home for an extended duration lasting a month, or more, will use a peripherally inserted central venous catheter (PICC) that requires intermittent flushing with 0.9% sodium chloride and heparin lock solutions. The literature reports asymptomatic intralumen occlusion rates of approximately 5-22+%.

Based on home health nursing protocols, patients use either normal saline or two different, standard concentrations of heparin for prophylactic line locking, 10 units/ml or 100 units/ml. Starting in December 2024 a major global manufacturers' shortage of heparin flushes, required our organization to modify our heparin flush protocol and omit the use of either strength of heparin for select therapy types. Central lines continued to use heparin 100 units/ml. Patients receiving total parenteral Nutrition (TPN) per home health protocol, received either 10 units/ml or 100 units/ml. Patients with an underlying oncology diagnosis also continued to receive heparin flushes. Regardless of the PICC line being valved or unvalved, heparin flushes were omitted for anti-infective therapies.We noted that certain therapies had higher rates of alteplase need, and evaluated whether heparin concentration helped prevent line occlusion.

Due to the change in heparin flush protocol, it was observed that patients on vancomycin represented a disproportional frequency of clotted PICCs requiring alteplase after the change in heparin flushing protocol at this organization. The purpose of this project was to determine if there was a different line occlusion rate using heparin 10 units/ml or heparin 100 units/ml line locks. Based on previous literature, we hypothesized that heparin line lock concentration was no better than normal saline alone in preventing PICC line, non-symptomatic intra-line occlusion.

Purpose

We wanted to determine if the rate of intravenous line alteplase decloting differed significantly based on treatment type, heparin concentration, gender, or age. We hypothesized that normal saline was an appropriate flush solution for many patients based on the literature and our experience. However, with heparin flush shortages sporadically occurring, could we identify those patients who are most likely to occlude their line and prophylactically provide heparin locking flushes?

Methods

Population: Patients who received alteplase and/or vancomycin over a 5.5 year range.

Setting: This was a single site, retrospective chart review of patients who received alteplase for an occluded intravenous line while on home infusion service between January 1, 2020 and July 25, 2025. 169 patients received alteplase. Alteplase use was skewed towards those prescribed vancomycin (as a solo agent or in combination with a second antibiotic or intravenous agent). 283 patients that received vancomycin during the study period were chart reviewed. The impact on other therapies' use of altepase was also analyzed.

Date of alteplase administration, age at time of alteplase, line type, lumen number, lock solution, gender, vancomycin dose, frequency, and duration of therapy were tabulated. For categorical data, chi-squared was used. For continuous data, unpaired two tailed t-tests were used. Significance was defined as probability less than or equal to 0.05.

Power calculation: To obtain 90% power, 50 patients in each arm were needed assuming alteplase incidence=25%, alpha 0.01, beta 0.1.

Result 1. Alteplase (Cathflo) use by treatment type

Treatment	Prescription Count	%
Vancomycin	44	26.0
Vancomycin combination	27	16.0
Total Parenteral Nutrition	27	16.0
Catheter Care	12	7.1
Hydration	12	7.1
Cefazolin	9	5.3
Ampicillin-sulbactam	8	4.7
Ceftriaxone	8	4.7
Pipercillin-tazobactam	4	2.4
Cefepime	4	2.4
Intravenous immunoglobulin	3	1.8
Agalsidase beta	2	1.2
Daptomycin	2	1.2
Daptomycin combination	1	0.6
Edaravone	1	0.6
Ertapenem	1	0.6
Ceftazidime	1	0.6
Imipenem/cilastatin	1	0.6
Ampicillin	1	0.6
Ceftolozane-tazobactam	1	0.6
Total	169	

Note: Patients concurrently receiving two or more intravenous therapies at the time of alteplase use, are labeled as "combination or combo."

Result 2. Alteplase use by heparin concentration

Heparin	Count(%)
10 units/ml	80 (50)
100 units/ml	80 (50)
no heparin	9

Result 3. Intravenous line type in patients who received alteplase

Type	Count
PICC DL	93
PICC	26
PAC	23
PICC SL	12
midline	9
PICC TL	3
not stated	3
Total	169

Result 4. Heparin concentration and need for alteplase use in patients who received vancomycin.

	Heparin Flush 10 units/ml		Heparin Flush 100 units/ml		No Heparin, Normal Saline Flush	
	Used alteplase	No alteplase	Used alteplase	No alteplase	Used alteplase	No alteplase
Vancomycin solo	25	58	16	83	1	4
Vancomycin combo	13	34	15	32	1	1
Combined Totals	38	92	31	115	2	5

A chi-square test of independence showed that there was no significant association between heparin concentration and need for alteplase use, irrespective of vancomycin being given alone or with an additional intravenous agent, X2(5,N=283) = 5.84, p = >0.05.

Result 5. Vancomycin and alteplase use compared to gender.

		Vancomycin solo		Vancomycin combination	
	Count(%)	used alteplase(%)	no alteplase(%)	used alteplase(%)	no alteplase(%)
Female	105(37)	16(38)	59(41)	12(41)	18(27)
Male	178(63)	26(62)	86(59)	17(59)	49(73)
Combined Totals	283(100)	42(15)	145(51)	29(10)	67(24)

A chi-square test of independence showed that there was no significant association between gender and need for alteplase use, irrespective of vancomycin being given alone or with an additional intravenous agent, X2(3,N=283) = 4.1, p >0.05.

Results

169 alteplase prescriptions during the study interval. Alteplase use was not equal across all treatment types, with 42% of alteplase prescriptions needed by those receiving vancomycin, followed by 16% by those on total parenteral therapy (Result 1) Heparin concentration did not change the rate of alteplase use (Results 2), nor did the addition of an additional intravenous treatment concurrently taken with the vancomycin.

For patients receiving vancomycin, chi-square tests of independence showed that there was no significant association between heparin concentration and alteplase use, X2 (3,N=277) = 5.18, p = .15 (Outcome 2a), no significant association between gender and alteplase use, X2(3,N=277) = 4.88, p = .18 (Outcome 2b). Nor did we see an association between the need for alteplase, and the patient's age (data not shown).

Conclusions

The use of heparin flushes is warranted for patients receiving vancomycin and total parenteral nutrition. Twenty-five percent of patients using heparin flushes and vancomycin are anticipated to need alteplase for intravenous line opening. Gender, age, and heparin concentration did not correlate with alteplase need in vancomycin patients.

Discussion

This study supports the use of heparin as a locking/flush solution for patients receiving vancomycin and total parenteral nutrition. The highest alteplase use was with vancomycin administered alone or in combination with another agent. The addition of an additional agent did not alter the alteplase use rate. Approximately 25% of our vancomycin patients developed an occluded lumen while using heparin flushes/lock solutions. It is uncertain as to why vancomycin use correlates with an increased chance of a line occlusion. However, vancomycin is acidic, is a known vesicant, and can cause thrombophlebitis. Our protocol is to dispense heparin flushes to pediatric patients, those on vancomycin, total parenteral nutrition, having a cancer diagnosis, a documented pro-thrombotic diagnosis, or whom have previously occluded their intravenous line. The rate of intravenous line occlusion in vancomycin patients is predicted to be higher without using heparin flushes. Retrospective studies can find associations, but not causation. Thus, a properly designed and executed randomized, prospective trial evaluating vancomycin and different flushing solutions should be able to determine if our preliminary findings are correct.

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