AN EVALUATION OF ALTEPLASE PRACTICES IN HEMODIALYSIS PATIENTS WITH OCCLUDED CENTRAL VENOUS CATHETERS

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Introduction

Before patients with end stage renal disease can initiate successful hemodialysis, one of three types of vascular access is created, including: arteriovenous fistula (AVF), arteriovenous graft (AVG), and central venous catheter (CVC). The CVC is the least desirable type of vascular access as it is prone to infection, poor blood flow and thrombosis. Thrombosis is a major complication of CVCs as it can lead to decreased blood flows and inadequate dialysis, which may increase a patient's risk of morbidity and mortality. While there is a great desire to minimize the numbers of CVCs in dialysis patients, significant numbers are in use for a variety of reasons.

Currently, when central venous catheters become occluded or partially occluded, thought to be due to thrombosis, one of three methods of alteplase instillation, a tissue plasminogen activator, is selected and administered by the nephrology nurse.

The three methods are:

- Push/pause (given over 30 – 60 minutes at the dialysis run)
- Dwell (left in catheter lumens for 1 – 72 hours)
- Infusion (completed during 1st 60 minutes of hemodialysis run)

Although the VIHA occluded catheter protocol has been in place for quite some time, it has not been evaluated with regards to what types of patients are receiving it, how often and by what method it is being used, and how closely it adheres to the protocol. This study aimed to evaluate these issues, as well as cost and to gain further information on differences existing between patients that would make them more likely to receive alteplase.

Objectives

- To characterize the patient population receiving alteplase for occluded CVCs by:
  - Determining the number of hemodialysis patients with CVCs as their vascular access and, of the CVC patients how many were administered alteplase
  - Quantifying the reasons for patients to have CVC over AVF or AVG
- To observe meaningful differences between those patients with CVCs who received alteplase:
  - Frequency of administration methods being used
  - Line reversal status (reversed or not) at alteplase administration
  - Hemoglobin level
  - Warfarin usage
  - INR
  - Upper body size (may affect CVC functioning)
- To determine the annual cost of alteplase use for CVC patients receiving this medication
- To compare the current alteplase usage patterns to the VIHA occluded catheter protocol (notify physician if inadequate CVC function persists after administering alteplase twice in a two-week period)

Methods

Design:

- Single centre, observational, retrospective chart review

Inclusion Criteria:

- Outpatient hemodialysis patients of the Royal Jubilee Hospital Hemodialysis Unit
- Patients with CVC as their vascular access anytime between Oct 1, 2008 to January 2, 2009 (3 months) who received alteplase
- Those who received alteplase by either the dwell, push/pause or infusion method

Exclusion Criteria:

- Inpatients with CVC receiving hemodialysis (1)
- Patients with CVCs who did not receive alteplase (22)
- Patients with arteriovenous fistula or arteriovenous graft as their vascular access

Study Analysis:

- PROMIS (Patient Records, Outcome & Management Information System) database utilized to determine CVC patients
- 66 charts reviewed, 43 included in study analysis
- Descriptive statistics used to analyze data

Results

Characteristics of Hemodialysis Patients:

Figure 1: Proportion of patients with each of the different vascular access

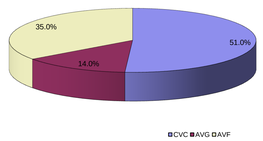
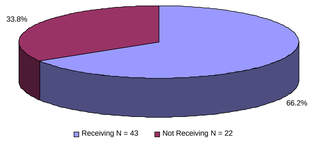
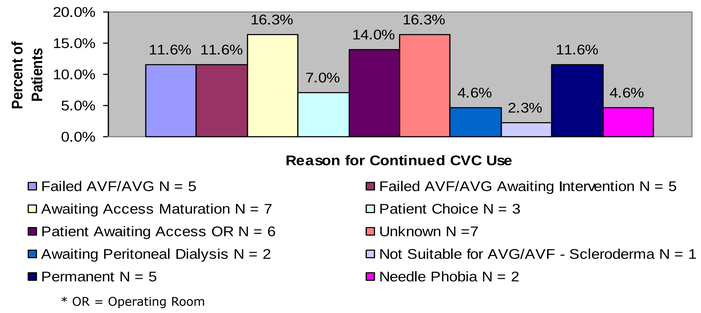


Figure 2: Proportion CVC patients receiving alteplase, N=65



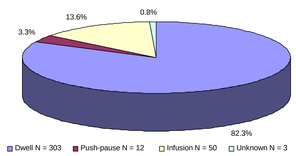
se who received alteplase:
Reasons for continued CVC use rather than AVF or AVG, N = 43



* OR = Operating Room

Characteristics of Patients Receiving Alteplase:

Figure 4: Proportion of each alteplase administration method used when alteplase given, N = 368



(96% of dwells were administered at the end of HD)

Figure 5: Proportion of alteplase usages associated with arterial & venous lines being reversed at administration, N = 368

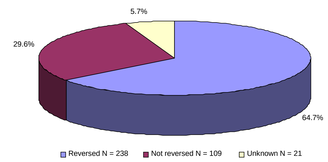


Figure 6: Distribution of hemoglobin levels at time of alteplase administration, N = 368

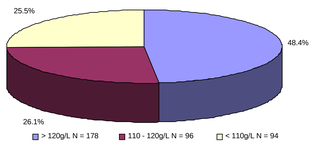
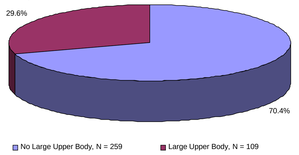


Figure 7: Proportion of alteplase usages administered to patients with large upper bodies, N = 368



(10 patients identified as having large upper body size)

Figure 8: Proportion of alteplase usages associated with an INR < 2 and INR 2-3, regardless of warfarin use, N = 368

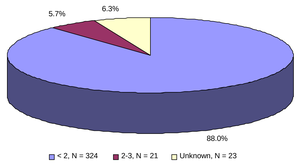
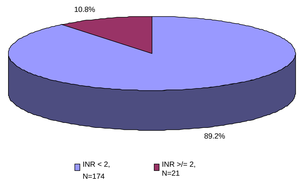
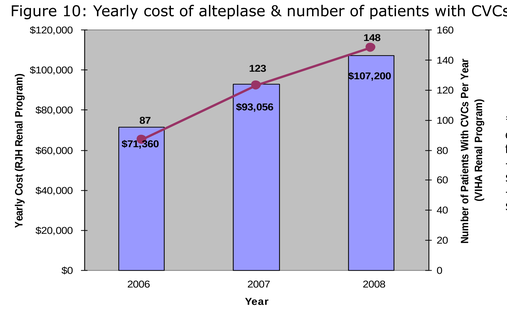


Figure 9: Proportion of alteplase usages associated with an INR < 2 and INR 2-3, in those taking warfarin, N = 195



Results

Cost: Figure 10: Yearly cost of alteplase & number of patients with CVCs



**2008 data extrapolated from this study
- 3 month cost: $26,800
- Yearly cost: $107,200

Comparison to VIHA Protocol:

Table 1: Breakdown of alteplase use by number of administrations

	Receiving > 3 alteplase administrations	Receiving > 5 alteplase administrations	Receiving > 10 alteplase administrations
# of patients	26	22	12
% of patients	60.5%	51.2%	27.9%

- % of patients with CVC replaced during study period: **18.6%**
- Number of alteplase administrations in those who did have CVC replaced: **96**
- % of patients with alteplase administered > than twice during 2 week period: **65.1%**

Discussion

- 51% of HD patients have a CVC as their vascular access
- 66% receive alteplase for a catheter occlusion
- 96% of dwells were administered at the end of HD
- Average hemoglobin in renal unit is 117g/L, 48.4% of administrations occurred when hemoglobin levels were > 120g/L
- Those with large upper body size received alteplase more often than those who did not, indicating that catheter functioning may be affected by size, not necessarily catheter occlusion
  - W*ith* large upper body size: 11 administrations per patient
  - W*ithout* large upper body size: 8 administrations per patient
- In warfarin takers more alteplase administrations were given to those with an INR of < 2 rather than those with an INR of 2-3
- Cost to treat 43 patients with occluded CVCs is $107,200 per year
- 3 patients accounted for 27.7% of alteplase administrations
- 18.6% of patients had their CVCs changed during study period
- 65.1% of patients had more than 2 alteplase administrations during a 2 week period
- Limitations:
  - Missing data from HD 'run' sheets
  - Small sample size and observational study design eliminates application to general HD CVC population
  - Inherent confounders associated with observational studies, not taken into account when performing data analysis (co-morbidities, duration on dialysis, other medications etc.)
  - Varied previous nursing experience with alteplase may effect if, when and how it is administered
  - Some patients with physician scheduled order for alteplase rather than prn

Conclusions

- Significant drug costs are being used to maintain CVC patency
- CVCs are the predominant method of vascular access for hemodialysis
- Study findings are hypothesis generating and warrant further research
- Suggestions for future research through randomized controlled trials include making comparisons between:
  - Hemoglobin levels on frequency of alteplase administration
  - Upper body size on frequency of alteplase administration
  - Therapeutic or patency INRs on frequency of administration
  - The three methods of administration (dwell, push/pause, infusion) to determine which one results in longest catheter patency

References available on request