The Five-Year Impact of a VAST Using Lean IV Care to Reduce CVAD Occlusions

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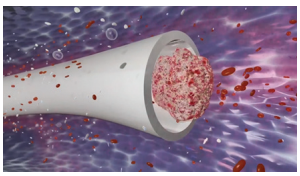
Thrombotic occlusions, caused by unintentional blood reflux in the catheter lumen(s), account for 25-30% of all Central Venous Access Device (CVAD) complications. Occlusions are preventable with proper processes, technique, and technology.[1] Led by the Vascular Access Specialty Team (VAST), our hospital has sustained CVAD occlusion reductions and associative costs for five years.

How do thrombotic occlusions form? Blood and plasma are the first body fluids to come into contact with CVAD materials such as polyurethanes and TFE/Teflon. When blood encounters the catheter material, a layer of plasma proteins adsorbs into the catheter surfaces and triggers a complex series of biological responses such as protein adsorption, platelet adhesion, coagulation, and then thrombosis.

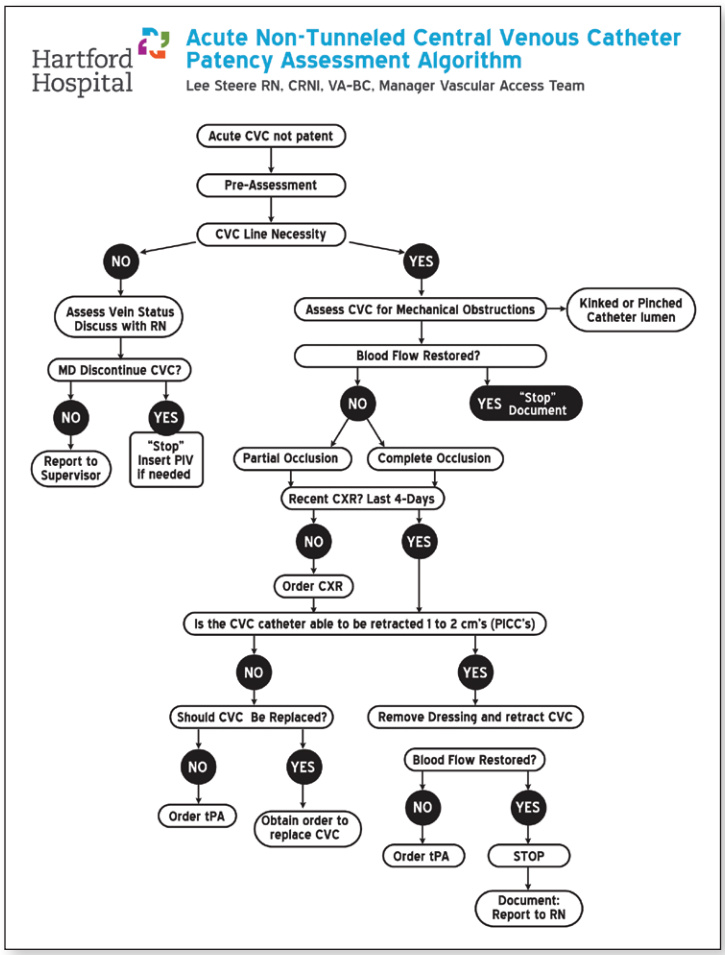


Link between thrombosis, alteplase, and infection: A 1998 study conducted by Timsit et al and published in the journal CHEST established that catheter-related thrombosis was present in 33% of patients 24 hours post-catheter removal.[2] Furthermore, catheter-related septicemia was 3.2 times higher in these patients. When catheters become occluded, alteplase is used to dissolve the fibrin clot. In 2014, Thakarar et al studied 3,723 PICC patients. Occlusion occurred in 28% of patients 5 days prior to CLABSI identification.[3] Patients with occluded catheters that required alteplase had a 3.59 times greater likelihood for developing a bloodstream infection.

Prevention: Blood reflux into the catheter lumen can be prevented. Proper flushing protocols are a key area of training and focus. Additionally, anti-reflux needleless connectors are designed to prevent blood reflux compared to negative, positive or neutral connectors.[4]

Methods

A retrospective study was conducted to establish a baseline monthly usage of alteplase, heparin, and needleless connectors (2014). Using a Lean Six Sigma DMAIC (Define, Measure, Analyze, Improve, Control) process, we analyzed the process, protocols, practices, products, and patient outcomes (5Ps) of CVAD Occlusion Management. In 2015, staggered interventions (i.e., algorithm for catheter patency, centralized alteplase Rx ordering, anti-reflux needleless connector, education for flushing) were implemented to reduce the waste, variability, and defects associated with CVAD occlusions. From 2016 to present, this process has been sustained by the VAST team.

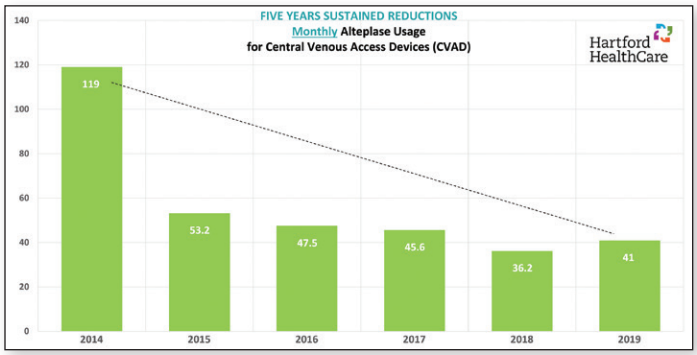


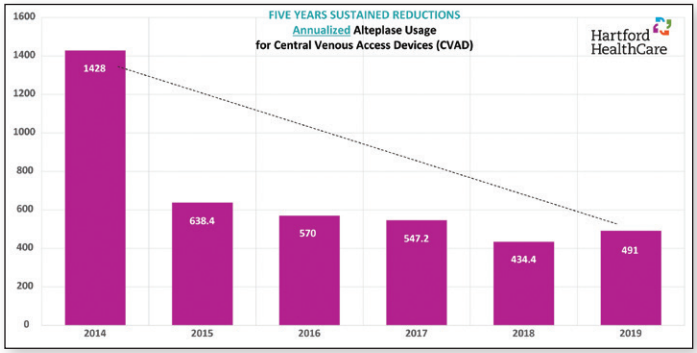
Results

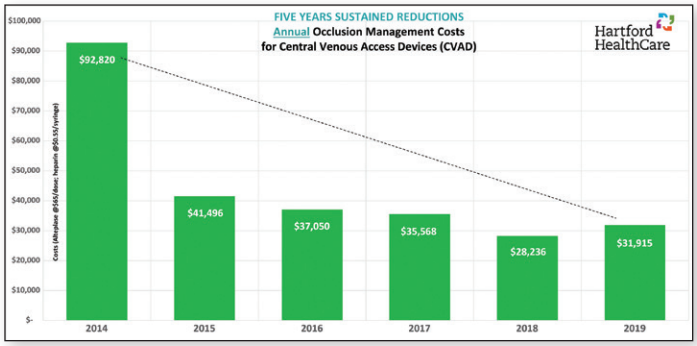
Patient Treatments: Our hospital has sustained a >69% reduction in Alteplase for five years; decreasing from 119 to 53 doses initially and sustaining an average of 40 doses per month. In year one, heparin was 100% eliminated and we had a 38% reduction in CVAD CLABSIs.[1]

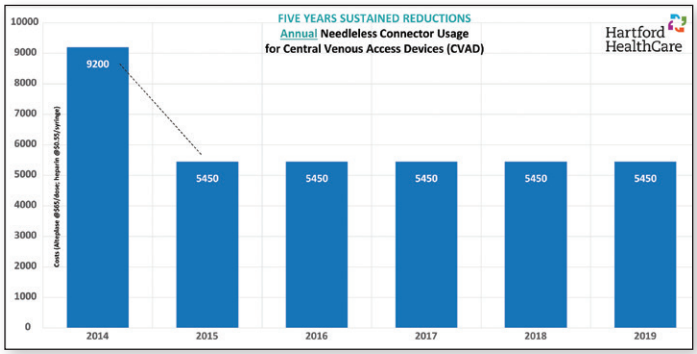
Supply Costs and Savings: Our needleless connector consumption was reduced by 41% using the anti-reflux device; decreasing from 9,200 to 5,400 connectors per month. Our overall savings from reducing alteplase/heparin was $92,820 in the first year alone. We estimate that between $250,000-430,000 was avoided in costs in subsequent years calculated by reducing CVAD Occlusions, alteplase, heparin, supplies, and CLABSIs.

Five-year charts shown in figures below:









Conclusions

CVADs were designed to help patients receive timely treatment. Our research shows that improvements to CVAD occlusions should be managed by the Vascular Access Specialty Team (VAST) to avoid costly interventions. We have grown our VAST team from 7 to 23 FTEs via value-based, sustained solutions like instituting policies that avoid premature catheter failure and replacement.

In 2019, we received Hartford's distinguished "Clinical Team of the Year Award."

References

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4. Hull G, Moureau NL, Sengupta S. Quantitative assessment of reflux in commercially available needle-free IV connectors. *J Vasc Access.* 2018 Jan;19(1):12-22.

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