

Revolutionary Change in IV Therapy Utilizing the LifeShield® TKO™-5 Anti-Reflux Device



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About the Author

Sarah Mitch, RN, is an experienced infusion therapy nurse. She obtained her Certified Registered Nurse Infusion (CRNI®) credential in 1991. Sarah holds two separate positions concurrently. She has practiced at Research Medical Center (RMC) in Kansas City, Missouri, for over 20 years. At RMC, she is a member of the peripherally inserted central catheter (PICC) team, which is responsible for inserting all PICC lines with the assist of an ultrasound. She also works for Care Staff Agency as a home infusion nurse working with HIV/AIDS patients obtaining and maintaining intravenous access lines and infusing medications. Sarah received the "Heart of Health Care" Award from the University of Kansas—School of Nursing in 2006. She also teaches classes on infusion therapy and precepts student nurses at RMC. Sarah's passion in life is raising and showing Tennessee Walking horses.

Introduction

IV therapy is a standardized component of treatment for millions of hospitalized patients each year, with an increasing number of these continuing their infusions on an outpatient basis. Therapies have also become increasingly complex, leading to a growing number of safety concerns. The purpose of this paper is to describe a year-long project undertaken that demonstrates the efficacy of implementing the LifeShield® TKO™-5 device.

Background

In late 2005, a team of experienced infusion nurses at Research Medical Center (RMC), a 500-bed teaching hospital in Kansas City, Missouri, were approached about utilizing a new product, the LifeShield TKO-5 device, which purportedly had the advantage of not requiring heparin to sustain patency of the line in which it was being used. The team agreed to incorporate this unique device into its practice and planned to collect data to challenge the aforementioned claim of not needing a heparin flush, which would represent a significant shift in their practice. The data would compare the incidence of thrombolytic intervention using the Baxter Interlink® valve versus the LifeShield TKO-5 device; the study began in January of 2006 and continued for just over one year.

Data Collection

Beginning in January 2006, 100% of patients at RMC who received peripherally inserted central catheters (PICC) or midline catheters were closely followed for complications, more specifically complications requiring thrombolytic intervention. In the ensuing 30 weeks, a total of 764 catheters were placed, or an average of 101 lines/month. Of these, 58 (7.59%) required thrombolytic intervention (RMC uses alteplase to de clot lines). For the next 26 weeks, a total of 784 patients had lines inserted, an average of 130/month, but these had the LifeShield TKO-5 devices in place. Only six or 0.77% (less than 1%) needed thrombolytic intervention, a major decrease in clotting incidence (Appendix A). Additionally, following the study there was a disruption in the supply of the LifeShield TKO-5 devices for approximately three weeks; during this time the occlusion rate spiked to seven occurrences in the first week and five the following week.

Technological Uniqueness of the LifeShield® TKO™-5 Device

Why was there such a clear advantage in utilizing the LifeShield TKO-5 device? Quite simply, the majority of IV line complications arise from blood reflux, usually caused when the bag of solution infusing into the line runs dry, from syringe plunger reflux or rebound, patient movement and manipulation, increased vascular pressure such as that related to ventilators, and/or the connecting and disconnecting related to syringe and luer lock use. The advantage of the LifeShield TKO-5 device is that it has a pressure activated anti-reflux valve, preventing the reflux which occurs with other devices. Additionally, it also allows for clamping before or after syringe removal with no difference in efficacy.

Cost/Benefit Analysis

Catheters Using the Baxter Interlink® Device (used for the first 30 weeks)

The Baxter Interlink device was used in the first 30 weeks for a cost of \$0.93 per device (the number of devices used per patient is dependent on the number of lumens attached to the catheter).

Flushes/Heparin—Per hospital protocol at RMC, lines are flushed at least every 12 hours and following medication/therapy delivery, etc. (i.e., a minimum of two flushes/day). Heparin flushes provided from the pharmacy cost \$0.45 each. For the 58 times that the catheter required alteplase to reestablish patency, this generated a cost from the pharmacy of approximately \$300 per dose.

Total cost = 764 lines

$$\begin{array}{r} 0.93 \text{ each for Baxter Interlink device} \\ + 0.90 \text{ for heparin (minimum dose)} \\ \hline \$ 1.83 \text{ per catheter} \times 764 \text{ catheters} = \$1,398.12 \\ 58 \text{ catheters requiring alteplase at } \$300/\text{dose} = + \$17,400.00 \\ \hline \mathbf{\$18,798.12} \end{array}$$

Other additional costs include extended time for hospital stay due to line complications, RN compensation for the time it took to declot the line; if a line needed to be replaced, and then the cost of additional catheter(s), flushes, etc., would need to be added to the equation. The cost of saline is not incorporated, as neither method necessitated saline flushes.

Catheters Using the LifeShield TKO-5 Device (used for the second 26 Weeks):

Total cost = 784 lines

$$\begin{array}{r} 2.10 \text{ each for Life Shield TKO-5 device} \\ + 0.00 \text{ for heparin (heparin was not used)} \\ \hline \$ 2.10 \text{ per catheter} \times 784 \text{ catheters} = \$1,646.40 \\ 6 \text{ catheters requiring alteplase at } \$300/\text{dose} = + \$1,800.00 \\ \hline \mathbf{\$3,446.40} \end{array}$$

As a result of fewer complications and less frequent changes in IV insertion, the LifeShield TKO-5 device remains on the patient longer and the financial savings for the hospital become significant.

Additional Benefits

While the financial impact alone cannot be overstated, other benefits to the patient may actually be more significant and include the following:

1. **Infection Rates**—According to the CDC, 15% of nosocomial infections each year are bloodstream infections. As of October 1, 2008, the Centers for Medicare and Medicaid Services have stopped paying the higher diagnosis-related group (DRG) for costs incurred as a result of catheter associated bloodstream infections (CABIs), necessitating an even greater diligence by hospital staff to prevent any line infection.¹

In addition, the LifeShield TKO-5 is a split septum device that has a flat surface, which provides for easy swabbing/disinfection.

Finally, as more patients are taught to self-administer medications at home, the fewer number of times that these patients need to flush a line, the less number of potential complications will occur. As many elderly patients have difficulty with the dexterity required to twist a luer lock syringe onto a valve in order to effectively flush it, using the LifeShield TKO-5 device will result in decreased time required for nursing interventions, improved quality of care and decreased costs.

2. **Patient Safety**
 - a. Using heparin increases the possibility of additional adverse medication reactions.
 - b. Potential for heparin-induced thrombocytopenia and heparin-induced thrombosis syndrome significantly decreases when heparin is not used.²

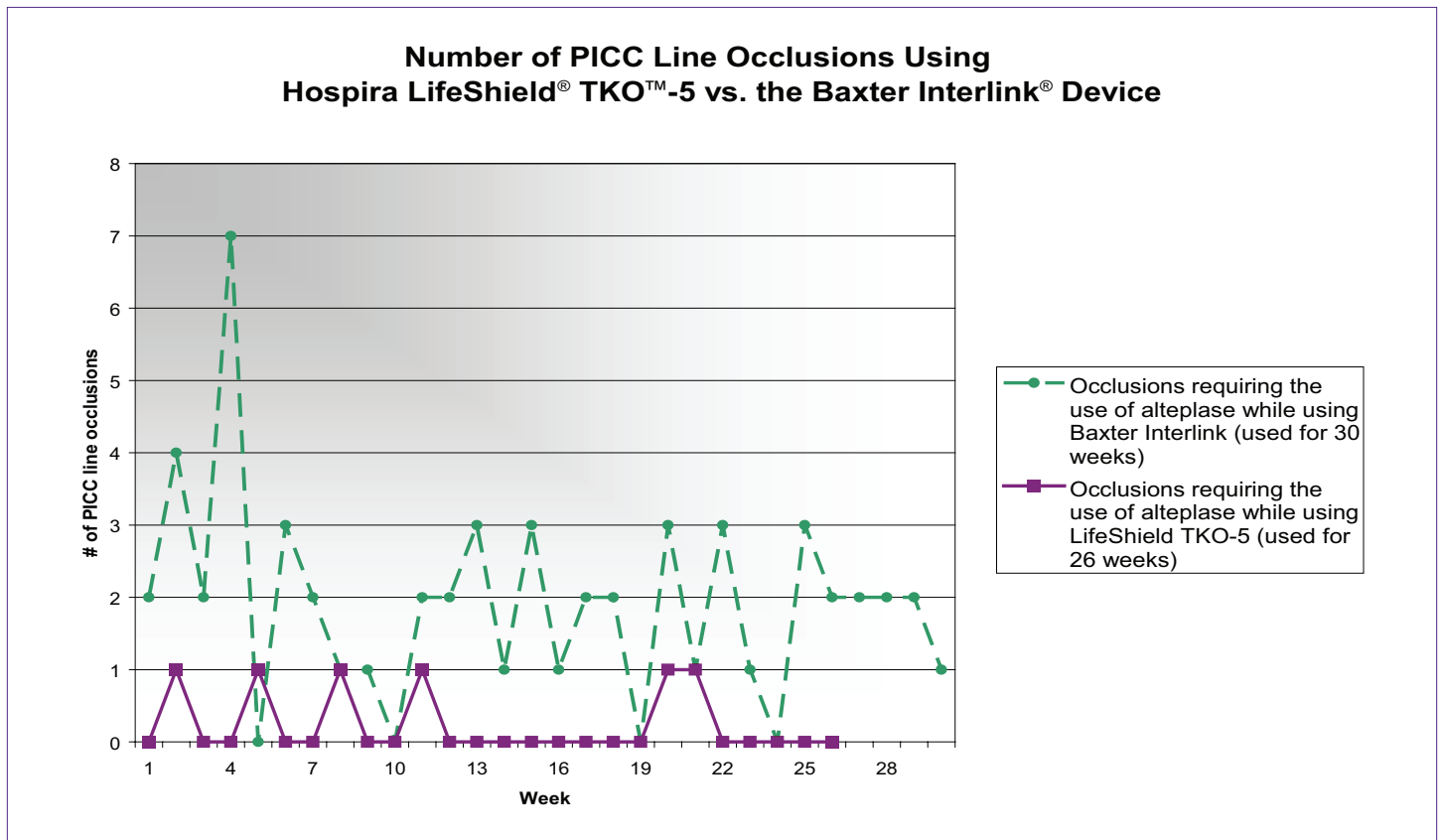
- c. While medication errors in home care are more difficult to measure, someone inexperienced with line care is more easily apt to forget to flush the line with heparin (or overuse heparin); again, the more times an intravenous line is entered, the greater the opportunity for infection.
 - d. Many elderly or non-English-speaking patients may have difficulty reading the flush directions correctly.
3. **Patient Satisfaction**—Patients whose veins and/or therapy necessitate the use of a PICC line appreciate efforts made on their behalf to increase their comfort, decrease stress and keep their line patent and functional. Declogging lines is not an unexpected complication but carries the risk of increasing potential harm to the patient. The time required to declog a line can also cause delays in treatment, e.g., missing a therapy, having to cancel a procedure, delay discharge, etc.
 4. **Physician Satisfaction**—The use of alteplase requires a physician order and clinicians are not always aware and/or comfortable with the process of administering alteplase.

Therefore, any intervention that can be implemented that removes the need for this intervention is more beneficial to the patient (saves time, decreases cost, etc.).

Conclusion

The increased use of heparin flushes, coupled with the complexities of IV care and greater infection rates, has led to a need for greater efficiencies and improved effectiveness in the administration of IV therapy. In an evaluation performed at Research Medical Center in 2006, a team of experienced infusion nurses compared the efficacy of the LifeShield® TKO™-5 device to the conventional flushing technique utilizing normal saline followed by a heparin flush. Patients in the group receiving standard therapy with a heparin flush required 58 thrombolytic interventions (7.59%), while patients in the group using the LifeShield TKO-5 device experienced 0.77% (less than 1%) rate of thrombolytic interventions. A cost/benefit analysis of the two groups revealed the use of the LifeShield TKO-5 device to be significantly more cost effective, i.e., a savings of \$15,351.72 over the course of the year, and potentially safer for the patients.

Appendix A: Study Data from Research Medical Center



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