

## Nexus TKO<sup>®</sup>-5: Blood Clearance Study

### Risk of Infection

Blood provides many of the nutrients to support the growth of bacteria. Blood which can be left to reside inside the fluid pathway of a needle-free injection site has the potential to increase the risk of blood stream infections.<sup>1,2,3,4</sup> It is crucial that all blood can be properly flushed from a needle-free injection site using established flushing protocols.<sup>2,3</sup>

### Background

Needle-free injection sites are an essential component of IV therapy which includes the infusion of blood, blood components, blood sampling and the aspiration of blood for the confirmation of catheter patency. Dr. Jarvis in his published article found in *"Infection Control Today"* stated, "the design of needle-free injection sites plays a substantial role in the risks of CRBSI's".<sup>2</sup> This risk is further amplified when blood is left to reside inside a needle-free injection site. The Nexus TKO<sup>®</sup>-5 was designed using a clear, direct, rigid internal fluid pathway which Dr. Jarvis promotes as an effective design to ensure blood is not trapped and can be productively flushed from the fluid pathway. A laboratory test for the presence of hemoglobin shall provide data about the design integrity of the tested device and its ability to be productively flushed and successfully cleared of hemoglobin. Volumes from 5 mL to 20mL using pre-filled syringes of normal saline is the most common clinical practice used in flushing peripheral I.V. catheters as well as the much longer PICC and central venous catheters which are used frequently for routine blood sampling.

### Methods

A study was conducted by an outside laboratory on the efficacy of flushing after a simulated blood draw on the Nexus TKO<sup>®</sup>-5.

A syringe was connected to the TKO-5 via a Nexus plastic blunt cannula and 5mL of human blood was aspirated through the injection site. A new syringe containing 5mL of sterile water for injection was then connected using the Nexus plastic blunt cannula. The sterile water was flushed through the injection site and the fluid was collected in a sterile test tube. This flushing procedure was repeated an additional 3 times for a total of four (4) separate 5mL flushes. Sterile water was used to flush the residual blood since it causes the red blood cells to lyse and release the hemoglobin which can be measured by spectrometry.

The collected samples were then mixed by inversion, centrifuged at 500xg for 5 minutes and the absorbance of the supernatant was read at 545 nm with sterile water being used for the blank.



## Results

Three of the five injection sites were completely cleared after the first 5mL flush as demonstrated by the subsequent flushes (#2 - 4) having 0% hemolysis. The other two injection sites had results of 6% hemolysis in the second flush eluate demonstrating the majority of the blood was cleared in the first 5mL flush. Those remaining two injection sites were completely cleared after the second 5mL flush (10mL total) as indicated by the 0% hemolysis in flushes 3 and 4.

## Conclusions

This study demonstrated the Nexus TKO<sup>®</sup>-5 can be cleared of blood using established flushing protocols. Virtually all the hemoglobin was cleared in the first 5mL flush, while all the hemoglobin was cleared after 10mL of flushing fluid.

## Discussion

Cather-related bloodstream infections (CRBSIs) create both clinical and financial risks for a facility and they are a major complication that impacts the patient's health. Therefore, catheter maintenance including productive flushing protocols is important in preventing CRBSIs.

The Nexus TKO<sup>®</sup>-5 was designed with a direct, clear, rigid internal fluid pathway which facilitates low volume flushing with standard flushing syringes.<sup>2</sup> Not only does the TKO-5 provide a visual assessment of blood clearance, this study supports that the design aids in clearing the device of blood using standard flushing protocols.

Overall, the Nexus TKO<sup>®</sup>-5 can provide the facility a needle-free injection site that can be readily cleared of blood using standard flushing protocols which can lead to improving CRBSI rates.<sup>2</sup>

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<sup>1</sup> Hanchett M. Visualizing the IV fluid path as an emerging concept in infection control. *Infection Control Today*. 2004 Feb.

<sup>2</sup> Jarvis, W. Choosing the best design for the Intravenous needleless connection to prevent HA-BSI's. *Infection Control Today*, 2010 Aug .

<sup>3</sup> Hadaway L. Flushing vascular access catheters: risks for infection transmission. *Infection Control Resource*, 2007; 4(2):1-8.

<sup>4</sup> Maki DG, Kluger DM, Crnich CJ. The risk of bloodstream infection in adults with different intravascular devices: a systematic review of 200 published prospective studies. *Mayo Clin Proc* 2006; 81(9):1159-71.

