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Concise Communication

Do blood contamination reduction devices work? A single institution comparison

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Abstract

We compare two initial specimen diversion devices evaluated over 3 months to investigate their utility in lowering blood culture contamination rates at or below 1%. Overall contamination rates during trial periods were 2.46% and 2.60% but usage was low, whereas device-specific contamination rates were 0.68% and 0.8%, respectively.

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Introduction

Monitoring and reporting of blood culture (BC) contamination rates is a laboratory quality best practice and a requirement by accrediting organizations.[1] Blood is a normally sterile body fluid, and as such, organisms isolated from it are likely to represent infection, prompting antimicrobial treatment. However, normal skin flora picked up at the time of specimen collection can be isolated from specimens rendering false positive results leading to unnecessary antibiotic use, removal of intravenous catheters, increased length of stay, and increased healthcare costs.[2] The American Society of Microbiology and the Clinical and Laboratory Standards Institute recommend that BC contamination rates should not exceed 3%.[3] To further improve patient care, the Military Constructions, Veterans Affairs Act 2022 mandated that Veterans Healthcare Administration hospitals aim for a contamination rate not exceeding 1%.[4]

Skin disinfection is an effective method to reduce contamination rates; however, blood specimens are collected in a variety of settings and circumstances making standardization problematic.[5] Skin material colonized with microbes may be introduced into the collected specimen as the needle goes through the skin,[6,7] an issue not solved with skin decontamination. To overcome this challenge, the diversion of the first few milliliters of blood, presumably containing contaminating bacteria, has been proposed. Several studies have compared the efficacy of initial specimen diversion devices (ISDD) in reducing BC contamination rates in different clinical settings with varying degrees of success as compared to the standard of care (SOC).[8–10] Two comparable ISDD available in the market claims significant reduction in contamination rates, the Steripath™ BC collection device and the Kurin™ BC collection set. The VA Northeast Ohio Healthcare System evaluated the clinical performance of both devices in a clinical setting.

Methods

The trial was conducted in two phases as a quality improvement project, sequentially testing the Kurin™ and Steripath™ devices. The Kurin™ device, which diverts the first 0.15ml of collected blood along with any skin plug, was studied from May 16 to August 18, 2022, followed by a washout period from August 19th through September 30th. Subsequently, the Steripath™ device, which diverts an initial 0.6 to 0.9 ml of blood, was studied from October 1 to December 31, 2022.

Vendor trainers educated all BC collector teams on device usage and adequate skin decontamination. BC collectors were instructed to submit bottles clearly marked with the site of the venipuncture, their initials, and a completed device slip. Both devices included a return slip with spaces to manually fill out the patient's identification, draw site and initials of the collector. The slips were counted as evidence of device usage,

A set of BCs was labeled as "contaminated" using the CDC's National Healthcare Safety Network definition.[1] The contamination rate and compliance rate were derived by the number of cultures collected using the devices out of the total number of cultures. To determine success two goals were established. The goal was to achieve contamination rates $< 1\%$ for each month of the trial; or alternatively, a decrease in contamination rate of $\geq 50\%$ compared to the baseline contamination rate of 2021.The device selected for use had to fulfill one of the two contamination rate criteria and have the highest usage rate. Usage rate was calculated as number of device-collected cultures divided by the total number of cultures processed during the trial. Lastly, user satisfaction and client support were assessed by post-trial survey. Results were collected by the infection control nurse using the same criteria

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Table 1. Blood culture contamination rates during trial

	MONTH	Total sets drawn	Total contaminated	Overall Facility Rate During Trial	Slips returned	Total cont with device	% cont with device
Kurin	MAY*	400	9	2.25%	115	0	0.00%
	JUNE	389	9	2.31%	108	0	0.00%
	JULY	364	12	3.30%	98	0	0.00%
	AUGUST*	473	10	2.11%	120	3	2.50%
	Total	1626	40	2.46%	441	3	0.68%
Steripath	OCTOBER	411	13	3.16%	100	2	2.00%
	NOVEMBER	357	9	2.52%	99	0	0.00%
	DECEMBER	358	7	1.96%	55	0	0.00%
	Total	1126	29	2.6%	254	2	0.8%

*Only two weeks in August and two weeks in May were part of the trial.

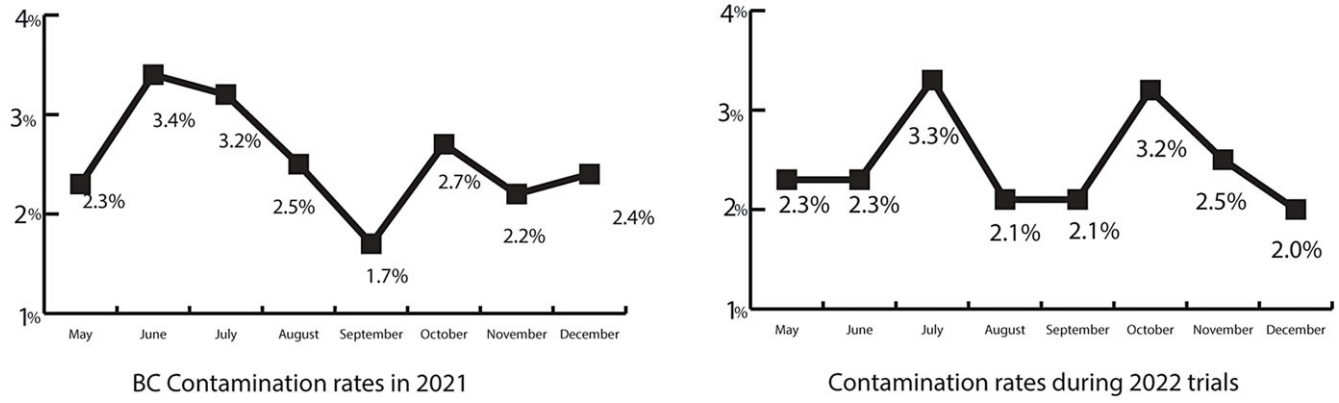

Figure 1. Comparison of overall contamination rates during trial and the year prior.

during the entire study period. Returned device slips were counted by the infection control nurse and their information compared to culture orders.

Results

During the first phase (Kurin) 441 of 1,626 (27.12%) BC sets returned with a completed device slip versus 254 of 1,126 (22.55%) during the second phase (Steripath). During the trial periods, the contamination rate was 2.46%% for the Kurin and 2.60% for the Steripath, which was lower than the same months the prior year (3%), but higher than the desired 50% reduction from the prior year, and higher than the new 1% benchmark. The device-specific contamination rates were 0.68% (3/441) for the Kurin device and 0.8% (2/254) for the Steripath device (Table 1). Twenty-six surveys were analyzed from Steripath and 20 from Kurin users. The device was rated worse than the standard of care by 73% of users for Steripath and 30% for Kurin.

Discussion

None of the devices met the preestablished overall facility goals; however, the BC contamination rate for sets reported as drawn with the studied devices had results like those found in the literature. Prior studies evaluating ISDDs in clinical practice have shown contamination rates of 1% or below with most showing reductions >50% from baseline.[8,9]

The discrepancy between contamination rates with ISDD and the overall contamination rates was likely due to the low usage of the devices despite education, training, and reminders. This may indicate an overall resistance to ISDDs by the healthcare teams; which is further supported by the fact that 73% of healthcare staff considered SteriPath™ worse than SOC with 23% usage. Kurin™ numbers were better with usage of 27% and only 30% of considering it worse than SOC. The decrease in BC contamination observed globally likely represent the combined success of the device and training program. With low usage, it is difficult to draw conclusions on the actual capacity for the diverting devices to decrease contamination rates alone; we cannot rule out observation bias accounting for the results The need for the phlebotomist to activate the Steripath by squeezing the device created complications for some users. No device failures were reported with Kurin.

The hospital system does not allow easy tracking of contaminated BC, and BC collectors can skip the use of the diversion device or use it inadequately and remain unidentified. The smaller number of BC analyzed is a limitation of the study; however, the inability to enforce the use of the device was the most important obstacle faced. Previous studies make no mention of device usage rates and reticence to use. Considering these findings, the devices were not adopted by the VANEOHS. Instituting a program that includes careful training, continuous education, and individual BC collector tracking may show better results than diversion devices alone. A study conducted using a departmental report card in the Emergency

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Department reported that a significant drop in BC contamination rates ($P < 0.001$).[10] Additional interventions such as the introduction of "BC collection kits" may be effective in promoting better skin decontamination techniques.

Conclusions

In conclusion, the tested devices, SteriPath™ and Kurin™, did not help VANEOHS meet the overall BC contamination goal of ≤1%, although such goal was achieved amongst users. Unfortunately, resistance among staff and low device usage were observed, indicating the need for better training programs and systems to enforce the use of the device. The devices were not recommended for network-wide implementation based on this study, further research and user feedback are necessary. The focus could shift to training programs, surveillance systems, and innovative strategies to enhance patient care.

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