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Patient Safety Abstracts

Contents

Assessing the risk of microbiological contamination with staphylococcus epidermidis in anesthetic emergency drugs

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82

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INTRODUCTION

Microbiological contamination in anesthetic medications is a potential source for patient exposure to pathogens, with conflicting evidence pertaining to the anesthetic environment, and little data to determine bacterial viability regarding colony-forming units (CFU) over time.[1–4] Predawn emergency medications stored for periods of time may be potential sources for patient exposure.[1,3,4] Our study sought to determine the viability of a potential bacterial contaminant, *Staphylococcus epidermidis,* in normal saline, phenylephrine prepared in normal saline, and norepinephrine prepared in 5% dextrose solution. *S. epidermidis* was selected as it represents a common skin microbe which may inadvertently contaminate our medications during preparation, and its role in opportunistic nosocomial infections is becoming more appreciated.[5]

METHODS

Two lab strains of *S. epidermidis* were cultured in a microbiology laboratory, where they were grown to saturation in liquid medium then normalized to specific optical densities as determined by absorbance spectroscopy at a wavelength of 595 nm. Bacteria from each optical density were serially diluted in normal saline and plated on solid media to determine the number of CFU per mL of culture. Based on these data, a known quantity of *S. epidermidis* (approximately 4.0×10^4 CFU/mL initial concentration) was inoculated into three samples for each solution: 250 mL of phenylephrine 60 $\mu g \cdot mL^{-1}$ 0.9% NaCl, 250 mL of norepinephrine 16 $\mu g \cdot mL^{-1}$ in 5% dextrose, and lab-prepared sterile 0.9% NaCl solution as a control. These agents were chosen as a representative sample of commonly-employed vasopressors and diluents. All the above were prepared aseptically in a biosafety cabinet. Medications and controls were stored at room temperature. Using strict aseptic technique, aliquots were collected at 24-hr intervals from each solution from days 0 to 7. Serial dilutions were performed, plated on trypticase soy agar, and incubated at 37 °C overnight. CFU counts were obtained from each plate and plotted over the 7-day study period. Concurrent control samples prior to inoculation were collected to rule out pre-existing contamination of the medications.

RESULTS

Normal saline control samples exhibited the longest viability. All medications and controls had similar CFU counts on day zero, indicating successful inoculation, but only normal saline controls exhibited viability beyond day zero. Counts rapidly diminished below the limit of detection by day 3 for normal saline, without any rebound detected within the remaining 7-day study period.

DISCUSSION

These data support that this isolate of *S. epidermidis* is viable for over 24 hr in 0.9% NaCl solution, but not in solutions with phenylephrine or norepinephrine. None of the agents studied exhibited contact antimicrobial activity, suggesting that *S. epidermidis* may remain viable for some short period of time in the above agents, leading to patient exposure after recent contamination. Saline "flush" bags used to prepare medications may represent an under-appreciated source of bacterial contamination and potential patient exposure given the timeframe of viability in this solution. The above provides a foundation for further research regarding in vitro antimicrobial effects of our medications against more virulent pathogens such as Staphylococcus aureus.

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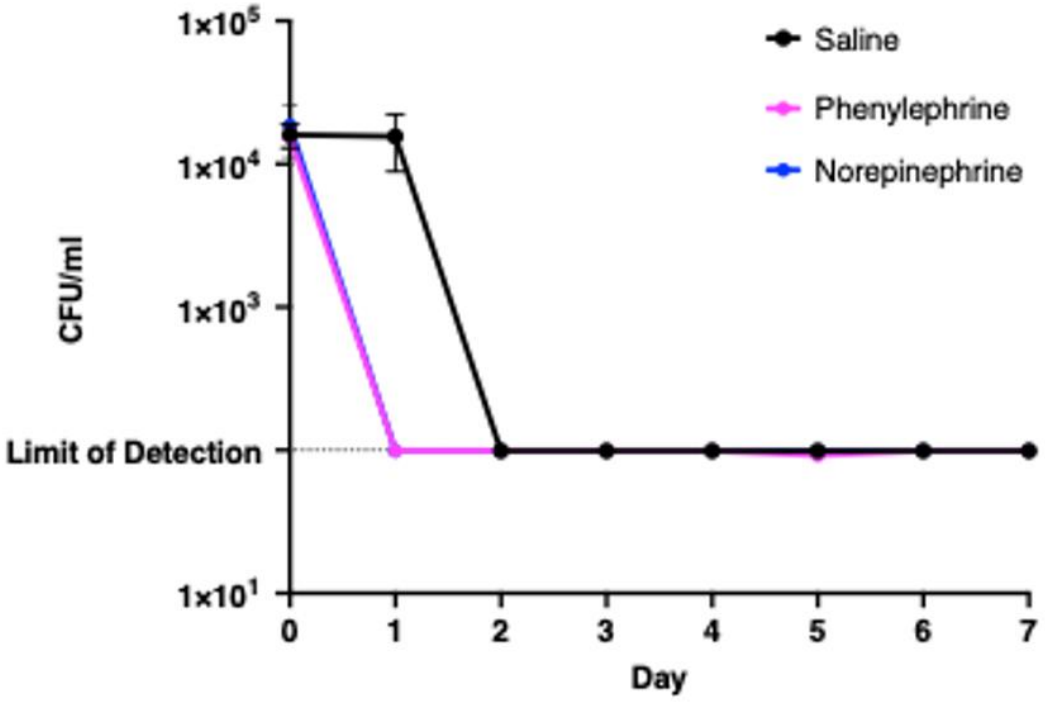
Figure


1×10^5
1×10^4
1×10^3
1×10^1
CFU/ml
Limit of Detection
0
1
2
3
4
5
6
7
Day
Saline
Phenylephrine
Norepinephrine

Comparison of catheter malposition between left and right ultrasound-guided infraclavicular subclavian venous catheterizations: a randomized controlled trial

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INTRODUCTION

Central venous catheterization is commonly used in the intensive care unit (ICU) and operating theatre, with the subclavian vein often chosen because of its lower infection risk and enhanced patient comfort. Nevertheless, this procedure carries potential complications, including subclavian artery puncture, pneumothorax, and catheter malposition. Catheter malposition is particularly problematic in certain clinical scenarios, such as cranial surgery, as it can increase the risk of venous wall erosion, catheter dysfunction, and inaccurate central venous pressure measurement. Despite the advantages of ultrasound-guided subclavian venous catheterization (SVC) over landmark-guided methods, catheter malposition remains a concern. This study hypothesized that the malposition rate after ultrasound-guided infraclavicular catheterization would be lower with left access than with right access because of the asymmetry of the brachiocephalic veins. The research compared catheterization-related complications, including malposition, and the overall performance of left and right ultrasound-guided infraclavicular catheterizations.

METHODS

Patients were randomly assigned to either left (n = 224) or right (n = 225) SVC group. After anesthesia induction, a board-certified anaesthesiologist with extensive experience performed left or right ultrasound-guided infraclavicular SVC based on group assignment. The patient, in a supine position, underwent skin disinfection, and the anesthesiologist, wearing sterile attire, used a central venous catheterization set and a portable ultrasound machine. The ultrasound probe was positioned in the infraclavicular fossa, and after obtaining optimal views, SVC was attempted. Successful puncture was confirmed by blood aspiration, and a guidewire, dilator, and catheter were inserted. Time points were recorded, and if desaturation occurred or exceeded three minutes, the attempt was considered failed. After successful SVC, ultrasonography checked for catheter malposition, and postsurgery, chest radiography was

performed. If needed, subsequent attempts or landmark-guided SVC were conducted. Catheterization-related complications (incidence of catheter malposition rate [primary outcome measure], artery puncture, hematoma formation, pneumothorax, chylothorax, and desaturation) and catheterization performance (overall and first-pass success rates, number of attempts, incidence of posterior venous wall puncture, times, and number of insertions for needle, guidewire, dilator, and catheter) were investigated.

RESULTS

Catheter malposition rate was fewer (10 [4.5%] *vs* 31 [13.8%]; *P* = 0.001), especially into the ipsilateral internal jugular vein (9 [4.0%] *vs* 24 [10.7%]; *P* =0.007), in the left SVC group than in the right SVC group. In the left SVC group, catheterization success rates on the first-pass (88 [39.3%] *vs* 65 [28.9%]; *P* = 0.020) and first attempt (198 [88.4%] *vs* 181 [80.4%]; *P* = 0.020) were higher whereas times for vein visualization (30 [18–50] sec *vs* 20 [13–38] sec; *P* < 0.001) and total catheterization (134 [113–182] sec *vs* 132 [103–170] sec; *P* = 0.034) were longer. There were no significant differences in other catheterization performance and catheterization-related complications between the two groups.

DISCUSSION

In this study, the catheter malposition rate was approximately 5% and 14% after left and right ultrasound-guided infraclavicular SVC, respectively. Left access demonstrated higher success rates on the first pass, although it required more time for vein visualization. Additionally, it is recommended to minimize catheter malposition, especially into the ipsilateral internal jugular vein, after ultrasound-guided infraclavicular SVC. Therefore, left access is recommended to reduce catheter malposition after ultrasound-guided infraclavicular SVC.

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