

The potential for catheter microbial contamination from a needleless connector

JD Brown, HA Moss, TSJ Elliott, J Hosp Infect. 1997.; 36:181-189

PURPOSE

This in vitro study evaluated the potential for contamination of needleless connectors, specifically, the Clave® connector, by challenging the system with *Staphylococcus epidermidis* in a clinical simulation.

MATERIALS AND METHODS

Sixty Clave connectors were subjected to 30 simulated clinical uses. Sterile saline was injected through each device; the devices were disinfected with 70% isopropanol swabs after each injection. Following the simulations, compression seals were inoculated with 1×10^4 cfu *S. epidermidis*. Fifty devices were disinfected with 70% isopropanol swabs; 10 were used as controls. All 60 devices were then injected with 5 mL sterile saline. The first mL aliquot, compression seals, and syringe tips were sampled for contamination. An additional 60 connectors were inoculated with 20 cfu *S. epidermidis*; 50 were cleaned with 70% isopropanol swabs, and 5 mL normal saline was flushed through each. The remaining 10 were used as controls. The number of organisms in fluid, syringe tips, and compression seals was determined as above.

To show the increased risk of potential contamination due to frequency of manipulation by different healthcare workers, 10 healthcare workers each manipulated one device to simulate clinical practice, after which the devices were assessed for microbial contamination by swabbing as above. One hundred sixty connectors were inoculated with *S. epidermidis* to compare disinfection methods: 50 were cleaned by isopropanol swabs as described above; 50 were sprayed with chlorhexidine gluconate; 50 were disinfected with chlorhexidine followed by an isopropanol swab; 10 were not disinfected. All connectors were incubated and examined for growth at 48 hours.

RESULTS

Forty-nine of 50 devices inoculated with 1×10^4 cfu *S. epidermidis* and disinfected with a 70% isopropanol swab allowed no microorganisms to pass through during injection. Eight of the 10 controls allowed no microorganisms to pass. Fifty samples inoculated with 20 cfu *S. epidermidis* and swabbed as above did not allow microorganisms to pass. Eight of the 10 controls allowed no microorganisms to pass. Seven of the 10 devices manipulated by healthcare workers were contaminated with up to 16 cfu of coagulase-negative staphylococci skin microflora. Of the three methods tested, the combination of chlorhexidine gluconate followed by a 70% isopropanol swab was the most effective. The alcohol chlorhexidine spray was the least effective.

CONCLUSION

When the Clave needleless connector was challenged with a high inoculum (1×10^4) and disinfected with isopropanol swabs, there was less than a 2% chance of contamination. Significantly, in a simulated clinical situation with healthcare workers manipulating the connectors, no organisms were able to pass—relevant because skin flora contamination is more likely when hand hygiene compliance is poor.

The study results are supportive of the Clave's internal fluid pathway construction, which is designed to keep the external surface, including the compression seal, separate from the channel. Because of this separation, even though 36 out of 50 compression seals still had microorganisms because of impacted organisms on the luer tip of the syringes, only one out of a total of 160 Clave connectors allowed organisms to pass.