

Bacterial transfer through needlefree connectors: comparison of nine different devices

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PURPOSE

The purpose of this in vitro study was to evaluate device design and compare needlefree devices by counting the bacteria transferred from the surfaces of nine different connectors to injected fluids.

MATERIALS AND METHODS

Nine needlefree connectors (see table) were inoculated with *Staphylococcus epidermidis*. They were not swabbed after inoculation. Connectors were flushed and bacteria were counted at two, four, and six hours. Based on results from a pilot study, the Clave[®] connector was chosen for the control.

RESULTS

Bacteria consistently appeared in the fluid flushed through the connectors. At the six-hour time point, the products could be segregated into three groups based on the typical bacteria transfer (see table). The p-values increased over time and correlated significantly with the type of connector design. In paired comparisons, significant differences were observed in flush counts between the different connector designs and increased over time. The most significant differences appeared after six hours. By six hours, p-values for significantly different connectors were very low (<0.001) while those for connectors that were not significantly different were often quite high.

TABLE

Colony-Forming Units (CFUs) transferred at six-hour time point by connector design

Connector	Design Type	Bacterial transfer CFU count range (6h)
Clave Connector	Luer activated, split septum: internal cannula	9-28
InVision-Plus [®]	Luer activated, split septum: internal cannula	9-28
Clearlink [®]	Luer activated, split septum: external mechanical valve	9-28
SmartSite [®]	Luer activated, split septum: external mechanical valve	9-28
MaxPlus [®]	Luer activated: internal mechanical valve	107-224
Q-Syte [™]	Luer activated, split septum: open flow	107-224
Securisend [®]	Luer activated, surface septum: internal mechanical valve	107-224
SmartSite Plus [®]	Luer activated, surface septum: internal mechanical valve	603-1380
Interlink [®]	External blunt cannula, split septum: open flow	603-1380

CONCLUSION

The differences among connector products observed in this study suggest that connector design has an important influence on bacterial transfer. The Clave connector's low amount of bacterial transfer is probably because the mating cannula has to pass through the septum before fluid can flow. No swabbing surfaces or seals "become" part of the fluid path. The internal mechanical valve and open flow connectors have several features that may facilitate bacterial growth and biofilm, such as parts that "become" part of the fluid path, moving parts in the fluid path, the surface area of the internal compartments, and irregular surfaces that prevent blood from clearing completely.