Reducing the overall particulate contamination exposure in paediatric patients: the advantage of using multilumen infusion sets

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Objective

Drug incompatibilities, as precipitate, may contribute to the clinical deterioration of paediatric patients (sepsis), especially when infusing vancomycin and piperacillin (VAN/PIP). Drug concentration and infusion sets influence the overall particulate contamination of paediatric infusion protocols. Using multilumen infusion sets could prevents these incompatibilities.

The purpose is to define and assess a new way to infuse VAN/PIP during leukemia treatment in paediatric patients, without any visible precipitate.

Methods

This *in vitro* study focused on a paediatric multidrug protocol for patients diagnosed with leukemia and receiving allogeneic transplantation. Two infusion sets were studied, which differ in conception and drug dead-space volume (V): 1) a standard single lumen set with 2 four-port manifolds with extension lines (ref RPB4320, Cair LGL, France; V ~ 12 mL; **Fig. 1**) and 2) a 5-lumen infusion set (ML-5) (Edelvaiss-Multiline-5®, Doran International, France; V ~ 1 mL; **Fig. 2**). The protocol consists in continuous infusions (i.e. VAN, PIP and cyclosporin) and discontinuous infusions (aciclovir, paracetamol and omeprazole). Different vancomycin concentrations (VANc) were tested to infuse VAN/PIP simultaneously without any precipitate (optimized multidrug protocol). A dynamic particle count test was performed (N=5) over 24h to evaluate the overall particulate contamination of our optimized protocol (VANc = 4 mg/mL), using both standard and ML-5. We performed a t-test to compare the collected data after assessing the normality of data distribution.

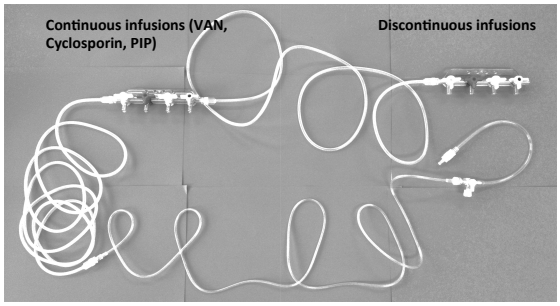

Fig. 1. Standard single lumen infusion set, with 2 4-port manifolds and 150-cm extension lines, commonly used in the paediatric unit care.

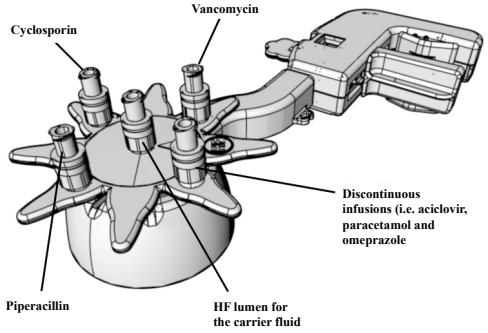

Fig. 2. New multilumen infusion set (Edelvaiss Multiline-5®, Doran International, Lyon, France).

Results

No visible particle was detected on decreasing VANc (4 mg/mL) when compared with the standard dose (42 mg/mL; **Fig. 3**). For the optimized multidrug protocol, using the ML-5 reduced the overall particulate contamination by 68%, compared to the standard infusion set (716 349 ± 89 322 vs. 251 980 ± 49 429; P = 0.002; **Fig. 4**). The number of large particle sizes was also significantly reduced when using the ML-5 ~ 60% (P = 0.027) and 90% (P = 0.009) for particle sizes ≥ 10 and 25 µm, respectively.

Conclusion

This study demonstrated the large number of particles administered during parenteral multidrug infusion. This can be minimized through the choice of the drug concentration and/or the type of infusion set (i.e. multilumen infusion devices). Although this kind of contamination is invisible, further studies are required to evaluate its adverse clinical impact.

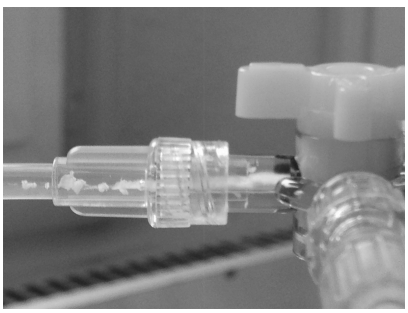

Fig. 3. Example of visible precipitate when using VAN standard dose with the standard infusion device.

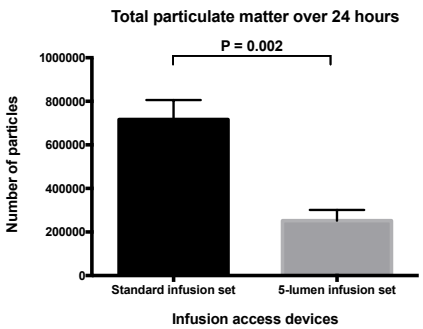

Fig. 4. Number of particles during the multidrug paediatric protocol over a 24h period.

Acknowlegments

We are pleased to thank Mr. Philippe Buisson for providing scientific and technological expertise.

GM-010