

Reduction of flushing volume and incompatibilities by a clinical pharmacist in a paediatric intensive care unit

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Introduction

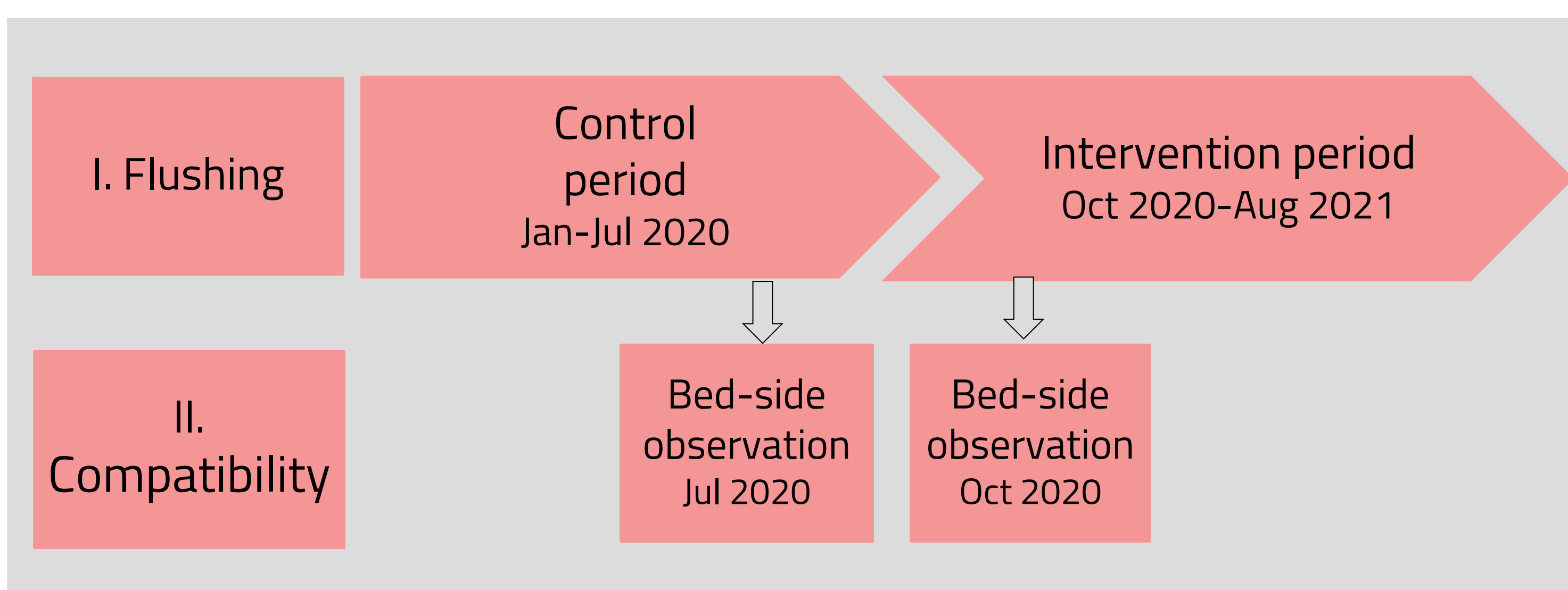
Critically ill children require a variety of intravenous fluids and drugs during their stay in a paediatric intensive care unit (PICU). However, vascular access is limited. Thus, different drugs must be administered through the same infusion line and there may be incompatibilities between. These are known to have a risk for worse outcomes like catheter occlusion, embolism, or decreased effectiveness^{1,2}. If incompatible drugs cannot be administered through different infusion lines, flushing with an inert fluid such as normal saline is required. However, children in PICU have also a high risk for fluid overload which is associated with a higher morbidity³. Consequently, unnecessary fluids should be avoided. The aim of our study was to evaluate the intervention to reduce flushing volume without increasing incompatibilities in a PICU.

Material and methods

Our study was conducted in a 13-bed PICU in Kassel, Germany.

Inclusion criteria:

- 0-18 years
- ≥2 IV drugs
- Period of stay >24h



Study design

For statistical analysis, the Mann-Whitney-U-Test was used for quantitative variables and the χ^2 -Test for categorical variables.

To optimize flushing processes and to avoid incompatibilities, patient-specific compatibility charts were created by a pharmacist during the intervention period. These indicate whether the IV drug was compatible or incompatible with the continuous infusion and the following IV drug.

Infusion line	Continuous infusion	Time Short infusion/Bolus injection			
CVC I	Nutrition	00:00	06:00		
CVC II	Fentanyl Midazolam	Vancomycin 1 hour			
CVC III	Norepinephrine				
PVC	Heparin	Furosemide bolus	Meropenem 4 hours	Flushing	Pantoprazole Flushing 15min

Example flushing chart

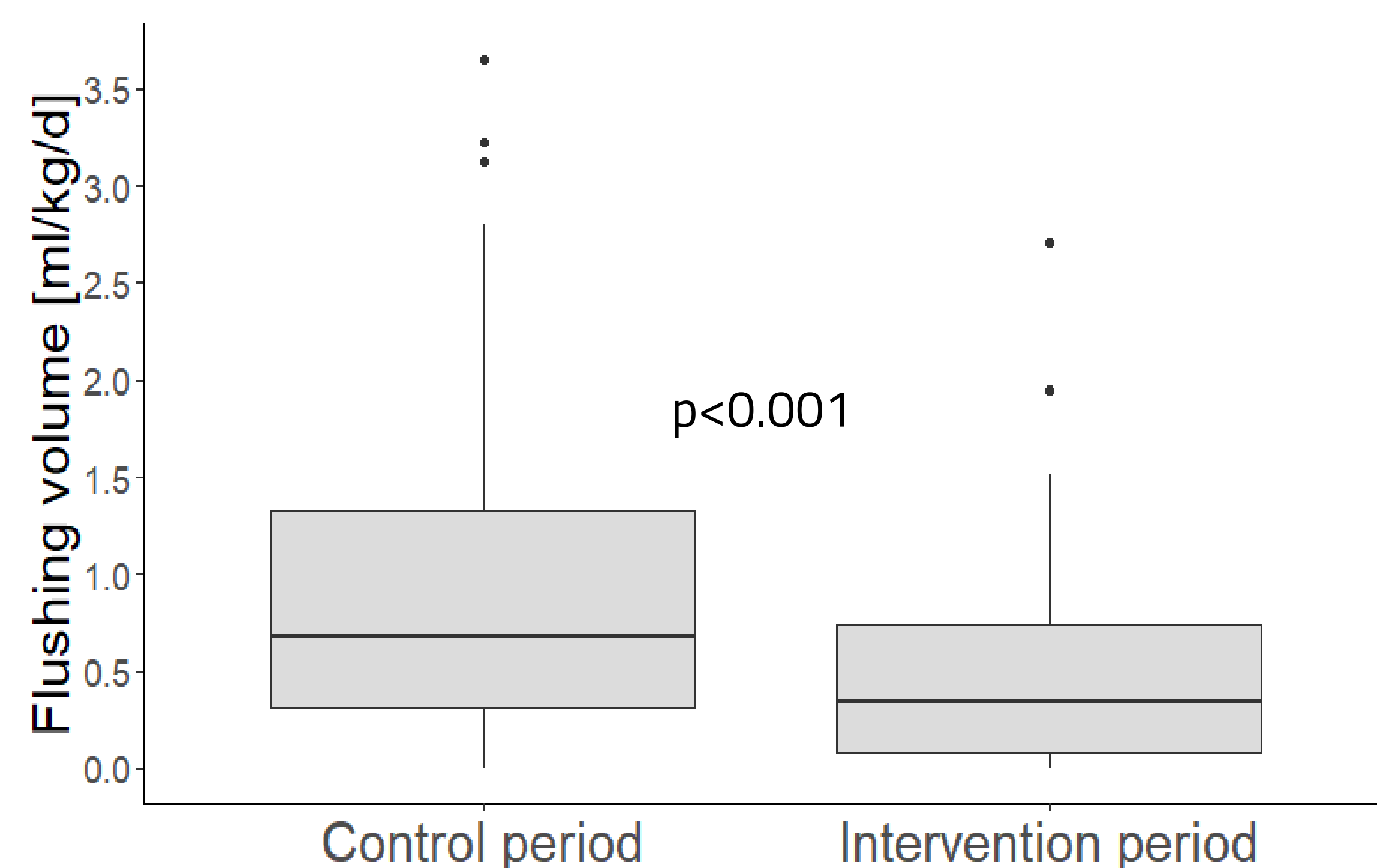
CVC central venous catheter; PVC peripheral venous catheter

Acknowledgements

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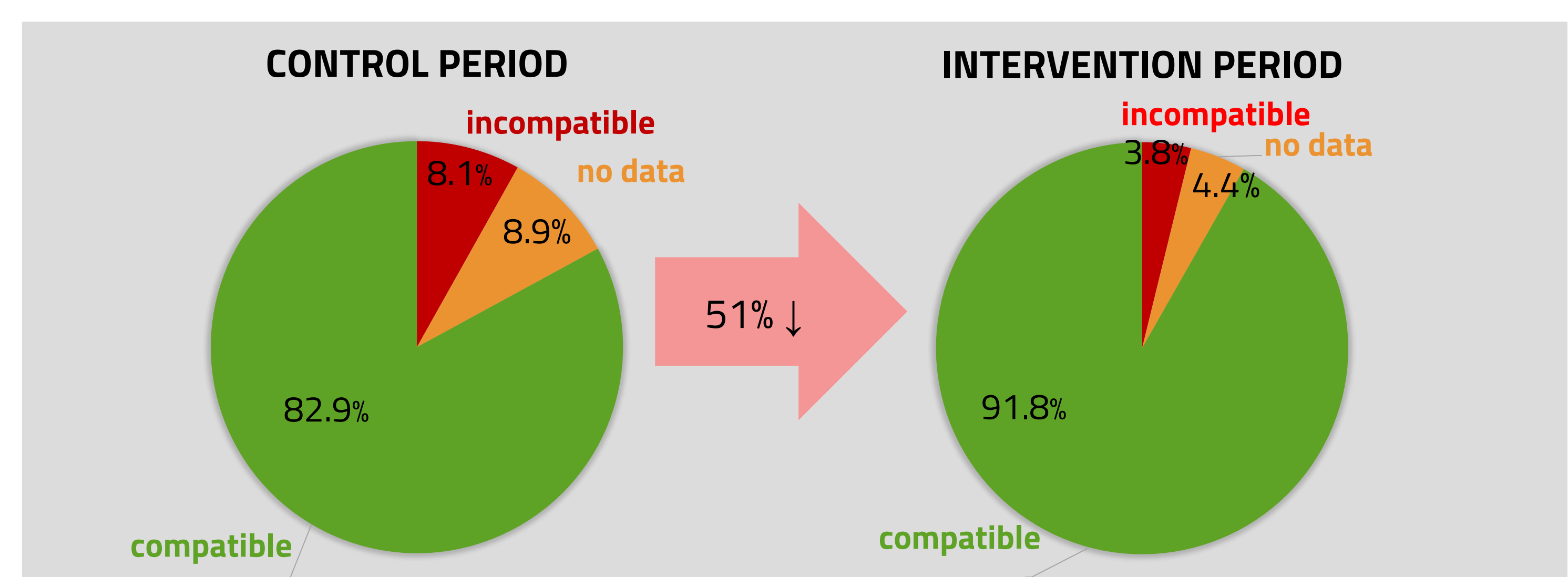
Results

In the intervention study 170 patients (85 per period) were included. The median of the flushing volume was significantly reduced from 0.68ml/kg/day to 0.35ml/kg/day. Also, the number of daily flushing processes decreased (median (Q25/Q75) 2.60 (1.33/3.40) vs. 1.44 (0.67/2.33); $p < 0.001$).



During the bed side observation, 504 drug combinations were observed from 24 patients in the control period and 523 drug combinations from 23 patients in the intervention period.

During the control period, 41 drug combinations were incompatible and literature data were not available for 45. In the intervention period, these numbers decreased to 20 incompatible combinations and 23 combinations with no literature data ($p < 0.001$).



Conclusion

Our results show that having a pharmacist in PICU can reduce the volume of flushing during IV drug administration. This can save nonessential volume and provides an approach to reduce fluid overload in children.

Furthermore, pharmaceutical interventions reduced the incidence of incompatibilities by 51%. Knowledge of drug incompatibilities is a core competence of clinical pharmacists and contributes to increase patient safety in children in the PICU.

Literature

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2 Bronzetti G, D'Angelo C, Mariucci E, et al. Incompatibility between intravenous amiodarone and heparin in an infant. *Int J Cardiol.* 2010;145(2):e70-e73.

3 Alobaidi R, Basu RK, DeCaen A, et al. Fluid Accumulation in Critically Ill Children. *Crit Care Med.* 2020 Jul;48(7):1034-1041.