



Peripheral infusions in neonatal and paediatric intensive care: extravasation rate and risk factors

C. Fonzo-Christe^{1,2}, A. Parron⁴, C. Combescure³, R. Pfister², P. Rimensberger², P. Bonnabry^{1,4}
¹Pharmacy, ²Neonatology and Pediatric Intensive Care Unit, ³Research Center and Division of Clinical Epidemiology
 Geneva University Hospitals, ⁴School of pharmaceutical sciences, Geneva, Switzerland

Background:

- Peripheral intravenous infusions of highly concentrated drugs and hyperosmolar parenteral nutrition is frequent in neonatology (NEONAT) and neonatal and pediatric intensive care units (NICU/PICU)
- Extravasation with peripheral venous catheters (PVC) may lead to severe skin lesions

Purpose:

- To determine in two care units (NEONAT and NICU/PICU):
- Extravasation rate of peripheral infusions
 - Associated risk factors

Results:

- A total of 1300 PVC in 695 patients were analysed (tab.1)
- Global PVC analysis (extravasation/no extravasation groups) :**
 - In situ duration of PVC (1.8d [1.1;3.0] vs 1.5 [0.8;2.7], p=0.01)
 - Patient's age at PVC removal (132d [4;966] vs 984 [154;4146], p<0.0001)
 - No difference in terms of location (hand (48.4%±9 and foot/ankle (24.4%) in most cases)
- Global patient analysis (extravasation/no extravasation groups) :**
 - Patient age at admission (0.27y [0.0;2.45] vs 1.74 [0.06;9.15], p<0.0001)
 - GA (34.1 vs 35.9 sem, p=0.002)
 - No difference in terms of sex
- Extravasation risk and independent associated factors:**
 - Neonates more at risk than older children (tab.2)
 - In situ duration of PVC>3 days associated to an increased risk
- Subgroup analysis NEONAT vs NICU**
 - Premature neonates more at risk than full-term neonates (tab.3)
 - Extravasation rate by PVC higher in neonates hospitalised in NEONAT than in NICU (tab.1). Patients in NEONAT with a lower GA (34.3 [33.0;38.2] vs 38.4 [34.0;39.4], p< 0.0001) and more patients with <2 PVC (81.5% vs 54.5%, p<0.0005). No differences in terms of sex, number of extravasation per patient, in situ duration of PVC.
 - In situ duration of PVC>3 days associated to an increased risk

Conclusion:

- ✓ Global extravasation rate of
 - 11.7% (PVC)
 - 17.6% (patients)
- ✓ Low age, prematurity and in situ duration of PVC >3 days were independent factors associated to an increased risk
- ✓ Implementation of PVC management guidelines and of an assessment scale is planned in the next future.

Methods:

Retrospective study (Jan-Dec 2013, electronic patient data) of all patients hospitalised with at least one PVC:

- Extravasation defined as** PVC removal or insertion site documented as "diffusion" and patient with at least one extravasated PVC
- Global PVC analysis** (location, in situ duration (days), patient's age at PVC removal (neonates <28days, infant >28d to <2y, child 2 to 11y, adolescent ≥12y) and **global patient analysis** (sex, age at admission (year), gestational age (GA, week) (extremely preterm < 28w, very preterm <32w, late preterm ≥32 - <37w, full-term ≥37w)
- Global comparison of "extravasation" and "no extravasation" groups and subgroup analysis** (neonates NEONAT vs NICU) (median value [IQR25-75] (Wilcoxon/ Fisher exact). **Multivariate global and subgroup analysis** of associated factors (sex, age class, GA, in situ duration of PVC, localisation, NEONAT/NICU) (Incidence rate ratio IRR (95% CI)

Extravasation rate and location ?

48.4% on the hand

Tab.1 Extravasation rate

Extravasation rate	GLOBAL for both units	Subgroup Neonates < 28j	
		NEONAT	NICU
By PVC	11.7% (n=152/1300)	28.3% (n=51/180) p=0.04	16.3% (n=15/92)
By patient	17.6% (n=122/695)	30.1% (n=44/146) p>0.05	23.6% (n=13/55)

Associated factors?

Patients: Neonates more at risk, Prematurity

PVC: In situ duration

Tab.2 Univariate and multivariate global analysis

Variable	Univariate		Multivariate	
	IRR (95%CI)	P*	IRR (95%CI)	P*
Age class				
Neonates	1 (ref)	<0.001	1 (ref)	<0.001
Infant	0.37 (0.25 to 0.57)	<0.001	0.33 (0.21 to 0.54)	<0.001
Child	0.24 (0.16 to 0.38)	<0.001	0.22 (0.13 to 0.36)	<0.001
Adolescent	0.19 (0.11 to 0.35)	<0.001	0.16 (0.08 to 0.31)	<0.001
In situ duration of PVC				
<1 day	1 (ref)	<0.001	1 (ref)	<0.001
≥1 to <4 days	3.22 (2.10 to 4.94)	<0.001	2.90 (1.91 to 4.40)	<0.001
≥4 days	4.03 (2.06 to 7.88)	<0.001	3.82 (2.02 to 7.24)	<0.001

Tab.3 Univariate and multivariate subgroup analysis in neonates (<28 days)

Variable	Univariate		Multivariate	
	IRR (95%CI)	P*	IRR (95%CI)	P*
Gestational age (GA) of neonates				
Extreme or very preterm (<32w)	1 (ref)	0.0509	1 (ref)	0.09
Late preterm (≥32w to <37w)	0.87 (0.46 to 1.66)	0.68	0.77 (0.40 to 1.50)	0.45
Full-term (≥37w)	0.43 (0.20 to 0.92)	0.03	0.44 (0.21 to 0.94)	0.03
In situ duration of PVC				
<1 day	1 (ref)	0.005	1 (ref)	0.01
≥1 to <4 days	2.71 (1.49 to 4.93)	0.001	2.65 (1.40 to 5.00)	0.003
≥4 days	2.98 (0.88 to 10.13)	0.08	3.54 (0.97 to 12.83)	0.055
Care unit				
NEONAT	1 (ref)		1 (ref)	
NICU	0.54 (0.31 to 0.97)	0.04	0.52 (0.22 to 1.21)	0.055