MEDICATION ERRORS RELATED **HUS** TO HIGH-ALERT MEDICATIONS IN A TERTIARY CARE PAEDIATRIC HOSPITAL **An analysis of register-based data**

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Background and importance

Paediatric patients are prone to adverse drug events, including medication errors (MEs). Although high-alert medications are often associated with serious MEs, fewer studies have focused on describing these errors within paediatric populations (1-3).

Aim and objectives

The aim of this study was to investigate the prevalence and characteristics of self-reported MEs related to high-alert medications in a paediatric university hospital setting.

Materials and methods

This was a cross-sectional study of self-reported MEs (n=2,404) in a tertiary care paediatric hospital during 2018–2020; 743 (31%) of the MEs involved high-alert medications (Figure 1) (3). A quantitative descriptive analysis (frequencies and percentages) was performed using Microsoft Excel®. The prevalence of different high-alert

medications, Anatomical Therapeutic Chemical (ATC) groups, drug formulations and administration routes appearing in the study sample were defined. Finally, the most severe MEs were identified and summarized.

Results

Among the studied sample of ME reports (n=743), 71 different high-alert medications were identified. The most common ATC subgroups were blood substitutes and perfusion solutions (Bo5; n=345, 40%) antineoplastic agents (Lo1; n=139, 16%), and analgesics (No2; n=98, 11%). The most common medications comprised parenteral nutritions (n=130, 15%), hypertonic sodium chloride (n=93, 11%), potassium chloride concentrate (n=66, 8%), morphine (n=47, 5%), and heparin (n=43, 5%) (Table 1). Most high-alert medications were administered intravenously (n=636, 73%) (Figure 2). Moreover, IV preparations were administered via off-label routes (n=52, 6%), such as oral, inhalation and intranasal routes. Most serious MEs (n=16, 2%)were associated with analgesics (NO2) (n=8), antineoplastic agents (LO1) (n=3), and antithrombotic agents (BO1) (n=3) (Figure 3).

Conclusions and relevance

According to the present and previous studies, MEs on concentrated electrolytes and parenteral nutritions represent a central risk to paediatric medication safety (1-2). While severe MEs in these groups remained low in this study, a high proportion of severe MEs associated with analgesics and antineoplastic agents represented a key finding. Preventive risk management actions should be targeted on these high-alert

medications as well as to secure safety in intravenous administration and off-label drug use in paediatric patients.

REFERENCES: 1. Nydert, et al. Acta Paediatrica 2020;109(12): 2810–9. 2. Stavroudis, et al. J Perinatol 2010;30(7):459–68. 3. Institute for Safe Medication Practices. ISMP list of High-Alert Medications in Acute Care Settings, 2018.

Medication safety incidents not meeting the inclusion	Pediatric medication safety incident		Medication	Administration route	ATC-code	n (%)
criteria (n=1,661) Incident reports excluded from the study sample	reports during 2018–2020 (n=2,404)		Parenteral nutrition preparations	IV	B05BA10, B05BA01, B05BA02, B05BA03, B05XA31, B05XC	130 (14.9)
	Total study sample: Medication safety incident reports involving ISMP		Hypertonic sodium chloride (greater than 0.9%)	IH*, IV, PO*	B05XA03	93 (10.7)
	high-alert medications (n=743)		Potassium chloride concentrate	IV, PO*	B05XA01	66 (7.6)
			Morphine	IV, PO	N02AA01	47 (5.4)
	Identification of different ISMP high- alert medications (n=71)	Classification according to	Heparin	arteria, IV	B01AB01	43 (4.9)
		Identification of formulations	Oxycodone	IM, IV, PO	N02AA05, N02AA55	42 (4.8)
		and administration routes	Vincristine	IV	L01CA02	33 (3.8)
			Fentanyl	IV, sublingual	N01AH01, N02AB03	28 (3.2)
	Identification of the most serious incident reports (n=16) with 10 different ISMP high-alert medications	Analysis of case narratives to	Methotrexate	IV, IT, PO	L04AX03, L01BA01	27 (3.1)
		identify and summarize the most serious incidents	Enoxaparin	SC	B01AB05	26 (3.0)
			Others	-	-	337 (38.6)
	Formation of the study sample	Analysis of the study sample	Total	-	-	872 (100)

Figure 1. Flowchart of the study.



Table 1. Active substances, administration routes and ATC-codes of ISMP high-alert medications (n=71) identified in the study sample (n=743 incident reports) (3). IH=inhalation, IM=intra-muscular, IT=intrathecal, IV=intravenous, PO=oral, SC=subcutaneous, *=off label route.

Accidental administration Heparin flush n=1 (5.6%)	Vincristin An extra	
of TPN to arterial line after a mix-up between infusionParenteral nutrition n=1 syringes (5.6%)	because	
Dopamine n=1 (5.6%)		

ncristine n=1 (5.6%)

An extra dose given to a patient suffering from neuropathy, because the previous dose was recorded in the wrong place

Morphine n=6 (33.3%)

 Infusion rate programmed 12.5 mL/h instead of 2.5 mL/h



Figure 2. An overview of dosage forms (n=872) of the ISMP high-alert medications identified in the study sample (n=743 incident reports) (3). IH=inhalation, IM=intramuscular, IN=intranasal, IT=intrathecal, IV=intravenous, PCA=patient controlled analgesia, PO=oral, SC=subcutaneous.

of pump programming error (23 mL/h instead of 0.23 mL/h)

Too rapid etoposide infusion (1 h instead of 3 h) because of a mix-up between infusion times Etoposide n=1 (5.6%)

Oxycodone n=2 (11.1%)

PO dose prescribed to IV route
A respiratory arrest resulting from a combination of too many PCA boluses and epidural analgesia

Enoxaparin n=2 (11.1%)
A 5-fold dose, because the dose was prepared from the undiluted medicine (100 mg/ml) instead of the diluted one (20 mg/ml)
The dose was decreased to from 20 mg to 10 mg (no prefilled syringe available), but a 100 mg syringe was mistakenly prescribed

 A full daily dose prescribed six times, although the daily dose should have been divided into six doses

• PO dose accidentally given IV

Three IV doses given within 30 min prior to the transfer resulted in the deterioration of the patient's condition in the receiving unit
The patient received accidentally another patient's medicine
Morphine IV infusion prescribed and given at 3.5mL/h instead of 0.35mL/h

Aspartinsulin n=2 (11.1%)

CVC blood glucose samples were contaminated by glucose infusion, which led to unnecessary dose increases of IV infusion and hypoglycemia

• The changes made into the insulin pump were not approved, which resulted in a new order on incorrect grounds the next day

Figure 4. An overview of the most serious medication errors (n=16) related to 10 different ISMP high-alert medications (3). CVC=central venous catheter, IV=intravenous, PCA=patient-controlled analgesia, PO=oral, TPN=total parenteral nutrition.

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