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Safe Administration of Intravenous Potassium Chloride in The Paediatric Ward

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Introduction

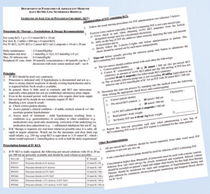
1. Administration of intravenous potassium chloride (KCl) carries clinical risks which can be life-threatening.
2. Paediatric patients span a wide age and body weight range from newborn babies to adolescents just below 18 years with heterogeneous intravenous fluid and electrolytes requirements.
3. Availability of pre-mixed KCl solutions suitable for newborn babies, infants and small children remains limited. Administration of intravenous KCl to such paediatric patients still require concentrated (14.9%) KCl to be appropriately diluted and tailor-made into their intravenous fluids.
4. A risk management system needs to be in place to minimize risks of inadvertent intravenous KCl administration in our two general paediatric wards.

Objective

To establish a risk management system to ensure safe administration of intravenous KCl in the paediatric ward

Methods

1. A registry was set up in each of our two general paediatric wards (E4 & F4) to monitor the use of concentrated KCl. Patient particulars, age, type of intravenous fluid and amount of concentrated KCl were recorded.
2. A department guideline was developed to manage the storage, prescription, preparation, labeling, administration and monitoring of intravenous KCl.



3. A time-out process was introduced as a standard nursing procedure before actual commencement of the KCl-containing solution infusion.
4. The registry data were audited periodically and analyzed to plan for procurement of pre-mixed intravenous KCl solutions.
5. Irregularities involving intravenous KCl administration were reported through Hospital Authority Advanced Incident Reporting System (AIRS) and investigated by Root Cause Analysis (RCA).

Results

1. Patient particulars, age, type of intravenous fluid and amount of concentrated (14.9%) KCl used were recorded by nursing staff upon retrieval of KCl from the designated drug cupboard in each paediatric ward.

2. From January 2008 to December 2009, a total of 1263 vials of concentrated (14.9%) potassium chloride were used for mixing into intravenous fluids to give potassium supplementation to in-patients of our two general paediatric wards. The age range distribution of these patients were as follows:

Age Group	2008				2009				Grand Total	
	E4	F4	Sub-total	Percentage	E4	F4	Sub-total	Percentage	E4+F4	Percentage
Neonate (1-29 d)	13	15	28	3.9%	4	12	16	2.9%	44	3.5%
Infant (1-11.99 m)	36	42	78	10.9%	21	22	43	7.8%	121	9.6%
1-7.99 y	340	136	476	66.7%	249	127	376	68.5%	852	67.5%
8 y and above	68	64	132	18.5%	68	46	114	20.8%	246	19.5%
Sub-total	457	257	714	100.0%	342	207	549	100.0%	1263	100.0%

3. Majority (80.5%) of the concentrated (14.9%) KCl were used in children younger than 8 years: 67.5%, 9.6% and 3.5% for the age groups 1-7.99 years, infants and neonates respectively.
4. Incidence involving intravenous KCl remained low, with one incident reported during the study period. It required increased monitoring and repeat blood tests but resulted in no adverse clinical outcome (AIRS severity index 2). Root cause analysis identified the different prescription format of fluid and electrolytes in neonatal patients as one of the contributory factors.
5. A department guideline on the safe use of KCl was developed. Except emergency, intravenous KCl use was recommended only for documented hypokalaemia where enteral form of replacement contraindicated or not tolerated.
   - It has significantly enhanced more judicious use of intravenous KCl and promoted the use of pre-mixed KCl solutions
   - Prescription format of pre-mixed or tailor-made KCl solutions was unified for all age groups.

2. The prescription order in the medical notes needs to be written as **per 500 ml** format:
e.g. IVF D5 + 10 (or 20) mmol K / **500 ml IVF** at __ ml/hr,
IVF NS + 10 (or 20) mmol K / **500 ml IVF** at __ ml/hr,
IVF ½⅓ soln + 10 (or 20) mmol K / **500 ml IVF** at __ ml/hr

If other additives are required, the prescription is still ordered as **per 500 ml** format:
e.g. IVF D5 + 10 (or 20) mmol K + __ ml 5.85% NaCl / **500 ml IVF** at __ ml/hr
(5.85% NaCl is the additive in this example)
IVF ½⅓ soln + 10 (or 20) mmol K + __ ml D50 / **500 ml IVF** at __ ml/hr
(D50 is the additive in this example)

(Note that writing the "__ ml" **before** the concentration of electrolyte helps to avoid misreading, for example, 5.85% NaCl "3ml" as "13 ml")

   - The time-out practice before infusing KCl solution as a standard nursing procedure has strengthened its correct administration.

	Before department guideline (Jan 08 - May 09)				After department guideline (Jun 09 - Dec 09)				Percentage Change		
		E4	F4	E4+F4		E4	F4	E4+F4	E4	F4	E4+F4
Conc. (14.9%) KCl	Total (17m)	755	444	1199	Total (7m)	44	20	64	—	—	—
	Per month	44.41	26.12	70.53	Per month	6.29	2.86	9.14	↓ 85.85%	↓ 89.06%	↓ 87.04%
Pre-mixed KCl soln	Total (17m)	0	0	0	Total (7m)	26	58	84	—	—	—
	Per month	0.00	0.00	0.00	Per month	3.71	8.29	12.00	↑	↑	↑


Read aloud patient identity, KCl content & infusion rate


Document the time-out process & sign


Press infusion pump start button to begin infusion

Conclusion

1. Until pre-mixed KCl solutions are readily available, need for tailor-making concentrated KCl into intravenous solutions remained high in paediatric wards, predominately for the younger children below 8 years.
2. Our paediatric ward KCl risk management program with a written department guideline, time-out practice and KCl use registry was effective in ensuring safe administration of intravenous KCl in the paediatric wards.
3. Incidence involving intravenous KCl remained low.
4. The paediatric ward KCl registry has provided valuable data for our planning towards using pre-mixed KCl solutions.
5. Our experience has demonstrated the importance and success of managing clinical risk and process improvement by a systematic approach using the F.A.D.E. (Focus-Analyze-Develop-Execute) Cycle.

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SPP-P1-37