The Physician Order for Standardized Concentration of Adult's Electrolyte Replacement Therapy: New Initiative in Saudi Arabia

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Received: 06-04-2019;

Accepted: 16-06-2019

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ABSTRACT

The electrolyte replacement therapy consternation considered one of the high alert drugs. Most of the medication safety organizations have established preventive guidelines for the prescription of electrolyte therapy. The General Administration of Pharmaceutical Care at the Ministry of Health in the Kingdom of Saudi Arabia also has established guidelines for the preparation and administration of electrolyte replacement for adult patients. This new initiative is regarding the standardized concentration of electrolyte preparation and administration for adult patients. The electrolyte therapy may be prescribed via a physician order form, which may be easily converted as computerized physician order entry. This form is designed to prevent all electrolyte-related errors and improve patient outcomes. This project is a new tool implemented for electrolyte safety at the Ministry of Health hospitals in the Kingdom of Saudi Arabia.

Keywords: Adult, Physician order, Standardized Concentration, Electrolyte, Ministry of Health, Saudi Arabia.

INTRODUCTION

The general administration of pharmaceutical care established in the past several pharmacy practice program including National Intravenous admixture program(1)(2)during author study at the college of pharmacy at King Saud University, the last year of studying required practice training at the hospital pharmacy. The author spent his training at King Faisal Specialist Hospital and Research Center (KFSH&RC). The program consisted of the design of IV admixture setting, application of USP 797 of regular medications and USP 800 standards of chemotherapy medications(3)(4). In addition, several booklets of the standardized concentration of medications for adults and pediatrics including the electrolyte and released in 2015(5)(6). The national accreditation organization and international one considered the electrolyte as high alert medications(7). Also, the ISMP published several publications about high alert medications with the emphasis on the electrolyte(8)(9). Three hospitals in Riyadh city in Saudi Arabia established new initiatives program of medications safety related issues and designed adult's standardized concentration of electrolyte physician order. That is a project to prevent any mistakes of the electrolyte with different concentration and improve the patient outcome of drug therapy(10)safety, and nursing acceptability of a nursing initiated, evidence-based order form to replace potassium, magnesium, and phosphate in the MICU. Methods: This retrospective study compared patients receiving electrolyte replacement with the order form to matched historical control patients receiving traditional electrolyte replacement (no order form(11)). The authors are not familiar with any investigations in Saudi

Arabia or Gulf and Middle East counties. The project the first times one founded in Arabic area

Adults Electrolyte Replacement Therapy order in Saudi Arabia

It standardized formulation of electrolyte requirements for adults. The formulation drove from current literature and guidelines for adult's population with an average of seventy-kilogram body weight. The electrolyte consisted of Potassium, Magnesium, Calcium, and Phosphate. The physician order form consisted of several parts demographic data of the patients, the laboratory level for each element of the electrolyte, the standardized concentration and maximum concentration, the type of crystallized fluid, the administration type through a central or peripheral vein, the dosing range requirements as explored in physician order forms appendix 1,2,3,4.

SWOT Analysis

The SWOT (Strength, Weakness, Opportunities, and Threads) used for benefit and risk of the project. The strength of the adult's physician order forms including all information of common electrolyte is available, dosing of medications is available, fixed standardized concentration of the electrolyte is available, the method of electrolyte administration is available, and prevent mistakes in writing electrolyte orders for adults. The weakness points are including it cannot apply to several disease renal or hepatic failure. The opportunity that is including it very easy to form to convert them into computerized and physician order entry; it can calculate all electrolyte statistical information. The third

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DOI:
10.5530/ijpcs.2019.8.46

points including the physician or pharmacist have not used the standardized concentration of the electrolyte.

Implementations steps of Adults Electrolyte Replacement standardized concentration

The pharmacy department Organize Consultation Committee from expert pharmacist especially from Intravenous admixture and total parental nutrition services and critical care clinical pharmacists inside the pharmacy department. The committee should extensive review then approve the standardized concentration of Adults Electrolyte replacement. The head of the committee will contact with the surgical and medical department for final revisions of the drafting and approval. The head of pharmacy services will submit the final draft of the formulation to Pharmacy and Therapeutic committee for review and approval. The head of the committee will arrange with Computer department to make as electronic order forms as explored in figure 1. The pharmacy education coordinator arranges with all department including nursing, surgical and medical department to Educate and train the medical staff of using the formulation with additional to pharmacy staff. The pharmacy quality management will set up the key performance indicators (KPI) to measure the impact of the project. All pharmacy concern team including electrolytes Preparation, clinical pharmacist will Collect the KPI of the project retrospectively in the past three to six months. Then collect the data prospectively in the coming months. The head of the committee will contact with musing and surgical development to start with one surgical department as the pilot trial. The pharmacist will Review the pilot trial and correct the form accordingly the pharmacy consultation committee. The team will expand to all surgical department and medical department. Review and alter the shape accordingly through committee. The head of the committee will Expand to all hospital department including adults critical care, Review and adjust the formulation accordingly. The pharmacy quality management coordinator measure the impact of the project by comparing the KPI before and starting the project. The head of the committee will analyze the results and review by the consultation committee. The head of the pharmacy will submit the final report to Pharmacy and therapeutic comments for final touch and comments. The consultation team Review the last comments on the project, update it accordingly, and continue the project for next year as explored in table 1.

CONCLUSION

The adults electrolyte standardized concentration is new tool of medications safety. The new

Potassium chloride

POTASSIUM CHLORIDE (20MMOL/100ML DEXTROSE 5%) CENTRAL LINE.	00009607
POTASSIUM CHLORIDE (20MMOL/100ML NORMAL SALINE) CENTRAL LINE.	00009607
POTASSIUM CHLORIDE (20MMOL/500ML NORMAL SLINE) PERIPHERAL LINE.	00009607
POTASSIUM CHLORIDE (30MMOL/100ML DEXTROSE 5%) CENTRAL LINE.	00009607
POTASSIUM CHLORIDE (30MMOL/100ML NORMAL SALINE) CENTRAL LINE.	00009607
POTASSIUM CHLORIDE (40MMOL/100ML DEXTROSE 5%) CENTRAL LINE.	00009607
POTASSIUM CHLORIDE (40MMOL/100ML NORMAL SALINE) CENTRAL LINE.	00009607
POTASSIUM CHLORIDE (40MMOL/500ML NORMAL SALINE) PERIPHERAL LINE.	00009607

Potassium phosphate

POTASSIUM PHOSPHATE (9 MMOL/100ML NORMAL SALINE) CENTRAL LINE	0000961
POTASSIUM PHOSPHATE (12 MMOL/100ML DEXTROSE 5%) CENTRAL LINE	0000961
POTASSIUM PHOSPHATE (12 MMOL/100ML NORMAL SALINE) CENTRAL LINE	0000961
POTASSIUM PHOSPHATE (15 MMOL/100ML DEXTROSE 5%) CENTRAL LINE	0000961
POTASSIUM PHOSPHATE (15 MMOL/100ML NORMAL SALINE) CENTRAL LINE	0000961
POTASSIUM PHOSPHATE (30 MMOL/100ML DEXTROSE 5%) CENTRAL LINE	0000961
POTASSIUM PHOSPHATE (30 MOOL/100ML NORMAL SALINE) CENTRAL LINE	0000961
POTASSIUM PHOSPHATE (6 MMOL/100ML DEXTROSE 5%) PERIPHERAL LINE	0000961
POTASSIUM PHOSPHATE (6 MMOL/100ML NORMAL SALINE) PERIPHERAL LINE	0000961
POTASSIUM PHOSPHATE (9 MMOL/100ML DEXTROSE) CENTRAL LINE	0000961

Magnesium sulfate

MAGNESIUM SULFATE (2G/100ML DEXTROSE 5%)	00009609
MAGNESIUM SULFATE (2G/100ML NORMAL SALINE)	00009609
MAGNESIUM SULFATE (4G/100ML DEXTROSE 5%)	00009609
MAGNESIUM SULFATE (4G/100ML NORMAL SALINE)	00009609
MAGNESIUM SULFATE (6G/100ML DEXTROSE 5%)	00009609
MAGNESIUM SULFATE (6G/100ML NORMAL SALINE)	00009610
MAGNESIUM SULFATE (8G/100 DEXTROSE 5%)	00009610
MAGNESIUM SULFATE (8G/100ML NORMAL SALINE)	00009610

Calcium gluconate

CALCIUM GLUCONATE (1G/100ML DEXTROSE 5%)	00009608
CALCIUM GLUCONATE (1G/100ML NORMAL SALINE)	00009608
CALCIUM GLUCONATE (2G/100ML DEXTROSE 5%)	00009608
CALCIUM GLUCONATE (2G/100ML NORMAL SALINE)	00009608
CALCIUM GLUCONATE (4G/100ML DEXTROSE 5%)	00009608
CALCIUM GLUCONATE (4G/100ML NORMAL SLINE)	00009608

Sodium phosphate

SODIUM PHOSPHATE (12 MMOL/100ML DEXTROSE 5%) PERIPHERAL LINE	00009610
SODIUM PHOSPHATE (12 MMOL/100ML NORMAL SALINE) PERIPHERAL LINE	00009610
SODIUM PHOSPHATE (15 MMOL/ DEXTROSE 5%) PERIPHERAL LINE	00009610
SODIUM PHOSPHATE (15 MMOL/100ML NORMAL SALINE) PERIPHERAL LINE	00009611
SODIUM PHOSPHATE (30 MMOL/100ML DEXTROSE 5%) PERIPHERAL LINE	00009611
SODIUM PHOSPHATE (30 MMOL/100ML NORMAL SALINE) PERIPHERAL LINE	00009611
SODIUM PHOSPHATE (9 MMOL/100ML DEXTROSE 5%) PERIPHERAL LINE	00009610
SODIUM PHOSPHATE (9 MMOL/100ML NORMAL SALINE)	00009610

Figure 1: CPOE of Electrolyte Replacement Concentrations

initiatives project prevent an electrolyte related problem and improve patient clinical outcomes

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Table 1: Implementation steps of the standardized concentration of adults' electrolyte replacement therapy.

No	Task	Months											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Organize Consultation Committee from expert pharmacist inside the pharmacy department												
2	Review and approve the standardized concentration form of Adults Electrolyte replacement												
3	Contact with the surgical and medical department for final revisions of the physician order form and approval												
4	Submit the final draft of the physician order form to Pharmacy and the Therapeutic committee for revision and approval												
5	Arrange with Computer department to make as electronic order forms												
6	Educate and train the pharmacy and medical staff of using the physician order form												
7	Setup the key performance indicators (KPI) to measure the impact of the project												
8	Collect the KPI of the project retrospectively in the past three to six months. Moreover, collect the data prospectively in the coming months												
9	Start with one surgical department as a pilot trial												
10	Review the pilot trial and correct the form accordingly												
11	Expand to all surgical department and medical department												
12	Review and correct the form accordingly												
13	Expand to all hospital department including adults critical care												
14	Review and correct the formulation accordingly												
15	Measure the impact of the project by comparing the KPI before and starting the project												
16	Analyze the results and submit the final report to Pharmacy and therapeutic comments												
17	Review the final comments on the project and update it accordingly and continue the project with next year												

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High-Alert Medications General High-Alert Medications Neuromuscular Blocking Agents Concentrated Electrolytes Injection Magnesium Sulfate Injection Moderate Sedation in Adults and Children, Minimal Sedation in .

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IV Electrolyte Replacement Therapy for Adult

Potassium Chloride (2 mmol/ml) (1)(2)(3)(4)

Diagnosis		Allergy		Weight		Starting Date	
	Standard Formula	Freq.	Disp.	Rate of infusion			
3.1 – 3.4 mEq/L	Peripheral line			mmol/hr		IV infusion over 8-24 hours	
	20 Mmol/500ml D5W			2.5			
	20 Mmol/500ml NS			2.5			
	20 Mmol/500ml D5 0.45 NS			2.5			
	30 Mmol/500ml D5W			3.75			
	30 Mmol/500ml NS			3.75			
	30 Mmol/500ml D5 0.45 NS			3.75			
	40 Mmol/500ml D5W			5			
	40 Mmol/500ml NS			5			
	40 Mmol/500ml D5 0.45 NS			5			
2.6 – 3 mEq/L	Peripheral line					IV infusion over 8-24 hours	
	20 Mmol/250ml D5W			2.5			
	20 Mmol/250ml NS			2.5			
	20 Mmol/250ml D5 0.45 NS			2.5			
	30 Mmol/250ml D5W			3.75			
	30 Mmol/250ml NS			3.75			
	30 Mmol/250ml D5 0.45 NS			3.75			
	Central line						
	40 Mmol/250ml D5W			5			
	40 Mmol/250ml NS			5			
	40 Mmol/250ml D5 0.45 NS			5			
	60 Mmol/250ml D5W			7.5			
	60 Mmol/250ml NS			7.5			
	60 Mmol/250ml D5 0.45 NS			7.5			
≤ 2.5 mEq/L	Central line					IV infusion over 8-12 hours	
	20 Mmol/100ml D5W			2.5			
	20 Mmol/100ml NS			2.5			
	30 Mmol/100ml D5W			3.75			
	30 Mmol/100ml NS			3.75			
	40 Mmol/100ml D5W			5			
	40 Mmol/100ml NS			5			
	60 Mmol/100ml D5W			7.5			
	60 Mmol/100ml NS			7.5			

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Name: _____ الاسم:

Nationality: _____ الجنسية:

Age: _____ العمر:

Gender: ☐ Male ☐ Female
الجنس:

IV Electrolyte Replacement Therapy Magnesium for Adult (1)(2)(3)(4)

Diagnosis			Allergy		Weight		Start Date	
Magnesium Sulphate (0.4 mmol/ml)								
Magnesium Sulphate 10% : (1 g = 8 mEq = 4 mmol)								
Level	Standard Formula		Freq.	Disp.	Rate Of Infusion mmol/hr			
1.6-1.8 mg/dl		1gm / 50ml D5W			1	IV infusion over 4 hours	Serum Mg++	
		1gm / 50ml NS			1		1.6-1.8 mg/dl	0.05 g/kg
		1gm / 100 ml D5W			1		1-1.5 mg/dl	0.1 g/kg
		1gm / 100 ml NS			1		< 1 mg/dl	0.15 g/kg
		2gm / 50ml D5W			2		Maximum Rate of infusion 1 g = 4 mmol/hr	
		2gm / 50ml NS			2			
		2gm / 100 ml D5W			2			
		2gm / 100 ml NS			2			
1-1.5 mg/dl		4gm / 100ml D5W			2	IV infusion over 8 hours		
		4gm / 100ml NS			2			
		4gm / 250 ml D5W			2			
		4gm / 250 ml NS			2			
< 1 mg/dl		6gm / 100ml D5W			2	IV infusion over 12 hours		
		6gm / 100ml NS			2			
		6gm / 250 ml D5W			2			
		6gm / 250 ml NS			2			
		8gm / 100ml D5W			2.6			
		8gm / 100ml NS			2.6			
		8gm / 250 ml D5W			2.6			
		8gm / 250 ml NS			2.6			

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IV Electrolyte Replacement Therapy Calcium for Adult(1)(2)(3)(4)

Diagnosis		Allergy		Weight	Start Date	
Level	Standard Formula	Freq.	Disp.		Rate Of Infusion	
Calcium Gluconate (0.23 mmol/ml) – Peripheral line						
Calcium gluconate 10% : (50 mg = 0.5 ml = 0.1 mmol)						
Level	Standard Formula	Freq.	Disp.	Rate Of Infusion mmol/hr		
Ionized Ca 1–1.12 mmol/L	1 gm/ 100 ml D5W			IV infusion over 4 hours		Serum Ca++
	1gm/ 100 ml I NS					
	1 gm/ 250 ml D5W					1 -1.2
	1gm/ 250 ml I NS					1 -2 gm over 2 hrs
	2 gm/ 100ml D5W					< 1 Mmol/L
	2gm/ 100 ml I NS					
	2 gm/ 250ml D5W					
≤ 0.99 mmol/L	2gm/ 250 ml I NS			IV infusion over 6 hours		Normal serum concentration: 8.5–10.5 mg/dL; normal serum ionized concentration 1.12–1.32 mmol/L
	4 gm/ 100ml D5W					
	4gm/ 100ml I NS					
	4gm/ 250 ml NS					
	4 gm/ 250 ml D5W					

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IV Electrolyte Replacement Therapy Phosphate for Adult (1)(2)(3)(4)

Diagnosis		Allergy		Weight		Start Date	
Sodium Phosphate (Ph 3 mmol/ml, Na 4 mmol/ml)							
Maximum Rate of infusion 7.5 mmol/hour.							
Level	Standard Formula	Freq.	Disp.	Rate of Infusion (mmol/hr)			
2.3-3 mg/dl	6 mmol / 100 ml D5W			1	IV infusion over 6 hours	Serum Ph	
	6 mmol / 100 ml NS			1		2.3-3 mg/dl	0.16 mmol/kg
1.6-2.2 mg/dl	9 mmol / 100 ml D5W			1.5		1.6-2.2 mg/dl	0.32 mmol/kg
	9 mmol / 100 ml NS			1.5		< 1.6 mg/dl	0.64 mmol/kg
	12 mmol / 100 ml D5W			2			
	12mmol / 100 ml NS			2			
< 1.6 mg/dl	15 mmol / 100 ml D5W			2.5	IV infusion over 12 hours		
	15mmol / 100 ml NS			2.5			
	30 mmol / 100 ml D5W			2.5			
	30mmol / 100 ml NS			2.5			

Potassium Phosphate (Ph 3 mmol/ml, K 4.4 mmol/ml)					
2.3-3 mg/dl	6 mmol / 100 ml D5W			1	IV infusion over 6 hours
	6 mmol / 100 ml NS			1	
1.6-2.2 mg/dl	9 mmol / 100 ml D5W			1.5	
	9 mmol / 100 ml NS			1.5	
	12 mmol / 100 ml D5W			2	
	12mmol / 100 ml NS			2	
< 1.6 mg/dl	15 mmol / 100 ml D5W			2.5	IV infusion over 12 hours
	15mmol / 100 ml NS			2.5	
	30 mmol / 100 ml D5W			3	
	30 mmol / 100 ml NS			3	

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